Euro Chlor
representing the chlor-alkali industry

# The Euro Chlor Sustainability Programme

Results of the 2001-2011 Programme
The 2011-2021 Programme

# 01

## Chairman's Foreword

Chlorine and caustic soda are vital feedstocks that underpin much of modern living. They help protect our health and wellbeing and contribute to our improved quality of life. Downstream derivatives of our products are crucial in providing more environmentally sustainable technologies, including energy-saving products to tackle the major concern about climate change. The economic contribution of the chlor-alkali sector is therefore substantial in its own right, but the contribution of industries that depend on these feedstocks is an order of magnitude greater still.

In the past 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. In addition to that, chlorine production remains energy-intensive which might seem to sit uncomfortably with the quest to reduce energy use wherever possible. But most of the energy used is not lost but retained in the high-energy chlorine molecule and is released (in exothermic reactions) when it is reacted to make downstream products.

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.

Over the last 10 years, energy consumption per tonne of chlorine has been reduced by some 10%. This improvement has been due to advances in cell technology and in more energy efficient ancillary equipment. Bearing in mind the nature of the electro-chemical reaction which fixes the energy required this is a major achievement. Under the second sustainability programme we will continue to strive for further technological advances including ways of obtaining better value for the hydrogen produced as a by-product.

Another important milestone of our past programme was the reduction of mercury and chlorinated organics emissions: about 60% of the total mercury emissions remaining in 2001 have now been eliminated. By the end of our second programme, mercury emissions from the European chlor-alkali industry will have ceased through the completion of the voluntary phase-out of its mercury process by 2020. The 90% reduction of chlorinated organics emissions from factories achieved in the 15 years prior to 2001 have now been extended to the point where they no longer constitute one of our major impacts, and a new focus will be sought for beneficially improving emissions.

Our past programme has also delivered major improvements in the safety field in terms of reducing lost-time injuries, process and transport incidents. All such incidents must simply be regarded as unacceptable. But although improved training and systems, and a strong safety culture, will help avoid problems re-occurring, this is a continuing battle which requires the ongoing focus of management and employees together. The new programme will strengthen the emphasis on training as the foundation of safe and sustainable operation. Our work to encourage and track training and accreditation to environmental management standards such as EMAS and ISO14001 will be extended by a new indicator which reports our investment in training in terms of "hours per employee".

Finally, our first sustainability programme dedicated to providing scientific data that are the essential basis for systematic risk assessment and focussed risk management. Our science teams delivered a great job in providing the facts and figures of our industry in the form of various publications, such as Marine Risk Assessments and Science Dossiers. This process will accelerate under the provisions of the REACH legislation which will publicly demonstrate the safe use of chlorine products. Euro Chlor will also maintain its strong contribution and leadership in the wider scientific study of the impacts and sustainability of the industry's products.

In summary, our programme just concluded 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. In parallel, our communications initiatives based on transparency and science have started to see the essential benefits that chlorine chemistry brings to society weighed in a truer and more realistic balance against the environmental impacts of our operations.

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, how the chlorine industry has continued to deliver more for society, from less.

