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Chlorine Industry Review

2010-2011

Fundamentally strong
up to a point



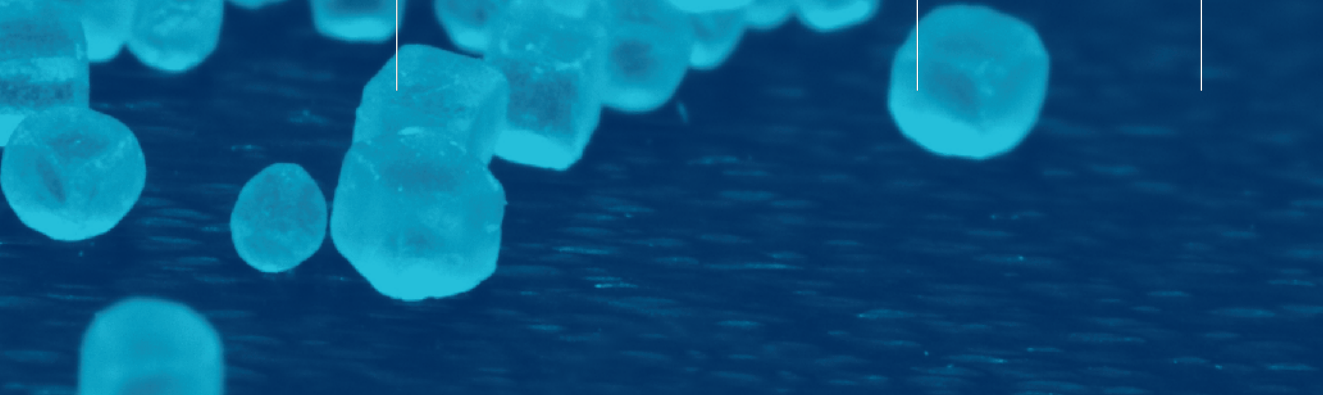
Fundamentally strong
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Cover picture: Chlorine is produced in electrolysis cells, where an electric current is sent through brine, a solution of salt (sodium chloride) in water. Salt, water and electricity – the three basic raw materials of chlorine/caustic production – form the central themes of our Industry Review trilogy 2008-2011.

In the 2008-2009 edition, we published artist's impressions of electric current. The cover of the 2009-2010 Review was illustrated with beautiful water droplets, and this new edition shows salt crystals in their cubic mineral form.



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01 Introduction



Fundamentally strong, up to a point

Ask yourself what factors need to be addressed to bring about recovery from the economic turmoil we have experienced over the past three years and competitiveness will probably be high on your list. Next ask what affects **your** ability to compete and what can **you** do to control it and ensure your commercial future and the answers are a little more difficult to find.

Let's be more specific and ask what can be done to enable the European Chlor Alkali Industry to compete with international competitors and prevent an erosion of market share.

The question is not a trivial one as the answer dictates the underlying message of Euro Chlor's advocacy work in the Commission and European Parliament. Are we a fundamentally well run, cost efficient industry who needs to be nurtured or are we unable to repel the un-

deniably strong competition from other parts of the world dooming us to a slow and painful demise!

I am firmly convinced that it is not the latter – but this is not to say that our future is guaranteed. We have to work tirelessly in pursuit of our competitiveness and sustainability.

Reassuringly the Commission recognises the importance of European competitiveness and has launched an initiative to promote the competitiveness of European industry. Called *Europe Flagship 2020: An Industrial Policy for the Globalization Era* it says 'Industry must be placed centre stage if Europe is to remain a global Economic Leader'. Paraphrasing Vice Commissioner Antonio Tajani "Only a European Industrial Policy targeting competitiveness and sustainability can muster the critical mass of change and coordination needed for success. (...) There will be no sustainability without competitiveness, and there will be no long-lasting competitiveness without sustainability. And there will be none of them without a quantum leap in innovation!"

Meanwhile, the major cost driver for our industry is electricity which with the highest price in the world – more than double compared to some regions – is a heavy burden to bear. Electricity efficiency of our member companies is amongst the best in the world which unlike the electricity cost is something which is under our own control. This is testament to our good industrial and management skills and is proof positive to my earlier assertion.



Polyvinylchloride or PVC is widely used in car manufacturing (e.g. dashboards) and piping



The current work to win state aid compensation to offset carbon dioxide emission costs for intensive energy consumers is crucial in the drive for competitiveness. This is where the opening questions become relevant. We are not a crippled industry looking for hand outs just to prolong the agony of inevitable failure. We are a fundamentally healthy industry able to compete with the rest of the world *but only up to a point*. The European economy needs industries like ours able to provide employment, pay taxes, and to provide the chemical building blocks for other manufacturing industries.

Though governments may be reluctant to use limited cash resources to support industry, recognition of deserving, legitimate cases like ours is vital if European Industrial Policy initiatives referred to above are to be credible.

We remain optimistic of a positive outcome by the end of 2011.

Hand in glove with competitiveness is sustainability, an area where we have much to be proud of. Our first 10 year sustainability programme achieved notable successes with increased energy efficiency, mercury emission reduction and the increased use of hydrogen (details can be found in Section 2 following this foreword). Our second 10 year initiative on the journey towards our goal of industrial immortality is now launched. We have taken the opportunity to broaden our approach to include aspects of economic and social factors.

This will take the form of success stories showing the progress we are making in areas like better water usage, conservation of local wildlife habitats and the socially responsible use of our products.

We should not delude ourselves on the ease by which we can achieve this or even the enthusiasm required to carry it through. It is a major challenge which we must respond to as befits a senior sector of the chemical industry as a whole. Over the last twenty five years we have built an admirable reputation based on transparency and a willingness to engage in debate with the various authorities using sound science and common sense to substantiate our point of view. Our new sustainability programme will advance our reputation still further by acknowledging the global issues of availability of clean water, feeding a growing population and biodiversity.

Be alert for new communications material and be prepared to use it in communicating with your employees, neighbours and national authorities. I wish you a successful and interesting year!



Alistair J. Steel
Executive Director

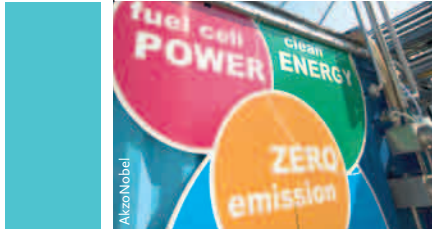
02 Sustainability

Learnings from the first 10 year programme

"This first 10 year sustainability programme has helped us to better understand the trends in our industry. If some indicators showed clear improvements, even better than targeted, some others did not, and the companies have been asked to analyze their own performances and draw the conclusions for possible actions.

At the other end, it appeared clearly that some of the indicators could be presented in a more positive way and that new interesting indicators could be added: this is the objective of a new programme."

Alistair J. Steel



Hydrogen produced in chlorine manufacture can be used effectively for power generation via fuel cell technology

Unified strategic approach

All of the European chlorine manufacturing members of Euro Chlor agreed on an industry-wide strategy that focused on six voluntary commitments. These were first developed to ensure a united industry approach and commitment to address key sustainability concerns:

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

Within this framework, 15 performance indicators were defined about 10 years ago, some of them with an improvement target for 2010, in the following main areas: economic aspects of production, environmental protection, safety and social progress. Each year, producers have reported their progress to Euro Chlor, which consolidated the results for the association's Management Committee prior to annual publication of the industry's performance.

In this section, we summarize the final results of this 10 year programme. Not all the indicators show the same degree of progress, but the lessons learned from this exercise were very useful for the companies and the association, and the Management Committee has decided to propose a new programme for the future.

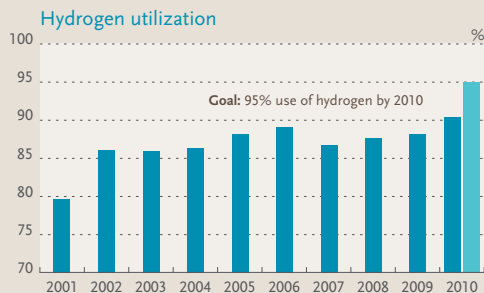
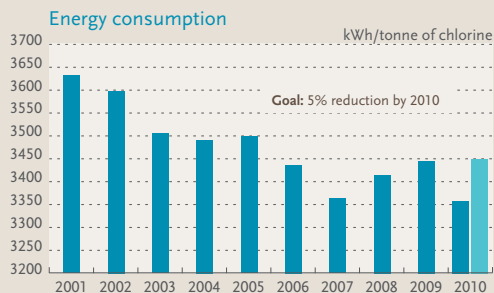
Economic contribution

Energy use

Target: By 2010, reduce industry-wide energy consumption by 5% in terms of kWh/tonne of chlorine produced compared with the 2001 base year.

Update: for the last year of the programme, the average energy consumption dropped significantly with a value of 3,358 kWh/t of chlorine produced, about 100 kWh lower than the target, confirming the general trend related to the progressive conversion from mercury to membrane technology.

Background: Since electricity is an indispensable raw material of the chlorine production process, the basic consumption – corresponding to the electrochemical reaction – cannot be significantly reduced. However, converting one technology into a more efficient one may save a certain amount of energy and, to a lesser degree, reduce ancillary energy use. The energy indicator is weight-averaged across all producers and based on steam and electricity. Energy is mainly used for electrolysis (transformers, rectifiers and cells) and also for illumination and motor power (pumps, compressors, centrifuges, etc.). Steam is used mainly for caustic soda concentration to 50% and for minor utility purposes.



Energy consumption

Real 
Objective 

Hydrogen utilization

Real 
Objective 

Hydrogen utilization

Target: Increase use of hydrogen gas from 80% (2001) to 95% by 2010.

Update: In 2010, the percentage of hydrogen use increased again, reaching for the first time more than 90% (90.4%). This value remains nevertheless quite low compared to the target of 95%. About one fourth of the companies are still below 80%, with a few remaining around 50%.

Comment: As several fuel cells projects have been announced, and with the development of oxygen depolarized cathodes (no hydrogen production), we are confident that this positive trend will continue, even if slowly, in the future!

Background: High-quality hydrogen is co-produced with chlorine and caustic soda during the electrolysis of brine. This can be used as a raw material for other processes or as fuel to produce steam; technologies are today in final industrial development to allow for local electricity recovery via fuel cells. See picture p.07.

Manufacturing technology

Target: The percentage of chlorine produced by mercury cells, diaphragm cells, membrane cells and other technologies will be communicated on a yearly basis.

Update: Membrane technology now represents more than the half (51.2%) of the installed production capacity of Euro Chlor members. The mercury process accounts for 31.8% at the beginning of 2011, continuing the progressive phase out of this technology in line with the

Chlor Alkali sector's voluntary agreement. The diaphragm process still accounts for a bit less than 14% of the total capacity. See also the graph on p.47.

Economic development

Target: Euro Chlor has decided to report monthly, quarterly and annually data on European production of chlorine and caustic soda. This includes utilization rates, caustic stocks, capacity and technology by plants and applications.

Update: In 2010, Euro Chlor continued to publish on its website and distribute to the media figures for monthly chlorine production and caustic soda stocks. The Industry Review includes every year a map of Europe showing the location of all plants and a table indicating the location, ownership, technologies and capacity of each plant (see p.49 for the situation at the beginning of 2010).

Safety & social progress

Lost-time injuries

Target: Reduce lost-time injuries (LTI) to 1.3 per million working hours for all workers - both company employees and contractors working in production units.

Update: The general trend is going slightly in the right direction (particularly for the contractors), but the values are still far from the target (7.5 for companies and 7.8 for contractors respectively).





Tessenderlo Chemie

PVC sustainable development on track despite the global recession

As reported by Vinyl 2010 in its 2011 annual progress report, the European PVC industry recycled nearly 261,000 tonnes of this chlorine-based plastic in 2010, exceeding by far the 10-year target of 200,000 tonnes post-consumer PVC to be recycled and this despite the difficulties faced in the years of crisis.

All the information reported is independently audited and verified by external third parties. The newest Report Vinyl 2010 – 10 years can be consulted and downloaded from www.vinyl2010.org.

Vinyl 2010 is a voluntary commitment from industry groups representing the complete PVC value-chain: the European Council of Vinyl Manufacturers (ECVM), the European Plastics Converters (EuPC), the European Stabiliser Producers Association (ESPA) and the European Council for Plasticisers and Intermediates (ECPI).

PVC constitutes one of the most sustainable materials in construction

Comment: All kinds of accidents are considered here - not only those specific to the chlor-alkali industry. It is also important to note that the indicators are related to the production units (and often maintenance activities) without integrating the administrative and commercial entities, that allow lower global figures at company level. Nevertheless, a number of companies still have a large margin of improvement for both indicators.

Background: A lost time injury (LTI) results in at least one day of absence from work. It is reported as the number of LTI per million working hours. The figures from companies reporting on a three day period of absence are converted to a "one day" equivalent using a Cefic correlation.

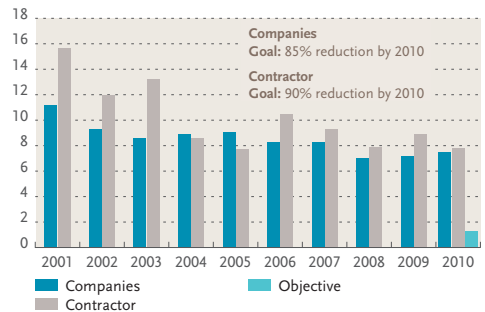
Process incidents and losses

Target: A 75% reduction in the number of process incidents from 67 (2001) to 15.

