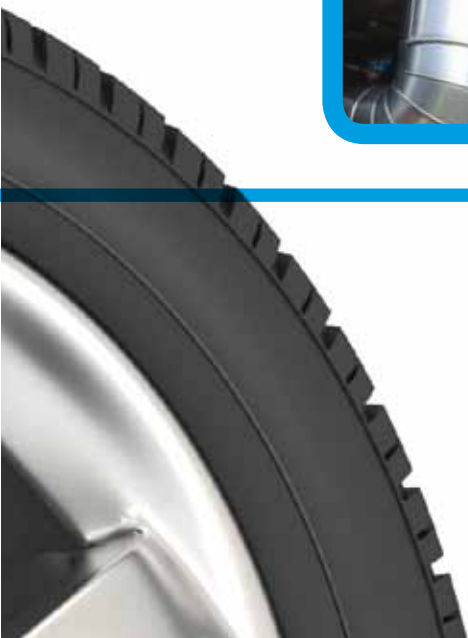




Global Product Strategy

Sound Chemicals Management as Global Responsibility.
Living the Principles of Product Stewardship.



Product stewardship is the industry's management of the health, safety and environmental aspects of a product throughout its total life cycle, working in cooperation with upstream and downstream users.

This brochure offers selected case studies to demonstrate how companies are implementing these risk management processes.

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Introduction

Members of the International Council of Chemical Associations (ICCA) are committed to product stewardship (the management of the health, safety and environmental risks of a chemical product throughout its life cycle).

This brochure offers selected case studies to demonstrate how companies are implementing these risk management processes.

ICCA's commitment to product stewardship dates back to the launch of the Responsible Care® initiative in 1985. The effort was expanded in 2006 through the creation of the Responsible Care Global Charter (RCGC) and the Global Product Strategy (GPS). The GPS in particular is designed to advance the industry's product stewardship performance, measure that performance, and improve communication and transparency about the management of chemical hazards and risks, and safety practices, across the value chain.

The RCGC and GPS are cornerstones of ICCA's contribution to implementing the Strategic Approach to International Chemicals Management (SAICM) and meeting the 2020 goals for safer chemicals management set at the 2002 World Summit on Sustainable Development. The programs are designed to ensure that society continues to enjoy the value and benefits of chemistry, while the industry and value chain continuously improve efforts to protect public safety, health and the environment. Through GPS, ICCA members work with stakeholders as colleagues and partners in product stewardship.

Under the GPS guidelines, companies will provide a risk assessment for all their chemicals in commerce by the year 2018. This ambitious process begins with a company-level determination of "high priority" products. By 2012, companies will report back to ICCA on their progress in developing these risk assessments. While there will be common elements and approaches globally, ICCA recognizes the need to accommodate national, historical, cultural, regulatory and legal distinctions in GPS implementation.



Risk Reduction - Many Roads to the Same Destination

Much of the information required by other regulatory or voluntary programs, including REACH, HPV and OECD-SIDS, can be adapted easily for a company's implementation of GPS. ICCA has created a portal through which member associations and companies can link product stewardship summaries.

Areas where companies may reduce the risks posed by their products include:

- **Product Conception** - determining the role the product will play and how it will play it.
- **Product Design** - creating the product so that it works safely and effectively.
- **Process Safety** - developing a manufacturing process that ensure the safe and reliable production.
- **Distribution and Use** - the shipping, handling, storage and use of the product, often by customers or other stakeholders.
- **End of Life** - the disposal or destruction of the product, and this too is often managed by customers or other stakeholders.

Each product must be viewed holistically in terms of what it is designed to do, how it is made, shipped, used and disposed. Typically, there are no simple, formulaic ways to reduce risk, and each measure must be closely analyzed to avoid unintended consequences.

ICCA Already Deeply Engaged

As ICCA reported at the second Session of the International Conference on Chemicals Management (ICCM-2, in May, 2009), ICCA has taken many steps to drive the GPS forward including:

- Defining best practices for information required to conduct chemical safety assessments.
- Developing and circulating global product stewardship guidelines for members.
- Strengthening accountability for performance under Responsible Care®.
- Building capacity in developing and transitional economies, particularly among small and medium-size enterprises.
- Expanding the Responsible Care® network to Russia, Eastern Europe and the Gulf states.

Moreover, since ICCM-2, ICCA has developed and distributed a wide range of metrics for use by companies in determining how best to assess and minimize chemical risks. And, we have begun the dialogue with customers and others along the value chain, particularly in the automotive and soaps and detergent industries.

This brochure offers case studies that demonstrate what stakeholders may expect of ICCA members as we pursue product stewardship excellence under the GPS. For additional information, please feel free to contact ICCA or any of the companies represented on the pages that follow.

**The Chemical Policy and Health Leadership Group
International Council of Chemical Associations
www.icca-chem.org**



Product Conception Case Study 1

ExxonMobil Chemical

“The product safety policy set by ExxonMobil Chemical reflects our commitment to high operational standards. ExxonMobil Chemical applies a rigorous and consistent approach to identify and evaluate risks associated with new and modified products and their manufacture, use and disposal” says Steve Pryor, President ExxonMobil Chemical.

