The Convention for the Protection of the Marine Environment of the North-East Atlantic (the "OSPAR Convention") was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Union and Spain.

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède et la Suisse et approuvée par l'Espagne et l'Union européenne.

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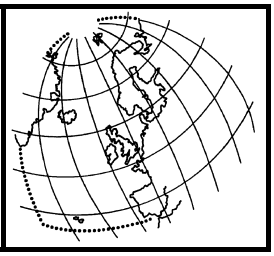


OSPAR Background Document on Mercury and Organic Mercury Compounds

Contents

SECRETARIAT NOTE:

This OSPAR background document was prepared by the UK (as lead country) in the 1999/2000 intersessional period and endorsed by OSPAR 2000 for publication on the OSPAR web site. Actions recommended in this background are taken into account, as appropriate, in the work of OSPAR.

A review statement on mercury and organic mercury compounds (Publication 400/2009) was adopted in 2009, highlighting new developments since the adoption of the Background Document

1. BASIS AND RATIONALE FOR ACTION

The objective stated in the OSPAR Strategy with regard to Hazardous Substances ('the Strategy'), which was adopted in Sintra in 1998 and endorsed by Ministers is:

> "*to prevent pollution of the maritime area by continuing to reduce discharges, emissions and losses of hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances*".

Setting out the basis for OSPAR's work for achieving this objective, the Strategy also includes a timeframe which states that:

> "*every endeavour will be made to move towards the target of cessation of discharges, emissions and losses of hazardous substances by the year 2020*".

Mercury and organic mercury compounds are on the OSPAR List of Chemicals for Priority Action (cf. Annex 2 of the Strategy), and the OSPAR Action Plan for 1998 - 2003 shows that the UK is the lead country for drawing up a background document on mercury.

This background document addresses this obligation and has the following aims:

- identifying the main sources of mercury and its various pathways into the marine environment;
- reviewing the various controls to limit discharges, emissions and losses of mercury;
- assessing what further activities should be undertaken by OSPAR, or other relevant international organisations, in order to achieve the various OSPAR commitments.

2. STRUCTURE OF THE BACKGROUND DOCUMENT

This background document takes into account the "Interim Guidance on how to address Hazardous Substances for Priority Action" agreed at OSPAR 1999 (cf. Annex 7 of OSPAR 99/15/1) and generally uses the basic structure for OSPAR background documents outlined in this document.

3. SIGNIFICANT SOURCES OF MERCURY AND RELEVANT PATHWAYS TO THE MARINE ENVIRONMENT

3.1 Forms of Mercury in the Environment

Mercury is classed as a heavy metal and has a high toxicity to both man and biota. As an elementary substance, mercury is persistent and cannot be degraded into harmless products. It will therefore be permanently recycled in the physical, chemical and biological processes in the environment. Metallic mercury can be oxidised to mercury ions which have a high affinity to sediments and which are easily transformed in the environment into mercuric ions. Many mercuric salts are very soluble in water. Mercury can also be transformed by biochemical and biological reactions into more toxic organic compounds (e.g. methyl mercury). In the environment, mercury mainly occurs as elemental mercury and as inorganic mercury compounds (chlorides, hydroxides, oxides and sulphides). For ease of reference, this document will subsequently refer to mercury, whilst recognising that mercury can exist in various forms (i.e. both elementary mercury and mercury compounds in any physical state).

3.2 Sources of Mercury

Several comprehensive reports on mercury have been published which review the various sources of mercury (e.g. Risk Reduction Monograph No 4: Mercury OECD Paris 1994; Integrated Criteria Document Mercury; RIVM 1995). This background document also refers to a Research Report "Mercury in the UK" commissioned by the UK Department of the Environment in 1996.

3.2.1 Global Sources of Atmospheric Mercury

In order to put the anthropogenic emissions, discharges and losses of mercury into perspective, and to acknowledge that mercury from natural sources will also be deposited in the OSPAR Convention Area, an estimation of the global sources of mercury[1] is given in Table 3.1, where natural sources of atmospheric mercury emissions are compared with the major anthropogenic sources.

Table 3.1 Comparison of Anthropogenic and Natural Sources of Atmospheric Mercury Emissions

Typical quantity emitted to atmosphere (t a^{-1})			
Natural sources		**Anthropogenic sources**2	
Windblown dust	50	Coal combustion	2 100
Seasalt spray	20	Lead production	10
Volcanoes	1 000	Copper/nickel production	120
Forest fires	20	Refuse incineration	1 200
Continental particulates	20	Fuel wood combustion	180
Continental volatiles	610	Chlor-alkali	7
Marine sources	770		
Total	**2 500**	**Total**	**3 600**

3.2.2 Emissions and Discharges from Industrial Activity

The following industry sectors have been identified in various UK reports as having the potential to release mercury to the environment. Of these, landfill of refuse, incineration of refuse and combustion of coal and wood are the main sources. Other industrial emissions contribute to a smaller extent. Norway has reported that ferromanganese production has been found to be a significant source of emissions and represents the main point source of emissions in Norway. The Netherlands has pointed out that the offshore industry is also a significant source of mercury.

- refuse landfill
- power generation by coal combustion
- cement manufacture
- chlor-alkali production
- iron and steel production
- by-product coke production
- lime manufacture
- paper and pulp industry
- copper/nickel production
- petroleum refining
- refuse incineration
- primary lead and zinc smelting
- secondary mercury production
- titanium dioxide manufacture
- power generation by fuel oil combustion
- phosphate production
- processing of and power generation from natural gas
- wood combustion
- carbon black production
- waste incineration and waste treatment

1 Nriagu, J. O. (1989): Natural versus anthropogenic emission of trace metals to the atmosphere. *In*: Pacyna J M and Ottar B (Eds): Control and Fate of Atmospheric Trace Metals. Kluwer Academic Publishers, Dordrecht, The Netherlands.

2 Mercury emissions to the atmosphere from landfills has not been included due to lack of data.

3.2.3 Emissions and Discharges from the Use of Mercury in Products

Mercury enters the environment from the intentional use of mercury in man-made products3. The main product sources are as follows:

- dental amalgam;
- batteries;
- biocides, pesticides and fertilisers;
- industrial and control instruments;
- laboratory and medical instruments;
- lighting appliances.

3.2.4 Mercury in Waste Streams

Mercury will also occur in the following waste streams (although a large part of the mercury that enters these waste streams is most likely to arise originally from products and industrial sources):

- municipal solid waste;
- clinical waste;
- municipal waste water and sewage sludge;
- crematoria;
- agricultural manure;
- contaminated sediments/dredged spoil.

3.2.5 Mercury Deposited as Waste

Mercury occurs in the waste products arising from a number of activities, industries and industrial processes, including the use of products intentionally containing mercury. The risks of mercury to the environment are well-known. Wastes put into landfills are subject to special conditions and controls to limit the leaching and evaporation of mercury into the environment. Volatilisation of mercury cannot be easily avoided. The main industries concerned in the UK are:

- chlor-alkali production;
- paper and pulp industry;
- phosphate production;
- primary lead and zinc smelting;
- coal-fired power stations;
- industrial coal combustion;
- domestic coal combustion.

3.2.6 Transboundary Sources of Mercury

Mercury can travel for substantial distances in the atmosphere and the work carried out on heavy metals under the UN/ECE Convention on Long-range Transboundary Air Pollution is currently addressing this issue. It is therefore very likely that mercury originating from non-OSPAR countries will constitute a significant source of mercury inputs to the OSPAR maritime area. Also, natural sources of mercury are likely to enter the maritime area by the transboundary route.

3 In Denmark, this source is responsible for 84% of the total anthropogenic emissions to air, water, soil and landfill.

3.2.7 Pathways to the Marine Environment

A detailed analysis of the specific pathways to the marine environment of the sources mentioned above in 3.2.1 to 3.2.6 is generally beyond the scope of this background document, but is covered to some extent in the sections on quantification of sources and the examination of existing measures and their effectiveness. However, if mercury does reach the marine environment from these sources it will generally do so via rivers, or via the atmosphere, and estimates of inputs from these sources are given in Section 5.1 and 5.2.

4. QUANTIFICATION OF SOURCES

To prioritise future actions to be taken by OSPAR, it is necessary to try and get some indication of the actual amounts of mercury coming from the sources mentioned above. However, it should be recognised that the figures will not necessarily reflect the actual current situation. A lot of the data quoted in this document comes from investigations carried out some years ago, often in specific countries, and it should also be borne in mind that the situation may well vary from country to country. However, the figures quoted should give a reasonable indication of what sources are significant.

