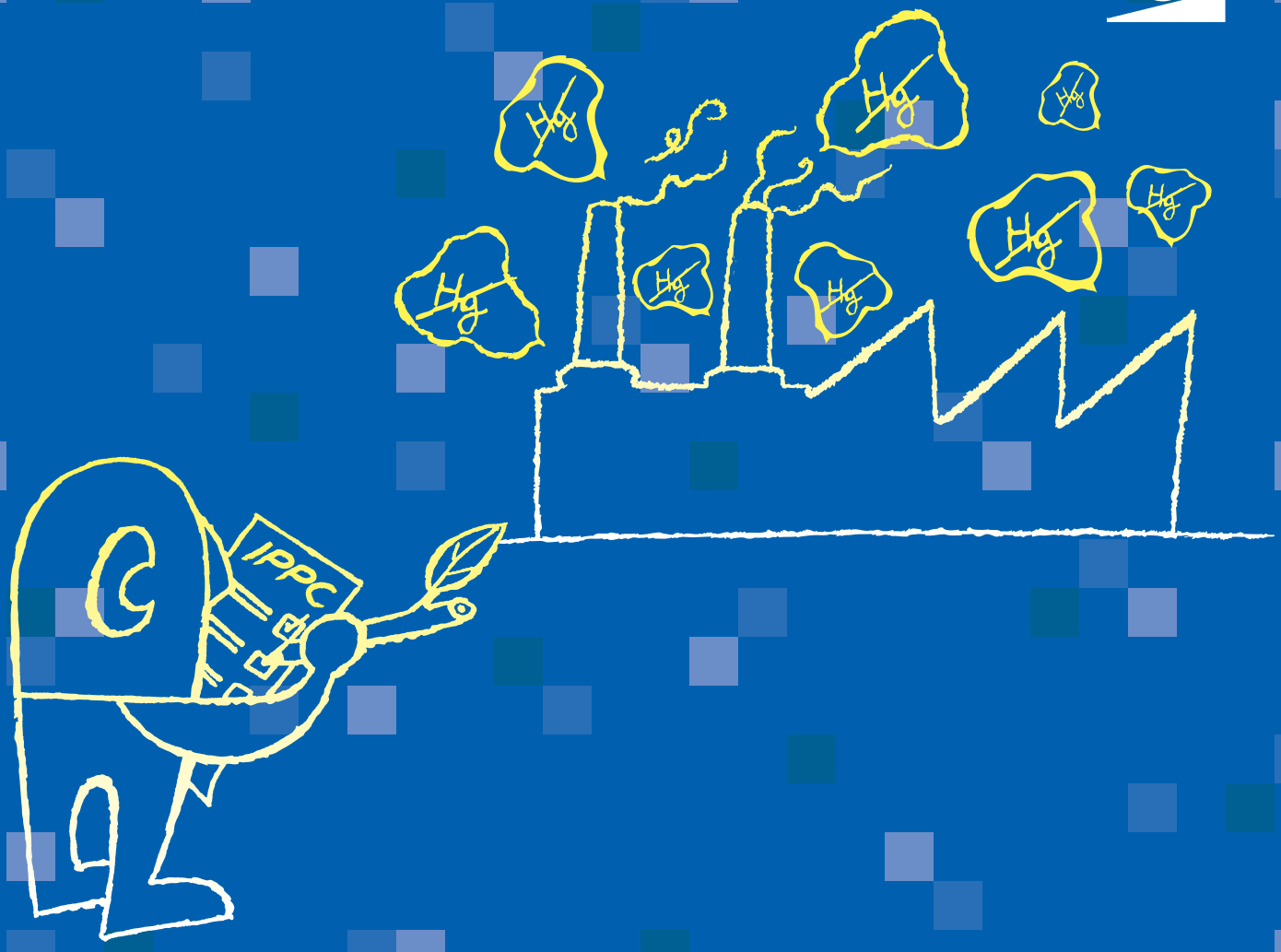
SNAPSHOT REPORT



The European Chlor-Alkali Industry

IS NATIONAL IMPLEMENTATION OF THE IPPC DIRECTIVE CONTRIBUTING TO A MERCURY-FREE INDUSTRY?

Results of an Environmental NGO Survey

zero Hg mercury working group

EEB

DECEMBER 2008

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The European Environmental Bureau (EEB) is a federation of over 150 environmental citizens' organisations based in most EU Member States, most candidate and potential candidate countries as well as in a few neighbouring countries. These organisations range from local and national, to European and international.

EEB's aim is to protect and improve the environment by influencing EU policy, promoting sustainable development objectives and ensuring that Europe's citizens can play a part in achieving these goals. EEB stands for environmental justice and participatory democracy. Our office in Brussels was established in 1974 to provide a focal point for our members to monitor and respond to the EU's emerging environmental policy. In 2004, EEB, working with the Mercury Policy Project/Ban Mercury Working Group, launched the 'Zero Mercury' campaign.

The Zero Mercury Working Group is an international coalition of over 75 Public-interest non-governmental organisations from around the world formed in 2005 by the European Environmental Bureau and the Mercury Policy Project. The group's aim is to reach 'zero' emissions, demand and supply of mercury, from all sources we can control, towards eliminating mercury in the environment, at EU level and globally.

Editor responsible: John Hontelez

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European Environmental Bureau (aisbl)

December 2008

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The European Chlor-Alkali Industry

Is National Implementation of the IPPC Directive Contributing to a Mercury-Free Industry?

Results of an Environmental NGO Survey

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DECEMBER 2008

European Environmental Bureau **Zero Mercury Working Group**

Report financed by the Sigrid Rausing Trust, UK, and the European Commission

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Executive summary

This report aims to evaluate the quality of the implementation of the EU Directive on Integrated Pollution Prevention and Control (IPPC) (Directive 96/61/EC[1]) in the European chlor-alkali industry with respect to mercury (Hg), based on environmental NGOs' (ENGOs) involvement in and observation of the implementation process. The report is based on the responses to a comprehensive questionnaire from eight countries (Belgium, Czech Republic, France, Germany, Greece, Italy, Spain and the United Kingdom), where the majority (36 out of 44) of mercury-cell chlor-alkali plants in operation in Europe today are located., representing 86,7% of the total mercury-cell chlorine production capacity in Europe.

In the EU more than 40% of the chlorine production is based on the mercury-cell process. Forty-four mercury-cell chlor-alkali plants (MCCAPs) are still in operation in Europe – 'housing' around 11.000 tonnes of mercury. Nevertheless, the membrane process, which is mercury-free and consumes up to 30% less energy leading to significant cost savings, has been available since the 1980s. Industry has estimated the total cost for conversion of these MCCAPs at less than 2.400 million Euro, whereas annual turnover for this sector amounts to more than 240.000 million Euro.

The IPPC Directive and broader supporting legislation such as the Water Framework Directive are the only 'hard' pieces of EU law applicable to mercury releases from the chlorine industry. Through the IPPC Directive, all chlor-alkali plants should have received a permit by October 2007, from the responsible local authorities. These permits are meant to use as reference the Best Available Techniques (BAT), setting the technical and performance benchmark of the installation, taking into account its technical characteristics, its geographical location and the local environmental conditions. Since the (mercury-free) membrane process is regarded as BAT for the chlorine industry, the BAT Reference document (BREF) does not set straightforward BAT associated emission levels for mercury releases from mercury-cell plants. However the BREF document suggests that mercury cell plants dating back before 2001 could achieve mercury emission levels in the range of 0,2-0,5 g Hg/tonne of chlorine capacity as a yearly average.

All countries surveyed have transposed the IPPC Directive through national laws and ministerial decisions. Half of the countries surveyed have adopted laws which set mercury emission limit values to air and water. Some countries have also set quality standards for mercury to ambient air, water and soil – in the absence of an EU standard for air and soil, but taking into consideration the recently adopted quality standards for water which will enter into force in 2012. Similarly, some countries have set occupational health exposure limits for mercury, since no EU limit exists. Further to that, some countries have set general binding rules and have provided more details as to what requirements should be considered when local authorities are granting a permit.

In the absence of clear EU level guidelines, overall releases of mercury are regulated in a different way by different EU Member States, and even plants in the same country may be regulated differently. This has lead to varying levels of protection of the environment and human health, ignoring the special challenges of dealing with mercury – an identified and acknowledged global pollutant. The lack of a standard permit for chlor-alkali plants at EU level makes implementation, enforcement and comparison very difficult, and does not contribute to a commercial level playing field, or to consistent and adequate protection of the environment and public health.

In terms of actual emissions, industry has been reporting an annual average of 41 tonnes of mercury as "unaccounted-for" during the period 2001-2005. This lost mercury amounts to more than five times the reported emissions. Further, supported by the convincing evidence presented in this report, it is generally accepted that the majority of these "unaccounted", or unexplained, mercury losses in fact represent unrecorded fugitive emissions to the atmosphere, waste disposal, releases to water, etc. Although different explanations have

[1] For the full text of the IPPC Directive please see: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0061:EN:NOT

been provided by industry regarding this 'lost' mercury, many studies have concluded that emissions from industry are under-reported. Furthermore, considering the size of these losses, it is absolutely critical that regulatory authorities require full reporting (and improved understanding) of all mercury losses as a primary permit condition.

On the basis of our findings, reported emissions per tonne of chorine produced vary from country to country, plant to plant and also within plants of the same industrial group. Reported emissions to air range from 0,28 - 1,910 g Hg/tonne of Cl_2. Almost all plants reported that emissions complied with their permits, which also differ among plants.

The methodology for measuring mercury emissions, especially to air, is rarely specified in the IPPC permit although some general guidance is available in the BREF and provided by industry association Euro Chlor. It is not clear, however, which plants follow this guidance or any other protocol, leading to potentially incorrect, inconsistent and/or incomparable emission estimates.

Furthermore the method and frequency of monitoring and auditing of mercury emissions vary considerably across Europe, within countries and between individual plants. As a result, mercury leakage and/or malfunctioning equipment may not be identified quickly, leading to uncontrolled/fugitive releases, potentially high workers' exposure and, as mentioned before, more mercury being added to the global environment.

No explanation is requested for those differences in permits, emission rates, measuring methods and frequency, leading to conclude once more, that citizens are not equally protected across the EU.

As already mentioned, the existing legislation does not set a clear date by which all MCCAPs should be converted to mercury-free process or closed down. Ignoring an OSPAR recommendation by which mercury-cell chlor-alkali plants should aim to close or convert by 2010, industry has offered a voluntary agreement to phase out MCCAPs by 2020, but no legal obligation to do so exists, and no conditions are set if this agreement is not fulfilled. Only Belgium has legally set a sunset date for MCCAPs, while France seems to have incorporated into national law the 2020 date, as offered by industry. Spanish plants are supposed to submit their plans for conversion by 2011, and some countries (e.g. the Czech Republic) have specified a phase-out date in their permits. Some sites have also received state financial aid to become mercury-free.

In the meantime, many MCCAPs have been decommissioned in the past years. However the mercury contamination of the sites/soil still amounts to 9,600 tonnes of mercury, according to recent estimates.

On the basis of the findings of our survey, it is obvious that without responsible EU direction, industry and authorities are free to decide as convenient with respect to both emissions and eventual conversion, although a correct consideration of the BREF document on the Chlor Alkali Manufacturing industry within the permits issued according to the IPPC Directive would have led to achieve a mercury-free conversion by October 2007, or as soon as possible after this date.

Apart from actual conversion of MCCAPs, according to the IPPC Directive, all plants should have been given operating permits by October 2007. According to the results of our survey, IPPC permits appear now to have been given to all surveyed countries' plants apart from Italy. Details of the permits differ significantly from country to country, where usually measurement methodology and frequencies of monitoring are not addressed. Although all plants were found to comply with their permit conditions, these conditions seem quite flexible and sometimes tailored for the operators to be able to comply. It can therefore be argued that permits are not ambitious enough to drive industry to better performance, but instead they encourage business as usual, confirming the status quo. Needless to say, this is completely contrary to the intent of the IPPC Directive, which was to drive industry rapidly in applying BAT.

Finally, the survey shows that stakeholders can indeed participate in the permit application consultations; however they are often not directly invited or informed about when the process takes place. In addition, when they are consulted, it appears that their views are seldom taken into consideration. As regards the conformity reports, these are not typically available or publicly accessible.

Recommendations

On the basis of the above observations, we propose the following:

- **A specific sunset date for all mercury-cell chlor-alkali plants, both sodium – and potassium-based should be set. The EEB has been advocating for 2010 as a phase out date for many years.**

- **At EU level, the European Commission should come forward with legislation specific to the chlor-alkali industry, including not only a specific sunset date for the mercury-cell chlor-alkali plants, but also minimum requirements, reporting obligations, and mercury emission limit values for the mercury-cell chlor-alkali plants that will choose to operate until the sunset date.**

  When minimum requirements are set, the Commission should take into consideration the following recommendations, below.

Until a sunset date is set, with respect to the MCCAPs it is further recommended that:

- **The role of the Best Available Technique Reference Documents (BREFs) in the IPPC Directive be made more precise and more stringent. Permit conditions must be based on the BREFs which considers the membrane technology as BAT and obliges MCCAPs to convert to membrane cell technology. Any derogations based on local conditions (technical characteristics, geographical location and local environmental conditions) should be subject to strict criteria defined by the Commission and dependent on the outcome of a public consultation.**

- **The BREF document on the Chlor Alkali Manufacturing Industry needs to be revised rapidly. Firstly, the mercury-cell technique shall not be presented under the BAT chapter. Secondly, for the remaining life of MCCAPs, and in a separate chapter, a maximum emission limit value of 0,2- 0,5 g Hg/tonne of Cl_2 production capacity, should be set, as well as additional strict minimum requirements defined according to the recommendations below.**

- **A plan for decommissioning, conversion or closure, and site remediation should be required from all MCCAP operators as soon as possible on the basis of the sunset date, or sanctions should apply.**

- **Similar to the common practice in the US, continuous monitoring should be required for plants still using mercury. The number of measuring devices per plant and their location should be required and specified in the permit. The methodology for monitoring and calculating/estimating mercury emissions should be defined at EU level, included in the permit and it should be ensured that it is followed by all operating MCCAPs. All mercury consumption and releases should be independently verified.**

- **Yearly reporting within no more than 6 months from the end of a calendar year, should be required from all operators, specifying their total mercury consumption and losses, including unaccounted-for mercury, similarly to the OSPAR reporting requirements for MCCAPs in the OSPAR region. These should be publicly available on the internet.**

- **All mercury wastes from the chlor-alkali industry should be retorted and the mercury recovered and stored according to Regulation EC/1102/2008.**

- **Companies should be required to account for any difference to their mercury mass balance. Big differences from one year to the other should be fully explained.**

- **Operators should be obliged to prepare a yearly report on their compliance with their operating permit, and the authorities should make this report publicly available on internet.**

- **Ambient air and water in the vicinity of MCCAPs should be periodically measured by the authorities and results should be made publicly available on the internet.**

- **The public concerned should be given early notice of a site permit application in order to be able to participate effectively in the process, under the IPPC Directive.**

Acknowledgments

The EEB would like to thank the participating NGOs for responding to this survey as well as all national and local authority representatives from the participating Member States for their assistance. The EEB and its partner organisations would like to give special thanks to LUMEX Analytics GmbH (Germany) and Universidad de Castilla la Manca - Depto. Ingeniería Geológica y Minera (Almadén, Spain) for providing equipment and training for the mercury monitoring exercise.

The EEB gratefully acknowledges financial support by the Sigrid Rausing Trust, UK and the European Commission for the Zero Mercury Campaign, this survey and report. Finally, the organisation would like to thank Peter Maxson for his valuable contributions and assistance on technical issues related to interpretation of industry reports on mercury emissions and releases.

1 The IPPC Directive Snapshot Report

1.1 Introduction: objectives of the EEB snapshot report

This report aims to evaluate the quality of the implementation of the EU Directive on Integrated Pollution Prevention and Control (IPPC) (Directive 96/61/EC[2]) in the European chlor-alkali industry, based on environmental NGOs (ENGOs) and their involvement in and observation of the implementation process. In particular, it draws attention to the mercury emissions resulting from the operation of the mercury-cell chlor-alkali plants (MCCAPs) across Europe, to the IPPC permit application process and to the role of local authorities in issuing permits and monitoring and controlling mercury emissions.

This report is based on the results of a survey questionnaire developed by the EEB and filled in by EEB member organisations located in the European countries where MCCAPs are still in operation, incorporating responses from regional or local Member State authorities. The objective of the EEB snapshot report is to bring past experiences[3] together with new evidence on the regulation of MCCA plants' mercury emissions. In particular, there are two main aims of this study: to investigate to what extent the IPPC permits are implemented, enforced and consistent or harmonised in the chlor-alkali industry within Member States and across the EU; and to investigate whether IPPC permits are sufficient to address the full range of mercury releases from the chlor-alkali industry.

This implementation 'snapshot report' is the first of its kind in the area of mercury policy[4], and follows on from similar implementation 'snapshot reports' that the EEB has been carrying out in the areas of water, air and waste policy[5]. These reports are part of the EEB's efforts to build awareness and knowledge about the state of transposition and implementation of key EU environmental laws, contributing in this way to better enforcement. In the case of the IPPC Directive, this report will hopefully not only contribute to better enforcement but also to an improvement in the formulation of the legislation during the current revision of the Directive.

Furthermore, this report will encourage the harmonisation of the implementation of the IPPC Directive in the chlor-alkali sector across the EU, on the one hand contributing to a more level competitive "playing field", while at the same time reinforcing the need to further accelerate the shift to a mercury-free chlor-alkali industry.

1.2 Participants in the survey and level of engagement

The Questionnaire was sent to 14 environmental NGOs (ENGOs) from the EEB mercury working group. We received eight responses to the questionnaire, covering eight European countries (Belgium, Czech Republic, France, Germany, Greece, Italy, Spain and the United

[2] For the full text of the IPPC Directive please see: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0061:EN:NOT

[3] In November 2004, the European Environmental Bureau (EEB) started, in collaboration with the (international) Ban Hg Working Group and the Mercury Policy Project, the 'Zero Mercury' Campaign, which, among others, has been focusing on the mercury-cell chlor-alkali industry in Europe, in view of promoting a swift conversion of the existing mercury-cell processes to mercury-free technologies and ensuring, at the same time, that decommissioned mercury be safely stored. Within this framework, five national NGOs have started campaigns since 2006: in Italy, Spain, Czech Republic, France and Germany. In addition, in 2006, a study "Status Report: Mercury cell chloroalkali plants in Europe" (http://www.zeromercury.org/EU_developments/Final_Report_CA_31Oct2006.pdf) and a special report "Risky Business! No need for mercury in the Chlorine industry" (http://www.zeromercury.org/EU_developments/061110RiskyBusinessFINAL.pdf) were published by the EEB.

[4] A Commission's report to the Council and the European Parliament (COM/2005/0540 final) was published in 2005 on the implementation of Directive 96/61/EC concerning integrated pollution prevention and control.

[5] Scheuer, S and Rouillard, J (2008), 'Letting the Public Have their Say on Water Management', EEB Publication No. 2008/006.
Hontelez, J. (2005), 'Particle Reduction Plans in Europe: Implementation of the First Daughter Directive on Ambient Air Quality in Europe', EEB Publication No. 2005/014.
Cioci, G. and Shinn, M. (2005) 'The Quality of National Implementation of the Waste Landfill Directive', EEB Publication No. 2005/010.