**Michael Träger**
Chairman of the Management Committee
September 2011

# 02

## Learnings from the first 10 year programme

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

# Programme 2001-2011

## 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

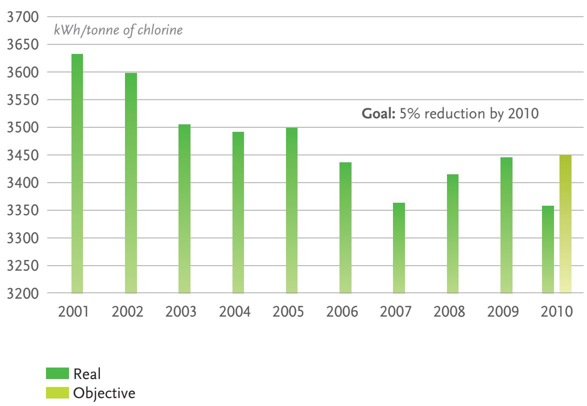
### Energy use

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

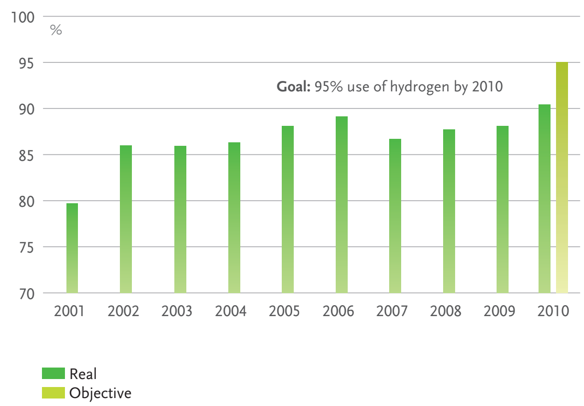
*Update:* for the last year of the programme, the average energy consumption dropped significantly with a value of 3,358 kWh/t of chlorine produced, about 100 kWh lower than the target, confirming the general trend related to the progressive conversion from mercury to membrane technology.

**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




### Hydrogen utilization




## 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.

## 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.

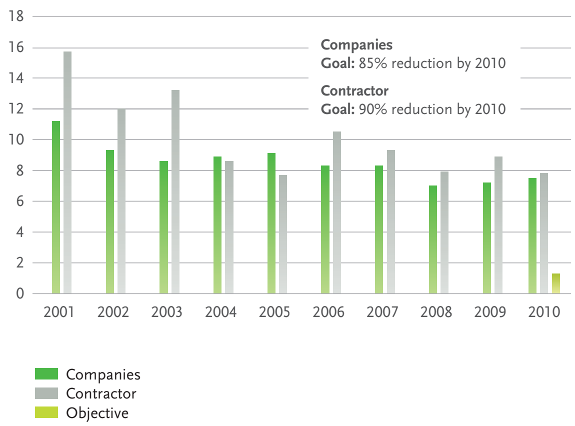
*Update:* Membrane technology now represents more than the half (51.2%) of the installed production capacity of Euro Chlor members. The mercury process accounts for 31.8% at the beginning of 2011, continuing the progressive phase out of this technology in line with the Chlor Alkali sector's voluntary agreement. The diaphragm process still accounts for a bit less than 14% of the total capacity.

## Economic development

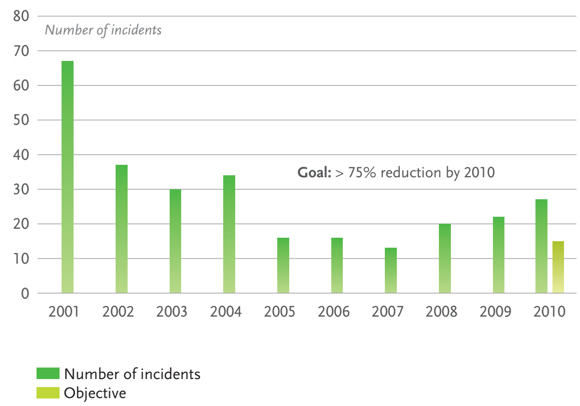
**Target:** Euro Chlor has decided to report monthly, quarterly and annually data on European production of chlorine and caustic soda. This includes utilization rates, caustic stocks, capacity and technology by plants and applications.

*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.

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




**Process incidents**




## 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).

**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

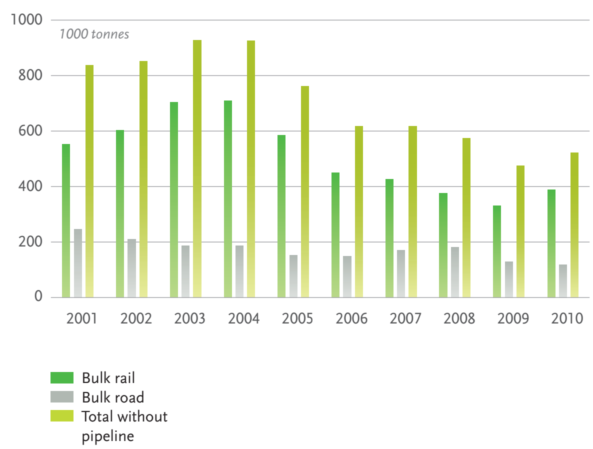
**Target:** A 75% reduction in the number of process incidents from 67 (2001) to 15.

