Introduction

Actions speak louder than words

Two recent opinion surveys – one in the UK and the other a pan-European study commissioned by Cefic – showed an increase in public acceptance of the chemical industry. In the latter, the industry moved up the league table, but only from 7th to 6th place (out of eight). It is not a comforting result; although the industry's environmental performance has improved continuously and significantly over the last 20 years, we have not fundamentally improved public understanding of such a vital sector. Attitudes to the chlorine industry have tended to be slightly more positive.

This may be because, in general, few people know anything about chlorine except that it is added to drinking water and swimming pools for protection of health and hygiene which, on the whole, is seen as good. Concerns expressed by activist groups over other chlorinated substances have failed to grip the public consciousness, although having more of a resonance with legislators and regulators. Dioxins, PCBs and heavy metals still figure in initiatives such as bio-monitoring, POPs and SCALE.

Euro Chlor does not oppose these activities – it welcomes and embraces them – although it will continue to fight for a science-based risk assessment methodology rather than an emotive intrinsic properties-based approach. (After all, roads, water and buildings are intrinsically hazardous – it is the risk management rules that we put around them that make their use acceptable; chemicals are no different).

As well as good legislation, there is room for voluntary initiatives. In this and previous Reviews, we have described our activities in pioneering targeted marine risk assessments, the Charter of the downstream PVC industry for emissions and the *Vinyl 2010* commitments on stabilisers, additives and recycling, the various commitments on mercury cell technology and, most recently, our approach to sustainability. The improvements made have been recognised and appreciated – as evinced by many of the comments by independent parties in this *Review* (pages 8–11).

However, much remains to be done.

One area that stands out is the need to spread the learning in safety and environmental performance we have gained over the years to emerging economies and lesser developed areas of the world – what is called in international jargon "capacity building".

In April, there was a major explosion in a Chinese chlorine factory. Five years ago, we would never have learned about it. Today, within 12 hours it made the front page of the Internet edition of *China People's Daily* – complete with photographs. Euro Chlor, with other members of the developed world's chlorine industry, subsequently visited the Chinese authorities and manufacturers have agreed to hold a stewardship seminar there next year.

This builds on industry outreach seminars held in the past year in Argentina, Brazil, India and Russia. Closer to home, we are holding a technical seminar in Prague in January, located to encourage participation by producers and users from the new EU-10 countries. We were delighted to welcome an additional Polish member this year – only two manufacturers in the former Accession countries are not yet members.

There is an expression that "actions speak louder than words". If our capacity-building activities can make a substantial improvement to the health, safety and environmental performance of the chlor-alkali industry across the world, then in time our reputation will catch up with reality.

Dr Barrie S Gilliatt
Executive Director

Sustainability

Major milestone in responsible production

Publication of long-term sustainability targets in January 2004 was a major milestone in the European chlor-alkali sector's responsible production programme. Producers have steadily worked together over the past 15 years to respond to environmental concerns and improve public acceptance of chlorine. Now, through Euro Chlor, measurable sustainability indicators have been set for 2010 and the federation will report on progress annually.

Long-term initiative

The seeds for the European chlor-alkali industry's responsible production strategy were sown nearly 10 years ago. At the chlorine industry conference *Environment and the Chlorine Industry* in 1995 – long before sustainability became fashionable – Dr Dieter Becher (former Bayer AG Board member) spoke of the importance of industry self regulation through voluntary agreements. He unveiled a four-point strategy to develop a sustainable future for chlorine and "a balanced progress between economy and ecology."
The strategy included voluntary agreements encompassing continuing efforts to reduce mercury pollution of the seas, better recycling programmes for chlorinated solvents and PVC plastics plus technical assistance to help East European and emerging industrialised nations reduce environmental pollution. Also at the conference Baron Daniel Janssen (Chairman of the Solvay Board of Directors) said that such agreements were "real commitments binding as to their objectives" and the best approach in dealing with the industry's impact on the marine environment.

Delivered on commitments

During the period from 1995-2003, the industry delivered significant progress on the commitments made at its 1995 conference in Brussels, including completion of a programme of marine risk assessments, continuing reductions in manufacturing emissions and recycling of chlorinated solvents. The PVC sector too laid the foundations for development of recycling technologies, which led to the *Vinyl 2010* initiative (see left panel).
Building on its earlier experience, Euro Chlor went on to develop a broader sustainability strategy based on six voluntary commitments. These required members to:

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

Indicators based on the above six commitments were announced in February 2003 and last year, performance improvement goals for 2010 were developed.

Goals unveiled for 2010

In January Euro Chlor unveiled the industry's goals for 2010. Now, through Euro Chlor, measurable sustainability indicators have been set and the federation will report on progress annually. About 150 experts from 14 countries heard about the goals at a sustainable chemistry workshop organised by the German Federal Environmental Agency (UBA) in Dessau. Euro Chlor Environment & Regulatory Affairs Director Arseen Seys described the goals and reported on baseline measurements for 2001-2003.
Dr Seys said that "by establishing sector performance goals – particularly for environmental emissions, energy saving and safety – producers will be able to benchmark their individual performances versus the whole industry...motivating individual plants to continuously improve."
The approach taken by Euro Chlor was commended during the workshop as a good example of how other industries could similarly approach sustainability.

A committed industry

Forty-one chlorine producers representing 97% of EU-25 chlorine capacity are committed to the programme, which is one of the first comprehensive approaches to sustainability within a major chemicals sector. It represents an important step for the industry in improving its performance by addressing the "triple bottom line" of environmental, social and economic issues.
The performance improvement goals encompass areas such as energy efficiency, emissions and the use of resources (see pages 4-7). They are described in detail in the special sustainabilty section on the Euro Chlor website at www.eurochlor.org and provide solid evidence of the sector's commitment to transparency and openness backed up by performance.

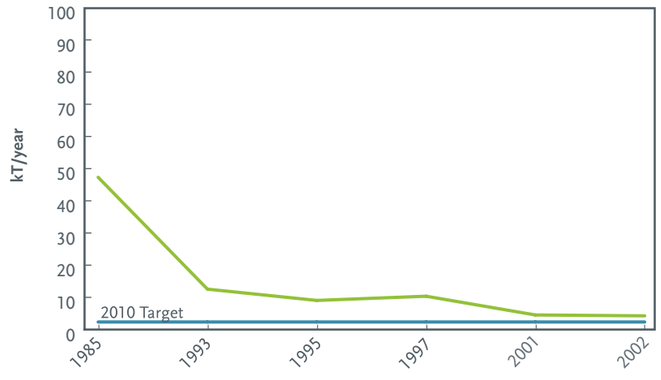
Vinyl 2010 on track to achieve challenging targets

PVC is the largest single application of chlorine in Western Europe and the drive for sustainability is as important for manufacturers and users of this plastic as it is with Euro Chlor members. In 2003, PVC resin producers and fabricators attained many of their waste management targets under the industry's *Vinyl 2010* sustainable development initiative. They are also well on track to achieve challenging targets for 2005.
During 2003, the industry exceeded its recycling target for PVC windows of 3,407 tonnes by 41% (4,817 tonnes). The 5,068 tonnes target for pipes and pipe fittings was exceeded by 21% (6,150 tonnes). For roofing membranes, the target 536 tonnes was just exceeded at 544 tonnes. The new 2005 targets require the sector to recycle 50% of collectable PVC waste.

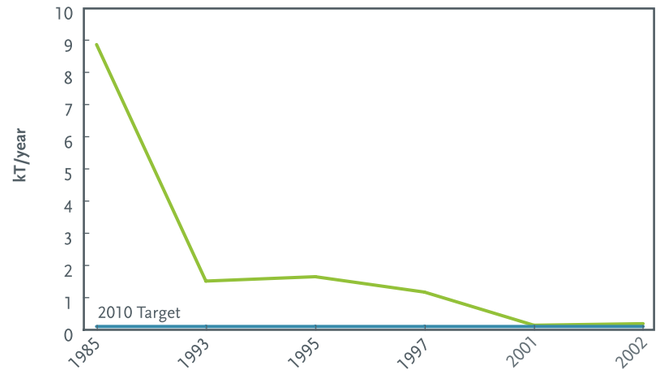
Eighty-five per cent of medicines are synthesised using chlorine chemistry. These include pain-killers, drugs to reduce blood clotting, cancer treatments and tranquilisers. Disinfection of drinking water is probably chlorine's best known application. Water-borne diseases such as typhoid, cholera, dysentery and gastroenteritis have killed more people than all the wars in history.

Performance measures

Emissions to air[1]



Emissions to water[1]



COC emissions

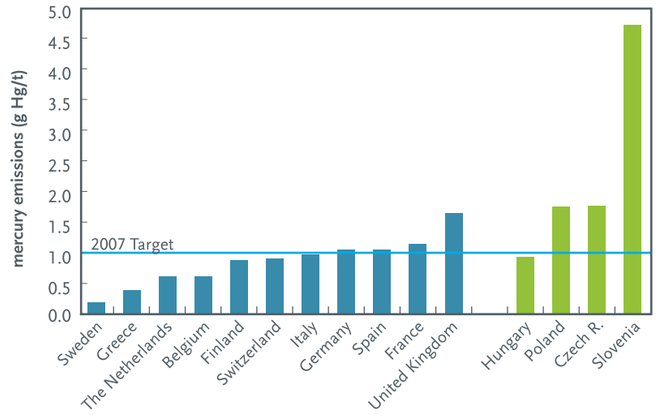
Measurable goals for 2010 have been established in order to further reduce total manufacturing emissions of 22 chlorinated organic compounds (COCs) by 75% to water and 50% to air against the 2001 base line.

The compounds were chosen from various regulatory priority lists for emission reductions. Projected future reductions come on top of an average 94% reduction in emissions from 1985 to 2001.