4.1 Quantification of Emissions from Industrial Sectors

In order to identify and prioritise future OSPAR actions to control mercury, it is necessary to get accurate and up to date figures for emissions, discharges and losses of mercury from the sources listed above. However, although recent data is not readily available, it is possible to get an indication of the relative contributions made by various industrial sectors from reports quoting figures from the early and mid nineties. Table 4.1 gives a picture of emissions from the main industrial sources in the UK. It should be noted that the sector categories used in Table 4.1 were taken from the EC CORINAIR SNAP categories, which changed between 1994 and 1997.

Table 4.1 National Atmospheric Emissions Inventory - UK Emissions of Mercury (tonnes per annum)

Sector	**1995**	**1996**	**1997**	**% in1997**
Public Power	4,1	2,5	1,6	13%
Public Power (waste)	0,2	0,2	0,8	6%
Petroleum Refining Plants	0,0	0,0	0,0	0%
Other Combustion & Transport	0,0	0,0	0,0	0%
Residential Plant	1,0	1,0	0,9	7%
Commercial, Public & Agricultural Combustion	0,2	0,2	0,2	1%
Iron & Steel Combustion	0,3	0,3	0,3	2%
Other Combustion Industry	1,6	1,3	1,2	10%
Non-Ferrous Metal	2,3	2,7	3,2	26%
Glass Production	0,1	0,1	0,1	1%
Processes in Industry4	4,2	2,4	1,1	9%
Iron & Steel	0,8	0,7	0,8	6%
Combustion (road transport)	0,0	0,0	0,0	0%
Other Mobile Sources & Machinery	0,0	0,0	0,0	0%
Railways	0,0	0,0	0,0	0%
Landfill	0,4	0,4	0,4	3%
Waste Incineration	1,5	1,0	0,5	3%
Cremation (assuming 3g Hg per corpse)	1,3	1,3	1,3	11%
TOTAL (ktonnes Hg)	**18,1**	**14,3**	**12,6**	**100**

4 This category includes emissions from the chlor-alkali industry which make a significant contribution to the totals.

The "Integrated Criteria Document Mercury" for RIVM quotes Dutch figures (tonnes per annum) for the major sources in 1990 shown in Table 4.1.1. Norway has reported that its three ferro-manganese plants emitted 115 kg of mercury to air in 1998.

Table 4.1.1 Main Industrial Sources of Mercury in the Netherlands - 1990

Source	**Air (t/year)**	**Water (t/year)**
Chlor-alkali Industry	0,8	0,05
Phosphorus fertilisers		0,37
Natural Gas	0,06	
Oil extraction		0,04
Processing metal ores	0,38	0,036
Oil refineries	0,2	0,04
Coal Combustion	0,4 - 0,7	
Other		0,09

4.1.1 Quantification of Emissions from the Chlor-Alkali Industry

Since 1982, data and information on mercury losses from the chlor alkali industry are being compiled, up-dated and published by OSPAR on an annual basis. These reports show, *inter alia*, the losses of mercury to air (from all mercury cell plants operated by Contracting Parties in the Convention area), water and products (from those mercury cell plants operating in the drainage area of the North East Atlantic). The totals of these losses for 1997, taken from the latest published OSPAR Report on Mercury Losses from the Chlor-Alkali Industry (1982 - 1997), are shown in Table 4.1.2.

Table 4.1.2 Losses of mercury to air, water and products in mercury cell chlor-alkali plants operated by Contracting Parties in 1997

Losses to air (tonnes)	**Losses to water (tonnes)**	**Losses to products (kg)**
7,468	0,502	0,505

4.1.2 Quantification of Emissions from the Offshore Industry

The OSPAR Working Group on Sea Based Activities has provided some limited data on discharges of mercury from offshore installations (cf. Table 4.1.3 below). Information on emissions of mercury from the offshore industry is currently not available within OSPAR.

Table 4.1.3 Discharges of heavy metals (tonnes) via produced water by offshore installations
(source: provisional data in documents SEBA 99/9/1 and SEBA 00/10/3)

Contracting Party	**total amount of Hg discharged/year (tonnes)**
Netherlands 1996	0,0185
Norway 1996	0,019
Norway 1998	0,036
UK 1999	0,015

5 1999 figures from The Netherlands: 2 kg via production water.

4.2 Quantification of Emissions from the Use of Mercury in Products

An estimate of the amounts of mercury coming from products in the UK and their route of disposal, taken from the report "Mercury in the UK", is shown in Table 4.2. It should be noted that the figures for some products will be considerably lower in 1999 due to changing management practices.

Table 4.2 Emissions from the Use of Mercury in Products **(tonne Hg/year)**

Use	Atmosphere	Sewer	Land	Landfill[(a)]	Other	Total
Dental amalgam	0,32	6,9	0,19	-	11,5[(b)]	**19,0**
Batteries	0,01	<0,01	-	2,05	2,37[(c)]	**4,44**
Biocides and pesticides	0,01	<0,01	9,00	-	-	**9,01**
Industrial and control instruments	nd	nd	nd	nd	nd	**nd**
Laboratory and medical instruments	nd	nd	nd	nd	1,00[(d)]	**1,00**
Lighting	0,04	-	-	2,40	1,60[(e)]	**4,04**
Total	**0,38**	**6,91**	**9,19**	**4,45**	**16,5**	**37,5**

Notes:
(a) Wastes discharged to landfill from the point of production.
(b) Includes mercury sent for recycling and disposed to the clinical waste stream.
(c) End of life batteries disposed to the municipal waste stream.
(d) Disposed to the clinical waste stream.
(e) Disposed to the municipal waste stream.
nd no data

4.2.1 Quantification of the Amounts of Mercury Amalgam

Mercury amalgam is one of the most significant product sources of mercury. It has been estimated that approximately 19 tonnes of mercury per annum are used for amalgam in the UK. Some 20 percent of this is actually put into teeth, and the remainder may either be discharged to sewer, collected in an amalgam separator device attached to the dental chair, or enter a solid waste stream for either disposal or recycling.

However, the mercury in amalgam is in a bound insoluble form which is not biologically available, and therefore is unlikely to pose a significant problem to the marine environment unless subjected to particular conditions which would make it available, such as might occur in conditions where abrasion takes place or in sewage sludge when it is incinerated or used as a soil conditioner.

4.2.1.1 Indirect Emissions from Cremation and Burial

Mercury may enter the environment as a result of either the cremation or burial of cadavers. The mercury emitted from crematoria arises from the volatilisation of the dental amalgam in the teeth of the corpses. Emissions are currently increasing and are likely to continue to increase until the replacement of amalgam for filling teeth by other materials has been phased in. It has been estimated that in the UK, crematoria give rise to approximately 1,32 tonnes of Hg / year being emitted to atmosphere and 0,03 tonnes of Hg / year being deposited on land as ash. However, these figures are dependent on a high estimate of mercury in fillings per corpse, and that the mercury retention in crematoria (e.g. in ashes) is in the order of 10%. Germany reports that releases from the crematoria sector are in the range of 0,048 - 0,168 tonnes per year.

4.2.2 Quantification of the Amounts of Mercury used in Batteries

Since January 1994, significant quantities of mercury are used in the UK only in one type of battery, i.e. the mercury (II) oxide button cell, which constitutes 1% of all batteries sold and contains on average 30% mercury by weight when finished.

The quantity of mercury used in the production of batteries was estimated to be 15 tonnes / year, of which 14,1 tonnes (or 94%) was used in the production of mercury oxide cells.

Estimates of emissions from the manufacture of mercury oxide cells have been made based upon monitoring information. Discharges to the atmosphere and sewer were approximately 0,014 and 0,005 tonnes Hg / year respectively. Solid wastes from the manufacture of cells were landfilled together with end of life batteries returned by users. An estimated 2,05 tonnes of Hg / year was landfilled.

4.2.3 Quantification of the Amounts of Mercury used in Biocides and Pesticides

The production, storage and sale or supply of pesticides containing mercury was banned in 1992. The following applications of mercury-based compounds have been addressed:

- use in paints;
- use in cosmetics;
- use in agriculture.

Council Directive 89/677/EEC regulates the following applications of mercury compounds:

- marine anti-fouling paints;
- wood preservation;
- textile treatment;
- industrial wastewater treatment.

Such applications are no longer permissible and EC Member States had to implement appropriate controls eighteen months from the date of the adoption of the Directive. It is therefore estimated that although there may be a small residual use of these products, this will keep decreasing and mercury from these products does now not represent a significant source.

4.2.4 Quantification of the Amounts of Mercury used in Industrial and Control Instruments

Mercury is an excellent conductor of electrical current and as such has a variety of electrical applications. The following types of electrical switches and valves may contain mercury, depending upon their mode of operation:

- Level switches — when switching on or off is induced by movement;
- Multipoled switches — used in machinery with moving parts;
- Thermo switches — or thermostat switches;
- Mechanical switches — use for the frequent switching of an electrical current;
- Mercury arc-rectifiers — gas filled valves used in welding and special high power electrification equipment.

