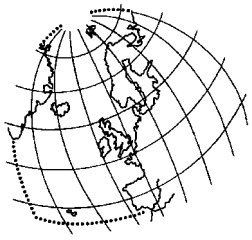
Hazardous Substances Series

Mercury Losses from the Chlor-Alkali Industry in 2000



OSPAR Commission

2002

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 Community 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 la Communauté européenne et l'Espagne.

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contents

EXECUTIVE SUMMARY

This report continues the series of reports on mercury discharges, emissions and losses of mercury by all routes from mercury-cell chlor-alkali plants.

After several years of more or less stable production capacities until 1998, mercury-cell-based chlorine production capacities have further decreased in 2000. Capacity reductions in Germany and the Netherlands seem to be mainly responsible for this decrease. Mercury losses through product, waste water and air have slightly decreased from 1999 to 2000 except for the UK, for which a slight increase is indicated (as already observed for the year 1999). This was due to a temporary problem of the water supply and maintenance activities in one plant in the UK. Air emissions from three plants in Spain indicate a substantial decrease due to technical improvements in these plants with a view to further reducing these emissions.

Over the years, atmospheric emissions of mercury have been significantly reduced. Subsequent to 1998, however, UK emissions slightly increased. The data show clearly that all plants comply with the limit value for air emissions (established by PARCOM Decision 90/3) of 2 g of mercury tonne of chlorine produced; actual values range from 0,13 to 2,0 g per tonne. The extent to which these values are considered to reflect BAT in general or only for individual plants concerned is not clear. However, the EC Reference Document on Best Available Techniques in the Chlor-Alkali Industry (August 2000) identified best available techniques which result in emissions that are much lower than the limit value of 2 g Hg/t Cl_2 specified in PARCOM Decision 90/3.

The complexity of the activities involved in handling mercury wastes (deposited, awaiting recovery, awaiting disposal, awaiting decision and temporarily stored) is clearly visible. No unique interpretation of the data is possible. Nevertheless, the data show that, in comparison with the amounts included in the data for total emissions, discharges and losses, wastes include significant amounts of mercury (ranging from zero up to 136,3 g of mercury per tonne of chlorine produced. They are safely disposed of.

RÉCAPITULATIF

Le présent rapport fait suite à la série de rapports sur les rejets, les émissions et les pertes de mercure, par toutes les voies, des installations d'électrolyse des chlorures alcalins à cellules de mercure.

Après plusieurs années de stabilité plus ou moins grande des capacités de production, ceci jusqu'en 1998, les capacités de production de chlore à base de cellules de mercure ont de nouveau baissé en l'an 2000. Il semble que ce soit la réduction des capacités de production en Allemagne et aux Pays-Bas qui soit pour l'essentiel à l'origine de cette baisse. Les pertes de mercure par les produits, les eaux usées et l'atmosphère ont légèrement diminué de 1999 à l'an 2000, excepté dans le cas du Royaume-Uni où une légère augmentation est signalée (comme cela avait déjà été constaté dans le cas de l'année 1999). Cette situation est due à un problème temporaire d'approvisionnement en eau et à des travaux d'entretien à l'une des installations du Royaume-Uni. En Espagne les émissions atmosphériques de trois installations ont nettement diminué en raison des perfectionnements techniques apportés à ces installations, ceci dans le but de réduire plus encore ces émissions.

Au fil des années, les émissions atmosphériques de mercure ont très nettement baissé. En revanche, après 1998, au Royaume Uni, les émissions ont légèrement augmenté. Les données prouvent clairement que toutes les installations ont respecté le plafond fixé pour les émissions atmosphériques (établi par la Décision PARCOM 90/3), soit 2 g de mercure par tonne de chlore produit ; les fourchettes effectives vont de 0,13 à 2 g par tonne. La mesure dans laquelle ces valeurs sont considérées comme reflétant les BAT en général ou au contraire uniquement à certaines des installations concernées n'est pas claire. Toutefois, le Document communautaire européen de référence sur les meilleures techniques disponibles dans l'industrie de l'électrolyse des chlorures alcalins (août 2000) définit les meilleures techniques disponibles qui permettent d'obtenir des émissions nettement inférieures au plafond de 2 g Hg/t Cl_2 stipulé par la Décision PARCOM 90/3.

La complexité des activités de traitement des déchets de mercure (en décharge, en attente d'être récupérés, en attente d'être éliminés, en attente d'une décision et stockés temporairement) ressort à l'évidence. Aucune interprétation unique des données n'est possible. Néanmoins, les données prouvent que par rapport aux quantités décomptées dans les données des émissions, rejets et pertes totaux, les déchets contiennent des quantités significatives de mercure (allant de 0 à 136,3 g de mercure par tonne de chlore produit). Ces déchets sont éliminés dans des conditions sûres.

1. INTRODUCTION

Since the beginning of the 1980s, mercury discharges, emissions and losses from the chlor-alkali industry have been addressed under the former Paris Commission (PARCOM). The following Decisions and Recommendations are applicable under the OSPAR Convention:

- PARCOM Decision on Limit Values for Mercury Emissions in Water from Existing and New Brine Recirculation Chlor-alkali 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.

In 1983, Contracting Parties to the former Paris Convention initiated an annual reporting of mercury discharges, emissions and losses from their national chlor-alkali industry. These data were compiled by the OSPAR Secretariat and, following examination by the relevant subsidiary bodies, published by the Commission in form of Annual Reports on Mercury Losses from the Chlor-alkali Industry, which comprised yearly data series from 1982 onwards.

Over time, reporting requirements and formats were regularly reviewed and up-dated in the light of the ongoing work under the Commission as regards the chlor-alkali industry. With a view to harmonising the way in which data and information are being established and reported, the Programmes and Measures Committee (PRAM) of the OSPAR Commission adopted in 2000 the current reporting formats and procedures (see OSPAR agreement reference number 2000-4), which set out the requirements for data and information to be provided:

- via Euro Chlor.

  Annual data on discharges, emissions and losses of mercury from each plant operating within OSPAR Contracting Parties are reported to the OSPAR Secretariat, which, following a check and confirmation by Contracting Parties, compiles these technical data in form of a report;

- via Contracting Parties.

  Data and information on the intended future phasing out of national mercury-based chlor-alkali production capacities (or their conversion to mercury free capacities) in the light of the recommendation set out in Art. 3 of PARCOM Decision 90/3.

OSPAR acknowledges the assistance of EuroChlor in assembling the information and appreciates the efforts made by Euro Chlor to provide all requested information on a plant-by-plant basis and recommends continuing this procedure in future.

