Chlorine Industry Review 2004-2005

Ensuring a sustainable future by building trust and confidence

Please accept this review of the chlor-alkali industry and 2006 desk diary with the compliments of Euro Chlor and its member companies

Euro Chlor
representing the chlor-alkali industry

Contents

Cover picture: A brittle, but beautiful icicle. Two percent of the earth's water is frozen. Only 1% is available to keep us alive, yet most is undrinkable without treatment. Chlorine-based water disinfectants help make our water safe – right up to the tap.

The cover of this diary is made from board coated with PVC – just one of thousands of consumer and industrial applications for this plastic. The largest single use of chlorine in Europe is the manufacture of PVC, also known as vinyl.

Introduction

An evolving role

It is almost 50 years since Euro Chlor was originally formed as a collaborative venture by chlor-alkali manufacturers to develop health and safety standards for production, storage and distribution. Today, we have an impressive library of technical recommendations and best practice guidelines. Mme Emmanuelle Fauchart of the prestigious Conservatoire National des Arts et Métiers in Paris believes that "...the [European] chlorine industry emerged... as a model for the other sectors in terms of knowledge sharing on safety." Safety alone, however, is no longer sufficient to retain a "licence to operate".

Increased prosperity and quality of life has led Western society to become more concerned with environmental issues, particularly those related to the use of and exposure to chemicals. Euro Chlor has responded to this challenge by developing broader skills in science, advocacy and communications.

We endeavour to foster productive working relationships with legislators, regulators, scientists and other opinion formers by becoming the most reliable and authoritative information source about our industry and its products. We listen and try to anticipate public concerns; our philosophy is to be part of the process by offering expertise and solutions, such as voluntary agreements and partnerships, to achieve effective and fair legislation.

Have we been successful? Justin Greenwood, Professor of European Public Policy at Robert Gordon University, Aberdeen, benchmarked a number of European organisations and concluded that Euro Chlor was possibly the most effective industry association. He identified nine factors within the control of an association that determine their effectiveness. Prominent amongst these is trust – between members themselves, with their association and the latter with external contacts.

Professor Greenwood also cited the provision of reliable information used in forming regulations and voluntary agreements or codes of practice. He valued highly the autonomy of a Secretariat to respond rapidly and take decisions on behalf of members. For all of these he awarded top marks to Euro Chlor.

However, to remain a leader we must continuously strive to do better. That is why we have put considerable effort into establishing industry-wide sustainability targets. The environmental provisions of the various European treaties are unique. In no other jurisdiction is so much prominence attached to environmental matters. It is clearly an area in which Europe leads – and wishes to be seen to lead – the community of nations.

Together with the EU's comparative prosperity and history of social justice, all three elements of sustainable development are present: economic security, social well-being and environmental conservation. It is not surprising, therefore, that European governments continually stress the importance of sustainability.

The effective associations of the future will be those that understand the directions of European society and policy and can contribute to international fora where the EU is trying to influence the world. I am sure that Euro Chlor will be one of those and will continue to make an impact.

Dr Barrie S Gilliatt
Executive Director

Editor's Footnote: Dr Gilliatt, who joined Euro Chlor as Executive Director in 1996, will retire May 2006.

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Sustainability

Targets achievable – with effort

Euro Chlor sustainability efforts continued in 2004 with addition of a new environmental accreditation commitment to 14 previously endorsed by European chlor-alkali producers. With experience gained during the past four years, Euro Chlor believes the targets set are achievable. Only by periodically communicating our industry's views, challenges, commitments and progress on sustainability can we build trust and confidence. This section reviews the industry's progress towards its performance improvement goals for 2010.

Programme evolved from earlier experiences

The seeds of Euro Chlor's sustainability strategy emerged in 1995 when the industry undertook four voluntary initiatives: to complete a programme of marine risk assessments for chlorinated substances; reduce mercury emissions 60%; develop recycling technologies for PVC and improve technology transfer to Eastern European producers.

From experience gained during the following five years, Euro Chlor evolved a more formal initiative in 2001 to improve performance by addressing the "triple bottom line" of environmental, social and economic issues. Member companies agreed an industry-wide sustainability strategy which focuses on six voluntary commitments. It required members to:

- Include environmental, social and economic aspects in all strategic business decisions
- Optimise energy efficiency in production
- Reduce water usage through recycling
- Continuously reduce polluting emissions to water, air and land
- Use more of the hydrogen generated by the industry as a raw material or fuel
- Give high priority to the safe transportation of chlorine.

Goals Set

Based on these commitments, 14 indicators were developed and agreed with producers to quantify and set performance improvement goals. Last year a 15th indicator was added: all chlorine-producing members in the EU-25 countries, Norway and Switzerland must gain EMAS and/or ISO 14001 Environmental Accreditation for their plants. Currently, 59 of the 74 plants operated by Euro Chlor members are accredited to one or other standard.

The industry's long-term programme is in the vanguard of efforts by the European chemical industry to embrace sustainable development.

Commented Euro Chlor chairman Udo Bergmann (BASF): "Ten years ago when our industry took its first tentative steps towards a sustainable future, most people considered the words *sustainable development* as synonymous with *the environment*. For this reason, we welcome the Commission's 2005 revision of guidelines for making impact assessments on policy proposals to ensure they identify not only the environmental, but also economic and social consequences of proposed changes."

On the following pages readers will find charts tracking progress.

EMAS stands for Eco-Management & Audit Scheme, a voluntary EU initiative designed to improve companies' environmental performance. The goal is to recognise those organisations that go beyond minimum legal compliance and continuously achieve improvements. ISO (International Organisation for Standardisation) 14000 family of standards is primarily concerned with environmental management and complements EMAS.

Economic contribution

Energy usage

Target: An improvement in energy consumption by 2010 of 5.0% in terms of kWh per tonne of chlorine produced. The main driver is energy savings derived from conversion of mercury cells to more efficient membrane technology. A slightly earlier rate of conversion than originally anticipated – coupled with some technological advances – has already resulted in good progress.

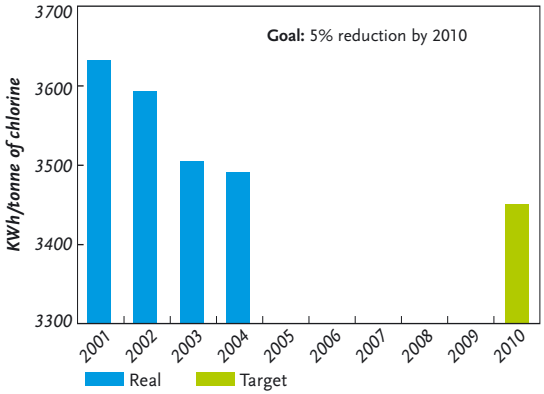
Update: Energy usage improved from 3,505 kWh/tonne of chlorine in 2003 to 3,491 kWh/t/chlorine in 2004. Most of this gain stemmed from producers phasing out mercury-based cells for more energy-efficient production using the membrane process. Since the programme started, a 3.3% reduction has been achieved against a target of 5.0% for 2010. Accordingly, Euro Chlor intends to re-examine the original goal in light of the progress that has already been achieved.

Hydrogen usage

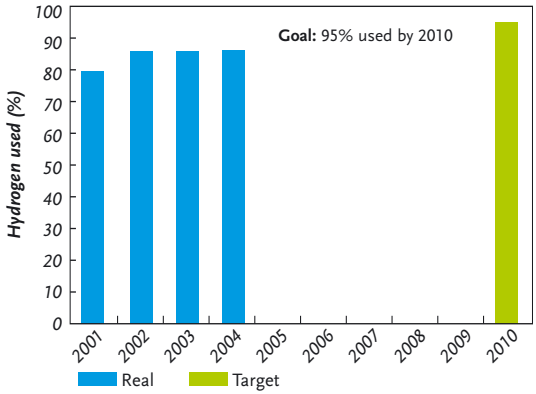
Target: Increase recycling and use of the hydrogen co-produced with chorine and caustic soda from 80% (2001) to 95% by 2010. Hydrogen produced during the electrolysis process is of high quality and can be used as a chemical raw material or fuel.

Update: In 2004, there was a slight improvement. The industry recycled 85.9% of this gas during 2003 and in 2004 this was practically unchanged at 86.3%.

Energy consumption



Hydrogen utilisation



Safety & social progress

Lost-time injuries

Target: A lost-time injury (LTI) rate of 1.3 per million working hours for both employees and contractors working on company sites. This means an 85% reduction for employees and a 90% reduction for contractors against the base year 2001. LTI is measured as being at least one day off work.

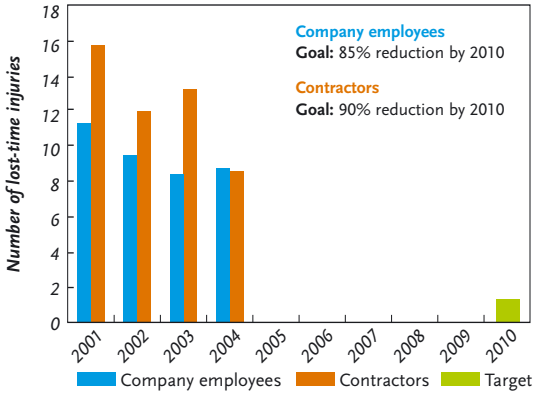
Update: At the outset of the programme, there was concern that the lost-time injuries rate for contractors was considerably higher than for company employees. This was unacceptable and a target was set to eliminate the difference and achieve further reductions. The difference has now been eliminated. Figures for 2004 show an injuries rate (per million working hours) of 8.58 for contractors and 8.78 for employees.