*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.

**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.


Chlorine Transported




## Transportation

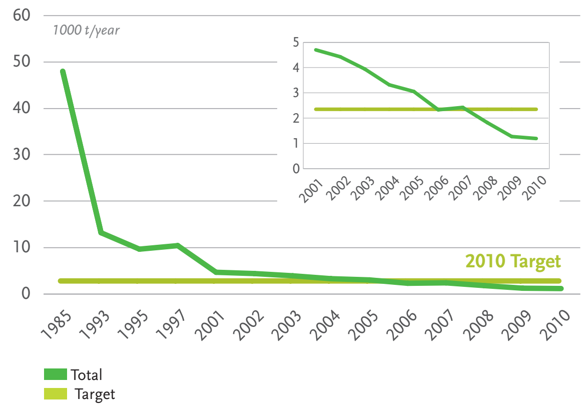
**Targets:** The tonnage of chlorine transported will be reported annually as well as the mode of transport involved; additionally, zero 'transport incidents' involving the bulk movement of chlorine by 2010 has been set as a target.

*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 little 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

**COC: Plant emissions to water**


**COC: Plant emissions to air**




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 38 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.

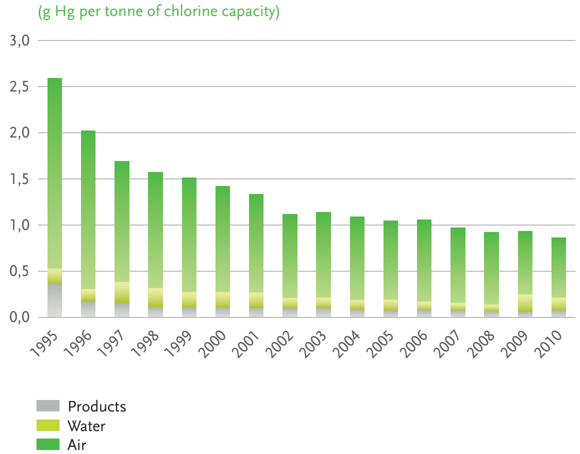
## Environmental protection - COC emissions

**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; the consolidated values reached a level of 78% reduction for water, and more than 70% 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-dichloro ethane; 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 1985-2009.

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



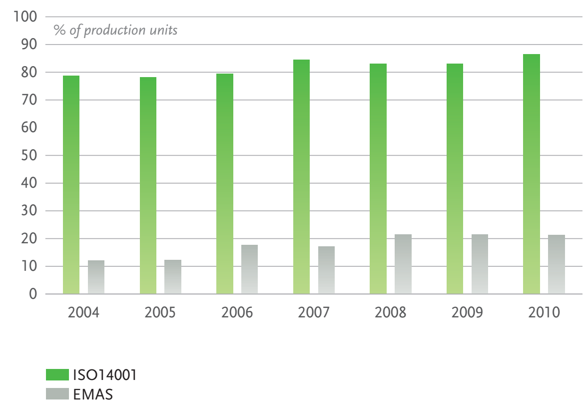

## Mercury emissions

**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.

**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.

**Environmental certifications**




## 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.

# 03

The European chlor-alkali industry has a good story to tell. For twenty-two years now, Euro Chlor has made concerted efforts to explain to regulators how chlorine is produced and used safely and efficiently to benefit society. We have achieved an outstanding reputation as a trustworthy organization that builds its visions and arguments on science-based information.

# The new Euro Chlor Sustainability Programme

The first Sustainability Programme created a united industry approach and has demonstrated industry's commitment to address the key factors determining sustainability across all the three pillars - environmental, social and economic. Its performance indicators well reflected the major impacts and while some of its targets were ambitious, up to a point that some of them were not met, substantial improvements were made and the industry has been firmly focused on the critical challenges. Successful sustainable development requires dialogue with the various stakeholders in society, so that there is a common understanding of industry benefits and impacts, and of the underlying issues involved. These debates have consistently been held in accordance with our commitment to transparency and openness.