ExxonMobil Chemical tests and monitors product safety and health factors. Our principles are consistent with our commitment to sustainability, including the need to balance economic growth, social development and environmental factors in how we operate our business and promote our products. We communicate results characterizing any risks and specify proper management processes to customers, third parties and the public where appropriate. Similarly, ExxonMobil Chemical is continuously adapting new technologies to improve product performance. In order to help ensure the safety of our products for both people and the environment, we regularly reassess our products as new, scientific information becomes available and apply those learnings in the manufacturing and marketing of our chemical products which are used as chemical intermediates, plasticizers, polymers, solvents and synthetic lubricants.

In addition, it is our Product Safety Policy to:

- Identify and manage risks associated with our products and not manufacture or sell products when it is not possible through proper design, procedures, or practices to provide an appropriate level of safety for people and the environment.
- Specify precautions required in handling, transporting, using, and disposing of our products and take reasonable steps to communicate them to employees, customers, and others who might be affected.
- Comply with all applicable laws and regulations and apply responsible standards where laws and regulations do not exist.
- Work with government agencies and others, as appropriate, to develop responsible laws, regulations, and standards based on sound science and consideration of risk.
- Include identification and control of potentially adverse health, safety, and environmental effects as priority considerations in the planning and development of products.
- Conduct and support research to extend knowledge about the health, safety and environmental effects of our products, and promptly apply significant findings and, as appropriate, share them with our employees, contractors, customers, the scientific community, government agencies, and the public.
- Undertake appropriate reviews and evaluations of our operations to measure progress and to foster compliance with this policy.

Our Experience

Our experience has lead us to employ a disciplined, systematic approach supporting our policies that we call OIMS (Operations Integrity Management System), which has been in place since 1992. Product Stewardship falls under our OIMS systems.



“ExxonMobil Chemical applies a rigorous and consistent approach to identify and evaluate risks associated with new and modified products and their manufacture, use and disposal!”

ExxonMobil Chemical developed this system to provide a robust framework for managing safety, security, health and environmental risks. It is used in our facilities worldwide and enables us to measure progress, ensures management accountability for results, and establishes common worldwide expectations for controlling operations integrity risks inherent in our business. OIMS also ensures engagement with the communities in which we operate, through activities such as conducting social and environmental impact assessments for new projects. OIMS is structured to meet our corporate requirements, industry initiatives such as Responsible Care®, government regulations and to be flexible enough to adapt to change.

How does OIMS work?

The OIMS process requires continual evaluation and improvement of management systems and standards, as well as the involvement of our employees. It has established a common language for discussing and sharing of successful systems and practices among different parts of ExxonMobil Chemical's business.

Management systems put into place to meet OIMS expectations must show documented evidence of the following five characteristics:

- The scope must be clear and the objectives must fully define the purpose and expected results.
- Qualified people are accountable to execute the system.
- Documented procedures are in place to ensure the system functions properly.
- Results are measured and verified that the intent of the system is fulfilled.
- Performance feedback from assessment and verification and measurement activities drive continual improvement of the system.

Our Best Practices

Chile is the world's largest copper producer, representing approximately one third of the global production capacity. The solvent extraction process accounts for a significant portion of total production capacity of the country. ExxonMobil Chemical has been a key player in this market by providing diluents for the solvent extraction process. The solvent extraction process is used in the recovery of metals in an aqueous solution. The metal is selectively transferred to an organic phase by contacting it with a blend of a hydrocarbon diluent and an extractant in which the metal complex is soluble. In 2009 ExxonMobil Chemical worked to replace the traditional diluents containing 10-20% of aromatics used in Chile for years with one of our premium hydrogenated hydrocarbon fluids that has been successfully tested in other countries. The replacement Fluid has proved to have similar performance in key variables of the solvent extraction process while enhancing industrial hygiene, improving employee safety and reducing environmental impacts due to the low aromatic content (less than 0.5%).

Benefits to Society

The toxicological assessment indicates that the replacement Fluid provides the following Health and safety improvements: mild skin irritant, not regarded as a mutagen or carcinogen, and there is a low concern for reproductive, developmental, or nervous system toxic effects. The replacement Fluid has a high Occupational Exposure Limit (OEL) of 1200 mg/m³ and it is not labeled as potential carcinogen. The replacement Fluid is considered to be readily biodegradable, has low potential for bioaccumulation, is not acutely toxic to freshwater or marine species, and contains essentially zero Hazardous Air Pollutants (HAPs).

After one year of using the replacement Fluids, the mines continue to operate effectively and in most cases have reported a significant reduction in diluent consumption which is a direct consequence of fewer emissions to the air due to the lower evaporation rate of the fluid. ExxonMobil Chemical anticipates that the mines would see the full benefits of this change after they have completely replenished their system with the replacement Fluid.

Product Conception Case Study 2

Solvay



The Solvay Product Stewardship Global Programme, as part of the Sustainable Development Strategy of the Company, includes a rigorous policy for risk management with objectives to reduce health and environmental impacts, while developing a structured dialogue with communities living adjacent to our manufacturing sites. A particular emphasis is given to minimizing consumption of energy and of natural resources.