2. ASSESSMENT OF THE ANNUAL OSPAR REPORT ON MERCURY LOSSES FROM THE CHLOR-ALKALI INDUSTRY IN 2000

On the basis of data provided by EuroChlor and all Contracting Parties, the expert assessment panel notes the following points:

a. as already stated for the year 1999 the mercury-cell-based chlorine production capacities have decreased from 1999 to 2000. Reductions in Germany and Netherlands seem to be mainly responsible for this decrease. Slight increases which do not affect the overall picture and can not be traced back to changes in the production techniques are indicated for Belgium, Sweden, Switzerland, UK and Spain, while slight decreases are indicated for Portugal. Figure 1 does not allow inferring the exact overall mercury-cell chlorine production capacity in the OSPAR area in ktonnes/year;

b. "Mercury losses through product, waste water and air" have decreased from 1999 to 2000 especially for Germany, Spain and Netherlands. For the UK a slight increase (as already observed for the year 1999) is indicated. The reasons for the decrease in Germany and Netherlands are the decommissioning of mercury-cell-based plants while the reason for the decrease in Spain is the result of a decrease in emissions to air from three plants that have made technical improvements to that effect during the last years;

c. over the years atmospheric emissions of mercury have been significantly reduced. Subsequent to 1999 atmospheric emission reductions are especially observed in 2000 for Germany, Spain and the Netherlands. The reasons for this decrease might be the same as mentioned in the indent dealing with "Mercury losses through product, waste water and air";

d. concerning the data provided by EuroChlor on mercury consumption and mercury in wastes, the complexity of activities of the companies in regard to the handling of mercury wastes (deposited, awaiting recovery, awaiting disposal, awaiting decision and temporarily stored) is clearly visible. There is no unique interpretation of the data possible as, for example, in the case of the data on "Mercury losses through product, waste water and air". Nevertheless the data for the plants show that compared to the data for "Total emissions, discharges and losses wastes" contain big amounts of mercury ranging from zero up to 136,3 g Hg/tonne Cl_2. These are disposed safely. There is no indication in the tables whether high values are caused or influenced by decommissioning of the respective plants or parts of their chlorine capacity.

The data in this 2000 report show clearly that every plant complies with the limit value of 2 g Hg/t Cl_2 for air emissions. There is a range in actual values from 0,131 to 2,0 g Hg/t Cl_2. The extent to which these values are considered to reflect BAT in general or only for individual plants concerned is not clear. However, the EC Reference Document on Best Available Techniques in the Chlor-Alkali Industry (August 2000) identified best available techniques which result in emissions, discharges and losses that are much lower than the limit value of 2 g Hg/t Cl_2 specified in PARCOM Decision 90/3.

Additional information of the intended future phasing-out of their national mercury-based chlor-alkali production capacities was delivered by Belgium, Finland, France, Germany, the Netherlands, Portugal, Spain, Sweden, Switzerland and the UK.

a. Germany submitted a time-table which gives a picture on phasing-out measures from 2000 up to 2006 (intended 43,9% reduction of mercury-based chlorine capacity);

b. Finland and Sweden have confirmed that the mercury-based production of chlorine will be ceased by 2010. Sweden has sent a Swedish Ordinance on Chemicals, which implies a ban on the use of mercury-cell-based Chlor-Alkali production from 2010 on, for notification to the European Commission;

c. Switzerland has indicated that there are no specific phasing-out-plans but that the two mercury based plants will follow the voluntary commitments offered by EuroChlor;

d. United Kingdom has stated that the various factors associated with conversion or phase out of mercury-cell plants are currently being addressed but it is not yet possible to provide a time-table regarding phasing-out or conversion;

e. Belgium has indicated that regional environmental legislation requires that mercury-cell technology may not be used anymore after 2010;

f. the Netherlands and Spain have indicated that on the basis of national legislation or a voluntary agreement with industry, chlor-alkali plants need to comply with BAT as described in the EC IPPC BREF and that conversion of mercury-cell technology should take place before 2010;

g. Portugal has indicated that the mercury cells in its only existing mercury-based plant have been replaced by membrane cells and that the chlorine production with mercury cells has finished in January 2002.

The expert assessment panel recommended in its assessment on the 1999 report a number of adjustments for future reports in order to improve the assessment. These recommendations are still valid for this 2000 report although these recommendations are not explicitly mentioned again for example under chapter 3. The OSPAR Secretariat, following the discussion at PDS 2000 on these recommendations by the Expert Assessment Panel, has investigated the possibilities (especially concerning the data availability of former years) and has suggested a “way forward” for the reporting of production capacities, atmospheric emissions, mercury losses through "Product, waste water and air, waste", "Decommissioned or Converted plants" and "Difference to balance". The expert assessment panel appreciates the proposals and agrees with the proposals for endorsement by PDS 2001 by the Secretariat for the future reporting on production capacities, atmospheric emissions, mercury losses through "Product, waste water and air and waste".

Concerning “Decommissioned or converted plants” the Expert Panel Assessment proposes, since the OSPAR Report on Mercury Losses from the Chlor-Alkali Industry is a tool to transfer information not only to the authorities concerned, but also to the public, that future reports will include basic information on “decommissioned or converted plants”. This information might be placed at the bottom of the data tables on the plants of the Contracting Parties under additional information. At least the name of the plant, its location, its decommissioned and converted chlorine capacity should be reported.

Concerning “Difference to balance” the expert panel assessment does not see the need for further investigations. It is clear from the viewpoint of the expert assessment panel that “Difference to balance” of a plant on a long term might be bigger than the mercury losses to air, water and products. Nevertheless the expert assessment panel feels that the information already provided by EuroChlor is sufficient to cope with the topic “Difference to balance”. Future reports on decommissioned and/or converted chlor-alkali plants might even more enlighten this topic.

In Germany the number of mercury-based chlor-alkali plants was reduced from 14 to 12. The numbering in the 2000 report is in accordance with the 1999 report, therefore future plant-by-plant assessment is still possible.

Recommendations

The expert assessment panel recommends that future reports should include some basic information on decommissioned and converted plants. Their name, location and decommissioned and/or converted chlorine capacity should be indicated under “Additional information” at the bottom of the national tables provided by EuroChlor. The expert assessment panel recommends that at present no further work on “Difference to balance” is needed.

3. EVOLUTION OF MERCURY LOSSES FROM THE CHLOR-ALKALI INDUSTRY (1982-2000)

The following figures give a rough indication of the evolution of mercury losses from the chlor-alkali industry in the period 1982-2000 as follows:

Figure 1: Chlorine Production Capacity with Mercury Cells;

Figure 2: Mercury Losses through Product, Waste Water and Air;

Figure 3: Atmospheric Emissions of Mercury.

It should be noted that these figures use data from previously published OSPAR Reports and that the way in which these data, in particular the pre-1999 data, were calculated and reported might differ:

- from Contracting Party to Contracting Party;
- within a time series of one Contracting Party.

Therefore, the interpretation of the figures is limited and any comparisons have to be carried out with extreme caution.

It should also be noted that Finland and Switzerland were not Contracting Parties to the former Paris Convention. Prior to the entry into force of the OSPAR Convention, the Contracting Parties supplied data on a voluntary basis as follows:

Finland from 1996 onwards, atmospheric emissions from the only mercury-based chlor-alkali plant, which discharges into the Baltic Sea (i.e. outside the OSPAR maritime area);

Switzerland from 1993 onwards, full data sets for the national mercury-based and mercury-free chlor-alkali industry.

Some information about changes in the reporting over time, as well as explanations of considerable increases or decreases in values, are given in footnotes to the OSPAR Report on Mercury Losses from the Chlor-alkali Industry (1982-1998), which was published in 2000.