Kingdom), where the majority (36 out of 44) of mercury-cell chlor-alkali plants in operation in Europe today are located (see map in Annex C and contacts of participating ENGOs in Annex D) representing 86,7% of the total mercury-cell production capacity of chlorine production in Europe. Five (IT, ES, CZ, FR and DE) of the eight NGO respondents are running national campaigns that promote the conversion of mercury-cell technology to membrane, and are working to ensure that decommissioned mercury is safely stored and will not re-enter the market.

All responding NGOs are national organisations that also have local/regional experience related to their local campaigns, which have brought them in regular contact with the operators of the MCCA plants and with the local authorities. This means that their answers to the questionnaire are primarily based on their direct experience in following and participating in the permit application process. However, the answers to the questionnaire not only reflect the experience of the NGOs but they also incorporate the expertise and experience of the local authorities responsible for regulating the chlor-alkali industry, who are familiar with specific issues regarding the permits.

1.3 Overview

This report begins with an overview, in chapter 2, of the legislative framework governing the chlor-alkali industry at the international, European and national levels. The chapter also explains the necessity of converting the chlor-alkali plants from the mercury-cell technology to the membrane technology. Chapter 3 gives an overview of the reported mercury emissions along with other mercury losses of the European MCCAPs and it explores whether and how the monitoring and auditing of emissions is carried out by the authorities. Chapter 4 focuses on the permit system in force and how it differs across Europe. It also assesses the compliance of the MCCAPs with their permit conditions. Chapter 5 focuses on stakeholder involvement in the permitting of chlor-alkali plants and on availability of information on the performance of the plants. Finally, Chapter 6 presents the main conclusions of the report and provides recommendations for European policy makers.

2 The Legislative Framework

2.1 Mercury and the legislative framework for the MCCAPs

Mercury and its compounds are extremely toxic to human life, ecosystems and wildlife. In humans, mercury can be fatal and, in low amounts, it can seriously harm the nervous, cardiovascular, immunological and reproductive systems. Mercury is also a substance that persists in the environment. Bacteria in aquatic and other natural systems convert a small proportion of mercury to methylmercury (MeHg), which bioaccumulates in fish and other wildlife, and may enter the human food chain. Methylmercury is an extremely toxic form of mercury that can easily cross the placental barrier and seriously impair the neurological development of the foetus. There is evidence that mercury and methylmercury pollution already affect the health of a significant number of European citizens. At a time when neuro-developmental diseases affect one out of six children in industrialised countries, it is remarkable that many national authorities appear to accept continued mercury pollution from the chlor-alkali industry even though mercury-free alternatives have long been available and are much more energy-efficient (See section 2.2).

As mercury travels across borders, it is well understood to be a global, widespread and chronic problem. The international community has long made efforts to reduce mercury pollution: in 1990, OSPAR Decision 90/3 of 14 June[6] recommended reducing chlor-alkali mercury emissions to 2 grams of mercury per tonne of Cl_2 capacity and phasing out the activities of existing mercury-cell installations in chlor-alkali production plants as soon as possible, with the aim of achieving the objective of their total closure by 2010 at the latest. In

[6] ww.ospar.org/documents/dbase/decrecs/decisions/pd90-03e.doc

order to tackle other mercury problems in a more holistic way the EU adopted in 2005, a Community Strategy on Mercury[7]. The Commission strategy proposes a series of actions to cut EU and global emissions and uses of mercury, including banning EU mercury exports by 2011. It also addresses safe storage of mercury removed from MCCAPs, which have been decommissioned by the EU chlor-alkali industry.

Even though the Strategy makes reference to the chlor-alkali industry, the Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC) is the only legally binding instrument applicable to the chlor-alkali sector, supported by some broader legislation, such as the Water Framework Directive. Before integrated pollution permits were required, Directive 84/360/EEC regulating mercury emissions into the atmosphere was applied to the chlor-alkali industry, until it was superseded by the IPPC Directive, which requires installations to seek permits based on the best available techniques (BAT). The benchmarks or criteria on which BAT relies are described in the BAT Reference Documents (BREFs).

The first chlor-alkali BREF document[8] was published at EU level in December 2001, and it is anticipated that the revision will start in 2009. According to the chlor-alkali BREF, the membrane (mercury free) process, and not the mercury-cell process, is regarded as BAT for the chlor-alkali industry. In addition, the Directive states that existing installations - installations in operation before October 1999 - should operate in accordance with the requirements of the Directive by 30 October 2007. However, when determining the permit requirements based on BAT for a specific installation, the competent authority is permitted to take into account the technical characteristics of the installation concerned, its geographical location and local environmental conditions. Therefore, it is the local competent authority that decides on the specific permit requirements, and the system has an inherent flexibility as to how these requirements may be (mis)interpreted, depending on the specific case.

In terms of quality standards in different environmental media, at EU level, the relevant legislation addressing ambient air quality standards for certain substances including mercury, is Directive 2004/107/EC of the European Parliament and of the Council relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (the 4th daughter directive of Council Directive 96/62 on ambient air quality assessment and management). Mercury in ambient air is not regulated via a target value; instead, it is measured at background sampling points with a spatial resolution of 100,000 km^2 in order to provide information on geographical variation and long-term trends. Monitoring of particulate and gaseous divalent mercury is also recommended. A review of Directive 2004/107/EC is foreseen by the end of 2010.[9]

In addition, with reference to water, Council Directive 82/176/EEC of 22 March 1982 on limit values and quality objectives for mercury discharges by the chlor-alkali electrolysis industry (OJ L 81, 27.03.1982, p. 29-34) applies, but will be repealed with effect from 22 December 2012. The newly adopted[10] EU directive on Environmental Quality Standards (EQS) in the field of water policy will then apply.[11] Transitional measures of monitoring for the Member States according to the Water Framework Directive (2000/60/EC) are foreseen. Member States shall apply the EQS laid down in Part A of Annex I to this Directive in bodies of surface water. In annex I, Part A, the following Environmental Quality Standards (EQS) apply for mercury:

[7] For further info please see: http://ec.europa.eu/environment/chemicals/mercury/index.htm
[8] For the full BREF document : http://ec.europa.eu/environment/ippc/brefs/cak_bref_1201.pdf
[9] European Commission. Commission Staff Working Paper. Annex to the Communication from the Commission to the Council and the European Parliament on Community Strategy Concerning Mercury – Extended Impact Assessment {COM(2005)20 final}, Brussels 28.1.2005, Annex IV, p.133-134.
[10] Second reading agreement, adopted by the Council 20/10/2008, http://register.consilium.europa.eu/pdf/en/08/st14/st14164.en08.pdf
[11] http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2008-0283+0+DOC+XML+V0//EN#BKMD-24

Name of substance	CAS number	AA-EQS Inland surface waters	AA-EQS(i) Other surface waters	MAC-EQS Inland surface waters(ii)	MAC-EQS(iii) Other surface waters
Mercury and its compounds	7439-97-6	0.05(viii)	0.05(viii)	0.07	0.07

i This parameter is the EQS expressed as an annual average value (AA-EQS). Unless otherwise specified, it applies to the total concentration of all isomers.
ii Inland surface waters encompass rivers and lakes and related artificial or heavily modified water bodies.
iii This parameter is the Environmental Quality Standard expressed as a maximum allowable concentration (MAC-EQS). Where the MAC-EQS are marked as "not applicable", the AA-EQS values are considered protective against short-term pollution peaks in continuous discharges since they are significantly lower than the values derived on the basis of acute toxicity.
viii If Member States do not apply EQS for biota they shall introduce stricter EQS for water in order to achieve the same level of protection as the EQS for biota set out in Article 3(2). They shall notify the Commission and other Member States, through the Committee referred to in Article 21 of Directive 2000/60/EC, of the reasons and basis for using this approach, the alternative EQS for water established, including the data and the methodology by which they were derived, and the categories of surface water to which they would apply.

Member States may opt to apply EQS for sediment and/or biota instead of those laid down in Part A of Annex I in certain categories of surface water. Member States that apply this option shall: apply, for mercury and its compounds, […], these EQS being for prey tissue (wet weight), choosing the most appropriate indicator from among fish, molluscs, crustaceans and other biota.

Another piece of legislation relevant to the chlor-alkali sector is the recently adopted EU Regulation on an EU export ban and safe storage of mercury (EC/1102/2008); the export of metallic mercury is banned after 15 March 2011, and mercury from decommissioned chlor-alkali plants shall be safely stored.

Finally, with respect to reporting obligations the European Pollutant Emission Register (EPER)[12], the first European-wide register of industrial emissions into air and water, was established in 2000. According to the EPER Decision, Member States have to produce a triennial report, which covers the emissions of 50 pollutants, including mercury, to be included if the threshold values indicated in Annex A1 of the EPER Decision are exceeded. For mercury the threshold values are 10 kg/year for mercury being emitted to air and 1 kg/year to water. The first reporting year was 2001 (although Member States also had the option of providing data for 2000 and 2002); this information was reported in June 2003 and published on the internet[13] in February 2004 (for EU 15). The second reporting year was 2004 and includes data from the new Member States. Those data were published in late autumn 2006 and comprise data of emissions from approximately 12.000 industrial facilities.

The European Pollutant Release and Transfer Register (E-PRTR)[14] adopted in 2006, will succeed the EPER. It is intended to fully implement the obligations of the UN-ECE PRTR[15] Protocol, which was signed in May 2003 by 36 countries and the European Community. The obligations under the E-PRTR Regulation extend beyond the scope of EPER mainly in terms of more facilities included, more substances to report, additional coverage of releases to land, off-site transfers of waste and releases from diffuse sources, public participation and annual instead of triennial reporting. The first reporting year under the E-PRTR will be the year 2007 and respective information will have to be reported by Member States in June 2009. The Commission will publish the data in autumn 2009 on the internet. The second reporting round (2008 data) will be initiated in March 2010 and become publicly available in

[12] COMMISSION DECISION of 17 July 2000 on the implementation of a European pollutant emission register (EPER) according to Article 15 of Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC) *(notified under document number C(2000) 2004)* (2000/479/EC) http://eper.ec.europa.eu/eper/documents/comission_17072000.pdf
[13] http://eper.ec.europa.eu/
[14] REGULATION (EC) No 166/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC, http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_033/l_03320060204en00010017.pdf
[15] United Nations Economic Commission for Europe, Pollutant Release and Transfer Register, http://www.unece.org/env/pp/prtr.htm

April 2010. E-PRTR will also require reporting of emissions of Hg to land when released above the threshold of 1kg/year.

Before introducing the national legislation and guidelines governing this sector, it is important to give an overview of the mercury-cell chlor-alkali process to confirm once again that conversion is technically feasible as well as economically viable.

2.2 Status of MCCAPs and Best Available Techniques for chlorine production

Among all of its commercial and industrial applications in the EU, mercury is most commonly used in the chlor-alkali industry, which produces chlorine gas and caustic soda (and sometimes caustic potash) from salt or brine. These products are important intermediate chemicals in many industrial processes, such as in the production of paper, soap, detergent and in the manufacture of polyvinyl chloride (PVC) and other plastics. To produce these chemicals, the chlor-alkali industry can make use of any of the following three technologies: mercury-cell, membrane and non-asbestos diaphragm technology. However, only the mercury-cell process uses mercury and, along with it, the unavoidable mercury releases into the environment. The membrane and the non-asbestos diaphragm technology are mercury-free processes, with the membrane one (available since the 1980s) being the most commonly used mercury-free option, because it is less costly, more energy-efficient and carries a lower environmental impact.

Many mercury cell chlor-alkali plants (approximately 20-30 in the EU and many elsewhere) have converted to mercury-free alternatives. However, 44 mercury-cell plants are still in operation in the EU (see annex A and Annex C) containing some 11,000 tonnes of mercury in electrolytic cells, responsible for more than 5,5 million tonnes of chlorine production annually. These plants consume 160-190 tonnes of mercury every year (of which some is recovered from recycled wastes, amounting to some 40 percent of the total EU mercury consumption[16]). The proportion of chlorine produced with the mercury-cell process is much lower elsewhere in the world than in the EU. For example, the US has only seven remaining MCCA plants, three of which have already committed to stop using mercury by 2010[17]. In India there is a voluntary agreement between government and industry, initiated by the (Indian) Central Pollution Control Board, according to which the phase-out of Indian MCCAPs will occur by 2012[18]. In Japan, the electrolytic cell technique has been largely phased out since the mid 1980s[19]. Therefore, as a region, the EU accounts for the greatest number of plants and the highest percentage of production capacity still using the mercury-based process. According to the industry association Euro Chlor, the European chlor-alkali industry has agreed to convert or close down most of the mercury-cell facilities by 2020, which the industry has described as the end of the normal economic lifetime of most EU MCCAPs; or in other words, simply as long as it believes it can keep its outdated MCCAPs operating profitably. Industry has more recently explained that '*the long time-frame is essential to allow chlor-alkali producers to absorb the estimated € 3.000 million investment required to effect the phase-out without damaging the industry's competitive position on global markets.*'[20]

Further to this last point, it is worth noting[21] though that the chlorine industry contributes 60% of the total profits of the chemical industry, currently at a figure of 380.000 million Euro[22] and

[16] "Options for reducing mercury use in products and applications, and the fate of mercury already circulating in society", COWI A/S and Concorde East/West Sprl for the European Commission, Directorate General Environment, September 2008, Brussels.
[17] Eleventh Annual Report to EPA: Chlor-Alkali Industry Mercury Use and Emissions in the United States for the Year 2007, The Chlorine Institute, Inc., September 26, 2008.
[18] Central Pollution Control Board, Annexure 1, Section 8, point 12, http://www.cpcb.nic.in/Charter/status.htm
[19] UNEP, Global Mercury Assessment, Overview of Existing and Future National Actions, including Legislation Relevant to Mercury. December 2002. The chlor-alkali BREF mentioned that some plants in Japan, which largely phased out the industrial use of mercury following the Minamata incident, were permitted to continue to use mercury cells to produce potassium hydroxide for many years after other uses were discontinued. Even for this use, however, the remaining Japanese plants had all been converted to mercury-free processes by 2002.
[20] Chlorine industry Review 2007 - 2008, http://www.eurochlor.org/upload/documents/document290.pdf
[21] DMA, OCEANA, 'The Implementation of the IPPC directive in the mercury-cell chlor-alkali production industry', September 2006, p.23
[22] Eurochlor en www.eurochlor.org/chlorine/issues/mercury.htm

55% of European chemical industry turnover (2006: € 665.687 million). In 2001, Euro Chlor estimated the total cost of conversion at around 3.100 million Euro[23] and cost per unit of production has changed little since then. Furthermore, considering that many plants have closed or already converted in the meantime, as well as that in the future some plants will close and not actually be converted, the remaining costs for conversion is estimated to be closer to 2.000 million rather than 3.000, a figure which as seen above is used for many years.
In view of the economic strength of this sector, it is obvious that the dismantling of mercury cells is economically viable, as per the definition of "available" for the chlor-alkali sector industry, under the BAT notion.

Furthermore, the production of chlor-alkali is a highly energy intensive process. The electricity consumption of MCCAPs in the EU is equivalent to the entire output of 10 large (250-300 MW) fossil fuel fired generating stations. Considering that the membrane process consumes around 30% less electricity than the mercury-cell technology, that the EU is already overly dependent on energy imports, and further considering that greenhouse gas emissions and climate change are of the highest political importance, it is imperative that conversion takes place rapidly.

This report provides further information below on the chlor-alkali plants that still use the mercury-cell technology in the EU, and on whether and by which date they intend to convert to membrane technology or eventually close down.

2.3 Relevant national legislation and guidelines

The IPPC Directive has been transposed into national legislation in all Member States. However, as the report shows, the transposition, let alone the implementation, of the Directive differ significantly among the various European Member States.

In Italy, the IPPC Directive was transposed into national legislation in 2005 by the legislative Decree 59/2005 ('*Decreto Legislativo n°59/2005'* of 18th February 2005) and a series of transposition decrees[24], which set out the national procedure of issuing permits. At EU level, the BAT Reference (BREF) Document for the chlor-alkali industry was published in 2001 in English but the Italian translation is still not available and specific guidelines for local authorities on how permits should be granted are not yet published.

In Germany the IPPC Directive was transposed on 27th July 2001 into 22 existing legislations by one amending law (titled '*Gesetz zur Umsetzung der UVP-Änderungsrichtlinie, der IVU-Richtlinie und weiterer EG-Richtlinien zum Umweltschutz',* 'Act to Implement the Environmental Impact Assessment Act, the IPPC Directive and other EC Directives for environmental protection')[25]. Changes based on the IPPC Directive were mainly implemented by revising the BImSchG (Federal Imission Control Act), WHG (Water Management Act), KrW-/AbfG (Recycling Management and Waste Law) and 4th and 9th BImSchV (Federal Emission Control Ordinances). The BREF on chlor-alkali was only partially translated into German. However, guidelines for local authorities on the issuing of permits are available through the BImSchG ('*Bundesimmissionsschutz-Gesetz*') or Federal Emission Control Act, and through the 4th and 9th BImSchV ('*Bundesimmissionsschutz-Verordnung'*) or Federal Emission Control Ordinances. In particular, the 4th BImSchV provides a list of the types of plants that are entitled to apply for either a simplified or a regular permit. MCCA plants must apply for a regular permit. The 9th BImSchV[26] gives details of the permit application process. The permit applications must include detailed information on the operations of the plant, the estimated emissions, the safety measurements, waste management, and energy efficiency.

[23] European Commission note 10 *ut supra* p.4
[24] For further information visit http://www.reteambiente.it/ra/normativa/indici/IPPC.htm; *http://aia.minambiente.it/intro.aspx* (only in Italian) of the Ministry for the protection of land and sea.
[25] For full text of the law visit (only in German): http://www.landtag.nrw.de/portal/WWW/dokumentenarchiv/Dokument/XBCBGI0140.pdf
[26] For more information: http://bundesrecht.juris.de/bimschv_9

In Greece, the IPPC Directive was transposed by National law 3010/2002, and Ministerial Decision 15393/2002 and 11014/2003 of 2002 and 2003 respectively[27]. It is further implemented through a series of laws, presidential decrees and common ministerial decisions that are related to industry's environmental problems. [28] The BREF on chlor-alkali is not available in Greek. However, guidelines exist on the permit issuing procedure and are provided by a couple of joint ministerial decisions and pieces of legislation[29].

In France the IPPC Directive was transposed in 1998 by the Decree ('*Arrêté'*) of 2nd February 1998; however, for the chlor-alkali sector the decree of reference is the '*Arrêté of 6th August 2007'*. In addition, guidelines exist for operators on how permits should be granted.

In Spain the IPPC Directive was transposed into national legislation in 2002 by the Law 16/2002 of 1st July 2002 ('*Ley 16/2002 de Prevención y Control Integrados de la Contaminación'*)[30]. A Summary of the BREF on chlor-alkali has been available in Spanish since 2001 but guidelines on the permit procedure are available only in some regions.

In the UK the IPPC Directive was transposed in 1999 through the Pollution Prevention and Control Act of 1999 and other relevant regulations (the IPPC regime)[31]. Guidelines for the permit procedure are available to the authorities through the Environment Agency website.

In the Czech Republic the IPPC Directive was transposed in 2002 by the IPPC Act of 5th February 2002. In general there are also guidelines issued by the Ministry of the Environment decree No. 554/2002 Col. (on content of IPPC application), and by Government Ordinance no 63/2003 Col. (on information exchange about BATs). The BREF on chlor-alkali has been available in Czech since January 2002 but guidelines on the permit issuing procedure are not available yet.