Update: After a remarkable decrease in the number of accidents, the indicators remained for 3 years at the level of the target before increasing significantly in the last few years to reach a value of 27.

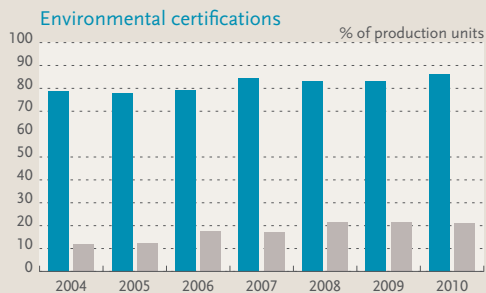
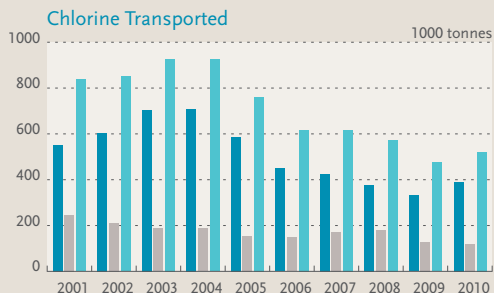
Comment: Past results show that the 2010 target can be achieved, but efforts are needed in the future.

Lost Time Injuries - production units and contractors indicators (number of incidents for 1 million working hours)



Process incidents





Chlorine Transported

Bulk rail
Bulk road
Total without pipeline
pipeline

Environmental certifications

ISO14001
EMAS

Background: Incidents are classified as events involving a fire, explosion or the release of chlorine, hydrochloric acid, sulphuric acid, sodium hypochlorite (bleach) or caustic soda, which cause a fatality, serious injury or property damage exceeding € 100,000. Losses include any of the above chemical spills in air, water or land, which impact human health or the environment, property or result in evacuation.

Transportation

Targets: The tonnage of chlorine transported will be reported annually as well as the mode of transport involved; additionally, zero 'transport incidents' involving the bulk movement of chlorine by 2010 has been set as a target.

Update: Two transportation incidents were reported in 2010, while four occurred in 2009 and only one in 2008. The quantity of chlorine transported in 2010 increased a bit after the dip caused by the economic crisis, but still is at a lower value than in 2008: chlorine producers in Europe transported 522,000 tonnes of chlorine, with almost 80% being shipped by rail and the remainder by road. The transport of chlorine (excluding pipelines) represented a little more than 5% of the 2010 production. The average distance chlorine was transported by rail remained about 490 km and 190 km by road.

Background: A "chlorine transport incident" is one which either involves death or injury, a spill/leak of more than 5 kg, substantial property damage, public disruption of more than one hour or the intervention of emergency services or media coverage. The amount of

chlorine transported in Europe by rail and road has halved during the past decade. Chlorine movement has been decoupled from production through supplier/customer relocations and more use of local pipelines. Rail transport dominates; road transport for bulk supply is used only in the United Kingdom and, to a limited extent, in Spain, France and Portugal.

Note: none of the incidents has led to a chlorine leak.

Responsible Care

Target: All chlorine-producing members of Euro Chlor to sign up to the 'Responsible Care' initiatives by 2010.

Update: Three companies of the 35 were not convinced of the desirability of a formal commitment and had still not signed for the programme at the end of 2010.

Background: Responsible Care is the chemical industry's global voluntary initiative by which companies, through national associations, work together to continuously improve their health, safety and environmental performance and to communicate with stakeholders about their products and processes. Responsible Care was conceived in Canada and launched in 1985 to address public concerns about chemical manufacture, distribution and use. The number of national chemical industry associations embracing the Responsible Care ethic has grown considerably from 6 to 52 countries since 1992.





Responsible Care® is the global chemical industry initiative to continuously improve health, safety and environmental performance

Environmental protection - COC emissions

Target: Emissions of 22 chlorinated organic compounds (COCs) to be reduced in 2010 by 75% to water and by 50% to air against the 2001 base year.

Update: At end of the programme, COC emissions from manufacturing plants confirmed globally the results from the last years for both water and air compartments, with even some further improvement for the air emissions; the consolidated values stayed at 78% reduction for water, and reached more than 75% for the air performance.

Background: The COCs were selected from various international regulatory priority lists for emissions reductions and comprise the following 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; hexachloro butadiene; hexachlorocyclohexane; pentachlorophenol; tetrachloroethylene; trichlorobenzene; trichloroethylene and vinyl chloride. In 2005, pentachlorobenzene was added to the list of the substances to be monitored, in line with the requirements of the EU Water Framework Directive. To provide a longer-term perspective of the sector's commitment to reducing emissions, the data shown spans the period 1985-2010.



Jean-Pol Debelle
Technical Director

“Continuous improvement in safety, health and environmental protection remains a strong basic mission of our association.”

Trained as a chemical engineer and with a long experience in chlorine production units within the Solvay Group, Jean-Pol Debelle has been seconded to Euro Chlor for more than six years to take charge of the technical aspects of health, safety and environmental protection issues (HSE).

Continuous improvement in HSE fields

The technical activities of the association started with its creation more than 60 years ago. Several Working Groups facilitated experience exchanges between member companies in the safety, health and environmental protection areas.

This experience is formalized in the publication of guidance documents, periodically updated and shared with all members via the Euro Chlor website.

On a global level (the World Chlorine Council), Euro Chlor is working with its international partner associations to enhance HSE aspects of chlor-alkali production, and especially on safety via the World Chlorine Council Global Safety Team (WCC GST), whose secretariat Euro Chlor is managing for two years.

In support of regulatory work

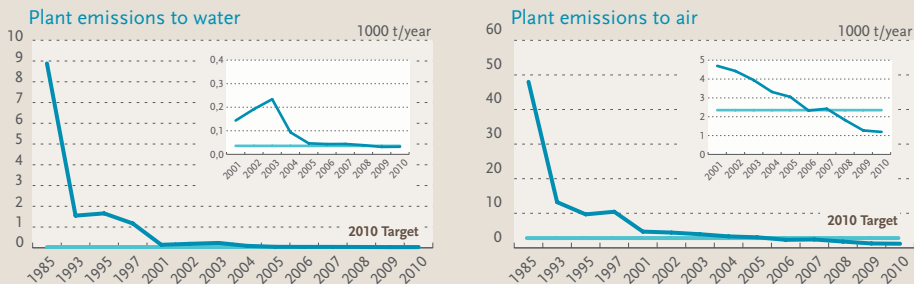
The technical activities include support to the regulatory activities of Euro Chlor through the collection and analysis of technical data.

This ranges from workers' exposure to chlorine, mercury and electromagnetic fields to emissions of mercury to air, water and products, handling of waste, evolution of the production technologies and specific energy consumption.

Euro Chlor is also working closely with the national authorities for the preparation of the new BAT reference document (BREF) which is of vital importance for the permitting of chlor-alkali production activities in Europe.

Euro Chlor has just completed a 10 year sustainability monitoring programme during which the evolution of a large number of sustainability parameters are published annually, contributing to the transparency of the sector towards all stakeholders.

Chlorinated organic compounds



Plant emissions to water
Total
Target

Plant emissions to air
Total
Target

Mercury emissions

Target: Although all other programme deadlines are for 2010, the industry decided to maintain an earlier 1998 commitment to achieve by 2007 an emission target of 1.5 g Hg/t chlorine capacity for each individual plant. The industry elected to keep the earlier date, since from October 2007 all EU chlor-alkali plants whether membrane, mercury or diaphragms require an operating permit under the Integrated Pollution Prevention and Control (IPPC) Directive.

Update: Overall European emissions in 2010 amounted to 0.88 g Hg/tonne chlorine capacity, with a real improvement compared to the previous years (0.93 g Hg/t in 2009 and 0.92 g Hg/t in 2008). The average mercury emissions for Western European countries remained at about 0.76 g/t capacity (see graph on p.13).

Comment: Plants that had quite high emissions in the liquid effluent last year did show some noticeable improvement, enabling global emissions to start going down again. Unfortunately, four plants are still above the 2007 target of 1.5 g Hg/tonne chlorine capacity for the total emissions, one of them being even at the level of 2.5 g Hg/t chlorine capacity.

Product knowledge

Target: The industry agreed to provide full eco-toxicological and environmental data on 29 chlorinated substances under the International Council of Chemical Associations/OECD initiative on high production volume (HPV) chemicals.

Update: These data have been published - except for four HPV chemicals which were either no longer relevant (not commercially available anymore) or are covered under REACH with a registration deadline of December 1st 2010. Key substance property data of substances registered under REACH will be made publicly available.

Environmental accreditation

Target: All full members to gain EMAS and/or at least ISO 14001 Environmental Accreditation for their plants by 2010.

Update: there was an increase in the number of ISO 14001 accreditations in 2010, from 54 to 57 on a total of 66 plants. There are still 14 production sites with EMAS accreditation.

Background: EMAS (The Eco-Management and Audit Scheme) is the EU voluntary instrument which acknowledges organizations that improve their environmental performance on a continuous basis. EMAS registered organizations are legally compliant, run an environmental management system and report on their environmental performance through publication of an independently verified environmental statement. ISO 14001 is an international quality assurance standard to evaluate an organization's environmental management systems and encourage continuous improvement. It helps organizations minimise negative environmental impacts (on air, water or land), and comply with applicable laws/regulations and other environmentally-oriented requirements. It is often the case that ISO 14001 is used as a part of the EMAS registration process.



“We can report substantial progress in our ECSA sustainability programme”

Wolfgang Marquardt
ECSA Manager

Wolfgang Marquardt studied chemistry and sharpened his profile on toxicology during his PhD thesis in Munich. He joined Euro Chlor in 2007. Wolfgang Marquardt started as science manager in the European Chlorinated Solvent Association (ECSA), becoming sector group manager of ECSA in 2009. He is responsible for the ECSA management and the different working groups such as the General Technical, Occupational and Environmental Health, Product, Communication and Outreach, and Sustainability Groups.

ECSA sustainability programme in a nutshell

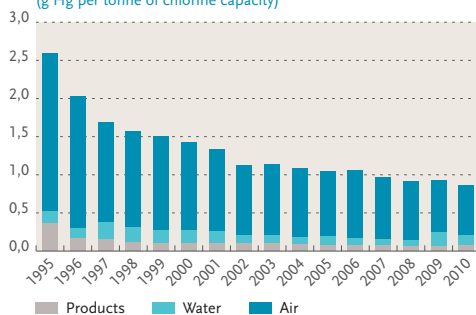
ECSA started its sustainability programme in 2007 with the ambitious aim to cover the whole chlorinated solvents value chain. The programme was prepared by an independent consultancy with the mission to ensure responsible production, distribution, use and end-of-life management of chlorinated solvents. Nine objectives were set under the three vision elements: Sustainability by product and application; Value chain engagement; Stakeholder engagement and communication.

ECSA reviewed the progress in 2011. The sheer number of results is already impressive: for example, ECSA analyzed 60 applications and summarized recommendations for safe & sustainable use of chlorinated solvents in an online toolbox. This Product & Application Toolbox contains recommendations for more than 350 individual activities.

Not only the quantity but also the quality of the results in the sustainability programme is worthy of mention: for example, one of the six awareness programmes with the value chain has led to an Excellence Award for ECSA's contribution.

European Chlorinated Solvents Producers can be proud of the substantial progress that has been made under their ECSA Sustainability Programme between 2007 and 2011. ECSA will continue its efforts in pro-active communication towards stakeholders, such as the revamped website which delivers comprehensive information about chlorinated solvents and adds tools for a further dialogue with the downstream users of chlorinated solvents.

European mercury emissions 1995-2010
(g Hg per tonne of chlorine capacity)





ECSA Sustainability Programme: Progress Report 2007-2011

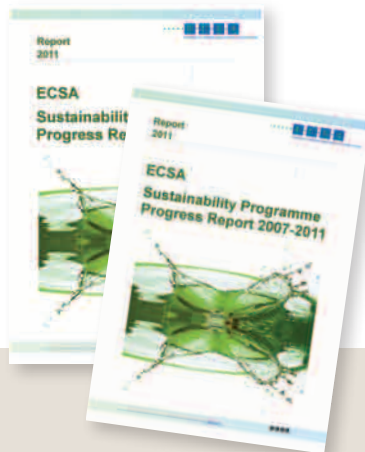
One of the well-researched categories of chemicals, chlorinated solvents are used in a variety of applications, which are mainly industrial. The properties and the health and environmental characteristics of these products have become better known over the years; as a result, the chlorinated solvents industry has engaged in active risk management and risk reduction programmes, including, for example, the development of solvents management services.

During the course of implementing measures under the ECSA Sustainability Programme, the REACH legislation was introduced in Europe, and ECSA integrated REACH aspects into the existing Sustainability Programme. The ECSA Sustainability Programme allows ECSA to review consistently and in depth the sustainability of chlorinated solvents, and to set itself challenging though achievable long-term objectives ensuring the sustainable use and end-of-life management of chlorinated solvents.





The ECSA Sustainability Progress Report is available on the ECSA web pages via www.eurochlor.org



The ECSA Vision Elements identify the three key areas in which the chlorinated solvents industry is taking concrete steps to ensure its sustainability. The objectives assigned under each key Element are not only a matter for ECSA members; they require direct and concrete engagement with third parties such as value chain actors and other external stakeholders.