Process incidents

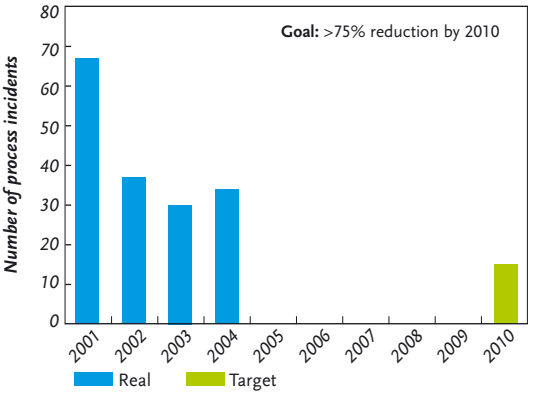
Target: A 75% reduction in process incidents from 67 in 2001 to 15 in 2010. Incidents are classed as events involving a fire, explosion or release of certain chemicals which cause a fatality, serious injury or €100,000 + property damage. Losses include chemical spills that impact health or environment and cause disruption to the plant or neighbouring community.

Update: There was a small blip last year in the decline in the number of process incidents reported – three more than the previous year. However, compared with the base year, a 50% reduction has been

Lost-time injuries (per million working hours)



Process incidents and losses



Emissions of COCs down by a third since 2001

achieved and the sector is still on track to achieve a 75% reduction by 2010.

Environmental protection

COC emissions

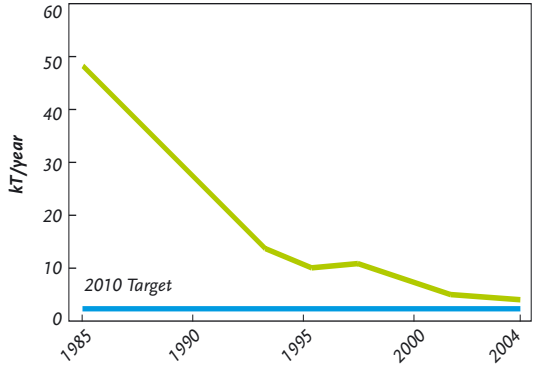
Targets: Set for 22 chlorinated organic compounds (COCs) with the objective of reducing emissions by 75% to water and by 50% to air against the 2001 base year. The COCs were selected from various international regulatory priority lists for emissions reductions.

Euro Chlor data shown here spans the period 1985-2004 and, therefore, demonstrates the sector's commitment to achieve significant reductions over time.

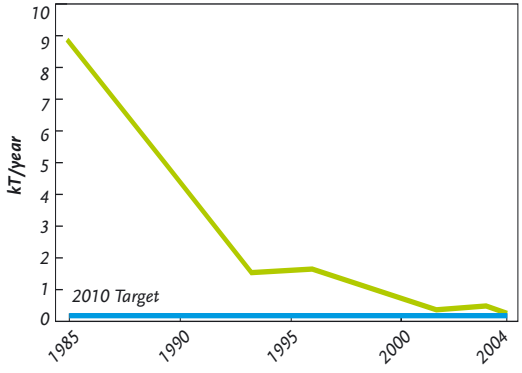
Targets cover the following 22 substances: 1,1,1-trichloroethane; 1,1,2-trichloroethane; 1,2-dichlorobenzene; 1,2-dichloroethane; 1,4-dichlorobenzene; 2-chlorophenol; 3-chlorophenol; 4-chlorophenol; carbon tetrachloride; chlorine; chlorobenzene; chloroform; dichloromethane; dioxins & furans (as TEQ); hexachlorobenzene; hexachlorobutadiene; hexachlorocyclohexane; pentachlorophenol; tetrachloroethylene; trichlorobenzene; trichloroethylene and vinyl chloride.

Update: For losses of chlorinated organic chemicals (COCs) to the environment from manufacturing operations, the industry has since 2001 achieved a 31% reduction for emissions to air and a 36% reduction to water.

Emissions to air (kT/year)



Emissions to water (kT/year)



Responsible Care

Target: For the chemical industry's voluntary *Responsible Care* stewardship programme, the 2010 goal is for all Euro Chlor members to become participants.

Update: At end 2004, the number of members participating in the *Responsible Care* initiative was unchanged at 35 out of 41 companies.

Mercury emissions

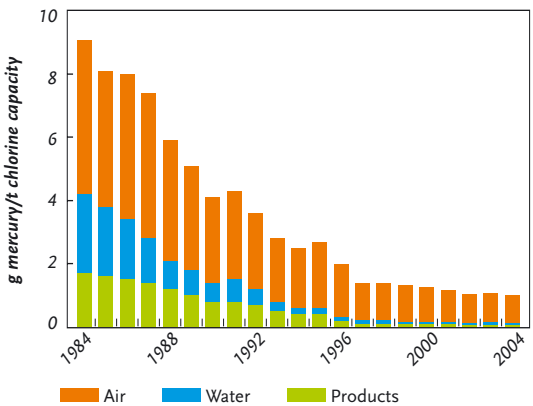
The formal target has been set for 2007 rather than 2010. The targets for emissions of mercury from Western European electrolysis cells was set in 1998 before the sustainability programme was inaugurated.

Euro Chlor has actually monitored emissions since 1977 in order to provide members with an annual benchmark against which to evaluate and improve the performances of their individual plants.

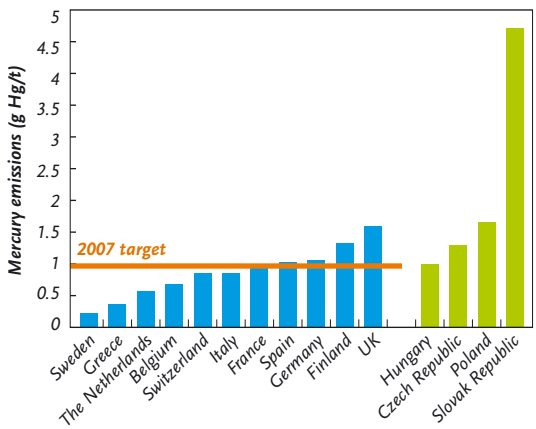
The 1998 commitment required the industry to achieve a voluntary emissions target of 1g/t/chlorine capacity on a national basis by 2007 with no individual plant exceeding 1.5 g/t capacity.

(Six East European companies have joined Euro Chlor since the mercury target was set. The 2004 performance of each country is shown on the right of the graph below for completeness.)

Western European mercury emissions



Compliance with commitments 2004



Industry on track to achieve 2007 mercury emissions target

Update: In 2004, Western European emissions from members' plants were reduced overall by 6% compared with 2003. In Eastern Europe, the comparable reduction was 8.8%. Average emissions for all mercury cell plants across Europe declined from 1.06 g Hg/t chlorine capacity to 1.01 g Hg/t chlorine capacity. Overall, mercury cells in Europe emitted 5.43 tonnes against 5.76 tonnes the previous year. Since 2001, a 27% reduction has been achieved.

Transportation

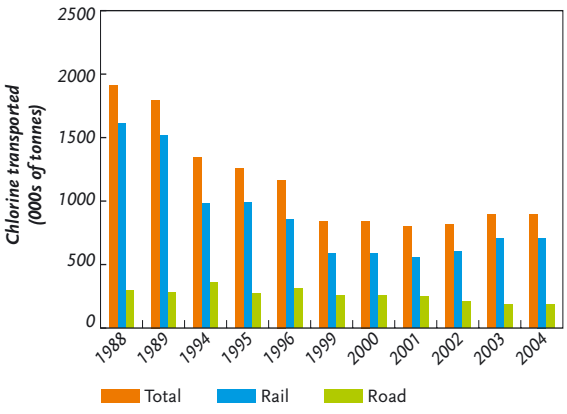
Target: Zero transport incidents involving bulk transportation of chlorine by 2010.

Update: There were no incidents in 2004. European producers transported 925,000 tonnes (2003: 927,000 tonnes) of chlorine in 2004. Of the total, 77% was shipped to customers by rail and 23% by road. The amount transported represented about 9% of 2004 production, which reached a record high of 9,856,302 tonnes. The average distance for rail transport of chlorine was 369 km while for road it was 182 km.

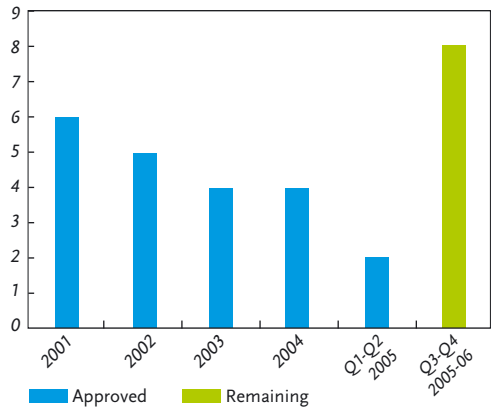
Product knowledge

There is no specific target for 2010 since the sector had already committed in 1999 to an earlier chemical industry deadline to provide full ecotoxicological and environmental data on 29 of 80 chlorine-related High Production Volume (HPV) chemicals identified

Transportation of chlorine



Assessed chlorinated chemicals



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under a voluntary chemical industry programme managed by the ICCA and OECD. The HPV programme aims to provide harmonised, internationally-agreed data and initial assessment reports for about 1,000 widely-used chemicals.

Update: During 2004 and the first half of 2005, member companies completed HPV assessment data on six chlorinated chemicals, bringing the total number submitted by Euro Chlor under the programme to 21.

Euro Chlor had aimed to submit all chemical assessments by end 2004. This was not achieved, primarily because of two factors: a lack of human resources within the industry and what proved to be a substantially heavier-than-expected workload to be accomplished in the projected timeframe. The federation is endeavouring to assist members to help complete the sector's contribution to this programme.