In Belgium the IPPC Directive has been transposed into regional law. In Flanders it is called 'Vlarem'. In addition, general binding rules exist for the industry as a whole and also specific to air emissions. The BREF on Chlor-Alkali has been translated into a checklist in Dutch; however, the full original document is not available in Dutch, although this is not a problem as all authorities have a high command of English.

As regards the designated authority for issuing permits, in Italy it is designated on the basis of the production capacity of the plant applying for the permit. In particular, the threshold which identifies the limit of competence between the national and the regional authorities is 100.000 tonnes of the total yearly production capacity of the plant per product category, which is calculated by summing up the production capacities of the single compounds (see tables 1 and 2 below). This means that if the production capacity per product category is greater than 100.000 tonnes per year, the competent authority would be national rather than regional. In Germany, Czech Republic, Spain, France and Greece the responsibility for permits rests at the local/regional level. Similarly, in the UK the competent authorities are the regional offices of the Environment Agency, and in Belgium it is the province that grants the permits but a subsequent appeal is legally possible.

Table 1: Threshold of Production Capacity per Product Category

Product Category	Threshold 1000 tonnes/year
a) simple hydrocarbons	200
b) oxygenated hydrocarbons	200
c) sulphur hydrocarbons	100
d) nitrogen hydrocarbons	100
e) phosphor hydrocarbons	100
f) halogen hydrocarbons	100
g) organic-metallic compounds	100

[27] It is noted that some parts of the IPPC directive, Articles 10 and 11, are not fully transposed – on BAT and quality standards as well as Developments in BATs.
[28] http://www.minenv.gr/4/ypexode4/nomo8eti.htm
[29] JMD 18186/271/1988, JMD 11014/703/03, Law 1650/1986, Law 3010/2002.
[30] For more information: http://www.todalaley.com/mostrarLey792p1tn.htm
[31] For further information: http://www.opsi.gov.uk/Acts/acts1999/ukpga_19990024_en_1

h) plastic materials	100
i) synthetic rubber	100
j) gases	100
k) acids	100
l) bases	100
m) Phosphor-based fertilisers	300

Source: Legislative Decree 59/2005, Annex V, Paragraph 4J.

Table 2: Plants and Competent Authorities in Italy

Name of MCCAPs	Location	Cl_2 production capacity tonnes/year (2005)	technology	Competent Authority
Caffaro	Tor Viscosa (Ud)	69.000	Mercury-cell	Environment Ministry
Altair Chimica	Volterra (Pi)	27.000	Mercury-cell	Province of Pisa
Solvay Solexis	Bussi (Pe)	70.000	Mercury-cell	Region of Abruzzo
Syndial	P.to Marghera (Ve)	200.000	Mercury-cell	Environment Ministry
Solvay	Rosignano (Li)	120.000	Mercury-cell	Environment Ministry
Eredi Zarelli	Picinisco (Fr)	6.000	Mercury-cell	N/A
Tessenderlo	Pieve Vergonte (Vco)	40.000	Mercury-cell	Environment Ministry

Source: Legislative Decree 59/2005, Annex V, Paragraph 4J.

In four of the eight European countries that participated in the survey a national law exists[32] that sets mercury emission limit values from MCCAPs to air and water. In some countries, the national or regional laws also set monitoring requirements for mercury ELV to air and water. Table 3 below shows the different emission limit values (ELV) across the eight surveyed Member States (MS) along with identifying the countries where monitoring is required by the law and with which frequency.

Table 3: Emission Limit Values (ELV) for MCCAPs to air and water per country

Country	ELV to air	ELV to water	Monitoring ELV to air	Monitoring ELV to water
Italy	1,5 – 2g (Hg/t of Cl_2)	0,5 – 5g (g Hg/t of Cl_2)	Yes but not detailed	Yes
Germany	1,0 g Hg/t or 1,2 g Hg/t per year	0,05 mg/l or 3 g/t depending on the Cl_2 capacity in 24 hrs	Yes, if diffuse emissions are above 25 mg/h (which is true for all plants)	Yes
Greece	No limit	50µg Hg/l monthly average 200 µg Hg/l daily average	None required	Yes, daily
France	1,5 g/t of Cl_2 1,2 g/t of Cl_2 from	0,05 mg/l. Specific streams :	Not specified	Not specified

[32] In Italy the national legislation regulating ELV to air and water is Decree 152/06, in Germany is TA Luft (Technical Instruction on Air Quality), in France is Arrêté of 6th August 2007, and in Belgium (Flemish Region) is called Vlarem (regional law) setting ELV only for air.

	2010. (annual average values)	0,3 g/t of Cl_2 (at the exit of the workshop). 0,6 g/t of Cl_2 at the exit of the industrial site		
Spain	No limit required by law. The following limits are specified in the voluntary agreement between the Ministry of Environment and Industry 0,9g +25% (1/1/08) and 0,9g +15% (1/1/10)	No limit required by law. The following limits are specified in the voluntary agreement between the Ministry of Environment and Industry 0,8g +15% (1/1/08) and 0,8g (1/1/10)	None required – depending on the plant	None required – depending on the plant
UK	1000 kg/year from all emission points, 2008-2010 - Not set by law but set by facility permit based on BAT	Not set by law but set per facility based on BAT	None required – set by permit, not by the law	None required – set by permit not by the law
Czech Republic	2 g/t of Cl_2 for old installations 0,01 g/t of Cl_2 for new installations	0,05mg/l average per month	twice a year[33]	twice a month
Belgium	Max of 2 g Hg/tonne of production capacity (this includes Hg in hydrogen that is emitted or burned)	The ELV to water are set in the plants' permits not by law: Solvic from 01/01/2007 : 0,01mg/l and 21g/d Tessenderlo Chemie: 0,005mg/l Solvin N/A	Yes, every month	Yes, every three months

The diversity of regulation in the EU is remarkable. In Spain, for example, MCCAP mercury emission limit values are not requested by law for air or water, but a voluntary agreement is signed between the Ministry of Environment and the Spanish chlor-alkali industry precising the allowed emission limit values[34]. On the contrary in Italy, Germany, the Czech Republic, Belgium and Greece (for air only) emission limit values exist, are quite stringent in some cases, and also supposed to be closely monitored. In Italy, Decree 152/06 requires monitoring of mercury emissions in water by a sampling procedure that consists of taking samples from the discharged water during a period of 24 hours and measuring the mercury concentration. During those 24 hours the total flow of discharged water should also be measured. In the Czech Republic mercury emissions to water are to be monitored once a year, in Belgium every three months (and monthly for emissions to air), and in Greece daily. In the UK monitoring for water emissions is supposed to be carried out weekly (monthly for air emissions) and is fixed by the plant's permit only. As monitoring of mercury emissions is not continuous, in the UK the single (large) MCCAP site estimates the mass discharge from periodic spot measurements and an estimated flow measurement. In practice they use an over-estimate of the flow rates and claim consequently to over-estimate the quantity of each pollutant (not just mercury) discharged in a given time period.

As regards quality standards for ambient air, water and soil, Greece, France and Spain do not appear to have any quality standards for mercury; on the contrary, UK has an air quality standard for mercury set at 0.25 µg/m^3 (long-term Environmental Assessment Level - EAL)

[33] according to decree No. 356/2002 Col.

[34] http://www.boe.es/g/es/bases_datos/doc.php?coleccion=indilex&id=2006/04566&txtlen=737

and at 7,5 µg/m^3 (short-term EAL) and a water quality standard (average annual values) set at 1 µg/l for fresh water and 0,3 µg/l for saline water, but it appears that a soil quality standard does not exist.. In the Czech Republic, there used to be an ambient air quality standard of 50 ng Hg / m^3, to be met by 1st January 2010, but this was cancelled after the last revision of the national air control act. Furthermore, the Czech Republic has a water quality standard for mercury of 1 µg/l and a soil quality standard of 0,6 µg/g for light soil and 0,8 µg/g for other types of soil. Germany does not have an ambient air quality standard for mercury. The 22nd BImSchV (22nd Federal Emissions Control Ordinance) regulates emissions for various air pollutants. It includes regulations for arsenic, cadmium, mercury, nickel and benzo[a]pyrene. However, although paragraph 15 sets target values for arsenic, cadmium, nickel and Benzo[a]pyrene, target values for mercury are not set. On the contrary, Germany has a water quality standard of 1 µg Hg/l for drinking water[35] and of 1 µg Hg/l for groundwater[36]. The same legislation that lays down the values for the groundwater quality standard also sets the values for the soil quality standard as follows:

- 10 mg Hg / kg soil for children's playgrounds,
- 20 mg Hg / kg soil for residential areas,
- 50 mg Hg / kg soil for parks and leisure facilities,
- 80 mg Hg / kg soil for industrial and commercial areas,
- 5 mg Hg / kg dried plants for agriculture, and
- 2 mg Hg / kg dried plants for grassland.

In Italy Decree 367 of 6th November 2003, sets water quality standards for dangerous substances. The values set for mercury emissions are: by 2008, 0,05 (µg/l) for stream water and 0,03 (µg/l) for sea water and by 2015, 0,02 (µg/l) for stream water and 0,003 (µg/l) for sea water. The same Decree also sets soil quality standard for mercury at 0,3 mg per Kg of soil. Although Belgium does not have ambient air quality standard, it has a water quality standard for mercury of 0,5 mg/l (yearly average) and a soil quality standard for mercury of 0,55 mg /kg soil (dry content, standard soil).

The European Chlorine Industry on the other hand, appears to have an agreement to achieve an emission target of 1 g Hg/t chlorine capacity on a national basis by end 2007, with no plant being above 1,5 g/t chlorine capacity. [37]

Amongst the eight countries surveyed, only the Czech Republic, Spain and Italy have an occupational exposure limit value for mercury. In the Czech Republic the acceptable[38] total mercury level is 50 µg /m^3 and the maximum acceptable level is 150 µg /m^3, while for organic mercury these levels are 10 µg /m^3 and 30 µg /m^3 respectively, according to the Government Ordinance no 361/2007. In Spain, there is an occupational exposure limit value for mercury equal to 25 µg /m^3 fixed in the 'Límites de exposición profesional para agentes químicos 2008' of the National Institute of Safety and Hygiene at Work (Instituto Nacional de Seguridad e Higiene en el Trabajo - INSHT) which depends from the Spanish Ministry of Labour and Immigration. In Italy the occupational exposure limit value is also fixed at 25 µg/m^3. This limit expresses the acceptable mean value for a working day of 8 hours, and 40 hours per week, which presumably represents the maximum level of mercury emissions to which workers can be exposed without encountering any negative impact on their health. At EU level, no occupational exposure limit exists – on the basis of the EU mercury strategy – but it is being developed[39].

Table 1 in Annex E provides a simple comparison of the countries surveyed in relation to their emission limit values and quality standards for ambient air, water, and soil. The *smileys* give a score to the countries to highlight which member states have better transposed the

[35] Trinkwasserverordnung 2001 §6 Abs.2 in conjunction with Annex 2 Nr. 12 (Drinking Water Ordinance) http://bundesrecht.juris.de/trinkwv_2001/anlage_2_36.html

[36] Bundes-Bodenschutz- und Altlastenverordnung Annex 2, No. 3.1 (Federal Soil Protection and Abandoned Polluted Area Ordinance).

[37] Eurochlor review 2007-2008, p7

[38] Acceptable level is medium level measured for one working shift (mostly 8 hours), and maximum acceptable level can not be exceeded at any moment at working place.

[39] Communication from the Commission to the Council and the European Parliament - Community Strategy Concerning Mercury {SEC(2005) 101} http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52005DC0020:EN:NOT

IPPC Directive and related European legislation and in some cases gone beyond them with stricter emission limit values and quality standard values fixed by either their national legislation or their permits. However, it is clear that the existence of good national legislation does not necessarily imply that industry complies with the legislation or that there is a good programme of enforcement and, therefore, adequate sanctions.

2.3.1 General binding rules and permit application requirements

The IPPC Directive contains a set of requirements prescribing the procedure for permit application along with general binding rules for the chlor-alkali installations which are fully transposed into national legislation in the majority of the eight countries surveyed. For example, in Germany the TA Luft (Technical Instruction on Air Quality) Law sets the following binding rules for chlor-alkali plants:

- It is illegal to build new plants using mercury-cell or asbestos diaphragm technology.
- Mercury emissions of existing MCCAPs must be below 1,0 g Hg/t of Cl_2 production in the cell room exhaust air. If alkali lye and dithionite or alkoxides are produced, emissions must be below 1,2g Hg/t of Cl_2. In addition, the best available technique to reduce mercury emissions must be implemented.

In France, the general binding rules for the chlor-alkali installations are prescribed by the 'Arrêté' of 2nd February 1998 which transposes the IPPC Directive. Article 72 of this 'arrêté' mentions that the construction of new chlor-alkali plants using the mercury cell process is forbidden and that the operation of the existing mercury-cell plants will be banned after 31 December 2019. However, on 20th April 2007[40], the French Environment Ministry further issued a note addressed to local authorities setting out the following rules:

- Decrease of 47% of mercury emissions in air by 2010 (base year: 2000).
- Decrease of 25% of mercury emissions in water by 2015 (base year: 2005).
- The process of electrolysis using a mercury cathode must no longer be used by 2020 at the latest.
- All permits issued during and after the summer of 2007 must be based on this note.

However, as it can be seen in tables 4 and 5 below, the local authorities have not respected this note while granting the permits in October 2007.

Table 4: On Air emissions: Reduction objective of 47% by 2010 (base year 2000)

Plant	Reference year 2000	Values to be met in 2010 based on the Ministry's note (-47%)	Values on permits to be met before 2010	Values on permits to be met from 2010	Values on permits to be met from 2015	Difference between Min. note and permit (% reached objective)
Solvay-Tavaux	315 kg/y	167 kg/y	240 kg/y 1 g /t	210 kg/y 0,87 g/t		+ 43 kg difference; 75% of objective reached
Albemarle PPC-Thann	104 kg/y (2000-2004) 154 kg/y (1999)	55,2 kg/y 80,62 kg/y (1999)	125 kg/y 1,8 g/t (<2010)	86 kg/y 1,2 g/t		+ 30,44 kg difference 55% On the basis of data 2000-2004
ARKEMA Jarrie	188,5 kg/y 1,11 g/t	99,9 kg/y	-	80 kg/y 0,47 g/t		- 19,9 kg/y 100%

[40] Circulaire 20 avril 2007, DPPR/SEI2/CD-07-0068 (not published)

ARKEMA Lavera	130 kg/y	68,9 kg/y	155 kg/y 0,93 g/t	128 kg/y 0.77 g/t		+ 59,1 kg/y difference 15% of objective reached
SPC Harbonnières	26 kg/y	13,78 kg/y	24,4 kg/y 1,09 g/t (<2010)	22 kg/y 0,98 g/t (2010)		
PC de Loos, Loos	26 kg/y	13,78 kg/y	11,4 kg/y 0.63 g/t (value 2008 ; the note is based on data of 2008 and not of 2000)		10,26 kg/y (« -10% in reference to 11,4 » mentioned on the note) (2015)	

Table 5: On Water emissions: Reduction objective of 25% by 2015 (base year 2005)

Plant	Reference year 2005	Values 2015 on basis of the Min. note (-25%)	Values on application permit	Values on application permit	Values on permit by 2015	Difference between Min. note and permit (% reached objective)
Solvay-Tavaux	14 kg/y 0,06 g/t	10,5 kg/y	14,4 kg/y (-2014)	14,4 kg/y (-2014)	14,1 kg/y	+3,6 kg/y 65,72%
Albemarle PPC- Thann	24 kg/y 0,33 g/t	18 kg/y	26 kg/y 0,36 g/t (-2014)	26 kg/y 0,36 g/t (-2014)	12 kg/y 0,17 g/t	-6 kg/y(100%)
ARKEMA Jarrie	34 kg/y 0,189 g/t	25,5 kg/y	-	-	32 kg/y 0,19 g/t	75%
ARKEMA Lavera	22 kg/y 0,141 g/t (3 incidents rejets totaux déclarés 4,6 kg sur période de 3 jours été 2005)	16,5 kg/y	0,5 g/t (<2015)	0,5 g/t (<2015)	15 kg/y 0,09 g/t (41 g/day)	-1,5 kg/y (100%)
SPC Harbonnières	0,002 g/t	0,0015 g/t	0,04 kg/an 0,002 g/t (-2014)	0,04 kg/an 0,002 g/t (-2014)	0,04 kg/an 0,002 g/t (-2014)	75%
PC de Loos, Loos	8,96 kg/y 0,5 g/t	6,72 kg/y	9,02 kg/y (site <2010)	7,2 kg/y (site >2010)	5,4 kg/y (site 2015)	-1,32 kg/y (100%)

In Belgium the general binding rules for the chlor-alkali installations prescribe gradual reduction of mercury emissions into the air. In addition to the regional legislation, the local authorities refer to the BREF and the BAT when looking at the plants' permits. Next to this, industry has been making some efforts in order to reduce the Hg-output, and all these actions together have resulted in lower air emissions than the 2 grams of Hg/tonne fixed by the law. However, this is not the case for the UK where general binding rules for the chlor-alkali industry do not exist.

As regards the requirements of Art 6 of the IPPC Directive, prescribing the procedure for permit application, they are also found in national legislation in the majority of the member states. In Germany, although in most cases the requirements are fully transposed, they are not clearly defined as such. The BImSchG (Federal Emission Control Act) sets out the requirements in a number of dispersed paragraphs. Following the BImSchG, applications must be in written form and they must include supporting documents. If the documents are not considered sufficient, the applicant is requested by the authority to provide further information. In addition, the BImSchG paragraph 6 states that the permit must be granted if the obligations established by paragraph 5 and by the ordinances based on paragraph 7 are fulfilled. Paragraph 7 sets certain technical requirements: maximum values of emissions allowed, requirements on energy use, monitoring of emissions, and security measurements. Furthermore, there are 38 ordinances based on the above-mentioned paragraph 7, and they regulate the construction, the technical conditions, the operation, the monitoring and the eventual closing and decommissioning conditions of a plant.

2.4 Conclusions

As the EEB survey shows, the IPPC Directive has been transposed in all Member States surveyed. The BREF on chlor-alkali does not propose emission limit values (for any mean) but shows lowest levels achieved in Europe. Nevertheless, some countries have gone further than the European Directive and have set, in their national legislation, limit values for mercury emissions to air and water. This is the case of Germany with the TA Luft (Technical Instruction on Air Quality), the case of Italy with Decree 152/06, of France with the Arrêté of 6th August 2007 and of Belgium with the Vlarem law for air emission limit values only. Emission Limit Values for water are also present, but set by the individual permits and not by the law, in the Czech Republic, the United Kingdom and Greece. Occupational emission limit values seem to be present only in three of the countries surveyed (Czech Republic, Spain and Italy), in absence of an EU limit.

Quality standards for mercury in ambient air do not exist at EU level, but are set in Italy and the UK. Quality standards for water, although already set by a few member states until now, will have to be applied at EU level soon. As far as soil is concerned, once more some countries (Czech Republic, Germany, Italy, and Belgium) have set limits whereas others have not.

It is evident that in the absence of clear guidelines at EU level, overall releases of mercury are regulated in a different way among EU Member States and plants, even when they are in the same country. In France, the internal ministerial note on emissions to air and water does not seem to have been followed by the local authorities, contradicting emission requirements set from the national ministry. As a result, requirements on releases of mercury do not seem to be controlled equally in all Member States in view of protecting adequately health and the environment. On the contrary, permit requirements sometimes appear to be established at levels industry is sure to be able to meet.