Euro Chlor is convinced that this clarity and openness has generated real benefits. Internally, it stimulated companies to improve their technology and health/safety/environmental performance. Euro Chlor support and guidance has helped companies throughout the industry move towards the standards of the best. It also triggered positive competition on these matters between member companies. Externally it has generated trust and respect by demonstrating the soundness of our approach.

This realization, as well as the clear potential for making further substantial gains, has led the Management Committee to initiate a second phase of the Sustainability Programme.

This Programme will continue monitoring concrete parameters and report yearly on the trends. Furthermore, the external communications dimension will be enhanced and supported by communications actions that underline for a wide range of stakeholders the intrinsically positive contributions of chlorine-based chemistry to society.

## A. Quantifiable parameters

The quantifiable part of the new Sustainability Programme will monitor and report on twelve parameters, eleven of which were already monitored in the first Programme:

- Energy consumption per unit of chlorine and caustic production
- The quantity of hydrogen used (or valorized)
- The transition towards more sustainable technologies
- Key production volumes
- Lost-time injuries
- Process incidents and losses
- Optimization of chlorine transportation
- Responsible Care commitment
- Mercury emissions from mercury-based production sites
- Publication of product data
- EMAS and/or ISO Environmental Accreditation

The monitoring of one parameter has been discontinued: The **emissions of chlorinated organic compounds**: this parameter is no longer included because emission loads have been so greatly reduced that this is no longer one of the major impacts.

A new parameter has been adopted: the **number of hours of training per year per employee**, expressed as the average percentage of training hours within the total of man hours work. Euro Chlor is convinced that well-trained workers are central to good performance in the safety, health and environment areas. It is part of Euro Chlor's mission to provide guidance in these domains.

## B. Qualitative parameters

During the ad hoc Task Force work leading up to the second Sustainability Programme, the **Euro Chlor Mission Statement** was an important point of reference. It stipulates that the federation should maintain an open, timely dialogue with regulators, politicians, scientists, media and all other stakeholders, contribute positively to all debates about the relevance of chlorine and its derivatives and make it clear at all times what the sector stands for.

The ad hoc Task Force on Sustainability acknowledged that **outreach, stakeholder engagement & communications and a central Euro Chlor coordination and guidance function** are important tools for applying the Mission Statement.

This is why the Management Committee has encouraged the Secretariat to develop over the forthcoming years a certain number of educational instruments, providing guidance to facilitate communications actions at site level.

- The **outreach** will enhance transparency, educate the public and create more goodwill towards industry. Euro Chlor will promote the sharing of experiences on communication with site neighbours and other stakeholders as well as on best practices between companies. The federation will create opportunities to learn from other companies, especially those with global operations. Examples of tools that will be developed are guidance documents on
  1. how to further develop local press relations
  2. how to organize a plant visit for a group
  3. how to organize 'open days', including a checklist and a retro-planning
  4. how to install and operate a free telephone 'hotline'
  5. how to develop a Neighbourhood Council with representatives of the local communities
  6. how to reinforce dialogue through a company news brief
- Euro Chlor will monitor and report on the member companies' activities in these areas.
- A second major activity within this qualitative communications scheme will be the **development, over several years, of a comprehensive communications plan** in order to highlight to large and varied **audiences the multiple benefits of chlorine and its value chain**. The core idea is to make target groups understand that 'Chlorine is more... ...than you think'. It is a fact that chlorine based chemistry is making a vital contribution to the realization of the United Nations Millennium Development Goals through delivering products and technology for
  1. Water issues: drinking water, community sanitation
  2. Cleanliness: personal hygiene, household sanitation
  3. Medicine: health care, pharmaceuticals
  4. Shelter: building materials, furnishings
  5. Nutrition: food production, food distribution, food safety
  6. Transportation: safe and energy friendly cars, buses, trains, bicycles
  7. Quality of life: public safety, (tele)communications, modern technologies
  8. Energy: insulation materials, generating green energy

Again, the chlor-alkali industry has a good story to tell and some vital issues to explain - about the economic value generated, the need for water as a raw material versus the need for drinking water, the industry's ecological footprint, the full life-cycle impact of renewable resources and the unique position of salt as a virtually inexhaustible raw material. We will do this with vigour.