Three Elements are the building blocks of ECSA's Vision. They set out the long-term objectives required to achieve the Vision, and they identify Key Performance Indicators (KPIs) that will help ECSA determine where it stands relative to these goals, resulting in nine concrete objectives.

1. Sustainability by product and application

A broad stakeholder consultation revealed that emissions of chlorinated solvents are the cause of most of the pressure being brought to bear against chlorinated solvents products. By reducing emissions we can achieve better efficiency of use, more value from each molecule of solvent and reduced potential for exposure. This Vision Element should achieve the benefits of:

- Driving industry and product sustainability by identifying challenges or opportunities for each emissive application
- Ensuring safety for human health and environment

- Demonstrating continual improvement of sustainability in emissive applications
- Resolving issues over impact of energy and raw materials.

1.1 ECSA will analyze emissive applications, prioritize them, and define sustainability improvement actions

- **ECSA has so far reviewed an impressive total of 60 applications**
- **ECSA Product & Application Toolbox:** ECSA has developed an online toolbox freely accessible via the ECSA website to provide users of chlorinated solvents with information about the safe & sustainable use of the products. It is built as a self-explanatory guide based on a simple decision tree of product applications to lead the user readily to the proper information on safe use, environmental protection as well as legislative requirements.



The online ECSA Products Application Toolbox provides information on the safe and sustainable use of chlorinated solvents

The integrated Safety & Quality Assignment System



The recommendations do take into account REACH (1907/2006/EC on the Registration, Evaluation, Authorization and Restriction of Chemicals) as well as other European legislation or voluntary industry commitments. The content of the Toolbox is based on the REACH Chemical Safety Assessment (CSA) of the substances.

However, the Toolbox also includes recommendations based on experience of ECSA members that go beyond the given legal framework of the CSA under REACH. The ECSA Product&Application Toolbox is accessible online: www.eurochlor.org/ECSA

1.2 Raw material, energy & production aspects will be coordinated with upstream organizations

- ECSA is in constant dialogue with Euro Chlor and is sharing events; e.g. a joint yearly General Assembly with reports on activities in the different committees
- ECSA is liaizing with Euro Chlor on its **new Sustainability Programme 2011-2020**.

2. Value chain engagement

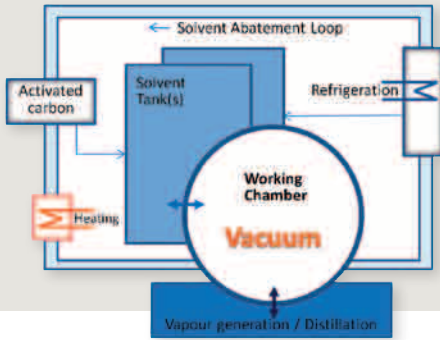
The buy-in and active involvement of the value chain will be essential to the overall success of the programme. Collaboration with distributors and downstream users is the only way to ensure sustainability goals are met, as there are limits to what ECSA members can achieve in their own right.

2.1 All ECSA members will adhere to ESAD/SQAS or a similar distributor assessment scheme

ESAD (European Single Assessment Document) is part of the SQAS (Safety & Quality Assessment System) that is a system to evaluate the quality, safety, security and environmental performance of Logistics Service Providers and Chemical Distributors. ESAD enables chemical producing companies to have the quality and safety management systems of their distributors assessed in a uniform manner, thus avoiding multiple assessments by each individual chemical company. Currently over 280 active assessment reports of distributors and their sites are listed in the ESAD database. **All ECSA members have committed themselves to the ESAD/SQAS programme.**

2.2 All distributors which are part of ESAD/SQAS or a similar programme will comply positively with a high score on the chlorinated solvents section of the questionnaire

The ESAD assessment questionnaire consists of four parts: Distributor Standard Activities, Site Assessment, Chlorinated Solvents, and Food, Cosmetic and/or Pharma. The questions on chlorinated solvents emphasize the specific needs associated with chlorinated solvents and are provided together with guidelines for consideration by chlorinated solvent producers and distributors as a way to implement Responsible Care® continuous improvement initiatives (source: www.sqas.org). A continuous yearly increase in positive answers of distributors, under the chlorinated solvent part, has been recognized in the ESAD programme since



ECSA gives guidance on the storage and handling of chlorinated solvents



2007. This leads to consistently high scores of distributors in the ESAD assessment. ECSA has actively participated in a revision of the ESAD questionnaire for chlorinated solvents.

2.3 ECSA will put together awareness programmes, in partnership with trade associations representing end-users, to help ensure the sustainable use of chlorinated solvents

ECSA has already put six different awareness programmes in place:

2.3.1 Chlorinated Solvents: Awareness

Questionnaire to the Value Chain: ECSA has distributed an 'awareness questionnaire' on the safe use of chlorinated solvents in 2009. The findings were shared with the participants in the Value Chain with one particularly surprising result: no participant was aware of the ECSA storage and handling guidance being freely available on the internet. This result led ECSA to take immediate action with a revision and update of the ECSA Guidance of Storage and Handling of Chlorinated Solvents and wide communication: **see next point.**

2.3.2 Chlorinated Solvents: Revized Guidance on Storage and Handling of Chlorinated Solvents:

This guidance is intended to help distributors and users of chlorinated solvents to handle those products safely and with care, thus protecting human health and environment against possible negative impact. In this guidance, ECSA strongly recommends the use of modern closed equipment of Best Available Technology (BAT).

The ECSA Guidance on Storage and Handling is accessible online: www.eurochlor.org/ECSA

2.3.3 Chlorinated Solvents: Revized Safety & Quality Assessment Questionnaire for Distributors of Chlorinated Solvents (ESAD).

With an updated Safety & Quality Assessment questionnaire in 2011, ECSA aims to enhance the overall safety and quality level in the chlorinated solvents distribution chain.

The reviewed questionnaire is applicable to distributors of the chlorinated solvents perchloroethylene (PER), trichloroethylene (TRI) and dichloromethane (DCM).

The recently launched SQAS 2011 programme has been titled "**SQAS: Driving excellence in safe and sustainable chemical logistics**". All revized questionnaires and further details are available on the SQAS website www.sqas.org.

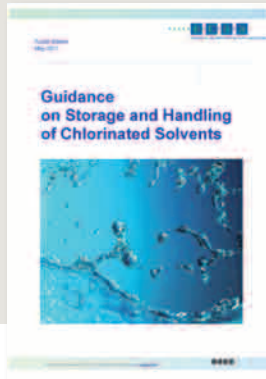
2.3.4 Dichloromethane: OECD HPV SIDS Commitment:

The chemical industry provides the OECD with data and initial hazard assessments for approximately 1,000 HPV chemicals, representing more than 90% of global chemicals production. The information gathered consists of a Screening Information Data Set (SIDS) Dossier, which is a basic set of health and environmental data required for making an initial hazard assessment of HPV chemicals by the member countries of the OECD. ECSA members are committed to improving the management and knowledge of their chemicals through voluntary initiatives such as the ICCA HPV (High Production Volume) Initiative. ECSA is actively supporting the Swiss authorities in preparing the SIDS Dossier for Dichloromethane and its submission to OECD in 2011.

All ECSA members have committed themselves to the ESAD/SQAS programme for quality, safety, security and environmental performance of logistics providers and chemicals distributors

Left picture: ECSA gives guidance on the storage and handling of chlorinated solvents

Right picture: The professional textile care industry recognized ECSA for its awareness programme of sustainable textile care



2.3.5 Perchloroethylene: E-DryClean sustainable dry cleaning processing: E-DryClean is an international initiative to create practical and easily accessible education material, especially for the European dry-cleaning industry. The didactical concept is based on e-learning and/or blended learning. E-learning is a complete digital self-study form of training, presented through a website. E-DryClean offers six different training modules (best practices and working methods) including a module on Perchloroethylene, for which ECSA was leading partner. **The E-DryClean Project groups** 15 partners from eight European countries. The objective of E-DryClean is to improve and adapt the educational level of entrepreneurs and employees working in dry cleaning sectors across the European Union. Read more about this project on <http://www.cinet-online.net/edryclean/>. The professional textile care industry recognized ECSA and its partners through its **Excellence Award 2010** for this awareness programme of sustainable professional textile care. E-DryClean is accessible online: <http://www.cinet-online.net/edryclean/>

2.3.6 Trichloroethylene: Charter for the safe use of Trichloroethylene; ECSA and the producers of Trichloroethylene (TRI) have worked proactively with the EU authorities to develop a voluntary industry-wide commitment – the “TRI CHARTER”. The charter is deemed to ensure adequate control of risks identified in the EU Risk Assessment related to the use of trichloroethylene in surface cleaning by use

of closed systems, also for installations not covered by the VOC directive (now IED). The charter – signed by all European Trichloroethylene producers and an importer – stipulates that latest by end 2010, trichloroethylene will only be supplied for metal cleaning or degreasing if the user has an enclosed cleaning system and has confirmed that trichloroethylene will only and exclusively be used in enclosed cleaning equipment. The ECSA TRI Charter is accessible online: www.eurochlor.org/ECSA

2.4 ECSA will put together, in partnership with other trade associations representing recyclers, awareness programmes to help promote the sustainable recovery of chlorinated solvents ECSA is in contact with the European Solvent Recyclers Group (ESRG), which aims to promote the safe and economic management of post-use solvents (www.esrg-online.eu). ECSA is regularly in dialogue with ESRG on latest information about chlorinated solvents.



The ECSA Trichloroethylene Charter

The ECSA Leonardo da Vinci Project for sustainable dry-cleaning is accessible online in six languages



3. Stakeholder engagement and communication

This Vision Element will be critical to ensure that ECSA and its members receive worthwhile and operational feedback and proper recognition from external stakeholders for the sustainability initiative.

Ultimately, this should also lead to a degree of co-determination of the sustainability of the chlorinated solvents industry, as several stakeholder groups will contribute to shaping its future.

3.1 ECSA will complete a detailed mapping of the activities, drivers and concerns of its priority stakeholders

A Chlorinated Solvent Stakeholder & End-user Perceptions Survey by IAL found that 75% of stakeholders are interested in **more information on Chlorinated Solvents**. Thus, ECSA has completely renovated the content and structure of the ECSA website in 2010 and 2011.

The renewed website delivers comprehensive information about chlorinated solvents. The website was re-structured, and the website content filled with new information on Facts & Figures. High prominence has been given to the Sustainability section and the current programmes (www.eurochlor.org/ECSA).

3.2 ECSA will translate its Sustainability strategy into a set of key messages, and will develop tools to support their delivery and report progress

Euro Chlor, representing the European Chlor-Alkali industry, issues the **Chlorine Industry Review** on the occasion of its Annual General

Meeting. It gives an overview of the most important dossiers the federation has been working on, and presents the progress achieved in the sectoral sustainability programme. ECSA extends its reporting on all nine sustainability objectives and includes its progress report 2007-2011 in the widely disseminated Euro Chlor Annual Review as part of the Chlorine Industry value chain.

3.3 ECSA will be in active dialogue with its priority stakeholders around its Sustainability Action Plan, and reflect stakeholder concerns in the ongoing implementation of the Action Plan

A Chlorinated Solvent Stakeholder & End-user Perceptions Survey by IAL found that 75% of stakeholders are interested in more information on Chlorinated Solvents. Thus, ECSA has completely renovated the content and structure of the ECSA website tools for active dialogue: **Additional communication tools** have been included to increase the dialogue with other stakeholders towards a pro-active communication.

- The **SME support** is targeting Small and Medium Sized Enterprises. As part of its continuous effort to encourage responsible and safe handling of chlorinated solvents, ECSA has developed several information and guidance documents designed to help use chlorinated solvents not only in the most effective but also in the safest and most responsible manner by following best industry practices.
- The **News & Innovation** section highlights some quite challenging innovations with chlorinated solvents.
- The **Ask an Expert tool** will help to answer questions going beyond the information on the website.

The World Chlorine Council® (WCC®) draws its membership from the chlorine producers and regional industry associations located around the world. Today, the membership represents a substantial part of global chlorine and caustic soda production and will increase to over 90% of both capacity and production by the end of 2011, taking into account the anticipated membership of the Chinese Chlor Alkali Industry Association (CCAIA). WCC® has a long affiliation with the International Council of Chemical Associations (ICCA) and is recognized by The United Nations and the Stockholm, Rotterdam and Basel Conventions as an official NGO (Non-Governmental Organization).

Overall, WCC® is focused on engaging producers worldwide to achieve its 2011-2013 goals which focus on:

- Engaging the global chlorine and vinyl industries;
- Participating proactively in key international fora and coordinating advocacy on priority issues;
- Promoting continuous improvement in safety, environment and health performance;
- Demonstrating progress towards sustainability for chlorine chemistry; and
- Communicating the benefits of chlorine chemistry to society.

As from the beginning of 2011, Euro Chlor has been given the task of managing for two years the WCC Secretariat and coordinating its related activities such as global task forces, publications and workshops.

Outreach to the global chlor-alkali sector

In 2009, 2010 and 2011, WCC® continued to strengthen relationships with the chlor-alkali associations of Russia, China, India and producers in the Asia-Pacific region. We are optimistic of concluding formal membership arrangements with each of these regions by the end of 2011 and will continue to build on past work with the Gulf Petrochemical and Chemical Association (GPCA) based in Dubai.