Our Experience

The concern about safety and risk reduction from the conception of a product as well as during its whole life cycle is one of the guiding principles of product innovation and development. Further selection criteria for innovative products and services are water consumption, waste and energy efficiency aspects during the production and use phase. As far as recycling is concerned, various solutions have been developed in response to market expectations: recycling of plastics (ex Vinyloop® for PVC waste) and fluorinated products (ex: SF₆) or also for the recycling of flue gases treatment by-products (Resolest®) or dredged slurries (Novosol®). Internal extended Safety Audits for transport firms applying to rail, road & sea transport also contribute to the Solvay group global risk reduction strategy.

For any Solvay product, a documentation exists in the form of a dossier identifying the properties that are potentially hazardous for human health and the environment. This documentation also describes the risks linked to the conditions in which the products may be used. The compliance with legal requirements, such as the REACH Regulation in Europe, is the minimum standard.

The Solvay SACHEM (SAfety of CHEmicals) Programme ensures a worldwide consistent system for delivering this product information in the framework of the recent Global Harmonized System (GHS) that will become the common reference system worldwide as it is the case in the EU with the CLP (Classification, Labeling and Packaging of substances) Regulation.



“Our product Stewardship Goal is developing, in partnership, essential products that are more sustainable and are consistent with social and regulatory changes.”

Christian Jourquin, CEO of Solvay

Some Best Practices

Improving products sustainability in collaboration with our customers

The Solvay Product portfolio continuously changes over the years enabling new requirements to be met in relation to performance and sustainability. Specialty polymers for example meet the more and more stringent requirements relating to very high thermal, electrical and mechanical resistance.

For more conventional polymers (i.e. vinyls), the attention has been put on replacement or substitution of various additives by more sustainable alternatives and by improved recycling initiatives such as those taken within the Vinyl 2010 Commitment of the European PVC industry.

A remarkable result has also been reached by putting in place dedicated fora with some customers, notably plastics converters leading for example to new extrusion technologies saving up to 80% energy.

Products and operations assessments to ensure higher environmental, economical and social efficiency

The commitment to quality and high performance is progressively applied to the whole Group's product portfolio and activities in order to drive the constant improvement of their sustainability. This strategy is based on the development and application of specific qualitative and quantitative self-assessment tools as well as the benchmarking with best existing practices.

These sustainability assessment tools are aimed at providing products and services in order to more efficiently meet the growing sustainability expectations of our customers regarding these products but also regarding our operations and social responsibility practices. This includes for example meeting the requirements of the UN Global Compact Principles and following the Global Reporting Criteria (GRI) framework.

Benefit to Society

Solvay has put in place a program operating worldwide to provide support to our customers for hazardous products management aimed to achieve product safety at every stage and going beyond the information strictly required by Regulations.

For some products that are particularly hazardous and for which risk management is essential, special trainings or advice (in the form of technical dossiers, video's, ...) are provided to our customers. Such collaborative action between the producer and the users is a concrete expression of the shared responsibility in managing the complete safety of chemicals.

Another example is the reprocessing of sulfur hexafluoride (SF6) which has been implemented worldwide in collaboration with customers and third party service providers. This gas is used as an insulating gas that is essential for running high and medium voltage electrical installations safely and cost-efficiently but has an intrinsic high GWP (Global Warming Potential). The recovery and recycling of this gas at the end of its life is therefore an essential component of its sustainable use.



Product Design Case Study 3

Mitsubishi Chemical

“We continue to believe that the foundation for our business activities is the trust we earn from society” says Dr. Yoshimitsu Kobayashi, President and Chief Executive Officer of Mitsubishi Chemical Corporation. “Safety is essential in every facet of our business activities as a manufacturer operating in the chemical industry. We diligently examine, evaluate and manage risk in the earliest phases of product design. By embracing this safety-first philosophy in our day-to-day activities, our commitment can be readily seen and appreciated by our stakeholders and by society at large.”

KAITEKI is an ideal state in which people live healthy and comfortable lives in sustainable ways. The chemical industry has embraced a joint mission to provide KAITEKI solutions to society through new and improved products and services. Sound chemicals management through careful product design is one example of how we minimize any risk to health and any impact on the environment, while improving the quality of peoples' lives. Leveraging its long history of materials research, Mitsubishi Chemical develops and distributes a wide range of performance products worldwide. Our product design process covers the full spectrum, including the development and selection of materials to be used in products, processes and packaging. Product and process safety is our first priority throughout the development process.

Our Experience

Mitsubishi Kagaku Media (MKM) and its Verbatim® group, which are group companies of Mitsubishi Chemical, develop, manufacture and market a broad variety of data storage products worldwide, including their flagship optical recording media. MKM and Verbatim share their in-depth knowledge of product design, production, use and safe disposal in order to best serve society's varied needs for information and data storage. For example, the companies have developed barrier-free products such as Braille printed CD-Rs as part of their commitment to social responsibility. The goal of the Braille project was to serve customers with vision impairment by providing accessible product information such as the disc standard, the capacity and identification of the front and back sides. This product development process involved close collaboration with the target organizations and individuals from the design stage through to the final review phase, including a detailed use analysis.

