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Assessment of emissions/ discharges of mercury reaching the Arctic environment

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Abstract

Processing of mineral resources at high temperatures, such as combustion of fossil fuels, roasting and smelting of ores, kilns operations in cement industry, as well as incineration of wastes and production of certain chemicals result in the release of several volatile trace elements into the atmosphere. Mercury is one of these elements and is very important due to its toxic effects on the environmental and human health, as well as its role in the chemistry of the atmosphere.

Our knowledge of mercury fluxes on a global scale is still incomplete. To improve this knowledge the Norwegian Pollution Control Authority (SFT) has contracted NILU to prepare a global Hg emission inventory for major anthropogenic sources in 1995. About 1990 tonnes of total Hg was emitted to the atmosphere from anthropogenic sources worldwide in 1995, compared to about 3000 tonnes assumed as emissions from natural sources annually.

The largest anthropogenic emissions of Hg to the atmosphere in 1995 were generated in Asia (56%), followed by emissions in Europe, North America and Africa (each contributing with 10 to 15%). As much as three quarters of the anthropogenic Hg emissions to the atmosphere were released during stationary combustion of mostly coal, particularly in China, India and South and North Korea.

The atmospheric deposition of Hg to the Arctic Ocean estimated on the basis of emission inventories, was then compared with the discharges with the three major Arctic rivers in Russia: Lena, Yenisey and Ob. It was concluded that the atmospheric deposition of Hg could be several times bigger than the riverine discharge.

Assessment of emissions/ discharges of mercury reaching the Arctic environment

1 Introduction and Rationale for the Project

A review of the monitoring and research projects performed during the 1st phase of AMAP (1991-1997) has been recently completed with conclusions on achievements and drawbacks, as well as recommendations for future work. Major deficiency of the 1st phase of AMAP program on fluxes was a lack of information on sources and transport of heavy metals with rivers to the Arctic region. Atmospheric emissions have been assessed but need further revision with respect to their completeness and accuracy.

Framework of the AMAP future work has been prepared on the basis of the requests of the Alta Ministerial Conference presented in its Ministerial Declaration. The following has been concluded concerning source inventories: "In spite of the fact that during Phase 1 the participating countries carried out substantial work on inventories of pollution sources which may impact the Arctic region, the AMAP Assessment has shown that the information available is not yet sufficient. During the next phase, this work should be continued".

The outline of the AMAP monitoring and research programme for 1998-2003 was further elaborated during the meeting of the Extended Board of AMAP at SFT in October 1997. It was concluded that the improvement of information on sources and emission quantities discharged within and brought to the Arctic environment should be approached quite soon.

2 Objectives of the Project and its Major Tasks

The overall objective of the proposed project is to assess: 1) current releases of three chemical forms of mercury to the atmosphere (updating and completeness), and 2) input of mercury to the Arctic region with rivers.

The following research tasks are foreseen in order to meet the above mentioned objectives:

Task 1. An assessment of anthropogenic emissions of total mercury fluxes to the atmosphere in 1995.

Task 2. An assessment of anthropogenic emissions of three chemical forms of mercury to the atmosphere in 1995: elemental gaseous mercury, bivalent mercury, and particulate mercury.

Task 3. Elaboration of a list of hot-spots of mercury emissions to the atmosphere transported to the Arctic, with information on geographical location of the hot-spots and the amount of emission.

Task 4. An assessment of fluxes of mercury to the Arctic with suspended solids and waters of the main Arctic rivers: Yenisey, Ob and Lena (this subject is almost non-existing in the AMAP Assessment, prepared within the 1st phase of AMAP).

3 Major Parameters Influencing Atmospheric Emissions of Mercury from Various Sources

Processing of mineral resources at high temperatures, such as combustion of fossil fuels, roasting and smelting of ores, kilns operations in cement industry, as well as incineration of wastes and production of certain chemicals result in the release of several volatile trace elements into the atmosphere. Mercury is one of the most important trace elements emitted to the atmosphere due to its toxic effects on the environmental and human health, as well as its role in the chemistry of the atmosphere.

Although substantial information has been collected on environmental effects of mercury and its behavior in the environment much less data is available on atmospheric emissions of the element. Information on emissions is needed for various policy and modeling purposes. This need has been recognized not only locally where mercury may pose direct problems but also on regional scale because the element is a subject of long-range transport while in the atmosphere.

There are four major groups of parameters affecting emission of mercury to the atmosphere:

- contamination of raw materials by mercury,
- physico-chemical properties of mercury affecting its behavior during the industrial processes,
- the technology of industrial processes, and
- the type and efficiency of control equipment.

3.1 Contamination of Raw Materials

Concentrations of mercury in coals and fuel oils vary substantially depending on the type of the fuel and its origin, as well as the affinity of the element for pure coal and mineral matter. The sulfide-forming elements, with mercury included, are consistently found in the inorganic fraction of coal.

Although it is very difficult to generalize on the impurities in coal, the literature data [1, 2, 3] seem to indicate that the mercury concentrations in coals vary between 0.01 and 1.5 ppm and that the lignites are somewhat less contamined than bituminous and subbituminous coals. It should be noted, moreover, that concentrations of mercury within the same mining field might vary by one order of magnitude or more.

There is only limited information on the content of mercury in oils. In general, mercury concentrations in crude oils range from 0.01 to as much as 30.0 ppm [3].

It is expected that mercury concentrations in residual oil are higher than those in distillate oils being produced at an earlier stage in an oil refinery. Heavier refinery fractions, including residual oil, contain higher quantities of ash containing mercury.

Natural gas may contain small amounts of mercury but the element should be removed from the raw gas during the recovery of liquid constituents, as well as during the removal of hydrogen sulfide. Therefore, it is believed that mercury emissions during the natural gas combustion are insignificant.

Mercury appears as an impurity of copper, zinc, lead, and nickel ores. Obviously, there are also mercury minerals, particularly cinnabar. The element is also present in the gold ores. It is very difficult to discuss the average content of mercury in the copper, zinc, lead, nickel and gold ores as very little information is available in the literature on this subject. On the basis of the review by Pacyna [4] it can be suggested that on average zinc ores contain larger amounts of the element compared to copper and lead ores.

Chemical composition of input material for incineration is one of the most important factors affecting the quantity of atmospheric emissions of various pollutants from waste incineration. Very limited information exists on mercury concentrations in various types of wastes. Another difficulty is that it is almost impossible to calculate an average value for these concentrations due to the high variabilities in the content and origin of wastes to be incinerated, even in the same incinerator. Therefore, it is rather difficult to extend the information on the mercury content measured in one incinerator for another one.

3.2 Physico Chemical Properties of Mercury Affecting its Behavior during the Industrial Processes

Most of the processes generating atmospheric emissions of mercury employ high temperature. During these processes, including combustion of fossil fuels, incineration of wastes, roasting and smelting operations in non-ferrous and ferrous metallurgy, and cement production, mercury introduced with input material volatilizes and is converted to the elemental form. It has been confirmed in various investigations that almost 100 % of the element is found in exhaust gases in a gaseous form [2, 5]. However, mercury in the exhaust gases may be oxidized by HCl and oxygen in the presence of soot or other surfaces as the temperature drops [6]. Methods capable of determining the exact speciation in exhaust gases from various industrial processes are not readily available, however, a number of reasonable assessments have been made.

3.3 Technology of Industrial Processes

Various technologies within the same industry may generate different amounts of atmospheric emissions of mercury. It can be generalized for conventional thermal power plants that the plant design, particularly the burner configuration has an impact on the emission quantities. Wet bottom boilers produce the highest emissions among the coal-fired utility boilers, as they need to operate at the temperature above the ash -melting temperature [7].

The load of the burner affects the emissions of trace elements including mercury in such a way that for low load and full load the emissions are the largest [8]. For a 50 % load the emission rates can be lower by a factor of two.

The influence of plant design or its size on atmospheric emissions of mercury from oil-fired boilers is not as clear as for the coal-fired boilers. Under similar conditions the emission rates for the two major types of oil-fired boilers: tangential and horizontal units are comparable [9].

Non-conventional methods of combustion, such as fluidized bed combustion (FBC) were found to generate comparable or slightly lower emissions of mercury and other trace elements than the conventional power plants [10, 11]. However, a long residence time of the bed material may result in increased fine particle production and thus more efficient condensation of gaseous mercury. Tests carried out in the former Federal Republic of Germany have shown that the residence time of the bed material can be regulated by changing the operating conditions of a given plant, the reduction of combustion temperature, coal size, moisture content, and bed flow rates [12]. A literature review of information on the influence of various FBC techniques on emissions of trace elements has been presented by Smith [2].

Among various steel making technologies the electric arc (EA) process produces the largest amounts of trace elements and their emission factors are about one order of magnitude higher than those for other techniques, e.g., basic oxygen (BO) and open hearth (OH) processes. The EA furnaces are used primarily to produce special alloy steels or to melt large amounts of scrap for the reuse. The scrap which often contains trace elements, and on some occasions mercury, is processed in electric furnaces at very high temperatures resulting in volatilization of trace elements. This process is similar from the point of view of emission generation to the combustion of coal in power plants. Much less scrap is used in other furnaces, where mostly pig iron (molten blast-furnace metal) is charged. It should be noted, however, that the major source of atmospheric mercury related to the iron and steel industry is the production of metallurgical coke.

Quantities of atmospheric emissions from waste incineration depend greatly on the type of combustor and its operating characteristics. The mass burn/waterwall (MB/WW) type of combustor is often used. In this design the waste bed is exposed to fairly uniform high combustion temperatures resulting in high emissions of gaseous mercury and its compounds. Other types of combustors seem to emit lesser amounts of mercury as indicated by the comparison of the best typical mercury emission factors for municipal waste combustors [13]. It is also suggested that fluidized-bed combustors (FB) emit smaller amounts of mercury to the atmosphere compared to other sewage sludge incineration techniques, and particularly multiple hearth (MH) techniques.

3.4 Type and Efficiency of Control Equipment

The type and efficiency of control equipment is the major parameter affecting the amount of trace elements released to the atmosphere. Unlike other trace elements, mercury enters the atmosphere from various industrial processes in a gas form. This section discusses the latest progress in developing the techniques to remove gaseous pollutants from exhaust gases with focus on the removal of mercury and its compounds. Major emphasis is placed on the removal of mercury and its compounds by the application of flue gas desulfurisation (FGD).

The distribution of trace elements in coal-fired boilers with wet and dry FGD was reviewed by Moberg et al. [14] within the Swedish KHM project. Halogens, mercuric chloride and selenium dioxide, were removed with SO2 absorption. Large variations of mercury removal were found, probably due to differences in the behavior of specific mercury compounds. Formation of particles of chloride and sulfate salts was considered to be an important removal mechanism for mercury in the FGD process. This would be promoted by high Cl content in the coal and for mercury sulfate, by low temperatures combined with the catalytic effect of activated carbon.

Two major types of FGD systems can be distinguished: wet and dry FGDs.

3.4.1 Wet FGD Systems

Distribution of mercury within various streams of the wet FGD system was studied in various countries [15]. As much as 70 % of mercury in exhaust gases has remained in the gas stream after passing through the FGD. In general, the trace element content of the gypsum and sludge is influenced by the solubility of the elements upstream, the settling behavior of solids in the thickener, and the waste water volume. In the waste water cleaning plant, the solubility of the trace elements is decreased by increasing the pH to the range of 8.0 to 9.5 so the waste water contains only very small amounts of the elements. Their concentrations in the waste sludge are at low levels (e.g. 6 ppm for Hg).

Wet FGD systems improve retention of trace elements from coal combustion where the elements have not already been retained by particulate control (e.g. mercury). The concentrations of trace elements in scrubber waste products depend largely on the amount of fly ash collected with the FGD wastes. The waste from dual collection FGD systems will resemble fly ash very closely, but for systems with efficient particulate removal, gypsum will contain very low or undetectable amounts of trace elements.

Removal of trace elements from exhaust gases by the wet FGD systems has also been studied in the Netherlands [16, 17], where only pulverized coal-fired dry-bottom boilers are used, equipped with high-efficiency electrostatic precipitators (ESP) and FGD using a wet lime/limestone-gypsum process with prescrubber. Mostly bituminous coals imported mainly from US and Australia are burnt. In one study [17] the Hg concentration upstream of FGD was 3.4 $\mu g/m^3$ and downstream was 1.0 $\mu g/m^3$. The relative distribution of mercury between bottom ash, collected pulverised-fuel ash and fly-ash in the flue gases and in the vapor phase was about 10% on fine particles and about 90% in vapor phase. Flue gases contained 87% of the mercury concentration found in coal, and up to 70% of that was removed by the wet FGD. About 60% of mercury removal takes place in the prescrubber and about 40% in the main scrubber.

In summary, the relatively low temperatures found in wet scrubber systems allow many of the more volatile trace elements to condense from the vapor phase and thus to be removed from the flue gases. In general, removal efficiency for mercury ranges from 30 to 50%.

3.4.2 Dry FGD Systems

Retention of vapor phase mercury by spray dryers has been investigated in Scandinavia and the United States for coal combustors and for incinerators [2]. The following conclusions have been reached:

Brosset [18]: Water soluble mercury (40 to 80%) was partly bound in lime slurry and so mostly retained by the lime.

Bergstrom [19]: 50–70% of the mercury from coal was retained in the ESP ash preceding the FGD spray dryer; 75% of the mercury from coal was retained overall, so the major portion of removal was by the ESP.

Nilsson [20]: 30–40% of gas phase mercury was retained.

Karlsson [21]: 52–63% of mercury was removed, with 15–33% retained in the FGD unit (including baghouse).

Moller and Christiansen [22]: inlet gas phase mercury concentrations of 0.2–0.7 mg/m^3 reduced to 0.1–0.01 mg/m^3 through the FGD unit.

An excellent retention of trace elements by spray dryer systems implies that fly ash or dry end product might contain high concentrations of mercury. Karlsson [21] showed that precollection was beneficial for some elements. The pattern for carry over of trace elements from the ESP to the dry end product is complicated by condensation of some constituents and varying degrees of enrichment, and interactions among the elements. For example, a high Ca concentration led to high As, Cr and Hg concentrations but low concentrations of other elements.

In summary, the overall removal of mercury in various spray dry systems varies from about 35 to 85%. The highest removal efficiencies are achieved from spray dry systems fitted with downstream fabric filters.

3.4.3 Low NOx Technologies

Low NO_x technologies are also likely to reduce mercury emission in the exhaust gases due to the lower operating temperatures. Very limited information on this subject is inconclusive. While some sources indicate that the reduction can be achieved, preliminary results of staged combustion in atmospheric fluidized bed combustion (AFBC) units indicated that low NO_x had only little effect on trace element emissions [2]. It should be noted, however, that low NO_X technologies are far less used compared to the FGD systems.

3.4.4 Technologies to Control Emissions of Mercury on Particles

Coal-fired power plants and municipal incinerators are mostly equipped with either electrostatic precipitators (ESPs) or fabric filters. The ESPs are particularly efficient in removing all types of particles with diameter larger than 0.01 µm, including those bearing mercury after condensation within exhaust gases. The ESPs can tolerate operating temperatures as high as 720 K [23]. The applicability of conventional precipitators is, however, limited by the electric resistivity of the particles. For example, low sulfur coals produce high-resistivity fly ash, and in such case the control efficiency of the ESPs drops off. The problem can be overcome by applying wet-type ESPs, which have the advantage of treating the exhaust gases under relatively cool satured conditions.

Concerning the particle size distribution from the ESPs in coal-fired power plants, it has been concluded that the particle mass containing trace elements is concentrated mostly in two size ranges: 1) at ca. 0.15 µm dia., and 2) between 2 and 8 µm dia. [24]. Mercury can be found on particles in both size ranges.

Fabric filters are also used in coal-fired power plants. The particle collection efficiency is always very high, and even for particles of 0.01 µm dia. exceeds 99%. However, the life time of fabric filters is very dependent upon the working temperature and their resistance to the chemical attack by corrosive elements in exhaust gases. The temperature of exhaust gases often exceeds the temperature tolerance for fabric filter material and therefore limits the fabric filter application. A bimodal particle size distribution has been measured at the outlet of fabric filters [25], similarly to the size distribution of particles at the outlet of ESPs.

Summarizing the information on removal of mercury from exhaust gases generated during the combustion processes in power plants and incinerators, it can be concluded that between 30% and 60% of mercury is retained by high efficiency ESPs or fabric filters and FGD systems capture further 10 to 20 %. If coal cleaning is applied prior to combustion, preliminary data from the U.S. Department of Energy indicate 10% to 25% removal of mercury from coal in the case of commercial cleaning [13].

3.4.5 Mercury Removal from Exhaust Gases Generated in Industries other than Electricity and Heat Production and Waste Incineration

Various techniques to remove mercury from exhaust gases generated by industries other than the production of electricity and heat, as well as during waste incineration have been developed, particularly for metallurgical processes. A selenium filter has been applied at both steel and non-ferrous plants. In this dry media process, the volatized mercury is reacting with red amorphous selenium forming mercury selenide. Mercury removal of 90 % has been achieved through this technique reducing the mercury concentrations to below 10 µg/m³. Carbon filter is also used showing the removal effects similar to those reached with the selenium filter [26].

Lead sulfide process is another dry media technique used to remove mercury from flue gases generated in non-ferrous metal smelters. The gases containing volatile mercury are passed through a tower packed with lead sulfide coated balls. One study at a Japanese smelter in Naoshima indicates reduction of mercury concentrations from 1–5 mg/m^3 in the feed to the absorption tower to 0.01-0.05 mg/m^3 at the outlet [26].

The two major wet media processes to remove mercury from flue gases include selenium scrubber and so-called Odda chloride process. The selenium scrubber method is in principle similar to the selenium filter technique except for that activated amorphous selenium is circulating in a scrubber with 20–40 % sulfuric acid. The mercury reduction is about 90–95 %.

In the Odda chloride process mercury vapors are oxidized to form mercuric chloride which then precipitates. Mercury is recovered and mercury chloride is regenerated. The mercury concentrations of the treated gases are 0.05-0.1 mg/m^3.

3.5 Emissions of mercury due to its various uses

Major uses of mercury include: 1) chlor-alkali production using the mercury cell process, 2) primary battery production, 3) production of measuring and control instruments, and 4) production of electrical lighting, wiring devices, and electrical switches. The use of the mercury cell process to produce chlor-alkali has decreased quite significantly over the part 10-15 years worldwide. Already in 1988 this process accounted for only 17% of all U.S. chlorine production. At present, this contribution is likely much lower. Major points of mercury emission generation in the mercury cell process of chlor-alkali production include: byproduct hydrogen stream, end box ventilation air, and cell room ventilation air. Typical devices/techniques for removal of mercury in these points are: 1) gas stream cooling to remove mercury from hydrogen stream, 2) mist eliminators, 3) scrubbers, and 4) adsorption on activated carbon and molecular sieves. The installation of the above mentioned devices can remove mercury with the efficiency of more than 90%.

The use of mercury in the battery production has decreased dramatically. Atmospheric emission of mercury from this source is low compared to other sources. Mercury emission on particles is controlled mostly by FFs, while some mercury vapor emissions from the anode processing and cell manufacturing areas are generally uncontrolled. An application of charcoal filter would likely remove of up to 75% of these emissions.

Emissions of mercury during electrical apparatus and instrument manufacturing are quite low compared to emissions from other sources. Often these emissions can be controlled by using effective gaskets and seals to contain mercury in the process stream.

Emissions of mercury due to its various uses are believed to be insignificant on a global and even regional (European) scale in 1995. These emissions are also insignificant for the long-range transport of Hg with air masses to the Arctic. Therefore, these emissions are not included in this work.

However, these sources can be significant for certain countries, e.g. Norway. The Norwegian emissions of Hg from the chlor-alkali plant in Sarpsborg were about 59 kg in 1995, placing this source on the top of the list of major point sources in the country. However, the total emission of Hg in the country was only 395 kg in this year [38].

4 Global Emissions of Total Mercury and its Major Chemical Forms from Major Anthropogenic Sources in 1995

4.1 History of emission estimates for Hg before the 1995 emission inventory

The first quantitative worldwide estimate of the annual industrial inputs of 16 elements to the environment, including mercury was prepared by Nriagu and Pacyna [27] for the reference year 1979/1980. It was concluded that the Hg emissions to the air was comparable with direct inputs of the element to the aquatic environment and are almost a half of the direct releases to the terrestrial environment. No re-emission of mercury from the aquatic and terrestrial surfaces to the air was considered in these estimates.