The above results have to be seen in conjunction with the fact that mercury is an identified and acknowledged global pollutant. Although the BREF on chlor-alkali industry and article 9.4 of the IPPC Directive mentions that *'In all circumstances, the conditions of the permit must include provisions on the minimisation of long-distance or transboundary pollution and must ensure a high level of protection for the environment as a whole'*, in reality the atmospheric mobility of mercury and the fact that it can have an effect far from where it is emitted, do not seem to be considered. Differences among Member States not only unequally protect their own populations, but also ignore the potential negative effect that can be created at European and/or global level, and the fact that they are adding to the global environment mercury from a process for which mercury-free alternatives exist since before the '1980s. This heterogeneous result is contrary to EU as well as the global responsibility of the EU. In addition, the objectives of the EU strategy on mercury have not been met, since no further measures have been taken to regulate this sector.

Furthermore, the omission of a standard permit for chlor-alkali plants at EU level makes implementation, enforcement and comparison at EU level virtually impossible, does not contribute to a level playing field nor to a consistent and reliable protection of the environment and public health across the EU.

3 Mercury releases of the Mercury-cell Chlor-alkali Plants in Europe

3.1 Introduction

This chapter collates all mercury uses and releases reported by MCCA plants in Europe and the emission limit values (ELV) set in their permits, in order to highlight differences in the way the IPPC Directive is implemented across Europe. It also sheds some light on the MCCAP closure or conversion plans and on the mercury emissions monitoring process carried out by the authorities. Finally, attention is drawn to the already-closed MCCA plants, the estimated contaminated land and the apparent absence of remediation activities across Europe.

3.2 Mercury losses of European MCCAPs

According to industry reports, in the production of chlorine and caustic between 2002 and 2005, the Euro Chlor member companies consumed all together, on average, 173 tonnes (range 160-190 tonnes) of mercury every year in mercury cell chlor-alkali plants. In line with mercury balances prepared by industry, “consumption” refers to all mercury that is required to be added to the electrolytic cells. This mercury may come from purchases outside the industry, it may come from intra-industry transfers of mercury stocks, or it may come from chlor-alkali industry wastes recycled off-site or on-site. Therefore, on average during 2002-2005, of the total 173 tonnes annually added to the electrolytic process, 30-40 tonnes of that came from off-site and on-site recycling operations.

Furthermore, these companies reported emissions and releases (mostly to the atmosphere, but also to water and to the chemical end-products) of 6-8 tonnes of mercury. They estimated the mercury disposed of in wastes at some 80-100 tonnes per year (after accounting for the 30-40 tonnes that were recycled). Based on a mercury-in vs. mercury-out (“mass balance”) accounting system, industry reported another 41 tonnes (annual average for 2002 to 2005) of mercury releases or losses that were unaccounted for, referred to by industry as “difference-to-balance.” All of these numbers are summarised in the table below.

Table 6: Mercury consumption in European chlor-alkali plants based on industry reports

	Tonnes mercury					
	2002	**2003**	**2004**	**2005**	**Average 2002-5**	**2006 (est.)**
Reported emissions to products, air and water	8	8	6	6	7	6
Reported mercury disposed of in waste	102	108	86	86	96	84
Reported unaccounted for (“difference-to-balance”) mercury losses	12	20	78	53	41	45
Total mercury losses and disposal (may not be exact due to rounding)	122	135	171	146	144	135
Estimated mercury recovered from waste	25	25	30	35	29	35
Total industry mercury consumption	147	160	201	181	173	170

Source: OSPAR, Mercury Losses from the Chlor-Alkali Industry in 2002, 2003, 2004, 2005, as published in “Options for reducing mercury use in products and applications, and the fate of mercury already circulating in society”, September 2008.

It is extremely important to note that 40 or more tonnes of mercury, referred to by industry as "difference-to-balance," continue to be lost every year. This lost mercury amounts to more than five times the reported emissions. Industry has offered explanations of these losses as annual variations in mercury inventories, uncertainties in measuring techniques or estimates of mercury in waste, accumulations of mercury in piping and equipment, etc. Each of these may explain minor mercury losses, but none comes close to technically justifying the large quantities of mercury that cannot be accounted for. A recent analysis[41] drew on several peer-reviewed research papers that support the hypothesis that the mercury emissions of chlor-alkali plants in the US and Europe are routinely underreported – not intentionally, but rather due to the design and complexity of the production process, equipment and structures that render any comprehensive measurement of mercury emissions virtually impossible (EEB 2006). This conclusion is further supported by measurements and analysis published by US EPA, DG Environment, NRDC, Greenpeace, Oceana, EEB site measurements (see table 7 below) and others[42] – a virtual consensus among all who have made the effort to better understand chlor-alkali mercury releases.

Table 7: EEB monitoring results of mercury in air around chlor-alkali plants, 2006-2008

Country	Monitoring Location	Maximum Mercury Concentration Measured Outside the Plant (ng/m3)	Date of monitoring
Italy	Syndial SPA (Porto Maghera, Venezia)	1.493	June 2006
	Tessenderlo Italia SRL (Pieve Vergonte, Viterbo)	Around 750	June 2006
	Caffaro Chimica Srl (Torviscosa, Udine)	1.208	June 2006
	Solvay Chimica Italia SPA (Rosignano, Livorno)	1.211	June 2006
	Solvay Chimica Bussi SPA (Bussi)	7.696	June 2006
	Syndial SPA (Priolo, Siracusa)	Around 50-60	June 2006
Spain	Solvay (Torrelavega, Cantabria)	510	June 2006
	Ercros (Aragonesas Huelva)	1.924	June 2006
	Quimica del Cinca (Monzón, Huesca)	19.650	June 2006
	Ercros (Flix, Tarragona)	4.793	July 2007
	Solvin-Hispavic iberica (Martorell, Barcellona)	3.890	July 2007
	Elnosa (Lourizán, Pantevedra)	1.244	July 2007
	Jodar (decomissioned)	552	July 2007
Czech Republic	Spolana (Neratovice)	989[43]	June 2006
	Spolchemie (Usti nad Labem)	412	June 2006

[41] "Status Report: Mercury cell chlor-oalkali plants in Europe" , http://www.zeromercury.org/EU_developments/Final_Report_CA_31Oct2006.pdf, EEB, October 2006

[42] "Petition [before the Administrator, United States Environmental Protection Agency,] for reconsideration of the National Emission Standard for Hazardous Air Pollutants (NESHAP): Mercury Emissions from Mercury Cell Chlor-Alkali Plants," 17 February 2004.

European Commission, Annex to the Communication from the Commission to the Council and the European Parliament on Community Strategy Concerning Mercury, *Extended Impact Assessment,* {COM(2005)20 final}.

EMECAP Project Progress Summary and Final Report, European Mercury Emissions from Chlor-Alkali Plants, carried out with the assistance of European Community research funds, DG Research, European Commission, 2006.

Quirindongo M, J Devine, A Leiter and L Greer, *Lost and Found: Missing mercury from chemical plants pollutes air and water*, NRDC Issue Paper, Natural Resources Defense Council, Washington DC, April 2006.

La industria del cloro: contaminación silenciosa – Análisis de los vertidos al agua de las plantas productoras de cloro en España, Greenpeace España, Madrid, Barcelona, October 2008.

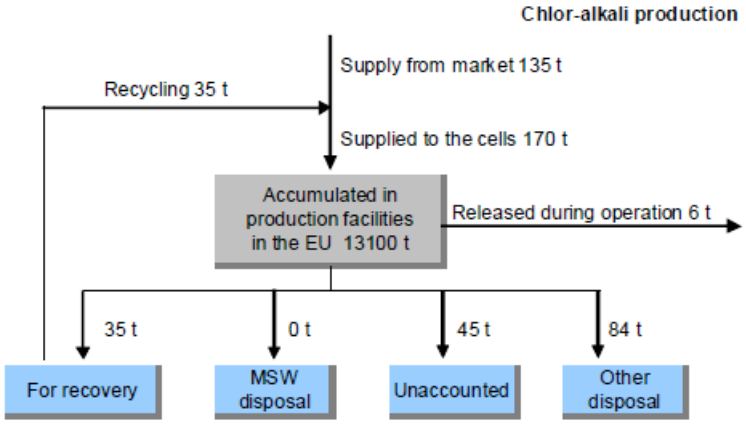
Winalski D, S Mayson and J Savitz, *Poison Plants: Chlorine factories are a major global source of mercury*, OCEANA, Washington DC, January 2005.

[43] A concentration of 1441 ng/m3 was observed near the railroad tracks near the facility, but it is not certain if this concentration is related to the plant.

Germany	Akzo Nobel (Ibben-büren)	396	August 2007
	Degussa (Lülsdorf)	83	August 2007
	Vinnolit (Hürth-Knapsack)[44]	28	August 2007
	Ineos (Wilhelmshaven)	38	August 2007
	Vestolit (Marl)[45]	35	August 2007
	Bayer (Krefeld-Uerdingen)	34	August 2007
	LII (Frankfurt am Main)	21	August 2007
	BASF (Ludwigshafen)	19	August 2007
France	Arkema (Jarrie)	20.761,9	August 2008
	SPCH (Harbonnieres)	1.359,51	September 2008
	Arkema (Lavera)	75,85	September 2008
	Solvay (Tavaux)	10,56	September 2008

All EEB 'snapshot' measurements of mercury in air, were taken off-site in public space, with a mobile mercury analyzer (Lumex RA 915+). The lower emissions observed in Germany and France were taken quite far (500m to 3km) from the chlor-alkali plant itself respectively since those plants are built within industrial parks and their exact location was not evident.

Industry data on the flows of mercury for EU chlor-alkali production are summarised in the flowchart below, showing estimated "unaccounted" mercury losses for 2006.[46]



In addition, as far as water emissions are concerned, Greenpeace carried out measurements around several chlor-alkali production facilities in Spain. For example in Sabinanigo discharges of mercury in water were measured at 2.6 µg/lt, undoubtedly contributing to the already existing substantial burden of historic mercury contamination (5,6 mg/kg adjacent to the discharge pipe).[47]

Based on the convincing evidence in the references mentioned above, it is generally accepted that the majority of these "unaccounted," or unexplained, mercury losses in fact represent unrecorded fugitive emissions to the atmosphere, waste disposal, releases to water, etc. Furthermore, considering the size of these losses, it is absolutely critical that regulatory authorities require full reporting (and improved understanding) of all mercury losses as a primary permit condition. In the US, for example, for precisely this reason, authorities have for many years required all mercury waste from MCCAPs to be recycled so

[44] Measurement taken 200-500 m far from the plant (plant was not producing chlorine on that day)
[45] Converted to membrane in 2007, measurement taken some weeks after conversion
[46] "Options for reducing mercury use in products and applications, and the fate of mercury already circulating in society", COWI A/S and Concorde East/West Sprl for the European Commission, Directorate General Environment, September 2008, Brussels.
[47] Characterisation of wastewater discharges from chlor-alkali plants and associate chlorinated chemical production facilities in Spain, Greenpeace Research Laboratories Technical note 12/2008, October 2008

that the specific mercury content can be known, which helps to understand other mercury flows and losses.

3.3 Mercury emissions by surveyed MCCAPs in Europe

Table 8 below provides information on the 2006 mercury emissions of MCCAPs as reported by the EEB survey and, where available, via OSPAR. Release data from the survey come mainly from national/local authorities' websites or contacts with industry. The mercury emissions are calculated in kilograms of mercury per year and in grams of mercury per tonne of chlorine capacity. The available data cover total mercury emissions as well as mercury emissions to air (the majority of reported emissions) and water. It is surprising to see that the 2006 emissions were not available for Greece in the European Pollutant Emission Register or any other publicly accessible database.

If we look at the emissions in grams of mercury per tonne of chlorine capacity, in Germany LII Europe (Frankfurt) reported in 2006 1,238 grams of total mercury emissions per chlorine production capacity, of which 1,170 grams of mercury was emitted to air alone. The plant can be considered emitting the highest quantity of mercury per chlorine production capacity in Germany. For France and Belgium the reported emissions via the survey differ from the reported data under the OSPAR report, which is surprising since these emission values are believed to come from the same industry source.

In the UK, an existing agreement between the operator (Ineos) and the Environment Agency allows for a total of 20,64 tonnes of mercury to be released to air between 1997 and the end of 2020. At the beginning of 2005, 8,764 tonnes of this allowance had been consumed. From 1 January 2005 until 31 December 2020, the total quantity of mercury released to air from all emission points shall not exceed 11,876 tonnes. These are based on a limit of 2g Hg / tonne per Cl_2.

As can be seen in the tables below, reported emissions per tonne of chorine produced vary from country to country and from plant to plant, ranging from reported 0,28 g Hg/ tonne of Cl_2 (Solvay, Bussi, IT) to 1,910 g Hg/ tonne of Cl_2 in Ineos UK.
It is interesting that emission rates may also differ among plants of the same industrial group, depending on the age of the plant, the manufacturer of the process equipment, the design of the process flow, the type of raw material, etc. As one example, Solvay operates plants in Belgium (Lillo and Antwerp), France (Tavaux) and Spain (Torrelavenga, Martorel)., Italy (Solvay Chimica Bussi SPA, Bussi). Within the group reported emission rates range from 0,28 g Hg/ tonne of Cl_2 in Bussi, IT to 0,79 g Hg/ tonne of Cl_2 in Tavaux, FR. Similar differences can be seen within other industrial groups.

In most cases these emissions comply with the emission limit values set in the permits, which as well vary between and within countries. Apart from the LII, all other plants in Germany are reported to be in line with the general limit of 1 gram of mercury emissions to air per tonne of chlorine capacity including the two plants that are presently allowed to release 1,2 g/t because they produce special products. According to the authority, LII should have met the limit in 2007. . Similarly, in France in 2006 all installations reported emissions in line with the permit limit values set until 2010; however, they differ to the emissions reported in the OSPAR report.

No explanation is required, however, from the authorities as to why different emission limit values and eventually emissions are allowed per plant. As mentioned above, the emission limit values frequently allow for releases that do not overall take into consideration the protection of the environment and human health, the special characteristics of mercury – its toxicity, persistence, bioaccumulation and biomagnification in the food chain.

Table 8: Mercury emissions per MCCA plants (kg Hg/year)

Name of MCCA Plant	*Plant's Cl_2 capacity-000 tonnes (OSPAR, 2006)*	*Hg emissions – reported by EEB survey (kg Hg/year)*					Hg emissions – reported by OSPAR (kg Hg/year)		
		Total *Year 2006*	***Air*** *Year 2006*	***Water*** *Year 2006*	***Air*** *Fixed in Permit*	***Water*** *Fixed in permit*	***Total*** Year 2006	***Air*** Year 2006	**Water** Year 2006
BELGIUM			[48]						
Tessenderlo Chemie	227.5		128	2,4			142	129	
SOLVIN Antwerp	120		56	NA			98	49	
SOLVIC Lillo	219		75.4	1,84			64	79	
Total	**566.5**		**259.40**	**4,24**			**304**	**257**	
ITALY	[49]		[50]						
Tessenderlo Italia Srl, Viterbo	42		20,3	2,2					
Syndial Spa, VE	200		91	N/A					
Caffaro Chimica Srl, UD	68		74,1	N/A					
Solvay Chimica Italia S.P.A, LI	125		50,9	192					
ALTAIR CHIMICA S.P.A., PI	27		29,9						
SOLVAY CHIMICA BUSSI SPA, PE	87		24	14,3					
Syndial SpA, SR	200		165	N/A					
Syndial SpA, CA	6		N/A	2,9					
Total	**755**		**455,2**						
GERMANY									
BASF, Ludwigshafen	170	169	153				169	153	
Bayer, Uerdingen	130	94	88				94	88	
Vinnolit, Knapsack	160	153	148				153	148	
Akzo Nobel, Ibbenbüren	125	86	84				86	84	
Evonik	136	170	141				170	141	

[48] Data on Belgian emissions, VMM, Vlaamse Milieu Maatschappij, http://www.vmm.be/lucht/publicaties/IMJV_emissies_2006.xls
[49] Data on Italian Chlor-alkali capacity, from FEDERCHIMICA
[50] Data on Italian chlor-alkali emissions from INES (National Register of Emissions and their Source IPPC activities)

Degussa, Lülsdorf									
Ineos Chlor, Wilhelmshaven	149	64	48				64	48	
LII Europe, Frankfurt	167	243	195				243	195	
Vestolit, Marl	176	194	166				194	166	
Vinnolit, Gendorf	82	56	53				56	53	
Total	**1119**	**1229**	**1076**				**1229**	**1079**	
FRANCE			[51]						
ARKEMA LAVERA	166		170	14	155 *Until 2010* 128 *After 2010*	15 *Until 2015*	195	172	
ARKEMA Jarrie	170		89	23	80 *After 2010*	32 *After 2015*	119	89	
SPC Harbonnières	23		25	No water, no river around the plant	24,4 *Until 2010* 22 *After 2015*	0,04	29	24	
Chemical Products of Loos	18		11	10	11, 4 -10% of 11,4 *After 2015*	9,02 (exit of plant) 1,8 (exit of workshop). *Until 2010* 7,2 (exit of plant) and 1,8 (exit of workshop) *2010-2015* 5,4 (exit of plant) and 1,8 (exit of workshop) ***After 2015***	13	11	
Albemarle PPC	72		109	19	125 *Until 2010* 86 *After 2010*	26 *Until 2015* 12 <u>At exit of treatment station</u> *After 2015* 3,6 *Until 2015* 2 *After 2015*	119	109	

[51] Emissions from survey for France come from the French EPER, called IREP; http://www.pollutionsindustrielles.ecologie.gouv.fr/IREP/index.php

Solvay Tavaux	241		213	11	240 *Until 2010* 210 *After 2010*	<u>At the exit of plant</u>: 14,4 *Until 2015* 14,1 *After 2015* <u>At the exit of the workshop</u> : 0,65 *Until 2015* 0,32 *After 2015*	224	212	
Total	**690**		**545,3**	**90,56**			**699**	**617**	
CZECH REPUBLIC			[52]						
Spolana	135		85	8,2	1.446				
Spolchemie	61		33	29,7	380				
Total	**196**		**118**	**37,9**	**1826**				
SPAIN			[53]						
ERCROS – Huelva, Aragonesas	101		59,5	1,8			109	59	
ERCROS – Sabinanigo, Aragonesas	25		22	?			25	22	
ERCROS - Vilaseca Hg-M 30% (Aragonesas)	135		117	7,62			139	117	
Elnosa – Lourizan	34		21	1,9			30	21	
Ercros – Flix	150		92,4	6			121	92	
Quimica del Cinca –Monzon	31		30	8,2			38	30	
Solvin-Hispavic iberica – Martorell	218		146	10 dir (12 indir)			203	146	
Solvay – Torrelavega	63		20,6	55,9			47	20	

[52] Emissions into the air and water in kg/year from Spolana and Spolchemie cover total emissions, including energy sources in the plants. Sources: http://www.irz.cz

[53] Emission values from the survey, for Spain, come from European Pollution Emissions Rregister (EPER)

Total	**757**		**508.5**	**91,42**			**713**	**509**	
UK									
Ineos Chlor (UK) (July 2005-2007)	**738**				1300	400	1444	1322	
(2008-2020)					1000	250 Resid. Quant.			
(2021 onwards*)					0				

Table 9: Mercury emissions per MCCA plants (g Hg/tn Cl_2 capacity).