Leading products such as DVDs and Blu-ray discs are produced at Mitsubishi Chemical Infonics (MCI) in Singapore, one of our global production sites. MCI comprehensively and thoroughly monitors and manages the safety of the chemicals it uses. For all chemicals purchased as raw materials or used in the manufacturing processes and shipping processes, MCI shares chemical safety data, legally restricted chemical substance data and relevant voluntary monitoring lists. Concurrently, strict self-control of emissions to water and air is practiced at the production sites. The management of chemicals safety extends beyond the fence to contract manufacturers via shared chemical safety information.

Given the scope of our global activities and the value chain of our businesses, we are convinced that information sharing on safe chemical handling is an essential part of both intra-company and inter-company communications. This exchange naturally enhances risk management communication with society.



"We diligently examine, evaluate and manage risk in the earliest phases of product design."

Our Best Practices

In the product design process, materials are selected, developed and optimized to meet the targeted performance requirements. For example, recordable optical discs are one of the staple products of MKM and the Verbatim group, and dye is a key material used in the manufacture of recordable optical discs. The particular dye synthesis technology that is used strongly differentiates the functionality of the discs. Dye development starts at an early stage of new disc innovation, and the selection of safe dye chemistry is a key step along with product innovation and enhanced functionality. No matter how well a material may perform, it will not be used in the product unless product safety is confirmed through rigorous risk assessment of the product.

Risk assessment of dyes is carried out first in a laboratory, where data are gathered ranging from physical-chemical properties such as flammability and a DSC test to toxicity data such as oral acute toxicity and genotoxicity. Legal regulations are also carefully evaluated. The same risk assessment applies to intermediates and byproducts in both manufacturing processes and final products. This risk management system is a mandatory internal system, ensuring that all personnel pay the utmost attention to product safety. Compliance with regulations for safe chemicals management is essential. Our compliance program extends further, to embrace even broader standards such as our corporate ethics policy. We have made compliance with these strict requirements for safe management of chemicals mandatory in our company.

Benefits to Society

MKM and Verbatim have for many years followed strict internal standards and a proprietary safety management system above and beyond global regulations and industry standards. Chemical substances will not be used for optical discs we manufacture unless they pass our internal risk assessment criteria during the design review process. This risk-based assessment and safety management of chemicals also extends to occupational safety of manufacturing processes and to environmental safety. Our uncompromising effort allows consumers to enjoy the high performance and reliability of optical discs, affords our employees healthy and clean working conditions and generates much less environmental stress, which is one of our examples of providing KAITEKI solutions.

Our goal is to provide our customers with safe and reliable products for recording valuable information and data, sharing precious memory with family and friends and remembering cherished times. It remains our goal to contribute to the development of a vibrant information storage culture through our business activities, while ensuring those activities are socially responsible.

Product Design Case Study 4

Dow



“At Dow, we are committed to sustainability and the principle that protecting people and the environment is part of everything we do and every decision we make. We have a tremendous responsibility and opportunity for our technologies to enable our customers, and their customers to develop more sustainable products and services” says Andrew Liveris, Dow Chairman and CEO.

For more than 75 years, Dow has had a program to assure that its products were safe for their intended use. The intent of our product safety leadership goal is to increase the transparency of our safety processes and results of this work in order to increase public confidence. By 2015, Dow is committed to making publicly available safety assessments for its products globally, and addressing relevant gaps in hazard and exposure information. This commitment extends beyond requirements specified in the European REACH legislation by requiring all products sold to have a completed product safety assessment regardless of locations of manufacture and sale or quantities of materials produced. Results of these product safety assessments are made accessible to customers and members of the public on Dow’s website, www.dowproductsafety.com

Our Experience

Environmental, Health and Safety evaluation of polymer product during development

Dow conducts product safety reviews for all of its products globally which includes evaluation of potential for human exposure throughout the life cycle of Dow products.

We have many examples that showcase our commitment to product design. One specific example occurred during the developmental phase of a polymer-product introduction, when it was determined that the material had excellent properties for a variety of food packaging applications. Since this was a new application area for this polymer, further research was initiated to evaluate the safety of this material for use in food-contact applications. This effort included, among other things, conducting an Environmental Health and Safety business risk review, which included a full safety evaluation (hazard determination, exposure determination, risk determination). The review encompassed not only the safety of the polymer, but also the safety of the components that went into the production process, even though the components were not integrated into the polymeric chain and were not necessarily incorporated into the polymer. These components included such things as solvents, production aids and catalysts.

In the evaluation process it was determined that there were no safety issues with the polymer itself or with the solvents and production aids used in the production process. The evaluation did reveal, however, that a catalyst break down product could be potentially harmful to human health. Even though analysis indicated that no catalyst was detectable in the finished polymer, the business decided not to pursue the food-contact applications until a time when a catalyst system that did not possess similar concerns was developed and implemented.



“At Dow we have a tremendous responsibility and opportunity for our technologies to enable our customers, and their customers to develop more sustainable products and services.”

Our Best Practices

$\text{Risk} = \text{Hazard} \times \text{Exposure}$.

Fundamental to assessing product safety is having adequate knowledge of the hazardous properties of the product and the potential for human or ecological exposures. Dow has a long-standing commitment to developing this kind of knowledge throughout a product's life cycle, and using it to reduce or eliminate risks. Dow conducts appropriate tests and modeling to determine the potential health and environmental effects of its products. The tests help determine the specific levels of exposure that produce health and or environmental effects – and the levels at which no adverse effects are observed.