In 1996 the 1979/1980 emission inventory was updated by Pacyna and Pacyna [28] for the reference year 1990. The 1990 emission inventory contains the information on emissions in more than 150 countries. Minimum and maximum emissions were estimated in each country for the following emission source categories:

- combustion of coal,
- oil product combustion,
- cement production,
- lead production,
- zinc production,
- pig iron and steel production,
- caustic soda production,
- mercury production,
- gold production,
- waste disposal, and
- other sources.

Then, a list of major point sources has been elaborated for each country with the information on emission value from each of the point sources and geographical location of the sources. This information was used to spatially distribute Hg emissions within the grid system of 1 degree by 1 degree. The area source emissions were distributed using the information on population density inn each country.

The 1990 emission data were updated to the reference year 1995 and are presented in the tables of this report. The major changes have occurred in Eastern and Central Europe and Asia during the period from 1990 through 1995. Information on these changes was collected and used to prepare the 1995 data presented in the tables.

4.2 Emission inventory for 1995

The following procedures were used in order to assure that the most accurate and complete emission data are reported for the year 1995 in the tables of this report. It was assumed that the national emission data for 1995 can be available directly from the national authorities in at least some countries. In such cases it was assumed that the national emission data can be accepted and used in this report, after some application of simple verification procedures.

4.2.1 Emission data received from national authorities

Information on emission of Hg was available to the authros of this report from only 17 countries. This information was either sent to us directly from the countries as a response to our request, or was found in the reports available from the national authorities in these countries. These were the following countries:

1. Austria:

Abschatzung der Schwermetallemissionen in Österreich, Umweltbundesamt, UBE Rept.-95-108, Wien, 1995, and

Winiwarter, W. Emission of Cd. Hg and Pb in Austria in 1985, 1990 and 1995. Austrian Research Centers, Seibersdorf, December 10, 1998.

2. Belarus

Belarusian Contribution to EMEP, Annual Report, 1996. Belarusian National Academy of Sciences, Meteorological Synthesizing Center – East, Minsk – Moscow, January 1997.

3. Bulgaria

Syrakov, D. 1997 Annual Report on Bulgarian Contribution to EMEP. National Institute of Meteorology and Hydrology, Sofia, January 30, 1998.

4. The Czech Republic:

Data reported to the UN ECE Task Force on Heavy Metals,

Machalek, P. Emissions estimates data –HMs in Czech Republic (1990-1995). Czech Hydrometeorological Institute, Emission Inventory Section, Division of Air Quality Protection, Prague, January 28, 1999, and

CHI: Air Pollution in the Czech Republic in 1997. The Czech Hydrometeorological Institute (CHI), Air Quality Protection Department, Prague, 1998.

5. Denmark:

Data reported to the UN ECE Task Force on Heavy Metals, and to the PARCOM/ATMOS program,

6. Finland:

Data reported to the UN ECE Task Force on Heavy Metals

7. France:

Fontelle, J.P. Heavy Metals emissions based on the 11 CORINAIR/MNECE/EMEP groups (take care of version SNAP 1997). CITEPA (Centere Interprofessionnel Technique D'Etudes De La Pollution Atmospherique), Paris, February 02, 1999.

8. Germany:

Schwermetallemissionen in die Atmosphare, TUV Rheinland, Koln, EP 10/93, 1993, and

Jockel, W., Hartje, J. Report on the Development of the Emissions of Heavy Metals in Germany 1985-1995. Umweltforschungsplan Des Bundesministers für UMWELT, Naturschutz und Reaktorsicherheit, Köln, July 1997, letter of Jockel, W. Environmental Protection/Air Pollution Control, Köln, December 02, 1998.

9. The Netherlands:

Emission inventory in the Netherlands. Emissions to air and water in 1992. The Ministry of Housing, Spatial Planning and the Environment, Directorate-General for the Environment, Gravenhage, Publ. No. 22, December 1994, and

Berdowski, J.J.M. et al. Emissions to air for the Inventories of CORINAIR, EMEP and OSPARCOM 1990-1996. Ministry of Housing, Spatial Planning and the Environment, January 1998.

10. Norway:

Miljøgifter i Norge. Statens forurensningstilsyn (SFT), Rept. 92/103, Oslo, 1993.

Statens forurensningstilsyn (SFT), Mercury emission in Norway, 1995. SFT and INKOSYS data.

11. Poland:

Report on Heavy Metals Emissions in Poland for 1990. The Institute for Ecology of Industrial Areas, Katowice, November 1993,

Mitosek, G. National annual total anthropogenic emissions of heavy metals 1990-1995. Institute of Environmental Protection, Air Protection Division, Warsaw, October 1997, and

Hlawiczka, S. Report on heavy metals emission in Poland for the year 1996. Institute for Ecology of Industrial Areas, Katowice, March 1998.

12. Slovenia:

Rode, B. Heavy Metals emission estimations of Cd, Hg and Pb based on Technical Paper to the OSPARCOM-HELCOM UNECE Emission Inventory, 1990-1996. Ministry of the Environment and Physical Planning Hydrometeorological Institute of Slovenia, Ljubljane, December 29, 1998.

13. Slovakia:

Heavy Metals in Slovakia. Ministerstvo Zivotneho Prostredia Slovenskej Republiky, Bratislava, December 1994.

14. Sweden:

Heavy Metal Emissions to Air in Sweden in 1992. Swedish Environmental Protection Agency, Industrial Department, Stockholm, December 1993.

15. Switzerland:

Vom Menschen Verursachte Schadstoff-Emissionen in der Schweitz 1950-2010. Bundesamt fur Umweltschutz, Schriftenreiche Umweltschutz No. 76, Bern, and

16. The United Kingdom:

The UK Atmospheric Emissions of Metals and Halides 1970-1991. National Atmospheric Emissions Inventory. Department of Environment, London, September 1993.

17. The United States:

National Air Pollutant Emission Trends, 1900-1995, The U.S. Environmental Protection Agency, EPA-454/R-96-007 Report, Research Triangle Park, NC, 1996.

After receiving the emission data from the above 17 countries, these data were checked for completeness and comparability.

The completeness of data regarded mainly the inclusion of major source categories which may emit mercury to the atmosphere. No major omissions have been detected. All major source categories in all countries reporting the emission data were included.

It is very difficult to verify the data obtained from national authorities in various countries in Europe. The following approach has been taken in the reported work. The information on emissions of mercury from various sources was brought together with the information on statistics on the production of industrial goods and/ or the consumption of raw materials and these two sets of data were used to calculate emission factors. Emission factors calculated in such way were then compared with emission factors reported in the Joint EMEP/ CORINAIR Atmospheric Emission Inventory Guidebook [29]. For majority of the cases, emission factors estimated on the basis of national emission data reported to the project were within the range of emission factors proposed in the Guidebook. This check was a prove that the estimates from various countries are comparable and thus can be accepted for the use in the tables presented in this report.

4.2.2 Emission data for other countries

For the European countries other than those listed in p. 4.2.1, emission data for Hg in 1995 were not available. These emissions were calculated by the authors of the report taking into account the information on:

- Statistical information on the consumption of raw materials and the production of industrial goods in 1995, using the following references for:
  - - energy production: UN Statistical Yearbook [33]
  - - non-ferrous metal production: the World Bureau of Metal Statistics [34] and Industrial Commodity Statistics Yearbook 1996 [35],
  - - iron and steel production and cement production: UN Statistical Yearbook [33],
  - - waste disposal: UN Environment Programme, Environmental Data Report 1993-1994 [36], and the OECD Environmental Data Compendium 1995 [37], and
- Emission factors of Hg, estimated by the authors of this report for the UN ECE Task Force on Emission Inventories in the period from 1997 through 1999 and presented in the Atmospheric Emission Inventory Guidebook [29].

Emission factors were multiplied by statistical data in order to obtain emission data.

4.2.3 Estimates of Total Mercury Emissions

The 1995 global emissions of total mercury from anthropogenic sources are presented in Table 1. About 1900 tonnes of total Hg was emitted in 1995, which is within the range between 1270 (minimum estimate) and 2140 tonnes (maximum) estimated earlier by Pacyna and Pacyna [28] for the year 1990. It can be concluded that no major changes were observed between 1990 and 1995 estimates of global Hg emissions from anthropogenic sources worldwide. Somewhat bigger is, however, contribution of stationary combustion of fuels to the total emissions in 1995. This contribution is as high as 77 % in 1995, compared to 60 % in 1990.

There have been major changes in emissions in 1995 compared to 1990, with respect to the location of major emission regions contributing the most to the global emission survey of the element. Whereas the Hg emissions in Europe and North America have decreased quite substantially during the period from 1990 through 1995, emissions in Asia, particularly in China and India, have increased significantly. The Asian sources contributed about 30 % to the total emissions of mercury in 1990, compared to 56 % in 1995. An increase of more than 250 tonnes was estimated for China between the years 1990 and 1995. This change could have altered the pattern of Hg transport to the Arctic within the air masses.

4.2.4 Global Emissions of Various Chemical Species of Mercury

For the first time global emissions of three different chemical species of mercury have been estimated: gaseous elemental mercury, gaseous bivalent mercury, and particulate mercury. The results of these estimates for major source categories are presented in Tables 2 through 4 for gaseous elemental mercury, gaseous bivalent mercury, and particulate mercury, respectively. Emission profiles of various chemical species of mercury, used in these estimates are presented in Table 5.

The major chemical form of mercury emitted to the atmosphere is gaseous elemental mercury, contributing with about 53 % to the total emissions, followed by gaseous bivalent mercury with 37 %. The Hg emissions on particles contribute only about 10 % to the total emissions. Again, Asia contributes about 50 % to the total emissions of all individual chemical forms of mercury. The main source of these emissions is combustion of coal to produce electricity and heat, particularly in China. Chinese emissions from power plants and small industrial and commercial furnaces account for about 500 tonnes per year contributing more than 25 % to the total global emissions of this contaminant.

Emissions of total mercury and its three chemical forms mentioned above are presented in Tables 6 through 22 for various major source categories and individual countries in the world.

4.2.5 Emissions from Major Point Sources

In the next step, lists of major point sources and emissions of Hg from these sources in 1995 were prepared for individual countries in Europe. These lists are presented in Annex 1.

The basis for the lists presented in Annex 1 was a set of similar lists prepared by Pacyna and Pacyna [28] in an earlier work for the year 1990. These 1990 lists of emission sources were checked for the completeness of sources and their location (new countries in 1995 after the political division of the former Soviet Union, Yugoslavia and Czechoslovakia, as well re-unification of Germany). Then, the estimates of 1995 emissions within major categories were adjusted into major point sources within these categories, using the 1990 emission split as a basis.

The following information is presented within the lists of major point sources in Annex 1:

- name of the source,
- geographical position of the source, including latitude and longitude,
- codes, indicating the type of industry and industrial technology (installation code), and
- emission of total mercury.

Information on emission from "Other sources" is also included in the lists. These sources include major area sources (or diffuse sources) related to the combustion of fuels to produce heat in small residential and commercial furnaces.

In the case of modelers need for the information on chemical species of mercury emitted from individual point sources, a table suggesting the split of the total emissions into the chemical species for each source category is also enclosed in the Annex 1.

4.2.6 Accuracy of emission estimates

It is very difficult to assess the accuracy of currently available emission data for mercury mostly due to limited information on the accuracy of emission factor estimates, and specific statistical data in various countries. Ideally, emissions from at least major sources, such as large power plants, waste incinerators, smelters, steel and iron plants, and cement kilns should be measured. The emission measurements would generate the most accurate data on emissions assuming that the proper sampling methods and analytical techniques are applied and the samples are collected at representative sites along the path of flue gases in the stack. However, to measure emissions at so many point sources of emissions is for many reasons impossible to accomplish in very many countries. Therefore, less accurate methods, based on emission factors and material balances are applied to assess the emissions.

Only single numbers of emissions are presented in this work for the individual source categories. In the case that emissions were estimated for the authors of this report using emission factors, these factors were the ones selected as the most relevant for a given industrial technology, an industrial development in a given country or region, a progress and improvements in application of advanced emission control equipment, the content of Hg in raw materials, etc. However, emission estimates for one category can be more accurate and complete than the estimates for another source category. It is concluded here that the following accuracy of emission estimates can be assigned to the estimates for individual source categories in this work:

- stationary fossil fuel combustion: $\pm$ 25%,
- non-ferrous metal production: $\pm$ 30%
- cement production: $\pm$ 30%
- iron and steel production: $\pm$ 30% and
- waste disposal: a factor of up to 5

As the emission data for several countries in Europe and North America have been evaluated by national emission experts, it can be suggested that the emission estimates for Europe and North America are more accurate than the emission estimates for other continents.

5 Comparison of Atmospheric and Riverine Inputs of Mercury to the Arctic Region

An interesting question posed to the project was to what extend Hg discharges with the three major Arctic rivers in Russia: Lena, Yenisey and Ob contribute to the total budget of mercury entering the Arctic environment.

Major review of the contamination of the above mentioned rivers by mercury has been carried out within the reported project. One of the major research programs reviewed in this respect was the Joint Russian-French-Dutch Scientific Program on Arctic and Siberian Aquatic Systems (SPASIBA), shortly described in [30]. It was concluded that Lena, Yenisey and Ob are least affected by anthropogenic impact, compared to rivers in other regions of Russia. The Hg concentrations in water in these rivers are between 0.8 and 5.4 nM/ liter [reported in [30] after several other authors]. These concentrations are significantly lower than mean global values [31].

The Hg concentrations measured during the SPASIBA project, as well as several national Russian projects have been reviewed by Gordeev and Tsirkunov [as reported in 30] in order to estimate riverine fluxes of dissolved and particulate mercury to the Arctic Ocean. The following results have been obtained:

- Ob: 0.2 tonnes Hg/ year dissolved and 0.8 tonnes Hg/ year in particulate form,
- Yenisey: 0.2 and 0.3, and
- Lena: 0.4 and 4.0

Thus, about 5.9 tonnes of Hg enter the Arctic Ocean with the three Russian rivers annually.

No estimates of atmospheric deposition of Hg to the Arctic Ocean were made within the reported project. This task was out of the project objective. In fact, the authors of the reported project have not found any estimate of Hg atmospheric deposition to the Arctic Ocean from anthropogenic sources. Some time ago Akeredolu et al. [32] have estimated that about 3 % of the total emissions of Sb, Cd, Pb, and Zn in the Eurasian basin is deposited to the Arctic Ocean. If the same is true for Hg this deposition will be about 40 tonnes in 1995, thus almost 7 times more than the input with the three most important Russian Arctic rivers. However, one should be cautioned that this estimate is a purely guess which need major justification and verification.

6 Concluding Remarks

Our knowledge of mercury fluxes on a global scale is still incomplete. The above presented estimates for Europe and North America seem to contribute less about 25 % to the global anthropogenic emissions of the element to the atmosphere. The majority of the remaining emissions originate from combustion of fossil fuels, particularly in the Asian countries including China, India, and South and North Korea.

Even less and very controversial information is available on emissions of mercury from natural sources, including volatilization of the element from terrestrial and aquatic surfaces. In general, it is assumed that natural emissions of the element are about 3000 t/year, thus contributing more 60 % to the total global emissions of mercury. However, much work needs to be done in order to verify the above estimate.

Information on chemical and physical species of mercury emitted from various sources is needed in order that a proper model of the transport and transformations of the element in the environment can be constructed. This work is the first approach to assess emissions of various chemical forms of mercury to the atmosphere.

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Table 1. Global emissions of total mercury from major anthropogenic sources in 1995 (in tonnes).

Continent	Stationary combustion	Non-ferrous metal production	Pig iron and steel production	Cement production	Waste disposal	Total
Europe	185.5	15.4	10.2	26.2	12.4	249.7
Africa	197.0	7.9	0.5	5.2		210.6
Asia	860.4	87.4	12.1	81.8	32.6	1 074.3
North America	104.8	25.1	4.6	12.9	66.1	213.5
South America	26.9	25.4	1.4	5.5		59.2
Australia&Oceania	99.9	4.4	0.3	0.8	0.1	105.5
TOTAL	**1 474.5**	**165.6**	**29.1**	**132.4**	**111.2**	**1 912.8**

Table 2. Global emissions of gaseous elemental mercury (Hg^0(gas) from major anthropogenic sources in 1995 (in tonnes).

Continent	Stationary combustion	Non-ferrous metal production	Pig iron and steel production	Cement production	Waste disposal	Total
Europe	92.8	12.3	8.2	20.9	2.4	136.6
Africa	98.6	6.3	0.4	4.2		109.5
Asia	430.3	69.9	9.7	65.4	6.5	581.8
North America	52.4	20.1	3.7	10.4	13.3	99.9
South America	13.5	20.3	1.1	4.5		39.4
Australia&Oceania	50.0	3.5	0.2	0.7		54.4
TOTAL	**737.6**	**132.4**	**23.3**	**106.1**	**22.2**	**1 021.6**

Table 3. **Global emissions of gaseous bivalent mercury (Hg^{++}) from major anthropogenic sources in 1995 (in tonnes).**

Continent	Stationary combustion	Non-ferrous metal production	Pig iron and steel production	Cement production	Waste disposal	Total
Europe	74.2	2.4	1.6	4.0	7.6	89.8
Africa	78.8	1.2	0.1	0.8		80.9
Asia	344.1	13.1	1.8	12.3	19.6	390.9
North America	41.9	3.8	0.7	1.9	39.5	87.8
South America	10.7	3.8	0.2	0.8		15.5
Australia&Oceania	39.9	0.7	0.1	0.1	0.1	40.9
TOTAL	**589.6**	**25.0**	**4.5**	**19.9**	**66.8**	**705.8**

Table 4. **Global emissions of particulate mercury from major anthropogenic sources in 1995 (in tonnes).**

Continent	Stationary combustion	Non-ferrous metal production	Pig iron and steel production	Cement production	Waste production	Total
Europe	18.5	0.7	0.4	1.3	2.4	23.3
Africa	19.6	0.4		0.2		20.2
Asia	86.0	4.4	0.6	4.1	6.5	101.6
North America	10.5	1.2	0.2	0.6	13.3	25.8
South America	2.7	1.3	0.1	0.2		4.3
Australia&Oceania	10.0	0.2				10.2
TOTAL	**147.3**	**8.2**	**1.3**	**6.4**	**22.2**	**185.4**

Table 5. Emission profiles of Hg from Anthropogenic Sources , 1995 .

	Emission profiles of Hg from Anthropogenic Sources , 1995 .											
	Coal Combustion		**Oil Combustion**	**Cement production**	**Non-Ferrous Metals**		**Pig & Iron**	**Caustic Soda**	**Waste Disposal**	**Other**	***Average***	**Information / Source**
SPECIE	Power Plants	Residential Heat			Lead	Zinc						
Hg^{o} (gas)	0,5	0,5	0,5	0,8	0,8	0,8	0,8	0,7	0,2	0,8	*0,64*	
Hg^{2+}	0,4	0,4	0,4	0,15	0,15	0,15	0,15	0,3	0,6	0,15	*0,285*	Modified, Pacyna, 1998
Hg (particulate)	0,1	0,1	0,1	0,05	0,05	0,05	0,05	0	0,2	0,05	*0,075*	
Codes	11 11		11 11	64 67	61 631, 632	61 641, 642	50 51, 54	32 83	14 16			

Table 6. Emissions of various chemical forms of Hg from stationary combustion sources in 1995 by continent, in tonnes.

Continent	Combustion,1995	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3 CEQ)	(t)	(t)	(t)	(t)
Europe	1 563 502	185.5	92.8	74.2	18.5
Africa	636 145	197.0	98.6	78.8	19.6
Asia	3 203 009	860.4	430.3	344.1	86.0
North America	1 552 706	104.8	52.4	41.9	10.5
South America	426 543	26.9	13.5	10.7	2.7
Australia&Oceania	208 110	99.9	50.0	39.9	10.0
World Total	**7 590 015**	**1474.5**	**737.6**	**589.6**	**147.3**

Table 7. Emissions of various chemical forms of Hg from stationary combustion sources in 1995, in tonnes.