## C. Relevance of the quantifiable parameters

### 1. Energy use

Sustainable energy supply is a major challenge for society and for industry, in particular for the chlor-alkali industry. In addition, there is concern about climate change being substantially driven by emissions of carbon dioxide and other 'greenhouse gases'. Most $CO_2$ emissions arise from burning fossil fuels to provide energy. The production of chlorine and caustic soda, which are key feedstocks for most sectors of the chemical industry and thus for most modern materials and products, is an energy intensive process. But most of the energy used is not 'lost' in the process: it is taken up in the electrochemical reaction and becomes stored as 'chemical energy' in the chlorine. This energy can be released again when chlorine is reacted to create other products. Chlorine is also vital to creating numerous energy-saving products – insulating materials, lightweight vehicles and solar panels for example. While a large proportion of the energy requirement is irreducible (electrochemical reaction), the challenge for chlorine makers is to ensure that the process of conversion of salt into chlorine, and all other aspects of their factory operations, are energy-efficient, and thus as sustainable as possible. Substantial leaps in energy-efficiency have been made, and can still continue to be made by introduction of new technology. At the operational level, small improvements across a high usage can yield big savings.

### 2. Hydrogen used

Conventional processes for producing chlorine generate hydrogen as a by-product of the electrochemical reaction. Historically, when there was no possibility to find a direct consumer, this was sometimes regarded as a waste product that was uneconomic to recover and was simply vented. However, sustainable development looks to make full use of all resources. Hydrogen, if not used as a chemical reagent like in ammonia, hydrogen peroxide or other productions, can also be burned as a fuel with no $CO_2$ emission to replace other sources of energy: it can produce heat energy and indirectly some electricity; recently it has been also increasingly used in fuel cells to produce electricity directly. Oxygen-depolarized cathode cells for producing chlorine can avoid the production of unwanted hydrogen altogether while simultaneously using substantially less energy. The first Euro Chlor sustainability programme halved the amount of hydrogen going to waste (20% down to 10%) and the second programme will look to drive this figure down further.

### 3. Manufacturing technology evolution

Thirty years ago almost 80% of Euro Chlor chlorine was produced using cells containing mercury which is a hazardous material that needs careful management. The other 20% was produced by the diaphragm process which does not use mercury and uses less energy: it originally used asbestos materials for the cathodes but these are now being replaced with other materials. In 2011, only around 30% of chlorine capacity uses the mercury process and the chlor-alkali industry is voluntarily committed to phase out this technology by 2020. Today, over 50% of chlorine is produced by the newer membrane process which is the most energy efficient of all. The new sustainability programme will continue to encourage and track the move to the more energy-efficient technologies: these are economically as well as environmentally more sustainable, and the reduction of hazardous emissions will benefit society by protecting health.

### 4. Reporting on production data

Data quantifying the industry's output in terms of chlorine and caustic soda are a key indicator which tracks our economic contribution, as well as societal benefits in terms of feedstock for modern products which support our well-being and quality of life. They also provide the base against which all the industry's environmental impacts can be assessed to chart progress in environmental sustainability. Transparency and reporting of such key data have been shown to build understanding and respect for the way the industry is addressing challenges and making progress towards sustainable development.

Courtesy by INEOS ChlorVinyls

### 5. Lost-time injuries

Injuries to workers are unacceptable: they are both socially and economically unsustainable. Yet the drive to eliminate lost-time injuries will be an ongoing struggle where progress can only be made through the continued and concerted efforts of all employees and management. Unlike some measures to improve sustainability, a low injury rate in one year doesn't automatically translate into a low rate the next. Encouragement must be drawn from sustained progress over time and against benchmarks which chart the progress of others. From this perspective, progress is being made and the majority of still recorded injuries arise not from anything specific to chlorine manufacture but from everyday incidents that happen in many other work and domestic situations. Injury rates in our factories are lower than in many other industrial activities, reflecting a good safety culture. But given the hazardous nature of our job, we will continue to strive for even better results.

### 6. Process incidents and losses

Process incidents and losses, involving fire, explosion or a release of chemicals to the environment are serious events that undermine all three pillars of sustainability and diminish the net value of our whole output. Such events can lead to damage to property, harm to health and social disturbance, and harm to the environment, even if generally temporary. Such incidents, like injuries to workers, are unacceptable. The effort to eliminate them must be unrelenting, and Euro Chlor has a special role to play in catalysing the sharing of best practice to improve performance across the industry.