Name of MCCA Plant	*Plant's Cl_2 capacity-000 tonnes (OSPAR, 2006)*	*Hg emissions – reported by EEB survey (g Hg/tn Cl_2 capacity)*					*Hg emissions – reported by OSPAR (g Hg/ tn Cl_2 capacity)*		
		Total *Year 2006*	***Air*** *Year 2006*	***Total*** *Fixed in permit*	***Air*** *Fixed in permit*	***Water*** *Fixed in permit*	***Total*** Year 2006	***Air*** Year 2006	**Water** Year 2006
BELGIUM			[54]						
Tessenderlo Chemie	227,5		0,56				0,565	0,565	
SOLVIN (Antwerp)	120		0,47				0,412	0,412	
SOLVIC (Lillo)	219		0,34				0,360	0,360	
Total	**566,5**								
ITALY	[55]		[56]						
Tessenderlo Italia Srl, Viterbo	42		0,48						
Syndial Spa, VE	200		0,46						
Caffaro Chimica Srl, UD	68		1,09						
Solvay Chimica Italia S.P.A, LI	125		0,41						
ALTAIR CHIMICA S.P.A., PI	27		1,11						
SOLVAY CHIMICA BUSSI SPA, PE	87		0,28						
Syndial SpA,	200		0,83						

[54] Air emissions gHg/tn Cl_2 for Belgian plants calculated on the basis of the capacity, from the reported kg/tonne Cl_2 from table 8 on the basis of OSPAR reported capacities
[55] Data on Italian Chlor-alkali capacity, from FEDERCHIMICA
[56] Air emissions gHg/tn Cl_2 for Italian plants calculated on the basis of the capacity, from the reported kg/tonne Cl_2 from table 8

SR									
Syndial SpA, CA	6		NA						
Total	**755**								
GERMANY									
BASF, Ludwigshafen	170	0,940	0,900		1,2	0,05 mg/l	0,940	0,900	
Bayer, Uerdingen	130	0,743	0,680		1,0	0,05 mg/l	0,743	0,680	
Vinnolit, Knapsack	160	0,985	0,924		1,0	0,05 mg/l	0,985	0,924	
Akzo Nobel, Ibbenbüren	125	0,730	0,673		1,0	0,05 mg/l	0,730	0,673	
Evonik Degussa, Lülsdorf	136	1,193	1,038		1,2	0,05 mg/l	1,193	1,038	
Ineos Chlor, Wilhelmshaven	149	0,655	0,324		1,0	0,05 mg/l	0,655	0,324	
LII Europe, Frankfurt	167	1,238	1,170		1,0	0,05 mg/l	1,238	1,170	
Vestolit, Marl	176	1,018	0,952		Converted in 2007		1,018	0,952	
Vinnolit, Gendorf	82	0,669	0,645		1,0	0,05 mg/l	0,669	0,645	
Total	**1119**								
FRANCE			[57]						
ARKEMA LAVERA	166		1,02		0, 93 *Until 2010* 0,77 *After 2010*	0,09 *Until 2015*:	1,173	1,035	
ARKEMA Jarrie	170		0,52		0,47 *After 2010*	0,19 *After 2015*	0,699	0,525	
SPC Harbonnières	23		1,09	1, 31 *Until 2011* 1, 20 *2011-2015* 1,10 *After 2015*	1,09 *Until 2010* 0,98 *After 2015*	0,002 *Until 2015 After 2015* : 0,04 the same (?)	1,277	1,075	
Chemical Products of Loos	18		0,61	0,83 *Until 2015* 0,77 *After 2015*			0,720	0,600	
Albemarle PPC	72		1,51	1,35 *After*	1,8 *Until 2010*	0,36 *Until*	1,658	1,510	

[57] Air emissions gHg/tn Cl_2 for French plants calculated on the basis of the capacity, from the reported kg/tonne Cl_2 from table 8

				2011	1,2 *After 2010*	*2015*: 0,17 *After 2015*: <u>At exit of treatment station</u> 0,05 *until 2015* 0,03 *After 2015*			
Solvay Tavaux	241		0,88		1,0 *Until 2010* : 0,87 *After 2010*		0,932	0,880	
Total	**690**								
CZECH REPUBLIC			[58]						
Spolana	135		0,63						
Spolchemie	61		0,54						
Total	**196**								
SPAIN			[59]						
ERCROS – Huelva, Aragonesas	101		0,59	0,9g +25% (1/1/08) and 0,9g +15% (1/1/10)	0,8g +15% (1/1/08) and 0,8g (1/1/10)		0,676	0,589	
ERCROS – Sabinanigo, Aragonesas	25		0,88				1,020	0,880	
ERCROS - Vilaseca Hg-M 30% (Aragonesas)	135		0,87				1,014	0,864	
Elnosa – Lourizan	34		0,641				0,810	0,641	
Ercros – Flix	150		0,62				0,730	0,616	
Quimica del Cinca – Monzon	31		0,97				1,122	0,970	
Solvin-	218		0,67				0,708	0,670	

[58] Air emissions gHg/tn Cl_2 for Czech plants calculated on the basis of the capacity, from the reported kg/tonne Cl_2 from table 8
[59] Air emissions gHg/tn Cl_2 for Spanish plants calculated on the basis of the capacity, from the reported kg/tonne Cl_2 from table 8

Hispavic iberica – Martorell									
Solvay – Torrelavega	63		0,33				0,458	0,328	
Total	**757**								
UK									
Ineos Chlor	**738**						1,957	1,791	

3.4 Monitoring and auditing of mercury emissions

Monitoring and auditing of mercury emissions vary considerably across Europe, as table 10 below shows. This process is very important, not only to understand as well as possible the mercury flows and releases of each facility, but also because early detection of mercury leaks in process equipment can lead to a rapid response and drastically reduce overall mercury emissions and losses.[60]

Operators have the responsibility to monitor their emissions; however, although continuous monitoring is suggested by the BREF as a good practice, and by the US EPA as a highly recommended practice (and implemented in 6 of the 7 US MCCAPs),[61] it is not requested by local authorities. In UK the monitoring frequency differs, depending on the emission points, ranging from weekly to monthly. Similarly, in Spain and Germany the monitoring frequency changes according to the plant. Only Solvay in Torrelavega, Spain, and Akzo Nobel in Ibbenbüren, Germany, have installed equipment for continuous monitoring.

Although the mercury emissions reports are periodically checked or "audited" by the competent authorities, the regulator is typically not a specialist in the monitoring of mercury emissions, which is carried out by the facility operator. For example in the UK, all monitoring is carried out by the operator (as detailed in the permit and in accordance with methods specified by the Environment Agency) and no direct monitoring of any sort is carried out by the regulator. However, the Environment Agency audits the monitoring data (both the data records and the techniques used) during plant's visits, approximately every three months. In addition, Ineos Chlor carries out reconciliation of mercury inventory periodically every few years. This is not an easy task because the mercury inventory is several hundreds of tonnes and the normal margin of error in that measurement (carried out by using radio-tracers) can easily account for several tonnes of mercury. The Environment Agency may be notified by the company about such a reconciliation but there is no limit on unaccounted loss by this means.

As regards inspections, the frequency also varies across the European countries. In France inspections are carried out at least once a year, in the UK, as mentioned, every three months, and

[60] Southworth GR, SE Lindberg, H Zhang, FR Anscombe, Fugitive mercury emissions from a chlor-alkali factory: sources and fluxes to the atmosphere, *Atmospheric Environment* 38 (2004) 597–611.

Landis MS, GJ Keeler, KI Al-Wali, RK Stevens, Divalent inorganic reactive gaseous mercury emissions from a mercury cell chlor-alkali plant and its impact on near-field atmospheric dry deposition, *Atmospheric Environment 38* (2004) 613–622, Elsevier.

Kinsey JS, J Swift and J Bursey. Characterization of fugitive mercury emissions from the cell building at a US chlor-alkali plant. *Atmospheric Environment 38* (2004) 623-631.

Kinsey JS, FR Anscombe, SE Lindberg, GR Southworth, Characterization of the fugitive mercury emissions at a chlor-alkali plant: overall study design, *Atmospheric Environment 38* (2004) 633–641, Elsevier.

Kinsey JS, Characterization of Mercury Emissions at a Chlor-Alkali Plant - VOLUME I, Report and Appendices A-E, NRMRL-RTP-236a, U.S. Environmental Protection Agency, Office of Research and Development, National Risk Management Research Laboratory, Research Triangle Park, North Carolina, January 2002.

[61] In its Eleventh Annual Report to EPA (Sept. 26, 2008), the Chlorine Institute noted that MCCAPs are required to either install continuous mercury emission monitors or test each main emission vent at least once per week. Six of the seven [US] facilities have chosen the cost-effective option of installing continuous mercury emission monitors.

in Germany they are less frequent, although apparently regular. In the Czech Republic the Spolchemie and Spolana plants are inspected in supposedly once a year.

In addition, state authorities also audit each plant once a year with regard to work safety. The frequency of inspections related to environmental impacts is planned yearly by the Czech Inspection body for Environment, although frequency is not clearly specified in any publicly available document.
Once more, the frequency of monitoring even within plants of the same industrial group differs, and appears to be left to the discretion of plant management, after discussion with the regulatory authorities. Detailed information as to the number and location of measuring instruments was not available for any plants surveyed, although some general information is indicated.

Table 10. Monitoring and auditing of mercury emissions

Name of MCCA Plan (indicate in case it is for all plants)	*Name of Authority (indicate in case it is for all authorities)*	*Audit frequency of Hg emissions by the authorities*	*Inspections frequency*	*Location where measurement is taken and measurement procedure*	*Frequency of measurement of Hg emissions by the operators and number of measuring devices*
UK					
Ineos Chlor (UK)	Environment Agency	3 months	3 months		No direct monitoring by the regulator
SPAIN					
ERCROS - Huelva (Aragonesas)	Regional Government	Every two years			Every two years
ERCROS - Sabinanigo (Aragonesas)	Regional Government	Every two years			
ERCROS - Vilaseca Hg-M 30% (Aragonesas)	Regional Government	Every two years			
Elnosa – Lourizan	Regional Government	Every two years			
Ercros – Flix	Regional Government	Every two years			
Quimica del Cinca - Monzon	Regional Government	Every two years			2 weeks
Solvin-Hispavic iberica – Martorell	Regional Government	Every two years			
Solvay - Torrelavega	Regional Government	Every two years			continuous
BELGIUM					
SOLVIN	For Water: VMM for Air: Milieu Inspektie= Environmental Inspection	Monthly (WATER)	Few times / year (AIR)		Air: monthly Water: every 3 months at least
SOLVIC	For Water: VMM for Air: Milieu Inspektie= Environmental Inspection	Monthly (WATER)	Few times / year (AIR)		Air: monthly Water: every 3 months

Name of MCCA Plan (indicate in case it is for all plants)	***Name of Authority (indicate in case it is for all authorities)***	***Audit frequency of Hg emissions by the authorities***	***Inspections frequency***	***Location where measurement is taken and measurement procedure***	***Frequency of measurement of Hg emissions by the operators and number of measuring devices***
Tessenderlo	For Water: VMM for Air: Milieu Inspektie= Environmental Inspection	Monthly (WATER)	Few times / year (AIR)	In the cell – room and on work stations Emissions: KMnO4 – method, on workstations: with portable equipment	Air: monthly (operator) Air: every three months by extern lab Water: every month (operator)
GERMANY					
BASF, Ludwigshafen	SGD Süd, Regionalstelle Gewerbeaufsicht Neustadt	No measurement by the authority	Regular inspections on all issues of responsibility of the authority (work safety, environment, etc.)	Defined emission sources, not continuous	Usually every 3 years (based on TA Luft)
Bayer, Uerdingen	Bezirksregierung Düsseldorf	Checking the reports every three years	Sometimes	3 levels of the cellroom (roof, cellroom, cellar)	At least weekly 10 meas. Devices
Akzo Nobel, Ibbenbüren	Bezirksregierung Münster, Dez. 53 Umweltüber-wachung	No measurement by the authority	Annual performance check through an independent auditor	4	Continuous 1 meas. Device
CZECH Republic					
Spolana Neratovice	Czech Inspection for Environment	Once per year (but not sure that authority takes part at every measurement)	NA	On the output from filtration system from cellrooms hall	Once every 14 days period
				Waste roasting room, demercurization unit, exhaustor from cellrooms	Once a year
Spolchemie Ústí nad Labem	Czech Inspection for Environment	Once per year (but not sure that authority takes part at every measurement)	NA	Cellrooms hall on the output from the filtration system 2 (methods: non-fire AAS according ČSN ISO 5666-1, and by equipment	Once a week

Name of MCCA Plan (indicate in case it is for all plants)	*Name of Authority (indicate in case it is for all authorities)*	*Audit frequency of Hg emissions by the authorities*	*Inspections frequency*	*Location where measurement is taken and measurement procedure*	*Frequency of measurement of Hg emissions by the operators and number of measuring devices*
				Jerome)	
				Demercurization unit	Twice a year

In recent years the US EPA, with chlor-alkali industry cooperation, has taken a special interest in reducing mercury releases across the board. Since the US industry's commitment to mercury reductions, facilities have taken many steps to reduce emissions. These changes have been detailed in Chlorine Industry reports,[62] but are summarized below because "each historic process improvement continues to pay dividends in the form of emissions reductions in every year that follows." Important emission reduction activities have included the design, use and installation of:

- improved collection devices to more effectively capture mercury during cell maintenance;
- new decomposer compression system design to improve efficiency of amalgam decomposition;
- new gasket materials to provide better seals on mercury containing equipment;
- additional collection devices such as weirs to cell room trenches to more effectively recapture and reuse accumulated mercury;
- process changes to reduce mercury carry-over with the water exiting the end boxes resulting in less mercury handling;
- more efficient electrical current distribution equipment;
- larger decomposers, thus lengthening the time between scheduled maintenance outages (i.e. reducing the need to open the equipment); and
- continuous emissions monitoring equipment in mercury cell rooms.

The US EPA's new Mercury NESHAP rule (40 *CFR* Part 63)[63] became effective on December 19, 2006. This new regulation replaced the old 40 *CFR* Part 61 Mercury NESHAP rule. The new regulation contained numerical emission limits for the three primary air sources of mercury at mercury cell facilities:

1) end-box ventilation system vents,
2) by-product hydrogen system vents, and
3) mercury thermal recovery unit vents.

It also requires that the plants either install continuous mercury emission monitors or test each vent at least once per week.

The US EPA has also recently published proposed amendments to 40 *CFR* Part 63.[64] The primary changes proposed by the Agency would require:

- daily work practices;
- continuous mercury emissions monitoring in the cell rooms (no longer optional);
- detailed record-keeping of the work practices for the time period during the semi-annual setting and resetting of the action level of the continuous cell room monitors;
- resetting the continuous monitoring action level at least every six months;

[62] Eleventh Annual Report to EPA: Chlor-Alkali Industry Mercury Use and Emissions in the United States for the Year 2007, The Chlorine Institute, Inc., September 26, 2008, Washington, DC.
[63] *See* 68 Fed. Reg. 70,904 (December 19, 2003).
[64] *See* 73 Fed. Reg. 33,258 (June 11, 2008).

- calculating the action level at the 90th percentile of the data acquired during the resetting time period(s); and
- thermal recovery units (that continue to operate in order to assist in the clean up of the site after the mercury cells have ceased to operate) to comply with the emission limitations for thermal recovery units in § 63.8190.

Contrary to the above US practice, the methodology for taking measurements is rarely specified in the IPPC permit but points for attention are provided in the BREF, and Euro Chlor has issued general guidance documents on that. It is apparent, however, that the industry guidance is not followed by all plants. Based on the observations in the table above, it is recommended that guidelines on how to monitor and calculate mercury emissions should be clarified and harmonised for all plants in the EU. Techniques must be specified for calculating the quantity of mercury in the cells and with what frequency, for recovering mercury from wastes, for proper record-keeping, etc. Operators of each plant must be mandated to complete the Euro Chlor forms (or other but common ones for all plants) for determining in a consistent way the plant's annual mercury balance in an accurate and timely manner. This should apply even if emissions are usually are measured by certified laboratories that operate on behalf of the authorities.

Big differences are observed in the frequency monitoring is carried out by the operators and regulators, once more between countries and among plants. As a result, leakage and/or potential malfunctioning may not be identified in time, leading to uncontrolled/fugitive releases, potential high workers' exposure and as mentioned before, more mercury being added to the global environment.

It is therefore imperative that for a specified and predetermined remaining life of those mercury-cell plants, continuous monitoring and frequent auditing takes place. The above suggestions from the US should be seriously considered for the revision of the BREF for the chlor-alkali industry, provided, however, that plants will be converted as soon as possible, and by 2010 at the latest, as recommended nearly 20 years ago in the PARCOM decision 90/3..

3.5 Conversion (or closing down) of MCCAPs

The OSPAR Decision 90/3 of 14 June 1990 recommended phasing out the activities of existing mercury cell installations in chlor-alkali production plants as soon as possible, with the aim of achieving their total closure by 2010. The IPPC Directive (96/61/EC), on the contrary, does not set any sunset date by which MCCA plants should convert or close down. Therefore, any closure or conversion date is the result of a voluntary agreement between the operators and the national or local authorities, and is sometimes fixed in the permits. This haphazard approach has complicated the position of the regulators and permitted many phase-out dates to slip as neighbouring countries waver in their commitment to cleaning up this industry. As Table 11 shows, the dates of commitment to convert to membrane technology now vary widely across Europe. Industry has recently offered a voluntary agreement that sets a date for closure or conversion at 2020, but there is no legal obligation, and no conditions are set if this agreement is not met.
In fact, in Germany two operators, BASF and Evonik, have refused to sign up to the industry voluntary agreement. Another 2 or 3 MCCAPs in Europe are not part of this agreement, and not members of Euro Chlor -- therefore a total of 4 or 5 MCCAPs with a combined capacity of over 350 thousand tonnes of Cl_2 per year.

In France, the Minister has made a deal with the chlor-alkali industry whereby the operators are obliged to phase out the mercury-cell process by 2020. Until this date, the industry has committed itself to gradually reduce their mercury emissions. This appears in the circular of the environment ministry of 20 April 2007 (Circulaire du ministère de l'écologie du 20 Avril 2007). According to our information, French operators have generally claimed that they would prefer to close their facilities rather than taking on the costs to convert. Such a position (including the threat of job losses) is often adopted by industry as a negotiating position in

order to obtain permission to continue operating mercury cells as long as possible. Someone should consider, however, whether industry will either build new membrane plants in the vicinity of the existing MCCAPs, or increase capacity elsewhere in the country to ensure production levels and market share in what has been a profitable industry.

In Italy, all operators have submitted their plans for conversion, except for the operator Caffaro Chimica at Torviscosa (UD), the operations of which have recently been seized by the authorities because it was revealed that the operator was involved in illegal operations.

In Belgium a general law has fixed at 2010 the deadline for MCCAPs to phase out. However, an adaptation of this law is in progress (due to the lack of similar laws in some other countries), setting the date of closure for sodium (Na) – based mercury-cells at 2010 and for potassium (K) – based mercury cells at 2015. This means that by law, Tessenderlo will have 5 more years than SOLVIC and SOLVIN to convert. Contrary to the above, to our information SOLVIN and SOLVIC are rather planning to convert by 2012, and as a result they have now applied for an "individual derogation" (this procedure is possible) for an extra five years to the Minister (the same Minister who changed the VLAREM-rules) who will have to decide. As far as Tessenderlo Chemie is concerned, there are no plans for conversion for the time being.

In Spain, all MCCAPs have to deliver a plan for conversion/closure by 2011, but the final date for conversion has been arbitrarily set at 2020 by industry voluntary agreement, completely ignoring the IPPC Directive objective of moving aggressively to available BAT in a timely manner.