Energy and Climate Change

The UN Climate Change conferences held in Copenhagen (2009) and Cancun (2010) failed to secure global agreements on CO₂ emissions and, with doubt persisting on whether the Kyoto Protocol will continue beyond 2012, CO₂ abatement initiatives are reverting to the regional level. Currently, only WCC members with manufacturing facilities in Europe and Japan are impacted by either Emission Trading Schemes (ETS) or energy taxation. Earlier suggestions that global sectoral agreements might be negotiated have not materialized either but nevertheless WCC® continues to exchange intelligence on political activity across the globe in an attempt to influence decision-making in a coherent and consistent way. However, this is now a lower priority for some regions, and a global approach is not foreseen in the short term.



Advocacy for Promoting Sound Implementation of International Conventions & Policies

WCC® continues to engage with intergovernmental programmes on a number of crucial subjects that could impact chlorine-based processes or products. Advocacy efforts cover outreach to governments and industry contacts on issues relating to chlorine and its derivatives. WCC® advocacy efforts, often in partnership with ICCA, are focused on the following priority issues:

- Stockholm POPs Convention – The World Chlorine Council® has continued outreach to governments regarding the process and criteria for reviewing candidate chemicals. Industry's efforts have resulted in improvements in the assessment of candidate POPs and the use of such information for risk management.
- UNEP Global Mercury Programme – WCC® continues to be an active participant in the UNEP Global Mercury Programme in providing its annual report on mercury use, consumption and emissions by mercury cell facilities. WCC® is also a contributor to various Partnerships linked to the Programme (e.g. Chlor-Alkali Sector, Supply and Storage, Waste Management). The first Intergovernmental Negotiating Committee meeting for the preparation of a Global Convention was held in Stockholm in June 2010 and a second one in January 2011 in Japan. WCC® participated in the discussions and shared its updated leaflet on "Reduction of Mercury Emissions and Use from the Chlor-Alkali Sector Partnership". It is expected that the Convention will be ready by 2013.

Improving Chlorine Safety, Environment & Health Performance

The World Chlorine Council® continues to organise stewardship workshops around the globe to promote best practices in environment, health, and safety. Through the WCC® safety programme, our industry sector is working to achieve continuous improvements in safety performance at production facilities world-wide as well as during transportation and use of chlorine. Key developments in 2010-2011 include:

- The quarterly publication of the WCC® Safety Newsletter to share best practices and to learn from past incidents, which is translated into Japanese, Portuguese, Spanish and Chinese.
- The preparation of new safety tools on specific topics that are made available to producers and packagers, including synthetic WCC® Safety Posters.
- Presentations made by experts from WCC® companies and associations on chlorine safety matters during stewardship/safety workshops. The next workshop is planned for October 2011 in Shanghai.

Demonstrating Sustainability of the Chlor-Alkali Industry

Work continued on the sustainability programme, as agreed the previous year. Though energy became a lower priority following the failure of Copenhagen and Cancun to reach global agreements, other energy related issues - including the use of chlorine derivatives in the field of insulation - continue.

A new brochure on sustainability will be published by the end of 2011 for use in various conferences, including Rio +20 to be convened in Rio de Janeiro during 2012.

03 Regulatory Affairs

Science-based legislation to support innovation

A critical role for Euro Chlor is to provide advocacy leadership in order to positively influence regulations in the areas of energy, environment, health and competitiveness. The federation works with European and international authorities in order to achieve a workable legislation to support the innovative role of the chlor-alkali industry.

Electricity efficiency
of our member
companies is among
the best in the world



Arzon/epel

Emission Trading Scheme (ETS) Directive implementation

The setting up of the rules for the financial measures that Member States may give to compensate for additional costs of CO₂ passed through in the electricity prices falls under the competences of the Commission. These State Aid rules will set the maximum compensation that Member States could provide to industries exposed to carbon leakage due to CO₂ costs passed on in electricity prices (so-called indirect emitters).

The chlor-alkali industry, as part of the sector "basic inorganic chemicals" (according to NACE 2413), has been recognized as one of the exposed sectors. The exposed sectors will be eligible for free carbon allowances or for financial measures under the state aid rules.

At the beginning of this year the European Commission confirmed that the State Aid rules should be available by the end of the year. Euro Chlor welcomed the Commission's recognition of the importance to have the rules in place so that industry can get their dossiers ready and talk to their national authorities prior the revised ETS Directive enters into force on 1 January 2013.

Stakeholders have the opportunity to provide their input and comments on the draft rules during two internet consultations. The first consultation ended on 11 May 2011. The secretariat had set up an ad hoc working group some time ago to deal with ETS matters and the team worked hard to complete the complex questionnaire.

The task was challenging because of differing electricity market characteristics in different parts of Europe which do not match country boundaries. But working in a cooperative spirit the differing views were largely resolved enabling a representative industry view to be submitted. Some individual member companies made their own submission with company confidential data but these did not conflict with the unified view.

A second consultation will follow later this year. Euro Chlor will again provide a consolidated input on behalf of the chlor-alkali industry.

Mercury Export Ban and Storage

The EU Regulation EC 1102/2008 on the Export Ban and Safe Storage of Metallic Mercury entered into force on March 15th of 2011. This European Regulation aims to ban the export of mercury and imposes a storage obligation of mercury. This requires the development of storage criteria for end-of-life mercury under the Landfill Directive. According to the Regulation the criteria should have been developed by January 1st 2010. When the Regulation entered into force Euro Chlor sent a letter to the Commission to draw attention to the uncertainty



AlzoNobel

Training is at the heart of safety and the safety culture which is essential in Euro Chlor companies

regarding storage of the excess mercury faced by Euro Chlor member companies using the mercury technology and planning to convert.

In early April temporary storage criteria have been proposed by the Commission for voting by a special Comitology Committee. However, several Member States had significant comments and objections to the proposal and finally the criteria were not voted. The Commission then proposed a Directive to amend the Landfill Directive (1999/31/EC) with regard to specific criteria for the temporary storage of metallic mercury considered as waste, which was not decided upon when this Review went to press.

Criteria for permanent storage of end-of-life mercury still lacking

There is little interest for our industry for temporary storage. For Euro Chlor companies it is much more important to have criteria for permanent storage. An investigation into the safety of permanent storage of liquid mercury is ongoing in Germany, but these studies may still take several years before being finalized. Euro Chlor member companies therefore continue to look into other permanent disposal solutions, including stabilized mercury, following closely the developments offered by various suppliers.

EU Mercury Strategy still recognizes Euro Chlor's voluntary phase out

The Commission published a review of the Communication on the EU Mercury Strategy in December 2010. This strategy covers all mercury uses in the EU and aims to reduce both use and emissions. Since the very beginning of the mercury strategy Euro Chlor has contributed by providing factual information on use and emissions of mercury in our sector. The Commission Communication was discussed in the Environment Council on March 14, 2011. Despite an attempt to introduce an earlier phase-out initiated by a group of three Member States, Euro Chlor's voluntary commitment to phase-out to end the use of mercury in the Chlor-alkali production by the end of 2020 is still recognized by the authorities. On March 17, the same Communication was also discussed in the Environment Committee of the European Parliament), but there was no discussion on chlor-alkali related mercury issues during the public session.

The overall mercury strategy of the Commission therefore is still broadly supported.





Over and over again, PVC proves to be a hit in sustainable construction



Dolf van Wijk
Science and Regulatory Affairs Director

Dolf van Wijk came to Euro Chlor in 2001 and was appointed Euro Chlor Science Director on January 1st, 2010.

As of January 2011 he has additional responsibility for Regulatory Affairs.

Euro Chlor branding

Euro Chlor succeeded in building a credible name with many in the regulatory and science community in the past. High external pressure on the chlorine sector stimulated the development of a well-organized industry association with a strong support from its member companies. The threat was directed specifically on chlorine, putting our industry in the forefront of many environmental debates and regulations. This foreground position has gradually changed into broader and less specific challenges. But earlier topics still emerge every now and then, sometimes still with a specific focus on chlorine.

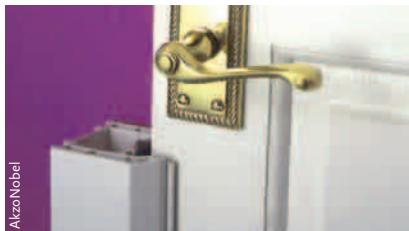
“Teaming up science and regulatory affairs”

EU increasingly risk averse

Today's pressures generally focus on the broader chemical industry. In addition, Europe is continuing on its path of ignoring the importance of science and technology and becoming increasingly risk averse. Chemical industries' role to innovate society to meet future needs is gaining some acceptance but the regulatory framework necessary to accommodate these new developments and needs is not sufficiently developed. The scientific knowledge and tools for effective and up-to-date regulations are available, but there is a great reluctance to incorporate these in legislation.

These broader and more global challenges and new emerging ones like mixtures or green chemistry will be challenging for Euro Chlor in the coming years. I am looking forward to contribute to ensuring we remain an effective organization defending the sustainable future of the Chlor-Alkali industry.

Elegance and efficiency combined thanks to the qualities of polyvinylchloride



Caroline Andersson
Senior regulatory affairs counsellor

“Staying actively on top of regulatory issues that matter for the members”

Caroline Andersson has a Master of Science in Business Administration (MBA). She is closely monitoring legislative developments and initiates advocacy activities, in close consultation with the Membership. She has privileged contacts with the European Commission and Parliament in order to discuss and present the views of the European Chlor-Alkali industry. From January 2011, she is also working as Cefic sector group manager.

For several years now, the energy issue and particularly the European Emissions Trading Scheme (ETS) have been dominating the regulatory activities. The Euro Chlor advocacy on this issue has entered a new crucial phase as the Commission has launched its stakeholder consultation on the state aid rules for compensating electricity intensive industries for the CO₂ costs passed through in electricity prices. Euro Chlor is actively contributing to the development of the rules.

Caroline makes sure that Euro Chlor does not miss important developments, and has the necessary timely contacts – internally and externally – to stay on top of the issues that matter for the member companies.

Chlor-alkali metallic mercury reporting to the Commission

The EU Regulation on export ban and storage obligation (1102/2008) requires that quantities of metallic mercury on chlor-alkali sites are reported yearly to the Commission, starting December 2009.

The Euro Chlor proposal to gather the data from the member companies utilizing the mercury cell technology has been recognized by a Commission Recommendation. All member companies contributed and we were successful in providing the following data for each reporting year:

- Best estimate of total amount of mercury still in use in the chlor-alkali cell and
- Total amount of metallic mercury stored in the facility, even if shut down.

The data are publicly available on DG Environment's website <http://ec.europa.eu/environment/chemicals/mercury> and can also be consulted at the EuroChlor website. Their evolution shows a continuous and rapid decrease due to the successive conversions of chlor-alkali plants using the mercury technology.

The export ban with storage obligation has been in force since March 15 2011, and metallic mercury that has been sent as waste to temporary or permanent storage facilities will have to be reported (next reporting in 2012).





Courtesy to INEOS ChlorVinyls

Chlor-alkali BREF update

The new Industrial Emissions Directive reinforces the importance of the Best Available Techniques reference document (BREF) for permitting the production units, and particularly of the BAT conclusions.

In the framework of the chlor-alkali BREF update, Euro Chlor created an ad hoc task force to define the industry position and gather the necessary information; this task force has produced a huge number of technical documents to submit correct and detailed information to the technical working group in charge of the update work.

A first draft of the updated BREF, without the specific “BAT” chapter is expected before the end of 2011. Some chapters are however already available on the dedicated Commission website and Euro Chlor has proposed comments and possible improvements.

Due to the lack of some information in the answers to the previous questionnaire prepared by the Commission, an additional information collecting round is planned for this autumn, with the help of Euro Chlor.

Blacklists still a regulatory tool: POPs/PBTs and SVHCs

In Europe, Substances of Very High Concern (SVHCs) are managed under REACH. Despite the regular assessment of all substances under REACH, additional requirements are applied for SVHCs under the so-called Authorization or Restriction regimes. SVHCs are PBTs (substances which are Persistent, Bioaccumulate in the food chain and are Toxic), CMRs (Carcinogenic, Mutagenic or Reprotoxic) or substances of “equivalent concern” (to be determined on a case by case basis). Substances which meet the hazardous properties criteria of SVHCs are not by definition put under Authorization. It is up to Member States to decide whether they will compile an Annex XV dossier for a substance, which effectively is a proposal to put them on the candidate list for Authorization. Alternatively, the route of Restriction may be followed to risk-manage specific uses of a substance more stringent than under the regular REACH regime.

Euro Chlor related substances which are SVHCs are trichloroethylene, which is considered carcinogen cat. 1b - and therefore fulfils the CMR criteria - and SCCP which is a PBT. Trichloroethylene has been placed on the candidate list for authorization with prioritization and for SCCPs the EU competent authorities decided to keep the substance listed under Restrictions (Annex XVII). In addition, they are planning to include the substance in the EU Directive on POPs (EC 805/2004) based on the decision of the UNECE LRTAP Convention to list the substance as a POP (POP Protocol).

Chlorine poetry
in action



Top maintenance by highly qualified personnel is essential to achieve top HSE performance

Some Member States suggested this route would be a faster way to ban the substance.