The quantities of mercury used in individual items are relatively large when compared with other applications, e.g. lighting (cf. section 4.2.6). A typical fluorescent light will contain between 10 and 20 mg of mercury; whereas a single mercury arc rectifier may contain 100 to 500 g.

There is only limited information available in the UK on the use of mercury in the manufacture of this group of products and this information is insufficient to allow reliable estimates to be made for the quantity of mercury

used in the UK in this group of products. Data reported from other countries for the manufacture of electrical switches indicate a mercury use of 0,6 tonnes in Germany (1985) and 2,5 tonnes in Sweden (1988).

4.2.5 Quantification of the amounts of Mercury used in Laboratory and Medical Instruments

Mercury is commonly used in laboratory and medical instruments such as clinical thermometers, sphygmomanometers and barometers.

In the UK, approximately 1 million thermometers are purchased annually for use in the National Health Service (NHS), indicating that the quantity of mercury contained in thermometers purchased for NHS use is approximately 1 tonne per annum. No information is available for the number of thermometers in domestic use. Data for sphygmomanometers is limited. A preliminary figure of 10,2 tonnes is estimated to be contained in these instruments. No data is currently available regarding mercury consumption and use in barometers.

4.2.6 Quantification of the Amounts of Mercury used in Lighting

Most of the information available on the mercury content of lighting is on fluorescent discharge lamps, although it should be noted that mercury is also used in three other types of discharge lamp:

- high pressure mercury vapour lamps;
- metal halide lamps;
- low and high pressure sodium lamps.

Fluorescent lamps contain 20 mg mercury, metal halide lamps contain 45 mg of mercury and sodium lamps contain 9 mg of mercury. The report "Mercury in the UK" estimates the following emissions from the manufacture and use of fluorescent lamps.

Compartment	**Quantity (tonnes mercury per annum)**
Atmosphere	0,04
Landfill	2,4
Municipal waste	1,6
Total	**4,04**

4.3 Quantification of Mercury in Waste Streams

An estimate of the amounts of mercury in waste streams in 1990, taken from the report "Mercury in the UK", is shown in Table 4.5. It should be noted that the figures for some products will be considerably lower in 1999 due to changing management practices. The "Integrated Criteria Document Mercury" for RIVM reports that in the Netherlands, 0,48 tonnes of mercury is added to agricultural land through the application of animal manure.

Table 4.3.1 Mercury in Waste Streams

Source	**Quantity tonnes/year**
Municipal waste incineration	2,2
Sewage sludge incineration	<0,1
Clinical waste incineration	8,2
Crematoria	4,0
Total	**14,4**

Considerable amounts of mercury are also be present in sediments removed in dredging activities, as shown by the data in Table 4.3.2, which were taken from the Annual OSPAR Reports on Dumping of Wastes at Sea in 1995 and 1996.

However, with respect to the amount of mercury originating from the dumping of dredged material, it should be noted that the contaminant input to the OSPAR maritime area is overestimated when summing up total loads in dredged material. Dredging activities in estuaries and navigation channels mainly relocate the sediments, whereas particularly harbour dredgings bear the risk of adding contaminants to the OSPAR maritime area and therefore can represent relevant inputs to the marine environment.

Table 4.3.2 Mercury in Dredged Material (DM)

Contracting Party	**1995**				**1996**			
	DM (total quantity in tonnes dry weight)	**Hg** (in tonnes) total load	harbours	estuary & sea channels	**DM** (total quantity in tonnes dry weight)	**Hg** (in tonnes) total load	harbours	estuary & sea channels
Belgium	31 189 436	6,1	1,6	4,5	29 264 498	6,5	1,4	5,1
Denmark	500 256	0,03	0,03	0,0	562 784	0,2	0,2	0,0
France *	28 792 778	1,8	0,9	0,9	28 792 778	1,8	0,9	0,9
Germany **	26 462 000	0,5	0,5	0,0	19 123 000	0,3	0,2	0,0
Iceland	131 721				220 698			
Ireland	620 207	0,0	0,0	0,0	1 372 734	0,2	0,1	0,1
The Netherlands	14 199 240	4,8	4,8		8 016 381	2,5	2,5	
Norway	288 647	0,0	0,0		399 716	0,0	0,0	
Spain	2 890 800	2,1	0,6	1,5	2 055 148	4,0	2,2	1,8
Sweden	1 748 600	0,0	0,0		3 308 608	0,1	0,1	
UK	20 254 200	8,7	7,3	1,3	24 105 334	7,6	7,2	0,4
Total	**127 077 885**	**23,6**	**15,7**	**8,2**	**117 221 679**	**23,2**	**14,8**	**8,3**

Notes:
France * - 1994 data used as an indication of approximate figures for 1996
Germany ** - including 381 000 tonnes of DM from the Netherlands

4.4 Quantification of Mercury discharged to Land or Landfill

An indication of the quantities of mercury discharged to land or landfill in the UK early in this decade is given in Table 4.4, which was taken from the report "Mercury in the UK". It should be noted that with a well constructed and efficiently managed landfill or land disposal, and appropriate treatment, mercury should be unavailable to the environment.

Table 4.4 Mercury Discharged to Land or Landfill

Sector	**Quantity (tonnes of Hg / year)**		**Estimation**
	Landfill	Land	Method
Chlor-alkali production	22,8[(a)]	-	MB
Paper and pulp industry	0,05	-	EF
Phosphate production	0,02	0,08	EF
Primary lead and zinc smelting	10,2[(b)]	-	MB
Coal-fired power stations	3,4[(c)]	-	EF
Industrial coal combustion	0,3[(d)]	-	EF
Domestic coal combustion	0,2	-	EF
Total	**37,0**	**0,08**	

Notes:
EF: Estimate produced using emission factors.
MB: Estimate produced using a mass balance method.
(a) Precise nature of disposal is dependent upon the mercury content and other characteristics of the particular waste stream.
(b) Mercury may be recovered from calomel or the material is disposed to landfill after appropriate pre-treatment.
(c) An additional 2,7 tonnes of Hg present in ash is not disposed to landfill as the ash may be used.
(d) Assumes that all ash is landfilled.

5. MONITORING DATA

Examination of relevant monitoring data enables an evaluation of the actual loads of mercury entering the marine environment and gives an indication of the actual concentrations of mercury in the marine environment and in biota. This gives some indication of the extent to which discharges, emissions and losses of mercury are present in levels which are of concern, and the extent to which levels of mercury are approaching background levels.

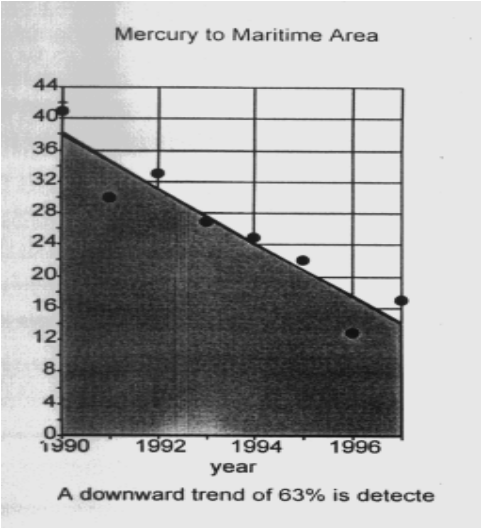
5.1 Aquatic Inputs to the Marine Environment

In 1998, the OSPAR Commission published a “Summary Report of the Comprehensive Study on Riverine Inputs and Direct Discharges (RID) for 1990 - 1995", which summarises data on aquatic inputs of selected substances (including mercury) reported by a number of OSPAR Contracting Parties under OSPAR's RID programme between 1990 and 1995. The degree of coverage varies between the five regions of the OSPAR maritime area, and the Greater North Sea Region (which comprises the North Sea and the Channel) has the greatest degree of completion. The report contains data for 6 years, but assessment of the data has been made separately. Table 5.1 takes information from the Summary Report and gives some indication of the loads of mercury entering the OSPAR Convention Area and the Greater North Sea from those OSPAR Contracting Parties (CPs) which reported and from the UK. Reference should be made to the Summary Report to ascertain the extent to which individual Contracting Parties reported on direct inputs, riverine inputs or both.