A further source of information to be taken into account are the expert assessments, which were included in the publication of the Annual OSPAR Reports on Mercury Losses from the Chlor-alkali Industry from 1996 onwards.

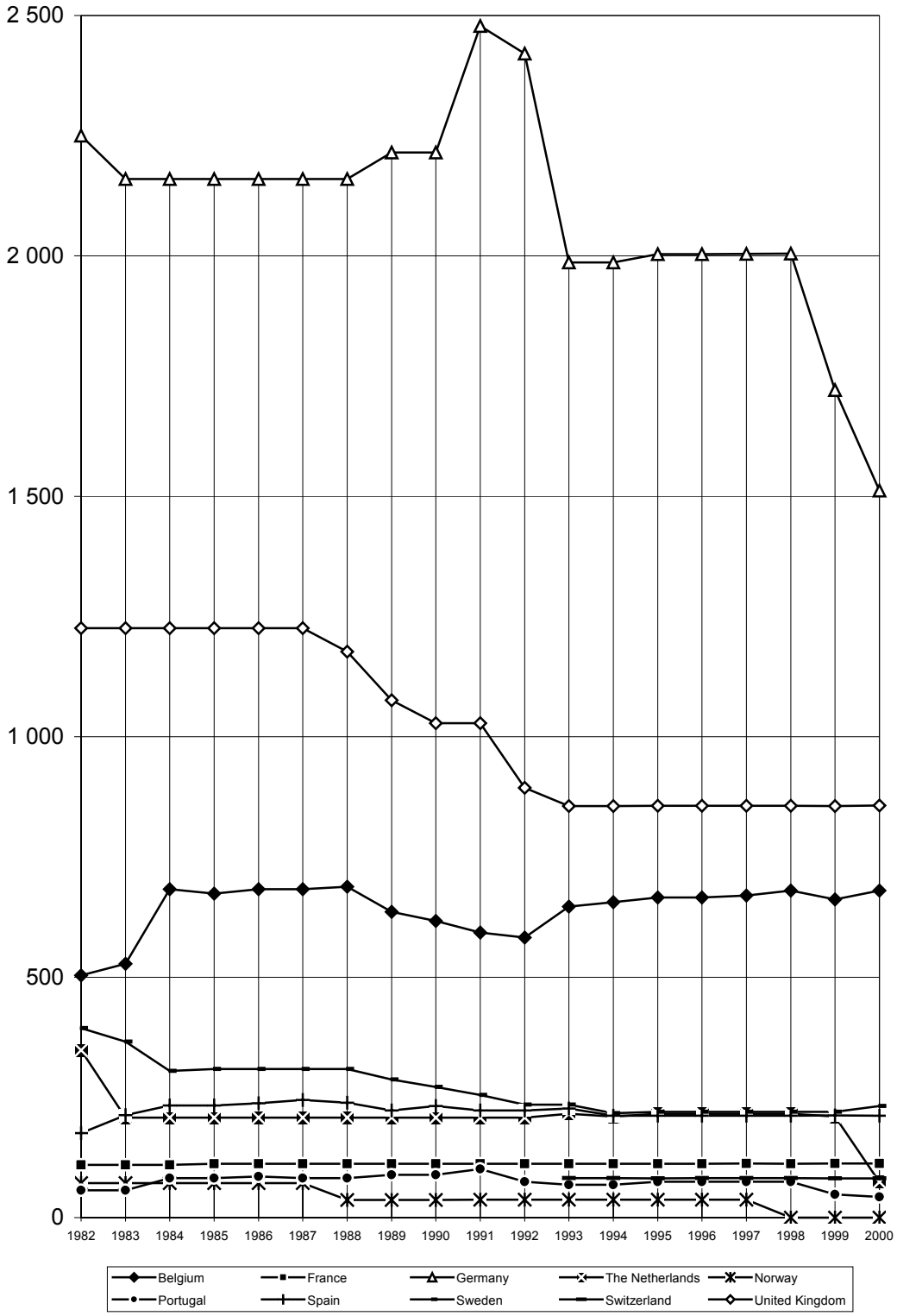


Figure 1: Chlorine Production Capacity with Mercury Cells of plants discharging into the OSPAR catchment area
(in kilotonnes per year)