Vinyl 2010: Delivering results against clear targets

Vinyl 2010 is putting into action the European PVC industry's Voluntary Commitment, which is a 10-year plan to achieve sustainability throughout the lifecycle of this plastic. It delivers against clear targets, especially on the use of lead-based stabilisers and on post-consumer recycling. Progress is reviewed by independent auditors and a monitoring committee, including representatives of the European Commission and Parliament.

Some 2004 highlights include:

- Achievement one year ahead of schedule of the target to reduce consumption of lead stabilisers by 15%
- Near completion of a new 50,000 tonnes-a-year feedstock recycling plant in Stigsnaes, Denmark
- Completion of a feasibility study concluding that PVC waste from buildings may be used to produce light concrete for certain building applications.

While progress has been steady, *Vinyl 2010* also saw a paradoxical challenge on PVC waste management. Recycling technology is now in place thanks to research, careful planning and heavy investment. However, the challenge is waste availability because of collection costs, increasing re-use of old products such as window-frames, and demand for waste from Asia. To encourage a steady supply of PVC waste for recycling, *Vinyl 2010* launched two new pan-European collection projects in 2004:

- *Roofcollect*, a collection and recycling initiative for end-of-life roofing membranes
- *Recovinyl*, a scheme to provide financial incentives to support the collection of end-of-life PVC products such as pipes, window profiles and shutters.

For more information visit:
www.vinyl2010.org

Legislative developments

Credible advocacy key to influence

Euro Chlor is actively following regulatory developments in the EU institutions, marine conventions and international fora, which could have an impact on the European chlor-alkali industry. Accordingly, a key element of Euro Chlor's strategy is to maintain and strengthen its role as a credible source of timely and reliable economic, technical and scientific data about the sector. Advocacy and supportive communications efforts have focused on topics such as the EU mercury strategy, water and energy policies as well as regulation of chemicals.

EU mercury strategy

Three years after the EU institutions first initiated steps to develop a pan-European strategy on mercury with emphasis on the fate of the metal from decommissioned chlor-alkali cells, environment ministers endorsed in June 2005 the EU Commission's proposal (adopted by the Commission in January 2005) to restrict the use of mercury and to ban exports to other parts of the world by 2011.

From an industry viewpoint, the Commission's proposal was balanced with the exception of the proposed export ban on mercury from the EU by 2011. Euro Chlor does not believe a unilateral EU export ban will solve the global mercury pollution problem. This concern has been recognised by the Council of Ministers, which has called for additional international efforts to reduce mercury emissions.

Euro Chlor fully recognises the importance of reducing levels of mercury in the environment and has provided the authorities with industry perspectives and data during development of the strategy. Euro Chlor's voluntary commitment to phase out chlor-alkali mercury cells by 2020 appears to be well accepted by most parties; there is an overall satisfaction with the emission control management by the industry; the proposed deep bedrock storage for mercury is excluded and the industry's underground storage solution is now supported.

Storage terms

The exact details of this still need to be defined and Euro Chlor has responded positively to a request by the Commission to work together on an industry voluntary agreement.

The global chlor-alkali industry is likely to be involved in one of the first UNEP "partnerships" with national governments, industry, international organisations and environmental NGOs to reduce mercury pollution.

Euro Chlor, under the umbrella of the World Chlorine Council (WCC), participated in the UNEP Governing Council meeting in Nairobi (February 2005), when more than 100 environmental ministers agreed to develop these "partnerships". Also under the WCC umbrella, Euro Chlor is contributing to an evaluation of emission limit values for existing mercury-based chlorine plants under the UN Economic Commission for Europe (UN-ECE) Heavy Metals Protocol.

Water policy

Euro Chlor continues to give high priority to the EU Commission's proposed Directive on Environmental Quality Standards & Pollution Control in the field of Water Policy. The Directive is one of five daughter directives of the Water Framework Directive (WFD) adopted in 2000, which aims to achieve a high level of water quality throughout the EU.

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The new daughter directive will set environmental quality standards for 33 priority substances, of which 11 are so-called priority hazardous substances (PHS). Collaborative advocacy efforts have been made with other industry bodies (Cefic, Concawe and the European Crop Protection Association) to ensure industry's views and concerns are considered.

Key concern

A key industry concern is that the directive proposes that releases and losses of PHS should cease within 20 years after adoption of the directive. This would apply to mercury and chlorinated chemicals such as hexachlorobenzene, hexachlorobutadiene and short chain chlorinated paraffins. The cessation requirement embedded in the WFD was requested by the European Parliament, and Euro Chlor is now strongly advocating that exemptions from this requirement should be included in the new directive.

Full cessation of unwanted by-products such as hexachlorobenzene and hexachlorobutadiene cannot be achieved and a study concerning potential impact commissioned by Euro Chlor from consultants BiPRO GmbH of Munich has confirmed that the proposal could lead to plant closures, the loss of more than 100,000 jobs and €12,000 million in business.

For this reason the industry strongly advocates the possibility of derogations and inclusion in the directive of the concept of a remaining "negligible load." This implies that by the application of best available techniques the emissions are at such low levels that they do not harm human health or the eco-system.

Optimum approach

According to Euro Chlor, this would provide the optimum approach to achieving a sustainable solution that takes into account economic, social and environmental considerations.

Electricity is a raw material which typically represents some 60% of chlor-alkali production costs. Producers face an increase in energy costs resulting from several factors including CO_2 trading under the EU Emissions Trading Scheme. The EU energy market is not yet fully liberalised and a competitive market is not yet truly functioning. Consequently, electricity producers can transfer some opportunity costs from emission trading to consumers by significantly increasing prices. This has become known as the "windfall profits" issue. It is believed that this will provide power generators with an unjustified profit, costing chlor-alkali producers alone an additional €250 million per year.

An alliance of seven energy-intensive industries, including the chlor-alkali sector, was formed in 2004 to draw attention to the problem, which has been recognised by the Commission, national governments and many energy experts, although no solution has been proposed.

Reliable, affordable energy needed to maintain longer-term competitiveness

Euro Chlor supports Cefic's energy strategy for the European chemical industry, which wants reliable and affordable energy that will maintain a competitive industry in Europe over the longer term.

The Commission - together with national regulators - must monitor and address this issue in a harmonised manner.

Industry committed

Euro Chlor continues to be closely involved in the implementation of the Stockholm Convention on Persistent Organic Pollutants (POPs), a global treaty focused on controlling 12 persistent, bioaccumulative and toxic chemicals that are subject to long-range transport in the environment.

The Conference of the Parties in May 2005 constituted the first gathering of governments that have ratified or signed the convention.

The international chemical industry welcomed the outcome and confirmed its commitment to support the implementation of the convention.

At this meeting the Guidelines on Best Available Techniques & Best Environmental Practices (BAT/BEP) for reducing emissions of by-product POPs was supported and governments encouraged to use it. The conference also provided support to Guidelines for the Environmentally Sound Management of POP wastes.

Euro Chlor, through WCC, has actively contributed to the development of these guidelines which should help resolve unjustified accusations that have been levelled during the past 10 years or so against the chlorine and PVC industries regarding by-product releases of dioxins and furans.

The global chlor-alkali industry will continue to actively contribute to the successful implementation of the Stockholm Convention by providing expertise, raising awareness and conducting stewardship seminars in countries where there is a significant chlorine or PVC industry.

At the EU level, Member States seek to add new POPs to both the Stockholm Convention and the UN-ECE POPs Protocol. Because some chlorinated chemicals could be potential future POPs candidates, Euro Chlor is closely monitoring developments, particularly related to the application of the guidelines to be followed when examining the POPs characteristics of chemical substances.

Separately under Annex IV of the EU POPs Regulation (April 2004), the EU Commission aims to establish concentration limits for POPs in waste by end 2005. Euro Chlor has contributed to these efforts.

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Legislative developments

EU chemicals policy

The development of the EU REACH chemicals policy is actively handled by Cefic, and Euro Chlor is participating in the process. The issues of particular interest to the chlor-alkali industry are authorisation and substitution that might affect chlorinated chemicals that are commercialised.

Proposals mid-2005 from both the Council and Parliament called for tougher conditions than were envisaged in the original Commission proposal.

Chlorinated solvents

As an extension to Euro Chlor's sustainability programme, the eight members producing chlorinated solvents are developing specific commitments. These focus on such aspects as recycling, customer education, improving scientific understanding and reducing emissions to water, air and land. In line with the sector's commitment to openness and transparency, these will be published late 2005.

Responsible Care practices of TRI and PER producers and distributors have enhanced prospects for a positive outcome to current discussions with the UK rapporteur for risk assessments on both solvents. Producers are now collaborating on risk reduction strategies to address the outcome of the assessments to be published before end 2005.

A special section on chlorinated solvents has been developed and incorporated in the ESAD II voluntary health, safety and environmental assessment scheme for distributors. The scheme is part of the Cefic Safety & Quality Assessment System and requires a tri-annual independent compliance assessment.

The EU Commission plans a forum before end 2005 with representatives of industry and professional users to discuss the risks vs. benefits of paint strippers using methylene chloride or possible substitutes.

The decision follows endorsement by an EU scientific committee of a study recommending restrictions on methylene chloride, but without considering the risks of alternatives.

Chlorinated paraffins

Euro Chlor continued throughout 2005 to make representations to the EU authorities regarding a draft risk assessment proposal to label medium-chain chlorinated paraffins (MCCPs) with the risk phrase R64 ("May cause harm to breast-fed babies"). Producers feel this is unjustified since the criteria for an R64 label relates to use of the product under normal handling and use.

Information & education

Information + Communication = Reputation

Euro Chlor remains committed to further increasing access to information related to the chlor-alkali industry. Throughout 2004-05 the federation has both organised and participated in various public fora and distributed or made available on the Internet a wide range of information and data. This included topics such as sustainability, toxicological and environmental effects of chlorinated chemicals, disinfection, chlorine production, health, safety and environmental performance.