Country	Combustion 1995	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3 CEQ)	(t)	(t)	(t)	(t)
Albania	858	0.20	0.10	0.08	0.02
Austria	3 295	0.40	0.20	0.16	0.04
Belarus	2 762	0.10	0.05	0.04	0.01
Bosnia Herzegovinia	437	0.20	0.10	0.08	0.02
Belgium	12 245	1.70	0.85	0.68	0.17
Bulgaria	12 054	5.50	2.75	2.20	0.55
Croatia	901				
Czech Rep.	39 770	14.10	7.05	5.64	1.41
Denmark	13 244	0.90	0.45	0.36	0.09
Estonia	3 730				
Finland	8 313	0.50	0.25	0.20	0.05
France incl.Monaco	76 641	1.60	0.80	0.64	0.16
Germany	162 117	11.30	5.65	4.52	1.13
Greece	11 067	1.30	0.65	0.52	0.13
Hungary	9 686	2.20	1.10	0.88	0.22
Ireland	1 724	0.20	0.10	0.08	0.02
Italy and San Marino	13 287	3.30	1.65	1.32	0.33
Latvia	386				
Lithuania	3 591				
Luxemburg	13	0.10	0.05	0.04	0.01
Macedonia	2 845				
Moldova,Rep of	26				
Netherlands	6 552	0.20	0.10	0.08	0.02
Norway	198 415	0.10	0.05	0.04	0.01
Poland	130 059	31.90	15.95	12.76	3.19
Portugal	470	0.20	0.10	0.08	0.02
Romania	12 309	13.40	6.70	5.36	1.34
Russian Federation	480 471	54.00	27.00	21.60	5.40
Slovakia	5 205	1.60	0.80	0.64	0.16
Slovenia	2 211	0.30	0.15	0.12	0.03
Spain	26 141	4.70	2.35	1.88	0.47
Sweden	10 268	0.20	0.10	0.08	0.02
Switzrld.Liechtenst.	547	0.20	0.10	0.08	0.02
United Kingdom	216 977	9.20	4.60	3.68	0.92
Ukraine	85 755	22.00	11.00	8.80	2.20
Yugoslavia	9 130	3.90	1.95	1.56	0.39
EUROPE Total	**1 563 502**	**185.5**	**92.75**	**74.20**	**18.55**
Algeria	87 531	5.25	2.63	2.10	0.52
Angola	37 907	2.27	1.14	0.91	0.22
Benin	127	0.01	0.01		
Burundi	1				
Cameroon	7 328	0.44	0.22	0.18	0.04
Central African Rep.	3				
Congo	13 095	0.79	0.40	0.32	0.07
Cote d´Ivore	550	0.03	0.02	0.01	
Dem.Rep. Of Congo	1 717	0.10	0.05	0.04	0.01
Egypt	67 578	4.05	2.03	1.62	0.40
Ethiopia	45				
Equatorial Guinea	357	0.02	0.01	0.01	
Gabon	26 099	1.57	0.78	0.63	0.16
Ghana	98	0.01	0.01		
Guinea	16				
Kenya	236	0.01	0.01		
Liberia	17				
Libyan Arab Jamah.	98 408	5.90	2.95	2.36	0.59

Table 7. Emissions of various chemical forms of Hg from stationary combustion sources in 1995, in tonnes.

Country	Combustion 1995	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3 CEQ)	(t)	(t)	(t)	(t)
Madagascar	24				
Malawi	23				
Mali	24				
Morocco	695	0.35	0.18	0.14	0.03
Mozambique	39	0.02	0.01	0.01	
Niger	173	0.09	0.05	0.04	
Nigeria	132 078	7.92	3.96	3.17	0.79
Reunion	30				
Rwanda	2				
S.Africa Customs Un.	152 959	76.48	38.24	30.59	7.65
Sudan	60				
Tunisia	6 096	0.37	0.18	0.15	0.04
Uganda	4				
United Rep. Tanzania	81	0.04	0.02	0.02	
Zaire	90	90.00	45.00	36.00	9.00
Zambia	408	0.20	0.10	0.08	0.02
Zimbabwe	2 246	1.12	0.56	0.45	0.11
AFRICA Total	**636 145**	**197.0**	**98.56**	**78.83**	**19.65**
Afganistan	25	0.01	0.01		
Armenia	265	0.02	0.01	0.01	
Azerbaijan	13 526	0.81	0.41	0.32	0.08
Bahrain	3 496	0.21	0.11	0.08	0.02
Bangladesh	56				
Bhutan	212	0.01	0.01		
Brunei Darussalam	12 344	0.74	0.37	0.30	0.07
Cambodia	9				
China	990 420	495.21	247.61	198.08	49.52
Georgia	726	0.04	0.02	0.02	
India	234 417	117.21	58.61	46.88	11.72
Indonesia	146 977	8.82	4.41	3.53	0.88
Iran	264 663	15.88	7.94	6.35	1.59
Iraq	54 019	3.24	1.62	1.30	0.32
Israel	11				
Japan	89 047	44.52	22.26	17.81	4.45
Jordan	5				
Kazakhstan	72 262	36.13	18.07	14.45	3.61
Korea,Dem.Rep.	87 617	43.81	21.91	17.52	4.38
Korea Rep. Of	24 902	12.45	6.23	4.98	1.24
Kuwait	150 525	9.03	4.52	3.61	0.90
Kyrgystan	1 533	0.77	0.39	0.31	0.07
Lao Peoples Dem.Rep	13	0.01	0.01		
Lebanon	57				
Malaysia	50 209	3.01	1.51	1.20	0.30
Mongolia	2 472	1.24	0.62	0.50	0.12
Myanmar	877	0.05	0.03	0.02	
Nepal	40	0.02	0.01	0.01	
Oman	60 883	3.65	1.83	1.46	0.36
Pakistan	5 474	0.33	0.17	0.13	0.03
Philippines	6 478	3.24	1.62	1.30	0.32
Qatar	30 506	1.83	0.92	0.73	0.18
S.Arabia	606 986	36.42	18.21	14.57	3.64
Sri Lanka	116	0.01	0.01		
Syrian Arab Rep.	40 989	2.46	1.23	0.98	0.25
Tajikistan	1 415	0.08	0.04	0.03	0.01
Thailand	12 131	6.07	3.04	2.43	0.60

Table 7. Emissions of various chemical forms of Hg from stationary combustion sources in 1995, in tonnes.

Country	Combustion 1995	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3 CEQ)	(t)	(t)	(t)	(t)
Turkey	19 768				
Turkmenistan	7 142	0.43	0.22	0.17	0.04
United Arab Emirates	158 379	9.50	4.75	3.80	0.95
Uzbekistan	14 950	0.90	0.45	0.36	0.09
Viet Nam	12 759	0.77	0.39	0.31	0.07
Yemen	24 308	1.46	0.73	0.58	0.15
ASIA Total	**3 203 009**	**860.4**	**430.30**	**344.13**	**85.96**
Barbados	90	0.01	0.01		
Canada	181 378	12.80	6.40	5.12	1.28
Costa Rica	296	0.02	0.01	0.01	
Cuba	1 527	0.09	0.05	0.04	
Dominican Republic	198	0.01	0.01		
El Salvador	324	0.02	0.01	0.01	
Guatemala	768	0.05	0.03	0.02	
Haiti	12				
Honduras	159	0.01	0.01		
Jamaica	15				
Mexico	229 999	13.80	6.90	5.52	1.38
Nicaragua	481	0.03	0.02	0.01	
Panama	166	0.01	0.01		
Puerto-Rico	41				
Trinidad and Tobago	9 330	0.56	0.28	0.22	0.06
Unites States	1 127 922	77.40	38.70	30.96	7.74
N.AMER. Total	**1 552 706**	**104.8**	**52.44**	**41.91**	**10.46**
Argentina	56 767	3.41	1.71	1.36	0.34
Bolivia	2 441	0.15	0.08	0.06	0.01
Brazil	57 027	3.42	1.71	1.37	0.34
Chile	2 369	1.18	0.59	0.47	0.12
Colombia	43 886	2.63	1.32	1.05	0.26
Ecuador	29 570	1.77	0.89	0.70	0.18
Paraguay	1 533	0.09	0.05	0.04	
Peru	9 765	0.59	0.30	0.24	0.05
Suriname	476	0.03	0.02	0.01	
Uruguay	516	0.26	0.13	0.10	0.03
Venezuela	222 193	13.33	6.67	5.33	1.33
S.AMER. Total	**426 543**	**26.9**	**13.47**	**10.73**	**2.66**
Australia	194 016	97.01	48.51	38.80	9.70
New Caledonia	34	0.02	0.01	0.01	
New Zealand	4 667	2.33	1.17	0.93	0.23
Papua New Guinea	9 325	0.56	0.28	0.22	0.06
Fiji	53				
French Polynesia	15				
OCEANIA Total	**208 110**	**99.9**	**49.97**	**39.96**	**9.99**

Table 8. **Emission of various chemical forms of Hg from non-ferrous metals in 1995 by continent, in tonnes**

Continent	Primary production Cu+Pb+Zn	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(t/y)	(t)	(t)	(t)	(t)
Europe	4 817.3	15.4	12.3	2.4	0.7
Africa	740.8	7.9	6.3	1.2	0.4
Asia	6 942.1	87.4	69.9	13.1	4.4
North America	4 380.3	25.1	20.1	3.8	1.2
South America	2 219.9	25.4	20.3	3.8	1.3
Australia&Oceania	766.6	4.4	3.5	0.7	0.2
World Total	**19 867.0**	**165.6**	**132.4**	**25.0**	**8.2**

Table 9.
Emissions of various chemical forms of Hg from non-ferrous metals in 1995 by continent, in tonnes.

Country	Primary Prod. Cu+Pb+Zn	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3t)	(t)	(t)	(t)	(t)
Albania	2.9				
Austria	6.0	0.1	0.08	0.02	
Belgium	465.4	0.5	0.40	0.08	0.02
Bulgaria	165.3	0.2	0.16	0.03	0.01
Czech Rep.	22.0				
Finland	249.3	0.3	0.24	0.05	0.01
France	405.6	1.8	1.44	0.27	0.09
Germany	522.6	7.0	5.60	1.05	0.35
Greece		0.1	0.08	0.02	
Ireland		0.1	0.08	0.02	
Italy	307.6	0.8	0.64	0.12	0.04
Macedonia	56.8				
Norway	155.7				
Poland	639.5	0.1	0.08	0.02	
Romania	68.3	0.4	0.32	0.06	0.02
Russian Federation	758.3	1.9	1.52	0.29	0.09
Slovakia	15.4				
Slovenia	7.8				
Spain	461.3	1.4	1.12	0.21	0.07
Sweden	129.3				
Switzerland	8.9				
United Kingdom	258.3	0.4	0.32	0.06	0.02
Ukraine	23.0				
Yugoslavia	88.0	0.3	0.24	0.05	0.01
EUROPE Total	**4 817.3**	**15.4**	**12.32**	**2.35**	**0.73**
Algeria	23.4	0.5	0.40	0.08	0.02
Congo	33.0	0.3	0.24	0.05	0.01
Morocco	62.4	0.2	0.16	0.03	0.01
Namibia	56.6	0.4	0.32	0.06	0.02
South Africa	233.3	3.3	2.64	0.50	0.16
Tunisia	0.5				
Zambia	318.8	3.1	2.48	0.47	0.15
Zaire	0.6				
Zimbabwe	12.2	0.1	0.08	0.02	
AFRICA Total	**740.8**	**7.9**	**6.32**	**1.21**	**0.37**
China	2 764.3	34.1	27.28	5.12	1.70
India	221.4	3.3	2.64	0.50	0.16
Iran	90.4	0.9	0.72	0.14	0.04
Japan	1 957.5	24.8	19.84	3.72	1.24
Kazakhstan	491.8	5.9	4.72	0.89	0.29
Korea,Dem.Rep.	297.0	4.4	3.52	0.66	0.22
Korea Rep. Of	639.9	8.3	6.64	1.25	0.41
Myanmar	1.8				
Oman	21.3	0.2	0.16	0.03	0.01
Philippines	158.1	1.6	1.28	0.24	0.08
Thailand	53.7	0.9	0.72	0.14	0.04
Turkey	124.9	1.4	1.12	0.21	0.07
Uzbekistan	120.0	1.6	1.28	0.24	0.08
ASIA Total	**6 942.1**	**87.4**	**69.92**	**13.14**	**4.34**

Table 9.
Emissions of various chemical forms of Hg from non-ferrous metals in 1995 by continent, in tonnes.

Country	Primary Prod. Cu+Pb+Zn	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3t)	(t)	(t)	(t)	(t)
Canada	1 379.7	8.7	6.96	1.31	0.43
Mexico	464.6	2.7	2.16	0.41	0.13
Unites States	2 536.0	13.7	10.96	2.06	0.68
N.AMER. Total	**4 380.3**	**25.1**	**20.08**	**3.78**	**1.24**
Argentina	45.9	0.73	0.58	0.11	0.04
Brazil	367.0	5.54	4.43	0.83	0.28
Chile	1 288.8	12.9	10.32	1.94	0.64
Colombia	2.6	0.01	0.01		
Peru	515.6	6.22	4.98	0.93	0.31
S.AMER. Total	**2 219.9**	**25.4**	**20.32**	**3.81**	**1.27**
Australia	766.6	4.4	3.52	0.66	0.22
OCEANIA Total	**766.6**	**4.4**	**3.52**	**0.66**	**0.22**

Table 10. Emission of various chemical forms of Hg from non-ferrous metals - Cu in 1995 by continent, in tonnes

Continent	Primary production Cu (t/y)	Emissions Hg (t)	Emissions Hg^0 (gas) (t)	Emissions Hg^{++} (t)	Emissions Hg (particulate) (t)
Europe	1 847.9				
Africa	520.5	5.1	4.1	0.8	0.2
Asia	3 184.9	31.8	25.4	4.8	1.6
North America	2 514.8	14.1	11.3	2.1	0.7
South America	1 735.8	17.4	13.9	2.6	0.9
Australia&Oceania	249.6	1.4	1.1	0.2	0.1
World Total	**10 053.5**	**69.8**	**55.8**	**10.5**	**3.5**

Table 11. **Emissions of various chemical forms of Hg from non-ferrous metals - Cu in 1995, in tonnes**

Country	Primary Prod. Cu $(10^3 t)$	Emissions Hg (t)	Emissions Hg^0 (gas) (t)	Emissions Hg^{++} (t)	Emissions Hg (particulate) (t)
Albania	2.9				
Austria	0.5				
Belgium	159.0				
Bulgaria	25.5				
Finland	70.7				
France	6.9				
Germany	247.0				
Norway	34.3				
Poland	406.7				
Romania	22.0				
Russian Federation	560.3				
Slovakia	15.4				
Spain	130.2				
Sweden	87.1				
United Kingdom	8.6				
Yugoslavia	70.8				
EUROPE Total	**1 847.9**				
Congo	33.0	0.3	0.24	0.05	0.01
Namibia	29.8	0.3	0.24	0.05	0.01
South Africa	131.7	1.3	1.04	0.20	0.06
Zambia	313.8	3.1	2.48	0.47	0.15
Zimbabwe	12.2	0.1	0.08	0.02	
AFRICA Total	**520.5**	**5.1**	**4.08**	**0.79**	**0.23**
China	1079.7	10.8	8.64	1.62	0.54
India	33.9	0.3	0.24	0.05	0.01
Iran	90.4	0.9	0.72	0.14	0.04
Japan	1112.8	11.1	8.88	1.67	0.55
Kazakhstan	255.6	2.6	2.08	0.39	0.13
Korea,Dem.Rep.	22.0	0.2	0.16	0.03	0.01
Korea Rep. Of	230.8	2.3	1.84	0.35	0.11
Oman	21.3	0.2	0.16	0.03	0.01
Philippines	158.1	1.6	1.28	0.24	0.08
Turkey	100.3	1.0	0.80	0.15	0.05
Uzbekistan	80.0	0.8	0.64	0.12	0.04
ASIA Total	**3 184.9**	**31.8**	**25.44**	**4.79**	**1.57**
Canada	481.7	2.7	2.16	0.41	0.13
Mexico	103.1	0.6	0.48	0.09	0.03
Unites States	1 930.0	10.8	8.64	1.62	0.54
N.AMER. Total	**2 514.8**	**14.1**	**11.28**	**2.12**	**0.70**
Brazil	165.0	1.7	1.36	0.26	0.08
Chile	1 288.8	12.9	10.32	1.94	0.64
Peru	282.0	2.8	2.24	0.42	0.14
S.AMER. Total	**1 735.8**	**17.4**	**13.92**	**2.62**	**0.86**
Australia	249.6	1.4	1.12	0.21	0.07
OCEANIA Total	**249.6**	**1.4**	**1.12**	**0.21**	**0.07**

Table 12. Emission of various chemical forms of Hg from non-ferrous metals - Pb in 1995 by continent, in tonnes

Continent	Primary production Pb	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(t/y)	(t)	(t)	(t)	(t)
Europe	761.3	1.9	1.5	0.3	0.1
Africa	97.5	0.3	0.2	0.1	
Asia	1 149.0	3.4	2.7	0.5	0.2
North America	687.2	2.0	1.6	0.3	0.1
South America	101.4	0.3	0.2	0.1	
Australia&Oceania	205.0	0 6	0.5	0.1	
World Total	**3 001.4**	**8.5**	**6.7**	**1.4**	**0.4**

Table 13. **Emissions of various chemical forms of Hg from non-ferrous metals - Pb in 1995, in tonnes**

Country	Primary Prod. Pb	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3t)	(t)	(t)	(t)	(t)
Austria	5.5				
Belgium	95.3	0.1	0.08	0.02	
Bulgaria	60.1	0.1	0.08	0.02	
Czech Rep.	22.0				
France	128.7	0.5	0.40	0.08	0.02
Germany	38.0				
Greece		0.1	0.08	0.02	
Ireland		0.1	0.08	0.02	
Italy	54.4	0.1	0.08	0.02	
Macedonia	22.3				
Poland	66.4				
Romania	18.0	0.2	0.16	0.03	0.01
Russian Federation	31.0	0.2	0.16	0.03	0.01
Slovenia	7.2				
Spain		0.2	0.16	0.03	0.01
Sweden	42.2				
United Kingdom	149.7	0.2	0.16	0.03	0.01
Ukraine	9.0				
Yugoslavia	11.5	0.1	0.08	0.02	
EUROPE Total	**761.3**	**1.9**	**1.52**	**0.32**	**0.06**
Morocco	62.4	0.2	0.16	0.03	0.01
Namibia	26.8	0.1	0.08	0.02	
South Africa	2.8				
Tunisia	0.5				
Zambia	5.0				
AFRICA Total	**97.5**	**0.3**	**0.24**	**0.05**	**0.01**
China	607.9	1.8	1.44	0.27	0.09
India	41.0	0.1	0.08	0.02	
Japan	192.0	0.6	0.48	0.09	0.03
Kazakhstan	88.5	0.3	0.24	0.05	0.01
Korea,Dem.Rep.	75.0	0.2	0.16	0.03	0.01
Korea Rep. Of	129.8	0.4	0.32	0.06	0.02
Myanmar	1.8				
Thailand	8.0				
Turkey	5.0				
ASIA Total	**1 149.0**	**3.4**	**2.72**	**0.52**	**0.16**
Canada	177.6	0.5	0.40	0.08	0.02
Mexico	135.6	0.4	0.32	0.06	0.02
Unites States	374.0	1.1	0.88	0.17	0.05
NORTH AMERICA Total	**687.2**	**2.0**	**1.60**	**0.31**	**0.09**
Argentina	10.2	0.03	0.02	0.01	
Brazil	14.0	0.04	0.03	0.01	
Colombia	2.6	0.01	0.01		
Peru	74.6	0.22	0.18	0.03	0.01
SOUTH AMERICA Total	**101.4**	**0.3**	**0.24**	**0.05**	**0.01**
Australia	205.0	0.6	0.48	0.09	0.03
OCEANIA Total	**205.0**	**0.6**	**0.48**	**0.09**	**0.03**

Table 14. Emission of various chemical forms of Hg from non-ferrous metals - Zn in 1995 by continent, in tonnes.