At the end of 2010, Germany attempted to propose trichlorobenzene as a substance of equivalent concern based on perceived PBT properties. Thanks to Euro Chlor past work done by its Marine Risk Assessment Group and follow-up work by the Environment Working Group, we could rapidly react to this attempt. It was possible to very quickly submit a scientific paper demonstrating that TCB does not fulfil any of the PBT properties and, therefore, should not be nominated as an SVHC. The nomination by Germany also met with a lack of support from several Member States, so the proposal did not proceed. This can be seen as a support for the need of a solid scientific basis for substances to be proposed as SVHC based on “equivalent concern”.

Stockholm Convention on POPs

The Stockholm Convention deals with POPs (Persistent Organic Pollutants), i.e. PBTs that are persistent enough to travel long distances and have adverse effects far from their point of release. The fifth COP meeting (Conference of the Parties) of the Stockholm Convention was held end of April. The major issue was the listing of endosulfan as the 22nd substance on the list, which started initially with the well-known “dirty dozen”. However, the COP meeting faced considerable difficulties regarding the Convention’s efficacy. This was exemplified by the many exemptions and (long) timelines agreed for endosulfan, as well as by repeated discussions on financing of the Convention’s activities and compliance checking. The latter two topics were postponed again to the next COP (COP6 in 2013).

In a final statement at COP5, the EU announced they would nominate three new substances as candidate POPs to be added to the Convention. These were HCBd (hexachlorobutadiene), PCN (polychlorinated naphthalenes) and PCP (pentachlorophenol). Euro Chlor and WCC will follow up the nomination of HCBd, which is an unintentional by-product related to our industry. Material has been prepared to contest the need for nomination of this substance. The evidence demonstrates that it is unlikely, based on current environmental concentrations, that HCBd poses adverse environmental or health effects.



The World Chlorine Council reported updated figures to the United Nations Global Mercury Programme on the progress made in the chlor-alkali industry in reducing the use and the emissions of mercury



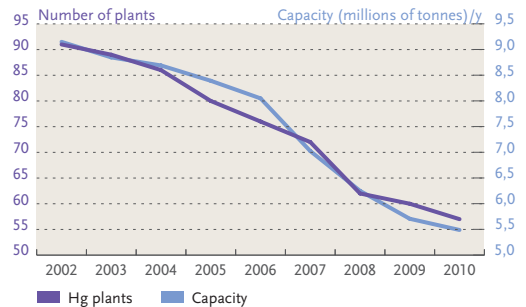
UNEP Global Convention on Mercury

At the UNEP Governing Council/Ministerial Forum convened on February 16-20, 2009 a decision was reached to establish an international convention to deal with mercury pollution which should include both binding and voluntary measures. The details of the new convention will be negotiated over the next years and will be completed by 2013.

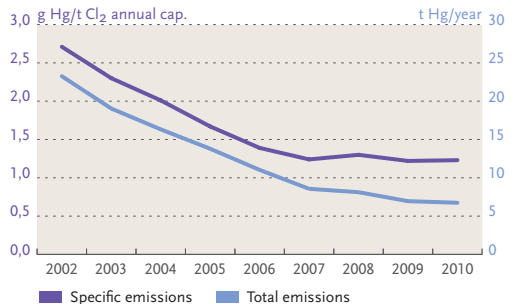
The UNEP meeting also decided on the provisions for the future mercury convention. The requirements that will be applicable to the chlor-alkali industry and VCM production are on reduction of emissions, measures on use and trade of mercury and addressing mercury-containing waste. The UNEP Partnership for the chlor-alkali industry continues under the US government lead. WCC is an active partner in this programme. The following positive results were reported to UNEP by WCC:

- The number of plants and the mercury cell-based production capacity continue to show a world-wide decrease: the number of plants went down from 91 to 57 over the period 2002-2010 (-37%) and the mercury cell-based capacity from 9.1 million tonnes to 5.5 million tonnes (-40%).
- Global mercury emissions have been further substantially reduced in the period 2002-2010. They went down from 24.6 tonnes/year to about 6.7 tonnes, or 73% decrease over the eight years of reporting by WCC. The emissions expressed in g mercury/tonne annual chlorine capacity show the same trend.

WCC - Chlor-alkali Industry / Number of plants and capacity of mercury electrolysis units (in USA/Canada/Mexico, Europe, Russia, India and Brazil/Argentina/Uruguay)



WCC - Chlor-Alkali Industry / Total mercury emissions (air + water + products) (for USA/Canada/Mexico, Europe, India and Brazil/Argentina plus 1 Uruguayan and 3 Russian plants from 2005 onwards)



04 Science

Effective advocacy based on sound science

Advocating sound, science-based regulatory decision-making has been Euro Chlor's core business for more than twenty years.

In 2010-2011, the organizational and technical challenges posed by REACH, chlorine-based biocides, classification and labelling and chemicals of special concern constituted key issues in the Federation's science activities.



Pumping brine and caustic soda in an electrolysist unit

Revitalization of the science programme

Euro Chlor and its member companies are proud of the high quality and effective science work that we do. Due to the immediate priority of REACH registration over the past two years, some of the science work had to be put on the back burner. However, now that the 2010 REACH registration deadline has passed, several meetings have been held on how to reorient the science teams towards providing the best possible value science support to our members. The science teams are structured around three core groups. The Science Steering Committee (SSC) meets twice a year to discuss the priorities for the science programme and the required budget for various projects. Under the SSC are two teams, the Health Working Group (HWG) and the Environment Working Group (EWG).

The HWG is made up of toxicologists, occupational physicians and epidemiologists, who meet twice a year to discuss medical and toxicological issues. This year the group has been arranged into 'issue teams' which work on specific issues such as EMF, mercury exposure and disinfection by-products, and report back to the main HWG. The HWG also organizes a yearly literature review of studies published, which may be of interest to the chlor-alkali community.

The EWG is made up of environmental experts who work on several specific projects of value to the Euro Chlor membership. These issues include developing a PBT risk assessment methodology, the hexachlorobenzene risk

assessment dossier, whole effluent testing, Water Framework Directive impact and mixture issues.

REACH registration

The major achievement of the last 12 months has been the preparation and registration of dossiers for eight high-production volume chemicals, under the European REACH Regulation (EC/1907/2006). The lead dossiers for all substances were submitted on time, as well as the individual dossier that each legal entity was required to submit. Several technical hurdles cropped up as we reached the finish line, including managing Letter of Access (LoA) sales, management of the SIEF and preparation for classification and labelling (discussed further below). The lead dossier consisted of the IUCLID file, which is itself made up of study summaries for all the data identified for specific substances. Additionally, many of the consortia decided to prepare a chemical safety report (CSR) in common to reduce costs where possible. All consortia are managed by Euro Chlor / ECSA staff working under the umbrella of ReachCentrum, and the substances covered are: caustic soda, chlorine, ethylene dichloride, hydrogen chloride, perchloroethylene, potassium carbonate, potassium hydroxide and sodium hypochlorite. The chlorinated solvents consortium covers the five substances tetrachloroethylene, trichloroethylene, chloroform, carbon tetrachloride and dichloromethane. But just because the registration deadline has been met, we must not be complacent. Further work is required with the possibility of



Shaun Presow
Science Counsellor

“Quality data collection is vital to continued improvement in occupational health”

The backbone of the Euro Chlor Science team, Shaun Presow, was awarded a PhD in Chemistry in Germany in 2008 before joining the Federation in 2009.

Data management and sharing

Shaun is involved in the management of health data provided by Euro Chlor member companies. These data include mercury in workers' urine, the self-assessment audit, in which companies assess their progress against Euro Chlor best practice guidelines in various areas, and reporting on chlorine inhalation incidents. The collated data is made available to the General Technical Committee and the Health Group for analysis, discussion, benchmarking and improving existing Guidelines in Best Practice documents.

Euro Chlor science

Since January 2011 Shaun has been organizing the work of the Environment Working Group and assisting in the management of the Science Steering Committee. Additionally he has taken on tasks within the Chlorinated Paraffins Sector Group.

REACH

Shaun is managing the dossiers for chlorine, hydrogen chloride, sodium hypochlorite and ethylene dichloride, as well as following up generic REACH issues for Euro Chlor. He is also responsible for the Biocides dossiers, namely the active substance registration for chlorine, sodium hypochlorite and calcium hypochlorite.

Euro Chlor scientific communication

Since the beginning of 2010 Shaun has taken over the management of science communication which covers for example the Science Dossiers (in-depth reviews on various chlorinated substances and topics addressing the scientific community) and the Focus on Chlorine Science (FOCS) leaflets aiming to help non-scientists understand chlorine-related science issues.



our dossiers being evaluated at some stage, new data going into the REACH dossier where required, and the preparation of summary exposure scenarios to append to the eSDS. Some substances have, moreover, been earmarked by authorities as requiring further work – one notable example being EDC, about which Slovakia has submitted an annex XV dossier by August to identify EDC as a substance of very high concern.

A REACH dossier for mercury was prepared by the Belgian-based consultant ARCHE, which specialises in risk assessments of metals. The cooperation of the companies involved was organized by Dela (a German recycling firm dealing with the recovery of mercury). Euro Chlor provided technical and scientific support before the registration deadline.

The chlorinated paraffins (medium-chain, long-chain and sulpho-) were managed separately by a consultant, and were also successfully registered.

Biocides

The registration of chlorine, sodium hypochlorite and calcium hypochlorite as active substances under the Biocidal Products Directive (98/8/EC) is continuing, albeit a little behind schedule. The registrations for product types of Main Group 1 (disinfectants and general biocides) were submitted in mid-2007. The dossiers for the three substances have been evaluated, and the draft competent authority report was provided to us for some minor correction.





Bayer-MaterialScience AG

Protecting life on the move: polycarbonate enables a safe vision for the biker

In this report, the Rapporteur Member State (RMS) agreed with our conclusions. Member states and other stakeholders were then provided with an opportunity to provide their own comments, which they did before the end of January 2011. The RMS then prepared a synthesis of these comments, after which the substances will be discussed at Technical Meetings. Euro Chlor will attend these meetings with experts from member companies to respond to any comments of the member states identified during the commenting process. If all goes well, we would expect a listing of the substances in Annex I of the BPD mid-2012. A second series of dossiers for Main Group 2 (preservatives) were submitted in October 2008 for the three active substances. These dossiers have been assessed as complete by the RMS, and have entered the evaluation procedure. This should be completed in 2011.

Classification and labelling

January 3rd 2011 was the deadline for the classification and labelling of substances under the CLP regulation (EC/1272/2008). The classification of all substances, no matter what tonnage produced, had to be notified to ECHA before this deadline. For most of our members, this was done in the REACH dossiers, but for those who did not submit a REACH dossier (due to a lower tonnage band) the substance had to be notified separately. All REACH consortia, as a part of their work, provided their recommended classification and labelling to the REACH consortia and SIEF members, and the

documents are available on the Euro Chlor website. Euro Chlor also provided a recommendation for calcium hypochlorite, as no REACH consortium is managed by Euro Chlor for this substance.

Additionally, several amendments (called adaptations to progress) have been published for the CLP regulation, amending the classifications. The most recent of these - published in March 2011 - introduced chronic toxicity criteria for the environment, which meant that the classification for sodium hypochlorite had to be amended. Moreover, the sodium hypochlorite consortium organized further testing of the substance on *Ceriodaphnia dubia*, which confirmed that the substance should keep the M-factor of 10, and thus be labelled as dangerous to the environment in concentrations greater than 2.5%. Mixtures may have a different classification threshold due to specific mixture testing.

Occupational health issues

In 2010 an occupational health workshop was held on mercury in Brussels. It was well attended, and feedback received was excellent, so we are considering holding a repeat workshop. This will be organized in early 2012 if it is decided to push ahead.

In early 2011, the Health Group also provided a questionnaire to all members regarding the health activities, to develop ideas around ways we can best support our membership through these activities.



Having fun with PVC
in a clean swimming
pool: chlorine is
giving a hand to both

An update has been organized for the chlorine exposure questionnaire, which we ask members to return after an incident that results in human exposure. This questionnaire collects details on the magnitude of exposure, symptoms shown and treatment given. By collecting this information, we hope to build a picture of how incidents are occurring across the industry, and how these can best be treated to optimise treatment outcomes.

The results of the mercury in urine questionnaire for 2009 and 2010 had an excellent response rate, with 100% achieved in 2010. The results also showed a general decrease in exposure in 2009, followed by a levelling off in 2010. There is still room for improvement, particularly at some sites.

Disinfection by-products, chlorine and asthma

The European Union is investigating the health-related effects of disinfection by-products (DBPs), by financing the research project HIWATE. The main findings were presented during a 3 day meeting in 2010 and publications are forthcoming.

Significant progress was made in our efforts to understand suggested links, based primarily on epidemiological studies, between swimming in chlorinated pools and respiratory symptoms including asthma. Euro Chlor organized an Experts Panel discussion on the subject during the International Conference on Swimming Pools and Spas, Porto, on 15 March.

The results of a study which Euro Chlor supported with the University of Utrecht (part of the EU HITEA project) on more than 2000 Dutch children were presented. The study found no link between swimming pool attendance and asthma or wheezing or rhinitis: it also provided valuable data on the typical levels of trichloramine (a respiratory irritant by-product of chlorination) to which these children were exposed.