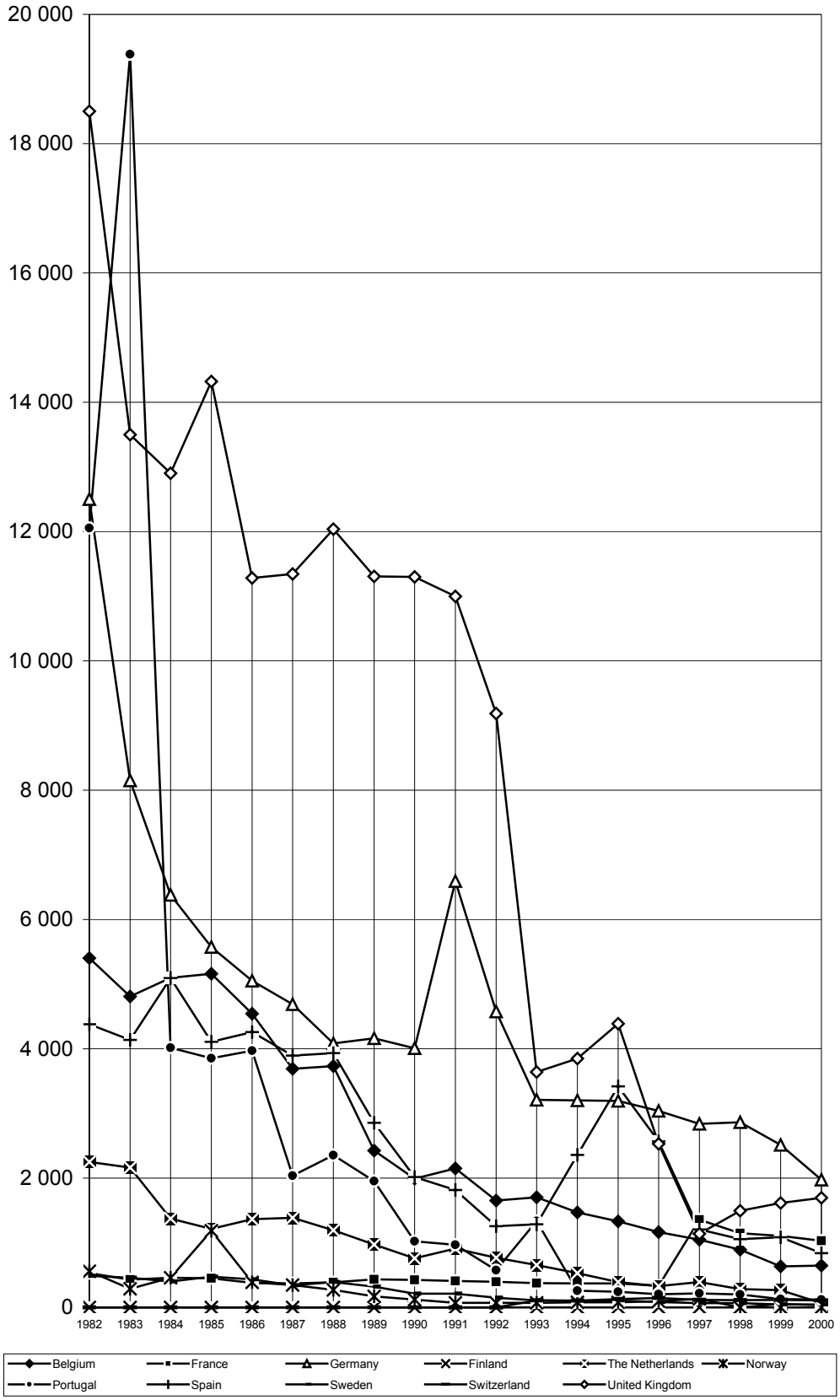


Figure 2: Mercury Losses through Product, Wastewater and Air
(in kilograms per year, sum of mercury losses to product and wastewater from national plants discharging into the OSPAR catchment area plus atmospheric emissions from all national plants)

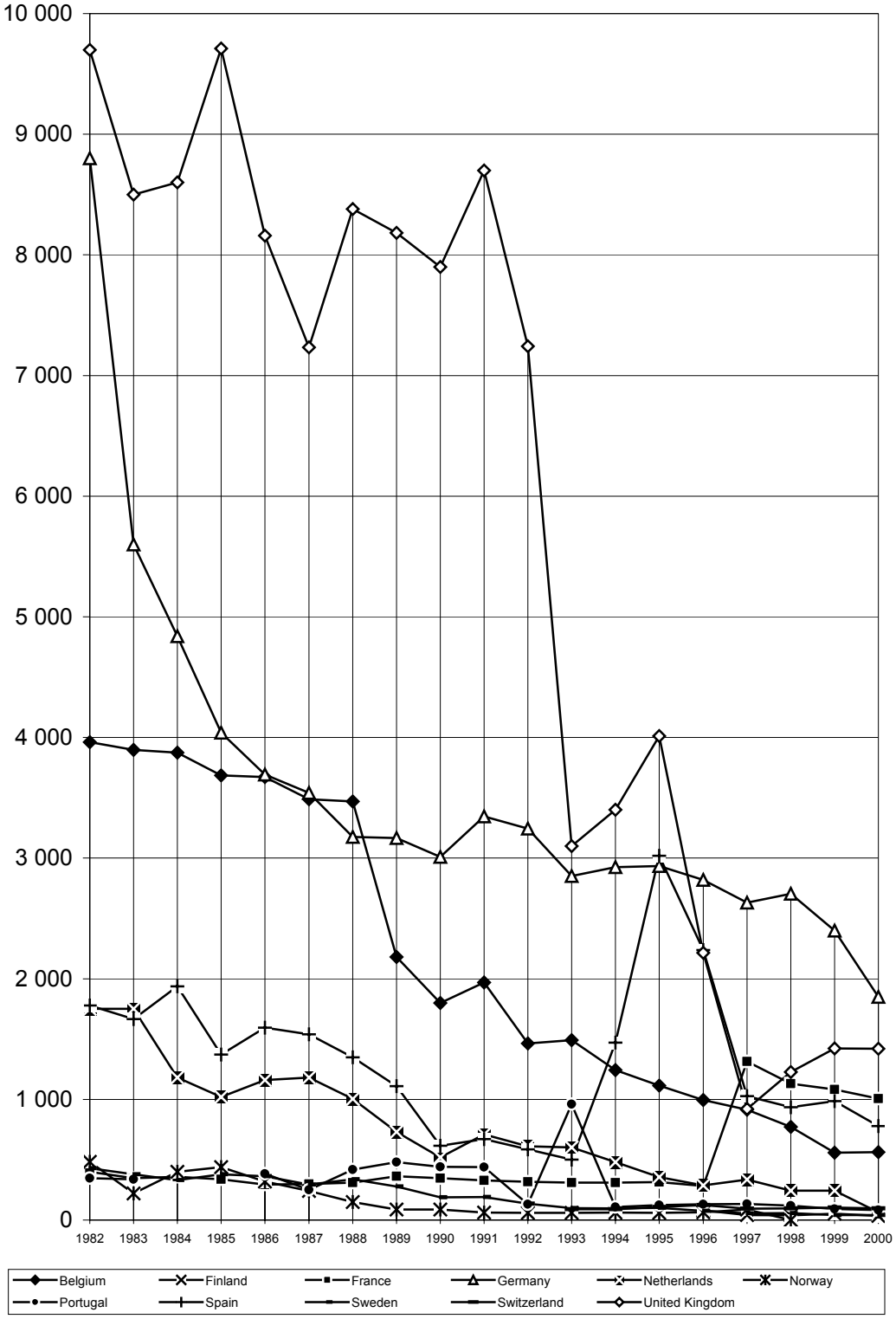


Figure 3: Atmospheric Emissions of Mercury from all plants of Contracting Parties
(in kilograms per year, all plants)

4. 2000 DATA AND INFORMATION

In this part of the report, data and information about the national chlor-alkali industry of each OSPAR Contracting Party is given as follows:

a. Contracting Parties with mercury-based chlor-alkali plants:

   (i) two overview maps showing the locations, the names and the operators of the sites;

   (ii) tables with technical data on the annual discharges, emissions and losses, including wastes, from plants of each Contracting Party (provided via Euro Chlor);

   (iii) information about the intended future phasing out of the mercury-based chlor-alkali industry (provided by Contracting Parties directly);

b. Contracting Parties with mercury-free plants or without chlor-alkali industry.

The column headings and abbreviations (e.g. C, E1, E2 etc) used in the tables correspond to the reporting requirements set out in the current formats:

Sea Area - Sea area in which liquid wastes from the plant is discharged, or is likely to be discharged

OSPAR maritime area
A - Atlantic

Areas not covered by the OSPAR Convention
Baltic - Baltic Sea
Bl Sea - Black Sea
M - Mediterranean Sea

Brine W - waste brine plant
R - brine-recirculation plant

Values are expressed in continental notation.