Website upgrade

In recent years the Internet has emerged as a major information resource. Euro Chlor launched the first *Chlorine Online* website in 1995 and updated it three years later. In 2004, it was decided to redesign and upgrade to enhance navigation and usability. The new website (at www.eurochlor.org) will be fully operational in the last quarter 2005.

During 2004, the number of visits to *Chlorine Online* rose 13% to a record 177,500 (2003: 154,400). The website also generated 243 enquiries about chlorine chemistry from around the world, a 5% increase over 2003.

Euro Chlor continued to promote sound chlorine science by participating in scientific meetings, visiting universities and publishing various studies, reports and information. For example, the federation had a stand with posters and literature explaining chlorine science issues at the 15th Society of Environmental Toxicology and Chemistry (SETAC) meeting in Lille, France (May 2005).

A special Chlorine Science newsletter was produced and distributed to 1,500 participants.

Modelling of organochlorine emissions and whole effluent assessment were two of the topics discussed by Euro Chlor science managers on visits to talk with postgraduates and lecturers at Zurich Technical University and Radboud University, Nijmegen, The Netherlands.

Also for the scientific community, Euro Chlor published four in-depth science dossiers during 2004. These examined the sources, environmental fate and risk characterisation of hexachlorobutadiene; natural organohalogens; soil chemistry and biodegradability of chlorinated aliphatic compounds.

For non-scientists, three information sheets were published – two on aspects of effluent testing and the third on bioaccumulation.
Euro Chlor also jointly provided with Cefic and PlasticsEurope a grant for 2004-05 to support growth of an increasingly well-regarded multilingual website www.GreenFacts.org. This is dedicated to providing unbiased scientific summaries on environment and health matters.

Helping tsunami survivors avoid disease and death

Within 48 hours of the devastating earthquake and tsunami in South Asia and East Africa, Euro Chlor launched an appeal. Member companies were asked for donations to help provide survivors with safe drinking water and avoid diseases such as typhoid and cholera.

The parent companies of most major members made substantial corporate donations on behalf of all their businesses to national relief efforts. A number of others elected to support the Euro Chlor appeal, which raised more than €50,000 for the worldwide chlorine industry's Water Relief Network. This is an established collaborative initiative with the Red Cross. Water and sanitation support was provided in Indonesia, Sri Lanka, the Maldives and Thailand.

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Sound science underpins industry advocacy

Science plays an important role in maintaining Euro Chlor's credibility and its efforts to listen and respond to society's concerns about the sustainability of chlorine chemistry. Without sound scientific arguments, Euro Chlor would face an even tougher challenge representing the industry. The media, non-governmental organisations and particularly legislators need reliable information when they try to balance conflicting views and evidence regarding environmental, health or safety concerns related to chlorine and its derivatives.

Workplace exposure

Since 1991, Euro Chlor has been collecting data on mercury levels in workers' urine from member companies operating mercury-based chlorine plants. This shows that exposure levels have not been decreasing at the same rate as the mercury emissions, also reported regularly. In order to make further progress on this aspect of occupational health, Euro Chlor has decided to focus support primarily on those plants with potential for the greatest improvement.

New tools

Euro Chlor has developed two new tools to help members: The first is a self-assessment audit questionnaire, which was sent to all operators of mercury-based plants mid-2005. The questionnaire will help members gain a clearer picture of their current level of compliance with Euro Chlor recommendations on best practices to limit mercury exposure in the workplace. A section of the questionnaire deals also with chlorine and observance of best practices.

A second tool aims to improve worker awareness of safe handling practices with mercury. A poster on *Housekeeping Do's and Don'ts* has been produced and translated into 12 languages for members to use and enhance worker awareness of safe handling practices in mercury cell rooms.

Biomonitoring

Environmental groups such as the World Wildlife Fund (WWF) have used biomonitoring techniques as part of a campaign to heighten awareness of the presence of chemicals in our bodies and justify demands for tighter regulations.

Not surprisingly, experiments conducted by WWF have revealed the presence of numerous chemicals, including some chlorinated compounds, in blood samples from different countries. Euro Chlor shares views expressed by Cefic and other international chemical organisations that the presence of trace amounts – particularly chemicals no longer manufactured – should not be used as a pretext for demanding tougher-than-necessary controls.

Chlorinated solvents and mercury (used in the electrolysis process that represents 50% of European capacity for chlorine) are examples of substances against which the European Parliament has called for preventive measures to reduce human exposure.

Euro Chlor is supportive of efforts under the EU Commission's Environment & Health Action Plan to measure the exposure to chemicals of humans, particularly children. However, the federation believes particular care needs to be exercised in interpreting the results since on their own the measurements do not provide sufficient information to fully assess risk. What is relevant is whether the exposure levels are such that they may affect human health.

Risk assessments

Work continued throughout 2004-05 to complete risk assessments for sodium hypochlorite, chlorine and caustic soda under the Existing Substances Regulation (ESR). The goal of the Regulation is to identify potential direct risks from chemicals to human health and the environment from production and use. It provides for data gathering; technical assessment of the risks; and the development of proposals for risk reduction measures where appropriate. Following in-depth discussions with the European Chemicals Bureau (ECB), Euro Chlor expects that any gaps in the assessments, which have been under preparation for 10 years, will be completed by end 2005.

Biocides registration

Euro Chlor established a project end 2004 to prepare dossiers for 2007-08 registration of chlorine, sodium hypochlorite and calcium hypochlorite under the 1998 EU Biocidal Products Directive. Completing the dossiers and authorisation procedures to permit continued marketing of the three chemicals as existing biocidal active substances will cost the industry about €900,000. Full risk assessments and efficacy data will be required for each type of application. Italy has been appointed as the Rapporteur Member State for all three chemicals.

"No problem"

The BOVOC study designed to assess whether the Dutch chlorine chain emits chlorinated organic micro-contaminants which are PBTs was submitted to the Dutch Parliament January 2005. Although unexpectedly finding minute quantities of dioxins in chloroprene rubber and chlorinated alkylbenzenes in monochloroacetic acid, the study concluded that "there was no general 'chlorine-chain-wide' problem with chlorinated organic micro-contaminants."

Technique to monitor presence of chemicals

Biomonitoring, which involves taking samples of blood, urine and human tissue, has been used for a long time by scientists to measure chemicals that enter our bodies through breathing, eating, drinking and skin absorption. For example, blood samples from athletes are analysed to detect the presence of banned performance-enhancing substances and the breath test is used to measure alcohol consumption of drivers.

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Industry overview

Strong growth continues unabated

Europe witnessed strong growth for both chlorine and its co-product sodium hydroxide (more commonly known as caustic soda) during 2004. In fact the strong first half upsurge of demand for caustic soda continued unabated throughout the year and resulted in the industry's lowest average monthly stocks for 20 years. Production of PVC resin, which accounts for about a third of annual chlorine consumption, increased, but sales of chlorinated solvents continued to decline as a result of improved recycling and tougher EU emissions standards.

Production reaches all-time high

Chlorine production in Europe – both East and West – totalled 10.55 million tonnes in 2004 and capacity utilisation rates averaged 85%. Figures for caustic soda production in Eastern Europe are not presently available to Euro Chlor, but in Western Europe a total of 10.34 million tonnes was produced.

Both chemicals are fundamental building blocks of the chemical industry and used in a wide range of industrial and consumer applications. The largest single application for chlorine is in the manufacture of PVC resin and for caustic soda it is the bleaching of pulp, paper and cellulose.

PVC resin is used to make a wide variety of products, including window profiles, roofing membranes, flooring, pipes and fittings. Companies belonging to the European Council of Vinyl Manufacturers (ECVM) produced 7 million tonnes of PVC resin in 2004 a 4.5% increase compared with 2003 (6.7 million tonnes).

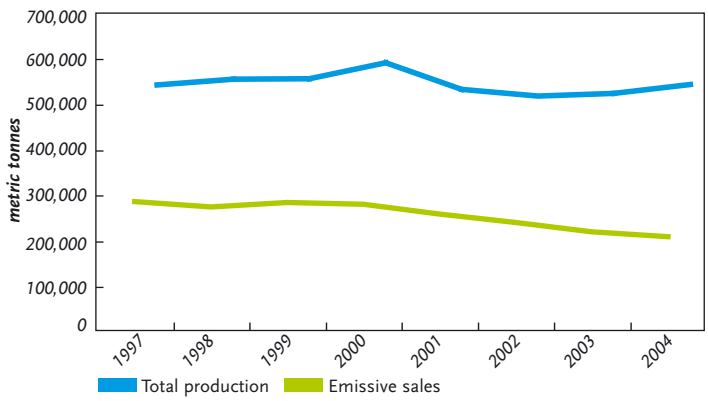
Other high-value plastics that depend on chlorine for their synthesis, but do not contain chlorine in the end product, include epoxy resins, polyurethanes and polycarbonates.

Solvents

Although overall sales in Western Europe (+ Turkey) of chlorinated solvents for emissive applications has progressively declined (see chart), total production has remained steady. One of the principal reasons is that perchloroethylene (PER) and trichloroethylene (TRI) are also used as non-emissive chemical intermediates in the production of fluorocarbons.

Since 1997, sales have declined whereas use within the industry as an intermediate has increased. The combined 2004 sales of PER, TRI and methylene chloride were 6% lower at 220,000 tonnes compared with 2003; sales of TRI fell 5,000 tonnes (15%); PER 3,000 tonnes(5%) and methylene chloride by 5,000 tonnes (4%).

Western Europe chlorinated solvents 1997-2004



Training pays off

The importance of high safety standards and continuous emergency response training was underscored in February 2005 when a chlorine train travelling in the south of Sweden was partially derailed at low speed. The engine and four of the 12 tank cars, each carrying 64 tonnes of chlorine, came off the line.