Dow's “tiered testing” approach helps us prioritize which products need further study. The first step in the process applies existing scientific knowledge to determine the hazards of all products. Then it generates technical data about the health and environmental effects of the products in specific applications, and identifies what additional studies are warranted.

Dow's product design standards are consistent with ICCA's Global Product Strategy and include the development of guidelines for product stewardship; a tiered process for risk characterization and management; focus on downstream industry customers; exploration of intergovernmental organization partnerships; and greater transparency in product stewardship information.

Benefits to Society

At Dow, we have always believed that the role of chemistry is to do more good in the world.

From the clothes we wear to the food we eat – from chemistry that purifies water to technology that reduces energy to the products that make our lives more comfortable, healthier safer and more enjoyable – Dow plays an important role in addressing the needs of our evolving planet.

As a world leader in chemistry, Dow is taking action to ensure that we are good stewards of our products, the environment and the human condition. We are committed to preserving the world in which we live and to protecting the health of our families, friends and neighbors. We are a leader in our industry by taking appropriate action to protect human health and the environment throughout the life cycle. We continue to improve our product stewardship and chemicals management principles while fostering product and technological innovations aimed at solve some of the world's most pressing problems.

The 2015 Sustainability Goals provide the framework for us to demonstrate citizenship through stronger, safer communities, offer solutions that will make a lasting, positive improvement on the world, and reduce our footprint by understanding our impact on global ecosystems and work towards the efficient and effective use of our precious resources.



Process Safety Case Study 5

BASF

“Process safety is at the forefront of our responsibilities” says Juergen Hambrecht, CEO of BASF. “BASF builds and operates production plants throughout the world. As The Chemical Company we are strongly committed to ensure that all of these plants meet very high standards with regard to process and occupational safety, health and environmental protection. We apply the same stringent standards worldwide and do not compromise them due to economic considerations.”

Our experience

We cannot imagine modern society without chemical and industrial products. But while handling raw materials, production, storage, transport or disposal of chemicals potential risks are involved. The safety of chemical facilities (process safety) is therefore very important.

Our philosophy is to consider all safety aspects as early as possible already during the design phase of chemical plants and to promote a strong safety culture. When planning a new plant, we determine and evaluate the possible risk posed by a production process or plant to people and the environment, develop a corresponding safety and environmental plan, and check its implementation. We promote “inherently safer technology” principles in designing and operating hazardous installations e.g. by minimizing to the extent practicable the quantity of hazardous substances used; replacing hazardous substances with less hazardous ones; reducing operating pressures and/or temperatures; improving inventory control; and using simpler processes. Devices are designed for a safe emergency shut-down in cases of any failures. And a plant only starts up when all steps have been completed and verified by appropriate audits.

Ludwigshafen (Germany) is the largest integrated chemical site in the world and the production plants at the site are closely interlinked. The by-products or even waste of one plant can be used as the raw material of another. The system not only saves resources and energy and lowers emissions but also reduces the potential risks for accidents as it minimizes the need to transport chemicals over long distances.

Our Best Practices

Prevention

[BASF Group Directive on Process Safety](#)

The directive provides a five-step review system for environmental protection, health and safety (EHS reviews) that covers all aspects of process safety, occupational safety, occupational health and environmental protection when planning plants. In the safety reviews during the planning and design stage possible malfunctions or accidents are investigated and examined thoroughly.



“All our plants meet very high standards with regard to process and occupational safety, health and environmental protection. We apply the same stringent standards worldwide and do not compromise them due to economic considerations.”

Safety Training Sessions

In order to implement uniform safety standards around the world, we place particular importance on training our safety experts in all regions. We hold regular seminars on plant safety and explosion protection with an emphasis on discussion how to even further improve process safety. At the Ludwigshafen (Germany) site alone, more than 500 employees took part in training courses in process safety in 2009. Our emergency response unit of BASF SE provides trainings to the fire brigades of other sites worldwide to foster the experience exchange and develop new teams at new sites.

Preparedness and Communications

Emergency Response

BASF has local emergency units as well as a global emergency network. Both are available 24 hours a day / 7 days a week. We create specific emergency response plans for our production facilities. If necessary, we include joint ventures, suppliers, neighboring companies, as well as cities and communities into these plans. Our experts provide technical assistance at short notice on toxicology, environmental protection and process safety. Our existing emergency systems are checked regularly, for example in drills with our employees and local authorities.

Global Incident Database (GID)

We have established a complete and current reporting of all incidents at BASF sites worldwide. In the GID, injuries, accidental releases, near hits, transportation and process safety incidents are documented. Every BASF site worldwide can enter information about their incidents. We actively communicate relevant incidents by describing causes and measures to avoid reoccurrence of incident in our company.

Community Advisory Panel

We are aware of the particular responsibility we have towards our neighbors. Thus we set up Community Advisory Panels (CAPs), mostly at our larger production sites closely located to a community. At present there are 75 CAPs. A CAP consists of a group of individuals who live near or around a chemical facility and who represent the fabric of their community. The CAP meets regularly to discuss common issues of mutual interest. It is a forum for open and honest dialogue between citizens and plant management.