Table 5.1 Loads of mercury entering the OSPAR Convention Area and the Greater North Sea

Inputs from:	**Geographical Area**	**Tonnes 1990** Lower (L) & Higher (H) estimates	**Tonnes 1995** Lower (L) & Higher (H) estimates
OSPAR CPs	Total OSPAR maritime area	L 35 H 48	L 17 H 27
OSPAR CPs	Greater North Sea	L 25 H 30	L 15 H 18
UK	Greater North Sea (Channel + North Sea)	L 1,8 H 4,5	L 0,72 H 2,6
UK	Channel	L 0,06 H 0,2	L 0,02 H 0,08
UK	North Sea	L 1,7 H 4,3	L 0,7 H 2,5

In the "Limited Update of the 1998 RID Assessment" (cf. INPUT 00/16/2), the following picture of the overall downward estimate of the trend in mercury inputs to the OSPAR Maritime area is given:



Median value (tonnes/year) = 26
Range (tonnes/year)= 10 - 50 (min - max)

5.1.1 Implications of Aquatic Monitoring Data

The reported data gives an indication that mercury levels entering the OSPAR maritime area and the North Sea via rivers and direct discharges have fallen considerably (in most cases by between 40 - 50 %).

5.2 Atmospheric Inputs

An indication of the atmospheric inputs of mercury to the OSPAR maritime area has been provided by the OSPAR Comprehensive Atmospheric Monitoring Programme (CAMP). A draft data report consisting of data from coastal stations in 1995 (cf. ASMO 97/5/6) gives estimates of atmospheric inputs of mercury based on measurements made at a limited number of coastal stations of the participating Contracting Parties. Table 5.2 below gives an extract of the mercury figures from 1987 - 1995 (taken from Table C in the CAMP Report).

Table 5.2 Atmospheric inputs of mercury to the North Sea from 1987 - 1995

Year	Mercury (tonnes/year)
1987	9
1988	9
1989	7
1990	5
1991	6
1992	6
1993	3
1994	3
1995	4

5.2.1 Implications of Atmospheric Monitoring Data

The reported data gives an indication that mercury levels entering the OSPAR Convention Area and the North Sea via the atmosphere has fallen considerably between 1987 and 1995 (by over 50%). The figures confirm the downward trend shown by the aquatic monitoring data (cf. section 5.1) and appear to indicate that pollution control measures are reducing inputs.

5.3 Concentrations in the Marine Environment

A compilation of data on mercury speciation in surface waters of rivers, estuaries and open ocean waters is given in Table 5.3. These figures were taken from Table A41 on page 265 of the ICES Co-operative Research Report no 233, ICES ACME 1998. The figures in Table 5.3 show that total dissolved mercury concentrations in the open sea range from 1 to 5 pM. Significantly higher concentrations can be found (up to 10 pM) in coastal areas.

Table 5.3 Mercury concentrations and speciation in rivers and coastal and open ocean waters

Location	*Hgt* (pmo1/1)	*Hgtd* (pmo1/1)	*Hgr* (pmo1/1)	*Reference*
Rivers/estuaries				
Scheldt estuary		3,5 – 14	1-10	Leemakers et al 1995
Rhone (France)		1,4 – 16,5		Cossa et al 1996
Seine (France)		2-5 – 59,5		Cossa et al 1996
Loire (France)		2,1 –10,1		Cossa et al 1996
Elbe (Germany)		3,8 – 16,4	0,8 – 4	Coquery and Cossa 1995
Framwaren fjord	10,7 – 30,8			Parkman et al 1995
Coastal and open sea waters				
Celtic Sea	1,8 – 13,7			
North Sea	1,6 – 21,4	0,9 – 4,8	0,4 – 1-8	Coquery and Cossa 1995
Belgian coast	0,65 – 80,5	0,65 –7,1		Leemakers, 1998
Central North Sea	1,00			Baeyens and Leemakers, 1998
Dogger Bank		0,95 – 2,1	0,8 – 1,9	Fileman et al 1991
Northern North Sea		1- 2,5		OSPAR 1996
English Channel	4 – 20,5	1,5 – 4,2		Cossa and Fileman 1991
English Channel	0,75 – 4,35			Leemakers, 1998
Dover Strait		0,6-6,7		Cossa et at 1994b
Open Ocean				
North Atlantic	1,55 – 4,25		0,75 – 1,05	Mason et al 1995c
			0,7 - 1,05	Dalziel 1995
Equatorial Pacific			0,8 - 2	Mason and Fitzgerald 1996

Notes: Hgt = total Hg Hgtd = total dissolved Hg Hgr = reactive Hg

These figures appear to indicate that there is still some mercury contamination in some industrial rivers and estuaries. However, the figures also suggest that there is a degree of variability in the mercury concentrations in the open sea that may not be dependent on anthropogenic mercury.

5.4 Concentrations in Biota

In 1999, OSPAR published "An assessment of trends in the concentrations of some metals, PAHs and other organic compounds in the tissues of various fish species and mussels". This assessment looks at long-term time trends of, *inter alia*, mercury in various species of fish and the blue mussel in the various OSPAR regions. Most of the time series originated from Region II (Greater North Sea). Time series analysis was carried out on 104 datasets. About 10% of the series revealed significant information on trends. All but 1 of these series showed downward trends. The analysis of region II revealed the following information:

- blue mussel data generally showed clearly elevated concentrations with respect to Background Reference Concentrations (BRCs);
- fish muscle tissue datasets generally showed concentrations close to, or slightly above, BRCs (ratios < 2).

The assessment concludes that in the one hundred time series analysed (mostly from Region I, Arctic Waters and Region II, Greater North Sea), twelve significant trends were detected. All trends were downwards except for one (Fladen). These figures appear to confirm the downward trends shown in atmospheric and aquatic inputs of mercury to the North Sea (cf. sections 5.1 and 5.2).

The Quality Status Report 2000 (QSR 2000) which is under preparation within OSPAR indicates that past discharges of mercury from chlor-alkali plants close to the Mersey and Wyre estuaries in north-west England have resulted in higher concentrations of mercury in muscle of fish from that area. Data for mercury in flesh of fish from this area, obtained for the application of an environmental quality standard, suggest declining concentrations. In Region III (Celtic Seas), mercury is the only metal for which the observed concentrations in biota gave rise to concern. Provided that measures to control the input of mercury continue to be applied, it is unlikely that concentrations will present a threat to marine organisms or human consumers of seafood.

Significant downward trends for mercury in flounder are observed for the Belgian coast, Ems-Dollard, Wadden Sea and Elbe, and also in plaice from the Southern Bight of the North Sea.

6. ACHIEVING THE DESIRED REDUCTIONS OF MERCURY

6.1 OSPAR Targets

The OSPAR Strategy with regard to Hazardous Substances sets out that the OSPAR objective with regard to hazardous substances is "to prevent pollution of the maritime area by continuing to reduce discharges, emissions and losses of hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances." The timeframe given in the Strategy states that "every endeavour will be made to move towards the target of cessation of discharges, emissions and losses of hazardous substances of concern by the year 2020."

As mercury is toxic, persistent and bioaccumulative, it is therefore imperative from OSPAR's point of view that discharges, emissions and losses which reach the marine environment in significant amounts should be stopped as soon as possible, and at the latest by 2020. Ideally, reductions should take place progressively.

A number of OSPAR Contracting Parties are also subject to the targets with respect to mercury agreed at the 3rd North Sea Conference, i.e. to reduce total inputs from all sources of mercury by around 70% or more between

1985 and 1995 (provided that for the atmospheric component the use of BAT and other low waste technologies enable such reductions).

6.2 OSPAR's Role in Achieving the Desired Targets

As has been shown in the sections above, mercury comes from a large number of sources and occurs in a variety of waste streams. However, recognition of the toxic nature of mercury means that most of the sources described above will already be subject to some form of regulation or administrative control, either at the national or at the international level. OSPAR has also adopted measures to control some of these sources.

In order to meet the targets specified in the OSPAR objective and timeframe, it will be necessary to:

- assess the need for further reductions from the various sources and the practicability of such reductions;
- review existing regulations and controls in the light of the need for further reductions;
- decide which organisation is responsible and/or best placed for carrying out detailed assessments and/or implementing controls;
- inform the relevant organisation (if not OSPAR) of the OSPAR Ministerial commitments with regard to hazardous substances and the need for action to address OSPAR concerns;
- set up mechanisms for monitoring the compliance with measures adopted in the relevant forum;
- set up mechanisms to monitor inputs to the marine environment and concentrations in the marine environment and biota to check that levels are falling at a satisfactory rate.

For a number of these sources, OSPAR will not be the most appropriate international body to instigate further controls or to assess whether the controls are practicable or necessary. Therefore it will generally only be possible to set out reduction targets through close co-operation with other international fora. However, OSPAR should keep in close touch with those other responsible bodies and draw their attention to the 2020 OSPAR target. It will also be possible, through appropriate assessment and monitoring activities, to see whether present mercury concentrations in the marine environment are at harmful levels, whether the levels are falling due to the implementation of programmes and measures, and whether values are approaching background levels.