Only a few weeks earlier a training exercise - following Euro Chlor procedures and closely resembling the incident - had been carried out by the same industry Emergency Response Team that responded to this incident. The team was, therefore, confident of its ability to handle the situation with the assistance of local emergency services. There was no chlorine leakage, no injuries nor evacuation of the surrounding area.

Elsewhere in the world, however, there were more serious incidents involving chorine transportation or storage. In China, more than 50 people were killed and 800 injured in accidents during 2004 and early 2005.

Euro Chlor and Chlorine Chemistry Council (CCC) representatives subsequently twice visited counterpart organisations in China for discussions, which led to plans for a World Chlorine Council (WCC) conference (Beijing, April 24-25 2006). The event, which will focus on safety, sustainability and regulatory developments, is being jointly sponsored by WCC, the China Petroleum & Chemical Industry Association and the China Chlor-Alkali Industry Association.

Security

Building on the experience of larger chlor-alkali producers in Europe and the rest of the world, Euro Chlor is preparing security guidelines for smaller producers to thwart possible terrorist attacks on production facilities. The guidelines will be available to member companies by end 2005.

Russia gets organised

Following the 2004 WCC safety seminar in Moscow, Russian chlor-alkali producers decided to form in 2005 an industry association modelled on Euro Chlor.

Named RusChlor, it represents the interests of 16 companies with a combined annual capacity of 1.5 million tonnes of chlorine. The new association has joined WCC and will be represented on the Global Safety Team, which shares experience and best practice in safety, health and environmental protection between participating organisations.

Success in Prague

The 6th International Chlor-alkali Industry Technical Seminar & Exhibition in Prague (January 2005) entitled *Improving health, safety and environmental practice in the chlor-alkali industry* was highly successful with more than 300 primarily industry participants from 36 countries. Thirty industry suppliers participated in an accompanying exhibition.

A first-ever commercial session with six Euro Chlor member companies presenting the latest technological developments was particularly popular and likely will be featured in the next technical seminar planned for 2008.

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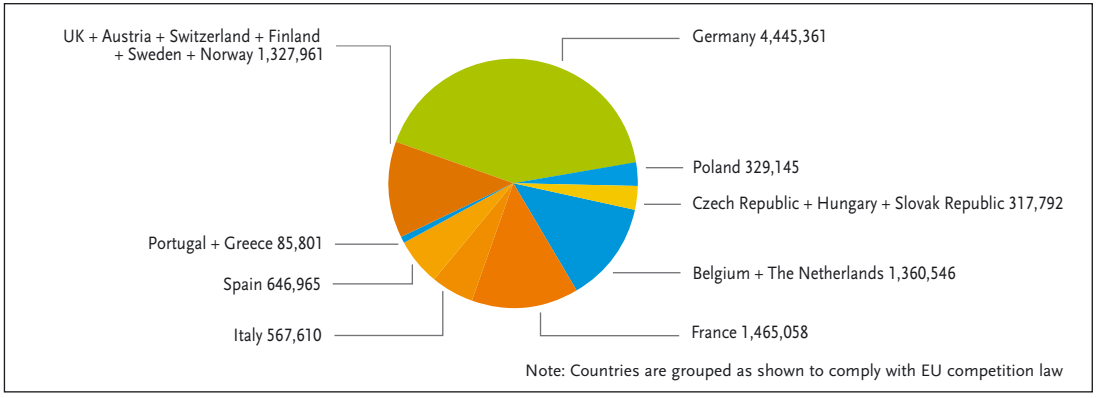
European production & use data

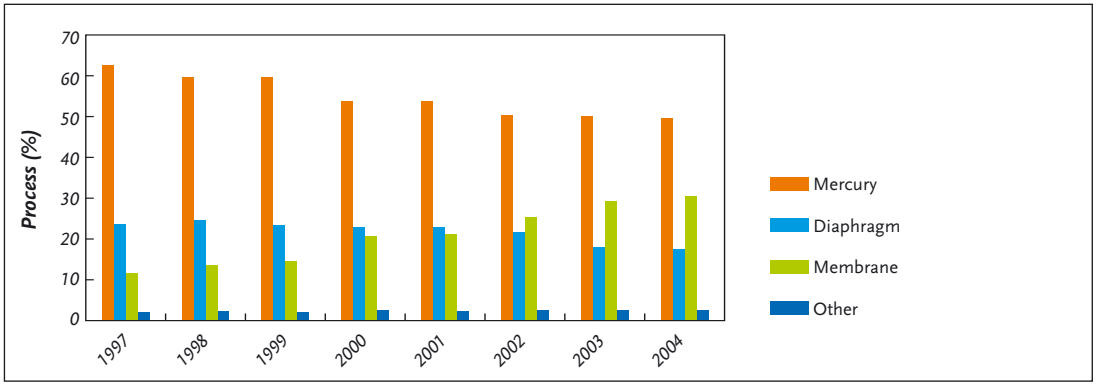
Where and how chlorine is made and used

This section comprises charts and diagrams quantifying the European chlor-alkali sector, which produces more than 20 million tonnes a year of chlorine and caustic soda (as well as hydrogen). These products underpin 55% of European chemical industry turnover (2003: €580,000 million). Illustrations show the production and use of chlorine and caustic soda; where plants are located across Europe with details of ownership, processes and capacities; diagrams of the various technologies – mercury, membrane and diaphragm - used to make these chemicals by electrolysis and the split between their uses in 2004.

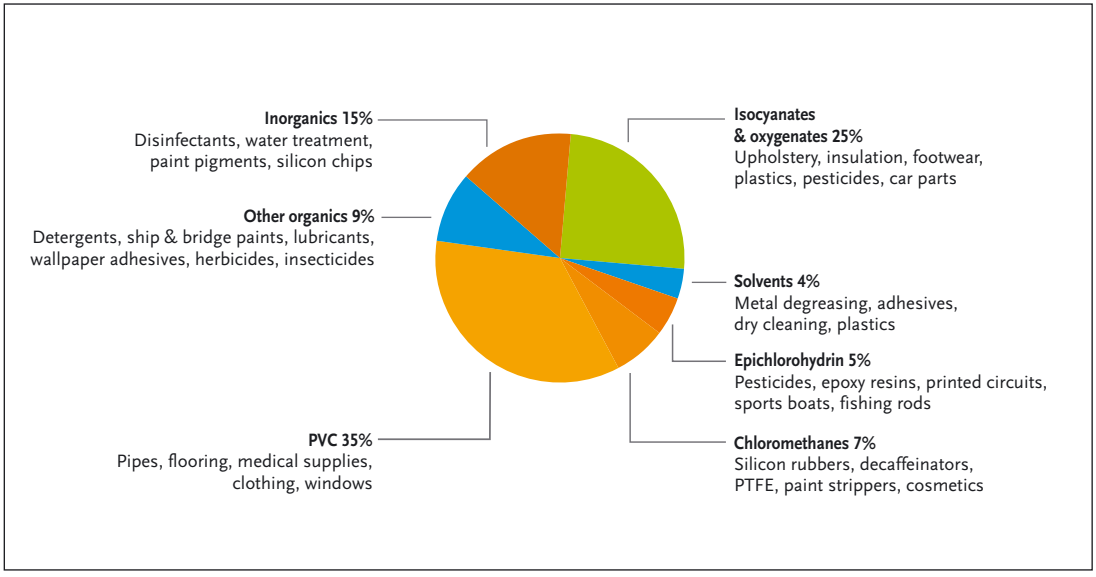
European chlorine production in 2004 (tonnes)



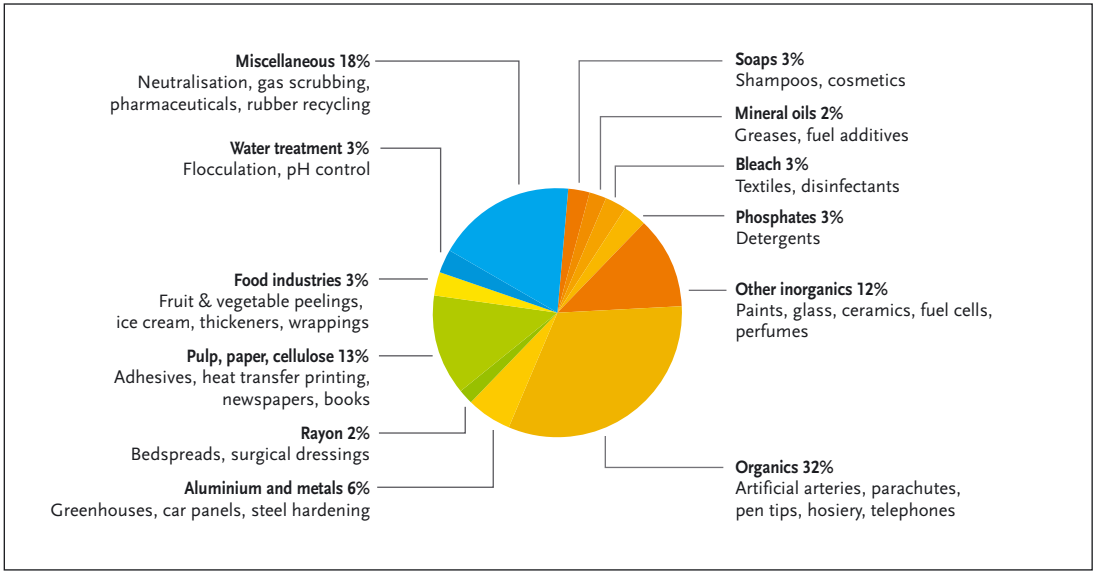
Evolution of chlorine routes by process



European chlorine applications in 2004 (10.35 million tonnes)