Benefits to Society

Incidents in the past have clearly demonstrated why robust safety systems are critical when handling hazardous materials. Today we profit from an overall safety management regarding a lot of different aspects, which has to be based on a culture of mutual trust. Only, if we talk openly about incidents, near misses and unsafe actions we will learn from past experience, raise awareness and share responsibility.

By strongly committing to and working on a high standard of process safety we not only protect our plants, our neighborhoods and the environment from accidents, but we also ensure a high efficiency of producing chemical products needed by the society.

For maintaining a good process safety culture it is however very important to maintain a sense of sensitivity. In other words, we must always remember, and respect, the possible hazards associated with our processes and materials. Taking responsibility has to be the principle how we act and we are working with all our expertise and experience on further improvements of processes, which means professional technologies, processes, information systems and risk management systems – a challenge for a sustainable future.

Process Safety Case Study 6

Sumitomo Chemical



"We are committed to the Sustainable Development of Global Society" says Hiromasa Yonekura, Chairman of Sumitomo Chemical Company. Sumitomo Chemical, as a member of the chemical industry, has defined as our corporate mission the realization of Sustainable Chemistry, whereby we help people live more fulfilling, comfortable lives by providing high-performance, high-quality and highly reliable products in a safer and more environmentally friendly manner, while also contributing to economic growth and the sustainable development of society.

In manufacturing chemical products, some processes may produce undesired byproducts and also generate waste. We aim to further promote Sustainable Chemistry through Green Processes, which minimize environmental impact. In addition, by steadily promoting Responsible Care® initiatives supported by the vital pillar of Product Stewardship, we ensure process safety, which includes protecting workers from risk and achieving our zero-accident and zero-disaster targets, as well as keeping to a minimum the impact of processes on the environment.

Our Experience

Development and Management of Chemicals

We at Sumitomo Chemical have our own principle of protecting human health and the environment throughout the life cycle of chemicals we manufacture or use. The following is the operating procedure we observe for the development and management of chemicals. At the research stage, where both the quantity of chemicals and the number of researchers involved in experiments are quite limited, we search in the public domain for basic toxicological information on the chemicals or predict their toxicity by carrying out simplified test assays. If the chemicals turn out to have the potential for any significant hazard, we take adequate risk management measures to minimize researchers' exposure to the chemicals or choose to use safer substances. Before proceeding to later stages, where much larger quantities of the chemicals are handled, we obtain a set of basic toxicological data by conducting experiments if existing data in the public domain is not available or is inadequate. Furthermore, before scaling up to commercial production, we gather existing comprehensive hazard data on the environment and human health. If the predicted toxicological concerns are significant, we consider performing additional studies. In parallel with hazard evaluation, we collect exposure information under envisaged conditions of use and conduct risk assessments for workers, downstream users and the environment. If manufacturing processes show measurable risk, we consider substitution of the relevant chemical or other raw materials, including solvents, as well as refinement of the processes. For the above procedure, we have established the Process Safety Review Committee to verify process safety at every step before moving on to the next stage of development.

Our Best Practices

Systematically Reducing the Release of PRTR Substances*

In 2002, as a means of strengthening the proper management of chemical substances in our manufacturing processes, we formulated "Sumitomo Chemical's PRTR Strategy," of which the central item is "Risk management based on environmental risks," and we have been working steadily to reduce emissions of chemical substances into the environment.



“Our Product Stewardship Goal is to promote Sustainable Chemistry through protecting the global environment and ensuring the safety of chemicals to fulfil our responsibilities as a corporate citizen.”

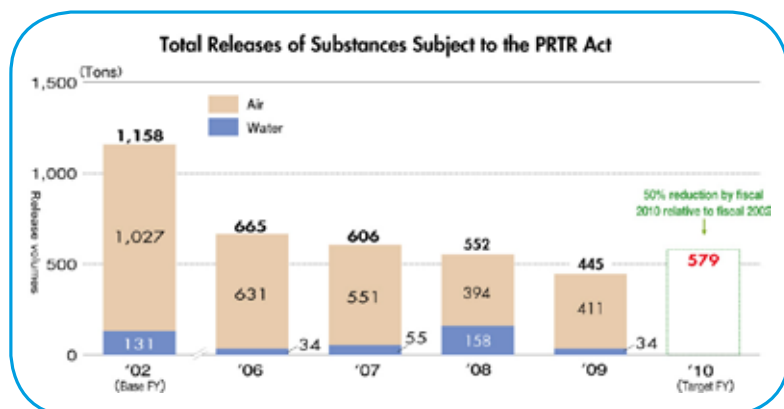
Risk Management Based on Environmental Risks

Targets for environmental concentrations of all chemical substances we manufacture and use are determined on the basis of our own management criteria for air and water emissions separately. These values are compared with monitoring or simulation data in order to assess potential risks, and then the assessment results are reflected in the emissions reduction plan. For example: “A 50% reduction in emission levels of chemical substances covered by the Japanese PRTR Act (into both air and water) by 2010 based on the amount emitted in 2002.” Until now, reduction of emissions into air and water has been carried out through a variety of extremely cost-effective measures, including stepping up efforts at recovery through utilization of adsorption agents and detergents, and through gas cooling, installation of floating roofs on storage tanks in order to control the generation of emissions, and also decomposition of emissions through incineration and activated sludge treatment. As a result, in fiscal 2008, we achieved a 52.3% reduction relative to fiscal 2002.