7. EXAMINATION OF EXISTING CONTROLS AND IDENTIFICATION OF POSSIBLE ACTIONS AND MEASURES

This section examines the existing controls which are present at national and international level for the control of mercury originating from the various sources mentioned above. It has not been possible to review all the various national instruments used in the various OSPAR Contracting Parties. However, it is hoped that reference mainly to OSPAR, EC and UK measures will be sufficient to act as a good basis for the evaluation of the need for further controls and how these would best be taken.

7.1 Control of Emissions from Industrial Sources

At national level in a number of OSPAR Contracting Parties, emissions, discharges and losses of mercury from industrial sources are normally subject to legislation which requires that Best Available Techniques are applied. The relevant national or local authority will assess the discharges, emissions and losses coming from a plant or from the relevant sector and draw up a permit which authorises a specific limit for discharges, emissions and losses. There are several measures applicable under OSPAR to control mercury emissions, discharges and losses from specific sectors, e.g. the measures related to the chlor-alkali industry (cf. section 7.1.1 below) and PARCOM Decision 85/1 on Limit Values and Quality Objectives for Mercury Discharges by Sectors other than the Chlor-alkali Industry. Furthermore, OSPAR measures on BAT for various industrial installations (e.g. the iron and steel , and non-ferrous metals sectors) and the offshore gas and oil installations (e.g. PARCOM Recommendation 92/6 which is currently being reviewed) will also help to limit discharges, emissions and losses of mercury.

More recently, the Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC) has been adopted by European Community Member States and countries in the European Economic Area. This Directive sets out a general framework for integrated pollution prevention and control for specified categories of industrial activities, including most of those industrial activities listed above as sources of mercury. Under the IPPC Directive, BAT Reference Documents (BREF notes) are being developed, which specify what is regarded as being BAT for these industrial activities. A draft EC BREF note on BAT for the chlor-alkali industry is currently under preparation.

In order to further reduce the emissions, discharges and losses of mercury from the industrial sectors listed in section 4, it will be necessary to apply BAT at the relevant installations, as specified in the relevant measures on point sources under OSPAR, or the activities arising from the IPPC Directive.

More recently, the transboundary effects of mercury (and other heavy metals) in air pollution are being addressed by the UN/ECE Protocol on Long Range Transboundary Air Pollution, and controls for some sectors have been agreed. Other sectors (e.g. the chlor-alkali industry) will be addressed when this Protocol enters into force.

7.1.1 OSPAR Controls on the Chlor-Alkali Industry

Under OSPAR, the following measures are applicable as regards the control of mercury in discharges to water and emissions to air from mercury cell chlor-alkali plants:

- PARCOM Decision on Limit Values for Mercury Emissions in Water from Existing and New Brine Recirculation Chloralkali Plants (exit of the purification plant), 1980
- PARCOM Decision on Limit Values for Existing Waste Brine Chlor-Alkali Plants, 1981
- PARCOM Decision on Limit Values for Existing Brine Recirculation Chlor-Alkali Plants (exit of the factory site), 1981
- PARCOM Decision on New Chlor-Alkali Plants Using Mercury Cells, 1982
- PARCOM Recommendation on Limit Values for Mercury Emissions in Water from Existing Brine Recirculation Chlor-Alkali Plants (exit of factory site), 1985
- PARCOM Decision 90/3 on Reducing Atmospheric Emissions from Existing Chlor-Alkali Plants.

Work on various aspects associated with the chlor-alkali industry has been carried out under OSPAR's Working Group on Point Sources (POINT) and an Intersessional Correspondence Group set up at POINT 1998. As part of this work, Spain, the lead country for mercury within POINT, convened a workshop in September 1999 to examine the possibilities for updating PARCOM Decision 90/3. Arrangements for further work were made at POINT 1999 and PRAM 2000.

7.1.2 The Most Significant Sources from Industrial Activity

On the basis of the limited data available (cf. section 4.1), it appears that the most significant mercury emissions for the marine environment from specific industrial sectors are those to air from combustion activities (particularly coal-fired power stations), primary metals production and the chlor-alkali industry.

7.1.3 Recommended Actions and New Measures to control Sources of Mercury from Industrial Activity

When deciding on what new OSPAR activities are necessary to control sources of mercury from industrial activities, the following provisions and requirements set out in the OSPAR Strategy with regard to Hazardous Substances must be borne in mind:

- the application of BAT is one of the guiding principles for the control of hazardous substances originating from industrial activities (cf. § 2.1 of the Strategy);
- duplication of work on hazardous substances should be avoided when BAT work is already agreed or being negotiated by other international fora (cf. § 5.11 of the Strategy).

It is therefore recommended that:

a. OSPAR should examine the various on-going activities and measures regarding the industrial sectors identified in Section 4.1 as being significant sources of mercury, and decide whether additional work is necessary, either within the framework of OSPAR or within that of other international fora;

b. if substantial additional work is necessary, OSPAR should nominate an appropriate lead country;

c. OSPAR should draw the attention of the EC and the UN/ECE LRTAP to OSPAR's concerns with respect to those industrial activities, which are regarded as being a significant source of mercury. To this end, OSPAR should request these international organisations that the control of mercury emissions should be addressed by them when developing the corresponding BREF notes in the IPPC Directive framework and in the work on the control of emissions from industrial sectors foreseen under the UNECE LRTAP Protocol on Heavy Metals;

d. POINT (or its successor body) should review the relevant EC BREF notes for the sectors concerned and comment on aspects concerning mercury emissions, discharges and losses relevant for the marine environment;

e. POINT (or its successor body) should continue with its work on the chlor-alkali sector, particularly the review of PARCOM Decision 90/3, bearing in mind the on-going work on BAT which is being carried out in the IPPC framework. This work under POINT (or its successor body) should seek to reduce the burden of mercury on the marine environment in the most effective way, and should take account of the environmental problems likely to arise when in dealing with the disposal of the 12 000 tonnes of pure mercury arising from the phase-out of mercury cell technology.

7.2 Control of Releases from the Use of Mercury in Products

The main tools for controlling releases of mercury from products are the placing of restrictions on the marketing and use of the products, or the development of products containing non hazardous substitutes for mercury. Under OSPAR, the following measures are applicable with the aim to restrict releases of mercury from products:

- PARCOM Recommendation on Other Land-Based Sources of Mercury Pollution (Thermometers, Batteries, Dental Filters), 1981
- PARCOM Recommendation on Other Land-Based Sources of Mercury Pollution, 1982
- PARCOM Decision 85/1: Programmes and Measures of 31 December 1985 on Limit Values and Quality Objectives for Mercury Discharges by Sectors other than the Chlor-alkali Industry

- PARCOM Recommendation 89/3 on Programmes and Measures for Reducing Mercury Discharges from Various Sources;
- PARCOM Decision 90/2 on Programmes and Measures for Mercury and Cadmium-Containing Batteries;
- PARCOM Recommendation 93/2 on Further Restrictions on the Discharge of Mercury from Dentistry.

Further information as regards mercury, in particular with respect to releases from the use of mercury in products, is given in:

a. the OSPAR Report on National Reduction Programmes for Land-Based Discharges of Mercury other than the Chlor-Alkali Industry. This report was published by OSPAR in 1989 (cf. Annex 7 to the Tenth Annual Report on the Activities of the Paris Commission) and led, *inter alia*, to the development and adoption of PARCOM Recommendation 89/3;

b. the OSPAR Background Document on Further Restrictions on the Discharge of Mercury, which was published by OSPAR in 1997.

Mercury in products gives rise to emissions, discharges and losses at different stages in the products' life cycles, primarily when the products become waste. Mercury is therefore not desirable in products, but the special properties of mercury makes some products difficult or impossible to dispense with. In order to assess the scope for further controls on mercury emissions from products, the various products are considered individually in the following sections.

7.2.1 Controls for Dental Amalgam

7.2.1.1 Overview of Measures for Controlling Discharges, Emissions and Losses of Mercury from Dental Amalgam

7.2.1.1.1 Use of Substitutes

A variety of substitutes for dental amalgam are being used in most Western countries. Some of these are significantly more expensive. UK Dentists have reported that in some applications, particularly for load-bearing cavities, mercury amalgam still offers the best technical choice.

It was concluded in the report "Assessment of Possibilities for Reducing the Use of Mercury" (published by the Nordic Council of Ministers) that "alternatives are available, but that further development is necessary to achieve cost effective and technically satisfactory substitutes".