Continent	Primary production Zn	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(t/y)	(t)	(t)	(t)	(t)
Europe	2 208.1	13.5	10.8	2.1	0.6
Africa	122.8	2.5	2.0	0.4	0.1
Asia	2 608.2	52.2	41.8	7.8	2.6
North America	1 178.3	9.0	7.2	1.4	0.4
South America	382.7	7.7	6.1	1.2	0.4
Australia&Oceania	312.0	2.4	1.9	0.4	0.1
World Total	**6 812.1**	**87.3**	**69.8**	**13.3**	**4.2**

Table 15. **Emissions of various chemical forms of Hg from non-ferrous metals - Zn in 1995, in tonnes**

Country	Primary Prod. Zn (10^3t)	Emissions Hg (t)	Emissions Hg^0 (gas) (t)	Emissions Hg^{++} (t)	Emissions Hg (particulate) (t)
Austria		0.1	0.08	0.02	
Belgium-Luxembourg	211.1	0.4	0.32	0.06	0.02
Bulgaria	79.7	0.1	0.08	0.02	
Finland	178.6	0.3	0.24	0.05	0.01
France	270.0	1.3	1.04	0.20	0.06
Germany	237.6	7.0	5.60	1.05	0.35
Italy	253.2	0.7	0.56	0.11	0.03
Macedonia	34.5				
Norway	121.4				
Poland	166.4	0.1	0.08	0.02	
Romania	28.3	0.2	0.16	0.03	0.01
Russian Federation	167.0	1.7	1.36	0.26	0.08
Slovenia	0.6				
Spain	331.1	1.2	0.96	0.18	0.06
Switzerland	8.9				
Ukraine	14.0				
United Kingdom	100.0	0.2	0.16	0.03	0.01
Yugoslavia	5.7	0.2	0.16	0.03	0.01
EUROPE Total	**2 208.1**	**13.5**	**10.80**	**2.06**	**0.64**
Algeria	23.4	0.5	0.40	0.08	0.02
South Africa	98.8	2.0	1.60	0.30	0.10
Zaire	0.6				
AFRICA Total	**122.8**	**2.5**	**2.00**	**0.38**	**0.12**
China	1076.7	21.5	17.20	3.23	1.07
India	146.5	2.9	2.32	0.44	0.14
Japan	652.7	13.1	10.48	1.97	0.65
Kazakhstan	147.7	3.0	2.40	0.45	0.15
Korea,Dem.Rep.	200.0	4.0	3.20	0.60	0.20
Korea Rep. Of	279.3	5.6	4.48	0.84	0.28
Thailand	45.7	0.9	0.72	0.14	0.04
Turkey	19.6	0.4	0.32	0.06	0.02
Uzbekistan	40.0	0.8	0.64	0.12	0.04
ASIA Total	**2 608.2**	**52.2**	**41.76**	**7.85**	**2.59**
Canada	720.4	5.5	4.40	0.83	0.27
Mexico	225.9	1.7	1.36	0.26	0.08
Unites States	232.0	1.8	1.44	0.27	0.09
N.AMER. Total	**1 178.3**	**9.0**	**7.20**	**1.36**	**0.44**
Argentina	35.7	0.7	0.56	0.11	0.03
Brazil	188.0	3.8	3.04	0.57	0.19
Peru	159.0	3.2	2.56	0.48	0.16
S.AMER. Total	**382.7**	**7.7**	**6.16**	**1.16**	**0.38**
Australia	312.0	2.4	1.92	0.36	0.12
OCEANIA Total	**312.0**	**2.4**	**1.92**	**0.36**	**0.12**

Table 16. Emissions of various chemical forms of Hg from pig iron and steel production in 1994 by continent, in tonnes.

Continent	Pig iron and crude steel production, 1994	Emission Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	10^3 t	(t)	(t)	(t)	(t)
Europe	259 338	10.2	8.2	1.6	0.4
Africa	12 111	0.5	0.4	0.1	
Asia	277 815	12.1	9.7	1.8	0.6
Nort America	113 878	4.6	3.7	0.7	0.2
South America	34 547	1.4	1.1	0.2	0.1
Australia & Oceania	8 398	0.3	0.2	0.1	
World Total	**706 087**	**29.1**	**23.3**	**4.5**	**1.3**

Table 17.
Emission of various chemical forms of Hg from pig iron and crude steel production in 1994 , in tonnes.

Country	Pigiron and crude steel production, 1994	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	10^3 t	(t)	(t)	(t)	(t)
Albania	19				
Austria	4 400	0.10	0.08	0.02	
Belarus	880				
Belgium	11 172	0.10	0.08	0.02	
Bulgaria	2 496	0.10	0.08	0.02	
Croatia	63				
Czech Rep.	7 075	0.30	0.24	0.05	0.01
Denmark	720				
Finland	3 420	0.10	0.08	0.02	
France	18 242	1.00	0.80	0.15	0.05
Germany	40 963	1.31	1.05	0.20	0.06
Greece	852	0.20	0.16	0.03	0.01
Hungary	1 932	0.10	0.08	0.02	
Ireland	325				
Italy	26 212	0.60	0.48	0.09	0.03
Latvia	332				
Lithuania	1				
Luxemburg	3 073	0.10	0.08	0.02	
Macedonia	65				
Moldova,Rep of	632				
Netherlands	6 171	0.30	0.24	0.05	0.01
Norway	468	0.10	0.08	0.02	
Poland	9 616				
Portugal	720				
Romania	5 943	0.80	0.64	0.12	0.04
Russian Fed.	48 812	1.80	1.44	0.27	0.09
Slovakia	3 974	0.20	0.16	0.03	0.01
Slovenia	424				
Spain	13 440	0.50	0.40	0.08	0.02
Sweden	4 956	0.10	0.08	0.02	
Switzerland	800				
Ukraine	23 800	2.0	1.60	0.30	0.10
United Kingdom	17 244	0.30	0.24	0.05	0.01
Yugoslavia	96	0.10	0.08	0.02	
EUROPE Total	**259338**	**10.20**	**8.17**	**1.60**	**0.44**
Algeria	772	0.04	0.03	0.01	
Angola	9				
Egypt	2 500	0.10	0.08	0.02	
Morocco	7				
Nigeria	140	0.01	0.01		
South Africa	8 320	0.33	0.26	0.05	0.02
Tunisia	183	0.01	0.01		
Zimbabwe	180	0.01	0.01		
AFRICA Total	**12111**	**0.5**	**0.40**	**0.08**	**0.02**
Azerbaijan	77				

Table 17.
Emission of various chemical forms of Hg from pig iron and crude steel production in 1994 , in tonnes.

Country	Pigiron and crude steel production, 1994	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	10^3 t	(t)	(t)	(t)	(t)
Bangladesh	34				
China	92 617	3.70	2.96	0.56	0.18
India	18 200	0.73	0.58	0.11	0.04
Indonesia	2 000	0.08	0.07	0.01	
Iran	4 500	0.18	0.14	0.03	0.01
Iraq	300	0.01	0.01		
Israel	160	0.01	0.01		
Japan	98 295	3.93	3.14	0.59	0.20
Kazakhstan	2 968	0.12	0.10	0.02	
Korea,Dem.Rep.	8 100	0.32	0.26	0.05	0.01
Korea Rep. Of	33 887	1.36	1.09	0.20	0.07
Philippines	640	0.03	0.02	0.01	
Saudi Arabia	2 410	0.10	0.08	0.02	
Thailand	100				
Turkey	13 227	1.50	1.20	0.23	0.07
Viet Nam	300	0.01	0.01		
ASIA Total	**277815**	**12.1**	**9.67**	**1.83**	**0.58**
Canada	13 900	0.56	0.45	0.08	0.03
Cuba	80				
Mexico	8 690	0.35	0.28	0.05	0.02
Unites States	91 208	3.65	2.92	0.55	0.18
N.AMER. Total	**113878**	**4.6**	**3.65**	**0.68**	**0.23**
Argentina	3 274	0.13	0.10	0.02	0.01
Brazil	25 752	1.03	0.83	0.15	0.05
Chile	996	0.04	0.03	0.01	
Colombia	702	0.03	0.02	0.01	
Equador	22				
Peru	338	0.01	0.01		
Uruguay	53				
Venezuela	3 410	0.14	0.11	0.02	0.01
S.AMER.Total	**34547**	**1.4**	**1.10**	**0.21**	**0.07**
Australia	7 632	0.31	0.25	0.05	0.01
New Zealand	766	0.03	0.02	0.01	
OCEANIA Total	**8398**	**0.3**	**0.27**	**0.06**	**0.01**

Table 18. Emissions of various chemical forms of Hg from cement production in 1994 by continent, in 1994

Continent	Cement production in 1994	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3 t)	(t)	(t)	(t)	(t)
Europe	273 229	26.2	20.9	4.0	1.3
Africa	51 961	5.2	4.2	0.8	0.2
Asia	817 711	81.8	65.4	12.3	4.1
North America	128 335	12.9	10.4	1.9	0.6
South America	55 450	5.5	4.5	0.8	0.2
Australia&Oceania	7 892	0.8	0.7	0.1	
World Total	**1 334 578**	**132.4**	**106.1**	**19.9**	**6.4**

Table 19.
Emissions of various chemical forms of Hg from cement production in 1994, in tonnes.

Country	Cement production in 1994	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	(10^3 t)	(t)	(t)	(t)	(t)
Albania	240				
Austria	4 828	0.20	0.16	0.03	0.01
Belarus	1 488				
Belgium 1)	7 569	0.20	0.16	0.03	0.01
Bulgaria	1 908	0.10	0.08	0.02	
Croatia	2 055	0.20	0.16	0.03	0.01
Czech Rep.	5 300	0.20	0.16	0.03	0.01
Denmark	2 427	0.20	0.16	0.03	0.01
Estonia	403				
Finland	864	0.10	0.08	0.02	
France	20 184	2.50	2.00	0.38	0.12
Germany	40 217	5.60	4.48	0.84	0.28
Greece	12 636	1.20	0.96	0.18	0.06
Hungary	2 793	0.30	0.24	0.05	0.01
Iceland	81				
Ireland	1 550	0.10	0.08	0.02	
Italy	32 698	3.00	2.40	0.45	0.15
Latvia	244				
Lithuania	736				
Luxemburg	711				
Macedonia	486				
Moldova,Rep of	39				
Netherlands 1)	3 142	0.30	0.24	0.05	0.01
Norway	1 464	v.l.	v.l.	v.l.	
Poland	13 834	0.10	0.08	0.02	
Portugal 1)	7 476	0.70	0.56	0.11	0.03
Romania	5 998	1.40	1.12	0.21	0.07
Russian Federation	37 220	3.80	3.04	0.57	0.19
Slovakia	2 879	0.20	0.16	0.03	0.01
Slovenia	1 667				
Spain	25 140	2.70	2.16	0.41	0.13
Switzerland 2)	4 260	0.20	0.16	0.03	0.01
Sweden 1)	2 152				
Ukraina 1)	15 012	2.00	1.60	0.30	0.10
United Kingdom 1)	11 916	0.60	0.48	0.09	0.03
Yugoslavia	1 612	0.30	0.24	0.05	0.01
EUROPE Total	**273 229**	**26.2**	**20.96**	**3.98**	**1.26**
Algeria	6 093	0.61	0.49	0.09	0.03
Angola 2)	370	0.04	0.03	0.01	
Benin	380	0.04	0.03	0.01	
Cameroon	620	0.06	0.05	0.01	
Congo 1)	95	0.01	0.01		
Dem. Rep. Of Congo	150	0.02	0.02		
Egypt	13 544	1.35	1.08	0.20	0.07
Ethiopia	464	0.05	0.04	0.01	
Gabon	126	0.01	0.01		
Ghana	1 350	0.14	0.11	0.02	0.01
Ivory Coast	500	0.05	0.04	0.01	
Kenya	1 452	0.15	0.12	0.02	0.01

Table 19.
Emissions of various chemical forms of Hg from cement production in 1994, in tonnes.

Libyan Arab Jamah.	2 300	0.23	0.18	0.04	0.01
Madagaskar 1)	36				
Malawi	122	0.01	0.01		
Mali 1)	14				
Morocco	6 284	0.63	0.50	0.10	0.03
Mozambique	62	0.01	0.01		
Niger	29				
Nigeria	3 086	0.31	0.25	0.05	0.01
Rwanda	60	0.01	0.01		
Senegal 1)	591	0.06	0.05	0.01	
South Africa	7 068	0.71	0.57	0.11	0.03
Sudan	250	0.03	0.02	0.01	
Togo	350	0.04	0.03	0.01	
Tunisia	4 605	0.46	0.37	0.07	0.02
Uganda	45	0.01	0.01		
United Rep. Tanzania 1)	749	0.07	0.06	0.01	
Zambia	350	0.04	0.03	0.01	
Zimbabwe 1)	816	0.08	0.06	0.02	
AFRICA Total	**51 961**	**5.23**	**4.19**	**0.82**	**0.22**
Armenia	122	0.01	0.01		
Azerbaijan	467	0.05	0.04	0.01	
Bangladesh	324	0.03	0.02	0.01	
China	421 180	42.12	33.70	6.31	2.11
China,Hong Kong	1 927	0.19	0.15	0.03	0.01
Cyprus	1 053	0.11	0.09	0.02	
India	61 776	6.18	4.94	0.93	0.31
Indonesia	21 912	2.19	1.75	0.33	0.11
Iran 2)	14 906	1.49	1.19	0.22	0.08
Irak 2)	2 453	0.25	0.20	0.04	0.01
Israel	3 500	0.35	0.28	0.05	0.02
Japan	91 624	9.16	7.33	1.37	0.46
Jordan	3 392	0.34	0.27	0.05	0.02
Kazakhstan	2 033	0.20	0.16	0.03	0.01
Korea,Dem.Rep.	17 000	1.70	1.36	0.26	0.08
Korea Rep. Of	52 088	5.21	4.17	0.78	0.26
Kuwait	800	0.08	0.06	0.02	
Kyrgystan	426	0.04	0.03	0.01	
Lebanon	1 000	0.10	0.08	0.02	
Malaysia	9 928	0.99	0.79	0.15	0.05
Mongolia	86	0.01	0.01		
Myanmar	477	0.05	0.04	0.01	
Nepal	190	0.02	0.02		
Pakistan	8 100	0.81	0.65	0.12	0.04
Philippines	9 576	0.96	0.77	0.14	0.05
Qatar	470	0.05	0.04	0.01	
Saudi Arabia	16 000	1.60	1.28	0.24	0.08
Sri Lanka 1)	466	0.05	0.04	0.01	
Syrian Arab Rep.	4 009	0.40	0.32	0.06	0.02
Thailand	29 928	2.99	2.39	0.45	0.15
Turkey	29 356	2.94	2.35	0.44	0.15
Turkmenistan 1)	1 118	0.11	0.09	0.02	
Uzbekistan 1)	5 278	0.53	0.42	0.08	0.03
Viet Nam 2)	3 926	0.39	0.31	0.06	0.02
Yemen 2)	820	0.08	0.06	0.02	

Table 19.
Emissions of various chemical forms of Hg from cement production in 1994, in tonnes.

ASIA Total	**817711**	**81.8**	**65.41**	**12.30**	**4.07**
Barbados	76	0.01	0.01		
Canada	10 584	1.06	0.85	0.16	0.05
Cuba	1 067	0.11	0.09	0.02	
Dominican Republic	1 276	0.13	0.10	0.02	0.01
El Salvador	598	0.06	0.05	0.01	
Guadeloupe	283	0.03	0.02	0.01	
Guatemala	1 163	0.12	0.10	0.02	
Haiti	228	0.02	0.02		
Honduras	368	0.04	0.03	0.01	
Jamaica	445	0.04	0.03	0.01	
Martinique	231	0.02	0.02		
Mexico	31 499	3.15	2.52	0.47	0.16
Panama	678	0.07	0.06	0.01	
Puerto Rico	1 356	0.14	0.11	0.02	0.01
Trinidad and Tobago	583	0.06	0.05	0.01	
Unites States	77 900	7.79	6.23	1.17	0.39
NORTH AMERICA Total	**128335**	**12.9**	**10.29**	**1.94**	**0.62**
Argentina	6 306	0.63	0.50	0.10	0.03
Bolivia 1)	629	0.06	0.05	0.01	
Brazil	25 231	2.52	2.02	0.38	0.12
Chile	3 001	0.30	0.24	0.05	0.01
Colombia	9 204	0.92	0.74	0.14	0.04
Ecuador	2 085	0.21	0.17	0.03	0.01
Paraguay	529	0.05	0.04	0.01	
Peru	3 177	0.32	0.26	0.05	0.01
Suriname	25				
Uruguay	701	0.07	0.06	0.01	
Venezuela	4 562	0.46	0.37	0.07	0.02
SOUTH AMERICA Total	**55450**	**5.5**	**4.45**	**0.85**	**0.24**
Australia	7 017	0.70	0.56	0.11	0.03
Fiji	94	0.01	0.01		
New Caledonia	97	0.01	0.01		
New Zeland 1)	684	0.07	0.06	0.01	
AUSTRALIA&OCEANIA Total	**7 892**	**0.80**	**0.64**	**0.12**	**0.03**

v.l. = very low

Table 20. **Emissions of various chemical forms of Hg from waste disposal by continent in 1990s, in tonnes.**

Continent	Municipal Waste Disposal 1990s	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	10^3 t	(t)	(t)	(t)	(t)
Europe	26 001.0	9.7	1.9	5.9	1.9
Asia	32 622.4	32.6	6.5	19.6	6.5
North America		64.3	12.9	38.5	12.9
Australia&Oceania	143.0	0.1		0.1	
World Total	**58 766.4**	**106.7**	**21.3**	**64.1**	**21.3**

Continent	Sewage Sludge Waste 1980s	Emissions Hg	Emissions Hg^0 (gas)	Emissions Hg^{++}	Emissions Hg (particulate)
	10^3 t	(t)	(t)	(t)	(t)
Europe	509.0	2.7	0.5	1.7	0.5
Asia					
North America	759.8	1.8	0.4	1.0	0.4
Australia&Oceania					
World Total	**1 268.8**	**4.5**	**0.9**	**2.7**	**0.9**

Table 21. **Emission of various chemical forms of Hg from municipal waste disposal in 1990s, in tonnes.**

Country	Municipal Waste 1990s 10^3 t	Emissions Hg (t)	Emissions Hg^0 (gas) (t)	Emissions Hg^{++} (t)	Emissions Hg (particulate) (t)
Austria	310	0.4	0.08	0.24	0.08
Belgium	720	0.1	0.02	0.06	0.02
Czech Rep.	104				
Denmark	1 320	1.0	0.20	0.60	0.20
Finland	50				
France	7 616	1.9	0.38	1.14	0.38
Germany	4 742	3.0	0.60	1.80	0.60
Greece	1	0.2	0.04	0.12	0.04
Italy	1 262	1.0	0.20	0.60	0.20
Luxemburg	117				
Netherlands	2 490	0.2	0.04	0.12	0.04
Norway	450	0.1	0.02	0.06	0.02
Poland		1.4	0.28	0.84	0.28
Slovakia	113				
Spain	606				
Sweden	1 300	0.4	0.08	0.24	0.08
Switzerland	2 300				
United Kingdom	2 500				
EUROPE Total	**26 001**	**9.7**	**1.94**	**5.82**	**1.94**
Hong Kong	2.2				
Japan	32 616.0	32.6	6.52	19.56	6.52
Malaysia	4.2				
ASIA Total	**32 622.4**	**32.6**	**6.52**	**19.56**	**6.52**
Canada		6.4	1.28	3.84	1.28
Unites States		57.9	11.58	34.74	11.58
N.AMERICA Total		**64.3**	**12.86**	**38.58**	**12.86**
Australia	143.0	0.1	0.02	0.06	0.02
OCEANIA Total	**143.0**	**0.1**	**0.02**	**0.06**	**0.02**

Table 22. **Emissions of various chemical forms of Hg from sewage sludge disposal in 1990s, in tonnes.**

Country	Sewage sludge Waste 1980s 10^3 t	Emissions Hg (t)	Emissions Hg^0 (gas) (t)	Emissions Hg^{++} (t)	Emissions Hg (particulate) (t)
Austria	74	0.4	0.08	0.24	0.08
Belgium	6				
Czech Rep.					
Denmark	35	0.2	0.04	0.12	0.04
Finland					
France	170	0.9	0.18	0.54	0.18
Germany	1.9				
Greece					
Italy	90	0.5	0.10	0.30	0.10
Luxemburg					
Netherlands	0.06				
Norway					
Poland					
Slovakia					
Spain					
Sweden					
Switzerland	57	0.3	0.06	0.18	0.06
United Kingdom	75	0.4	0.08	0.24	0.08
EUROPE Total	**509.0**	**2.7**	**0.54**	**1.62**	**0.54**
Hong Kong					
Japan					
Malaysia					
ASIA Total					
Canada		0.2	0.04	0.12	0.04
Unites States	759.8	1.6	0.32	0.96	0.32
N.AMERICA Total	**759.8**	**1.8**	**0.36**	**1.08**	**0.36**

Appendix A

1995 Emissions of Mercury from Major Anthropogenic Sources in Europe

estimated by the authors of this report or accepted from the national authorities, as described in p.4.2.1. and p.4.2.2.