European caustic soda applications 2004 (10.10 million tonnes)



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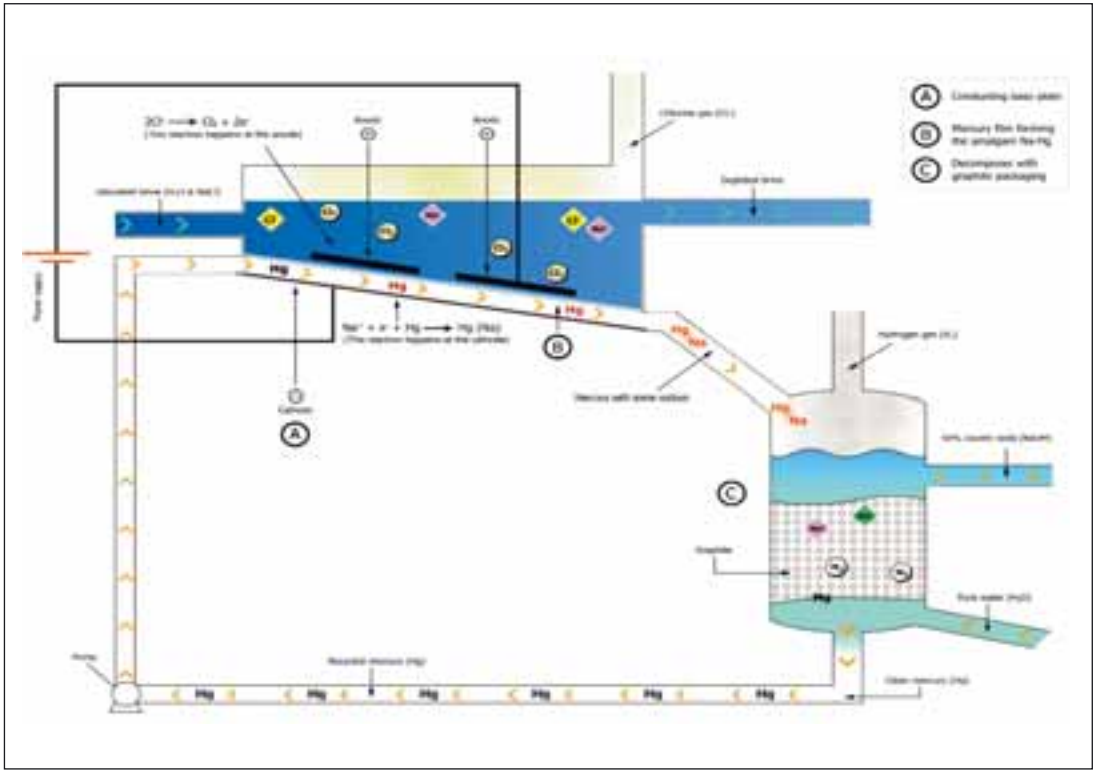
Animated flow charts on new *Chlorine Online*

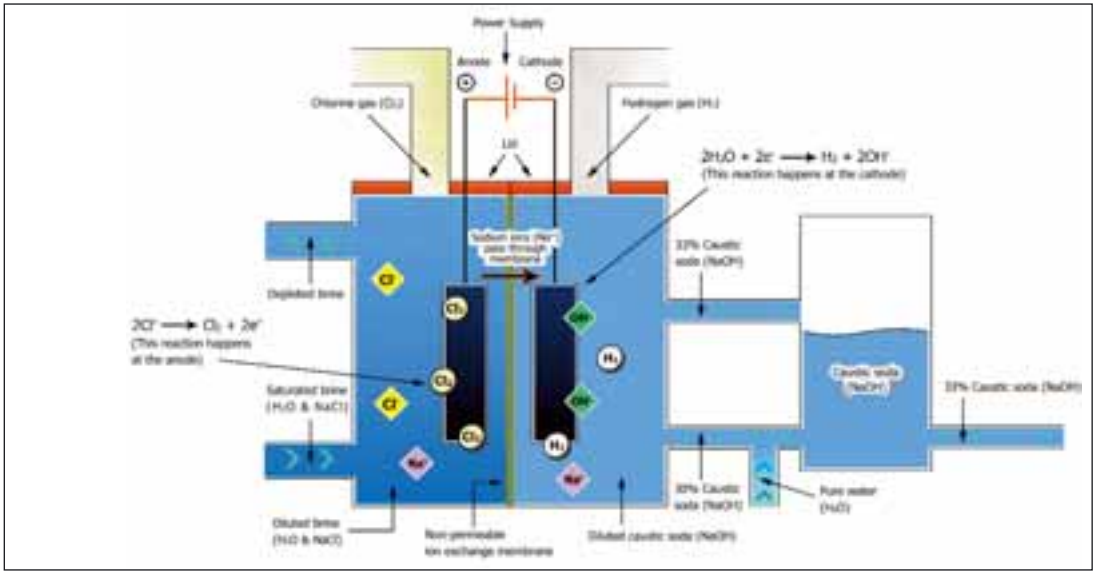
These diagrams show how chlorine is produced by electrolysis in enclosed cells using three different processes – mercury, membrane and diaphragm. Animated versions of these can be viewed on the new *Chlorine Online* website, which can be found at www.eurochlor.org from 1 September, 2005.

In 2004, the mercury process accounted for 47% (4,960,000 tonnes) of production; the membrane process 33.1% (3,490,000 tonnes); diaphragm 17.4% (1,830,000 tonnes) and other 2.5% (270,000 tonnes).