### 7. Transportation mode

Chlorine is a highly hazardous gas: leaks of chlorine can harm health and substantial leaks can require evacuation of people nearby to protect them. Recognizing this, the industry has invested heavily in developing the techniques, procedures and equipment required to transport liquid chlorine safely. However, this is an expensive activity prompting the seeking of opportunities to locate supplier and user plants next to each other, and extend the use of pipelines. During the 10 years of the sustainability programme just completed, the amount of chlorine moved by rail and road in Europe has been halved. This drive will continue under the second sustainability programme and where chlorine is moved in bulk, the transport arrangements will be optimized to give the safest option for each traffic flow.

### 8. Responsible Care®

Responsible Care® is the global chemical industry's unique initiative to improve health, environmental performance, enhance security, and to communicate with stakeholders about products and processes. Responsible Care commits companies, national chemical industry associations and their partners to continuously improve the environmental, health, safety and security knowledge and performance of our technologies, processes and products over their life cycles so as to avoid harm to people and the environment. This also includes the efficient use of resources and the minimization of waste. Companies are expected to report openly on performance, achievements and shortcomings and to listen, engage and work with people to understand and address their concerns and expectations. The concept also embraces a good cooperation with governments and organizations in the development and implementation of effective regulations and standards, and to meet or go beyond them. Finally, Responsible Care also means providing help and advice to foster the responsible management of chemicals by all those who manage and use them along the product chain.

### 9. Mercury emissions

Mercury is a naturally-occurring metal which is nevertheless highly toxic for humans, animals and environmental organisms. Though the risk of harm depends on the level of exposure, the effects of exposure can be compounded because mercury can bioaccumulate. Consequently there are clear guidelines for safe levels and international programmes to manage the use of mercury and minimize emissions. Emissions of mercury from mercury cells used for chlorine/caustic soda production have been driven down: during the programme the specific emissions per tonne of chlorine capacity (improvements of the performances) were reduced by a further third while absolute emissions were reduced by 60% (additional impact of less production units using this technology). This process will be completed during the period of the new sustainability programme by the phase out of the chlor-alkali mercury cell process altogether. Management and safe storage of the redundant mercury to prevent it being released via other uses is being put in place.

### 10. Publishing product data

Ensuring that substances and products that are used in industry and by consumers are handled and disposed of in ways that are safe for people and the environment is fundamental to sustainable development. Unsafe uses are unsustainable. The assessment of the risks that could arise, and the management of exposure to eliminate those risks, depends on the availability of good quality scientific data on the hazards of substances for human health and the environment, and on the uses, flows and metabolic processes which determine exposure. Euro Chlor has for many years worked voluntarily to make the wealth of data developed by member companies available to the wider community: we will continue to publish data as part of the second sustainability programme, based on available dossiers such as produced under REACH and newly acquired information. We will produce data summaries for the key chlor-alkali products according to the guidelines of the Global Product Strategy initiative of the chemical industry.

### 11. Environmental accreditation

Sustainable development is a journey. It requires continual improvement to be made across all three pillars of sustainability. Environmental sustainability needs to be pursued by continual reduction of environmental impacts across all stages of the product life-cycle. EMAS and ISO14001 provide schemes and methodologies to help organizations put in place procedures that collectively ensure this happens in respect of their own operations. The process of training and certification under such schemes helps develop the sustainable development culture within an organization and verifies that such systems are in place and are being operated.

### 12. Hours of training per employee

Training is vital for sustainable development: everyone needs to understand the potential impacts of the operations under their control on people, the environment and on economic prosperity so that everyone can contribute to continually improving performance. Training in itself improves social sustainability by maximizing the potential of each individual; it allows individuals to work collectively and successfully to deliver results that need the input of everyone. Training is at the heart of safety and the safety culture which is essential in organizations such as Euro Chlor companies that manage hazardous processes for the wider benefit of society. As progress has been made on reducing some of the most significant impacts to the point where they are no longer among the most significant, training is vital to gain focus and improvement against new and more diverse targets.