Many of the 22 substances, but not all, are included in the European Pollutant Emission Register (EPER) published on behalf of the European Commission in May. However, EPER shows only a specific moment in time (2002 data). Euro Chlor data for each substance spans the period 1985-2002 and therefore can be used to demonstrate significant reductions in emissions over time.

[1] 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 and furans (as TEQ); hexachlorobenzene; hexachlorobutadiene; hexachlorocyclohexane; pentachlorophenol; tetrachloroethylene; trichlorobenzene; trichloroethylene; vinyl chloride.

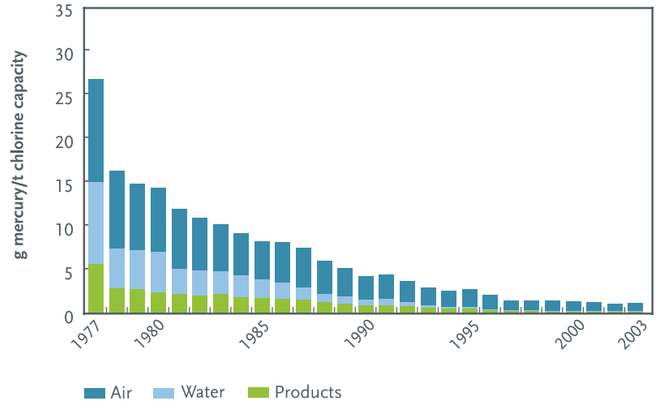
Compliance with commitments in 2003



Mercury emissions

Commitments for mercury emissions were set in 1998 for West European plants to achieve total emissions of less than 1g/t of chlorine capacity on a national basis by 2007 with no individual plant exceeding 1.5 g/t of chlorine capacity. These values are to be reviewed at the end of the target period. Plants in the four countries shown on the right of the graph were not part of the original voluntary commitment and are not yet all signatories to the agreement, but are shown for completeness.

Western European mercury emissions



In 2003, emissions from all plants across Europe reached an all-time low of 6.8 tonnes (Western Europe 5.8 tonnes) or 1.14 g/t of capacity (1.06 g/t for W. Europe). Emissions to water are almost negligible and accounted for less than 400kg in Western Europe.

Performance measures

Energy consumption

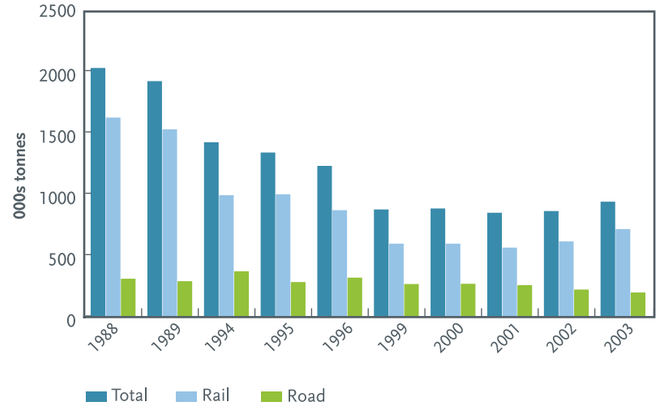
Energy utilisation

The main contribution for energy savings derives from the conversion of mercury plants to membrane technology. Net savings in the order of 15% have been identified in the Best Available Techniques reference (BREF) document for chlor-alkali production. However, since today less than half of chlorine production in Europe is mercury-based, savings from this source are unlikely to exceed 7.5% when all plants are converted.
An improvement of 5% by 2010 has been set as a challenging target. New technological developments, such as the combination of an electrolytic cell with a fuel cell, have the potential to significantly decrease the energy use, but these are realistically unlikely to be commercially available in this decade.

Hydrogen utilisation

The hydrogen co-produced with chlorine and caustic soda is of high quality and can be used as a fuel or chemical raw material. The 2010 goal is for 95% to be utilised and less than 5% vented.

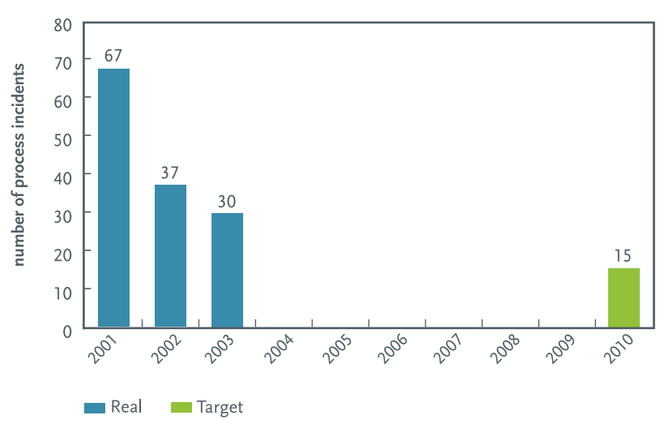
Transportation



Transport & production

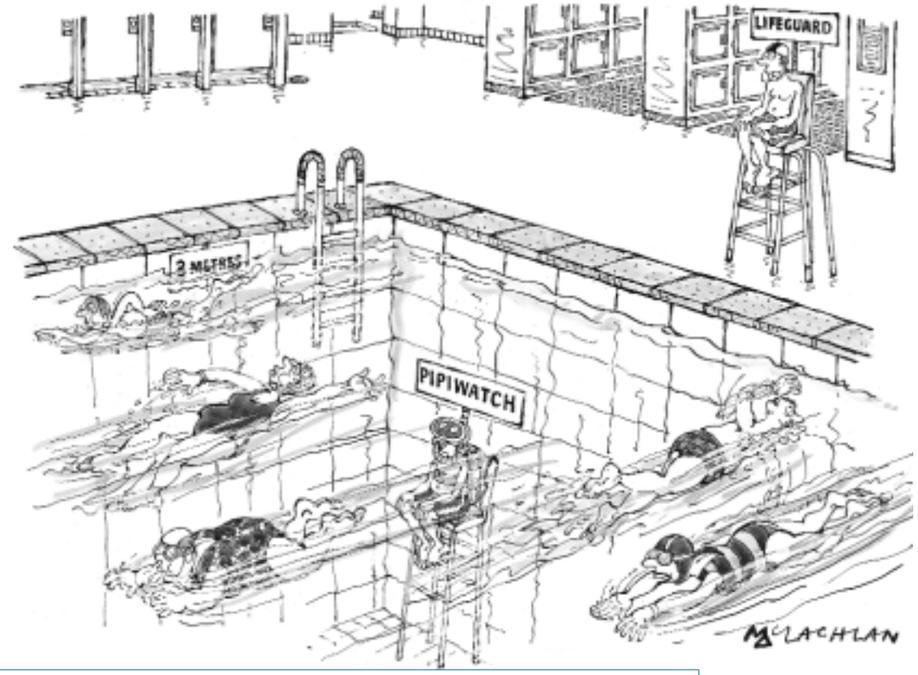
There were no transport incidents in 2003, nor the previous two years. The target for 2010 is also zero. There have been no fatalities from bulk chlorine movement in Western Europe in the last 50 years (incidents are defined as any injury, spill greater than 5kg, damage or public disruption).
In 2003, 927,000 tonnes of chlorine were transported (less than 10% of total production) of which 76% was by rail and 24% by road. The average distance for rail transport was 316 km while for road it was 182 km. Additionally, 1.2 million tonnes were moved by inter-plant pipeline to adjacent facilities. The remaining 7.4 million tonnes (representing 78% of the total chlorine produced) were all used captively on site.

Process incidents and losses



Incidents are classed as events involving a fire or explosion or release of certain chemicals which cause a fatality, serious injury or property damage of more than €100,000. Losses include any spill of chemicals to air, water or land that have an environmental or health impact and result in disruption of the plant or neighbouring community. Industry aims to achieve a 75% reduction in process incidents from 67 in 2001 to 15 in 2010.

Stakeholders' views



Swimming is an increasingly popular recreational activity in Europe. Good hygiene requires swimmers to shower, wear a cap and visit the toilet before entering the pool. Regular and proper use of chlorine disinfectant destroys illness-causing germs in the water.

More progress than most, but key questions remain

Spontaneous feedback from stakeholders on the chlor-alkali industry's sustainability efforts has been relatively muted since Euro Chlor published a strategy in January 2002. The federation decided, therefore, to throw open the pages of this year's *Industry Review*. Nine people, each with different perpectives on the chlor-alkali industry, were invited to express their viewpoints in this section.

Patrick Hennessy
Director of Environmental Aspects of Enterprise Policy, Resource-Based and Specific Industries, Enterprise Directorate-General, European Commission

Sustainability efforts show what can be achieved

Euro Chlor's programme illustrates what can be achieved when companies work together to improve the sustainability of their production processes and products. In the coming year we shall be looking at better ways to give these types of industry initiatives impetus within a policy framework. This will aim to create conditions for the maximum number of enterprises to find an economic interest in improving their environmental performance. It will also develop measures to strengthen partnerships between local authorities and the private sector.

The EU has seen a major shift towards environmental sustainability through considerable improvements in industry's eco-efficiency over the last two decades. These improvements result from increased environmental regulation and stronger market competition as well as increased investment and better management of resources by industry.

A competitive and innovative economy is a key prerequisite for environment quality and high levels of employment. Favourable economic conditions and flourishing businesses are essential to generate the financial resources necessary to tackle the environmental pressures of economic activity and make it possible for companies to invest in cleaner technologies and innovation.

Many European businesses now aim to "produce more with less", recognising the economic value of more efficient production. It is these moves towards more sustainable production patterns which will help break links between environmental degradation, economic growth and production.

Dr Steffi Richter
German Federal Environmental Agency (Umweltbundesamt)

Need for "continuing dialogue"

Euro Chlor's initiative to develop and track measurable sustainability indicators for the European chlor-alkali sector is very useful and welcomed by our agency. This approach permits the authorities to monitor progress and the producers to benchmark their performance against the industry as a whole. We believe that this will enhance public understanding and confidence in your industry.