Locations of mercury-based chlor-alkali plants

The two following maps give an overview of the locations of the mercury-based chlor-alkali plants indicated below and their operators:

Country/Code	Company	Location
Belgium		
B/1	Solvay	Lillo
B/2	Tessenderlo	Tessenderlo
B/3	Solvin	Antwerpen
B/4	Solvay	Jemeppe
Finland		
SF/1	Eka Chemicals	Oulu
France		
F/1	PC de Loos	Loos
F/2	Albemarle PPC	Thann
F/3	Solvay	Tavaux
F/4	Atofina	Jarrie
F/5	SPC Harbonnières	Harbonnières
F/6	Atofina	Lavera
F/7	Atofina	St Auban
Germany		
D/2	Bayer	Uerdingen
D/3	ECI	Ibbenburen
D/4	Bayer	Leverkusen
D/5	BASF	Ludwigshafen
D/6	Ineos	Wilhelmshafen
D/7	Vestolit	Marl
D/8	Hüls	Lülsdorf
D/9	LII	Frankfurt
D/11	Clariant	Gersthofen
D/12	Wacker Chemie	Burghausen
D/13	Vintron	Knapsack
D/14	Vinnolit	Gendorf
The Netherlands		
NL/1	Akzo Nobel	Hengelo
Portugal		
P/1	Uniteca	Estarreja
Spain		
E/1	Quimica del Cinca	Monzon
E/2	Hernani	Hernani
E/3	Elnosa	Lourizan
E/4	Ercros	Flix
E/5	Solvay	Torrelavega
E/6	Solvay	Martorell
E/7	Aragonesas	Sabinanigo

E/8	Aragonesas	Vilaseca
E/9	Aragonesas	Huelva/Palos

Sweden

S/1	Akzo Nobel	Bohus
S/2	Hydro Polymers	Stenungsund

Switzerland

CH/1	Solvay	Zurzach
CH/2	Syngenia	Monthey
CH/3	Säurefabrik	Pratteln

United Kingdom

UK/1	Rhodia	Staveley
UK/2	Hays	Sandbach
UK/3	Ineos	Runcorn

Other OSPAR Contracting Parties

Denmark

Denmark has no chlor-alkali plants.

Luxembourg

Luxembourg has no chlor-alkali plants.

Iceland

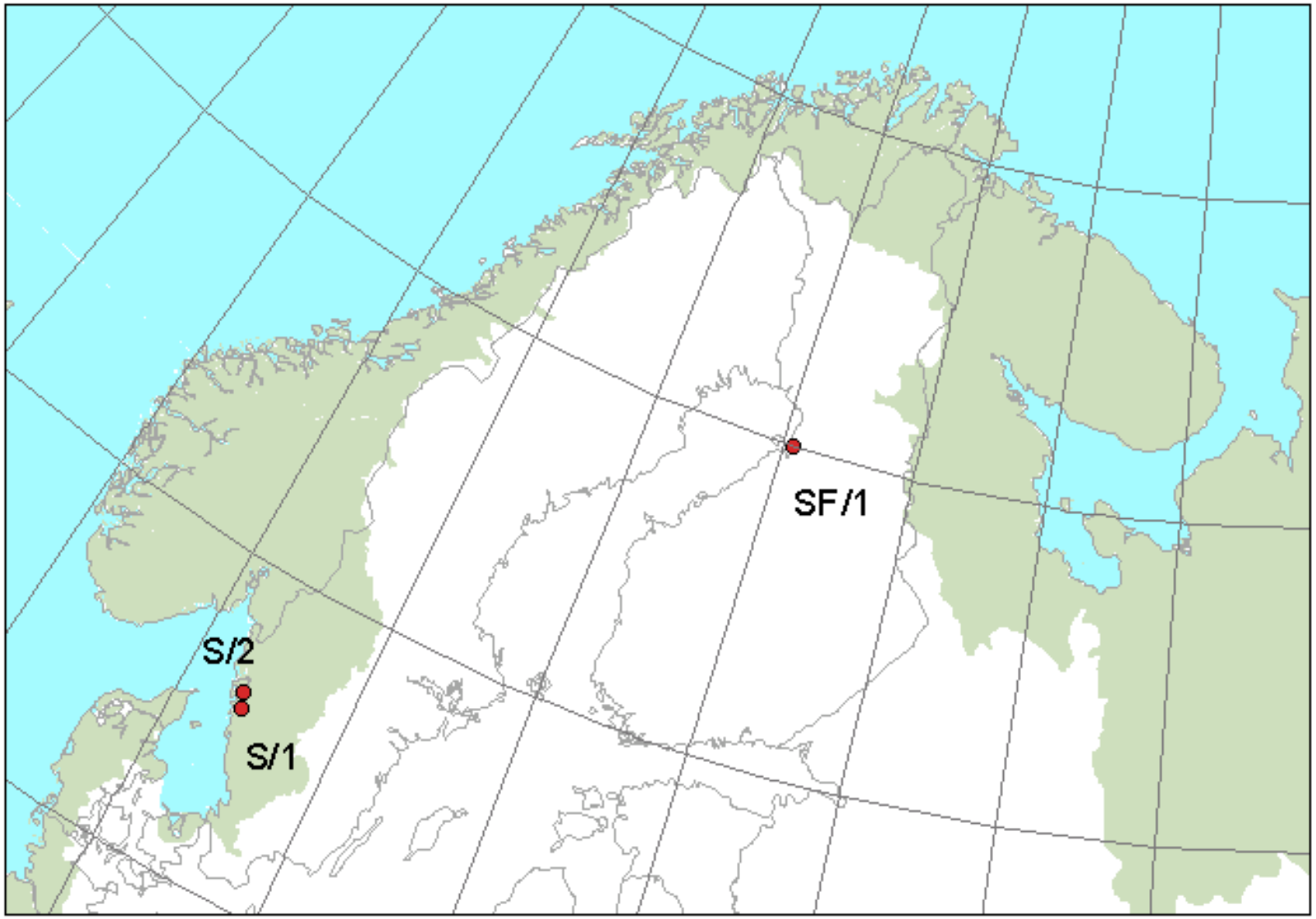
Iceland has no chlor-alkali plants.