7.2.1.1.2 OSPAR Measures on Dental Amalgam

Several PARCOM Recommendations relating to the reduction of mercury discharges from dental sources are applicable under OSPAR. In 1981, the Paris Commission recommended "The installation of special filters in dental surgeries and clinics to collect the residues of mercury amalgams." PARCOM Recommendation 89/3 urges that "Alternative materials to dental amalgams should be used where appropriate and where excessive cost can be avoided. Surplus or old amalgam should be trapped and separated efficiently, then sent for recovery of the mercury content." PARCOM Recommendation 93/2 states "Equipment should be installed to separate water and amalgam to enable collection of the amalgam as from 1 January 1997."

It appears from the recent implementation reports on PARCOM Recommendation 89/3 that most Contracting Parties have implemented, or are in the process of implementing, these recommendations and a number of countries have introduced national legislation or codes of practice to put the recommendations into effect. It was concluded that they have been successful in substantially reducing the amount of mercury reaching the aquatic environment.

7.2.1.1.3 European Controls

The International Organization for Standardization (ISO) has recently agreed, but not yet adopted, an international standard for amalgam separator which revises the International Standard for the "Dental Unit" (ISO 7494, 1990) and which contains requirements for solids collectors of particle sizes more than 2 mm and connections to amalgam separator devices.

7.2.1.2 Appropriate actions and new measures to control mercury from dental amalgam

The existing PARCOM Recommendations and the revision of the ISO standard appear to be stimulating a lot of serious activities and implementation is far advanced in most of the Contracting Parties. The most important aspects (installation of separating equipment, the need for separate collection systems for mercury-containing waste, and the use of alternatives) are covered.

It is therefore recommended that no additional OSPAR activity on this issue is undertaken.

7.2.1.2.1 Mercury Emissions from Crematoria

Mercury emissions from crematoria are largely due to the existence of mercury amalgam fillings in the teeth of cadavers. There may be scope for reducing emissions from crematoria, although BAT for this sector, together with technical feasibility of mercury abatement and associated cost considerations, would need first to be carefully addressed, taking account of local sensitivities and practices.

Bearing in mind the sensitivities associated with this issue, it is recommended that POINT or its successor body should consider whether emissions from crematoria represent a significant threat to the marine environment and should examine the scope and the appropriate framework for further action.

7.2.2 Controls for Batteries

7.2.2.1 Overview of Measures for Controlling Discharges, Emissions and Losses of Mercury from Batteries

7.2.2.1.1 Use of Substitutes

A range of alternatives for mercury are available and include zinc-air cells with a mercury content of 1% and lithium cells which contain no mercury. Both these types of cell are considered to be more expensive than the mercury oxide cell; however, this is mitigated by their longer lifetime. There are some reports that mercury oxide batteries are still the best technical option for some medical uses such as pacemakers.

7.2.2.1.2 OSPAR Measures on Batteries

PARCOM has already proposed measures for dealing with mercury in batteries. PARCOM Decision 90/2 on Programmes and Measures for Mercury and Cadmium-Containing Batteries lays down various measures dealing with the recovery, disposal and marketing and use of certain mercury and cadmium batteries.

Due to the fact that a number of the measures proposed in this PARCOM Decision could have direct effects on the Single Market, and in order to approximate laws in this field, the measures set out in this PARCOM Decision have all been incorporated into the EC Council Directive 91/157/EEC on Batteries and Accumulators containing Certain Dangerous Substances.

7.2.2.1.3 EC - Batteries Directive

EC Directive 91/157/EEC sets controls on the use of mercury in batteries. The European Commission is currently assessing the risks of mercury in a number of mercury containing products (including mercury button cells) with a view to amending the EC marketing and use directive if appropriate.

7.2.2.2 Appropriate actions and new measures to control mercury from batteries

PARCOM Decision 90/2 has stimulated a lot of serious activities and implementation is far advanced in most of the Contracting Parties. The need for a measure to further restrict the use of mercury oxide batteries was discussed within OSPAR in 1995/1996 (cf. DIFF 95/19/1, PRAM 96/17/1, OSPAR 96/17/1) and it was concluded that there was very little added value in adopting further OSPAR controls.

It is therefore recommended that OSPAR initiates no further action to control mercury in batteries, but should request the EC to consider the need for further controls in its intended amendment of the EC Marketing and Use Directive.

7.2.3 Control of Biocides and Pesticides

7.2.3.1 Overview of Measures for Controlling Discharges, Emissions and Losses of Mercury from Biocides and Pesticides

7.2.3.1.1 Use of Substitutes

Viable substitutes are available for the majority of applications of mercury-based biocides and pesticides. Zinc, copper and sulphide-based substitutes are available for use in paints and whilst these have an associated potentially adverse environmental impact, this is considered to be less significant than that associated with the use of mercury.

7.2.3.1.2 Relevant OSPAR Measures

PARCOM Recommendation 89/3 has already proposed measures on restricting the use of biocides and pesticides containing mercury.

7.2.3.1.3 Relevant EC Measures

EC Member States have implemented more stringent, legally binding, measures through Directive 79/117/EEC on the phasing out the marketing and use of pesticides containing mercury compounds or certain other substances.

7.2.3.2 Appropriate actions and new measures to control mercury from biocides and pesticides

It is recommended that no additional OSPAR controls on biocides and pesticides are necessary.

7.2.4 Control of Industrial and Control Instruments

7.2.4.1 Overview of Measures for Controlling Discharges, Emissions and Losses of Mercury from Industrial and Control Equipment

7.2.4.1.1 Use of Substitutes

The potential for substitution of mercury in this group of products is generally technically feasible. The principal barriers to the widespread substitution of mercury would appear to be largely related to cost.

7.2.4.1.2 Relevant OSPAR Measures

PARCOM Recommendation 89/3 has already proposed measures on recycling mercury used in electrical equipment and encouraged the use of equipment not containing mercury, whenever replacements become available at comparable costs. Some Contracting Parties have reported that they have taken action, or are intending to take action, regarding some electrical equipment.

7.2.4.1.3 Relevant EC Measures

The European Commission is currently assessing the risks of mercury in a number of mercury containing products (including electrical equipment) with a view to amending the EC marketing and use directive if appropriate.

7.2.4.2 Appropriate actions and new measures to control mercury from industrial and control equipment

It is recommended that no additional OSPAR controls on industrial and control equipment are necessary, but that OSPAR should request the EC to consider the need for further controls in its intended amendment of the EC Marketing and Use Directive.

7.2.5 Control of Laboratory and Medical Instruments

7.2.5.1 Overview of Measures for Controlling Discharges, Emissions and Losses from Laboratory and Medical Control Instruments

7.2.5.1.1 Use of Substitutes

The principal alternatives to the use of mercury in thermometers are as follows:

- electronic thermometers - variety of types available;
- alcohol or redspirit based thermometers - general purpose use, but no maximum;
- reading clinical thermometers;
- indium or gallium liquid in glass thermometers;
- thermo-dot matrix type - clinical versions available.

Whilst these substitutes may be appropriate for a number of medical and industrial uses, certain specialist applications may continue to rely upon mercury-based instruments.

Some countries in the EU, such as Sweden and Denmark, have already introduced substitutes for the use of mercury thermometers. They have reported that technically adequate alternatives to mercury appear to be available for all but the most specialised applications, although there may be implications for cost, calibration and, in the case of clinical instruments, re-training in nursing practices which also need to be considered.

7.2.5.1.2 OSPAR Measures for Controlling Discharges, Emissions and Losses of Mercury from Laboratory and Medical Control Instruments

PARCOM Recommendation 89/3 has already proposed measures on recycling mercury used in control instruments and encouraged the use of equipment not containing mercury whenever replacements become available at comparable costs. Some Contracting Parties have reported that they have already initiated actions to limit the use of mercury thermometers.

7.2.5.1.3 EC Measures

The European Commission is currently assessing the risks of mercury in a number of mercury containing products with a view to amending the EC marketing and use directive if appropriate. However, action might also be taken under the Medical Devices Directive (93/42/EEC).

7.2.5.2 Appropriate Actions and new Measures to control Releases of Mercury from Laboratory and Medical Control Instruments

It is recommended that no additional OSPAR measures to control mercury from laboratory and medical control instruments are necessary, but that OSPAR should request the EC to consider the need for further controls in its intended amendment of the EC Marketing and Use Directive.

7.2.6 Control of Lighting Containing Mercury

7.2.6.1 Measures for Controlling Discharges, Emissions and Losses of Mercury from Lighting

7.2.6.1.1 OSPAR/HELCOM Measures

PARCOM Recommendation 89/3 has already proposed measures on recycling mercury used in electrical equipment and encouraged the use of equipment not containing mercury whenever replacements become available at comparable costs. Some Contracting Parties have reported that they have already initiated actions to encourage the development of low-mercury lighting and recycling and special collection schemes have been initiated.