Some key questions remain unanswered, however, because such an approach can only be considered sustainable if the environment is not used excessively as a resource or as a sink for residual materials. For example, in the longer term will all chlorine-based products be safely recycled? Is there a convincing solution to the problem of safe recovery or disposal of long-lived chlorinated derivatives? How does the chlor-alkali industry plan to meet the goals of the OSPAR Ministerial Conference (1998) to move towards the target of the cessation of discharges, emissions and losses of hazardous substances by the year 2020?

Your current initiative is an effective contribution towards answering these questions and it remains important that we maintain a continuing dialogue as the industry works towards achieving its sustainability targets.

Peter Knight
Former UK Environmental Journalist of the Year
Director, Context (corporate social responsibility consultancy)

Resisting the inevitable

If you have ever dragged a kicking, screaming child to the dentist you'll have some idea of how an outsider views the progress of Euro Chlor as you resisted the inevitable over the past decade or so. But while your squeals have been loud and unpleasant, you have made a lot more progress than most. Congratulations are in order, but hold the party.

No matter how essential chlorine might be (and this is not an incontrovertible truth!), certain of your everyday industrial practices are quite alarming to an outsider. Take mercury. You will continue pouring this horrible stuff into our environment until 2020. The mercury target in your sustainability programme is hardly stretching, even within the cost constraints of an industry under threat from cut-price manufacturers in the East.

Then there is climate change, finally and begrudgingly acknowledged by most as one of the biggest threats to man. You have promised to cut energy use by 5% within six years. Is this really enough for one of the most energy-intensive processes around?

Maybe I'm being naively harsh. You have tried hard and continue to do so even now when the critical spotlight has shifted to others. Much of your success is because you have been brave enough to debate issues with your critics and to respond to criticism. Keep it up. But be warned: dentists remain as beastly ever.

Stakeholders' views

Dr John Emsley
Author of *Nature's Building Blocks* (Oxford University Press).

Chlorine "not something we can do without"

It is reassuring that chlorine manufacturers are not only setting sustainability targets for their industry, but are letting people know what these are and the timescale for achieving them. Lack of information about the industry in the past has led to public suspicion – perhaps not surprisingly, because chlorine is highly dangerous. Some compounds previously made from it, such as CFCs, were environmentally damaging, while others, such as PCBs, were a threat to heath. In an atmosphere of ignorance there is every danger that misinformed public opinion might lead to misguided legislation.

Chlorine is not something we can do without. Its benefits can be universal and should be universal. Thanks to chlorine, much of the world's drinking water is free of pathogens. If all products requiring chlorine for manufacture were removed from society, we would find ourselves back to the days when disease, scarcity, and drabness were the lot of the vast majority of people.

By the end of this century, the chemical industry will have to be based on sustainable resources and will be expected to generate products without any concomitant waste production. There is no reason why the chlorine industry cannot achieve this goal within the present generation's lifetime. Its willingness to set targets to this end, and push hard to achieve them, serves as a model for others.

Philippe Engel
Manager, Atofina Lavera plant, France

Local communities: key stakeholders

The chlorine industry remains acutely aware of the need for sustainable development, a concept that became more concrete in 1995 when the industry first unveiled plans to achieve "a balanced progress between economy and ecology." After all, hasn't every manufacturing or production engineer worked to reduce consumption of electricity in an electrolysis cell? Hasn't every foreman aimed to ensure plant reliability and security? And hasn't every process technician thought about how to reduce steam usage? At a local level, the future of a plant depends on continuing to demonstrate to the surrounding community a commitment to sustainability. Safety at chlorine plants remains paramount, with producers under continuous pressure to achieve zero accident rates. An industry's painstakingly-built reputation for safety can be rapidly destroyed by a single accident and chlorine could all too easily regain its image as a dangerous product.

Companies must demonstrate that they are committed to operating safely, protecting the health of their workers and minimising the impact of their operations and products on the environment. There must be open communications with local communities and consumer organisations, who need reassurance about the industry's potential health effects on people and nature.

Martin Greenhalgh
Managing Director
Shaw Valves, UK

Efforts to improve "go largely unnoticed"

Equipment manufacturers play a key role in helping the chlor-alkali industry meet its sustainability goals. As suppliers, we contribute valuable expertise and experience to meet the many, detailed equipment specifications set by Euro Chlor. The federation's GEST (safety) standards are recognised worldwide and make a significant contribution to the global reduction of emissions, accidents and energy consumption.

Efforts by Euro Chlor, its members and equipment suppliers to develop and maintain high-standard equipment specifications are substantial and go largely unnoticed. However, it is vital work: equipment that meets GEST standards gives the purchaser confidence that products reflect best available techniques and industry know-how.

During the past decade, there have been dramatic advances in the performance of isolation and control valves manufactured by my company, which is a technical correspondent of Euro Chlor. Our progress represents a small part of the broader picture. Combined with enhancements across a wide range of equipment, it provides clear evidence of how suppliers can contribute to the chlorine industry's efforts to achieve continuous improvements in its safety, environmental and economic performance.

Professor Kevin C Jones
Environmental Science Department
Lancaster University, UK

Monitoring to check performance

It is extremely encouraging to see that Euro Chlor has developed key performance indicators for its sector. This is one clear way for the chlorine industry to demonstrate that it is "lightening its footprint", and to assess future needs. It also encourages training and education, for example, by better understanding potential impacts of specific processes on emissions.

Monitoring and assessment programmes will be needed to check performance against targets. These may fulfil different purposes: government-sponsored monitoring may focus on specific urban or background sites, for example, while industry may focus on trends in specific discharges to air or water. Industry's substantial reduction in mercury emissions has been clearly detected by ambient monitoring.

Risk assessment and research funding are an extension of these industry efforts. Our research at Lancaster University on dioxins is a good example. With Euro Chlor funding, we have assessed how the environmental 'footprint' of dioxin has changed over time and gauged implications for changing sources.

Sound science-based knowledge is essential in supporting sensible and reasoned decision-making on future chemicals management. Informed choices can then be made on whether further investment in source reduction is necessary, or whether resources may be more appropriately used to tackle other priorities.

Dr Michael Reubold
Editor, *CHEManager*, Germany

Industry has regained credibility

There is no doubt that chlorine is one of the most important basic raw materials for many goods and processes that improve the quality of modern life. Chlorine-based products and technologies help us save energy, reduce waste and pollution, cure diseases or provide clean water. Without chlorine, innovation in fundamental sectors like healthcare, construction and transportation would be impossible.

However, chlorine production has long been a process with high energy consumption and an environmental impact. The industry has faced criticism, but it improved environmental performance by developing new technologies that are more efficient and sustainable in terms of resource consumption and hazardous emissions.

The chlorine sector has also demonstrated its social responsibility by taking care of manufacture and transport safety, setting up life cycle analysis and risk assessment programmes, and developing PVC recycling technologies. In taking these initiatives early and voluntarily, the chlorine industry regained a high level of credibility. Much has been achieved in enhancing public understanding of the challenges faced by the chlorine industry, but the sector should continue to further improve transparency and communications.

The EU Commission's future plans for chemicals legislation will bring major challenges for the chlor-alkali sector. It will require the combined efforts of the chemical industry to convince politicians that the current draft will yield little environmental benefit, while significantly reducing the industry's competitiveness.

Janet Wright
Senior Consultant
Tecnon OrbiChem, UK

Environmental pressures jostle with economic concerns

One of the biggest threats to the European chlor-alkali industry has been environmental pressure. In our opinion, Euro Chlor has demonstrated that the industry operates in a safe and responsible manner by setting targets and providing data on key emissions.

Two environmental issues remain: conversion from mercury technology and elimination of asbestos diaphragms. Mercury conversion is underway, but cost implications could result in smaller, less integrated plants closing. While possible alternatives to asbestos diaphragms exist, producers may convert to membrane technology due to customer demand for low-salt material. A net reduction in European capacity is likely.

Another major issue is transportation safety. The Dutch government plans to eliminate chlorine transportation by 2005; Akzo Nobel is to restructure production in The Netherlands as a result. If other governments follow, this will put pressure on producers and could jeopardise the long-term future of some businesses.

Many businesses are now owned by investment companies, which demand a quick and high rate of return. Chlor-alkali business cycles used to last seven years; today they are much shorter. To remain competitive, costs must be controlled. Escalating prices for electricity – which accounts for over half of chlor-alkali production costs – mean that moves to improve energy efficiency are receiving heightened attention.

Again, Euro Chlor is helping in this area, as it has set targets for reduction in overall energy consumption.

Legislative developments

In addition to their role in medicines, chlorine compounds help protect hospital patients from infections through their use as disinfectants and antiseptics. PVC, a plastic made with chlorine, is used in 25% of medical devices. These include blood bags, sterile tubing, catheters and prosthetics.

Active advocacy on many fronts

During the past year, Euro Chlor has maintained a strong and consistent emphasis on communicating industry perspectives on European and international regulatory issues related to chlorine. Advocacy efforts have focused on the new EU mercury strategy, water policy, air quality, persistent organic pollutants, workplace exposure to electromagnetic fields and on some unintended effects of the EU emissions trading scheme.

Water Framework Directive

The Water Framework Directive (WFD) of 2000 aims to meet society's expectations for cleaner rivers, lakes, groundwater and coastal beaches. It provides a classic example of why it is essential for industry to maintain a continuing dialogue with regulators and remain vigilant as broad policy is transposed into detailed regulations.
Four years ago, a former Euro Chlor chairman underscored the WFD's importance when he predicted that it could be "potentially extremely serious" for the chlorine sector. Since then, the federation and its members have actively contributed to the process of standard setting. There has been emphasis on development of Environmental Quality Standards (EQS) and Emission Limit Values (ELVs) for 33 priority substances, of which 11 are chlorinated compounds (including 1,2-dichloroethane, dichloromethane and chloroform). EQS and ELVs must be set this year by the EU Commission.