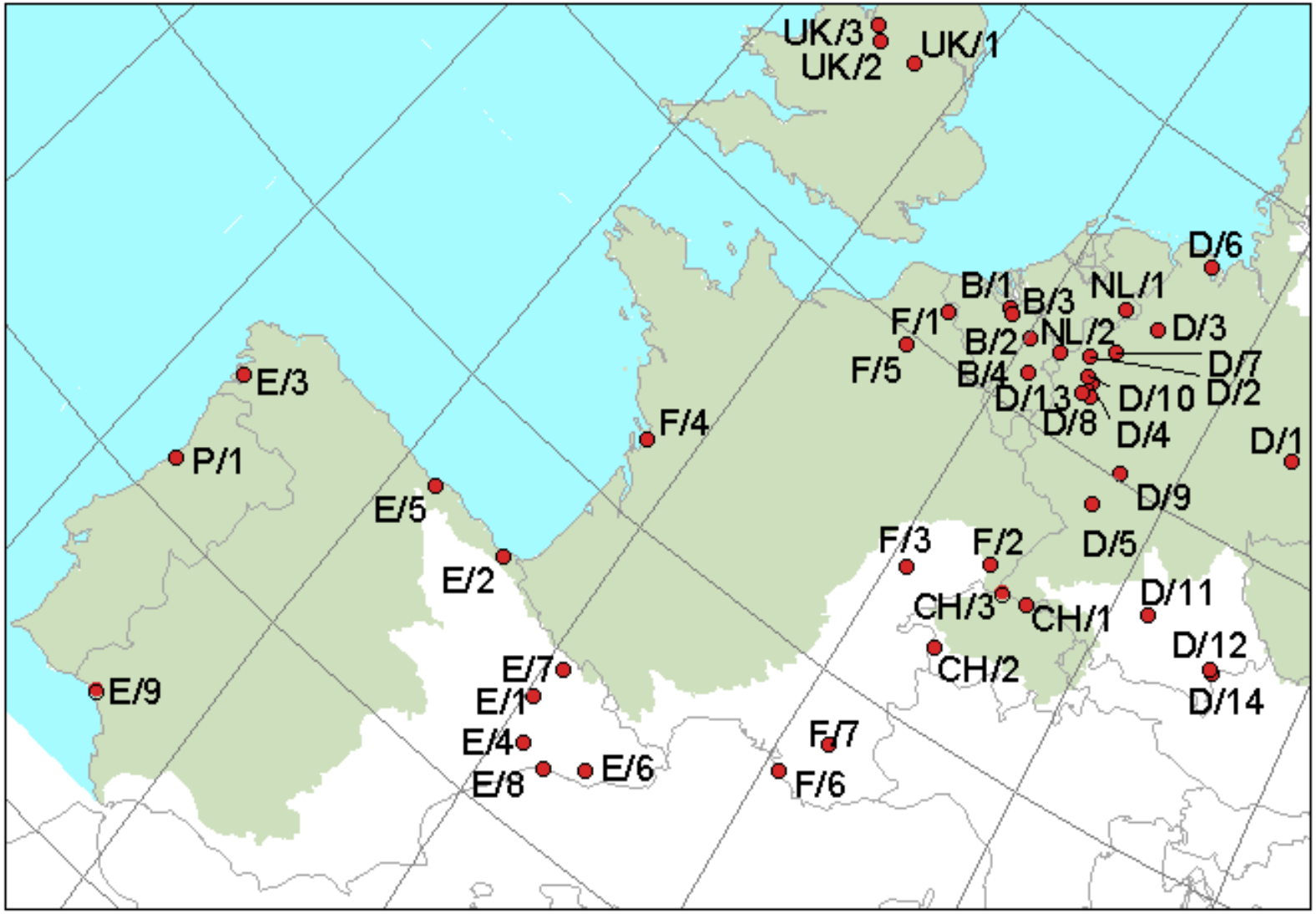
Ireland

Ireland has only one chlor-alkali plant, which operates mercury-free.

Norway

The last Norwegian plant with mercury cells ceased its mercury-based operations in September 1997.


SF/1
S/2
S/1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E/6
E/8
F/6

Belgium

Site	Chlorine Production Capacity with Hg-cells (tonnes)	Sea Area	Brine W or R	Mercury consumption C (g/t)	Losses via Products E1 (g/t)	Discharges via Waste Water E2 (g/t)	Emissions to the Atmosphere: Process Exhaust 2.3.1 (g/t)	Emissions to the Atmosphere: Cellroom 2.3.2 (g/t)	Emissions to the Atmosphere: Total E3 (g/t)	Total Emissions Discharges Losses (g/t)	Mercury in Wastes: Disposed off D (g/t)	Mercury in Wastes: Awaiting recovery c (tonnes)	Mercury in Wastes: Awaiting disposal f (tonnes)	Mercury in Wastes: Awaiting decision I (tonnes)	Mercury in Wastes: Temporarily stored F (g/t)	Difference to Balance DB (g/t)
B/1	219000	A	R	-29,986	0,077	0,011	0,003	0,624	0,627	0,715	31,155	2,845	-7,331		-20,484	-41,372
B/2	250000	A	R	23,372	0,082	0,011	0,003	0,624	0,627	0,720	14,264	2,097			8,388	
B/3	120000	A	R	-4,425	0,049	0,059	0,013	0,800	0,813	0,921	0,039					-5,385
B/4	90900	A	R	6,254	0,087	0,237	0,158	1,730	1,888	2,212	0,026	0,250	0,103		3,887	0,129
Total	679900															

Additional information:

The plants located in the Flemish region (all but one plant) are subject to the Flemish environmental legislation that states that the mercury-cell technique may not be used anymore after the year 2010 (Ref: VLAREM II, section 5.7.5.1 paragraph 3).

The plant located in the Wallonian region will replace its technology before 2010.

Finland

Site	Chlorine Production Capacity with Hg-cells	Sea Area	Brine W or R	Mercury consumption	Losses via Products	Discharges via Waste Water	Emissions to the Atmosphere			Total Emissions Discharges Losses	Mercury in Wastes					Difference to Balance
							Process Exhaust	Cellroom	Total		Disposed off	Awaiting recovery	Awaiting disposal	Awaiting decision	Temporarily stored	
	(tonnes)			C (g/t)	E1 (g/t)	E2 (g/t)	2.3.1 (g/t)	2.3.2 (g/t)	E3 (g/t)	(g/t)	D (g/t)	c (tonnes)	f (tonnes)	I (tonnes)	F (g/t)	DB (g/t)
SF/1	40000	Baltic	R	-33,475	0,060	0,133		0,885	0,885	1,078	0,004	-0,188			-4,700	-29,789
Total	40000															

Additional information:

The only plant producing mercury-based chlor-alkali in Finland, Eka Chemicals Oy in Oulu will stop mercury-based chlor-alkali production by 2010.

France

Site	Chlorine Production Capacity with Hg-cells	Sea Area	Brine W or R	Mercury consumption	Losses via Products	Discharges via Waste Water	Emissions to the Atmosphere			Total Emissions Discharges Losses	Mercury in Wastes					Difference to Balance
							Process Exhaust	Cellroom	Total		Deposed off	Awaiting recovery	Awaiting disposal	Awaiting decision	Temporarily stored	
	(tonnes)			C (g/t)	E1 (g/t)	E2 (g/t)	2.3.1 (g/t)	2.3.2 (g/t)	E3 (g/t)	(g/t)	D (g/t)	c (tonnes)	f (tonnes)	I (tonnes)	F (g/t)	DB (g/t)
F/1	18040	A	R	22,062	0,105	0,084	0,101	1,341	1,442	1,631		0,125	0,206		18,320	2,111
F/2	72000	A	R	59,750	0,111	0,111	0,016	1,408	1,424	1,646	36,560	-0,442	1,600		16,083	5,461
F/3	240900	M	R	9,651	0,100	0,003	0,430	0,870	1,300	1,403	5,380			0,537	2,231	0,638
F/4	170070	M	R	8,002	0,041	0,143	0,228	0,880	1,108	1,292	0,215	0,027	0,133		0,942	5,553
F/5	22500	A	R	16,844	0,303	0,001	0,032	1,100	1,132	1,436	3,100		0,164		7,289	5,020
F/6	166000	M	R	9,801	0,049	0,092		0,776	0,776	0,917	0,094					8,790
F/7	184300	M	R	20,100	0,030	0,080		1,210	1,210	1,320	0,190					18,590
Total	873810															

Additional information:

France does not have a timetable yet for achieving the recommendation as set out in PARCOM Decision 90/3. However, operators in France have finalised their environmental assessment studies for 7 individual plants. These studies are currently being assessed by the authorities and a synthesis will be prepared for future action.