Point source codes

Industrial code	Installation code	Emission category
11	11	Power plants
64	67	Cement production
61	631 / 632	Lead production
61	641 / 642	Zinc production
50	51, 54	Pig & iron production
32	83	Caustic soda production
14	16	Waste disposal

Country code: 01 - **UK** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Aberthaw A-Barry	51°24'	3°18'W	11	11	0.10
2	Aberthaw B-Barry	51.24	3.18W	11	11	0.25
3	Acton Lake - London	51.29	0.13W	11	11	0.02
4	Agecroft - Manchester	53.30	2.15W	11	11	0.04
5	Ballylumford	54.30	5.28W	11	11	0.06
6	Bankside - London	51.30	0.10W	11	11	0.02
7	Barking B - London	51.30	0.10W	11	11	0.02
8	Barking C London	51.30	0.10W	11	11	0.02
9	Battersea A London	51.30	0.10W	11	11	0.02
10	Battersea B - London	51.30	0.10W	11	11	0.02
11	Belfast	54.35	5.55W	11	11	0.04
12	Belvedere - London	51.30	0.10W	11	11	0.02
13	Blackburn	53.45	2.29W	11	11	0.02
14	Blackburn - Meadows	53.45	2.29W	11	11	0.02
15	Blyth A	55.07	1.30W	11	11	0.07
16	Blyth B	55.07	1.30W	11	11	0.25
17	Boold A - St. Helens	53.28	2.44W	11	11	0.01
18	Bold B - St. Helens	53.28	2.44W	11	11	0.02
19	Brighton	50.50	0.10W	11	11	0.04
20	Bromborough	53.28	2.40W	11	11	0.02
21	Brunswick Wharf - London	51.30	0.10W	11	11	0.02
22	Carmarthen Bay - Burry Port	51.42	4.15W	11	11	0.04
23	Carolina Port - Dundee	56.28	3.00W	11	11	0.02
24	Carrington - Manchester	53.20	2.15W	11	11	0.04
25	Castle Donington - Derby	52.55	1.30W	11	11	0.10
26	Chadderton B - Manchester	53.30	2.15W	11	11	0.02
27	Clarence Dock	51.27	2.35W	11	11	0.01
28	Cliff Quay -. Ipswich	52.04	1.10W	11	11	0.04
29	Cockenzie	55.58	2.58W	11	11	0.01
30	Connah's Quay	53.13	3.03W	11	11	0.02
31	Londonderry	55.00	7.19W	11	11	0.02
32	Cottam - Morton	53.24	0.48W	11	11	0.32
33	Croydon B - London	51.30	0.10W	11	11	0.04
34	Dalmarmock	55.27	3.13W	11	11	0.01
35	Deptford East - London	51.30	0.10W	11	11	0.02
36	Didcot	51.37	1.15W	11	11	0.25
37	Doncaster	53.32	1.07W	11	11	0.02
38	Drakelow A - Burton-u-Trent	52.48	1.36W	11	11	0.02
39	Drakelow B - Burton-u-Trent	52.48	0.36W	11	11	0.07
40	Drax	53.35	0.39W	11	11	0.25
41	Dunston B - Newcaslte - Tyne	54.59	1.35W	11	11	0.04

UK cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
42	Earley - Reading	51.28	0.59W	11	11	0.02
43	Eggborough - Temple Hurs	53.32	1.07W	11	11	0.25
44	Elland	53.41	1.50W	11	11	0.02
45	Fawley	50.48	1.20W	11	11	0.15
46	Ferrybridge A - Knottingle	53.43	1.14W	11	11	0.02
47	Ferrybridge B - Knottingle	53.43	1.14W	11	11	0.04
48	Ferrybridge C - Knottingle	53.43	1.L14W	11	11	0.40
49	Fiddler's Ferry - St. Helens	53.28	2.44W	11	11	0.40
50	Fullham - London	51.30	0.10W	11	11	0.02
51	Goldington - Bedfor	52.08	0.29W	11	11	0.02
52	Grain - Isle of Grain	51.28	0.42	11	11	0.04
53	Hams Hall A - Birmingham	52.30	1.50W	11	11	0.02
54	Hams Hall B - Birmingham	52.30	1.50W	11	11	0.04
55	Hams Hall C - Birmingham	52.30	1.50W	11	11	0.04
56	Hearts Head - Manchester	53.30	2.15W	11	11	0.02
57	Hastings	50.51	0.36	11	11	0.01
58	High Marnham - Lincoln	53.14	0.33W	11	11	0.02
59	Huncoat - Burnely	53.48	2.14W	11	11	0.02
60	Ince - Ellesmere Port	52.54	2.54W	11	11	0.02
61	Inverkip 1	55.39	4.49W	11	11	0.06
62	Ironbridge A - Telford	52.20	2.10W	11	11	0.02
63	Ironbridge B - Telford	52.20	2.10W	11	11	0.20
64	Keadby - Scunthorpe	53.35	0.39W	11	11	0.04
65	Kemsley	51.28	0.42	11	11	0.04
66	Kilroot 1 - Belfast	54.40	5.50W	11	11	0.02
67	Kincardine	57.51	4.21W	11	11	0.15
68	Kingsnorth - Isle of Grain	51.28	0.42	11	11	0.04
69	Kingston	50.37	2.05W	11	11	0.02
70	Kirkstall	57.50	4.20W	11	11	0.01
71	Letchworth	52.08	0.29W	11	11	0.01
72	Lister Drive	53.30	2.15W	11	11	0.01
73	Little Barford A - St. Neots	52.14	0.17W	11	11	0.02
74	Little Barford B - St. Neots	52.14	0.17W	11	11	0.02
75	Littlebrook B - London	51.30	0.10W	11	11	0.01
76	Littlebrook C - London	51.30	0.10W	11	11	0.01
77	Llynfi	53.42	1.29W	11	11	0.02
78	Longanet - Dunfermline	56.04	3.29W	11	11	0.04
79	Marchwood - Southampton	50.55	1.25W	11	11	0.03
80	Meaford A - Stone	52.54	2.10W	11	11	0.02
81	Meaford B - Stone	52.54	2.10W	11	11	0.04
82	Mexborough	53.30	1.16W	11	11	0.02
83	Neepsend - Sheffield	53.23	1.30W	11	11	0.02
84	Nechells B - Birmingham	52.30	1.50W	11	11	0.02

UK cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
85	Northfleet - Gravesend	51.27	0.24	11	11	0.04
86	North Tees C - W. Auckland	54.35	1.14W	11	11	0.04
87	Norwich	52.38	1.18	11	11	0.02
88	Nottingham	52.38	1.10W	11	11	0.04
89	Ocker Hill - Birmingham	52.30	1.50W	11	11	0.02
90	Padihan B	53.48	2.14W	11	11	0.02
91	Pembroke	51.41	4.55W	11	11	0.15
92	Plymouth B	50.23	4.10W	11	11	0.01
93	Poole Bournemouth	50.43	1.54W	11	11	0.02
94	Portishead B - Bristol	51.27	2.35W	11	11	0.02
95	Portsmouth	50.48	1.05W	11	11	0.01
96	Partciffe on Sour - L. Eato	52.58	1.10W	11	11	0.32
97	Ribble B	53.48	2.14W	11	11	0.02
98	Richborough - Ramsgate	51.20	1.25W	11	11	0.03
99	Rogerstone - Newport	51.35	3.00W	11	11	0.02
100	Roosecote - Barrow-Furness	54.07	3.14W	11	11	0.02
101	Rotherham	53.26	1.20W	11	11	0.02
102	Rugeley A	52.46	1.55W	11	11	0.10
103	Rugeley B	52.46	1.55W	11	11	0.15
104	Rye House - Harlow	51.47	0.08	11	11	0.04
105	Skelton Grange A - Leeds	53.50	1.35W	11	11	0.05
106	Skelton Grange B - Leeds	53.50	4.20W	11	11	0.07
107	South Denes	57.50	1.10W	11	11	0.02
108	Spondon	52.58	0.40W	11	11	0.02
109	Newark - Trent	53.05	0.49W	11	11	0.04
110	Newark - Trent	53.05	1.35W	11	11	0.04
111	Stella North - Newcastle	54.59	1.35W	11	11	0.04
112	Stella North - Newcastle	54.59	2.16W	11	11	0.04
113	Stourport A	52.21	2.16W	11	11	0.02
114	Stourport B	52.21	1.29W	11	11	0.02
115	Thornhill - Wakefield	53.42	1.07W	11	11	0.02
116	Thorpe March - Doncaster	53.32	0.10W	11	11	0.19
117	Tilbury A - London	51.30	0.10W	11	11	0.02
118	Tilbury B - London	51.30	0.10W	11	11	0.25
119	Ulksmouth A - Newport	51.35	3.00W	11	11	0.04
120	Ulksmouth B - Newport	51.35	3.00W	11	11	0.04
121	Wakefield	53.42	1.29W	11	11	0.04
122	Wallsall - Birmingham	52.30	1.50W	11	11	0.02
123	Watford - London	51.30	0.10W	11	11	0.02
124	West Burton A - Gainsborough	53.24	0.48W	11	11	0.32
125	West Ham - London	51.30	0.10W	11	11	0.02
126	West Thurrock - London	51.30	0.10W	11	11	0.25
127	Westwood - Leigh	51.12	0.13	11	11	0.02

UK cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
128	Willington A - Derby	52.55	1.30W	11	11	0.05
129	Willington B - Derby	52.55	1.30W	11	11	0.05
130	Woolwich - London	51.30	0.10W	11	11	0.02
131	Braehead	53.20	2.15W	11	11	0.02
132	East Yelland	51.30	0.10W	11	11	0.02
133	Commonwealth Smelting Ltd. - Avonmouth	51.31	2.42W	61	631	0.03
134	Commonwealth Smelting Ltd. - Avonmouth	51.31	2.42W	61	641	0.20
135	Associated Lead Manufacturs - Newcastle u. Tyne	54.59	1.35W	61	632	0.03
136	Billiton (UK) Ltd. - Darley Dale	52.55	1.30W	61	632	0.03
137	Britannia Refined Metals Ltd. - Northfleet	51.27	0.24	61	632	0.03
138	Capper Pass & Sons Ltd. - North Ferriby	53.44	0.31W	61	632	0.03
139	Chloride Metals - Wakefield	53.42	1.29W	61	632	0.02
140	Wilson & Jubb Ltd. - Leeds	53.50	1.35W	61	632	0.03
141	Weardale	54.35	2.13W	64	67	0.05
142	Padewsood	53.12	2.54W	64	67	0.05
143	Cauldon	53.50	1.35W	64	67	0.05
144	Aberthaw/Rhoose	51.24	3.18W	64	67	0.05
145	Long Itchington	50.30	0.10W	64	67	0.05
146	Barrington	50.30	0.10W	64	67	0.05
147	Pistone	50.30	0.10W	64	67	0.05
148	Greenhith	50.30	0.10W	64	67	0.05
149	Rochester	51.24	0.30	64	67	0.05
150	Stone	51.49	0.53W	64	67	0.05
151	Shoreham-by-sea	50.49	0.16W	64	67	0.05
152	Westbury	51.16	2.11W	64	67	0.05
153	Newport	51.35	3.00W	50	51,54	0.06
153	Port Talbot	51.36	3.47W	50	51,54	0.06
154	Scunthore	53.35	0.39W	50	51,54	0.06
155	Motherwell	55.48	4.00W	50	51,54	0.06
156	Middlesborough	54.35	1.14W	50	51,54	0.06
157	Residential Heat					1.40
158	Other Sources					9.60
	TOTAL					20.10

Country code: 02 - **FRANCE**

1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Aramon 1	$48^0 50'$	$2^0 20'$	11	11	0.04
2	Aramon 2	48.50	2.20	11	11	0.04
3	Albi	43.56	2.08	11	11	0.02
4	Ambes	45.01	0.32W	11	11	0.08
5	Ansereuilles	50.30	3.00	11	11	0.02
6	Arjuzanx	44.01	0.51W	11	11	0.02
7	Arrighi	48.37	4.43	11	11	0.02
8	Artix	43.24	0.43W	11	11	0.02
9	Beautor	44.34	0.27W	11	11	0.02
10	Bienod	49.30	0.30	11	11	0.05
11	Carling	49.10	6.43	11	11	0.02
12	Chalon II	46.47	4.51	11	11	0.02
13	Champagne	45.54	5.41	11	11	0.02
14	Commines	50.20	3.30	11	11	0.02
15	Courrieres	50.28	2.58	11	11	0.02
16	Cordemais	47.18	1.52W	11	11	0.14
17	Creil	49.16	2.29	11	11	0.02
18	Dunkerque	51.02	2.23	11	11	0.02
19	Emile - Huchet	49.10	6.43	11	11	0.04
20	Gardanne	43.27	5.27	11	11	0.04
21	Gennevilliers II	48.56	2.17	11	11	0.02
22	Grosbliederstroff	49.09	7.01	11	11	0.02
23	Harnes	50.39	3.05	11	11	0.01
24	Herserange	49.00	6.10	11	11	0.01
25	Hornaing	50.20	3.30	11	11	0.02
26	La Maxe	49.49	1.38	11	11	0.02
27	Le Bec	44.02	5.47	11	11	0.01
28	Le Havre	49.30	0.06	11	11	0.09
29	Loire-sur-Rhone	47.37	0.58W	11	11	0.05
30	Lucy III	50.20	3.30	11	11	0.02
31	Martigues - Ponteau	43.24	5.03	11	11	0.05
32	Montereau	47.51	2.34	11	11	0.05
33	Nantes/Chevire	47.14	1.35W	11	11	0.05
34	Pont-de-Claix	50.20	3.30	11	11	0.02
35	Pont-sur-Sambre	50.14	3.50	11	11	0.02
36	Porcheville A	48.50	2.20	11	11	0.02
37	Porcheville B	48.50	2.20	11	11	0.16
38	Richemont	49.49	1.38	11	11	0.02
39	Saint-Quen	48.52	2.20	11	11	0.02
40	Strasbourg II	48.35	7.45	11	11	0.02
41	Vaires	48.52	2.I38	11	11	0.02
42	Violaines	50.30	3.00	11	11	0.02

France cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
43	Vitry	48.52	2.20	11	11	0.05
44	Yainville	49.30	0.30	11	11	0.02
45	Ste. Metallurgique de Normandie - Mondeville	49.10	0.18W	50	51	0.20
46	Sollac. St. Lorraine de Lam. Cont. - Sollac - Fensch	49.49	1.38	50	51	0.10
47	Usinor-Union Siderurgique (UUS) - Dunkerque	51.02	2.23	50	51	0.10
48	UUS - Neuves Maisons	48.37	6.07	50	51	0.10
49	UUS - Longwy	49.32	5.46	50	51	0.10
50	St. Nouv. Des Acieries de Pomey - Pomey	48.37	6.07	50	54	0.10
51	Sacilor - Ac. et Lamin de Lorrain - Gandranch - Rombas	49.49	1.38	50	54	0.10
52	Sacilor - Ac. et Lamin de Lorrain - Joef - Homecourt	49.00	6.10	50	54	0.10
53	Usinor-Union - Siderurgique - Isbergues (Chatillon div.)	50.37	2.27	50	54	0.10
54	Ciments Vicat (CV) - Xeuilley	49.30	0.30	64	67	0.40
55	CV - Montelieu Vercien	47.51	2.34	64	67	0.40
56	CV - Grave de Peille	45.03	6.18	64	67	0.40
57	CV-St. Pierre le Cour	48.52	2.38	64	67	0.40
58	Cedest - Thionville	49.22	6.11	64	67	0.30
59	Mallemort	43.43	5.10	64	67	0.30
60	Origny	49.54	4.02	64	67	0.30
61	Societe Miniere et Metallurgique de Penarroya - Pas-de-Calais - Noyelles-Godault	50.17	2.46	61	631	0.10
62	" "	50.17	2.46	61	631	0.10
63	" "	50.17	2.46	61	641	0.40
64	Asturienne - France Auby - Les-Douai, Nord	50.20	3.30	61	641	0.45
65	STE des Mines et Fonderies de Zinc de la Vieille Montagne, Viviez Aveyron	44.34	2.12	61	641	0.45
66	STE Miniere et Metallurgique de Penarroya - Escaudoeuvres, Nord	46.31	2.18	61	632	0.10
67	STE Miniere et Metallurgique de Penarroya -Villefrance, Rhone	46.24	2.52	61	632	0.10
68	STE de Traitements Chimiques des Metaux - Toulouse	43.37	1.27	61	632	0.05
69	STE de Traitements Chimiques des Metaux - Bazoches-les-Gallerandes, Loiret	48.10	2.I02	61	632	0.05
70	Saint-Quen Incin. - Paris	48.52	2.20	14	16	0.65
71	Issay-les-Moulineaux	43.18	5.22	14	16	0.65
72	Ivry incin.	47.02	4.38	14	16	0.60

France cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
73	Residential Heat					0.10
74	Other Sources					8.80
TOTAL						17.60

Country code: 03 - **BELGIUM** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Hoboken, Antwerp	$51^0 13'$	$4^0 25'$	61	641	0.40
2	Beerse	51.19	4.51	61	632	0.03
3	Brussels	50.50	4.21	61	632	0.07
4	Obourg	50.28	4.01	64	67	0.20
5	La Louviere	50.28	4.01	11	11	0.04
6	Angleur - Liege	50.38	5.35	11	11	0.08
7	Charleroi	50.25	4.27	11	11	0.04
8	Mons	50.28	3.58	11	11	0.04
9	Bressoux - Liege	50.38	5.35	11	11	0.04
10	Drogenbos - Brussels	50.50	4.21	11	11	0.16
11	Farciennes - Charleroi	50.25	4.27	11	11	0.04
12	Gent	50.58	5.30	11	11	0.04
13	Gent	51.02	3.42	11	11	0.04
14	Kallo - Antwerp	51.13	4.25	11	11	0.12
15	Langerbrugge - Gent	51.02	3.42	11	11	0.04
16	Langerlo - Gent	50.58	5.30	11	11	0.12
17	Les Awris - Liege	50.38	5.35	11	11	0.12
18	Mol	51.11	5.07	11	11	0.04
19	Fontaine - Charleroi	50.25	4.27	11	11	0.04
20	sur Sambre - Charleroi	50.25	4.27	11	11	0.04
21	Peronnes	50.33	3.27	11	11	0.04
22	Brussels	50.50	4.21	11	11	0.04
23	Rodenhuize - Gent	51.02	3.42	11	11	0.16
24	Oudenaarde	50.50	3.37	11	11	0.30
25	Schelle - Antwerp	51.13	4.25	11	11	0.12
26	La Louviere	50.28	4.01	50	54	0.04
27	Gent	50.02	3.42	50	54	0.06
28	Brussels	50.50	4.21	14	16	0.10
29	Other sources					0.70
TOTAL						3.30

Country code: 04 – **LUXEMBURG** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Luxemburg	49°37'	6°08'	11	11	0.10
2	Arbed SA - Esch sur Alzette	49.37	6.08	50	51	0.08
3	Arbed SA - Differdange	49.37	6.08	50	54	0.01
4	Arbed SA - Dudelange	49.28	6.05	50	54	0.01
TOTAL						0.20

