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.
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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.
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 chlorine 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%.
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 achieved.
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.
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 1 g/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.)
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.
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.
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 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 CO2 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.
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 for 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, bio-accumulative 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.

**Reliable, affordable energy needed to maintain longer-term competitiveness**
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.

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.

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

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.

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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.
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).

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 fluoro-carbons.

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%).
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 chlorine 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.
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.

**Where and how chlorine is made and used**

European chlorine production in 2004 (tonnes)

<table>
<thead>
<tr>
<th>Country</th>
<th>Production (tonnes)</th>
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<tr>
<td>Czech Republic + Hungary + Slovak Republic</td>
<td>317,792</td>
</tr>
<tr>
<td>Italy</td>
<td>567,610</td>
</tr>
<tr>
<td>UK + Austria + Switzerland + Sweden + Norway</td>
<td>1,327,961</td>
</tr>
<tr>
<td>Germany</td>
<td>4,445,361</td>
</tr>
<tr>
<td>Portugal + Greece</td>
<td>85,801</td>
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Note: Countries are grouped as shown to comply with EU competition law.

Evolution of chlorine routes by process

The evolution of chlorine production by process from 1997 to 2004 is shown in the diagram. The processes include mercury, diaphragm, membrane, and other technologies. The percentages for each process are indicated for each year, illustrating the shift towards more efficient technologies over time.
European chlorine applications in 2004 (10.35 million tonnes)

- **Inorganics 15%**: Disinfectants, water treatment, paint pigments, silicon chips
- **PVC 35%**: Pipes, flooring, medical supplies, clothing, windows
- **Isocyanates & oxygenates 25%**: Upholstery, insulation, footwear, plastics, pesticides, car parts
- **Solvents 4%**: Metal degreasing, adhesives, dry cleaning, plastics
- **Epichlorohydrin 5%**: Pesticides, epoxy resins, printed circuits, sports boats, fishing rods
- **Chloromethanes 7%**: Silicon rubbers, decaffeinators, PTFE, paint strippers, cosmetics
- **Other organics 9%**: Detergents, ship & bridge paints, lubricants, wallpaper adhesives, herbicides, insecticides
- **Inorganics 15%**: Disinfectants, water treatment, paint pigments, silicon chips
- **PVC 35%**: Pipes, flooring, medical supplies, clothing, windows
- **Isocyanates & oxygenates 25%**: Upholstery, insulation, footwear, plastics, pesticides, car parts
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- **Chloromethanes 7%**: Silicon rubbers, decaffeinators, PTFE, paint strippers, cosmetics
- **Other organics 9%**: Detergents, ship & bridge paints, lubricants, wallpaper adhesives, herbicides, insecticides

European caustic soda applications 2004 (10.10 million tonnes)

- **Miscellaneous 18%**: Neutralisation, gas scrubbing, pharmaceuticals, rubber recycling
- **Water treatment 3%**: Flocculation, pH control
- **Food industries 3%**: Fruit & vegetable peelings, ice cream, thickeners, wrappings
- **Pulp, paper, cellulose 13%**: Adhesives, heat transfer printing, newspapers, books
- **Rayon 2%**: Bedspreads, surgical dressings
- **Aluminium and metals 6%**: Greenhouses, car panels, steel hardening
- **Soaps 3%**: Shampoos, cosmetics
- **Mineral oils 2%**: Greases, fuel additives
- **Bleach 3%**: Textiles, disinfectants
- **Phosphates 3%**: Detergents
- **Other inorganics 12%**: Paints, glass, ceramics, fuel cells, perfumes
- **Organics 32%**: Artificial arteries, parachutes, pen tips, hosiery, telephones
European production & use data

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
Chlorine production plants
January 2005
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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

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<td>Peter Whippy</td>
<td>Communications Coordinator</td>
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<tr>
<td>Bronwen Pickering</td>
<td>Technical &amp; Safety Director</td>
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<td>Jean-Pol Debelle</td>
<td>Assistant</td>
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<td>Caroline Ashdown</td>
<td>Assistant</td>
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</table>
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

<table>
<thead>
<tr>
<th>Management</th>
<th>Technical &amp; safety</th>
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<tbody>
<tr>
<td>• Management Committee</td>
<td>• General Technical Committee (GTC)</td>
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<td>• Mercury ad hoc Task Force</td>
<td>• Environmental Protection WG</td>
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<tr>
<td>• Sustainability ad hoc Task Force</td>
<td>• GEST (Safety) WG</td>
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<td>• Statistics Committee</td>
<td>• Equipment WG</td>
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<td>• Transport WG</td>
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<td>• Health WG</td>
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<td>• Electromagnetic Fields WG</td>
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<td>• Analytical WG</td>
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</tbody>
</table>

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

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
## 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
- Lily Europe
- MSSA
- Norsk Hydro
- Nováček Chemické Závody
- Produits Chimiques d’Harbonnières
- Quimica del Cinca
- Quimigal
- Rokita
- SF-Chem
- Solvay
- Solvin
- 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 Electroquímica (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 (PiPiC)
- Plast- & Kernforstagen – The Swedish Plastics & Chemicals Federation
- PPG Industries
- Procter & Gamble Eurocor
- SGCI Chemie Pharma Schweiz
- Shikoku Chemicals
- Sojitz Europe
- Syndicat des Halogènes, France
- Tejin 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
- Ermet
- Garlock Sealing Technologies
- ISGEC
- Kerr-McGee Pigments
- Koruma Klor Alkali
- Kronos Worldwide
- KSB-AMRI
- Nufarm Coogee Pty
- Occidental Chemical
- Pall Corporation
- Phoenix 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
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1 August 2005
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.