Germany

Site	Chlorine Production Capacity with Hg-cells	Sea Area	Brine W or R	Mercury consumption	Losses via Products	Discharges via Waste Water	Emissions to the Atmosphere			Total Emissions Discharges Losses	Mercury in Wastes					Difference to Balance
							Process Exhaust	Cellroom	Total		Disposed off	Awaiting recovery	Awaiting disposal	Awaiting decision	Temporarily stored	
	(tonnes)			C (g/t)	E1 (g/t)	E2 (g/t)	2.3.1 (g/t)	2.3.2 (g/t)	E3 (g/t)	(g/t)	D (g/t)	c (tonnes)	f (tonnes)	I (tonnes)	F (g/t)	DB (g/t)
D/2	140000	A	R	15,000	0,080	0,006	0,030	1,650	1,680	1,766			0,030		0,214	13,020
D/3	125000	A	R		0,071	0,005	0,004	0,503	0,507	0,583	0,021	0,131	0,000		1,045	-1,649
D/4	300000	A	R	23,317	0,032	0,016	0,030	1,145	1,175	1,223	10,180					11,914
D/5	160000	A	R	11,875	0,030	0,010		1,000	1,000	1,040	3,600					7,235
D/6	148828	A	R	60,889	0,021	0,005		0,390	0,390	0,416	25,290		-1,300	3,210	12,834	22,349
D/7	182000	A	R	87,912	0,060	0,010	0,020	1,320	1,340	1,410	113,200		-5,070		-27,857	1,159
D/8	135951	A	R	7,429	0,270	0,010	0,030	1,230	1,260	1,540	17,000		1,036		7,620	-18,731
D/9	160000	A	R	-11,298	0,076	0,014	0,085	0,857	0,942	1,032	28,560			-6,606	-38,873	-2,016
D/11	9804	Bl Sea	R	-0,204	0,008	0,010	0,603	1,243	1,846	1,864						-2,068
D/12	157000	Bl Sea	R	-66,968	0,052	0,004	0,061	0,754	0,815	0,871	1,120	0,539		0,091		-68,959
D/13	160000	A	R	103,756	0,055	0,025	0,018	0,971	0,989	1,069	35,371	2,808	2,154		31,013	36,304
D/14	82355	Bl Sea	R	-11,293	0,033	0,001	0,190	1,140	1,330	1,364	9,150	-9,810	0,140		-117,418	95,612
Total	1760938															

Additional information:

The plants D/1 (Elektro Chemie, Bitterfeld, 75 000 t/a) and D/10 (Bayer, Dormagen, 370 000 t/a) as reported in the previous annual report have been converted to membrane technology.

The timetable of the intended future phasing out of the German national mercury-based chlor-alkali production is as follows:
01.01.2000 Chlorine capacity: 1,770 Million tonnes = 100,0%
01.01.2001 Chlorine capacity: 1,545 Million tonnes = 87,3%
Planned phasing out activities:
01.01.2006 Planned capacity : 0,993 Million tonnes = 56,1%

The Netherlands

Site	Chlorine Production Capacity with Hg-cells	Sea Area	Brine W or R	Mercury consumption	Losses via Products	Discharges via Waste Water	Emissions to the Atmosphere			Total Emissions Discharges Losses	Mercury in Wastes					Difference to Balance
							Process Exhaust	Cellroom	Total		Disposed off	Awaiting recovery	Awaiting disposal	Awaiting decision	Temporarily stored	
	(tonnes)			C (g/t)	E1 (g/t)	E2 (g/t)	2.3.1 (g/t)	2.3.2 (g/t)	E3 (g/t)	(g/t)	D (g/t)	c (tonnes)	f (tonnes)	I (tonnes)	F (g/t)	DB (g/t)
NL/1	74294	A	R	-31,039	0,013	0,023	0,177	0,696	0,873	0,909	0,027	-2,053	0,025		-27,297	-4,678
Total	74294															

Additional information:

The plant NL/2 (Solvay, Linne-Herten, 140 000 t/a) as reported in the previous annual report have been decommissioned.

On the national level the IPPC BREF for the chlor-alkali industry and OSPAR Decision 90/3 is being considered to give the guiding principles for the BAT on chlorine production. Briefly, this means that membrane technology and electrolyses using asbestos free diaphragms are considered as BAT and conversion of mercury-cell technology should take place before 2010. These guiding principles will be laid down in an explanatory memorandum and together with the BREF text this will be incorporated in the Dutch emission regulation systems (CIW and NER). These emission regulations are considered to be binding to a large extent, meaning that the permitting authorities can only deviate from these regulations in exceptional cases. Such a deviation will be subjected to a permitting procedure in accordance with the IPPC Directive.
It is to be expected that the above mentioned procedure, of incorporation of the BREF and the confirmation of the OSPAR Decision in the emission regulations, will be brought into effect in the next months.

Portugal

Site	Chlorine Production Capacity with Hg-cells (tonnes)	Sea Area	Brine W or R	Mercury consumption C (g/t)	Losses via Products E1 (g/t)	Discharges via Waste Water E2 (g/t)	Emissions to the Atmosphere: Process Exhaust 2.3.1 (g/t)	Emissions to the Atmosphere: Cellroom 2.3.2 (g/t)	Emissions to the Atmosphere: Total E3 (g/t)	Total Emissions Discharges Losses (g/t)	Mercury in Wastes: Disposed off D (g/t)	Mercury in Wastes: Awaiting recovery c (tonnes)	Mercury in Wastes: Awaiting disposal f (tonnes)	Mercury in Wastes: Awaiting decision I (tonnes)	Mercury in Wastes: Temporarily stored F (g/t)	Difference to Balance DB (g/t)
P/1	43302	A	R	28,867	0,500	0,400	0,300	1,600	1,900	2,800			0,700		16,166	9,901
Total	43302															

Additional information:

The only existing mercury-based plant in Portugal is replacing the mercury cells by membrane cells. The chlorine production with mercury cells ceased operation in January 2002.

Spain

Site	Chlorine Production Capacity with Hg-cells	Sea Area	Brine W or R	Mercury consumption	Losses via Products	Discharges via Waste Water	Emissions to the Atmosphere			Total Emissions Discharges Losses	Mercury in Wastes					Difference to Balance
							Process Exhaust	Cellroom	Total		Disposed off	Awaiting recovery	Awaiting disposal	Awaiting decision	Temporarily stored	
	(tonnes)			C (g/t)	E1 (g/t)	E2 (g/t)	2.3.1 (g/t)	2.3.2 (g/t)	E3 (g/t)	(g/t)	D (g/t)	c (tonnes)	f (tonnes)	I (tonnes)	F (g/t)	DB (g/t)
E/1	31373	M	R	39,715	0,250	0,350	0,010	1,410	1,420	2,020	136,300	-0,670	-2,513		-101,455	2,851
E/2	14815	A	R	20,250	0,225	0,451	0,010	1,262	1,272	1,948	0,556	0,086	-0,006		5,434	12,312
E/3	33552	A	R	21,042	0,410	0,009	0,040	1,240	1,280	1,699	17,850	-0,003	0,008		0,149	1,344
E/4	150000	M	R	23,427	0,230	0,080	0,006	0,778	0,784	1,094	41,860	0,335	2,327		17,747	-37,274
E/5	62747	A	W	25,053	0,234	0,051	0,054	1,293	1,347	1,632	6,564	-0,465	-0,336		-12,766	29,623
E/6	217871	M	R	6,160	0,062	0,014	0,084	0,674	0,758	0,834	3,533					1,793
E/7	25000	M	R	-18,920	0,460	0,420	0,010	1,050	1,060	1,940	0,380	-0,600			-24,000	2,760
E/8	135004	M	R	23,244	0,230	0,070	0,130	1,380	1,510	1,810	3,200	1,620			12,000	6,234
E/9	100929	A	R	22,481	0,137	0,066	0,012	0,723	0,735	0,938	3,970	1,100			10,899	6,674
Total	771291															

Additional information:

Spain has a voluntary agreement with its industry and will implement BAT as set out in the IPPC BREF, and will respect the phase-out of mercury-cell technology by 2010.