A subset of the priority substances – classified as priority hazardous substances (PHS) – potentially poses the greatest challenge for industry as releases and losses should cease by 2020. These include mercury, hexachlorobenzene, hexachlorobutadiene and short chain chlorinated paraffins.

Unrealistic approach

There are five draft "daughter" directives to the WFD and in the one on EQS and emission controls, the EU Commission wants to define the term "cessation" of emissions for PHS as meaning "no detectable concentration" in effluents. Chlorine producers continue to optimise their environmental performance, but believe that such a definition is unrealistic and unworkable. It potentially threatens the continued operation of some plants. Euro Chlor, Cefic, and other European associations representing crop protection and oil refining companies have expressed their key concerns in a joint submission to the Commission.

EU Member States too are increasingly questioning the scientific workability of the Commission's water policy proposals and the feasibility of a uniform EU-wide compliance system. However, in general they support the need for legislation on management of river basins across geographical boundaries.
The EU Scientific Committee on Toxicity, Ecotoxicity and the Environment has commented on the scientific basis of the Commission's EQS proposals for a number of substances, including mercury, on which discussions continue. At several meetings called by the Commission to discuss EQS values, Euro Chlor has drawn on results from the industry's voluntary marine risk assessment programme in advocating a science-based approach. Discussions between Euro Chlor and EUREAU, representing the water supply industry, resulted in an approach to defining EQS values for drinking water abstraction that resolves the concerns of both industries. The Commission has responded positively to this approach.
To define possible emission control measures, the Commission has reviewed and ranked by importance various sources taking into account industry's input. Euro Chlor supports the use of the IPPC Directive for implementing measures on point sources.
Under new guidelines, the Commission is required to undertake an impact analysis on the effect of new legislation. In conjunction with the European Council of Vinyl Manufacturers, Euro Chlor has provided input to the study on the impact of the WFD. The first draft section released – on the effect on the chlor-alkali industry of a ban on mercury emissions – is highly unsatisfactory and submissions will be made. In addition, Euro Chlor is conducting its own economic impact study for use in advocacy efforts with the EU institutions.

Emerging EU mercury strategy

The EU's original motivation for developing a mercury strategy arose in 2001 when the Council of Ministers called on the Commission to report on handling metallic mercury from decommissioned chlorine plants. The concern arose from a realisation that an estimated 11,600 tonnes of pure mercury remain in 52 European plants yet to be converted.
Based on current global market conditions, this represents sufficient to meet worldwide demand for several years. Subsequently, the remit has been broadened to examine production, use and disposal of mercury from all sources.
In anticipation of this issue, Euro Chlor members had already agreed with the sole European mercury producer, Minas de Almadén, to return pure mercury from decommissioned cells and replace tonne-for-tonne newly-mined metal. This saves energy through eliminating the need to process ore and reduces emissions from mining new metal. About 1,000 tonnes has been recycled under the initiative. As well as the direct environmental benefits, the agreement provides market stability and potentially easier control of the eventual destination of the material. Should the supply of mercury eventually outstrip market demand, Euro Chlor is finalising contingency plans for long-term storage.
In preparation for the publication of the EU mercury strategy later this year, consultations have been held both in public and on the Internet. Euro Chlor's position has been well ventilated. In their own submissions, France, Germany and the UK supported the Euro Chlor approach of reusing surplus mercury from decommissioned plants to replace metal that would otherwise be mined.

Air quality legislation acknowledges low mercury risk

The fourth and final "daughter" directive to the 1996 Air Quality Framework Directive encompasses mercury, arsenic, cadmium, nickel and polycyclic aromatic hydrocarbons (PAHs) and was adopted in April 2004 by the European Parliament and Council of Ministers.
The directive has no binding emission limits, but does set ambient air target values for arsenic, cadmium, nickel and PAHs. The deadline for achieving these targets is December 2012. No target values have been set for mercury, since it has been concluded that current mercury levels in ambient air do not pose a human health risk. The directive will also require countries to monitor emissions to air and depositions of heavy metals, including mercury. The results will be made public.
Euro Chlor has provided inputs to the Commission and followed progress of the directive through the European Parliament, where amendments requiring zero deposition of mercury into the atmosphere were rejected.

Support for POPs legislation

The EU Regulation on persistent organic pollutants (POPs) was adopted by the Council of Ministers in April 2004. It aims to prevent production, marketing and use of intentionally-produced POPs and minimise emissions of unintentional by-products such as dioxins and hexachlorobenzene.
The regulation will allow the EU to implement the main provisions of the Stockholm Convention on POPs that came into effect May 2004, but which are

Legislative developments

not yet covered by EU legislation. It will also encompass the protocol of the 1979 Convention on Long-Range Transboundary Air Pollution on POPs, which came into effect October 2003.
The final compromise agreed by the Council is supported by industry and follows extensive advocacy efforts by Euro Chlor and Cefic. It recognises three key points:

1. Incineration on land is the preferred disposal method to ensure POPs are destroyed or irreversibly transformed;
2. The Regulation maintains the possibility of allowing restricted uses of substances categorised in future as POPs;
3. Release of unintentional by-products should be minimised in line with the Stockholm Convention.

The next step is for the Commission to set concentration limits for POPs in waste by end 2005. Euro Chlor has offered to contribute to these efforts.

Discussions continue on disposal of POPs in waste

Under the Stockholm Convention, parties to the Basel Convention are working on three key definitions – what is meant by "low POPs content", destruction levels (in order to eliminate substances with POPs characteristics), and environmentally-sound disposal methods. These are essential for cases where destruction or irreversible transformation is not required under the Stockholm Convention (typically when the POPs content is low or if destruction or irreversible transformation is not the environmentally-preferred option).
Although discussions continue, Euro Chlor has achieved a number of policy objectives under the umbrella of the World Chlorine Council. These include acknowledgement that incineration is environmentally sound, and that Best Available Techniques (BAT) should be applied. Industry's position was strengthened because the EU POPs Regulation recognises incineration as a preferred means of destruction.

Successful collaboration on EMF Directive

Euro Chlor successfully collaborated with European aluminium and electricity-generating industries on an intensive advocacy initiative prior to European Parliament and Council of Ministers' adoption April 2004 of the Electromagnetic Fields (EMF) Directive.
The directive, which has to be implemented by Member States no later than April 2008, aims to improve health and safety standards for workers exposed to EMFs. During more than 100 years of industrial chlor-alkali manufacturing experience, there has been no evidence of adverse worker health effects. However, the chlorine industry remains concerned that the directive could unnecessarily affect the small number of specialised workers active around transformers and rectifiers in electrolysis cell rooms. This concern arises because standardised methods to calculate values defined in the directive have yet to be developed.
CENELEC, the official body for electricity standardisation, has been charged with developing such a methodology and this could take up to four years. Euro Chlor's technical experts plan to support the process by offering inputs based on the industry's long production experience.

Concerns about excessive power prices

Electricity is a raw material which typically represents some 60% of chlor-alkali production costs. Energy for electrolysis is excluded from the EU Energy Taxation Directive that came into effect in January 2004. However, chlor-alkali producers are potentially faced with an increase in energy costs resulting from several factors, including the EU Emissions Trading Scheme.
Early projections indicate that this scheme will provide power generating companies with a windfall profit, costing chlor-alkali producers alone an additional €250 million. Euro Chlor has joined an alliance of energy-intensive industries in Europe to increase awareness of the issue among European and national authorities and to advocate measures to counteract excessive power prices.

The Peruvian government reacted to negative environmentalist claims by suspending chlorination of public water supplies. The resulting cholera epidemic in 1991 spread to neighbouring countries, affecting 1,000,000 people and causing more than 10,000 deaths.

CHLORINATED SOLVENTS AND PARAFFINS

Naturally-occurring TCA a likely cause of forest die-back

A €400,000 study funded mainly by industry has confirmed that the decomposition of dry-cleaning solvent perchloroethylene (PER) is not a significant contributor to environmental damage of pine trees in wet, elevated forest areas. The 18-month study on the degradation product trichloroacetic acid (TCA) was required by the EU after some academics had hypothesised that TCA contributed to the destruction of trees in Germany's Black Forest.
Eight sites from the Austrian border to the Black Forest and two in France (Vosges and the Ardennes) were selected for investigation. Results confirmed earlier research by the European Chlorinated Solvent Association, a part of Euro Chlor, that natural formation of TCA within soil is primarily responsible for forest damage and that degradation of man-made PER does not significantly contribute to TCA formation.
Completion of this study, which was also supported financially by the UK Environment Agency, removed an important obstacle to completion of the EU risk assessment for PER, which will be discussed in 2005 along with the trichloroethylene (TRI) risk assessment.
Two new studies of kidney toxicity – a key factor when evaluating human health risks – contradict the concept of a direct link between TRI and kidney cell DNA damage. They also support the existence of a threshold for TRI-induced kidney cancer.
If this is validated by two ongoing epidemiological studies among metalworking communities in France, ECSA will propose reversal of the 2001 reclassification of TRI from a Category 3 to a Category 2 carcinogen under the Dangerous Substances Directive.

Regulatory pressures continue

Pressure continued in 2003 from some countries, particularly Denmark and Germany, to ban methylene chloride in paint strippers. An EU study on vapour retardants published mid-2004 recommends further usage restrictions. The industry view is that all alternative systems have their own risks and formulators have proposed an EU-facilitated forum to debate the risks versus benefits.
The EU ban on short-chain chlorinated paraffins (SCCPs) for metal and leather working came into effect January 2004. This year, the EU Commission is updating risk assessments for other SCCP applications and medium-chain chlorinated paraffins (MCCPs). Additional use restrictions will likely ensue for SCCPs, but not MCCPs.

Science

Few people realise that nature produces an abundance of chemicals – from malic acid in apples to an Agent Orange isomer tick sex pheromone. Despite propaganda by opponents, chlorinated chemicals are not exclusively man-made – more than 2,320 organochlorines occur naturally. Chemophobia must not be allowed to overshadow chemistry's benefits to human welfare.