Country code: 05 – **THE NETHERLANDS** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Amsterdam/Hemweg	$52^0 21'$	$4^0 54'$	11	11	0.01
2	Buggenum/Maascentrale	51.14	5.51	11	11	0.01
3	Geertruidenbeg/Amer	51.43	4.52	11	11	0.01
4	Groningen/Hunze	53.13	6.35	11	11	0.01
5	Lelystad/Flevo	52.30	5.26	11	11	0.01
6	Rotterdam/Waalhaven	51.55	4.29	11	11	0.01
7	Utrecht/Lage Weide	52.06	5.07	11	11	0.01
8	Velsen	52.58	4.30	11	11	0.01
9	Zwolle/JHarculo	52.31	6.06	11	11	0.01
10	Maasbracht	51.08	5.54	11	11	0.01
11	Hoogovens - Ijmuiden	52.28	4.37	50	54	0.28
12	Nedstaal	51.51	4.40	50	54	0.02
13	Dordrecht	51.48	4.40	14	16	0.02
14	Den Haag	52.05	4.16	14	16	0.02
15	Rotterdam (AVR)	51.55	4.29	14	16	0.02
16	Rotterdam (ROTEB)	51.55	4.29	14	16	0.02
17	Alkmaar	52.38	4.44	14	16	0.02
18	Amsterdam	52.21	4.54	14	16	0.02
19	Zaanstad	52.27	4.49	14	16	0.02
20	Roosendaal	51.32	4.28	14	16	0.02
21	Arnhem	52.00	5.53	14	16	0.02
22	Leeuwarden	53.12	5.48	14	16	0.01
23	Leiden	52.10	4.30	14	16	0.01
24	Maastricht	50.51	5.45	64	67	0.30
25	Residential Heat					0.10
	TOTAL					1.00

Country code: 06 – Former **FRG** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
	Baden-Wuerttemberg					
1	Altbach	48°47'	9°12'	11	11	0.04
2	Gaisburg	48.47	9.12	11	11	0.04
3	Heillbronn	49.08	9.14	11	11	0.04
4	Karlsruhe/Rheinhafen	49.00	8.24	11	11	0.04
5	Mannheim	49.30	8.28	11	11	0.07
6	Marbach	48.02	8.28	11	11	0.04
7	Münster	51.58	7.37	11	11	0.04
8	Walheim	50.24	6.10	11	11	0.04
	Bayern					
9	Arzberg	50.03	12.12	11	11	0.04
10	Aschaffenburg	49.58	9.10	11	11	0.04
11	Dettingen	50.02	9.02	11	11	0.04
12	Frauenaurach	49.27	11.05	11	11	0.04
12a	Gebersdorf	49.27	11.05	11	11	0.04
13	Ingolstadt	48.46	11.27	11	11	0.04
14	Irsching	48.46	11.27	11	11	0.04
15	München - süd	48.08	11.35	11	11	0.04
16	München - nord	48.08	11.35	11	11	0.04
17	Pleiting	48.40	13.08	11	11	0.04
18	Schwandorf	49.20	12.07	11	11	0.04
19	Zolling - Anglberg	47.51	12.09	11	11	0.04
	Bremen					
20	Bremen/Farge	53.05	8.48	11	11	0.04
21	Bremen/Hagenkraftwerk	53.05	8.48	11	11	0.04
22	Bremen/Hastedt	53.05	8.48	11	11	0.04
	Hamburg					
23	Hamburg/Hafen HKW	53.31	10.03	11	11	0.04
24	Hamburg/Neuhof	53.31	10.03	11	11	0.04
25	Hamburg/Tiefstack	53.31	10.03	11	11	0.04
26	Hamburg/Wedel	53.31	10.03	11	11	0.04
	Hessen					
27	Borken	51.03	9.18	11	11	0.04
28	Frankfurt	50.06	8.41	11	11	0.04
29	Frankfurt	50.06	8.41	11	11	0.04
30	Grosskrotzenburg/Staudinger	49.52	8.39	11	11	0.04
31	Kassel	51.18	9.30	11	11	0.04
32	Wölfersheim	50.23	8.04	11	11	0.04
33	Grosskrotzenburg/Staudinger	49.52	8.39	11	11	0.04
	Niedersachsen					
34	Afferde	52,23	9,44	11	11	0.04

Former **FRG** cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
35	Emden	53.23	7.13	11	11	0.05
36	Hallendorf	52.09	9.58	11	11	0.05
37	Hannover	52.23	9.44	11	11	0.05
38	Herrenhausen	52.20	9.30	11	11	0.05
39	Lahde/Heyden	52.22	9.00	11	11	0.05
40	Landesbergen/R. Frank	52.34	9.07	11	11	0.05
41	Mehrum	52.15	10.30	11	11	0.05
42	Offleben	52.14	11.01	11	11	0.05
43	Stade/Schilling	53.36	9.28	11	11	0.05
44	Wilhelmshaven	53.32	8.07	11	11	0.05
45	Wolfsburg	52.27	10.49	11	11	0.05
	Nordhein-Westfalen					
46	Alsdorf/Anna	50.53	6.10	11	11	0.05
47	Bochum	51.28	7.11	11	11	0.05
48	Datteln	51.39	7.20	11	11	0.05
49	Dortmund/Gustav Kneppen	51.32	7.27	11	11	0.05
50	Dortmund/Harpen	51.32	7.27	11	11	0.05
51	Düsseldorf/Flingeln	51.13	6.47	11	11	0.05
52	Düsseldorf/Lausward	51.13	6.47	11	11	0.05
53	Duisburg	51.25	6.45	11	11	0.05
54	Duisburg Ruhrort	51.25	6.45	11	11	0.05
55	Elverlingsen	50.44	7.06	11	11	0.05
56	Essen	51.27	6.57	11	11	0.05
57	Fortuna II & III	50.10	8.20	11	11	0.05
58	Frimmersdorf	51.12	6.25	11	11	0.11
59	Gelsenkirchen/Bismarck	51.30	7.05	11	11	0.05
60	Gelsenkirchen/Horst	51.30	7.05	11	11	0.05
61	Golden Bergwerk	50.44	7.06	11	11	0.05
62	Hamborn	51.25	6.45	11	11	0.05
63	Herdecke/Cunowerk	51.24	7.26	11	11	0.05
64	Herne/GKW	51.32	7.12	11	11	0.05
65	Herne/Shamrock	51.32	7.12	11	11	0.05
66	Ibbenbüren	52.17	7.44	11	11	0.05
67	Köln	50.56	6.57	11	11	0.05
68	Krefeld-Verdingen	51.20	6.32	11	11	0.05
69	Leverkusen	51.02	6.59	11	11	0.05
70	Lünen/GK OST	51.37	7.31	11	11	0.05
71	Lünen/Kellermann	51.37	7.31	11	11	0.05
72	Marl	51.38	7.06	11	11	0.05
73	Marl	51.38	7.06	11	11	0.05
74	Marl	51.38	7.06	11	11	0.05
75	Möllen	51.30	7.30	11	11	0.05

Former **FRG** cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
76	Neurath	51.04	6.06	11	11	0.08
77	Niederhaussem	50.09	8.20	11	11	0.11
78	Rauxel	51.30	7.30	11	11	0.05
79	Rheinpreussen	50.40	7.10	11	11	0.05
80	Schmehausen	51.00	6.40	11	11	0.05
81	Scholven	51.00	6.40	11	11	0.11
82	Siersdorf	51.25	6.45	11	11	0.05
83	Stockum/Gersteinwerk	51.38	7.10	11	11	0.08
84	Weltheim	52.20	9.20	11	11	0.05
85	Walsum	51.32	6.41	11	11	0.05
86	Weisweiler	50.55	6.21	11	11	0.08
87	Westerholt	50.50	7.00	11	11	0.05
88	Düsseldorf/Lausward	51.13	6.47	11	11	0.05
89	Scholven F	51.20	6.30	11	11	0.05
	Rheinland-Pfalz					
90	Ludwigshafen	49.29	8.27	11	11	0.05
91	Mainz	50.00	8.16	11	11	0.05
	Saarland					
92	Bexbach/St. Barbara	49.29	7.16	11	11	0.05
93	Endorf	49.19	6.46	11	11	0.05
94	Fürstenhausen/Fenne	49.15	6.58	11	11	0.05
95	Göttelborn/Weiher	49.15	6.58	11	11	0.05
96	Wehrden	51.42	9.22	11	11	0.05
	Schleswig-Holstein					
97	Brunsbüttel	53.54	9.08	11	11	0.05
98	Kiel-Förde	54.20	10.08	11	11	0.05
99	Lübeck	53.52	10.40	11	11	0.05
	West Berlin					
100	Charlottenburg	52.32	13.25	11	11	0.05
101	Lichterfelde	52.32	13.25	11	11	0.05
102	Moabit	52.32	13.25	11	11	0.05
103	Oberhavel	52.32	13.25	11	11	0.05
104	Reuter	52.32	13.25	11	11	0.05
105	Rudow	52.32	13.25	11	11	0.05
106	Wilmersdorf	52.32	13.25	11	11	0.05
107	Alsen-Breitenburg Zemen - u. Kalk. GmbH	53.53	9.31	64	67	0.03
108	Nordcement AG	51.39	9.49	64	67	0.03
109	Hannoverische Portl. - Cementfab.	52.23	9.51	64	67	0.03
110	Teutonia Misburger	52.22	9.52	64	67	0.03
111	Nordcement AG	52.21	9.53	64	67	0.03
112	Nordcement AG	52.25	9.26	64	67	0.03

Former **FRG** cont.

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
113	Hemmoor Zement AG	53.42	9.08	64	67	0.03
114	Dyckerhoff Zementwerke AG	42.12	8.02	64	67	0.03
115	Rheinische Kalkstein-werke GmbH	51.18	6.59	64	67	0.03
116	Bonner Zementwerk AG	50.43	7.08	64	67	0.03
117	Rheinische Kalkstein-werke GmbH	50.31	6.32	64	67	0.03
118	Dyckerhoff Zementwerke AG	51.48	8.00	64	67	0.03
119	"	51.37	8.30	64	67	0.02
120	"	50.00	8.15	64	67	0.02
121	"	50.25	7.27	64	67	0.02
122	"	52.10	7.53	64	67	0.02
123	"	49.35	8.01	64	67	0.03
124	Beckumer P-ZW Bosenber	51.48	7.55	64	67	0.03
125	PZW Wotan	50.20	6.46	64	67	0.03
126	PZW Heidelberg	49.58	8.18	64	67	0.03
127	"	49.18	9.08	64	67	0.03
128	"	49.21	8.41	64	67	0.03
129	"	48.24	9.47	64	67	0.03
130	"	48.22	9.44	64	67	0.03
131	"	47.37	12.11	64	67	0.03
132	"	49.16	11.27	64	67	0.03
133	"	49.13	12.02	64	67	0.03
134	"	49.48	9.36	64	67	0.03
135	Wueritt. P-C-W Zu Lauffen	49.04	9.09	64	67	0.03
136	E. Schwenk Zement und Steinwerke	48.40	10.09	64	67	0.03
137	"	48.20	9.43	64	67	0.03
138	"	49.57	9.47	64	67	0.03
139	PZW Woessingen GmbH	49.00	8.48	64	67	0.03
140	PZW Obergimpern	49.16	9.01	64	67	0.03
141	Breisgauer P-CF Kleinkems GmbH	47.39	7.34	64	67	0.03
142	Dotterhausen	48.13	8.47	64	67	0.03
143	Suedbayer. PZW Gebr Wiesb. & Co GmbH	47.47	12.10	64	67	0.03
144	A. Bueechl Kalk u. PZW	49.00	12.9	64	67	0.03
145	PCW "Hellbach"	51.46	8.00	64	67	0.03
146	C. Mersmann Zement u.kalk GmbH	51.46	8.00	64	67	0.03
147	Phoenix ZW Krogbeumker	51.46	8.02	64	67	0.03
148	Readymix Zementwerke GmbH	51.45	8.03	64	67	0.03
149	Anneliese	51.51	8.01	64	67	0.03
150	"	51.48	8.01	64	67	0.03
151	"	51.41	8.44	64	67	0.02

Former **FRG** cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
152	Anneliese	51.37	8.29	64	67	0.03
153	ZWI-Zementwerk "Ilse"	51.41	8.44	64	67	0.03
154	PZW Seibel u. Soehne	51.35	8.20	64	67	0.03
155	"	51.35	8.21	64	67	0.03
156	Spenner Zement KG.	51.37	8.21	64	67	0.03
157	PZW Wittekind	51.36	8.21	64	67	0.03
158	H. Milke KG	51.38	8.31	64	67	0.03
159	Westdeutsche PZW u. Kalkwerke	51.38	8.31	64	67	0.03
160	Zementwerk Wetzlar	50.34	8.29	64	67	0.03
161	Kalw. u. P-CF C. Sebald Soehne	49.29	11.32	64	67	0.03
162	Solnhofer PZW	48.53	11.00	64	67	0.03
163	Maerker Zement Werk GmbH	48.48	10.41	64	67	0.03
164	Berzelius Metallhütten GmbH - Duisburg	51.25	6.45	61	641	0.90
165	Preussag AG Metall - Harlingerode	51.55	10.30	61	641	3.10
166	Preussag - Weserzink, Nordenham	53.32	8.32	61	641	0.50
167	Ruhr Zink GmbH - Datteln	51.37	7.19	61	641	0.50
168	Thyssen AG	51.29	6.43	50	54	0.05
169	"	51.28	6.43	50	54	0.05
170	"	51.28	6.45	50	54	0.05
171	"	51.25	7.10	50	54	0.05
172	"	51.31	7.07	50	54	0.05
173	Stahlwerke Roechling - Burbach GmbH	49.15	6.50	50	54	0.05
174	Ew Gesellschaft Maximillianshütte	49.29	11.45	50	54	0.05
175	Mannesmann AG	51.22	6.42	50	54	0.05
176	Stahlwerke Peine - Salzgitter AG	52.10	10.24	50	54	0.10
177	" "	52.16	10.13	50	54	0.05
178	Kloeckner Werke AG	53.08	8.41	50	54	0.05
179	Estel Hüttenwerke	51.30	7.25	50	54	0.10
180	Hoesch Hüttenwerke	51.32	7.29	50	54	0.10
181	Krupp Stahl Ag	51.23	6.43	50	54	0.05
182	AG Der Dillinger Hüttenwerke	49.21	6.44	50	54	0.10
183	Neunkirchner Eisenwerke AG	49.21	7.10	50	54	0.05
184	Duisburger Kupferhütte AG	51.25	6.44	50	54	0.10
185	Pont-A.Mousson	49.13	7.02	50	54	0.05
186	Kloecknerwerke AG	52.13	8.03	50	54	0.05
187	Bremerhaven	53.33	8.35	14	16	0.30
188	Bamberg	49.54	10.54	14	16	0.30

Former **FRG** cont.

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
189	Hamburg	53.31	10.03	14	16	0.30
190	Ingolstadt	48.46	11.27	14	16	0.30
191	Kiel	54.20	10.08	14	16	0.30
192	Krefeld	51.20	6.32	14	16	0.30
193	Marktoberdorf	47.47	10.37	14	16	0.30
194	Pinneberg	53.40	9.49	14	16	0.30
195	Wuppertal	51.15	7.10	14	16	0.30
196	Zirndorf	49.27	10.58	14	16	0.30
197	Residential Heat					1.50
198	Other Sources					2.04
	TOTAL					19.70

Country code: 07 – Former **DDR** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Boxberg	51°25'	14°34'	11	11	0.35
2	Hagenwerder	51.03	14.47	11	11	0.17
3	Lübbenau	51.57	13.58	11	11	0.13
4	Vetschau	51.48	14.06	11	11	0.13
5	Thierbach	51.10	12.29	11	11	0.06
6	Lippendorf	51.11	12.22	11	11	0.04
7	Vockerode	51.50	12.13	11	11	0.03
8	Jänschwalde	51.51	14.31	11	11	0.34
9	Tratendorf	51.33	14.25	11	11	0.03
10	Hirschfelde	50.57	14.54	11	11	0.02
11	Harbke	52.12	11.07	11	11	0.01
12	Lauta	51.27	14.06	11	11	0.02
13	Zschornewitz	51.43	12.24	11	11	0.01
14	Sonstige	51.20	12.25	11	11	0.12
15	Schwarze Pompe	51.32	14.22	11	11	0.12
16	Espenhain	51.10	12.28	11	11	0.01
17	Regis/Borna	51.06	12.25	11	11	0.01
18	Brandenburg	52.25	12.34	50	54	0.03
19	Riesa	51.18	13.18	50	54	0.02
20	Henningsdorf	52.38	13.13	50	54	0.03
21	Thale	51.46	11.02	50	54	0.03
22	V.E.B. Bergbau u.Hüttenkombinat A. Funk - Freiberg	50.55	13.20	61	641, 642	2.00
23	Karsdorf	51.16	11.39	64	67	1.00
24	Rüdersdorf	51.29	13.50	64	67	1.00
25	Bernburg	51.48	11.45	64	67	1.00
26	Deuna	51.48	11.45	64	67	0.94
27	Residential Heat					2.90
28	Other Sources					1.05
	TOTAL					11.60

Country code: 08 - **DENMARK** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Mies - Aarhusvaerket - Aarhus	56.10	10.13	11	11	0.02
2	Amagervaerket - Copenhagen	55.43	12.34	11	11	0.02
3	Asnaesvaerket IFV - Kalundborg	55.42	11.06	11	11	0.06
4	SHA - Enstedvaerket - Åbenrå	55.03	9.26	11	11	0.07
5	FI - Fynsvaerket - Odense	55.24	10.25	11	11	0.06
6	IFV - Kyndbyvaerket - Dalby	55.31	10.40	11	11	0.10
7	SEAS - Masnedövaerket - Naested	55.14	11.47	11	11	0.02
8	Nordkraft - Aalborg	57.03	9.56	11	11	0.05
9	H.C. Orstedvaerket - Copenhagen	55.43	12.34	11	11	0.02
10	Skaerbaekvaerket - Kolding	55.29	9.30	11	11	0.05
11	Stigsnaesvaerket SEAS - Skaelsskor	55.16	11.18	11	11	0.05
12	MIES - Studstrupsvaerket - Aarhus	56.10	10.13	11	11	0.05
13	Svanemöllevaerket - Copenhagen	55.43	12.34	11	11	0.02
14	NEFO - Vendsysselvaerket - Aalborg	57.03	9.56	11	11	0.06
15	Vestkraft - Esbjerg	55.28	8.28	11	11	0.05
16	A/S Aalborg Portland Cem. Fab. - Aalborg	57.03	9.56	64	67	0.20
17	Waste Disposal			14	16	1.00
18	Ind. comm. Resid. combustion					0.20
19	Other Sources					0.30
	TOTAL					2.40

Country code: 09 - **NORWAY** 1995

No.	Source name	Geographical position		Codes		Emission kg/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Cement plant, Porsgrunn	59°08'	9°39'	64	67	14.3
2	Cement plant, Tysfjord			64	67	no data
3	Ferromanganese plant, Sauda	59°39'	6°22'	50	54	5.0
4	Ferromanganese plant, Porsgrunn	59°08'	9°39'	50	54	5.0
5	Silica manganese plant, Kvinesdal	58°18'	6°58'	50	54	92.0
6	Incinerator Klementsrud - Oslo	59°55'	10°46'	14	16	12.7
7	Incinerator Haraldrud - Oslo	59°55'	10°46'	14	16	8.4
8	Incinerator Trondheim	63°25'	10°22'	14	16	8.3
9	Incinerator Årdal	61°33'	6°21'	14	16	0.10
11	Incinerator Fredrikstad	59°15'	10°55'	14	16	5.19
12	Incinerator Ål	60°38'	8°33'	14	16	3.0
13	Incinerator Harstad	68°47'	16°32'	14	16	0.184
14	Incinerator Levanger	63°44'	11°18'	14	16	0.054
15	Incinerator Sandefjord	59°08'	10°13'	14	16	0.0005
16	Incinerator Tromsø	69°39'	18°57'	14	16	0.0131
17	Incinerator Trondheim	63°25'	10°22'	14	16	0.316
18	Incinerator Ålesund	62°28'	6°12'	14	16	7.9
19	Incinerator Lenvik (Norskehavet)			14	16	2.6
28	Chlor alkali plant, Sarpsborg	59°17'	11°08'	32	83	58.93
29	Residential Heat + Other Sources					145.0
	TOTAL					**369.0**