Benefits to Society

Sumitomo Chemical started business in 1913 as a producer of fertilizers from sulfur dioxide gas emitted by copper smelters. This business, which solved the environmental problem of air pollution while meeting the social demand for more agricultural production, embodied the business philosophy of the Sumitomo family handed down from the 17th century. Now, we engage in a variety of social actions based on the above philosophy that companies must grow hand in hand with society.

As mentioned above, we have achieved our goal of reducing the release of PRTR substances. This is one example of how we contribute to society by pursuing improvements in process safety that minimize environmental impact. In 2007, Sumitomo was awarded the “PRTR Grand Prize,” sponsored by Japan’s Center for Environmental Information Sciences under the auspices of the Ministry of Economy, Trade and Industry and the Ministry of the Environment. Furthermore, by providing our insecticidal Olyset® Net mosquito net, we have been able to contribute not only to the prevention of malaria, but also to the development of local economies in Tanzania by creating employment opportunities through the establishment of local production facilities. The following is a quotation by Dr. Ali Mohammed Shein, Vice President of Tanzania: “The Olyset® model produces a vital public health product and simultaneously boosts economic development in Africa. This is truly an advance beyond aid, toward self-sustaining enterprise in the service of public health. It is a model that should be vigorously applied in other industries across the continent.” These are just a few examples of how we are engaged in global initiatives. Sumitomo Chemical will continue to protect the global environment and ensure the safety of chemicals in order to fulfill our responsibilities as a corporate citizen while gaining the further trust of society.



*Pollutant release and transfer register (PRTR): a system for recording emissions and movement of environmental pollutants.



Distribution and Use Case Study 7 Evonik Industries

“We cannot enjoy life to the fullest, let alone thrive economically, if we ignore people and the environment. This is why a chemical company like Evonik has to ensure that its products are handled and used safely - when it produces and distributes them, when customers process them, and when consumers use the end-product. The tools we use in this endeavor include a proven chemicals management system; regular training for employees, shippers, and customers in how to handle our products; and, wherever possible, fence-to-fence production instead of shipping. “Our business philosophy is based on credibility and reliability” says Dr. Klaus Engel, Chairman of the Executive Board of Evonik Industries. This means nothing more than that we accept responsibility - that is, for our business activities, our employees, society and, of course, our products.”

Our Experience

The way our chemicals, once they are produced in our production facilities, are being used and handled throughout their entire life-span can vary enormously. Many applications are managed internally by using chemicals either as intermediates or building blocks for the production of finished goods for our daily life without intended or unintentional release of the substance. Other chemicals are used in preparations (e.g., cosmetics, cleaners, paints...) or as such (e.g., solvents) thus being designed for the direct end consumer use. This incredible variety in uses and different experiences in chemicals handling needs to be addressed by our chemicals management system to ensure anytime safe use of our products.

For ten years, we have used this system to assess any risks that our products might pose and to check whether our safety precautions are sufficient or have to be improved. All key information is captured in searchable databases, regularly updated, and made available to our employees for further use. With this system, we are continually broadening our knowledge of any potentially hazardous properties our products might have and are able to take the right action.

Our Best Practices

We train our employees regularly in how to handle chemicals. In 2009, the focus of training was on securing loads, and it paid off. Although we shipped more than 9 million metric tons of products in 2009 – more than half of them hazardous materials – the number of logistics incidents dropped to 16, a greater than one-third reduction over the three previous years. We also avoid shipping whenever we can. In Korea, for example out of many others, we supply one customer directly over the fence, as it were, with more than 50,000 metric tons of hydrogen peroxide per year, which is then used to produce propylene oxide by the HPPO process that we developed. In Bitterfeld, we produce silicon tetrachloride for our neighbor customer, who uses it to manufacture high-purity quartz glasses for optical fibers by simultaneously recycling waste hydrochloric acid into our production process.



“With our chemicals management system, we are continually broadening our knowledge regarding any potential problem in safe handling and use our products might have, enabling us to take the appropriate action to safeguard men and environment!”

The Evonik subsidiary CyPlus, who produces and sells sodium and potassium cyanide, takes it a step further. Customers are selected based on strict safety and environmental criteria. If a customer fails to meet these criteria, CyPlus ceases to deliver to the company and ends its business with it.