Sound science underpins industry advocacy

Science plays a key role in Euro Chlor's efforts to listen and respond to society's concerns about the sustainability of chlorine chemistry. Without sound science, Euro Chlor faces an even tougher challenge representing the industry. Legislators need to be faced with the facts when they try to balance conflicting views and evidence regarding environmental, health or safety concerns related to chlorine and its derivatives. About a third of Euro Chlor's annual budget and four of the Secretariat's staff of 14 is devoted to scientific initiatives such as those described in this section.

HPV initiative update

About 80 chlorinated substances are being assessed for toxicological and environmental effects by the chemical industry in Europe, Japan and North America under a voluntary programme managed by the International Council of Chemical Associations (ICCA) in conjunction with the OECD. The High Production Volume (HPV) initiative aims to provide harmonised, internationally-agreed data and initial assessment reports for about 1,000 chemicals.
Upon completion, assessments are peer reviewed by an OECD member country sponsor prior to general discussion with representatives of other OECD members. Euro Chlor committed three years ago to compiling data on 31 of the 80 chlorine-related chemicals as part of a global risk assessment programme. Sixteen of these assessments have been completed and a further three submitted are expected to progress through the system this year. Although OECD is unlikely to be able to process any further assessments, Euro Chlor companies aim to have the data available for the remaining 12 substances by the year end. At the OECD meeting in May 2004, the chlorine dossier was assessed. It was agreed that current use of chlorine posed no human health concerns. With OECD endorsement, the environmental risk section for chlorination by-products will be covered by the EU risk assessment being undertaken through the Existing Substances Regulation.

Assessments posted on Internet

To enhance transparency and public confidence in the HPV process, Euro Chlor is posting assessments on its website, *Chlorine Online*, as they are finalised by industry and submitted to the OECD. Once reviewed by the authorities, final OECD-endorsed versions are posted.
In addition, the Euro Chlor website includes background information on 14 other chlorinated substances being worked upon by members under the EU Existing Substances Regulation risk assessment programme.

Sodium hypochlorite

The risk assessment for sodium hypochlorite bleach under the Existing Substances Regulation is due to be finalised by end 2004 following discussion by Member States and the European Chemicals Bureau.
Information was provided to the Italian rapporteur by Euro Chlor in partnership with the International Association for Soaps, Detergents and Maintenance Products (AISE). The assessment covers potential direct risks to human health and the environment in a range of applications. These include household disinfection, textiles, industrial cleaning, cooling water, pulp and paper, drinking water and sewage treatment.
Sodium hypochlorite's direct environmental impact is minimal, since it is quickly broken down due to its high reactivity. Chlorinated by-products such as trichloroacetic acid and chloroform are also covered by the risk assessment. Other compounds that may be produced at very low levels have been investigated in a Whole Effluent Assessment of raw sewage (a "worst-case" model).
Results showed that chlorination of raw sewage does not cause additional toxicity, potential for bioaccumulation or persistency.
For human health, new information and monitoring data have been compiled to assess workers' and consumers' exposure under various scenarios. To date, no risks for human health have been identified.

Children's health initiative

In June 2003, the EU Commission launched plans for a long-term initiative on environmental factors linked to children's health entitled SCALE (science, children, awareness, legislation and evaluation).
The Commission set up technical working groups covering priority health effects and monitoring activities with an ambitious programme to report findings by the year end. The timescale was determined by the EU's need to have an adopted action plan before the WHO ministerial conference in June 2004. Representatives of Euro Chlor participate in three technical groups: monitoring of dioxins and PCBs (polychlorinated biphenyls), heavy metals (including mercury) and endocrine disruptors. Cefic is involved in other groups and is liaising closely with Euro Chlor on neurodevelopmental effects. Four pilot studies have evolved as part of the EU action plan and these could complement the Euro Chlor data gathering and monitoring activities.

Workshop on soil chlorine chemistry

Information on the natural chlorine cycle in soil – including how organochlorines are formed and degraded, and their ecological role – was shared at a successful Euro Chlor workshop on Soil Chlorine Chemistry (Brussels, December 2003). Chlorine is a natural constituent of soil organic matter, but the roles played in the ecosystem by natural organochlorines continue to provoke interest within the scientific community. The number of natural organochlorines that have so far been identified in nature has risen to 2,200.

WCC Ambassador programme

Speakers and support were provided by Euro Chlor for two World Chlorine Council science congresses in Sao Paulo, Brazil (September 2003) and Buenos Aires, Argentina (May 2004). Held under the WCC Ambassador Programme, these events aim to promote the application of science-based human health and environmental risk assessment procedures around the world.

Information & education

Chlorine is everywhere. It occurs naturally in the environment and has been used industrially for more than 100 years. Thousands of indispensable products – surgical equipment, medicines, car components, herbicides, waterproof clothing and computer equipment – are made using chlorine or its co-product caustic soda.

Expanding access to wide-ranging information

Euro Chlor is committed to being as transparent and open as possible about issues of concern to the European chlor-alkali industry and its effects – perceived or real – on the environment, people and society at large.
Of course, there will always be a few legal or competitive constraints to making certain data publicly available. However, during the past decade the federation has progressively expanded and enhanced public access to a wide range of scientific, economic and general information.

A consistent policy of openness has enhanced trust among stakeholders and key opinion formers at all levels – national, European and international. Improved public understanding also has a positive impact within the industry: it enhances confidence in collaboration under the umbrella of Euro Chlor on key issues. This results in timely decision making within committees or working groups and strengthens representation on emerging issues.

Main Internet resource

The *Chlorine Online* website continues to be our main Internet information resource. In 2003, the year-on-year number of visits rose 9% from 142,000 (2002) to 154,400. Website-generated enquiries on chlorine chemistry totalled 233, a 34% decline compared with 351 in 2002. Information requests were handled from 47 countries with Germany (88) the leader, followed by the USA (57), UK (42), The Netherlands (26) and Belgium (25).

To extend the impact of the *Chlorine Industry Review 2002-2003*, the dramatic black and white photos used to illustrate the publication were used in a 2004 desk calendar. Both were distributed to key European stakeholders.

Caustic stocks reported monthly

During the year, Euro Chlor issued 18 news releases on a variety of topics and expanded its publication of key statistics to include monthly stocks of caustic soda as well as chlorine production data.
Chemical industry writers participated in a press briefing with Euro Chlor co-chairman René Scheffers and Executive Director Dr Barrie Gilliatt when the industry's 2010 sustainability targets were announced in January 2004.
Communications at the country level are the responsibility of national chlorine groups, with Euro Chlor providing support for projects that can be adapted or adopted in different markets.
For example, the English-language *Chlorine Tree* poster was translated into a fourth language and 2,000 copies were produced in Dutch by BelgoChlor; Spain's Asociación Nacional de Electroquímica (ANE) distributed an additional 1,500 of the Spanish version with its newsletter, *Infoclor*.
BelgoChlor, which is part of the Federation of the Belgian Chemical Industries, was the sponsor of several conferences for young people and developed two digital learning packs for primary and secondary school teachers (see www.anywize.net). This latter initiative was supported by the Flemish Department of Education.

Belgian website updated

BelgoChlor updated and promoted its website (www.belgochlor.be), which notched up more than 100,000 visits in 2003, and completed the third edition of its CD ROM-based White Book on Chlorine (*Witboek van Chloor – Livre Blanc du Chlore*) in French and Dutch.
Federchimica Assobase, the Italian chlorine sector group, concluded its three-year educational programme *Cloro Amico Mio* focused on young people, and in September 2003 implemented an opinion survey that also encompassed other stakeholders. This revealed a positive shift in the views of young people about chlorine.
The results will be used to guide the development of future communications initiatives.
An institutional advertising campaign was launched in September 2003 in *QUARK*, the Italian monthly magazine covering the environment, science and innovation. The advertisements were based on *Cloro Amico Mio* publications and messages.
In France, the Syndicat des Halogènes et Dérivés (SHD) organised a conference jointly with the Ministry of Ecology and Sustainable Development to reveal the results of research on the local environmental impact of seven mercury-based chlorine production plants.
More than 150 politicians, consumer association and union representatives attended. The three-year research project cost €460,000 and demonstrated that the plants had no significant health or environmental impact on their local communities.

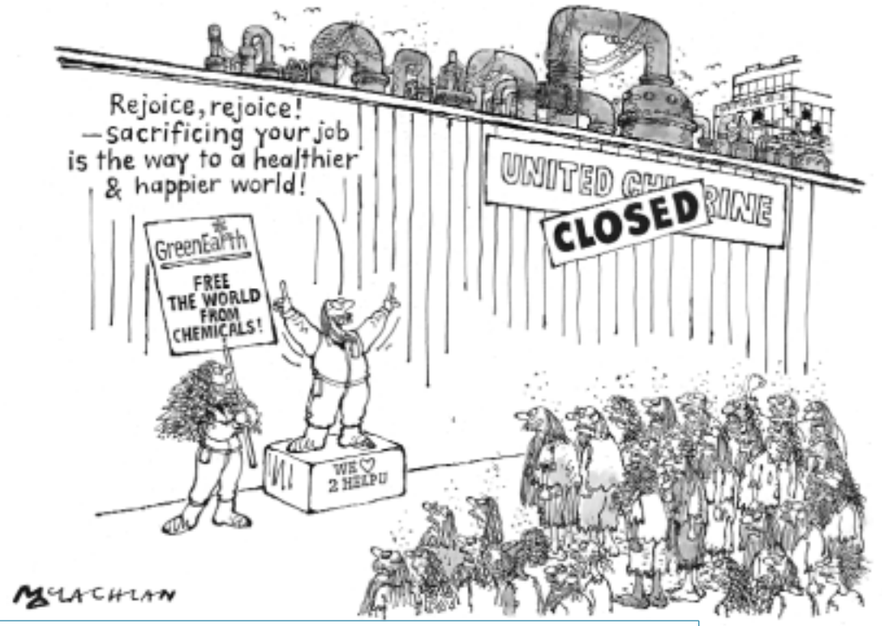
Science information

A key element of Euro Chlor's activities is to provide reliable information to various audiences on issues and topics related to chlorine. The scientific community is one such target group.
As a sustaining member of the Society of Environmental Toxicology and Chemistry (SETAC), Euro Chlor exhibited at the society's 14th annual conference in Prague (April 2004). A special newsletter, *Chlorine Science*, was distributed to 1,400 delegates.
During 2003-04, Euro Chlor issued several new Key Science Information Sheets on topics such as marine risk assessments, naturally-occurring organohalogens, effluent testing with cell-based in vitro bioassays, and a glossary of abbreviations used in ecotoxicology. These easy-to-understand explanations for non-specialist readers are complemented by comprehensive, technically-detailed dossiers for those who want more information. A new dossier was completed on how chlorine in molecules affects biological activity.
These and other documents are available on *Chlorine Online*.