Country code: 10 - **SWEDEN** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Sandvik - Sandviken	60.38	16.50	50	54	0.01
2	SKF Steel (Ovako Steel) - Hofors	60.38	16.50	50	54	0.01
3	SKF Steel (Ovako Steel) - Hällefors	59.46	14.30	50	54	0.01
4	Avesta	60.09	16.10	50	54	0.01
5	Bofors	59.20	18.05	50	54	0.01
6	Boxholm	58.12	15.05	50	54	0.01
7	Degefors	59.14	14.26	50	54	0.01
8	Fagersta	59.59	15.49	50	54	0.01
9	Hogfors	59.58	15.03	50	54	0.01
10	Halmstad	54.41	12.55	50	54	0.01
11	Göteborg	57.45	12.00	14	16	0.08
12	Linköping	58.25	15.35	14	16	0.08
13	Malmö	55.35	13.00	14	16	0.08
14	Stockholm	59.20	18.05	14	16	0.08
15	Uppsala	59.55	17.38	14	16	0.08
16	Uppsala	59.55	17.38	11	11	0.01
17	Göteborg	57.45	12.00	11	11	0.01
18	Malmö	55.35	13.00	11	11	0.01
19	Karlskrona	56.10	15.35	11	11	0.01
20	Kimstadt	58.33	15.58	11	11	0.01
21	Marviken	58.29	16.52	11	11	0.01
22	Norrköping	58.35	16.10	11	11	0.01
23	Stornorrfors	63.41	20.20	11	11	0.01
24	Västerås	59.18	15.05	11	11	0.01
25	Slite	57.43	18.50	11	11	0.01
26	Residential Heat					0.10
27	Other Sources					0.20
	TOTAL					0.90

Country code: 11 - **POLAND** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Siekierki - Warszawa	$52^0 15'$	$21^0 00'$	11	11	1.32
2	EL Zeran - Warszawa	52.15	21.00	11	11	1.02
3	Z.E.L. Bydgoszcz	53.16	17.33	11	11	0.23
4	EL Gorzow	51.01	18.21	11	11	0.23
5	EL Rybnik	50.07	18.30	11	11	0.29
6	EL Halemba - Ruda SL	50.15	18.59	11	11	0.23
7	EL Bytom	50.21	18.51	11	11	0.29
8	EL Zabrze	50.18	18.47	11	11	0.29
9	EL Bedzin	50.15	18.59	11	11	0.14
10	EL Szombierki - Bytom	50.21	18.51	11	11	0.06
11	EL Leg - Krakow	50.03	19.55	11	11	0.29
12	Z.E.L. Ostroleka	53.05	21.32	11	11	0.46
13	Z.E.L. Lodz	51.49	19.28	11	11	0.65
14	EL Belchatow	51.23	19.20	11	11	2.14
15	EL Konin	52.12	18.12	11	11	1.06
16	EL Patnow-Adamow	52.12	18.12	11	11	0.85
17	EL Turow-Turoszow	51.10	15.00	11	11	2.05
18	EL Jaworzno I	50.13	19.11	11	11	0.29
19	EL Jaworzno II	50.13	19.11	11	11	1.32
20	EL Jaworzno VI	50.13	19.11	11	11	0.29
21	EL Kozienice - Radom	51.26	21.10	11	11	1.05
22	EL Blachownia - Kedzierzyn	50.40	17.56	11	11	0.46
23	EL Dolna Odra - Szczecin	53.25	14.32	11	11	0.53
24	EL Lagisza - Bedzin	50.15	18.59	11	11	0.29
25	EL Polaniec - Tarnow	50.01	20.59	11	11	0.14
26	EL Siersza - Trzebinia	50.03	19.55	11	11	0.53
27	EL Stalowa Wola	50.15	18.59	11	11	1.14
28	EL Skawina - Krakow	50.03	19.55	11	11	0.60
29	EL Chorzow	50.19	18.56	11	11	0.14
30	EL Laziska - Katowice	50.15	18.59	11	11	0.62
31	EL Pomorzany - Szczecin	53.25	14.32	11	11	0.06
32	EL Czechnice - Wroclaw	51.05	17.00	11	11	0.68
33	Z.E.L. Wroclaw	51.05	17.00	11	11	0.68
34	EL Gdansk	54.22	18.41	11	11	0.06
35	EL Gdynia	54.31	18.30	11	11	0.06
36	EL Szczecin	53.25	14.32	11	11	0.06
37	CEM Ozarow	50.40	17.56	64	67	0.01
38	CEM Strzelce Op.	50.40	17.56	64	67	0.01
39	CEM Malogoszcz - Opole	50.40	17.56	64	67	0.01
40	CEM Kujawy - Bydgoszcz	53.16	17.33	64	67	0.01

Poland cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
41	CEM Gorazdze - Opole	50.40	17.56	64	67	0.01
42	CEM Rejowiec	51.06	23.18	64	67	0.01
43	CEM Groszowice - Opole	50.40	17.56	64	67	0.01
44	CEM Wysoka	50.51	20.39	64	67	0.01
45	CEM Wierzbica	51.18	22.31	64	67	0.01
46	Z.C.W. Rudniki - Czestochowa	50.49	19.07	64	67	0.01
47	H.M.N. Szopienice - Katowice	50.15	18.59	61	631. 641	0.03
48	Huta "Miasteczko"	50.15	18.59	61	631. 641	0.02
49	KGH Boleslaw - Olkusz	50.18	19.33	61	631. 641	0.03
50	Huta Cynku Tarnowskie Gory	50.28	18.40	61	641	0.02
51	Residential Heat					11.30
52	Waste Disposal			14	16	1.40
53	Other sources					0.10
	TOTAL					33.60

Country code: 12A – **THE CZECH REPUBLIC** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Pocerady	50°32'	13°35'	11	11	0.90
2	Ledvice	50.31	13.33	11	11	0.50
3	Tusimice	50.23	13.20	11	11	0.90
4	Prunerov	50.25	13.16	11	11	1.25
5	Brezova - Tisova	50.16	12.41	11	11	0.40
6	Vresova	50.09	12.38	11	11	0.20
7	Ervenice	50.35	13.40	11	11	0.05
8	Zaluzi	50.33	13.45	11	11	0.05
9	Melnik	50.33	14.25	11	11	0.90
10	Detmarovice	50.20	14.20	11	11	0.30
11	Ostrava	49.50	18.15	11	11	0.05
12	Karvina	49.50	18.30	11	11	0.05
13	Chvaletice	50.07	14.36	11	11	0.60
14	Porici	50.18	14.35	11	11	0.05
15	Hodonin	48.52	17.10	11	11	0.20
16	Novaky	49.39	13.49	11	11	0.50
17	Litvinov	50.30	13.30	11	11	0.10
18	Plzen	49.45	13.25	11	11	0.10
19	Chomutov tube works - Chomutov	50.28	13.26	50	54	0.01
20	Poldi-Snop Kladno	50.10	14.02	50	54	0.04
21	Nova Huta Klementa Gottwalda - Kunice - Ostrawa	49.50	18.15	50	54	0.02
22	TZ Trinec/Ostrava	49.50	18.15	50	54	0.12
23	Vitkovice/Ostrawa	49.50	18.15	50	54	0.04
24	Skoda/Pilzno	49.45	13.25	50	54	0.03
25	SZ Podbrezowa	49.45	13.25	50	54	0.02
26	ZDB Bohumin	49.45	13.25	50	54	0.02
27	Cement Plant (C.P.) Kraluv Dvur	50.00	14.00	64	67	0.04
28	CP Lochkov	50.00	14.00	64	67	0.04
29	CP Cizkovice	50.10	14.00	64	67	0.04
30	CP Prachovice	50.07	14.25	64	67	0.04
31	CP Hranice	49.34	17.45	64	67	0.04
32	Residential Heat					7.0
33	Other sources					0.4
	TOTAL					15.00

Country code: 12B - **SLOVAKIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Vojany	48°40'	21°10'	11	11	0.20
2	Kosice	48.44	21.15	11	11	0.05
3	Ruzomberok	49.04	19.15	11	11	0.10
4	Sonstige	49.00	19.10	11	11	0.10
5	Vojany	48.40	21.10	11	11	0.35
6	EASF Slovak Iron & Steelworks - Kosice	48.44	21.15	50	54	0.20
7	CP Cepicne	48.44	19.10	64	67	0.10
8	CP Rohoznik	48.44	19.10	64	67	0.10
9	Residential Heat					0.80
10	Other Sources					1.20
	TOTAL					3.20

Country code: 13 - **AUSTRIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Bleiberger Bergwerks - Ggailitz	46.34	13.43	61	641	0.10
2	Kindberg	47.31	15.27	50	54	0.015
3	Kapfenbeg	47.31	15.27	50	54	0.01
4	Bruck	47.18	12.49	50	54	0.015
5	Leoben	4723	15.06	50	54	0.01
6	Donawitz	47.23	15.04	50	54	0.01
7	Krems	48.25	15.36	50	54	0.01
8	Linz	48.19	14.18	50	54	0.01
9	Liezen	47.35	14.15	50	54	0.01
10	Ferlach	46.32	14.18	50	54	0.01
11	Weitersdorf	48.29	14.45	64	67	0.03
12	Kuhl	47.26	13.07	64	67	0.03
13	Gartenan	47.48	13.03	64	67	0.03
14	Niederndorf	47.39	12.14	64	67	0.02
15	Reutte	47.30	10.44	64	67	0.03
16	Weitendorf	46.50	15.20	64	67	0.03
17	Mannersdorf	47.59	16.36	64	67	0.03
18	Wien	48.13	16.22	11	11	0.06
19	Korneuburg	48.22	16.20	11	11	0.03
20	Simmering	48.20	16.00	11	11	0.03
21	Theiss	48.10	15.50	11	11	0.03
22	Timelkam	47.59	13.37	11	11	0.03
23	Timelkam - Riedersbach	47.59	13.37	11	11	0.03
24	Linz	48.19	14.18	11	11	0.03
25	Graz	47.05	15.22	11	11	0.03
26	St. Andra	46.47	14.49	11	11	0.06
27	Zeltweg	47.12	14.46	11	11	0.07
28	Waste Disposal			14	16	0.40
29	Other Sources					1.00
	TOTAL					2.20

Country code: 14 - **HUNGARY** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Wieselburg - Altenburg	47°50'	17°15'	11	11	0.05
2	Odenburg	47.36	17.01	11	11	0.05
3	Szony	47.31	18.25	11	11	0.05
4	Nyirad	47.41	17.40	11	11	0.05
5	Kaposvar	46.21	17.49	11	11	0.05
6	Petfurdo	47.11	18.22	11	11	0.05
7	Komlo	46.11	18.15	11	11	0.05
8	Maza	46.10	18.10	11	11	0.05
9	Pecs	46.04	18.15	11	11	0.10
10	Kovagoszollos	46.04	18.10	11	11	0.05
11	Oroszlany	47.28	18.16	11	11	0.13
12	Tatabanya	47.31	18.25	11	11	0.05
13	Tokod	47.46	19.08	11	11	0.10
14	Diosd	47.30	19.03	11	11	0.05
15	Budapest	47.30	19.03	11	11	0.15
16	Dunaujvaros	47.00	18.55	11	11	0.05
17	Lorinci	48.07	20.47	11	11	0.12
18	Gyongyos	47.46	20.00	11	11	0.05
19	Szolnok	47.10	20.10	11	11	0.05
20	Kazincbarcika	48.15	20.40	11	11	0.05
21	Satoraljaujhely	48.22	21.39	11	11	0.05
22	Debreczin	47.30	21.37	11	11	0.05
23	Tiszapakonya	47.56	21.20	11	11	0.10
24	Gyula	46.39	21.17	11	11	0.05
25	Pusztafoldvar	46.15	20.09	11	11	0.05
26	Mako	46.15	20.09	11	11	0.05
27	Dunaujvaros	47.00	18.55	50	51	0.06
28	Miskolc	48.07	20.47	50	51	0.04
29	Hejocsaba - Miskolc	48.07	20.47	64	67	0.15
30	Vac	47.46	19.08	64	67	0.15
31	Residential Heat					0.50
32	Other Sources					2.20
	TOTAL					4.80

Country code: 15 - **RUSSIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Kolskaya	67°55'	33°01'	11	11	0.20
2	Leningrad	59.55	30.25	11	11	1.90
3	Kirischi	58.30	31.20	11	11	0.50
4	Ladyszinskaya	49.50	24.00	11	11	0.50
5	Moscow	55.45	37.42	11	11	1.30
6	Konakowo	58.01	38.52	11	11	0.80
7	Kostroma	57.46	40.59	11	11	0.80
8	Nowomoskowsk	54.06	38.15	11	11	0.80
9	Kaszira	54.32	38.13	11	11	0.80
10	Nowoworonez	51.15	39.11	11	11	0.40
11	Woloszilograd	51.00	46.40	11	11	1.80
12	Saratow	51.30	45.55	11	11	0.40
13	Nowoczerkassk	47.25	40.05	11	11	1.40
14	Jerewan	40.10	44.31	11	11	0.50
15	Baku	40.22	49.53	11	11	0.70
16	Ali - Bairamly	39.00	49.50	11	11	0.50
17	Sainsk (Kujbyszew)	53.19	66.55	11	11	0.50
18	Perm	58.01	56.10	11	11	1.40
19	Karmanowo	55.49	34.51	11	11	0.50
20	Swerdlowsk	56.52	60.35	11	11	0.90
21	Czelyabinsk	55.12	61.25	11	11	0.90
22	Troizk	54.08	61.33	11	11	0.80
23	Magnitogorsk (Jushno-Uralsk)	53.28	59.06	11	11	1.10
24	Uralsk (Irklinski)	51.19	51.20	11	11	0.80
25	Stawropol	45.03	41.59	11	11	0.50
26	Inta	66.04	60.01	11	11	0.10
27	Vorkuta	67.27	64.00	11	11	0.10
28	Archangelsk	64.35	39.50	11	11	0.10
29	Ukrzinc lead - zink plant - Konstantinovka	48.33	37.45	61	631	0.03
30	Ukrzinc lead-zinc plant-Konstantinovka	48.33	37.45	61	631	0.05
31	Elektrozinc plant - Ordzhonikidze	42.00	43.16	61	641	0.80
32	Elektrozinc plant - Ordzhonikidze	42.00	43.16	61	631	0.12
33	Czelyabinsk	55.12	61.25	61	641	0.50
34	Alaverdi Copper Smelter & Refinery	41.08	44.40	61	641	0.40
35	Nizhniy Tagil	58.00	59.58	50	50,54	0.06
36	Magnitogorsk	53.28	59.06	50	50,54	0.06
37	Chelyabinsk	55.12	61.25	50	50,54	0.06
38	Novotroizk	51.11	58.16	50	50,54	0.06

Russia cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
39	Zlatoust	55.10	59.38	50	50,54	0.06
40	Alapayevsk	57.55	61.42	50	50,54	0.06
41	Orsk	51.13	58.35	50	54	0.05
42	Serov	59.42	60.32	50	54	0.05
43	Sverdlovsk	56.52	60.35	50	54	0.06
44	Lysva	58.07	57.49	50	54	0.06
45	Ascha	54.00	57.00	50	54	0.06
46	Beloretsk	53.59	58.20	50	54	0.06
47	Kamensk Uralski	56.29	61.49	50	54	0.06
48	Cherepovets	59.09	37.50	50	54	0.06
49	Izhevsk	56.49	53.11	50	54	0.06
50	Omutnisk	58.35	52.28	50	54	0.06
51	Leningrad	59.55	30.25	50	54	0.05
52	Kolpino	59.44	30.39	50	54	0.05
53	Olenegorsk	68.04	33.15	50	51,54	0.06
54	Moscow & Noginsk	55.45	37.42	50	54	0.05
55	Kosaya Gora & Tula	54.08	37.33	50	51,54	0.06
56	Lipetsk	52.37	39.36	50	54	0.05
57	Vyksa	54.37	39.43	50	54	0.05
58	Zaporozhye	47.50	35.10	50	54	0.05
59	Makeyevka	48.01	38.00	50	51,54	0.06
60	Konstantinovka	48.33	37.45	50	51,54	0.06
61	Taganrog	47.14	38.55	50	54	0.05
62	Zhdanov	47.05	37.34	50	54	0.05
63	Volgograd	48.45	44.30	50	54	0.06
64	Sestafoni	42.15	42.44	50	54	0.05
65	Dashkasan	40.29	46.05	50	51,54	0.06
66	Sumgait	40.35	49.38	50	54	0.05
67	Volkhov	59.54	32.15	64	67	0.17
68	Kunda	59.30	26.30	64	67	0.17
69	Belgorod	50.38	36.36	64	67	0.17
70	Volsk	52.04	47.22	64	67	0.18
71	Mikhaylovka	50.05	43.15	64	67	0.17
72	Moscow	55.45	37.42	64	67	0.19
73	Kolomna	55.05	38.45	64	67	0.17
74	Ryazan	54.37	39.43	64	67	0.17
75	Dobromino	53.00	39.00	64	67	0.17
76	Bryansk	53.15	34.09	64	67	0.17
77	Lipetsk	52.37	39.36	64	67	0.17
78	Voronezh	51.40	39.11	64	67	0.17
79	Kharkov	50.00	36.15	64	67	0.18
80	Vorkuta	67.27	64.00	64	67	0.17

Russia cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
81	Novo – Pashiysiy	58.00	59.00	64	67	0.17
82	Nizhniy Tagil	58.00	59.58	64	67	0.17
83	Nevyansk	57.34	60.10	64	67	0.17
84	Yemanzhelansk	54.50	61.22	64	67	0.17
85	Katav Ivanovsk	54.45	58.11	64	67	0.17
86	Ufa	55.46	60.08	64	67	0.17
87	Magnitogorsk	53.28	59.06	64	67	0.19
88	Novotroitsk	51.11	58.16	64	67	0.17
89	Residential Heat					33.0
90	Other Sources					26.2
TOTAL						87.70

Country code: 15A - **BELARUS** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Lukomskaya	53.51	27.30	11	11	0.07
2	Gorki	57.36	45.04	11	11	0.03
TOTAL						0.10

Country code: 15B - **ESTONIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Other Sources					0.20
	TOTAL					0.20

Country code: 15C - **LATVIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Other Sources					0.20
TOTAL						0.20

Country code: 15D - **LITHUANIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Other Sources					0.10
TOTAL						0.10

Country code: 15E - **MOLDOVA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
2	Other Sources					1.50
TOTAL						1.50

Country code: 15F - **UKRAINA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Bursztyn	54.40	20.30	11	11	1.10
2	Kanew	49.46	31.28	11	11	1.10
3	Smijew	50.00	37.00	11	11	1.20
4	Starobeszewskaya	47.05	37.34	11	11	1.50
5	Kriwoi Rog	47.55	33.24	11	11	1.20
6	Pridneprowsk	48.29	35.00	11	11	0.90
7	Kriwoi Rog	47.55	33.24	50	50,54	0.30
8	Dneprodzerzhinsk	48.30	34.37	50	54	0.30
9	Dnepropetrovsk	48.29	35.00	50	54	0.30
10	Kerch	45.22	36.27	50	51,54	0.30
11	Voroshilovsk	51.08	46.39	50	54	0.30
12	Yenakiyevo	48.14	38.15	50	54	0.25
13	Donetsk	48.00	37.50	50	51,54	0.25
14	Balakleya	49.27	36.53	64	67	0.25
15	Amvrosiyevka	47.46	38.30	64	67	0.25
16	Tokmak	47.13	35.43	64	67	0.25
17	Kramatorsk	48.43	37.33	64	67	0.25
18	Dneprodzerzhinsk/ Dnepropetrovsk	48.30	34.37	64	67	0.25
19	Kriwoi Rog	47.55	33.24	64	67	0.25
20	Amayansk	47.50	32.20	64	67	0.25
21	Novorossiysk	44.44	37.46	64	67	0.25
22	Residential Heat					15.0
23	Other Sources					10.0
	TOTAL					36.00

Country code: 16 - **IRELAND** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	ESB - Grerat Island - Dublin	$53^0 20'$	$6^0 15'W$	11	11	0.02
2	ESB - Ringsend - Dublin	53.20	6.15	11	11	0.04
3	ESB - Poolberg - Dublin	53.20	6.15	11	11	0.10
4	ESB - Tarbert	52.34	9.22	11	11	0.04
5	Tara Mines Ltd. - Navan Mine, County Meath	53.39	6.14	61	631	0.10
6	Irish Cement Ltd. - Platin County Meath	53.39	6.41	64	67	0.10
	TOTAL					0.40