Table 11. Details of MCCAPs conversion or closing down plans

Name of MCCAP	*Converting to Membrane (specify date)*	*Closing down (specify date)*	*Dates set by Authority*	*Dates set by general industry Voluntary Agreement*	*Dates set in another way specify*	*Authority responsi-ble for providing permit*
FRANCE						
ARKEMA LAVERA	2020					
ARKEMA Jarrie (FR)	2020					
SPC Harbonnières	2020					
Chemical Products of Loos	2020					
Albemarle PPC	2020					
Solvay Tavaux	2020 (2 out of 4 units using Hg, 1 is being converted (ready in 2010), 1 will continue using mercury)					
SPAIN						
ERCROS - Huelva (Aragonesas)	2011: plan of conversion or closure			2020		Andalucia

ERCROS - Sabinanigo (Aragonesas)	2011: plan of conversion or closure		2020		Aragon
ERCROS - Vilaseca (Aragonesas)	2011: plan of conversion or closure		2020		Catalunya
Elnosa - Lourizan	2011: closure expected				Galicia
Ercros – Flix	2011: plan of conversion or closure		2020		Catalunya
Quimica del Cinca -Monzon	2011: plan of conversion or closure		2020		Aragon
Solvin-Hispavic iberica - Martorell	2011: plan of conversion or closure		2020		Catalunya
Solvay - Torrelavega	2011: plan of conversion or closure		2020		Cantabria
CZECH REPUBLIC					
Spolana Neratovice	By Dec-31-2014	In the IPPC Permit			Regional Authority for Middle-Bohemian Region
Spolchemie Ústínad Labem	By Dec-31-2012	In the IPPC Permit			Regional Authority for Ustecky Region and Ministry of Environment
GERMANY					
BASF	Not specified		Did not sign voluntary agreement	2010 (PARCOM decision 90/3)	SGD Süd Neustadt a.d. Weinstraße (Rheinland-Pfalz)
Bayer	Not specified		2020		District Government Düsseldorf (NRW)
Vinnolit / Knapsack	Reduction by 60kt by end of 2008; full conversion by mid 2009.		2020		District Government Köln (NRW)
Akzo Nobel	Conversion or closing estimated between 2010 and 2015		2020		District Government Münster (NRW)
Evonik (Degussa)	Not specified		Did not sign voluntary agreement		District Government Köln (NRW)

Ineos Chlor	Not specified	2020		Municipal Environmental Agency Wilhelmshaven (Niedersachsen)
LII Europe	Conversion estimated by 2010	2020		District Government Darmstadt (Hessen)
Vestolit	Converted in 2007			District Government Münster (NRW)
Vinnolit / Gendorf	Conversion estimated by mid 2009	2020		District Office Altöttingen (Bayern)
ITALY				
Solvay Rosignano	Converted in October 2007			Environment Ministry
Solvay Ausimont Bussi	In the process of converting			Abruzzo Region
Altair Chimica Volterra	Converted in June 2008			Province of Pisa
Eredi Zarelli Picinisco	NA			NA
Syndial S.p.A. (Porto Marghera - VE)	In the process of converting – submitted conversion plan on 29 March 2007 – estimated necessary conversion time of 18 months			Environment Ministry
Tessenderlo ITALIA s.r.l. (Pieve Vergonte - VB)	In the process of converting – submitted conversion plan on 29 March 2007			Environment Ministry
Caffaro Chimica s.r.l. (Torviscosa - UD)	No conversion plan or date submitted			Environment Ministry
BELGIUM				
SOLVIN Zandvliet	2010			Province of Antwerp
SOLVIC, Lillo	2010			Province of Antwerp
Tessenderlo	2015			Province of Limburg

As regards decommissioned mercury-cell chlor-alkali plants in Europe, 11 chlor-alkali installations with mercury-cell technology, of which more than half located in Germany, have closed down in the past 20 years. However, it is not clear whether cleaning up operations have been carried out, exception made for the German city of Bitterfeld, which was one of

the worst polluted cities in the whole of Europe, due to its chemical industry. After 1990 the entire industrial areas have been cleaned up. More details on the number of decommissioned MCCAP plants as well as the extent of contamination (around 9.600 tonnes of mercury) are reported in a recent study for the European Commission.[65]

In Germany at the end of 2006, 6 out of the initial 15 chlor-alkali plants (according to 1991 data) had been completely converted to mercury-free technology. Another two plants had closed down some mercury-cells and substituted that capacity with membrane technology. By the end of 2007 one additional plant had completely converted from mercury–cell process to membrane. By the end of 2009 two more plants are expected to complete their conversion to mercury-free electrolysis. The table below shows the phasing-out of mercury-cell technology in Germany until the end of 2007 and an estimate of the further phasing out of mercury-cell technology by the year 2009. It is in fact expected that chlorine capacity of MCCAPs in Germany will be reduced by 35% from 1991 by 2009 (see table 12 below).

Table 12: The phasing out of mercury cell chlor-alkali plants in Germany

Year	Chlorine capacity (kt/a)	[%] Base year: 1991
1991	2478	100
2001	1595	64
2005	1291	52
2007	1104	45
2009	**862**	**35**

As regards the financing for converting chlor-alkali plants from mercury-cell to membrane technology, in Italy some operators have received state aid. In particular, the operators for whom funding for conversion was approved are: Solvay Rosignano (which converted in October 2007), Solvay Saline of Volterra (which converted in June 2008) and Tessenderlo Pieve Vergonte and Caffaro Torviscosa that have not yet converted. Italy is one of the few recorded examples that funding has been given to operators to cover the costs of conversion. The Italian authorities have estimated that industry is able to recover the investment cost after about five years, as it was also discussed in the 2006 EEB Status report.[66]

In Germany, all plants are aware of the economic details and long-term savings of conversion. The operator LII has expressed the intention to convert both for economic and environmental reasons. However, they were refused the bank loan to undertake such conversion. Vestolit converted their plant in 2007 for 80 million Euro. In a press release they wrote: “Rising energy costs and high fixed costs of the old plant are good economical reasons for a quick technology switch from mercury to membrane. The new plant will need much less energy.” Vinnolit received in 2008 about 45 million Euro to invest in membrane technology with 90.000 tonnes of chlorine production capacity. They will also convert in 2009 because of energy savings. In fact, the German Association of Chemical Industry (VCI) has estimated that energy savings when using membrane technology instead of mercury-cell are in the region of 500-1100 kWh per tonne of chlorine capacity. In Spain, to our information, discussions are also taking place on potential state subsidies for at least one MCCAP plant to convert to membrane technology. Finally, in Belgium, the partial conversion of Tessenderlo Chemie has been supported by EU-approved financing from the Flemish

[65] “Options for reducing mercury use in products and applications, and the fate of mercury already circulating in society”, COWI A/S and Concorde East/West Sprl for the European Commission, Directorate General Environment, September 2008, Brussels., p. 162

[66] “Status Report: Mercury cell chlor-oalkali plants in Europe” , http://www.zeromercury.org/EU_developments/Final_Report_CA_31Oct2006.pdf, EEB, October 2006

government. The future conversion of Tessenderlo and SolVin is also expected to be assisted by the Flemish government.

On the basis of the above it is obvious that in the absence of EU direction, industry and authorities are free to decide as convenient with respect to the conversion, As earlier mentioned, the cost for conversion for the chemicals-chlorine industry should not be an issue, given the profits of the sector and the future cost savings from the more energy efficient membrane method.

Furthermore, there have been different interpretations of the IPPC directive and the role of the BREF for the chlor-alkali sector. Given that new permits should have been given to all industries by October 2007 and that for the chlor-alkali sector it is clearly mentioned in the relevant BREF that membrane technology is BAT, in our opinion no permit should have been given to plants continuing to use the mercury-cell process. This interpretation is further supported by a legal analysis carried out by DMA/OCEANA in 2005 where they concluded that "from October 2007 onwards installations in that sector whose production process is based on mercury cells should have been modified to ensure that BAT is implemented."[67] Therefore, the fact that mercury-cell plants are continuing their operation with no concrete deadline for conversion at EU level, undermines the purpose of the IPPC directive and of the EU mercury strategy.

Finally, attention should also be drawn to the chlorine + potassium hydroxide plants. These do not seem to have been included in the industry voluntary agreement and will continue to operate as usual, as noted in a recent study for the Representing about 1 million tonnes of annual chlorine capacity, these plants may argue for continued use of mercury after 2020, although viable mercury-free alternatives are in use elsewhere in the world.[68]. From experiences in other parts of the world, the membrane process can also be used for such plants.

3.6 Conclusions

This chapter has shown that mercury-cell chlor-alkali plants operate under very different regulatory conditions across Europe, leading to substantially different competitive, health and environmental implications. Furthermore, it has been stressed that every year an average of 41 tonnes of mercury releases and losses are unaccounted for by EU chlor-alkali producers. This is five times the industry reported emissions, and proves not only that emissions are not being accurately and fully reported, but also that many operators of MCCAPs don't know what their real mercury releases are. Even worse, many of the regulators seem completely unaware of the significance of these enormous losses. The most obvious evidence is that every time a serious research effort is carried out to measure atmospheric or water concentration of mercury in the vicinity of EU MCCAPs, a significant number of the measurements are far above the generally accepted limits for the protection of public health and the environment.

In order to deal with this problem it is critical that regulatory authorities require full and accurate reporting of all mercury releases as a primary condition of the plants' operating permits, following the example of the United States where all mercury flows must be accurately measured and reported. All mercury wastes should be retorted and the mercury recovered. Any mercury not specifically accounted for (or a large percentage thereof) should be considered to be fugitive emissions. Furthermore, ambient air and wastewater releases in the vicinity of MCCAPs should be periodically measured and publicly reported.

Techniques for measuring mercury cell inventories and emissions are rarely specified in the operating permits, and have contributed to the present unacceptable situation. It is evident

[67] DMA/OCEANA The implementation of the IPPC Directive in the mercury cell chlor-alkali production industry (September 2005)

[68] Options for reducing mercury use in products and applications, and the fate of mercury already circulating in society", COWI A/S and Concorde East/West Sprl for the European Commission, Directorate General Environment, September 2008, Brussels

that monitoring of mercury emissions is not consistent across the EU, and emission reports rely all too frequently on the operators' irregular measurements as well as on the authorities' documentation controls or lack thereof, which also differ drastically.

It is therefore imperative that for a specified and predetermined remaining life of those mercury-cell plants, continuous monitoring and frequent auditing takes place and the BREF should be revised accordingly.

As regards the reported emissions per tonne of chlorine produced (and related data, as published in OSPAR reports), these vary significantly from country to country and from plant to plant, even within the same industrial group. While the data reported as emissions in most cases appear to comply with the emission limit values set in the permits, other important data (i.e. mercury consumption, waste disposal) are not explained, and the major quantities of mercury that go missing are completely ignored. No, explanation is required from the authorities as to why different emission limit values are allowed within countries and industrial groups. In addition, no justification is provided as to why these values are far from those suggested by the BREF on chlor-alkali (0,5 g/tn of Cl_2 production capacity).

This chapter has also revealed that most operators and authorities are fully aware of the energy saving and associated environmental benefits of the MCCAP conversion. Nevertheless the logical consequence of this, the conversion, is not followed across the board for many reasons. Although the cost for conversion should not be an issue on the basis of the profits of this sector, some operators across Europe have, nonetheless, requested and received state financial assistance as an extra incentive for converting to membrane technology.

The plans for conversion contained in some permits are much more ambitious - ranging from as early as 2009 to 2014, not to mention those plants already converted - than the industry voluntary agreement which sets the ultimate phase-out date at 2020. The authorities should be urged to include a date for MCCAP closure or conversion in every permit, and to encourage conversion as soon as possible through a combination of legislation and low-interest loan system, should this be necessary. Such measures could also be taken at European level.

Belgium is the only country which had put into law the dates of conversion as agreed at the PARCOM 90/3 decision, although some other countries (Netherlands, Switzerland) negotiated aggressive phase-out dates directly with industry. Instead of seeing this as an example to be followed by other countries – who had also signed the PARCOM decision – Belgium, under industry pressure, is in the process of changing its regulation to require conversion by 2010 for the sodium based plants and 2015 for the potassium based ones. On top of that, no penalty is foreseen for countries that have not respected the PARCOM decision.

Furthermore, in France, it has been announced in the 'arrete' of 1998 and in a 2007 note from the ministry that the process of electrolysis with cathode of mercury will no longer be allowed after 2020. Although the French "national" phase-out date of 2020 is not a welcome revision of the 2010 date set in the OSPAR Decision, and is clearly an abuse of the IPPC Directive's effort to provide flexibility, it at least represents a fixed deadline for the phasing out of the mercury-cell technology that is missing altogether in the IPPC Directive.

To recapitulate, there are surprising and significant differences among EU countries in the phase-out dates required by different authorities (for example, some countries took quite seriously the OSPAR date of 2010), in the level of emissions permitted, in the monitoring requirements, in the enforcement procedures, and in sanctions that may or may not be applied if legal requirements are not respected. This results in the absence of a level competitive playing field for chlor-alkali producers in the EU, in the absence of apparent urgency for chlor-alkali producers to comply with BAT and, therefore, the absence of an adequate protection of citizens across Europe as required by EU law. In addition, the

flexibility that was designed into the IPPC process is being seriously abused by the chlor-alkali industry in order to keep polluting mercury-cell plants operating for as long as they are profitable.

Finally, further attention should be paid to the contaminated MCCAP sites, many of which contain significant quantities of mercury. Measures are necessary to ensure that human exposure is minimised.

4 The European Permit System for MCCAPs

4.1 Introduction

This chapter provides an overview of the different permitting systems in Europe and it explores whether installations across Europe operate in compliance with their permit conditions, given that on the basis of the IPPC directive, all plants should have been given new permits by October 2007.

4.2 General characteristics of the permit system: information requirements, the updating and issuing process.

In Germany all mercury chlor-alkali plants are existing installations that had permits issued under the legislation in force prior to the implementation of the IPPC Directive. Since this legislation already contained most of the IPPC Directive's requirements, each permit was reviewed and, when necessary, updated. As an official of the Federal Environment Agency (UBA) has stated; 'the installations meet the requirements of the German legislation (i.e. TA Luft and Waste Water Ordinance). The permits are therefore granted for an unlimited period of time, unless a plant undergoes modifications or is rebuilt, in which case a new permit is issued (table 13).
In Italy, the MCCAPs are working with renewed/updated authorisations which are in compliance with sectoral regulations (DLgs 152/2006) (releases to air, water, etc), rather than under the IPPC as they have not yet obtained an integrated environmental authorisation. Since the environment ministry is still lacking BAT guidelines for the issuing of IPPC permits, the existing permits have not been updated to fully comply with the IPPC Directive yet. The Ministry of Environment reviews permits every 5 years with some exemptions: In case the plant, at the time of the issuing of the permit, is certified with ISO 14001, the revision takes place every 6 years. In case the plant, at the time of the issuing of the permit, is registered following Regulation 761/2001/EC, the revision takes place every eight years.Six months before the end date of the permit, the operator has to submit an application for revision and the authority has one hundred and fifty days before it renews the permit and its conditions. During this time the installation is allowed to continue its operations under the previous permit. The revision of a permit can also be initiated by the competent authorities in the following cases: 1) the pollution of the installation is so high that the emission limit values need to be revised; 2) the best available technologies have been substantially modified to reduce mercury emissions without increasing costs; 3) the safety of the operations requires the implementation of different technologies; 4) new European and national legislation require a permit revision.

In Spain, the IPPC permits have been mainly issued in 2008. They will be updated every four, six and a maximum of eight years depending on the date specified on each permit. This time difference in the updating of the permits is due to the IPPC Directive being transposed to regional law. Therefore, in Spain each autonomous region (comunidad autónoma) is free to fix its own deadline.
In the Czech Republic, both existing chlor-alkali operators hold IPPC permits and permits for conversion. In general permits are updated every 8 years after the issuing date.

In UK the permit for the Ineos plant was issued in 2005. This was the first time that a permit was issued under the IPPC Directive as it previously had different permits under different

regulations. The permit will be reviewed in a few years (currently there is no fixed date) and only updated if deemed necessary.
In Belgium, the two Solvay plants have IPPC permits and only the Tessenderlo plant is expecting (October 2008) to still being granted the permit. Permits are granted for a maximum of 20 years during which the conditions of the permit can be changed on the basis of the initiative of the regional authority or even an NGO. The EEB Flemish member was once responsible for requesting the change in the conditions of a permit.

Table 13: IPPC Permits

Name of plant (country)	**Permit**		
	Yes (date)	*Validity*	*Update in progress (date)*
Belgium			
SOLVIN	30/06/05 -		
TESSENDERLO	1982 – latest update 2003		Should have been granted already, expect anytime now
SOLVIC	2005		
Germany			
BASF, Ludwigshafen	17.3.1992		
Bayer, Uerdingen	30.4.2004 (permit to convert to membrane, not completely used by Bayer yet)		
Akzo Nobel, Ibbenbüren	24.4.2006 (decree to implement TA Luft) 19.12.01 (for waste water, limited to 31.12.2015)		
LII Europe, Frankfurt	Updated 2007		
FRANCE			
ARKEMA LAVERA	28/08/2007		
ARKEMA Jarrie	29/06/2007		
SPC Harbonnières	22/06/2007		
Chemical Products of Loos	24/10/2007		
Albemarle PPC	01/08/2007		
ITALY			
Solvay Rosignano			Application submitted on 30/03/2007 but update still in progress
Solvay Ausimont Bussi			Update in progress
Altair Chimica Volterra			Update in progress
Eredi Zarelli Picinisco			Unpdate in progress
SYNDIAL S.p.A. (Porto Marghera - VE)			Application submitted on 29/03/2007, but update still in progress
TESSENDERLO ITALIA			Application submitted

s.r.l. (Pieve Vergonte - VB)			on 29/03/2007, but update still in progress
CAFFARO CHIMICA s.r.l. (Torviscosa - UD)			Application submitted on 30/03/2007, but update still in progress
Spain			
ERCROS –Huelva (Aragonesas)	17/03/08	Valid until 2016	
ERCROS –Sabinanigo (Aragonesas)	21/04/08	Valid until 2012	First permit 17/07/1993
ERCROS –Vilaseca (Aragonesas)	28/05/08	Valid until 2016	30% is membrane
Elnosa –Lourizan	May 2008	Valid until 2011	
Ercros – Flix	28/05/08	Valid until 2016	Cl_2 prod. started in 1897
Quimica del Cinca – Monzon	25/05/08	Valid until 2012	First permit 9/10/1985
Solvin-Hispavic iberica – Martorell	07/02/07	Valid until 2015	
Solvay –Torrelavega	29/04/08	Valid until 2016	Cl_2 prod. started in 1908
UK			
Ineos Chlor (UK)	21 July 2005		

In Spain and in Germany permit applications contain information on the installations, their activities, on the sources of emissions, on the nature and quantities of foreseeable emissions for each medium, and on the emission monitoring measures. In Germany, they also contain information on the measurement methodology and on the proposed technology to reduce emissions. On the contrary, in Spain indications on the technology used to reduce emissions and on the measurement methodology do not appear in the permit although the latter is required by Law 16/2002, Art. 22.
In France permit applications usually contain information on the source of mercury emissions in the installation, on the proposed technology to reduce mercury emissions, and on emission monitoring measurements and requirements. However, they do not contain any indication on the measurement methodology and frequency and on the evaluation procedure. Permits are in general revised every ten years on the basis of the installation's operational activity.