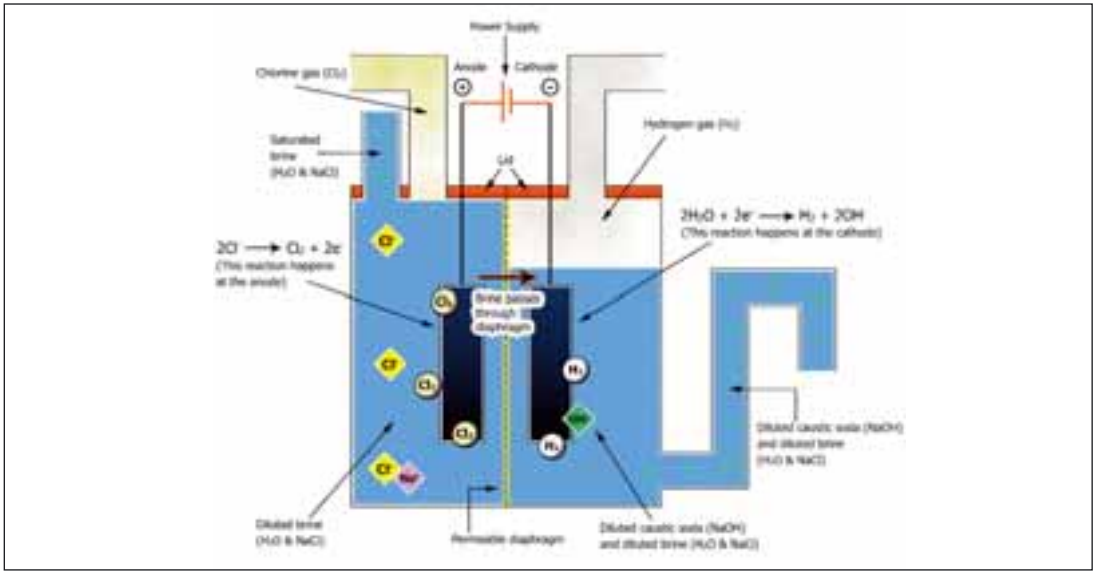
The mercury cell process



The membrane cell process



The diaphragm cell process



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Chlorine production plants

January 2005

Country	*N°	Company	Site	Process	Capacity (000 tonnes)
Austria	1	Donau Chemie	Brückl	M	65
Belgium	3	SolVin	Antwerp (Lillo)	Hg	330
	4	SolVin	Jemeppe	M	176
	5	Tessenderlo Chemie	Tessenderlo	Hg	250
Czech Rep.	6	Spolana	Neratovice	Hg	135
	7	Spolchemie	Usti	Hg	61
Finland	8	Akzo Nobel	Oulu	Hg	43
	9	Finnish Chemicals	Joutseno	M	75
France	10	Albemarle	Thann	Hg	72
	11	ChlorAlp	Pont de Claix	D	240
	12	Arkema	Fos	D, M	270
	13	Arkema	Jarrie	Hg	170
	14	Arkema	Lavera	Hg, D	341
	15	Arkema	Saint Auban	Hg	184
	16	MSSA	Pomblières	Na	42
	17	Prod. Chim. d'Harbonnières	Harbonnières	Hg	23
	18	Solvay	Tavaux	Hg, M	375
	19	Tessenderlo Chemie	Loos	Hg	18
Germany	20	BASF	Ludwigshafen	Hg, M	370
	21	Bayer	Dormagen	M, HCl	450
	22	Bayer	Leverkusen	M, HCl	330
	23	Bayer	Uerdingen	Hg, M	220
	24	Bayer	Brunsbuttel	HCl	190
	25	Dow	Schkopau	M	215
	26	Vinnolit	Knapsack	Hg, M	280
	27	Clariant	Gersthofen	M	40
	28	Dow	Stade	D, M	1585
	29	Akzo Nobel	Ibbenbüren	Hg	125
	30	Akzo Nobel	Bitterfeld	M	75
	31	Degussa	Lülsdorf	Hg	136
	32	INEOS Chlor	Wilhelmshaven	Hg	149
	33	LII Europe	Frankfurt	Hg	167
	34	Solvay	Rheinberg	D, M	200
	35	Vestolit	Marl	Hg, M	216
	36	Vinnolit	Gendorf	Hg	82
	37	Wacker	Burghausen	M	50
Greece	38	Hellenic Petroleum	Thessaloniki	Hg	40
Hungary	39	BorsodChem	Kazincbarcika	Hg	137
Ireland	40	MicroBio	Fermoy	M	6
Italy	41	Altair Chimica	Volterra	Hg	27
	42	Solvay	Bussi	Hg	87
	43	Caffaro	Torviscosa	Hg	68
	44	Syndial	Assemini/Cagliari	M	170
	45	Syndial	Porto Marghera	Hg	200
	47	Syndial	Priolo	Hg	204
	48	Eredi Zarelli	Picinisco	Hg	6
	49	Solvay	Rosignano	Hg	125
	50	Tessenderlo Chemie	Pieve Vergonte	Hg	42
Netherlands	51	Akzo Nobel	Botlek	M	516
	52	Akzo Nobel	Delfzijl	D	60
	53	Akzo Nobel	Hengelo	Hg	74
	54	GE Plastics	Bergen op Zoom	M	87
Norway	55	Borregaard	Sarpsborg	M	45
	56	Elkem	Bremanger	M	10
	57	Norsk Hydro	Rafnes	D	136
Poland	58	Rokita	Brzeg Dolny	Hg	125
	59	Zachem	Bydgoszcz	D	60
	60	Anwil	Wloclawek	D	197
	86	Dwory	Oswiecim	Hg	39
	87	Tarnow	Tarnow	Hg	43
Portugal	61	Solvay	Povoa	M	29
	62	Quimigal	Estarreja	M	68
Slovak Rep.	63	Novacke Chemicke	Novaky	Hg	76
Slovenia	88	TKI Hrastnik	Hrastnik	M	15
Spain	64	Aragonesas	Huelva	Hg	101
	65	Aragonesas	Sabinanigo	Hg	25
	66	Aragonesas	Vilaseca	Hg, M	190
	67	Electroquimica de Hernani	Hernani	M	15
	68	Elnosa	Lourizan	Hg	34
	69	Ercros	Flix	Hg	150
	70	Quimica del Cinca	Monzon	Hg	31
	71	SolVin	Martorell	Hg	218
	72	Solvay	Torrelavega	Hg	63
Sweden	73	Akzo Nobel	Bohus	Hg	100
	74	Akzo Nobel	Skoghall	M	88
	75	Norsk Hydro	Stenungsund	Hg	120
Switzerland	77	SF-Chem	Pratteln	Hg	27
	89	Borregaard	Atisholtz	M	9
UK	80	Albion Chemicals	Sandbach	Hg	90
	82	INEOS Chlor	Runcorn	Hg, M	767
	84	Rhodia	Staveley	Hg	29
	85	Albion Chemicals	Thetford	M	6
Total					12,505

* Number on map

Process: Hg: Mercury M: Membrane Na: Sodium D: Diaphragm HCl: Electolysis of HCl to Cl_2

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Euro Chlor

Key leadership role on sustainability initiative

Based in Brussels at the heart of Europe, Euro Chlor represents the interests of 98% of chlor-alkali producers in the EU-25 and EFTA regions. The federation plays a key role in guiding and supporting this important chemical industry sector's efforts to achieve a sustainable future based on balanced environmental, social and economic considerations.

Euro Chlor places a strong focus on sound science coupled with continual improvements in enhancing health, safety and environmental standards. This is essential if the federation is to build trust with key stakeholders. A key link between industry and policy makers as well as industry and the general public, Euro Chlor works to further the transparency of the chlorine industry thus strengthening society's confidence in this sector.

Euro Chlor was originally founded nearly 50 years ago as a production-oriented technical organisation. In 1989 it was restructured to provide the sector with strengthened scientific, advocacy and communications capabilities.

Integral to the structure of Euro Chlor are its chlorinated solvents, chlorinated paraffins, chloroisocyanurates and potassium hydroxide product groups.

Management committee

Chairman, Bergmann, U	BASF
Co-chairman, Paini, G	Syndial
Aparicio Díez, M	Solvay Química
Baccani, C	Solvay
De Grève, J-P	ECVM
Dubinski, M	Tessenderlo Chemie
Fuhrmann, W	Akzo Nobel
Griessmann, K-H	Degussa
Lamm, R	Dow
Mäki-Kala, J	Finnish Chemicals
Ohm, C	Bayer MaterialScience
Pelzer, A	Rokita
Pernot, Ph	Arkema
Raae, S	Norsk Hydro
Redon, A	ChlorAlp
Tane, C	INEOS Chlor
Träger, M	Vestolit
Winhold, M	Vinnolit

Secretariat staff

Barrie Gilliatt	Executive Director
Françoise Minne	Senior Assistant
Véronique Garny	Science Director
Dolf van Wijk	Science Manager
Raf Bruyndonckx	Science Manager
Valentina Bertato	Science Manager
Viviane Norré	Assistant
Arseen Seys	Environmental & Regulatory Affairs Director
Caroline Andersson	Regulatory Affairs Counsellor
Isabelle Coppens	Assistant
André Orban	ECSA & Chlorinated Paraffins Manager
Peter Whippy	Communications Manager
Bronwen Pickering	Communications Coordinator
Jean-Pol Debelle	Technical & Safety Director
Caroline Ashdown	Assistant

Membership encompasses 41 chlorine producers in a growing Europe where the industry employs about 39,000 people at 74 manufacturing locations in 17 countries. Euro Chlor also has 39 Associate Members and 33 Technical Correspondents, including five recruited since 2004, which brings total membership to 113. These include downstream users and producers outside Europe as well as suppliers of equipment, materials and services.

Organisation

Guidance and overall strategic direction is given to the Euro Chlor Secretariat by the Management Committee. Thirty-eight committees and working groups provide specialist knowledge in advocacy, science as well as health, safety and the environment.

Queen honours former chairman

Former Euro Chlor chairman René Scheffers was named a Knight of the Order of Orange-Nassau in the 2004 Dutch Royal Honours List for outstanding service to the chemical industry and Akzo Nobel. The award recommendation noted his leadership role in the chlorine industry. Mr Scheffers, who was President of Akzo Nobel Base Chemicals until he retired early 2005, served on the Euro Chlor Management Committee for 10 years and is the only member to have served two terms (1995 and 2004) as chairman.

Committees & working groups

Management

- Management Committee
- Mercury ad hoc Task Force
- Sustainability ad hoc Task Force
- Statistics Committee

Advocacy & communications

- Regulatory Affairs Committee
- EU Advisory Group
- Nat. Chlorine Associations WG
- Chlorine Communicators' Network

Product groups

- Chlorinated Paraffins Sector Group
- Chloroisocyanurates Group
- Potassium Group

Science

- Steering Committee
- Monitoring & Environmental Chemistry WG
- Toxicology WG
- Risk Assessment ad hoc Working Groups
  - Caustic Soda
  - Chlorine
  - Marine
  - Sodium Hypochlorite
- Biocides Strategy Group
  Biocides Registration Groups
  - Chlorine
  - Sodium Hypochlorite
  - Calcium Hypochlorite

Technical & safety

- General Technical Committee (GTC)
- Environmental Protection WG
- GEST (Safety) WG
- Equipment WG
- Transport WG
- Health WG
- Electromagnetic Fields WG
- Analytical WG

European Chlorinated Solvent Association

- Management Committee
- Communication & Outreach WG
- General Technical WG
- Occupational & Environmental Health WG
- Product WG
- Chlorinated Solvents Risk Assessment WG
- Chloroform Risk Assessment WG

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Euro Chlor membership

Full members

Akzo Nobel Base Chemicals
Albemarle Europe
Albion Inorganic Chemicals
Altair Chimica
Anwil
Aragonesas
Arkema
BASF
Bayer MaterialScience
Borregaard Industries
BorsodChem
Caffaro
ChlorAlp
Clariant
Degussa
Dow
Dwory
Electroquímica de Hernani
Electroquímica del Noroeste (Elnosa)
Ercros
Finnish Chemicals
Hellenic Petroleum
INEOS Chlor
LII Europe
MSSA
Norsk Hydro
Novácke Chemické Závody
Produits Chimiques d'Harbonnières
Química del Cinca
Quimigal
Rokita
SF-Chem
Solvay
SolVin
Spolana
Spolchemie
Syndial
Tessenderlo Chemie
Vestolit
Vinnolit
Zachem

Associate members

Ahlia Industrial Projects
Angelini A.C.R.A.F.
Arch Chemicals
Asahi Kasei Chemicals
Asociación Nacional de Electroquimica (ANE), Spain
Association of Chemical Industry of the Czech Republic (SCHP)
Bochemie
Chemical Industries Association, UK
Chemieanlagenbau Chemnitz
Chemoform
Chlorine Engineers
Cotelle
De Nora
DuPont de Nemours
ExxonMobil Chemical Europe
Fédération des Industries Chimiques de Belgique (Fedichem)
Federchimica Assobase, Italy
K+S
Leuna Tenside
Lonza
Nankai Chemical
National Petrochemical, Iran
NCP Chlorchem
Nippon Soda
Polish Chamber of the Chemical Industry Employers' Association (PIPC)
Plast- & Kemiföretagen – The Swedish Plastics & Chemicals Federation
PPG Industries
Procter & Gamble Eurocor
SGCI Chemie Pharma Schweiz
Shikoku Chemicals
Sojitz Europe
Syndicat des Halogènes, France
Teijin Twaron
Tosoh Corporation
Uhde
Unilever Hellas
Verband der Chemischen Industrie (VCI), Germany
Vereniging van de Nederlandse Chemische Industrie (VNCI)
WATERCHEM