The Utrecht results are paralleled by those from a new longitudinal study on almost 6000 children from the ALSPAC cohort in the UK whose health and lifestyle have been followed in detail from birth. This study also found no association between swimming (invariably in chlorinated pools) and the risk of asthma. On the contrary, the authors noted that swimming was associated with increased lung function and lower risk of asthma symptoms, especially among children with pre-existing respiratory conditions.

Reviewing these two large studies, and relevant literature published since a previous workshop in Leuven in 2007, the Experts Panel concluded that the accumulated evidence does not support the suggestion sometimes made that swimming in chlorinated pools as a child has been a major factor in the rise in asthma in recent decades. Work will continue to clarify any possible more limited risks for all sections of the population.



Euro Chlor presents its science work at the SETAC Europe Congress in Milan

The 2011 SETAC congress in Milan was attended by over 2,000 environmental scientists, chemists and ecotoxicologists from around the globe. The congress consisted of 4 days (8 parallel sessions) of presentations and daily poster sessions. This year mercury did not feature prominently, but legacy PCBs remained high on the agenda, and several posters discussing water chlorination as a method for removal of pharmaceuticals or other chemicals from drinking water were presented. There was a lot of interest in the Euro Chlor booth, with the new FOCS on long-term mercury exposure and the selection of science dossiers available (<http://eurochlor.amaze/download-centre/science-dossiers.aspx>).

Additionally, Dolf van Wijk presented the work Euro Chlor has done on hexachlorobutadiene, showing how this persistent, bioaccumulative and toxic substance can be risk assessed, and that the substance shows no risk to predators through secondary poisoning.

Kees van Ginkel from Akzo Nobel presented work done on the biodegradation of chlorinated paraffins, showing how the biodegradation potential is linked to the degree of chlorination, and that chlorination above 50% retards the degradation of CPs.

New Science Publications

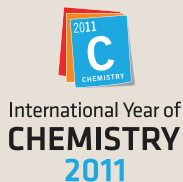
Now that the REACH registration for the chlor-alkali substances is largely behind us, more focus can be turned towards the Euro Chlor science agenda, and a major part of this is the publication of this science work.

In early 2011, Euro Chlor published two new FOCS (Focus On Chlorine Science) documents, which are designed to give a quick introduction to various topics. The first, entitled 'Metallic mercury: the health effects of long-term, low to moderate exposure' is a distillation of the complex discussion in our science dossier of the same name. In clear, understandable language, this shows that the effects of long-term low exposures leading to exposures of lower than 30µg/g creatinine pose no risk to workers. The second FOCS discusses the issues around bioaccumulation – how it is defined, how substances bioaccumulate and how to risk assess these substances.

It is hoped later this year to prepare a science dossier on the human health effects of disinfection by-products from the use of chlorine. A risk assessment for hexachlorobenzene is also being finalized for publication by the Environmental Working Group.

Left picture:
Flexible and elastic polyurethane shapes this comfortable Italian seat

Right picture:
Flame-retardant polyurethane skin is used for these fashionable rear projection monitors



In the International Year of chemistry (IYC) 2011, focus is put on motivating women to develop a career in chemical science



“Glad to be part of the Euro Chlor team”

Marleen Pauwels
Sector Group and Science Manager

Marleen Pauwels joined Euro Chlor on 1 September 2011 as Sector Group and Science Manager. She will manage some Fluor Sector groups for half of her time, while the other half she will be managing the health related science issues for Euro Chlor.

Toxicity and health

Marleen is a doctor in pharmaceutical sciences and obtained her PhD degree in 2008 at the Vrije Universiteit Brussel (VUB) on a thesis entitled: ‘Critical evaluation of the current EU regulatory framework for the safety assessment of cosmetics’.

She started her career at this university giving logistical and scientific support to the experts of the Belgian High Council of Public Health. Marleen then went to Albemarle Europe as a Senior Regulatory Affairs and Toxicology Analyst. She then returned to the VUB to take on responsibility for the preparation of technical information files and their acceptance by authorities for cosmetic companies in order to put them in compliance with the current cosmetics legislation.

For her science activities in Euro Chlor Marleen will be dealing with a variety of health and toxicity related topics, including mercury and occupational exposure and chlorine and asthma.

Workers’ exposure to electromagnetic fields (EMF)

The update work on the European Directive to protect workers against the effects of electromagnetic fields has led to successive draft documents discussed with the social partners. The final draft, integrating the latest ICNIRP guideline for low frequencies EMF and the German authorities’ study results, has led to the editing of a formal opinion by the Advisory Committee for Safety and Health. The Commission was asked to make several technical improvements and to add clarifications to the draft Directive. In the latest version distributed, the Commission has mostly integrated the comments made by the stakeholders, and the Directive has been submitted to the Council and the Parliament just before the summer.

Clarifications are still required, but they will probably be integrated in a guideline to be prepared by the Commission with the stakeholders. The target is to have this new directive voted before April 2012, allowing the old one to be repealed before the time limit for its implementation.

In parallel, Euro Chlor is restarting the work with CENELEC to finalize a standard for measurement methods applicable to the electrolysis industries, based on the new draft Directive’s content.



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New pages in history of aviation are written by the **SOLARIMPULSE**, the world's first airplane aiming to fly night and day around the world only propelled by solar energy.

Chlorine chemistry contributes to the manufacturing of its 12,000 solar cells, lightweight polyurethane foams and unbreakable polycarbonate films and sheet for the cockpit glazing.



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05 Communication & Education

Relevant, scientific and timely information

The European chlor-alkali industry has based its reputation management on providing relevant, scientifically sound and timely information. Stakeholders are informed of the newest scientific findings linked to the sector's activities and of Euro Chlor news on regulatory developments.

Unexpected events concerning chlorine-related substances have called for prompt and adequate communication. Immediately after the Hungarian red sludge disaster and at the start of the dioxin crisis in the German food chain, Euro Chlor published one-pagers explaining the basic facts about caustic soda and dioxins. This transparency is closely linked to Euro Chlor's credibility.



The newly designed Euro Chlor website fulfils the modern surfer's wishes for ergonomics

Euro Chlor website entirely renovated

Over the last twelve months, the Euro Chlor website – initially created in 2005 – has been completely revamped. Its structure is now content-driven and no longer driven by the Secretariat's structure. This approach enhances user friendliness, the aim being that any page of interest can be found in just three clicks. The fresh and colourful design meets today's standards for corporate websites. The Euro Chlor Management Brief, sent monthly to selected readers among member companies, has also been restyled and harmonized with the website appearance.

Web communication remains very successful

The former Euro Chlor website, online until September 2011, counted about 160,000 visitors in 2010 and even still showed a positive trend in 2011 (+ 6% average monthly visitors). More than half a million web pages are viewed every year. With 30,000 visits per year, the pages on the chlorine production processes are the most popular. One quarter of all visitors regularly return to the site to visit other pages. The site also generates hundreds of mails ordering Euro Chlor publications and technical documents.

Technology Conference & Exhibition: eighth edition

With the eighth edition of its Chlorine Technology Conference in Budapest, Euro Chlor continues a series of important world-scale events that started quite modestly in 1981 in Paris. It was at that point in time that a member-only gathering on chlorine handling and safety was organized, under Euro Chlor's initial name Bureau International Technique du Chlore. After that, it would take until 1990 to organize in Brussels the second Technical Seminar on Safety. Since then, further conferences have taken place in Paris, Leipzig, Barcelona, Prague and Lyon.

The 2011 event counted about 330 participants and 33 exhibitors at this international forum for exchanging and discussing the latest trends on health matters, environmental protection and safety issues linked to chlor-alkali production. They shared the newest technological developments related to all aspects of production, transportation and use of chlorine and caustic soda.

The eighth Chlorine Technology Conference in Budapest gathered 330 participants





The Euro Chlor exhibition stand documents the impact of chlorine and caustic in dozens of areas of modern life

High level international speakers contributed to help us see new perspectives in the chlor-alkali industry. The majority of the participants came from all over Europe, but 14 non-European countries from all continents were also represented.

New exhibition stand

Communications has prepared a modular exhibition stand on 'Chlorine is more ... than you think'. Keywords and eye-catching pictures illustrate how chlorine and caustic are fundamental building blocks for thousands of useful chemical and pharmaceutical compounds. The stand will enhance the Euro Chlor visible presence at congresses and major meetings.



“Intensive electronic communication, wrapped in a new jacket””

Dirk Clotman
Communications Manager

From his chemical background, Dirk Clotman has been active all his career in defending, explaining and promoting chemistry and the chemical industry at large. For more than three years now, he has been developing and refreshing Euro Chlor's internal and external communications, including science communication, and adapted the visual identity of Euro Chlor.

In the electronic field, a brand new website has been created and Euro Chlor's Management Brief restyled. Other types of electronic communication – such as social net-

works – are studied. The daily maintenance of the Euro Chlor and ECSA web pages - as well as the management of the ChlorVinyl network document exchange site - are also handled by Communications. Relevant information related to Euro Chlor and to member companies' activities are shared in the electronic newsletter.

Finally, an extensive communication programme is being developed in order to increase the visibility of the chlorine industry and to highlight more intensively the benefits of its downstream products.





Euro Chlor Information Sheets explain complex scientific issues in a very accessible way

Information Sheets

Euro Chlor's communications strategy embraces efforts to explain a number of topics linked to chlorine chemistry to a large audience. So we have created Information Sheets on various subjects. These sheets can be easily translated into other European languages. Policy makers, the press and the public at large may be interested in these one-pagers, which can of course be downloaded from the website as PDF files. Responding to industrial incidents in Hungary and Germany, Euro Chlor issued Information Sheets on caustic soda and dioxins. Other Sheets, like the ones on PCBs and the fight against malaria, have been updated, explaining Euro Chlor's position on these issues.

New Science Dossier on halogenated by-products

Euro Chlor published a new Science Dossier in 2010: *Environmental safety of halogenated organic by-products from the use of active chlorine*. This publication presents a detailed examination of the halogenated by-products generated when using active chlorine for disinfection of water and the environmental impact of these species.

Two FOCS publications

FOCS publications ('Focus on Chlorine Science') cover science issues aiming to clarify and consolidate in a relatively simple way research in the field of chlorine chemistry. Initiated in 2010, two issues have been published in 2011: *Metallic Mercury: the health effects of long-term, low to moderate exposures* (March) and *Bioaccumulation* (May).



Euro Chlor FOCS publications cover in a relatively simple way research topics in the field of chlorine chemistry

06

Industry overview

European chlor-alkali industry shoots back up

While the European chlor-alkali industry was one of the first chemical sectors to be severely hit by the dramatic economic and financial crisis, which started during the second half of 2008, it was also among the first ones to show signs of improvement in 2010. Demand for caustic soda, an essential co-product in chlorine manufacture, managed to recover from the drastic drop in 2009. The chlorinated solvents market also recovered from a substantial decrease in 2008-2009, but remained below the pre-crisis levels.



In 2010, European chlorine production was nearly ten per cent higher than in the previous year

After being deeply affected by the 2008-2009 downturn, 2010 chlorine production and demand registered the fastest rebounds, albeit remaining well below the pre-crisis levels. With nearly 10 million tonnes in 2010, European chlorine production was 9.9% higher than in the previous year. The 2010 average capacity utilization rate reached 79.0% compared to 71.1% in 2009.

Germany remained Europe's largest chlorine producer, accounting for 45% of European production, followed by Belgium/The Netherlands with 15.7%, and France with 11.4%. These top three regions accounted together for 72% of total European chlorine manufacture in 2010.

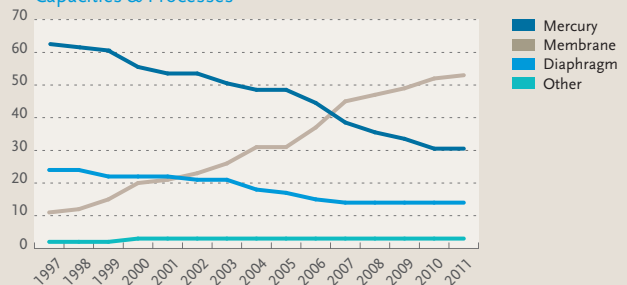
After a drastic drop and, consequently, record high stock levels in 2009, demand for caustic soda – an essential co-product in the making of chlorine –, managed to recover although it is still not as robust and stable as before the crisis. Overall average monthly stock levels remained just below the 250,000 tonnes mark.

Chlorine and caustic soda, which are key chemical building blocks for a wide range of products and processes, are produced by electrolysis using three main technologies: mercury, membrane and diaphragm. After having used the mercury technology for more than a century, the European chlor-alkali industry committed voluntarily to close or convert its mercury based plants by 2020. In the year 2000, the mercury process still accounted for 54% of European capacity. The target was for mercury cells to represent less than 35% of

the installed capacity by the end of 2010. And the industry did not fail to deliver: the gradual shift away from the mercury cell technology continued, accounting for 30.9% of the total installed capacity in 2010, a 8.9% change on 2009. The more energy-efficient membrane technology accounted for more than 50% of 2010 European chlorine capacity.

After two difficult consecutive years the chlorinated solvents market is slowly recovering. With nearly 158,000 tonnes in 2010, combined sales of dichloromethane (methylene chloride) and perchloroethylene (tetrachloroethylene) were 10.4% higher than in 2009. But the situation differs for each solvent. Sales of dichloromethane went up by 13.8% in 2010 compared to the previous year, whereas for perchloroethylene the situation remained rather stable with a 2.7% increase. With only one producer in Western Europe, sales of trichloroethylene can no longer be reported in observance of the Cefic statistics rules.