Funds raised to improve public health and water supply in Guatemalan village

An initiative by Euro Chlor to mark the 2003 UN World Environment Day raised funds to improve public health and the water supply for a village of 550 people in Guatemala. During one week, 500 visitors to the Brussels offices that Euro Chlor shares with other chemical industry federations each received a bottle of water with an explanatory leaflet and envelope for a donation.
In total, €22,500 was raised, including additional donations from Euro Chlor, ECVM, Cefic and five affiliated associations. The money was donated via the global chlorine industry's Water Relief Network, which collaborates with the Red Cross to build sustainable water supply systems in lesser-developed countries.

Industry overview



European production rises on back of global growth

Western European chlorine production continued to rise throughout 2003 with prospects of further growth in 2004. Currently Europe ranks third after Asia and North America in the world chlorine market. However, latest data shows that China's capacity, which is already larger than Europe, is projected to overtake North America within the next few years.

Production second highest in 10 years

Western European chlorine production in 2003 was the second highest annual figure for 10 years at 9.52 million tonnes, a 3.2% increase compared with 2002 (9.22 million tonnes). Capacity utilisation averaged 85.5% in 2003, compared with 85.2% the previous year.
Germany continued to be the leading chlorine-producing region, increasing its share of European production to more than France, Belgium, The Netherlands, the UK and Spain combined.
Chlorine is typically co-produced with caustic soda (1.1 tonnes of caustic soda for each tonne of chlorine) and the latter too has experienced an upsurge in demand – particularly during the first half of 2004.
Both chemicals are used in a wide range of industries. PVC remained the largest single application for chlorine in Western Europe accounting for 35% of production. About a third of chlorine is used to make products that depend on chlorine for their synthesis, but contain no chlorine in the end product. These include high added-value materials such as polycarbonates, polyurethanes and epoxy resins. Caustic soda's largest single application is in bleaching pulp, paper and cellulose.

Global demand forecast to rise 20% by 2010

On the global market, Western Europe ranks No 3 behind Asia and North America. World demand for chlorine is forecast by industry watchers to rise by 20% between 2003 and 2010 to about 52 million tonnes. The Middle East is projected to become the world's largest ethylene dichloride (EDC), vinyl chloride monomer (VCM) and caustic soda exporter by 2007, due to competitive costs and proximity to growing Asian markets. Within a few years, China's rapidly-expanding chlor-alkali capacity, already larger than Europe's, is projected to outstrip that of North America, unless the government reins back economic growth which is already stretching the electrical energy infrastructure.
Sales of chlorinated solvents trichloroethylene (TRI), perchloroethylene (PER) and methylene chloride declined – a record 8% to 233,000 tonnes – for the eighth successive year in 2003. The decrease was due primarily to more efficient technology, improved recycling (for PER and methylene chloride) and substitution of alternative products (for TRI).

Health & safety

For the past three years, Euro Chlor has been working under the auspices of the World Chlorine Council (WCC) to develop – with sister chlor-alkali organisations – a global incident tracking system based upon the European model successfully used for some years.
Global data collected for 2003 shows 18 reported process incidents (fires, explosions or releases of chemicals) around the world with one incident causing 80 injuries. Thirty-two people were injured in other incidents, but there were no fatalities. Most incidents involved small chlorine leaks at the point of use rather than in production or transport.
Over the years Euro Chlor has produced more than 100 technical standards and guidelines. It is a target to ensure that every document is reviewed and up-dated if necessary at least every five years. In the past year, 27 documents have been up-dated; one major new document (250 pages) on the properties of chlorine has been approved. It is anticipated that this will become the standard textbook for chlorine physical properties.
In September 2003, Euro Chlor audited a chlorine-producing plant and a plant where chlorine is used, both belonging to a member in India. The results of the audits and recommendations arising from them were agreed with the company management.

Best practice presentations made in three countries

Presentations on best practices in minimising mercury emissions, together with visits to mercury cell rooms, were made at workshops in Brazil (also September 2003), India (April 2004) and Russia (May 2004).
In Moscow, Euro Chlor members and staff also made presentations on chlorine storage, transportation, emission detection equipment and accidents.
Views were exchanged on the standards that could be achieved with up-to-date equipment, techniques and management procedures. Following this and a Budapest meeting with Central European members in June, Russian and Romanian producers requested assistance in setting up chlorine associations along the lines of Euro Chlor.

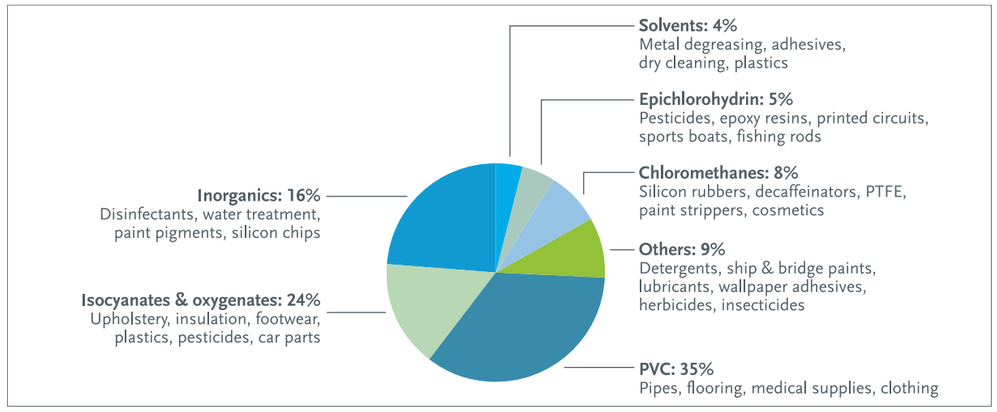
Assessing health effects of low exposure to mercury

Euro Chlor held a mini-seminar in Göteborg, Sweden (October 2003) on health effects of mercury at low doses. Delegates and independent experts discussed exposure of workers and communities near mercury-based chlor-alkali plants. Data presented during the event confirmed that exposure levels around such plants in Europe were well below the thresholds at which health effects occur. Among plant workers exposed for long periods to low levels of mercury, any observed effects were reversible. The conclusions were presented at an international mercury conference in Ljubljana (June 2004) and will be submitted for publication later this year.
As part of an initiative to enhance worker awareness of best practices, Euro Chlor has developed a pilot project to make posters available to member companies in four languages highlighting the "Do's and don'ts" of handling mercury.

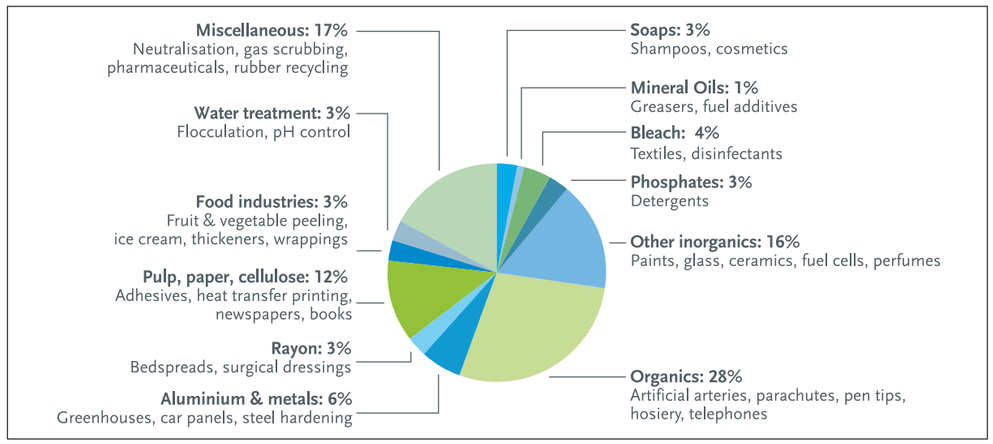
Attacks on chlorine often target environmental or health concerns, but generally ignore the other two essential pillars of sustainability – economic and social. The European chlor-alkali sector directly employs about 39,000 people. Almost 2,000,000 European jobs depend indirectly on chlorine and caustic soda in industries such as food production, packaging, construction, automotive, aviation and leisure.