Significant reductions of atmospheric emissions have been established at the plants E4, E7 and E9 between 1999 and 2000:

E 4: 1,45 g/t in 1999 and 0,78 g/tonnes in 2000;

E 7: 1,40 g/t in 1999 and 1,06 g/tonnes in 2000;

E 9: 1,50 g/t in 1999 and 0,73 g/tonnes in 2000.

Both analyses have been carried out in accordance with the official homologated protocol for testing and analysis of atmospheric emissions.
The three plants have made important efforts during the last years in order to reduce emissions. For instance, the floor of basements has been covered with a waterproof resin, the old heads of the cells and the decomposer systems (where there were frequent losses previously) have been changed and, moreover, workers have been trained to be more alert to situations when minor losses are detected and take direct and immediate action to prevent such losses.

Sweden

Site	Chlorine Production Capacity with Hg-cells (tonnes)	Sea Area	Brine W or R	Mercury consumption C (g/t)	Losses via Products E1 (g/t)	Discharges via Waste Water E2 (g/t)	Emissions to the Atmosphere			Total Emissions Discharges Losses (g/t)	Mercury in Wastes					Difference to Balance DB (g/t)
							Process Exhaust 2.3.1 (g/t)	Cellroom 2.3.2 (g/t)	Total E3 (g/t)		Deposed off D (g/t)	Awaiting recovery c (tonnes)	Awaiting disposal f (tonnes)	Awaiting decision I (tonnes)	Temporarily stored F (g/t)	
S/1	100000	A	R	17,310	0,012	0,016	0,003	0,247	0,250	0,278	0,064	1,851	-0,004		18,470	-1,492
S/2	132000	A	R	8,092	0,010	0,003	0,002	0,129	0,131	0,144	0,010	3,995			33,292	-25,355
Total	232000															

Additional information:

In autumn 2001, the Swedish Government has sent a revised version of the Swedish Ordinance on Chemicals for notification to the European Commission. The Ordinance implies ban on the use of Hg-cells for chlor-alkali production from 2010. If the Commission approves the Ordinance via the “Simple procedure”, the Ordinance will be put into force within approximately three months from approval. If the European Commission decides to follow the "Detailed statement procedure”, it may take approximately an additional three months to put into force, i.e. about 6 months in total from the initial response of the Commission to the revised version.

Switzerland

Site	Chlorine Production Capacity with Hg-cells	Sea Area	Brine W or R	Mercury consumption	Losses via Products	Discharges via Waste Water	Emissions to the Atmosphere			Total Emissions Discharges Losses	Mercury in Wastes					Difference to Balance
							Process Exhaust	Cellroom	Total		Deposed off	Awaiting recovery	Awaiting disposal	Awaiting decision	Temporarily stored	
	(tonnes)			C (g/t)	E1 (g/t)	E2 (g/t)	2.3.1 (g/t)	2.3.2 (g/t)	E3 (g/t)	(g/t)	D (g/t)	c (tonnes)	f (tonnes)	I (tonnes)	F (g/t)	DB (g/t)
CH/1	55000	A	R	-19,436	0,078	0,047	0,042	1,104	1,146	1,271	3,230					-23,937
CH/2	26500	M	R	0,000	0,027	0,006	0,002	0,708	0,710	0,743	0,104					-0,847
CH/3	27000	A	R	35,556	0,131	0,044		0,517	0,517	0,692				0,941	34,852	0,012
Total	108500															

Additional information on the intended future phasing out of mercury-based chlor-alkali industry or conversion to mercury free capacities:

There are no specific plans for the phasing out or conversion for the two mercury-based plants operating in the OSPAR catchment area in Switzerland. However, both companies are signatures to the voluntary commitments (see Summary Record WOCAI 99/7/1, Annex 5 or Document POINT 99/10/Info.4) presented to POINT 1999 (POINT99/10/7) by Euro Chlor and are willing to adhere to the fixed proposals, inter alia, to the timetable for emission reductions and plant closures.

United Kingdom

Site	Chlorine Production Capacity with Hg-cells (tonnes)	Sea Area	Brine W or R	Mercury consumption C (g/t)	Losses via Products E1 (g/t)	Discharges via Waste Water E2 (g/t)	Emissions to the Atmosphere			Total Emissions Discharges Losses (g/t)	Mercury in Wastes					Difference to Balance DB (g/t)
							Process Exhaust 2.3.1 (g/t)	Cellroom 2.3.2 (g/t)	Total E3 (g/t)		Disposed off D (g/t)	Awaiting recovery c (tonnes)	Awaiting disposal f (tonnes)	Awaiting decision I (tonnes)	Temporarily stored F (g/t)	
UK/1	29413	A	R	13,735	0,068	0,009	0,033	0,428	0,461	0,538	9,115					4,082
UK/2	89872	A	R	10,220	0,060	0,020	0,070	1,450	1,520	1,600	0,530					8,090
UK/3	738000	A	W	-1,302	0,040	0,320	0,210	1,510	1,720	2,080	4,190	5,040	-4,963	-15,180	-20,465	12,893
Total	857285															

Additional information:

There are 3 UK plants currently using mercury-cell technology. The various factors associated with conversion or phase out of mercury-cell plants are currently being addressed but it is not yet possible to provide a timetable regarding phasing out or conversion.

The level of releases to air from UK/3 has not decreased as expected in relation to the level of releases in 1999. The main reason behind the level of release to atmosphere in 1999 was the effect of phosphate addition to the water used for cooling purposes by the water supplier, and the consequential effect on cooling capacity. As was predicted at the time, this effect was progressively less pronounced in 2000 as the agreed solutions took effect. However, the expected improvement in releases to air was not realised, the gains from the cooling water work being offset by increased releases due to maintenance activities. In 2000 it became necessary to repair and refurbish parts of the plants which were found to be contaminated with mercury, and despite best endeavours, this undoubtedly made a contribution to the UK/3 release level. This maintenance work is an essential part of the strategy for reducing the levels of release to atmosphere. Maintenance activities were also the main reason for the deterioration in the level of releases to water. Large projects to improve the reliability and availability of the waste brine treatment unit meant that the unit was not fully operational at all times. Again, the purpose of the work is to improve the longer-term environmental performance of the plant complex. It should be noted that the plant has operated within the limits and conditions set in its IPC permit, and continues to do so.