Capacities & Processes



Plant visits of neighbours and other stakeholders are typical for the openness of the chlorine industry



Chlorinated Paraffins: scientific developments are continuing

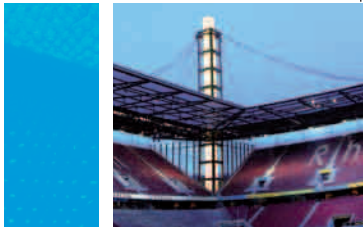
Chlorinated paraffins sales in 2010 were above 45,000 tonnes, approximately 1% up on the previous year. Dossiers to register MCCP and LCCP under REACH were submitted ahead of the 1 December deadline. There was no Consortium for SCCP, but a dossier for SCCP has been submitted. The dossiers are currently being evaluated by ECHA, the European Chemicals Agency in Helsinki.

Formal testing requirements to assess whether MCCP fulfils **the PBT criteria** were met and submitted to the UK, as rapporteur Member State. The required bioaccumulation test on a chlorinated tetradecane showed a bioaccumulation potential above the criteria. However, as this specific component has also been found to be biodegradable, the overall conclusion was that no MCCP components are 'PBT'. The rapporteur acknowledged in the report to ECHA the fact that different components of MCCPs may have very different environmental properties and referred to the ongoing work carried out by the Sector Group.

In Europe, Norway has maintained **pressure on MCCPs**, which they have put on their national list of substances of concern. The CP Sector Group believes this is done based on incorrect data and assumptions. With the help of Cefic this approach, affecting MCCPs as well as other substances such as phthalates, is being contested arguing that Norwegian authorities have agreed to follow REACH. By following an unscientific approach and listing the substances incorrectly an unjustified business pressure is put on the product.

SCCPs were discussed under **the Stockholm Convention** by the POP Review Committee (POPRC) meeting in October 2010 for the fifth year in a row. This is exceptional as no other substance has been discussed more than once per evaluation stage. Once again the POPRC could not reach a consensus view with several Parties opposing to list SCCP as a POP, including Japan, India and China. Alternatively there was also no unanimous support to set the substance aside. Therefore it was decided to evaluate the interpretation of the Annex E criteria and also to focus on the 'toxic interaction' issue which refers to mixtures. SCCPs are expected to be only briefly revisited at POPRC7 with another in-depth discussion planned for POPRC8 (2012).

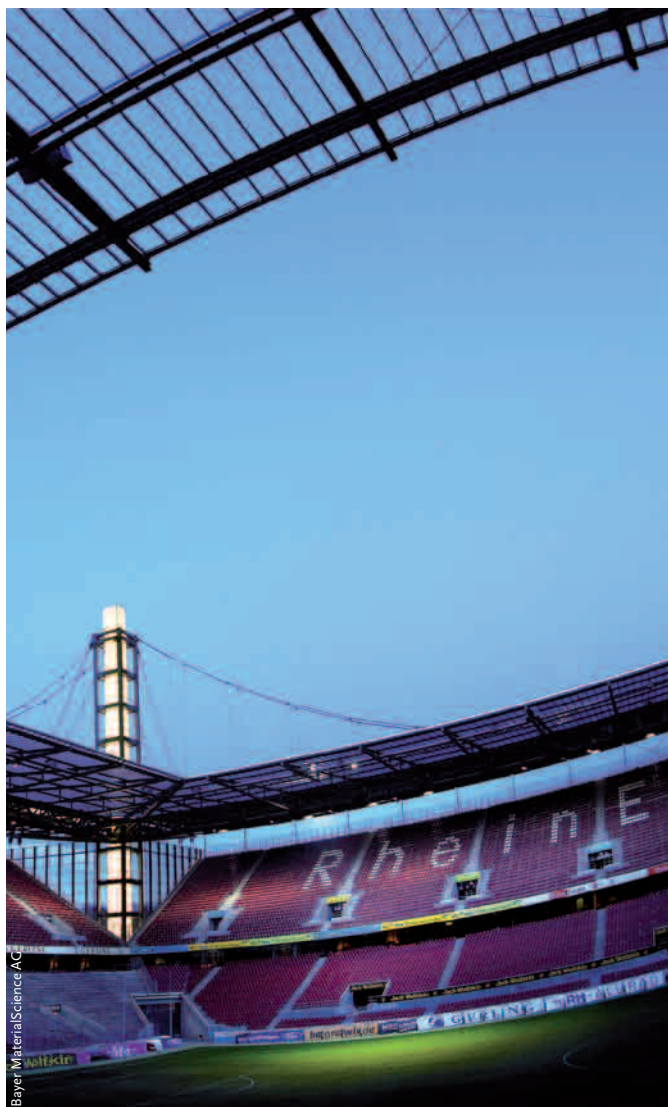








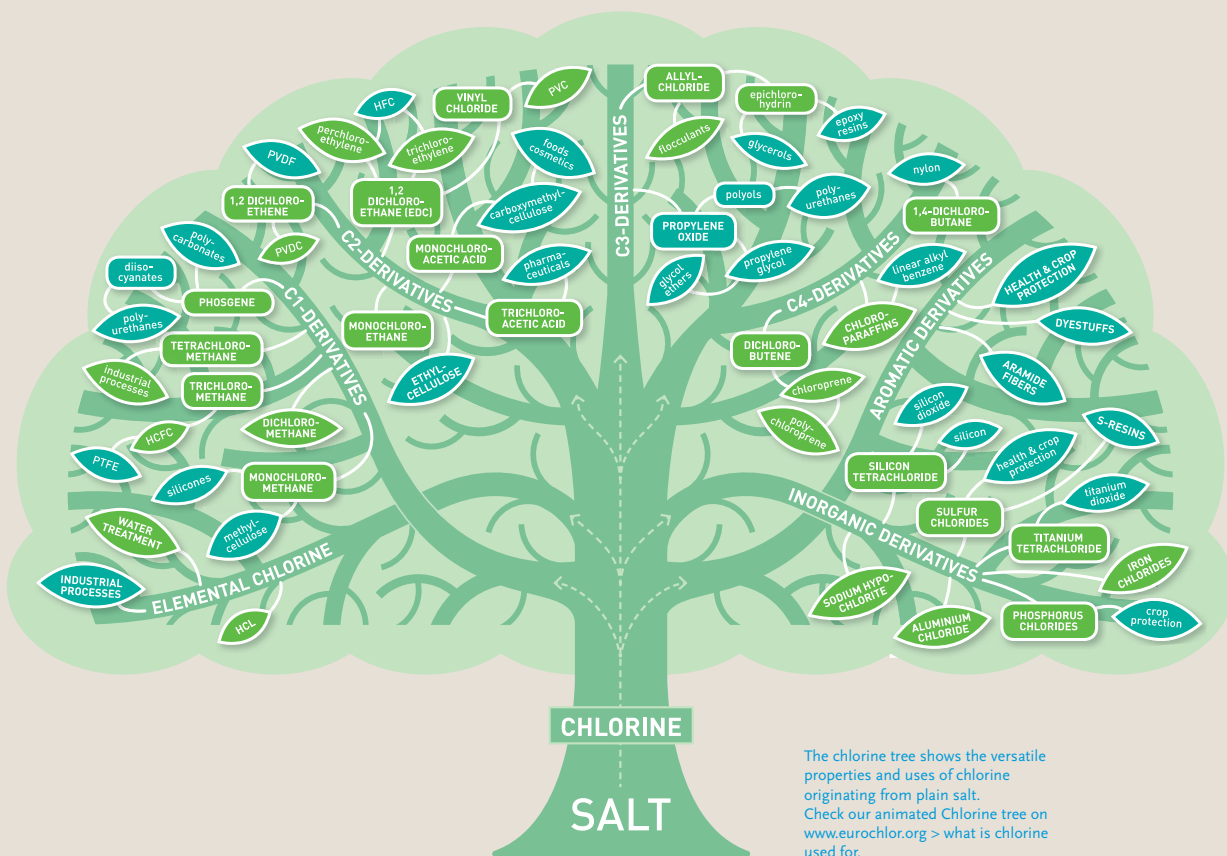
The roof of the Cologne "Rhein Energy" soccer stadium consists of polycarbonate panels

Scientific developments are continuing. A project is being run to investigate the possibility that MCCPs interfere with vitamin K absorption in the gut. Initial results show that this is not the case, but there are some issues with the test model that need to be further investigated. Additionally work is ongoing with the biodegradation of MCCPs at various levels of chlorination. Results demonstrate that MCCPs up to 50% chlorination are rapidly and easily biodegradable. Components with higher levels of chlorination are also biodegradable but are prone to produce some recalcitrant metabolites. The nature of these metabolites is being investigated further. The biodegradation results were presented at SETAC in May 2011 and a peer-reviewed paper is forthcoming.

Additionally in late August a presentation on the risk assessment of SVHC compounds was delivered at the Dioxin 2011 symposium in Brussels, which included CPs as an example.



MOLECULE	END USE	INTERMEDIATE
contains chlorine		
contains no chlorine		



The chlorine tree shows the versatile properties and uses of chlorine originating from plain salt. Check our animated Chlorine tree on www.eurochlor.org > what is chlorine used for.

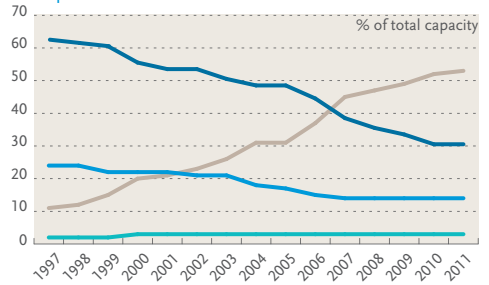




Alze/Nobel

- Mercury
- Membrane
- Diaphragm
- Other

Capacities & Processes



European Chlorine production in 2010

9,999 kilotonnes

UK+Poland+Portugal+Switzerland

885 kt (8.9%)

Spain

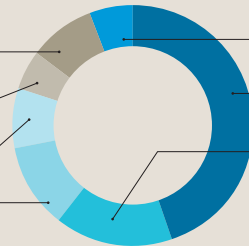
531 kt (5.3%)

Italy+Austria+Greece+Romania+Norway

795 kt (7.9%)

France

1,136 kt (11.4%)



Czech Republic+Slovak Republic+Hungary+Finland+Sweden

583 kt (5.8%)

Germany

4,497 kt (45.0%)

Belgium+the Netherlands

1,572 kt (15.7%)

European chlorine applications in 2010

10,010 kilotonnes

Solvents 312 kt (3.1%)

Metal degreasing, adhesives, dry cleaning, plastics

Epichlorohydrin 545 kt (5.4%)

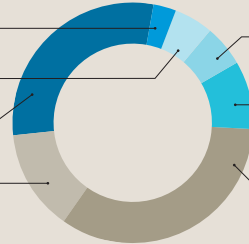
Pesticides, epoxy resins, printed circuits, sports boats, fishing rods

Isocyanates & Oxygenates 2,937 kt (29.3%)

Upholstery, insulation, footwear, plastics, pesticides, car paints

Inorganics 1,351 kt (13.5%)

Disinfectants, water treatment, paint pigments



Chloromethanes 540 kt (5.4%)

Silicon rubbers, decaffeinated, Teflon®, paint strippers, cosmetics

Other Organics 922 kt (9.2%)

Detergents, ship & bridge paints, lubricants, wallpaper adhesives, herbicides, insecticides

PVC 3,403 kt (34.0%)

Doors and window frames, pipes, flooring, medical supplies, clothing

European caustic soda applications in 2010

9,801 kilotonnes

Soaps 349 kt (3.6%)

Shampoos, cosmetics, cleaning agents

Miscellaneous 1,645 kt (16.8%)

Neutralization of acids, gas scrubbing, pharmaceuticals, rubber recycling

Bleach 379 kt (3.9%)

Textiles, disinfectants

Food industries 447 kt (4.6%)

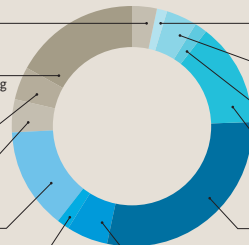
Fruit and vegetable peelings, ice cream, thickeners, wrappings

Pulp, paper, cellulose 1,336 kt (13.6%)

Adhesives, heat transfer printing, newspapers, books

Mineral oils 139 kt (1.4%)

Greases, fuel additives



Rayon 142 kt (1.5%)

Bedspreads, surgical dressings

Water treatment 436 kt (4.4%)

Flocculation of waste, acidity control

Phosphates 167 kt (1.7%)

Detergents

Other inorganics 1,372 kt (14.0%)

Paints, glass, ceramics, fuel cells, perfumes

Organics 2,818 kt (28.8%)

Artificial arteries, parachutes, pen tips, telephones

Aluminium and metals 571 kt (5.8%)