European production & use data

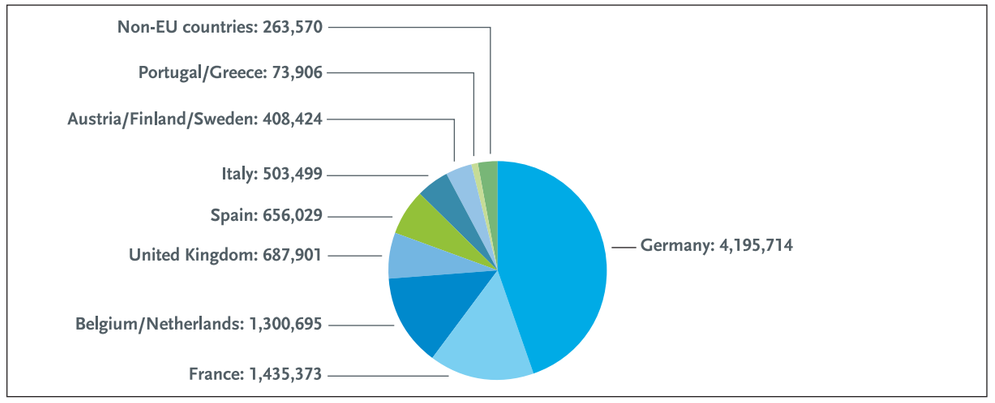
Western Europe chlorine applications in 2003 (9.39 million tonnes)



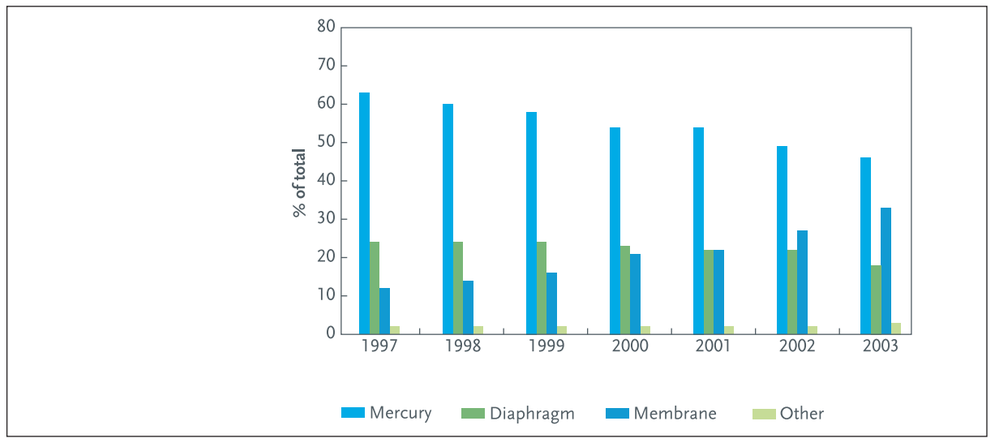
Western Europe caustic soda applications in 2003 (9.72 million tonnes)

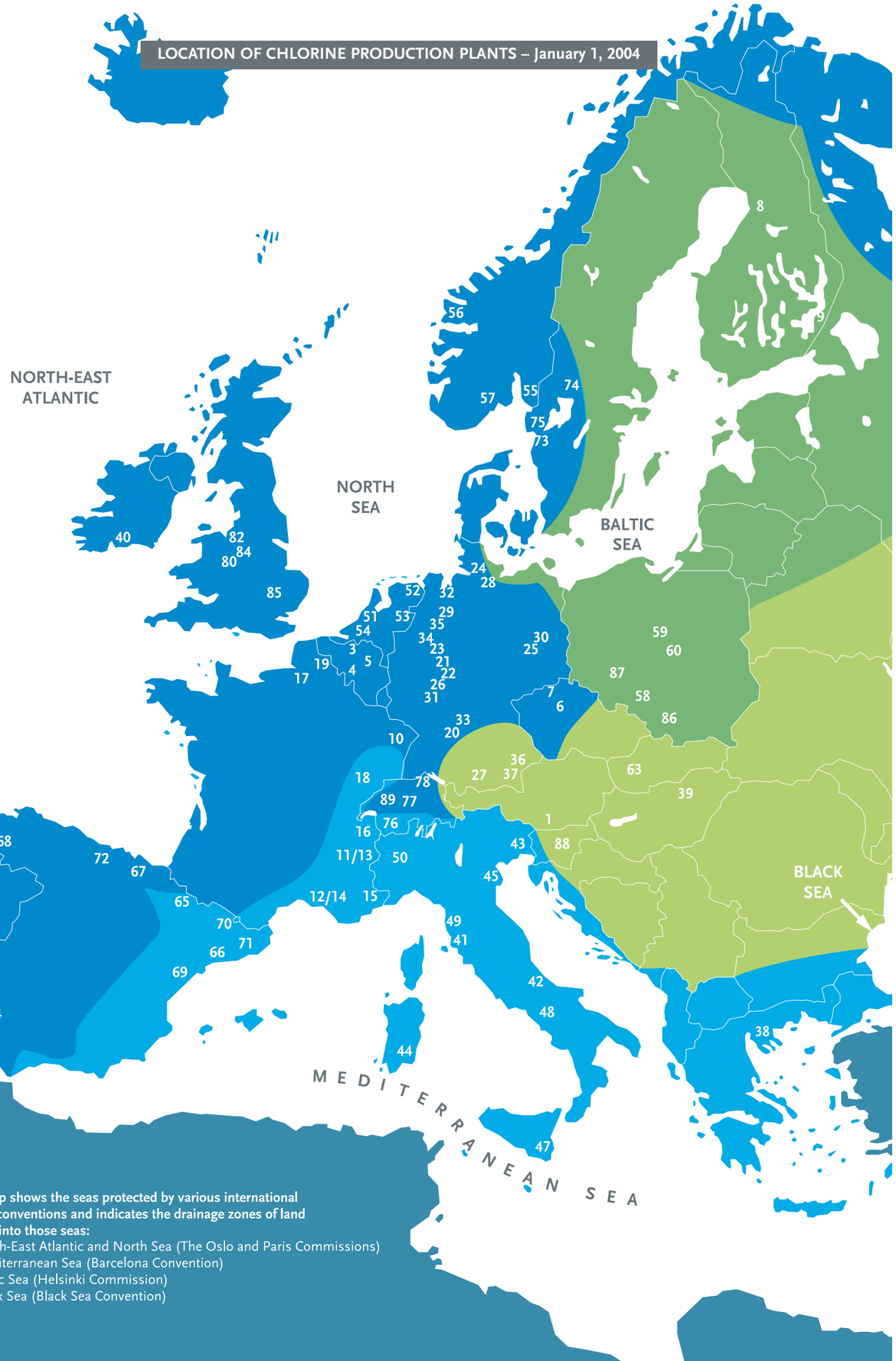


Chlorine production in 2003 (tonnes)



Evolution of chlorine production routes by process





Country	Number on Map*	Company	Site	Basin	Process	Capacity (000 tonnes)
AUSTRIA	1	Donau Chemie	Brückl	D	M	60
BELGIUM	3	Solvin	Antwerp (Lillo)	A	Hg	330
	4	Solvin	Jemeppe	A	M	174
	5	Tessenderlo Chemie	Tessenderlo	A	Hg	250
CZECH REPUBLIC	6	Spolana	Neratovice	A	Hg	135
	7	Spolchemie	Usti	A	Hg	62
FINLAND	8	Akzo Nobel	Oulu	C	Hg	43
	9	Finnish Chemicals	Joutseno	C	M	75
FRANCE	10	Albemarle	Thann	A	Hg	72
	11	ChlorAlp	Pont de Claix	B	D	240
	12	Atofina	Fos	B	D, M	270
	13	Atofina	Jarrie	B	Hg	170
	14	Atofina	Lavera	B	Hg, D	341
	15	Atofina	Saint Auban	B	Hg	184
	16	MSSA	Pomblières	B	Na	42
	17	Prod. Chim. D'Harbonnières	Harbonnières	A	Hg	22.5
	18	Solvay	Tavaux	B	Hg, M	375
	19	Tessenderlo Chemie	Loos	A	Hg	18
GERMANY	20	BASF	Ludwigshafen	A	Hg, M	370
	21	Bayer	Dormagen	A	M, HCl	450
	22	Bayer	Leverkusen	A	M, HCl	330
	23	Bayer	Uerdingen	A	Hg, M	220
	24	Bayer	Brunsbuttel	A	HCl	190
	25	Dow	Schkopau	A	M	215
	26	Vinnolit	Knapsack	A	Hg, M	280
	27	Clariant	Gersthofen	D	M	40
	28	Dow	Stade	A	D, M	1444
	29	Akzo Nobel	Ibbenbüren	A	Hg	125
	30	Akzo Nobel	Bitterfeld	A	M	75
	31	Degussa	Lulsdorf	A	Hg	138
	32	Ineos Chlor	Wilhemshafen	A	Hg	149
	33	LII Europe	Frankfurt	A	Hg	167
	34	Solvay	Rheinberg	A	D	200
	35	Vestolit	Marl	A	Hg, M	216
	36	Vinnolit	Gendorf	D	Hg	82
	37	Wacker	Burghausen	D	M	50
GREECE	38	Hellenic Petroleum	Thessaloniki	B	Hg	40
HUNGARY	39	BorsodChem	Kazinbarcika	D	Hg	137
IRELAND	40	MicroBio	Fermoy	A	M	6
ITALY	41	Altair Chimica	Volterra	B	Hg	27
	42	Solvay	Bussi	B	Hg	89
	43	Caffaro	Toreviscosa	B	Hg	68
	44	Syndial	Assemini/Cagliari	B	M	170
	45	Syndial	Porto Marghera	B	Hg	200
	47	Syndial	Priolo	B	Hg	204
	48	Eredi Zarelli	Picinisco	B	Hg	6
	49	Solvay	Rosignano	B	Hg	127
	50	Tessenderlo Chemie	Pieve Vergonte	B	Hg	42
THE NETHERLANDS	51	Akzo Nobel	Botlek	A	M	424
	52	Akzo Nobel	Delfzijl	A	D	125
	53	Akzo Nobel	Hengelo	A	Hg	74
	54	General Electric Plastics	Bergen-op-Zoom	A	M	87
NORWAY	55	Borregaard	Sarpsborg	A	M	45
	56	Elkem	Bremanger	A	M	10
	57	Norsk Hydro	Rafnes	A	D	136
POLAND	58	Rokita	Brzeg Dolny	C	Hg	127
	59	Zachem	Bydgoszcz	C	D	60
	60	Anwil	Wloclawek	C	D	197
	86	Dwory	Oswiecim	C	Hg	39
	87	Tarnow	Tarnow	C	Hg	32
PORTUGAL	61	Solvay	Povoa	A	M	29
	62	Quimigal	Estarreja	A	M	68
SLOVAK REPUBLIC	63	Novacke Chemicke	Novaky	D	Hg	76
SLOVENIA	88	TKI Hrastnik	Hrastnik	D	M	15
SPAIN	64	EIASA (Aragonesas)	Huelva	A	Hg	101
	65	EIASA (Aragonesas)	Sabinanigo	B	Hg	25
	66	EIASA (Aragonesas)	Villaseca	B	Hg, M	190
	67	Electroq. de Hernani	Hernani	A	M	15
	68	Elnosa	Lourizan	A	Hg	34
	69	Ercros	Flix	B	Hg	150
	70	Quimica del Cinca	Monzon	B	Hg	31
	71	Solvay	Martorell	B	Hg	223
	72	Solvay	Torrelavega	A	Hg	63
SWEDEN	73	Akzo Nobel	Bohus	A	Hg	100
	74	Akzo Nobel	Skoghall	A	M	85
	75	Norsk Hydro	Stenungsund	A	Hg	120
SWITZERLAND	76	Syngenta	Monthey	B	Hg	27
	77	SF-Chem	Pratteln	A	Hg	27
	78	Solvay	Zurzach	A	Hg	55
	89	Borregaard	Atisholtz	A	M	9
UK	80	Albion Chemicals	Sandbach	A	Hg	90
	82	Ineos Chlor	Runcorn	A	Hg, M	767
	84	Rhodia	Staveley	A	Hg	30
	85	Albion Chemicals	Thetford	A	M	6
					Total	**12412.5**