Country code: 17 - **SWITZERLAND** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Liesberg	47.33	7.36	64	67	0.01
2	Laufen	47.26	7.32	64	67	0.02
3	Schinznach	47.28	8.08	64	67	0.02
4	Obersiggenthal	47.24	7.40	64	67	0.01
5	Olten	47.22	7.55	64	67	0.01
6	Holderbank - Lindegg	47.10	7.30	64	67	0.02
7	Baulmes	46.48	6.32	64	67	0.01
8	St.-Sulpice	46.31	6.34	64	67	0.02
9	Roche	46.23	6.I56	64	67	0.02
10	Interlaken	46.42	7.52	64	67	0.01
11	Därlingen	46.30	8.00	64	67	0.02
12	Beckenried	46.58	8.29	64	67	0.01
13	Brunnen	46.59	8.38	64	67	0.01
14	Niederurnen	47.00	8.40	64	67	0.01
15	Residential Heat					0.10
16	Other Sources					3.00
	TOTAL					3.30

Country code: 18 - **FINLAND** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Imatrn Voima OY - Inkoo	$60^0 00'$	$24^0 15'$	11	11	0.01
2	Imatran Voima OY - Naantali	60.28	22.05	11	11	0.01
3	Prohjolan Voima OY - Kristiinankaupunki	62.16	21.18	11	11	0.02
4	Tampereen Koupungin Sahkolaito - Tampere	61.32	23.45	11	11	0.02
5	Outokumpu OY - Kokkola	63.50	23.10	11	11	0.02
6	Vaakiluodon Voima OY - Vaasa	63.06	21.36	11	11	0.01
7	Lansi Rannikon Voima OY - Tahkoluoto Pori	61.28	21.45	11	11	0.01
8	Helsinki	60.08	25.00	50	54	0.05
9	Imatra	61.14	28.50	50	54	0.05
10	Outokumpu OY - Kokkola	63.50	23.10	61	641	0.20
11	Harjavalta	61.19	22.10	61	621	0.10
12	Pargas	60.18	22.20	64	67	0.05
13	Lappeenranta	61.04	28.15	64	67	0.05
14	Residential Heat					0.40
15	Other Sources					0.60
TOTAL						1.60

Country code: 19 - **ROMANIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Interprinderea Metalurgica de Metale Neferoase - Corsa Mica	46°09'	24°15'E	61	631	0.20
2	Interprinderea Metalurgica de Metale Neferoase - Corsa Mica	46.06	24.15	61	641	0.20
3	Cimpia Turzi	46.33	23.53	50	54	0.10
4	Kalan	45.00	23.30	50	51,54	0.10
5	Nadrag	45.00	23.30	50	51,54	0.10
6	Hunedoara	45.45	22.54	50	54	0.10
7	Buchuresti	44.25	26.07	50	51,54	0.10
8	Braila	45.17	27.58	50	54	0.10
9	Galantz	45.27	28.02	50	51,54	0.10
10	Roman	46.56	26.56	50	54	0.10
11	Medgidia	44.15	28.16	64	67	0.30
12	Fieni/Azuga	45.30	25.00	64	67	0.40
13	Bicaz	46.53	26.05	64	67	0.35
14	Turda	46.35	23.50	64	67	0.35
15	Sathmar	47.40	23.40	11	11	0.20
16	Sasar	47.39	23.36	11	11	0.20
17	Jassy	47.09	27.38	11	11	0.30
18	Bicaz	46.53	26.05	11	11	0.30
19	Klausenburg	46.33	23.53	11	11	0.15
20	Zau de Cimpie	46.33	23.53	11	11	0.70
21	Singheorghiu	46.15	24.40	11	11	0.30
22	Uioara	46.22	23.50	11	11	0.20
23	Lucacesti	46.00	26.00	11	11	0.30
24	Darmanesti	46.22	26.30	11	11	0.20
25	Ilimbav	45.35	24.40	11	11	0.30
26	Craiova	44.18	23.47	11	11	0.30
27	Buchuresti	44.25	26.07	11	11	0.20
28	Vladeni	47.24	27.02	11	11	0.20
29	Doicesti	44.57	25.40	11	11	0.30
30	Kronstadt	45.27	25.40	11	11	0.20
31	Podeni	44.57	26.01	11	11	0.20
32	Galatz	45.27	28.02	11	11	0.15
33	Braila	45.17	27.58	11	11	0.15
34	Tulcea	45.10	28.50	11	11	0.20
35	Constanza	44.12	28.40	11	11	0.30

Romania cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
36	Steierdorft	44.50	22.00	11	11	0.15
37	Reschitza	45.16	21.55	11	11	0.20
38	Parosen	45.00	23.40	11	11	0.70
39	Boita	45.00	23.30	11	11	0.20
40	Ferdinandsberg	45.35	21.15	11	11	0.20
41	Arad	46.10	21.19	11	11	0.20
42	Hunedoara	45.45	22.54	11	11	0.20
43	Gura Barza	46.22	23.30	11	11	0.20
44	Residential Heat					6.00
45	Other sources					7.00
	TOTAL					23.00

Country code: 20 - **BULGARIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Sofia	$42^0 40'$	$23^0 18'$	11	11	0.25
2	Pernik	42.36	23.03	11	11	0.25
3	Maritza III	42.01	25.50	11	11	0.25
4	Maritza - Istok	42.01	25.50	11	11	1.30
5	Reka Dewnja (Varna)	43.12	27.57	11	11	0.30
6	Rasgrad	43.25	25.50	11	11	0.25
7	Ruse	43.50	25.59	11	11	0.20
8	Kardjali	41.40	25.20	61	631	0.05
9	Kardjali	41.40	25.20	61	641	0.05
10	Plovdiv	42.08	24.45	61	631	0.05
11	Plovdiv	42.08	24.45	61	641	0.05
12	Varna	43.12	27.57	64	67	0.03
13	Pleven	43.25	24.40	64	67	0.02
14	Temelkovo	42.20	24.40	64	67	0.02
15	Dimitrovgrad	42.03	25.34	64	67	0.03
16	Sofia	42.40	23.18	50	54	0.02
17	Jelisseina	43.00	24.00	50	54	0.02
18	Pernik	42.36	23.03	50	54	0.02
19	Plovdiv	42.08	24.45	50	54	0.02
20	Kremikowzi	42.47	23.30	50	54	0.02
21	Residential Heat					2.70
22	Other Sources					1.0
	TOTAL					6.90

Country code: 21 - **GREECE** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Ptolemaida 1,2,3,4	40.29	21.43	11	11	0.08
2	Liptol	40.24	21.50	11	11	0.01
3	Kardia 1,2,3,4	40.24	21.47	11	11	0.17
4	Aminteo 1,2	40.37	21.41	11	11	0.09
5	Megalopoli 1,2,3,4	37.27	22.07	11	11	0.14
6	St. Dimitrios 1,2,3,4,5	40.23	21.56	11	11	0.21
7	E.M.M.E.L. Lavrion (closed in 1982) - Laurium Attique	38.00	23.44	61	631	0.10
8	Aspra Spitia	37.40	21.30	50	51	0.05
9	" "	37.40	21.30	50	54	0.05
10	Hag	38.30	22.30	50	51	0.05
11	"	38.30	22.30	50	54	0.05
12	Milaki	38.23	24.03	64	67	0.53
13	Volos			64	67	0.30
14	Elefsina	38.00	23.35	64	67	0.37
15	Waste Disposal			14	16	0.20
16	Residential Heat					0.60
	TOTAL					3.00

Country code: 22 - **ICELAND** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Reykjavik	$64^0 09'$	$21^0 58'W$	64	67	
2	Other Sources					
TOTAL						0.00

Country code: 23 – **ITALY** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Brindisi	40.37	17.57	11	11	0.03
2	Chivasso	45.11	7.35	11	11	0.01
3	Civitavecchia	42.05	11.47	11	11	0.01
4	Fusina	45.25	12.15	11	11	0.01
5	La Casella	43.33	10.18	11	11	0.03
6	La Spezia	44.07	9.48	11	11	0.06
7	Marghera	45.26	12.20	11	11	0.01
8	Marchera Levante	45.26	12.20	11	11	0.01
9	Marzocco	41.53	12.30	11	11	0.01
10	Milazzo (Messina)	38.13	15.33	11	11	0.01
11	Milazzo-Levante	38.13	15.33	11	11	0.01
12	Monfalcone	45.49	13.32	11	11	0.01
13	Napoli	40.50	14.15	11	11	0.01
14	Ostigilia	45.04	11.09	11	11	0.03
15	Piacenza-Levante	45.03	9.41	11	11	0.01
16	Piombino	42.56	10.32	11	11	0.01
17	Porto Corsini	45.54	8.54	11	11	0.01
18	Sulcis/Sardegna	39.13	9.08	11	11	0.01
19	Rossano	39.35	16.38	11	11	0.01
20	Tavazzano	40.50	14.15	11	11	0.01
21	Termini Imerese/Sicilia	37.59	13.42	11	11	0.01
22	Torre Valdaliga	46.14	9.51	11	11	0.03
23	Turbigo Levante	45.32	8.44	11	11	0.03
24	Vado Ligure	44.16	8.26	11	11	0.04
25	Piombino 1 & 2	42.56	10.32	11	11	0.01
26	Brindisi 4	40.37	17.57	11	11	0.01
27	Fusina 4	45.25	12.15	11	11	0.01
28	Rossano 3 & 4	39.35	16.38	11	11	0.01
29	Termini Imerese	37.59	13.42	11	11	0.01
30	Melilli 1 & 2	37.12	15.08	11	11	0.01
31	Morto Toile 1	41.05	9.37	11	11	0.01
32	Tavazzano 1	40.50	14.15	11	11	0.01
33	Samin S.p.A. – Porto Vesme	39.12	8.23	61	631	0.01
34	Samin S.p.A. – Porto Vesme	39.12	8.23	61	641	0.65
35	Pertusola Sud S.p.A. – Crotone	39.05	17.08	61	641	0.05
36	Italpiombo – Arcola	44.07	9.48	61	632	0.01
37	Nissometal S.p.A. – Nissoria	37.39	14.28	61	632	0.01
38	Pimbiffera Bresciana di Guerini Aldo – Maclodio	45.33	10.13	61	632	0.02
39	Piomboleghe – Brugherio	45.28	9.12	61	632	0.01
40	Sarpi S.p.A. – Borgo S. Siro	45.24	11.53	61	632	0.01

Italy cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
41	Tonolli Grezzi S.p.A. – Paderno Dugnano	45.28	9.12	61	632	0.02
42	Tonolli Sud Grezzi S.p.A. – Marcianise	43.18	10.31	61	632	0.01
43	Aosta	45.43	7.19	50	51	0.02
44	Aosta	45.43	7.19	50	54	0.03
45	Torino	45.04	7.40	50	51	0.02
46	Torino	45.04	7.40	50	54	0.03
47	Novi L	44.46	8.47	50	51	0.02
48	Novi L	44.46	8.47	50	54	0.03
48	Dalmine	45.30	10.00	50	51	0.02
50	Dalmine	45.30	10.00	50	54	0.03
51	Sesto S. Giovanni	45.33	10.13	50	51	0.02
52	Sesto S. Giovanni	45.33	10.13	50	54	0.03
53	Mailand	45.33	10.13	50	51	0.02
54	Mailand	45.33	10.13	50	54	0.03
55	Maghera	45.26	12.20	50	51	0.02
56	Maghera	45.26	12.20	50	54	0.03
57	Genua	44.24	8.56	50	51	0.02
58	Genua	44.24	8.56	50	54	0.03
59	Piombino	42.56	10.32	50	51	0.02
60	Piombino	42.56	10.32	50	54	0.03
61	Terni	42.34	12.39	50	51	0.02
62	Terni	42.34	12.39	50	54	0.03
63	Bagnoli	41.42	14.28	50	51	0.02
64	Bagnoli	41.42	14.28	50	54	0.03
65	Tarent	40.28	17.15	50	51	0.02
66	Tarent	40.28	17.15	50	54	0.03
67	Merone	45.47	9.15	64	67	0.15
68	Calusco d'Adda	45.18	7.53	64	67	0.15
69	Bergamo	45.42	9.40	64	67	0.15
70	Como	45.48	9.05	64	67	0.10
71	Casale M	45.08	8.27	64	67	0.15
72	Arquata SCR	44.42	8.53	64	67	0.10
73	Ravenna	44.25	12.12	64	67	0.15
74	Modena	44.39	10.55	64	67	0.15
75	Livorno	43.33	10.18	64	67	0.15
76	Greve	42.56	10.32	64	67	0.15
77	Spoleto	42.44	12.44	64	67	0.15
78	Scafa	42.27	14.13	64	67	0.15
79	Segni Colleferro	40.59	12.50	64	67	0.15

Italy cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
80	Napoli	40.50	14.15	64	67	0.15
81	Barletta	41.20	16.17	64	67	0.15
82	Bari	41.07	16.52	64	67	0.15
83	Vibo Valentia	38.40	16.06	64	67	0.15
84	Messina	38.13	15.33	64	67	0.15
85	Palermo	38.08	13.23	64	67	0.10
86	Syrakus	37.04	15.18	64	67	0.15
87	Cagliari	39.13	9.08	64	67	0.15
88	Waste Disposal			14	16	1.00
89	Residential Heat					2.80
90	Other Sources					4.50
	TOTAL					13.20

Country code: 24 - **PORTUGAL** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Maceira & Outao	39.41	8.53	64	67	0.70
2	Other Sources					0.80
	TOTAL					1.50

Country code: 25 - **SPAIN** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Asturiana de Zinc S.A. - San Juan de Nieva	$43^{0}33'$	$5^{0}55'$	61	641	0.80
2	Espanola del Zeinc S.A. - Cartagena	37.36	0.59W	61	641	0.30
3	Metal Qujimica del Nervion S.A. - Axpe - Bilbao	43.15	2.56W	61	641	0.10
4	Compania la Cruz S.A. - Linares	38.05	3.38W	61	631	0.07
5	Sociedad Minera y Metallurgica de Penarroya - Espana A.S. - Cartagena	37.36	0.59W	61	631	0.10
6	Antonio Casas S.A. - Barcelona	41.25	2.10	61	632	0.01
7	Jose Ballesteros Peinado - Pulianas	37.10	3.3W	61	632	0.01
8	Perdigones Azor, S.A. - Espinardo	37.59	1.08W	61	632	0.01
9	Ensidesa S.A. - Aviles	43.33	5.55W	50	52,54	0.07
10	Ensidesa S.A. - Gijon	43.32	5.40W	50	52,54	0.06
11	Iron Industry - Leon	42.35	5.34W	50	51	0.07
12	Bilbao	43.15	2.56W	50	54	0.07
13	Vizcaya	43.15	2.56W	50	51,54	0.08
14	Ojos Negros	40.44	1.30W	50	51,54	0.08
15	Sagunto	39.40	0.17W	50	54	0.07
16	Cementos del Cantabrico A.S. - Gijon	43.32	5.40W	64	67	0.25
17	Tudela la Farge A.S. Oviedo	43.21	5.50W	64	67	0.25
18	Olazagutia	43.00	2.20W	64	67	0.15
19	Lemona	43.13	2.46W	64	67	0.15
20	San Sebastian	43.19	1.59W	64	67	0.15
21	La Robla	42.40	4.00W	64	67	0.15
22	Oural	42.43	7.27W	64	67	0.15
23	Toral de los Vados	42.32	6.47W	64	67	0.10
24	Venta de Banos	41.55	4.30W	64	67	0.15
25	Els Monjos	40.30	2.00W	64	67	0.10
26	San Vincente dels Horts	41.14	1.49	64	67	0.10
27	Morata de Jalon	41.28	1.28W	64	67	0.10
28	Vallaluenga	40.02	3.54W	64	67	0.15
29	Castillejo	40.42	6.39W	64	67	0.15
30	Vicalvaro	40.24	3.35W	64	67	0.15
31	San Vincente del Raspeig	38.50	0.26W	64	67	0.15
32	Burjasot	39.33	0.26W	64	67	0.15
33	Villcarca	41.14	1.49	64	67	0.15

Spain cont.:

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
34	Puentes	37.44	1.50W	11	11	0.85
35	Teruel	42.21	1.06W	11	11	0.85
36	Meirame	43.13	7.17W	11	11	0.45
37	Compostilla	43.00	7.00W	11	11	0.45
38	Residential Heat					2.10
39	Other Surces					3.90
TOTAL						13.20

Country code: 26 - **YUGOSLAVIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Sour Rudarsko - Metalursko - Hemijski Kombinat Olava i Cinka "Trepce" - Kosovska Mitrovica	42.54	20.52	61	631	0.10
2	"Trepce" - Kosovska Mitrovica	42.54	20.52	61	641	0.03
3	"Zorka" – Sabac	44.45	19.41	61	641	0.01
4	RTB Bor-Rudarsko - Topionicarski Basen – Bor	44.05	22.06	61	641	0.16
5	Smederewo	44.40	20.56	50	51,54	0.10
6	Sururac	42.40	18.07	11	11	0.83
7	Elemir	45.15	19.51	11	11	0.83
8	Sabac	44.45	19.41	11	11	0.82
9	Smederevo	44.40	20.56	11	11	0.82
10	Residential Heat					0.60
11	Other Sources					2.30
	TOTAL					6.60

Country code: 26A - **CROATIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Other Sources					0.30
	TOTAL					0.30

Country code: 26B – **BOSNIA-HERZEGOVINA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Banja Luka	44.47	17.11	11	11	0.07
2	Zenica	44.11	17.53	11	11	0.07
3	Kakanj	44.10	18.20	11	11	0.06
TOTAL						0.20

Country code: 26C - **MACEDONIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Other Sources					1.50
TOTAL						1.50

Country code: 26D - **SLOVENIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Trifail	45.48	15.58	11	11	0.15
2	Cilli	45.48	15.58	11	11	0.15
3	Other Sources					0.30
	TOTAL					0.60

Country code: 27 - **ALBANIA** 1995

No.	Source name	Geographical position		Codes		Emission, t/y
		Latitude	Longitude	Ind.	Instal.	Total Hg
1	Valona	40.29	19.29	11	11	0.04
2	Fier	40.44	19.33	11	11	0.04
3	Korcë	40.38	20.44	11	11	0.04
4	Tirana	41.20	19.49	11	11	0.04
5	Cërrik	41.01	20.02	11	11	0.04
6	Other Sources					0.10
TOTAL						0.30

SPECIE	Emission profiles of Hg from Anthropogenic Sources in Europe, 1995 (in Tonnes / Year)											
	Coal Combustion		**Oil Combustion**	**Cement production**	**Non-Ferrous Metals**		**Pig & Iron**	**Caustic Soda**	**Waste Disposal**	**Other**	***Average***	**Information / Source**
	Power Plants	Residential Heat			Lead	Zinc						
Hg^{0} (gas)	0,5	0,5	0,5	0,8	0,8	0,8	0,8	0,7	0,2	0,8	*0,64*	
Hg^{2+}	0,4	0,4	0,4	0,15	0,15	0,15	0,15	0,3	0,6	0,15	*0,285*	Modified, Pacyna, 1998
Hg (particulate)	0,1	0,1	0,1	0,05	0,05	0,05	0,05	0	0,2	0,05	*0,075*	
Codes	11 11		11 11	64 67	61 631, 632	61 641, 642	50 51, 54	32 83	14 16			

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ABSTRACT

Our knowledge of mercury fluxes on a global scale is still incomplete. The above presented estimates for Europe and North America seem to contribute less about 25 % to the global anthropogenic emissions of the element to the atmosphere. The majority of the remaining emissions originate from combustion of fossil fuels, particularly in the Asian countries including China, India, and South and North Korea.

Even less and very controversial information is available on emissions of mercury from natural sources, including volatilization of the element from terrestrial and aquatic surfaces. In general, it is assumed that natural emissions of the element are about 3000 t/year, thus contributing more 60 % to the total global emissions of mercury. However, much work needs to be done in order to verify the above estimate.

NORWEGIAN TITLE
Assessment of emissions/ discharges of mercury reaching the Arctic environment

KEYWORDS		
Mercury	Emission	Anthropogenic source

ABSTRACT (in Norwegian)

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