HELCOM recommends maximum limits for the mercury content in fluorescent lamps. The HELCOM limit values are currently under revision.

7.2.6.1.2 EC Measures

The European Commission is currently assessing the risks of mercury in a number of mercury containing products (including electrical equipment) with a view to amending the EC marketing and use directive if appropriate.

7.2.6.1.3 Recycling of Lamps

Recycling schemes for mercury discharge lamps, which enable 100% recovery, are now being set up and run in several EU countries and offer an environmentally acceptable basis for the continuing use of these products, pending mercury-free lamps. In Belgium, lamps replaced from public use are stored pending recovery of both glass and mercury. In the UK, several national recycling schemes for mercury lighting have been set up by the private sector and in the Netherlands, fluorescent tubes must be dealt with separately from other wastes and removed only by authorised firms.

7.2.6.2 Appropriate Actions and new Measures to control Mercury from Lighting

It is recommended that no additional OSPAR measures to control mercury from lighting are necessary, but that OSPAR should encourage the use of no, or low-mercury lamps and lamp recycling schemes and request the EC to consider the need for further controls in its intended amendment of the EC Marketing and Use Directive

7.2.7 Other Products

7.2.7.1 Usage of other Mercury-containing Products

Mercury is used in a number of other products. Products containing mercury, such as arm and leg bands and recoil softeners for rifles may still be available for use by participants in certain sports (e.g. tennis, golf, hunting) for absorbing shock on limbs and body. At least one OSPAR country (The Netherlands) has banned the import of these products and another country (the UK) has already requested the EC to take Community-wide action to ban the supply of these manufactured articles. Mercury is also used from time to time in certain executive toys. Executive toys can be defined as enclosed puzzles which utilise the fragmentary properties of elemental mercury in tests of skill, such a steering a blob of mercury through a maze without it breaking up. Such examples demonstrate unnecessary and undesirable application, since the mercury will be released to the environment on disposal at the end of its serviceable life.

7.2.7.2 Appropriate Actions and new Measures to control Mercury from Other Products

It is recommended that no additional OSPAR measures to control mercury from the above sources are necessary, but that OSPAR should request the EC to consider the need for further controls on all undesirable and unnecessary applications of mercury in products in its intended amendment of the EC Marketing and Use Directive.

7.3 Control of Emissions from Waste Streams

The quantification of mercury in waste streams given in section 4.3 estimates that a considerable load of mercury enters the atmosphere from municipal waste and clinical waste. OSPAR has not addressed the problem of mercury in waste streams.

7.3.1 National Controls

In the UK, the Integrated Pollution Control Guidance Note S2 5.01 on Waste Incineration gives mandatory emission limits for mercury and cadmium combined (0,2 mg/Normal m^3 to air for municipal waste incinerators). There are also mandatory values set for new hazardous waste incinerators and for existing hazardous waste incinerators which enter into force in the year 2000. The position in other OSPAR Countries is not known.

7.3.2 Controls in the EC

The EC has adopted various directives which cover waste and waste incineration:

- Directive 75/442/EEC on waste as amended by Directive 91/156/EEC;
- Directive 89/369/EEC on the prevention of air pollution from new municipal waste incineration plants;
- Directive 89/429/EEC on the reduction of air pollution from existing municipal waste incineration plants;
- Directive 91/689/EEC on hazardous Waste;
- Directive 94/67/EEC on the incineration of hazardous waste;

- Directive 96/61/EEC concerning integrated pollution prevention and control which covers the application of BAT to specified types of waste disposal processes.

Furthermore, the proposed Waste Incineration Directive, which received political agreement to a Common Position at the June 99 Environment Council, will replace and extend the two 1989 Directives.

7.3.3 Appropriate Actions and new Measures to control Mercury Emissions in Waste Streams

There is a lot of work currently underway to determine which is the best practice for the sustainable treatment of mercury waste to prevent long-term emissions of mercury through evaporation and leaching into the biosphere, and a debate about the environmental and sustainability issues associated with the recycling of mercury from wastes and the disposal of mercury into mines and special landfills.

7.3.3.1 Removal of Mercury-containing Waste prior to Incineration

Through the drawing up of appropriate guidelines, it would be possible to reduce the amount of mercury-containing products or waste which go to municipal, clinical or hazardous waste incinerators, and to take steps to ensure that this waste is deposited in a manner which will minimise the threat to the environment.

It is recommended that OSPAR should encourage such separation and disposal in other international fora.

7.3.3.2 Application of BAT at Municipal Waste Incinerators and Hazardous Waste Incinerators

In view of the fact that BAT for Municipal Waste Incinerators and Hazardous Waste Incinerators is already covered by relevant EC Directives and these sectors are also covered in some respects by the EC IPPC Directive,

it is recommended that OSPAR keeps a watching brief on the various activities where such directives are amended, and where BREF notes are developed, so that concerns about the marine environment can be taken into consideration as appropriate.

7.4 Control of Mercury Wastes going into Landfills

7.4.1 Controls in the EC

As has been shown in section 4.4, a considerable tonnage of mercury wastes from various sectors is disposed of to landfills or other means of land disposal. There is a considerable amount of EC legislation dealing with waste, e.g. Directive 75/442/EEC on waste as amended by Directive 91/156/EEC, Directive 91/689/EEC on hazardous waste and Directive 96/61/EEC concerning integrated pollution prevention and control which covers the application of BAT to specified types of waste disposal processes. Furthermore, Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste which covers such operations.

7.4.2 Appropriate Actions and new Measures to control Mercury Wastes going into Landfills

In view of the fact that the operation of landfills is already covered by relevant EC legislation,

it is recommended that OSPAR keeps a watching brief on the various activities where such directives are amended, so that concerns about the marine environment can be taken into consideration as appropriate.

8. FUTURE MONITORING AND ASSESSMENT ACTIVITIES

In section 5, it has been shown that the monitoring activities carried out under OSPAR's Joint Assessment and Monitoring Programme (JAMP) and in particular under OSPAR's Comprehensive Study on Riverine Inputs and Direct Discharges (RID) and the Comprehensive Atmospheric Monitoring Programme (CAMP)

have shown that the inputs of mercury to the marine environment have been steadily decreasing over the last few years. Also, it was shown that trend analysis has confirmed that concentrations of mercury in the flesh of fish in particular locations of the Convention Area have also been decreasing. It would obviously be advantageous to continue with such monitoring to assess the extent to which the measures for reducing emissions, discharges and losses of mercury are being effective, although it may be possible to adjust the monitoring frequency in some of the programmes. It would also be useful to review existing ecological/biological assessment criteria with a view to enhancing them and possibly developing new approaches which would help to assess (and prevent) actual biological harm to the most sensitive species in the marine environment at locations where mercury concentrations are elevated above background levels.

It will also be necessary for the relevant OSPAR Strategy Committees to examine whether any particular sources need further monitoring or investigation to quantify discharges, emissions and losses of mercury (e.g. mercury emissions from offshore installations).

It is recommended that:

- ASMO should examine the scope for continuing with its routine monitoring programmes, the scope for developing appropriate ecological/biological assessment criteria and whether any specific "one-off" programmes would be appropriate to assess the extent to which the various sources of mercury are constituting an environmental problem.6
- OSPAR Strategy Committees should examine whether any particular sources need further monitoring or investigation to quantify discharges, emissions and losses of mercury.

9. OVERVIEW OF PROPOSED OSPAR ACTIONS

9.1 Actions to address Mercury arising from Various Sources

A summary of the various actions identified in the above sections for the control of mercury arising from industrial point sources, products, waste streams and land disposal is given in Table 9.1.

6 "SIME 2000 noted this recommendation and agreed that:

a. the next meeting of SIME should evaluate monitoring activities for mercury and organic mercury compounds under the CEMP, taking account of the findings of the regional QSRs and the QSR 2000;

b. depending on the outcome of this evaluation, the 2002 meeting of SIME should adopt an optimal monitoring strategy for mercury and organic mercury compounds which should be implemented by 1 January 2003;

c. [the UK] would be the lead country for this activity."