*Note to readers: The map references are provided for identification purposes only and are not sequential.
The total number of plants at the end of 2003 was 84.

BASIN **A**: North Sea – Atlantic **B**: Mediterranean Sea **C**: Baltic Sea **D**: Black Sea
PROCESS **Hg**: Mercury **M**: Membrane **Na**: Sodium **D**: Diaphragm **HCl**: Electrolysis of HCl to Cl_2

EURO CHLOR

Voice of the European chlorine industry

Euro Chlor is the voice of the European chlorine industry. It plays a key communications and representation role on behalf of its members, listening and responding to society's concerns about the sustainability of chlorine chemistry. Founded nearly 40 years ago as primarily a production-oriented technical organisation, Euro Chlor was reorganised in 1989 to reach out to stakeholders by developing and strengthening its scientific, advocacy and communications capabilities.

Groups representing the interests of the chlorinated solvent, chlorinated paraffin, chloroisocyanurate, chloro-biocide and potassium hydroxide sectors are integral parts of Euro Chlor, which altogether represents 41 European producers employing about 39,000 people at 84 manufacturing locations in 20 countries. The membership of Euro Chlor has grown in recent years and today encompasses 111 companies. These include downstream users and producers outside Europe as well as suppliers of equipment, materials and services. The federation speaks on behalf of 97% of the chlorine production capacity in the EU-25 and EFTA regions.

Organisation

The Management Committee provides guidance and strategic direction to the Euro Chlor Secretariat. There are 33 committees and working groups (WGs), providing specialist input in areas such as advocacy, science, manufacturing, transportation, safety, health and the environment.

MANAGEMENT COMMITTEE
Co-chairman: Scheffers, HCJ – Akzo Nobel
Co-chairman: Bergmann, U – BASF
Aparicio Díez, M – Solvay Química
Aumann, M – Dow Deutschland
Dubinski, M – Tessenderlo Chemie
Fearn, P – Finnish Chemicals
Gielen, F (Alternate: Baccani, C) – Solvay
Griessmann, K-H – Degussa
Guinet, J-F – ChlorAlp
Heber, J – Norsk Hydro
Ohm, C – Bayer
Paini, G – Syndial
Pernot, P – Atofina
Tane, C – Ineos Chlor
Träger, M – Vestolit
Winhold, M – Vinnolit
Zak, J – Rokita
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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
Guy Mesrobian – Technical & Safety Manager
Maria Prieto – Assistant

Committees and Working Groups

MANAGEMENT	
Management Committee	Sustainability ad hoc Task Force
Mercury ad hoc Task Force	Statistics Committee
ADVOCACY & COMMUNICATIONS	
Regulatory Affairs Committee	National Chlorine Associations WG
EU Advisory Group	Chlorine Communicators' Network
PRODUCT GROUPS	
Biocides Strategy Group	Chloroisocyanurates Group
Chlorinated Paraffins Sector Group	Potassium Group
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	
SCIENCE	
Steering Committee	
Monitoring & Environmental Chemistry WG	
Toxicology WG	
Risk Assessment ad hoc WGs:	
– Caustic Soda	– Mercury
– Chlorine	– Sodium Hypochlorite
– Marine	
TECHNICAL & SAFETY	
General Technical Committee (GTC)	Transport WG
Environmental Protection WG	Health WG
GEST (Safety) WG	Electromagnetic Fields WG
Equipment WG	

MEMBERSHIP OF EURO CHLOR

FULL MEMBERS	ASSOCIATE MEMBERS	TECHNICAL CORRESPONDENTS
Akzo Nobel Base Chemicals	Angelini A.C.R.A.F.	3V Sigma
Albemarle Europe	Arch Chemicals	Arabian Chlorine Co
Albion Chemicals	Asociación Nacional de	Arch Chemicals
Altair Chimica	Electroquímica (ANE)	Asahi Glass Europe
Anwil	Association of Chemical Industry	Beltech
Aragonesas Industrias y Energia	of the Czech Republic (SCHP)	Buckbee-Mears Europe
Atofina	Bochemie	Carburos Metalicos
BASF	Chemicals Industries Association (UK)	Chemtec
Bayer MaterialScience	Chemoform	Claushuis Metaalmaatschappij
Borregaard Industries	Chlorine Engineers	Crane Resistoflex
BorsodChem	Colgate-Palmolive	Descote
Caffaro	De Nora Tecnologie Elettrochimiche	Electroquimica de Sagua
ChlorAlp	DuPont de Nemours (Belgium)	Eltech Systems Corporation
Degussa	Erco Worldwide	Eramet
Dow	ExxonMobil Chemical Europe	Garlock Sealing Technologies
Dwory	Federchimica	Kerr-McGee Pigments
Electroquímica de Hernani	Federation des Industries Chimiques	Kronos
Electroquímica del Noroeste (Elnosa)	de Belgique (Fedichem)	KSB-AMRI
Ercros	Leuna Tenside	Nufarm Coogee
Finnish Chemicals	Lonza	Occidental Chemical Belgium
Hellenic Petroleum	Lurgi Life Science	Pall Schumacher
Ineos Chlor	Nankai Chemical Industry Co	Phoenix Armaturen-Werke Bregel
LII Europe	National Petrochemical Company	Quicksilver Recovery Services
MSSA	NCP Chlorchem	Reliance Industries
Norsk Hydro	Nichimen Europe	Samson
Novácke Chemické Závody	Nippon Soda	Sasol Polymers
Produits Chimiques d'Harbonnières	Pentachlorophenol Task Force	Senior Flexonics Ermeto
Química del Cinca	Polish Chamber of the Chemical	Severn Trent Water
Quimigal	Industry Employers' Association (PIPC)	Shaw Valves
Rhodia	Plast- & Kemiföretagen – The Swedish	SIEM Supranite
Rokita	Plastics and Chemicals Federation	Technip LCI
SF-Chem	PPG Industries	WL Gore & Associates
Solvay	Procter & Gamble Eurocor	
Solvin	SGCI Chemie Pharma Schweiz	
Spolana	Shikoku Chemicals	
Spolchemie	Syndicat des Halogènes & Dérivés/	
Syndial	Chimie Minérale	
Tessenderlo Chemie	Syngenta	
Vestolit	Teijin Twaron	
Vinnolit	Tosoh Corporation	
Zachem	Unilever Hellas	
	Verband der Chemischen Industrie (VCI)	
	Vereniging van de Nederlandse	
	Chemische Industrie (VNCI)	
	WATERCHEM	

Risk & hazard – how they differ

Jargon is often used when talking about risk and some of this can be confusing. In the discussion about chemicals, the words "risk" and "hazard" are very often used as if interchangeable. In this section we offer our understanding of the difference between these expressions, appreciation of which is fundamental to any informed debate on the safety of chlorine and other chemical products or processes.

HAZARD
The way in which an object or a situation may cause harm

A hazard exists where an object (or substance) or situation has a built-in ability to cause an adverse effect. Such hazards include uneven pavements, unguarded machinery, an icy road, a fire, an explosion and a sudden escape of toxic gas.

EXPOSURE
The extent to which the likely recipient of the harm is exposed to – or can be influenced by – the hazard

The presence of a potential target in the area and its distance from the hazard will determine the extent of the risk. For instance, a fire or explosion may cause damage to nearby buildings and their contents, or to vehicles and equipment, but will not harm people if there are no people present at the time.

RISK
The chance that harm will actually occur

As mentioned, a hazard exists where an object (or substance) or situation has a built-in ability to cause an adverse effect. Risk, on the other hand, is the chance that such effects will occur: the risk can be high or negligible.
Risks are all around us in our daily lives. Likewise, we all carry out risk assessments constantly, in one form or another, whether consciously or sub-consciously. When deciding whether to cross the road, whether to eat healthily, and how to care for the family, we make judgements about the hazards involved, and assess the risks before taking action. Just as there are risks in our every day lives, so there are risks in activities that companies carry out, and in products they make.

Sound science should be the cornerstone of a successful chemical policy

The only reliable basis for the assessment of risks from chemicals is sound science. This should be the cornerstone of workable and successful chemicals policy.
In addition, all risk management decisions should be based on risk assessments taking into account the actual use and exposure, not simply the intrinsic properties of a chemical.