# 04

Whether you insulate a house, make synthetic rubber, use microchips or solar cells, purify waste water or simply apply deodorant, chlorine is always in the game. Based on plain salt, chlorine is a major building block in today's chemistry. This does not necessarily mean that end products contain chlorine. But chlorine and chlorinated substances are used in many hundreds of production processes.

# Chlorine and the chlor-alkali industry

Salt – composed of sodium and chlorine – makes up 2.9% of the world's oceans. Salt brine is the main raw material used to produce chlorine, by passing electricity through it. So, electricity is used as a raw material and as such cannot be substituted.

Essential co-products are caustic soda (sodium hydroxide) and hydrogen. Caustic soda is an alkali and is widely-used in many industries, including the food industry, aluminium and textile production, in soap and other cleaning agents as well as water treatment and effluent control. Hydrogen is a combustible gas used in various processes including the production of hydrogen peroxide and ammonia.

## Three technologies

There are three electrolysis technologies for producing chlorine and caustic soda: membrane, mercury and diaphragm. 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.

In 2010, European chlorine production was nearly 10 million tonnes. Germany remains 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 three regions accounted together for 72% of total European chlorine manufacture in 2010.

## Numerous applications

The chlorine industry underpins 55% of all chemical production. Approximately two thirds of European chlorine production is used in engineering materials – polymers, resins and elastomers. The largest single end use (35%) continues to be PVC plastic primarily for the construction, automotive, electronic and electrical industries. PVC is also used in 25% of medical devices. These include blood bags, sterile tubing, heart catheters and prosthetics. Polyurethane insulation materials help save energy and reduce $CO_2$ emissions. Chlorine also plays an essential role in obtaining 99.9999% pure silicon that is used for the production of solar panels and microchips.

More than 90% of European drinking water is made safe with the help of chlorine, which disinfects right up to the tap. Chlorine plays a key role in controlling pathogens such as typhoid, cholera and diarrhoea. Chlorine in household bleach combats a wide range of microbes in homes, hospitals, swimming pools and restaurants.

Approximately 85% of all pharmaceuticals contain chlorinated compounds or make use of them in the synthesis of the active substances. And half of the crop protection chemicals used to boost yields and food quality are based on chlorine chemistry.

# 05

The Membership has been actively involved in reviewing the first Sustainability Programme (2001-2011) and in shaping the second one (2011-2021).

# The Euro Chlor ad hoc Sustainability Task Force

In order to evaluate the Sustainability Programme 2001-2010 and to establish the fundamentals for the second Programme 2011-2021, several Euro Chlor members delegated specialists who had face-to-face meetings as well as telephone conferences with the Euro Chlor Secretariat. The parameters measured in the first programme were thoroughly evaluated and were found to be very relevant for our industry. Consequently, the second Programme shows a high level of continuity.

The members of the Task Force provided invaluable input and views on the industry's collective commitment to sustainability.

The Chairman of the Management Committee and the Secretariat wish to sincerely thank the following member delegates for their valuable contribution:

- Vincent Delannoy,
  Industrial Affairs Manager
  RBU Essential Chemicals, Solvay SA
- Patrice Guesnet,
  Environmental Affairs Manager,
  Vinyl Products, Arkema
- Roger Mottram,
  Group Environmental & Regulatory Affairs Manager,
  INEOS ChlorVinyls
- Ute Müller-Eisen,
  Industrial Operations Basic Chemicals,
  Bayer MaterialScience
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  Dow Anlagengesellschaft mbH
- Michael Träger,
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  VESTOLIT GmbH & Co. KG
- Arie Volmer,
  Director QHSE Chlor-Alkali,
  AkzoNobel Industrial Chemicals BV
- Dirk Weinmann,
  Leiter Produktion Services /
  GSUQ, VESTOLIT GmbH & Co. KG
- Jakub Zak,
  Director Chlorine Complex,
  PCC Rokita SA

INEOS ChlorVinyls

The long and fascinating chlorine story starts with plain salt.

More than one third of European chlorine production is used for the manufacture of the plastic PVC, one of the most sustainable construction materials.

Courtesy to Tessenderlo Chemie

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OUR COMMITMENT TO SUSTAINABILITY

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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