4.3 Compliance of selected MCCAPs with permit conditions

In Spain authorities are sometimes put under pressure by operators who threaten that jobs will be lost if more stringent measures are taken. As a result permits seem to rather be tailored for installations to comply. In addition, if the operator is found to be non-compliant during the first inspection, then a deadline for compliance is given. If, at the second inspection the operator is still non-complaint then the non-compliance is advertised. The sanction is issued only at the third inspection.

In France the mercury-cell chlor-alkali plants comply with the conditions of their permits. However the situation seems to be similar to Spain. This becomes more evident from Tables 4 and 5 which show that local authorities have actually set emission limit values higher than the limit values foreseen by the Ministry of Environment. Therefore, the permits are validating the operators' emission reduction plans – rather than encouraging the operators to

do more and better. However, some unforeseen discharges occasionally occur and, if reported, the authorities apply the appropriate sanctions.

In Germany, whilst BASF in Ludwigshafen, Bayer in Uerdingen, and Akzo Nobel in Ibbenbüren have declared that they comply with the conditions of their permits, LII Europe in Frankfurt did not meet the ELV of 1 gram per tonne of Chlorine production, which came into effect in October 2007, and was therefore required by the authority to take measures to reduce emissions.

On the contrary, in Italy the permits are all in the process of being updated to meet the IPPC requirements, since the applications guidelines are still missing due to political and bureaucratic problems. Therefore, it is still premature to evaluate whether the plants comply with the IPPC permit conditions.

In the Czech Republic, the operators are obliged to draft a report yearly on their compliance with the IPPC Directive and the authorities have to make this report publicly available; however in practice the public has to show an interest in order to get a copy of the report from the public authority as reports are not published on the website.

4.4 Conclusions

This chapter has shown lack of uniformity in the dates IPPC permits have been granted or are still in the process of being updated according to IPPC (the case of Italy) across Europe, ranging from as early as 2004 to being still under revision. In addition, permits differ in terms of information requirements and general conditions foreseen. For example Germany is the only country (among those surveyed) that requires that information on the mercury emissions measurement methodology be included in the plants' permit. As a result, on a few aspects European authorities have no basis of comparison. Furthermore, emissions reported may differ if the methodologies used are not comparable or at least known. Permit conditions seem therefore quite flexible and sometimes even tailored for the operators to comply. It can therefore be argued that permits are not ambitious enough to drive industry to better performance; rather they sometimes encourage business as usual, confirming the status quo.

5 ENGO and Stakeholder Involvement in and Access to Information to the Chlo-ralkali Industry Permit Application System

5.1 Introduction

This chapter focuses on the availability of information and involvement of Environmental NGOs in the permit application process of the chlor-alkali industry. Whilst information on permit applications is available widely across Europe and the stakeholder consultation in the permit application process is carried out according to the requirements of the IPPC Directive, there has been, in reality, very little attention to the comments that Environmental NGOs have submitted to local authorities during the issuing of permits.

It is furthermore worth noting that during this present survey, NGOs requested information from local authorities. Although some information was indeed received, it was not easy to identify the right people, authorities were sometimes hesitant in providing information, the responses took considerable time and in some cases a fee was requested.

5.2 The stakeholder consultation process

Article 15 of the IPPC Directive states that:

'Member States shall ensure that the public concerned are given early and effective opportunities to participate in the procedure for:
— issuing a permit for new installations,
— issuing a permit for any substantial change in the operation of an installation,
— updating of a permit or permit conditions for an installation in accordance with Article 13, paragraph 2, first indent.
The procedure set out in Annex V shall apply for the purposes of such Participation'.

The experiences of the ENGOs that participated in the EEB survey were consistent across Europe and revealed that the requirements embodied in article 15 and Annex V of the IPPC Directive have been implemented.

In Germany, when a plant applies for a permit, the application is published on the official journal of the municipality, in the local newspaper and is made available on the local or regional authority's website. This information must be available for a period of 30 days before the permit is issued. In addition, any objections to the application need to be submitted no later than two weeks after the publication period is over. In Germany, the stakeholders that are consulted in a permit application process are the local and intermediate authorities, whereas NGOs and the public are consulted only in some cases. The participation of the authorities is regulated by the BImSchG and 9th BImSchV. The participation of other stakeholders (NGOs, technical agencies, businesses) relies entirely on the authorities' decision to involve them: some authorities explicitly invite NGOs or other stakeholders. In Germany NGOs can be accredited as environmental consultants for the application process (§29 BNatSchG: Bundesnaturschutzgesetz or Federal Nature Conservation Act). This is done locally or by the Länder, because the application is issued at this level. For minor changes to the permit and if the authority does not expect any environmental impact a shortened permitting process without environmental impact assessment (EIA) and involvement of NGOs can be used. However, the rules for shortening the process are quite strict. For example Bayer (Krefeld-Uerdingen) already received a permit to convert their plant to membrane in 2004 (the permit is unlimited and has not been used so far). This permit was given without EIA and therefore without participation of NGOs or the general public, because there no environmental impact is expected. Therefore, the majority of the permit renewals was carried out with no EIA and no NGO involvement.
.
In France NGOs are consulted only in the process of issuing permits for new installations. In this case, a legal procedure of public consultation called 'public inquiry' is held and announced in the local newspapers or on the walls of the city hall. During this consultation NGOs give an opinion which is seldom taken into consideration in the final decision, published for a month period. The project of issuing a new permit is submitted to a local committee – CODERST[69] – that NGOs attend together with other stakeholders. On the contrary, during the revision of a permit no stakeholder consultation is held. The final decision is taken after consulting the operator and the technical experts of the authorities. The EEB French member has not participated in any permit application process because no stakeholder consultation was held for the revision of the existing permits.

Similarly, in Spain permit applications are published on regional official bulletins and the consultation period lasts for one month. NGOs are not consulted, but the authorities are legally obliged to mention NGOs comments when giving the permits; in some cases authorities may even supposedly carry out the consultation without the NGOs being informed, even though those were checking the official bulletin regularly. At the city of Huelva, where one of the MCCAP operates, the local administration also informed the

[69] COnseil Départemental de l'Environnement et des Risques Sanitaires, a local committee composed of every actor of the territory, including NGO's. They meet once a year.

population. In addition, regional authorities need to inform national authorities annually on the permits they issue. The EEB Spanish member organisation has been involved in some permit applications and has given opinions on mercury cell technology, on mercury losses and monitoring results. However, the NGO's opinion was not taken into consideration and all permits were eventually given, regardless of the NGO's concerns and objections.

In the Czech Republic, permit applications can be checked on the internet[70] although they are not available in full. Local/municipal authorities and technical agencies are explicitly invited to participate at the consultation, but NGOs need to see the announcement if they are interested in getting involved. NGOs can apply to be involved in an application process within 8 days from the process starting date and they also have 30 days to send comments on the permit applications. The EEB member organization pushed for earlier dates for conversion of the mercury-cell chlor-alkali plants present in the Czech Republic to membrane technology and succeeded to have those included in the permit. The NGO also succeeded in enforcing mercury emissions monitoring around the Spolana Neratovice plant and in having the waste analysed for the presence of POPs[71].

In the UK, when a permit application is submitted to the authorities there is a public consultation, subject to national security and commercial in confidence matters. There is, like in the other EU countries a period of 28 days after an advert has been placed in the local newspaper and the official journal, during which the public can send comments. Also other stakeholders, such as the local authority sewerage undertaker, are identified at an earlier stage and they have the same time constraint of 28 days to send comments on the permit application.

In Belgium operators report yearly on their emissions and reports are available under request to the authorities. In addition, when a permit is requested information is made publicly available on line and in paper copy. The consultation period with the stakeholders lasts 30 days. When a consultation period starts certain stakeholders are formally invited, among which local authorities, intermediate authorities, local population and technical agencies. However, although NGOs are not usually invited, the EEB Flemish member has been consulted in permit applications.

Therefore, although NGOs are consulted across Europe on the permit application process and are invited to send comments, like any other stakeholder and in accordance with the IPPC Directive, they have had very little influence on the conditions of the permit or on the date for conversion from mercury-cell to membrane technology. In the Czech Republic, however, the EEB member has pressured the local authorities to introduce earlier dates (2009) in the permits that were issued to the two MCCAPs, than what it was asked by industry (2014). Finally the authority decided that the plant of Spolana will have to convert by 2014 and the plant of Spolchemie by 2012, earlier than the date asked by industry. In addition, the requirements demanded by the NGO were listened to, including steps to be taken by companies heading towards final mercury phase out.

5.3 Availability of information on implementation of and conformity with the IPPC Directive

As regards the availability of information on the implementation of and conformity with the IPPC Directive, the experiences also differ across Europe. In France, reports are not available or publicly accessible. In Germany, on the contrary, operators will have to report every year, from 2007, on the installations' performance and conformity with the IPPC Directive. So far, reports have been published every four years by the local authorities, but in the future they will have to be published annually. Similarly, in the Czech Republic, operators are obliged to report every year on the conformity of the installation with the IPPC permit. These reports are not published on the internet, but they are available and can be obtained

[70] http://www.mzp.cz/C1256C8F00336A13, and also on regional websites
[71] Persistent organic pollutants

from the local authorities. In Spain the operators are also obliged to report on the installations' conformity with the IPPC permit. However, the frequency of the reporting differs and is usually specified on the permits. Finally, in Belgium and the UK operators have to report yearly on their installations' conformity. In the UK reports are placed on the public registers held at the local authority where the company is based and at the local environment agency area office.

5.4 Conclusions

This chapter has shown that information on permit applications is, for the most part, publicly available and accessible across Europe, and NGOs in most cases participate in the stakeholders' consultation process. However, even though the IPPC Directive seems to be well implemented as regards accessibility of information and stakeholders' consultation, in reality authorities are not likely to take comments and suggestions from NGOs into consideration when granting a permit. In addition, in some cases NGOs are not formally invited to join the consultation process but have to keep abreast of whether a permit consultation has started by checking the official journal regularly. On the other hand, information on the installations' conformity with the IPPC Directive is not always available.

It is therefore important that a correct implementation of the IPPC Directive is ensured with respect to public consultation, transparency and access to information. Clear legislation is necessary as well as strict enforcement in order to ensure protection of the environment and human health in an integrated way across Europe.

6 Conclusions and recommendations

6.1 Conclusions

From the outcome of the EEB survey, a number of important conclusions can be drawn:

- No local authorities have actually denied a permit to a MCCAP on the basis that the mercury-cell technique is not BAT.
- The BREF is not considered as a legally binding document which authorities have to seriously include in the permit process. Furthermore the BREF for chlor-alkali does not contain mercury emission limit values which need to be met, therefore does not provide any specific benchmark or direction for local authorities.
- There is no broad and consistent level of protection of EU citizens in terms of mercury releases from MCCAPs.
- The specific characteristics of mercury – being persistent, bio-accumulative, bio-magnifiable and transported long distances as a global pollutant – are not really taken into account, overlooking the potential negative effect that can be created at European and/or global level, and the fact that this industry is adding mercury to the world environment from a process for which mercury-free alternatives exist since before the 1980s
- The aim of the EU mercury strategy, to ensure that we can eventually have mercury-free fish, is not respected since the emissions from this sector are not regulated in reality.
- No standard measuring methods exist for all plants, and those that are available are not fully used by the different operators.
- Emissions are not being accurately and fully reported, and moreover many operators of MCCAPs don't know what their real mercury releases are.
- Air emissions from most sites are likely underreported on the basis of various research reports.
- The missing – unaccounted or – mercury releases have not been questioned by most regulators who seem to be unaware of the significance of these losses.
- It is evident that monitoring of mercury emissions is not consistent across the EU, and emission reports rely entirely on the operators' irregular measurements as well

as on the authorities' documentation controls or lack thereof, which also differ drastically.

- The EU and most Member State authorities, although they are aware of the wider environmental and economic benefits of conversion, as well as the good financial situation of the chlorine industry, have avoided setting a legally binding phase-out date for MCCAPs.
- The flexibility that was designed into the IPPC process is being seriously abused by the chlor-alkali industry in order to keep old and polluting mercury-cell plants operating for as long as they are profitable.
- No standard permit for chlor-alkali plants at EU level exists, making harmonisation, implementation and enforcement at EU level difficult to ensure.
- Permit requirements are often not ambitious enough to drive industry to better performance, rather encouraging business as usual, confirming the status quo.
- The diverse and inconsistent regulatory environment for this industry across the EU makes a level playing field for commercial competition impossible to guarantee for the chlorine producing industry.

From all of the above it can further be concluded that for the chlor-alkali sector the existing IPPC permits (limits, measurements, controls etc.) are far from adequate to protect the environment and public health.

6.2 Recommendations

On the basis of the above conclusions it is recommended that the following actions are taken:

- **A specific sunset date for all mercury-cell chlor-alkali plants, both sodium – and potassium-based should be set. The EEB has been advocating for 2010 as a phase out date for many years.**

  This recommendation is consistent with the PARCOM Decision 90/3 and the European Parliament's resolution (March 2006) as well as with the fact that the membrane technique is regarded as BAT in the EU. Therefore, mercury emissions from this sector should not be accepted anymore.

- **At EU level, the European Commission should come forward with legislation specific to the chlor-alkali industry, including not only a specific sunset date for the mercury-cell chlor-alkali plants, but also minimum requirements, reporting obligations, and mercury emission limit values for the mercury-cell chlor-alkali plants that will choose to operate until the sunset date.**

  Since the IPPC Directive has permitted a flexible regulatory regime for MCCAPs, leaving regulation subject to the whims of the various member states, the environmental requirements for this industry across the EU are haphazard, progress is stalling and the impact on public health is not a high priority.
  Given the recent recast of the IPPC Directive(renaming it the Industrial Emissions Directive), integrating a number of sectoral Directives into it as annexes, an industry-specific law could be included as another Annex. Such a law (an addition to the new Industrial Emissions Directive), should be proposed by the Commission immediately; otherwise, at the latest, such an action should be included in the reviewed EU Mercury strategy foreseen to be completed by end 2010[72].

  When minimum requirements are set, the Commission should take into consideration the following recommendations, below.

Until a sunset date is set, with respect to the MCCAPs it is further recommended that:

[72] Communication from the Commission to the Council and the European Parliament on a Community Strategy concerning Mercury SEC(2005) 101, p.11

- **The role of the Best Available Technique Reference Documents (BREFs) in the IPPC Directive be made more precise and more stringent. Permit conditions must be based on the BREFs which considers the membrane technology as BAT and obliges MCCAPs to convert to membrane cell technology. Any derogations based on local conditions (technical characteristics, geographical location and local environmental conditions) should be subject to strict criteria defined by the Commission and dependent on the outcome of a public consultation.**

Until now the inherent flexibility of the IPPC Directive and the fact that no clear benchmarks are given by the BREF on chlor-alkali have led to the abuse of the Directive by industry and authorities which have been confirming the status quo rather than driving industry towards conversion.

- **The BREF document on the Chlor Alkali Manufacturing Industry needs to be revised rapidly. Firstly, the mercury-cell technique shall not be presented under the BAT chapter. Secondly, for the remaining life of MCCAPs, and in a separate chapter, a maximum emission limit value of 0,2- 0,5 g Hg/tonne of Cl_2 production capacity, should be set, as well as additional strict minimum requirements defined according to the recommendations below.**

The current BREF on Chlor-alkali industry dates back to 2001 and updating was to have begun in 2008, which has not been the case. The revised BREF should be completed rapidly and in not more than 2 years at the latest given the wide existing knowledge of this industry.
The suggested emission limit value was already indicated in the BREF in 2001 as a yearly average of total mercury losses to air, water and with products for the best performing mercury cell plants.

- **A plan for decommissioning, conversion or closure, and site remediation should be required from all MCCAP operators as soon as possible on the basis of the sunset date, or sanctions should apply.**

This will ensure that concrete measures for the reduction of emissions are taken and that the sunset date will be met.

- **Similar to the common practice in the US, continuous monitoring should be required for plants still using mercury. The number of measuring devices per plant and their location should be required and specified in the permit. The methodology for monitoring and calculating/estimating mercury emissions should be defined at EU level, included in the permit and it should be ensured that it is followed by all operating MCCAPs. All mercury consumption and releases should be independently verified.**

In this way accuracy and comparability of emissions will be ensured as far as possible and a 'level playing field' will be guaranteed for this sector as far as monitoring requirements are concerned.

- **Yearly reporting within no more than 6 months from the end of a calendar year, should be required from all operators, specifying their total mercury consumption and losses, including unaccounted-for mercury, similarly to the OSPAR reporting requirements for MCCAPs in the OSPAR region. These should be publicly available on the internet.**

Mercury losses from the chlor-alkali industry reported under OSPAR are not covering all EU Member States. It is not clear whether all the information including consumption and unaccounted-for mercury will actually be included in the European Pollutant Release and Transfer Register (E-PRTR),thresholds apply as to when mercury emissions have to be

reported by the operator, currently set at 10kg/year to air and 1kg/year to water and land per plant facility, and reporting period is longer.

- **All mercury wastes from the chlor-alkali industry should be retorted and the mercury recovered and stored according to Regulation EC/1102/2008.**

In this way the exact amount of mercury in wastes will be known, recovered and safely stored and, as a consequence, mercury will not re-enter the European environment.

- **Companies should be required to account for any difference to their mercury mass balance. Big differences from one year to the other should be fully explained.**

  An average of 41 tonnes of mercury per year is reported to be unaccounted for by the chlor-alkali industry. Authorities have not questioned this 'missing' mercury which is most probably ending up in the environment.

- **Operators should be obliged to prepare a yearly report on their compliance with their operating permit, and the authorities should make this report publicly available on internet.**

Law enforcement is absolutely critical to ensure that measures are indeed being taken to protect human health and the environment. Operators should report on the operating conditions of their plants – this should be their part in the agreement – since they are allowed to operate. Furthermore such information should be publicly available to allow the public to be informed and involved if needed, in view of safeguarding public health.

- **Ambient air and water in the vicinity of MCCAPs should be periodically measured by the authorities and results should be made publicly available on the internet.**

Snapshot measurements of air outside MCCAPs carried out by EEB member organisations, showed substantial mercury emissions during days when no exceptional mercury releases were reported from the relevant plants.

- **The public concerned should be given early notice of a site permit application in order to be able to participate effectively in the process, under the IPPC Directive.**

There have been frequent cases where consultations were no readily accessible. The permit application process should be more open and visible to allow for independent input, if necessary.