Greenhouses, car and airplane panels, steel hardening

07

Chlorine production plants

January 2011



COUNTRY	*	COMPANY	SITE	PROCESS	CAPACITY (ooo tonnes)	
Austria	1	Donau Chemie	Brückl	M	70	
Belgium	3	SolVin	Antwerp	Hg	290	
				M	144	
	4	SolVin	Jemeppe	M	174	
	5	INEOS ChlorVinyls	Tessenderlo ¹	Hg	170	
				M	270	
Czech Rep.	6	Spolana	Neratovice	Hg	135	
	7	Spolchemie	Usti	Hg	61	
Finland	8	AkzoNobel	Oulu	Hg	40	
	9	Kemira	Joutseno	M	75	
France	10	PPChemicals	Thann	Hg	72	
	11	Perstorp	Pont de Claix	D	170	
	12	ARKEMA	Fos	D	150	
				M	150	
	13	ARKEMA	Jarrie	Hg	170	
	14	ARKEMA	Lavera	Hg	166	
				D	175	
	15	ARKEMA	Saint Auban	M	20	
	16	Métaux Spéciaux	Pomblière	Na	42	
	17	Prod. Chim. d'Harbonnières	Harbonnières	Hg	23	
	18	Solvay	Tavaux	Hg	240	
				M	120	
	19	Prod. Chim. Loos	Loos	Hg	18	
	Germany	20	BASF	Ludwigshafen	Hg	170
					M	215
		21	Bayer	Dormagen	M	400
					HCl	80
		22	Bayer	Leverkusen	M	330
23		Bayer	Uerdingen	Hg	130	
				M	110	
24		Bayer	Brunsbüttel	HCl	210	
25		Dow	Schkopau	M	250	
26		Vinnolit	Knapsack	M	250	
27		CABB GmbH	Gersthofen	M	45	
28		Dow	Stade	D	1030	
			M	555		
29	AkzoNobel	Ibbenbüren	Hg	125		
30	AkzoNobel	Bitterfeld	M	88		
31	Evonik Degussa	Lülsdorf	Hg	137		
32	INEOS ChlorVinyls	Wilhelmshaven	Hg	149		
33	AkzoNobel	Frankfurt	Hg	167		
34	Solvay	Rheinberg	D	110		
			M	85		
35	VESTOLIT	Marl	M	260		
36	Vinnolit	Gendorf	M	180		
37	<i>Wacker Chemie</i>	<i>Burghausen</i>	<i>M</i>	<i>50</i>		
Greece	38	Hellenic Petroleum	Thessaloniki	Hg	40	
	94	Kapachim	Inofita Viotias	M	4	
	95	Unilever Knorr	Marousi	M	20	
Hungary	39	BorsodChem	Kazincbarcika	Hg	131	
				M	160	
Ireland	40	<i>MicroBio</i>	<i>Fermoy</i>	<i>M</i>	<i>9</i>	

COUNTRY	*	COMPANY	SITE	PROCESS	CAPACITY (ooo tonnes)
Italy	41	Altair Chimica	Volterra	M	27
	93	Procter and Gamble	Campochiaro	M	20
	42	Solvay	Bussi	M	25
	44	Syndial	Assemini/Cagliari	M	150
	49	Solvay	Rosignano	M	120
	50	Tessenderlo Chemie	Pieve Vergonte	Hg	42
	51	AkzoNobel	Botlek	M	633
Netherlands	52	AkzoNobel	Delfzijl	M	109
	54	SABIC	<i>Bergen op Zoom</i>	<i>M</i>	<i>89</i>
Norway	55	Borregaard	Sarpsborg	M	45
	56	<i>Elkem</i>	<i>Bremanger</i>	<i>M</i>	<i>10</i>
Poland	57	INEOS ChlorVinyls	Rafnes	M	260
	58	Rokita	Brzeg Dolny	Hg	78
				M	48
	59	Zachem	Bydgoszcz	D	72
Portugal	60	Anwil	Wloclawek	M	214
	61	Solvay	Povoa	M	26
	62	CUF Quimicos Industriais	Estarreja	M	72
			HCl	44	
Romania	91	Oltchim	Ramnicu Valcea	Hg	186
				M	105
	92	ChimComplex	Borzesti	M	107
Slovak Rep.	63	Novacke Chemicke	Novaky	Hg	76
Slovenia	88	<i>TKI Hrasnik</i>	<i>Hrasnik</i>	<i>M</i>	<i>16</i>
Spain	64	Ercros	Huelva/Palos	Hg	48
	65	Ercros	Sabinanigo	M	30
	66	Ercros	Vilaseca	Hg	135
				M	55
	67	EHERSA	Hernani	M	15
	68	ELNOSA	Lourizan	Hg	34
	69	Ercros	Flix	Hg	115
	70	Quimica del Cinca	Monzon	Hg	31
	71	Hispavic	Martorell	Hg	218
	72	Solvay	Torrelavega	Hg	63
Sweden	75	INEOS ChlorVinyls	Stenungsund	Hg	120
Switzerland	77	CABB AG	Pratteln	Hg	27
UK	82	INEOS ChlorVinyls	Runcorn	Hg	277
				M	400
	85	Brenntag	Thetford	M	7
TOTAL					12544
					Non members
					Members (98,7%)
					12379

* Number on map

1 Total combined chlorine production capacity Permit to 400

Process: Hg: Mercury M: Membrane D: Diaphragm HCl: Electrolysis of HCl to Cl₂ Na: molten salt electrolysis / Company names in italics are not Euro Chlor members

08

Euro Chlor

In the centre of chlor-alkali regulatory and HSE issues

Euro Chlor represents the interests of 98% of chlor-alkali producers in the EU-27 and the EFTA regions with the EU institutions and international authorities. It constitutes a central partner for member companies to share best practices on health, safety and environment matters. The Federation co-ordinates scientific and communications activities in order to improve understanding of chlorine chemistry and its great importance providing basic building blocks for thousands of substances.



Apart from its 38 producer member companies, Euro Chlor counts 45 Associate Members and 43 Technical correspondents

In Europe, 38 producer members of Euro Chlor directly employ about 39,000 people at 70 manufacturing locations in 22 countries. However, almost 2,000,000 jobs are directly or indirectly related to chlorine and its co-product caustic soda when the numerous downstream activities are taken into consideration.

Apart from producers, Euro Chlor also has 45 Associate members and 43 Technical Correspondents. These include national chlorine associations and working groups, suppliers of equipment, materials and services as well as downstream users and producers outside Europe.

From its offices in Brussels, Euro Chlor provides the Secretariat for the World Chlorine Council, a global network of national or regional organizations in more than 27 countries. By the end of this year, WCC will represent over 90% of world-wide chlor-alkali production, taking into account the anticipated membership of the Chinese Chlor-Alkali Industry Association (CCAIA).

Euro Chlor was founded nearly 60 years ago as a production-oriented technical organization (Bureau International Technique du Chlore, BITC) but was restructured in 1989 in order to provide the sector with strengthened scientific, advocacy and communications capabilities. Since then, a strong focus has been placed on sound science coupled with continual health, safety and environmental improvements complemented by open and transparent communications with key stakeholders.

On the occasion of the 20th anniversary of Euro Chlor in 2009, the Federation underlined that one of its major objectives has always been the full recognition by Europe and the rest of the world of the benefits of chlorine chemistry to society.

The 13 Secretariat staff employed at offices in Brussels represents seven nationalities (Belgian, English, Dutch, French, German, New Zealand and Swedish) and speak 9 languages.

Guidance and overall strategic direction is provided by the Management Committee and a few dozen committees and working groups provide specialist knowledge and support.

CHLORINE AND CAUSTIC SODA – KEY CHEMICAL BUILDING BLOCKS

Adhesives	Ceramics	Fiber-glass	Lubricants
Advanced composites	Computers	Flame-proofing	Paints
Air bags	Cosmetics	Footballs	Paper
Antibiotics	Credit cards	Fungicides	Perfumes
Antifreeze	Detergents	Gaskets	Pharmaceuticals
Bleach	Disinfectants	Golf bags	Plastics
Blood bags	Drilling fluids	Greenhouses	Refrigerants
Brake fluids	Drinking water	Hairdryers	Roller blades
Bullet-resistant glass	Dry cleaning	Herbicides	Roofing
Bumpers	Dyestuffs	Inks	Safety belts
Car seats	Electronics	Insulation	Vitamins
Carpets	Explosives	Intravenous drips	Window frames ...
CDs and DVDs	Fertilizers	Lighting	... and much more.



Euro Chlor helps to improve understanding of the importance of chlorine chemistry for providing basic building blocks for thousands of substances

Management Committee (20 June 2011)

Chairman:	
Michael Träger	VESTOLIT
Andreas Amling	Bayer MaterialScience
José Berges	Evonik Degussa
Filipe Constant	Solvay
Francisco García Brú	Ercros
Fabrice Garrigue	Perstorp
Yves Heroes	LVM (Tessenderlo Chemie)
Janusz Kwaśny	PCC Rokita
Martin Procházka	Spolchemie
Gianfranco Russo	Syndial
Knut Schwalenberg	AkzoNobel Industrial Chemicals
Otto Takken	ARKEMA
Chris Tane	INEOS ChlorVinyls
Arnd Thomas	Dow Deutschland
Thomas Wehlage	BASF
Michael Winhold	Vinnolit

Secretariat staff

Alistair Steel	Executive Director
Françoise Minne	Senior Assistant
Dolf van Wijk	Science & Regulatory Affairs Director Chlorinated Paraffins Manager
Marleen Pauwels	Science Manager
Shaun Presow	Science Counsellor
Caroline Andersson	Senior Counsellor Regulatory Affairs
Davina Stevenson	Assistant
Isabelle Coppens	Assistant
Jean-Pol Debelle	Technical & Safety Director
Chantal Peeters	Assistant
Dirk Clotman	Communications Manager
Wolfgang Marquardt	ECSA Manager





PVC offers virtually unlimited possibilities for the creative production of window frames

Committees and working groups

Management

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

Advocacy & communications

- Regulatory Affairs Committee
- National Chlorine Associations Network
- Ad hoc Energy WG
- Chlorine Communicators' Network

Product groups

- Chlorinated Paraffins Sector Group
- Potassium Group

European Chlorinated Solvent Association

- Management Committee
- Communication & Outreach WG
- General Technical WG
- Occupational & Environmental Health WG
- Product WG
- Sustainability WGs

Science

- Steering Committee
- Environment WG
- Biocides Strategy Group
- Biocides Registration Groups
- REACH Project Team

Technical & safety

- General Technical Committee (GTC)
- Environmental Protection WG
- GEST (Safety) WG
- Equipment WG
- Instruments WG
- Transport WG
- Health WG
- Electromagnetic Fields WG
- Analytical WG
- Ad hoc Group Chlor-Alkali BREF Update
- Carbon Footprint TF
- Mercury in soil TF

World Chlorine Council

- WCC Governing Council
- WCC Management Committee
- WCC Joint Global Advocacy & Science Team
- WCC Global Safety Team
- WCC Global Sustainability Team

Full Members

AkzoNobel Industrial Chemicals
Altair Chimica
Anwil
Arkema
BASF
Bayer MaterialScience
Borregaard
BorsodChem
CABB (Germany)
CABB (Switzerland)
CHIMCOMPLEX
CUF-Químicos Industriais
Donau Chemie
Dow Deutschland Anlagengesellschaft
Electroquímica de Hernani
Electroquímica del Noroeste
Ercros
Evonik Degussa
Hellenic Petroleum
INEOS ChlorVinyls
Kemira
MSSA
Novácké chemické závody
OLTCHIM
PCC Rokita
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d'Harbonnières
Solvay
SolVin
Spolchemie,
Spolek pro chemickou a hutní výrobu
Syndial
Tessenderlo Chemie
VESTOLIT
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ZACHEM
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Al Kout Industrial Projects
Angelini Acraf.
Aquadrop
Arch Chemicals
Asahi Kasei Chemicals Corporation
Asociación Nacional de Electroquímica
(ANE)
Association of Chemical Industry of
the Czech Republic (SCHP)
BOC
Bochemie
Brenntag UK Group
Caffaro Brescia
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Chemoform
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Inquide
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NCP Chlorchem (Pty)
NIPPON SODA CO.
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SGCI Chemie Pharma Schweiz
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Syngenta Crop Protection
Syngenta
Teijin Aramid
The Swedish Plastics and Chemicals
Federation (Plast- & Kemiföretagen)
Tosoh Corporation
Uhde
Unilever R&D Vlaardingen
Verband der Chemischen Industrie (VCI)
Vereniging van de Nederlandse
Chemische Industrie (VNCI)

Technical Correspondents

AFC Energy
AGC Chemicals Europe
Aker Kvaerner Chemetics
Applitek
BLUESTAR (Beijing) Chemical Machinery
CAN-TECH
Chemtec UK
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Coogee Chlor Alkali Pty
Crane Resistoflex
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Occidental Chemical Belgium
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Richter Chemie-Technik
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The Euro Chlor Sustainability Programme



In the past the chlorine chemistry was often regarded as unsustainable, because of problems that arose with certain chlorine derivatives, now no longer produced or emissions, now considerably reduced.

The 21st century needs a sustainable chlorine industry. Already, our first sustainability programme has delivered major improvements across a broad range of our key impacts, and it has focused companies throughout the sector on the areas where further improvements can most beneficially be made.

Our first sustainability programme, announced in 2001, dedicated to providing scientific data that are the essential basis for systematic risk assessment and focused risk management. It has not only shown the industry's collective commitment to sustainable development. It has shown the ability to lead and deliver major improvements, bringing all in the industry towards the standards of the best.

The route towards further improving this balance to create a yet more sustainable chlorine industry is charted, and the second stage of the journey has begun. We look forward to reporting, over the next 10 years time, how the chlorine industry has continued to deliver more for society, from less.

Discover the Euro Chlor Sustainable Development Programme online via www.eurochlor.org.





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

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