Table 9.1

Source	Proposed Action to be taken by OSPAR
Industrial Sources	a. Examine existing controls and intended activities on various industrial7 sectors identified as being significant sources of mercury, and assess whether additional work might be necessary, either in the OSPAR framework, the EC or other international fora; b. Keep all industrial sectors under review to ensure that significant discharges, emissions and losses are controlled; c. Set up dialogue with other international fora to ensure that OSPAR concerns are noted and taken into consideration in new activities; d. Examine the relevant EC BREF notes for the sectors concerned and comment on aspects concerning mercury in respect of the marine environment; e. Continue with work on the chlor-alkali sector, particularly the review of Decision 90/3, bearing in mind the on-going work on BAT being carried out in the IPPC framework.
Mercury in products	
Dental amalgam	No additional OSPAR measures required
Batteries	No additional OSPAR measures required - OSPAR to request the EC to consider (*)
Biocide/pesticides	No additional OSPAR measures required - OSPAR to request the EC to consider (*)
Industrial/control instruments	No additional OSPAR measures required - OSPAR to request the EC to consider (*)
Laboratory/medical instruments	No additional OSPAR measures required - OSPAR to request the EC to consider (*)
Minor sources	No additional OSPAR measures required - OSPAR to request the EC to consider (*)
Lighting	No additional OSPAR measures required - OSPAR to request the EC to consider (*)
Mercury in Waste Streams	
Hazardous waste Municipal waste Clinical waste	Keep a watching brief on activities in the relevant EC Directives and flag up any specific points regarding the marine environment
Crematoria	Consider possibilities for the control of emissions from crematoria
Mercury disposed to Land	Keep a watching brief on activities in the relevant EC Directives and flag up any specific points regarding the marine environment
Review Activities	Review at regular intervals the progress made by OSPAR (especially with regard to the examination of implementation reports on measures dealing with discharges, emissions and losses of mercury), HELCOM and other international organisations (e.g. those actions directed to the EC in table 9.3) in reducing mercury emissions, discharges and losses, with a view to determining whether OSPAR objectives for the marine environment are being achieved.

Notes:

(*) review of relevant Directives (e.g. EC Marketing and Use Directive / in update of Marketing and Use Directive)

7 Industrial sectors include offshore installations

9.2 Actions on Monitoring and Assessment

It is recommended that ASMO or its successor body should examine:

- the scope for continuing with its routine JAMP monitoring programmes for mercury;
- whether any specific "one-off" programmes would be appropriate to assess the extent to which the various sources of mercury are still constitute an environmental problem;
- the scope for enhancing existing or developing new biological/ecological assessment criteria for mercury.8

It is recommended that the OSPAR Strategy Committees examine whether any particular sources need further monitoring or investigation to quantify discharges, emissions and losses of mercury.

9.3 The Need for Follow-up of the Recommendations made in this Background Document

A number of the recommendations made in this background document will require that OSPAR reviews at regular intervals the progress made by OSPAR (especially with regard to the examination of implementation reports on measures dealing with emissions, discharges and losses of mercury) and other international organisations (e.g. those actions directed to the EC in table 9.1) in reducing mercury emissions, discharges and losses, with a view to determining whether OSPAR objectives for the marine environment are being achieved.

8 ASMO 2000 endorsed the further work agreed by SIME 2000(cf. footnote 7) for mercury and organic mercury compounds (cf. ASMO 00/12/3, Annex 1, §§ 5.12 and 5.15), and to accept the kind offer from the UK to act as lead country for further monitoring and assessment activities on mercury and organic mercury compounds.

MONITORING STRATEGY FOR MERCURY AND ORGANIC MERCURY COMPOUNDS

As part of the Joint Assessment and Monitoring Programme (*reference number 2003-22*), OSPAR 2004 adopted an Agreement on monitoring strategies for OSPAR Chemicals for Priority Chemicals (*reference number 2004-15*) to implement the following monitoring for tracking progress towards the objectives of the OSPAR Hazardous Substances Strategy (*reference number 2003-21*) with regard to mercury and organic mercury compounds. The Monitoring Strategy for mercury and organic mercury compounds will be updated as and when necessary, and redirected in the light of subsequent experience.

In general, the sources of mercury are well characterised and understood, and have been described in the EC Water Framework Directive source inventory and the HARP-HAZ guidance document on mercury. Methodologies for environmental monitoring of mercury are generally well understood and a number of relevant monitoring activities are already underway or planned in OSPAR's existing monitoring programmes.

There are a number of relevant controls (e.g. regulations, directives, recommendations and decisions) on a) marketing and/or use, b) emissions and/or discharges of mercury which have been agreed by Contracting Parties both in OSPAR and in other international forums and have been highlighted as important measures for achieving the OSPAR Hazardous Substances objective with respect to mercury in the "choice for actions" chapter of the Background Document. Evidence from reports on the implementation of such measures will be used to make an initial judgement of the extent to which the amounts of the substance emitted or discharged are likely to have been reduced.

Point source emissions to air, which represent the largest source of exposure to the marine environment, can be estimated reasonably well. OSPAR will examine and assess the reports by Contracting parties of emissions of mercury to the UNECE/EMEP database, and the reports required for the EPER database under the IPPC Directive in order to track progress on the reduction of air emissions of mercury.

To track progress on the reduction of discharges and losses to water OSPAR will examine and assess data on discharges and losses from point sources to water reported regularly to the EPER database under the IPPC Directive.

OSPAR will continue to report annually on discharges, emissions and losses from the chlor-alkali industry offers to track progress on the reduction of releases from this sector.

A methodology for monitoring or estimating discharges to water from non-IPPC, such as diffuse sources (e.g. releases from mercury-containing products or run-off from agriculture) has been described in the HARP-HAZ Guidance Document on Mercury. However, not all Contracting Parties have the resources and infrastructure to carry this out and it should therefore be welcomed as an additional voluntary activity. Contracting parties carrying out such monitoring on a voluntary basis are urged to co-ordinate their work.

Quantitative information on the production, use/sales of products containing mercury will also provide useful information, and this will be made available by the lead country at the next review of the Background Document in 2007/08.

OSPAR will continue to report annually on the quantities of mercury in dredged material disposed in the marine environment.

Existing OSPAR monitoring programmes (CAMP on atmospheric inputs, RID on riverine inputs, and CEMP on concentrations in marine sediments and biota) will continue with appropriate modifications in order to provide information on concentrations in the environment. The requirements for monitoring under the CEMP will be reviewed following the assessment of CEMP data in 2004/05 taking into account *inter alia:*

a. the fact that mercury is a priority hazardous substance under the EC Water Framework Directive, and where available, OSPAR will seek to periodically compile results from EC WFD monitoring;
b. the conclusions of the North Sea Pilot Project Ecological Quality Objective on mercury in seabirds' feathers.

The significance of inputs from the offshore sector is not clear, past data on the mercury content of produced water should be examined to assess its significance.

Concentrations in biota, and their possible harmful effects will be assessed both through the developments of the North Sea Pilot EcoQO on mercury in seabirds' feathers and the collation of information on concentrations in marine mammals to gauge whether this is a gap in knowledge which OSPAR should attempt to fill, prior to the 2010 Quality Status Report.

Contracting Parties are also encouraged to support research on the biological effects of existing concentrations of mercury and its compounds in the marine environment.

MERCURY AND ORGANIC MERCURY COMPOUNDS MONITORING STRATEGY	
Implementation of actions and measures	• Examination of progress in the implementation of regulations on marketing and/or use or emission and/or discharge which have been agreed, or are endorsed, by the Background Document
Emissions to air	• Examination and assessment of trends in emissions to air as reported annually by Contracting Parties to the UNECE/EMEP database in LRTAP Convention and, for IPPC sources, to EPER • Continued reporting to OSPAR on emissions from the chlor-alkali industry
Discharges and losses to water	• Examination and assessment of trends in discharges to water from IPPC sources in data reported annually by Contracting Parties to EPER • Continued reporting to OSPAR on discharges and losses from the chlor-alkali industry *Additional voluntary activities:* • *Estimation of data on discharges to water from sources not covered by EPER*
Production/use/sales /figures	• The lead country will update information on production, sales and use of products containing mercury during review of the Background Document. The next review is planned for 2007/08
Atmospheric inputs	• Monitoring will continue under the CAMP
Riverine inputs	• Monitoring will continue under the RID study
Concentrations in sediments	• Monitoring will continue under the CEMP
Inputs from the offshore industry	• Past data on the heavy metals content of produced water discharges will be examined to judge its significance
Maritime area:	
Dredged materials	• Continued reporting to OSPAR of the concentrations of mercury in dredged materials disposed to the maritime area
Concentrations in water	• Where available, data will be periodically compiled from EC WFD monitoring
Concentrations in biota	• Monitoring will continue under the CEMP, but will be reviewed in the light of conclusions on the North Sea Pilot Project EcoQO on mercury in seabirds' feathers • Before [2006] the lead country will collate information on concentration of mercury and its compounds in marine mammals and possible harmful effects in order to assess whether this is a gap in knowledge which OSPAR should fill prior to the 2010 QSR
Biological effects	• Contracting Parties will be encouraged to support research on biological effects of existing concentrations of mercury and its compounds in the marine environment

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