Annexes

ANNEX A: Mercury cell chlor-alkali plants in Europe (Jan. 2008)

Country	Company	Site	CL_2 Capacity (000 tonnes)	Raw material	CL_2 Capacity with Hg Update
BELGIUM	SolVin	Antwerp (Lillo)	330[73]	NaCl	
	Tessenderlo Chemie	Tessenderlo	250	KOH	
CZECH REPUBLIC	Spolana	Neratovice	135	NaCl	
	Spolchemie	Usti	61	NaCl	
FINLAND	Akzo Nobel	Oulu	43	NaCl	
France	Albemarle	Thann	72	KOH	
	Arkema	Jarrie	170	NaCl	
	Arkema	Lavera	166	NaCl	
	Prod. Chim. d'Harbonnières	Harbonnières	23	NaCl	
	Solvay	Tavaux	241	NaCl	
	Tessenderlo Chemie	Loos	18	NaCl	
GERMANY	BASF	Ludwigshafen	170	KOH	Hg also used to produce specialities (alcoholates, dithionite, caustic potash)
	Bayer	Uerdingen	130	NaCl	
	Vinnolit	Knapsack	160	NaCl	Reduction of 60.000 t Hg by end of 2008
	Akzo Nobel	Ibbenbüren	125	NaCl	
	Degussa	Lülsdorf	136	KOH	Hg only used to produce specialities (alcoholate)
	Ineos Chlor	Wilhelmshaven	149	NaCl	
	LII Europe	Frankfurt	167	NaCl	
	Vestolit	Marl	0 (176 in 2006)	NaCl	Fully converted to membrane in 2007 (= 0t Hg)
	Vinnolit	Gendorf	82	NaCl	
GREECE	Hellenic Petroleum	Thessaloniki	40	NaCl	
HUNGARY	BorsodChem	Kazincbarcika	137	NaCl	
ITALY	Altair Chimica	Volterra	27	NaCl	
	Solvay Ausimont	Bussi	87	NaCl	
	Caffarro	Toreviscosa	70,9	NaCl	
	Syndial	Porto Marghera	208	NaCl	
	Eredi Zarelli	*Picinisco*	*6*	NaCl	
	Solvay	Rosignano	125	NaCl	Fully converted to membrane in 2007

[73] Although one Solvay plant appears in this table, the capacity figure probably refers to the capacities of Solvin and Solvic plants

Country	Company	Site	CL_2 Capacity (000 tonnes)	Raw material	CL_2 Capacity with Hg Update
	Tessenderlo Chemie	Pieve Vergonte	42	NaCl	
POLAND	Rokita	Brzeg Dolny	125	NaCl	
	Tarnow	*Tarnow*	*43*	NaCl	
ROMANIA	S.C. Oltichim	Râmnicu Vâlcea	186	NaCl	
	Grupul Indus. de Petrochimie	Braila	5	NaCl	
SLOVAK REPUBLIC	Novacke Chemicke	Novaky	76	NaCl	
SPAIN	EIASA (Aragonesas)	Huelva	101	NaCl	
	EIASA (Aragonesas)	Sabinanigo	25	KOH	
	EIASA (Aragonesas)	Villaseca	135	NaCl	
	Elnosa	Lourizan	34	NaCl	
	Ercros	Flix	150	NaCl	
	Quimica del Cinca	Monzon	31	NaCl	
	SolVin	Martorell	218	NaCl	
	Solvay	Torrelavega	63	NaCl	
SWEDEN	Norsk Hydro	Stenungsund	120	NaCl	
UNITED KINGDOM	Ineos Chlor	Runcorn	738	MAIN: NaCl To produce NaOH +Cl2 MINOR: KCl to produce KOH + Cl2 KOH**	

Sources: Chlorine Industry Review 2007-2008, Euro Chlor, Brussels, 2008, modified on basis of OSPAR 2006 report and the responses to the EEB survey

*From the permit, currently NaCl used with mercury cells. KCl is used with membrane technology, capacity 30,000 t/yr of chlorine.

ANNEX B: EEB Questionnaire

Respondents please note:

1.The questionnaire only concerns issues related to the implementation of the IPPC Directive in the chlor-alkali industry.
2.Please provide your answers by ticking the boxes or by writing in the grey text boxes.
3.In the questionnaire you will see some questions indicated with @. You are welcome to send them to your local authorities and follow up on their answers.
4.For any questions, please contact Grazia at: grazia.cioci@eeb.org.

I. Information on the respondent

Name:

Organisation/Authority:

Address:

Direct telephone:	Fax:	Email:

II. Transposition to national legislation

1. What national law has the IPPC Directive been transposed into (name, date, link – reference in your national language and in EN)?

Please specify below
Name:
Date:
Link-reference in national language:
Link – reference in EN:

2. Please specify/clarify whether the authority for issuing permits rests at the national, regional or local (in case of Federal states).

Please specify in the grey box

3. Is the chlor-alkali industry covered by general binding rules (as per art. 9 para 8 of IPPC)?

Please specify
Yes ☐
No ☐
If yes provide website address

4. Are the requirements of Art 6 of the IPPC Directive[74] prescribing the procedure for permit applications fully transposed into your national law? Please indicate if any requirements are missing.

[74] For the full text of the IPPC Directive in all languages see: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31996L0061:EN:NOT

Please specify
Yes ☐
No ☐
Requirements missing- list
☐

5. Is the BREF on chlor-alkali (http://ec.europa.eu/environment/ippc/brefs/cak_bref_1201.pdf) available to the relevant local authority in your national language? When was it first available? (published at EU level in EN in December 2001) @

Please specify
☐ *Yes* *Date published* ☐
☐ *No*

6. Is there a national law/requirement that sets air and water emission limit values (ELV) for mercury emissions from MCCAPs? What are the ELV for each environmental medium? Is monitoring required by your national law; how often? Is there a maximum quantity of mercury emissions to air allowed per industry/plant per year or overall in your country? @

Please specify
National law/requirements setting air emission limit values
Yes ☐ *ELV* ☐
No ☐

National law/requirements setting water emission limit values
Yes ☐ *ELV* ☐
No ☐

Monitoring required
Yes ☐ *How often?* ☐
No ☐

Maximum quantity of mercury emissions to air per year

Per industry/plant *Yes* ☐ *Please specify* ☐
No ☐

Overall in your country *Yes* ☐ *Please specify* ☐
No ☐

7. Does your country have a national and/or regional ambient air quality standard for mercury?

Yes ☐ Please specify (provide standard) ☐

No ☐

8. Does your country have a national and/or regional water quality standard for mercury?

Yes ☐ Please specify (provide standard) ☐

No ☐

9. Does your country have a national and/or regional soil quality standard for mercury?

Yes ☐ Please specify (provide standard) ☐

No ☐

10. Is there a national law that sets an occupational exposure limit value for mercury in your country? Please provide the name of the law and respective figures.

Please provide details
Yes ☐ *No* ☐
Name ☐
Limit value ☐

11. In your national/regional legislation, are there guidelines (especially guidelines relevant to MCCAPs) for local authorities on how permits should be given? Please attach a copy or provide the link. @

Yes ☐ No ☐ in progress ☐

III. Information on Mercury-cell Chlor-alkali Plants

12. Please refer to Annex A, listing MCCAPs in Member States as published by Euro Chlor. Please confirm/update in the appropriate column the capacity figures for mercury-cell technology indicated in the Annex. *Note:* Please consider that a chlor-alkali plant may be using both mercury and non-mercury technology.

13. Please refer to Annex A. Has a conversion/closing down date been agreed for each of the mercury cell chlor-alkali plants (MCCAP)? Indicate whether these dates were set by the authorities in a permit, or whether they were agreed by industry in a voluntary agreement, or other. Please complete information in the table below for the annex A listed plants in your MS.

Name of MCCAP	*Converting to Membrane (specify date)*	*Closing down (specify date)*	*Dates set by Authority*	*Dates set by specific plant*	*Dates set by general industry Voluntary Agreement*	*Dates set in another way specify*	*Authority responsi-ble for providing permit*
Other national/regional horizontal requirements:							

IV. Permitting

14. Indicate when permits were issued for each plant. If permit update is in progress indicate by when they should be granted (in case of delays after the 30 October 2007 deadline set by the IPPC directive). @

Name of plant (country)	**Permit**		
	Yes (date)	*No*	*Update in progress (date)*

15. How often are they updated? Is the time period for updating set at national, regional level or per plant? @

Please specify

☐ How often
☐ Due period for updating
☐ National
☐ Regional
☐ Plant (deadline for permit updated included in permit)

16. Do permit applications for MCCAPs contain the following required information? @

Requirements included in Art. 6 (IPPC)	*Please make reference to every MCCA Plant in your country (Yes / no)*
Installation and its activities	
Sources of emissions from installation	
The nature and quantities of foreseeable emissions from the installation, for each medium	
Proposed technology and other techniques for preventing or reducing emissions and waste from the installation	
Hg emission monitoring measures/requirements (including for stack and fugitive emissions)	
Measurement methodology	
Measurement frequency	

17. Does the installation comply with the conditions of its permit? Have sanctions or other measures been applied in cases of non compliance with permit conditions? Please provide examples in the table below. @

Name of MCCA Plant	*Compliance with conditions of permit (Y/N)*	*Conditions of permit that installation does NOT comply with*	*Sanctions for non compliance*

V. Emissions

18. What are the mercury emissions in *kg Hg/year and g Hg/tn Cl_2 capacity* specified in the *last* and *present* permits *of each plant*? Please indicate the date of issue and expiration of previous and present permits.

Name of MCCA Plant ***CURRENT PERMIT***	*Date(duration) of Permit (e.g. 30 October 2007-30 October 2017)*	*Hg emission Limit Values fixed by permit (kg Hg/year)*					*Hg emission Limit Values fixed by permit (g Hg/tn Cl_2 capacity)*				
		Total	*air*	*water*	*waste*	*product*	*total*	*air*	*water*	*waste*	*product*

Name of MCCA Plant ***PREVIOUS PERMIT***	*Date(duration) of Permit (e.g. 30 October 1997-30 October 2007)*	*Hg emission Limit Values fixed by permit (kg Hg/year)*					*Hg emission Limit Values fixed by permit (g Hg/tn Cl_2 capacity)*				
		Total	*air*	*water*	*waste*	*product*	*total*	*air*	*water*	*waste*	*product*

19. What are the 2006 and 2007 mercury emissions to air, water, and waste for each MCCAP in your country?

Name of MCCA Plant *Year 2006*	*Hg emissions (kg Hg/year)*					*Hg emissions (g Hg/tn Cl_2 capacity)*				
	total	*air*	*water*	*waste*	*product*	*total*	*air*	*water*	*waste*	*product*

Name of MCCA Plant *Year 2007*	*Hg emissions (kg Hg/year)*	*Hg emissions (g Hg/tn Cl_2 capacity)*

	total	*air*	*water*	*waste*	*product*	*total*	*air*	*water*	*waste*	*product*

20. What protocol are MCCAPs using to estimate emissions? Do they use the Eurochlor guidelines to estimate their emissions? If possible, please provide an example of how they estimate mercury emissions. Try to be as precise as possible since there are various ways to interpret the Euro Chlor guidelines.

Please specify in the grey boxes

Protocol ☐

Eurochlor guidelines Yes ☐ *No* ☐

Please provide examples
☐

21. What is the procedure of MCCAPs submitting emission reports to the competent (national, regional, local) authorities and getting approval? Have the national (regional/local) authorities ever questioned, audited or checked the reported emissions? @

Please specify
Procedure:

Authorities questioned/audited reported emissions: Yes ☐ *No* ☐
National ☐ *Regional* ☐ *Local* ☐
Provide example
☐

22. It is known that many tonnes of mercury are unaccounted for every year[75]. What measures have been taken to explain and minimize the missing mercury? @

Please specify

VI. Monitoring

23. How frequently are mercury emissions to air measured by the operators (according to the permit)? Where precisely do the measurements take place in the plant (eg if measurements are taken in the cellrooms, where in the cellrooms, and with what equipment?). How many continuous monitoring devices are in the plant, and where are they located? Is the present measurement procedure different from the procedure in place before the IPPC permit? Please refer to each MCCA plant in the table below. @

Name of MCCA Plant	*Measurement frequency of Hg emissions*	*Number of measurement devices*	*Location where measurement is taken*	*Difference in measurement procedures*

[75] As also pointed out in the EEB report Risky Business, October 2006, http://www.zeromercury.org/EU_developments/061110RiskyBusinessFINAL.pdf

24. How often do authorities control or audit emissions in the MCCAPs? How often are inspections carried out? What is the methodology used by the authorities for taking measurements? @

Name of MCCA Plan (indicate in case it is for all plants)	*Name of Authority (indicate in case it is for all authorities)*	*Audit frequency of Hg emissions*	*Inspections frequency*	*Methodology for measurements*

25. What additional measures or emission limit values are foreseen in your country's permitting system to minimize mercury emissions from MCCA plants? Please specify whether those measures apply nationally or regionally and where. Please tick as appropriate. @

Measures	*Please tick in the appropriate box*	*Nationally/ Regionally/other*	*Plants where measure applies*
Training of personnel	☐		
Housekeeping of the cell room including daily cleaning of staff clothes	☐		
Continuous monitoring of mercury concentration in cell room	☐		
Removal of mercury spillage	☐		
Instructions for safe operation (e.g. permanent monitoring of installation, compliance with safety parameters, etc)	☐		
Planning for emergencies and recording of accidents	☐		
Additional emission limit values – (specify next to box if relevant)	☐		
Other (please specify)			

VII. Consultation and access to information

26. Are operators obliged to provide regular reports on installation performance and conformity with the IPPC Directive to the regulatory authorities? How frequently? @

Please specify
Yes ☐ *Reporting Frequency* ☐
No ☐

27. Are these reports made publicly available? How often are they published, and where? @

Please specify
Yes ☐ *Frequency of publishing reports* ☐
Published at (link, publication etc) ☐

No ☐

28. How is Article 15 and Annex V (consultation with the public) of the directive implemented in your country? Is information made available publicly when a plant is applying for a new permit? Where is this published? How much time is allocated for the public to respond?

Please specify:
National/regional way of implementation of Art. 15, annex V

Information publicly available when permit requested
Yes ☐ *Published at (link, publication, etc.)*
Duration of consultation period
No ☐

29. Who are the public authorities and stakeholders that are consulted during the permitting of chlor-alkali plants? Are these explicitly invited/informed when a consultation period starts, or do they have to be aware/seek whether it was announced? @

Authorities/Stakeholders	*Please tick the appropriate box*	*Explicitly Invited (Yes/No)*	*Stakeholders have to seek announcement (Yes/No)*
Local/municipal authorities	☐		
Intermediate authorities	☐		
Local population	☐		
Environmental NGOs	☐		
Technical agencies	☐		
Business organizations	☐		
Other (please specify)	☐		

30. Have you or your organization participated/been involved/been consulted in any permit application? Please provide details on what the industry asked for in terms of emission limit values and total emissions of mercury and conversion date. What were your comments and recommendations and what was the final decision of the authority? Were your comments taken into consideration?

Participation in permit application consultation
Yes ☐
No ☐

Please specify what industry asked for

Your comments/recommendations

Were your comments taken into account?
Yes ☐
No ☐

Final decision taken by the authority

31. In your opinion is the competent authority taking adequate/satisfactory measures to protect the environment following the law? Please explain.

Yes ☐
No ☐

Please specify how

32. In your experience, do you believe there are some requirements, in the IPPC Directive and/or in national implementing laws and regulations, necessary but missing altogether?

If yes, please specify - your comments will be useful for future amendments to the laws and regulations in force.

Optional Questions

33. How many old (closed) chlor-alkali plants are in your country? Where are they located? Are mercury emissions monitored after closure? Have cleaning up operations taken place? Please indicate how much land is still contaminated, if there is any estimate of the amount of mercury content and whether there are plans for cleaning up or other treatment operations.

Name of old chlor-alkali plant	*Location*	*Hg Monitoring (Y/N)*	*Cleaning up operations (Y/N)*	*Contaminated land (estimated figure)*	*Future plans for cleaning up or other treatments (if yes, provide examples)*

34. Are you aware whether the MCCAPs in your country have studied the economic details of conversion? Are you aware of national or local authorities or structural funds (EU) that would provide financial assistance to help with conversion?

Please specify

Thank you very much for your time and input!

ANNEX C: Location of surveyed Chlor-alkali Plants in the EU using the mercury-cell process

Source: Euro Chlor Industry Review 2006-7 (2007), as published in "Options for reducing mercury use in products and applications, and the fate of mercury already circulating in society", September 2008.

Number and Country of Reference	Name of Plant	Location
Belgium		
3	Solvic	Lillo (Antwerp)
3	Solvin	Zandvliet (Antwerp)
5	Tessenderlo	Limburg
Czech Republic		
6	Spolana	Neratovice
7	Spolchemie	Ústí nad Labem
France		
10	ALBEMARLE PPC, Thann	Haut-Rhin
13	Arkema Jarrie	Isère
14	Arkema Lavera	Bouches du Rhône
17	Société des Produits Chimiques d'Harbonnières (SPCH)	Somme
18	Solvay Tavaux	Jura
19	Produits chimiques de Loos, Loos	Nord Pas de Calais
Germany		
20	BASF	Ludwigshafen
23	Bayer	Krefeld-Uerdingen
26	Vinnolit	Knapsack
29	Akzo Nobel	Ibbenbüren
31	Degussa	Niederkassel-Lülsdorf
32	INEOS	Wilhelmshaven
33	LII Europe	Frankfurt am Main
36	Vinnolit	Gendorf
Italy		
41	Solvay Chimica Italia SPA	Rosignano (Li)
42	Solvay Chimica Bussi SPA	Bussi (Pe)
43	Caffaro Chimica Srl	Torviscosa (Ud)
44	Syndial SPA	Assemini (Ca)
45	Syndial SPA	Porto Marghera (Ve)
47	Syndial SPA	Priolo (Sr)
49	Altair Chimica SPA.	Saline di Volterra (Pi)
50	Tessenderlo Italia SRL	Pieve Vergonte (Piemonte)
Spain		
64	ERCROS	Aragonesas (Huelva)
65	ERCROS	Sabinanigo
66	Ercros	Vilaseca a)
68	Elnosa	Lourizan (Pantevedra)
69	ERCROS	Flix (Tarragon
70	Quimica del Cinca	Monzon (Huesca)
71	Solvin-Hispavic iberica	Martorell (Barcellona)
72	Solvay	Torrelavega (Cantabria)
Greece		
38	Hellenic Petroleum	Thessaloniki
United Kingdom		
82	Ineos Chlor	Runcorn

ANNEX D: Contacts of Participating Organisations to EEB Survey

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ANNEX E: Survey Indicators

I. Emission Limit Values and quality standards

Country	*ELV for air*	*ELV for water*	*Ambient Air Quality Standard*	*Water Quality Standard*	*Soil Quality Standard*	*Occupational ELV law*
	☺ = yes ELV≤ 0.5 g Hg/tonne chlorine capacity 😐 = yes ELV 0.5 g Hg/t and ≤ 1 g Hg/t ☹ = no or ELV 1 g Hg/t	☺ = yes ELV≤ 0.5 g Hg/tonne chlorine capacity 😐 = yes ELV 0.5 g Hg/t and ≤ 1 g Hg/t ☹ = no or ELV 1 g Hg/t	☺ = yes ☹ = no	☺ = yes ☹ = no	☺ = yes ☹ = no	☺ = yes ☹ = no
BELGIUM	☺	N/A	☺	☺	☺	☹
CZECH REPUBLIC	☹ for old installations ☺ for new installations	N/A	☹	☺	☺	☺
FRANCE	☹	☺	☺	N/A	N/A	☹
GREECE	☹	N/A	☹	☹	☹	☹
GERMANY	😐	☹	☹	☺	☺	☹
ITALY	☹	😐/☹	☺	☺	☺	☺
SPAIN	☹	☹	☹	☹	☹	☺
UNITED KINGDOM	☹	☹	☺	☺	☹	☹

2. Consultation and access to information in the permit application process

Country	*Consultation*	*NGO involvement*	*Access to information*
	☺ = all stakeholders consulted 😐 = only a few stakeholders consulted ☹ = no stakeholders consulted	☺ = NGOs have been involved in latest permits' consultation and comments taken into consideration 😐 = NGO have been involved in permits' consultation but comments not taken into consideration ☹ = NGOs have not been involved in latest permits' consultation	☺ = information published on official journals and available on the internet ☹ = information not published and not available on the web
BELGIUM	☺	☺	☺
CZ REP.	☺	☺	☺
FRANCE	☺ for new permits ☹ for revision of permits	☹	☺
GREECE	N/A	N/A	N/A
GERMANY	😐	☹	☺
ITALY	N/A	N/A	N/A
SPAIN	☺	😐	☺
UK	☺	☹	☺

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