Technical correspondents

Arabian Chlorine
Asahi Glass Europe
Asahi Organic Chemicals Industry
Bayer Technology Services
Beltech
Carburos Metalicos
Chemtec
Crane Resistoflex
Descote
Electroquimica de Sagua
Eltech Systems
Eramet
Garlock Sealing Technologies
ISGEC
Kerr-McGee Pigments
Koruma Klor Alkali
Kronos Worldwide
KSB-AMRI
Nufarm Coogee Pty
Occidental Chemical
Pall Corporation
Phöenix Armaturen- Werke Bregel
Quicksilver Recovery Services
Reliance Industries
Samson
Sasol Polymers
Senior Flexonics Ermeto
Severn Trent Water
Shaw, Son & Greenhalgh
SIEM Supranite
Technip LCI France
Thasco Chemical
WL Gore & Associates

Euro Chlor full members

Akzo Nobel Base Chemicals BV
P O Box 247
NL-3800 AE Amersfoort
THE NETHERLANDS
Switchboard: +31 33 4676767
General fax: +31 33 4676100
http://www.basechemicals.com

Albemarle Europe sprl
Parc Scientifique Einstein
Rue du Bosquet, 9
B-1348 Louvain-la-Neuve
BELGIUM
Switchboard: +32 10 481711
General fax: +32 10 481717
http://www.albemarle.com

Albion Inorganic Chemicals Ltd
Sandbach
GB-CW11 3PZ Cheshire
UNITED KINGDOM
Switchboard: +44 1270 759759
General fax: +44 1270 759166
http://www.albionchemicals.co.uk

Altair Chimica SpA
Via Moie Vecchie, 13
I-56047 Saline di Volterra (PI)
ITALY
Switchboard: +39 05 88 98 118
General Fax: +39 05 88 98 183
http://www.altairchimica.com

Anwil SA
ul. Torúnska, 222
PL-87-805 Wloclawek
POLAND
Switchboard: +48 54 2363091
General fax: +48 54 2369786
http://www.anwil.com.pl

Aragonesas Industrias y Energia SA
Paseo de Recoletos, 27
E-28004 Madrid
SPAIN
Switchboard: +34 91 5853800
General fax: +34 91 5852300
http://www.grupoaragonesas.com

ARKEMA
4-8, Cours Michelet
La Défense 10
F-92091 Paris la Défense Cedex
FRANCE
Switchboard: +33 1 49008080
General fax: +33 1 49008396
http://www.arkemagroup.com

BASF AG
Carl-Bosch-Str., 38
D-67056 Ludwigshafen
GERMANY
Switchboard: +49 621 600
General fax: +49 621 6042525
http://www.basf-ag.de

Bayer MaterialScience AG
D-51368 Leverkusen
GERMANY
Switchboard: +49 214 30-1
General fax: +49 214 30-38810
http://www.bayermaterialscience.com

Borregaard Industries Ltd
P O Box 162
N-1701 Sarpsborg
NORWAY
Switchboard: +47 69118000
General fax: +47 69118770
http://www.borregaard.com

BorsodChem RT
P O Box 208
H-3702 Kazincbarcika
HUNGARY
Tel/fax: +36 48 511211
Tel/fax: +36 48 511511
http://www.borsodchem.hu

Caffaro SRL
Piazzale Marinotti 1
I-33050 Torviscosa (UD)
ITALY
Switchboard: +39 0431 3811
General fax: +39 0431 381343
http://www.caffarochem.com

ChlorAlp
rue Lavoisier
B P 21
F-38801 Le Pont-de-Claix
FRANCE
Switchboard: +33 4 76695000
General fax: +33 4 76635061
http://www.chloralp.com

Clariant GmbH & Co. KG
Am Unisyspark 1
D-65843 Sulzbach
GERMANY
Switchboard: +49 6196 75760
General fax: +49 6196 7578856
http://www.clariant.de

Degussa AG
Corporate Centre
Post Box 302043
40402 Düsseldorf
GERMANY
Switchboard: +49 211 650410
General fax: +49 211 65041472
http://www.degussa.com

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Dow Deutschland GmbH & Co. KG
Werk Stade
PO Box 1120
D-21677 Stade
GERMANY
Switchboard: +49 4146 910
General fax: +49 4146 912600
http://www.dow.com

Dwory SA
ul Chemikow 1
PL-32-600 Oswiecim
POLAND
Switchboard: +48 33 8441821
General fax: +48 33 8424218
http://www.dwory.pl

Electroquimica de Hernani SA
Avenida de Madrid, 13 - 1
E-20011 San Sebastian
SPAIN
Switchboard: +34 94 3451141
General fax: +34 94 3453965

Electroquimica del Noroeste SA
P O Box 265
E-36080 Pontevedra
SPAIN
Switchboard: +34 986 853750
General fax: +34 986 864132

Ercros SA
Avenida Diagonal 595 - 10a pl.
E-08014 Barcelona
SPAIN
Switchboard: +34 93 439 30 09
General fax: +34 93 430 80 73
www.ercros.es

Finnish Chemicals Oy
P O Box 7
FIN-32741 Äetsä
FINLAND
Switchboard: +358 204 3111
General fax: +358 204 310431
www.finnishchemicals.com

Hellenic Petroleum SA
P O Box 10044
GR-541 10 Thessaloniki
GREECE
Switchboard: +30 2310 750000
General fax: +30 2310 750001
http://www.hellenic-petroleum.gr

INEOS Chlor Ltd
Runcorn Site HQ
South Parade
PO Box 9
Runcorn
Cheshire WA7 4JE
UNITED KINGDOM
Switchboard: +44 1928 561111
General fax: +44 1928 516635
http://www.ineoschlor.com

LII Europe GmbH
Industriepark Hoechst
D-65926 Frankfurt am Main
GERMANY
Switchboard: +49 69 3052050
General fax:+ 49 69 3052057
www.liieurope.com

MSSA SAS
Pomblière
F-73600 Saint Marcel
FRANCE
Switchboard: +33 4 79247070
General fax: +33 4 79247050
http://www.metauxspeciaux.fr

Norsk Hydro ASA
Drammensvn. 264
N-0240 Oslo
NORWAY
Switchboard: +47 22 538100
General fax: +47 22 532725
http://www.hydro.com

Novácke Chemické Závody as
M.R. Stefánika, 1
SK-97271 Nováky
SLOVAK REPUBLIC
Switchboard: +421 46 568111
General fax: +421 46 5461223
http://www.nchz.sk

PCC Rokita SA
c/o PCC AG
Moerser Straße 149
47198 Duisburg
GERMANY
Switchboard: +49 2066 201911
General fax: +49 2066 54682
www.pcc.de

Produits Chimiques d'Harbonnières
P O Box 1
Place de l'Eglise
F-80131 Harbonnières
FRANCE
Switchboard: +33 3 22857630
General fax: +33 3 22857631
http://www.spch.fr

Quimica del Cinca SA
Avenida Diagonal, 352 Entlo.
E-08013 Barcelona
SPAIN
Switchboard: +34 93 4584000
General fax: +34 93 4584007
http://www.qcinca.es

QUIMIGAL -
Química de Portugal SA
Quinta da Indústria
Beduído
3860-680 Estarreja
PORTUGAL
Switchboard: +351 234 810 300
General fax: +351 234 810 420

SF-Chem
P O Box 1964
CH-4133 Pratteln 1
SWITZERLAND
Switchboard: +41 61 8253111
General fax: +41 61 8253636
www.sf-chem.com

Solvay SA
Rue du Prince Albert, 44
B-1050 Bruxelles
BELGIUM
Switchboard: +32 2 5096111
General fax: +32 2 5096617
http://www.solvay.com

SolVin SA
Rue de Ransbeek, 310
B-1120 Bruxelles
BELGIUM
Switchboard: +32 2 2642111
General fax: +32 2 2642064
http://www.solvinpvc.com

Spolana as
ul. Prace 657
277 11 Neratovice
CZECH REPUBLIC
Switchboard: +420 315 661 111
General fax: +420 315 682 821
http://www.spolana.cz

Spolchemie as
Revoluční 1930/86
400 32 Ústí nad Labem
CZECH REPUBLIC
Switchboard: +420 47716 1111
General fax: +420 47716 3333
http://www.spolchemie.cz

Syndial SpA
Piazza Boldrini, 1
I-20097 San Donato Milanese (MI)
ITALY
Switchboard: +39 02 52032600
General fax: +39 02 52032616

Tessenderlo Chemie SA
Rue du Trône, 130
B-1050 Bruxelles
BELGIUM
Switchboard: +32 2 6391811
General fax: +32 2 6391702
http://www.tessenderlo.com

Vestolit GmbH & Co. KG
P O Box 10 23 60
D-45753 Marl
GERMANY
Switchboard: +49 2365 4905
General fax: +49 2365 4000
http://www.vestolit.de

Vinnolit GmbH & Co. KG
Chemiepark Knapsack
Industriestrasse
D-50354 Hürth
GERMANY
Switchboard:+49 2233 48 6963
General fax: +49 2233 48 6970
http://www.vinnolit.de

ZACHEM SA
ul. Wojska Polskiego 65
PL-85-825 Bydgoszcz
POLAND
Switchboard: +48 52 374 8200
General fax: +48 52 374 7100
http://www.zachem.com.pl

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Euro Chlor provides a focal point for the chlor-alkali industry's drive to achieve a sustainable future through economically and environmentally sound manufacture and use of its products. Based in Brussels, at the heart of the European Union, the federation works with national, European and international authorities to ensure that legislation affecting the industry is workable, efficient and effective.

Euro Chlor
Avenue E. van Nieuwenhuyse 4, box 2
B - 1160 Brussels, Belgium
tel: +32 2 676 72 11
fax: +32 2 676 72 41
eurochlor@cefic.be
www.eurochlor.org