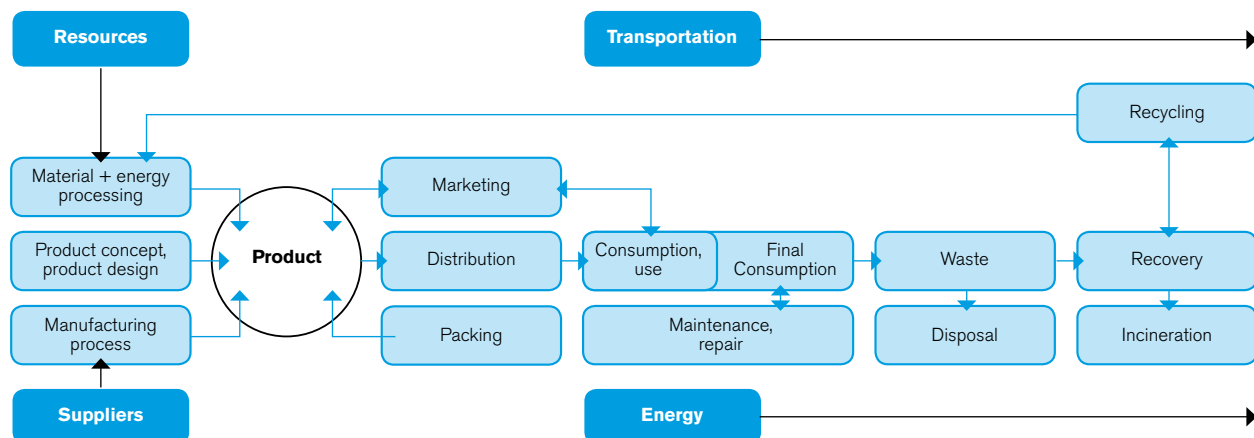
CyPlus offers existing customers extensive support in the use of cyanide and treatment of cyanide-based residue from ore processing. Moreover, CyPlus hires only those logistics service providers who meet comprehensive requirements for reliability and quality in all activities that are related to the transport of hazardous materials.

Benefits to Society

We are facing enormous challenges: climate change, scarce resources, globalization, population growth, demographic change. Evonik is helping to meet these challenges in a number of areas – with products for generating and storing regenerative energies, with catalysts and additives to produce eco-friendly raw materials and products, with solutions for electromobility, and intermediates for effective medicines.

But our products offer long-term benefits only if they do what they are supposed to do and are produced sustainably and handled safely. This is the foundation of society's trust and acceptance, without which there is no commercial success. That is why Evonik is committed to protecting people and the environment, as expressed in its ESH values, and also explicitly requires that its Chemicals Business Area implement product stewardship according to the specifications of the Responsible Care® Initiative. In an extreme case, this can mean that we actively publish restrictions on the use of products when the risk cannot be contained.

Schematic Lifecycle of a Product





Distribution and Use Case Study 8 Shell Chemicals

The chemical industry is highly integrated and relies on efficient, reliable and competitive transport to move its goods globally. Safe, sustainable and efficient logistics are critical to the future of the chemical industry. Ensuring safe transport and handling of its products, with care for the environment and in full accordance with regulations, is of key importance for the image and reputation of the chemical industry.

In Shell, we believe that good health, safety, security and environment performance is essential for business success - and a strong commitment to Responsible Care® is one of the tenets by which we operate. We invest continually in designing and implementing new measures to improve further the safety of our chemical logistics operations. Shell Chemicals have also taken a proactive stance in the drive to raise overall standards across the industry, using our leading participation in industry bodies to share learning's and promote best practices. As a key member of industry groups, such as Cefic in Europe, we have taken a leading role in promoting efforts to develop a coherent, cross-industry approach.

Our Experience

At Shell, we deliver more than two million tonnes (around 125,000 consignments) of chemicals products to our customers globally each year by road. We entrust around 40 primary haulage companies contracted across the globe to deliver products to our customers. It is therefore extremely important to ensure compliance to Shell's safety standards among our contractors. Shell has proactively identified the potential hazards right across our logistics operations. It has taken steps to address them by implementing new standards or processes and working closely with our customers and transport providers to raise awareness and drive changes in behavior. Shell actively shares its experience with industry partners and logistics service providers.

Our Best Practices

At Shell Chemicals we want to be one step ahead, proactively identifying and preventing any potential safety risks by taking appropriate measures to manage and control risks.

Non-standard Operations

In 2008 a review of our operations identified ten non-standard practices in Europe that could potentially compromise safety, for example drivers taking samples and adding products during transit themselves. We took immediate action, empowering our customer account managers to identify and re-direct any non-standard operations of any kind to the appropriate experts.



“We invest continually in designing and implementing new measures to improve further the safety of our chemical logistics operations.”

Sampling

Shell Chemicals introduced a policy in late 2007 preventing drivers of contracted hauliers from taking samples at customer premises. This policy aligns with industry (Cefic) guidelines and is designed to ensure that all supply chain activities are carried out safely, and by qualified personnel. We have been working closely with our customers on rolling this out and the feedback we've received has been positive.

Track and Trace

The safe transportation of hazardous goods remains a top priority for our business, our customers and the public. To meet this demand, Shell Chemicals have introduced satellite-based tracking system for all deliveries of Ethylene Oxide (EO) by rail in Europe and North America. This allows us to know the exact location of any rail tank car, and the condition of the product in it, at any time. It means we are able to identify and resolve any potential problems earlier and therefore more quickly and effectively.

Rollover Warning Device

Although fortunately rare, truck rollovers represent a potential serious safety risk both in terms of loss of product containment and personal injury. To reduce – and hopefully eliminate – this risk Shell Chemicals are piloting a warning device for road tanker drivers. The device, which can be fitted retrospectively, contains an accelerometer that detects and measures the vehicle's acceleration and inclination, sending a warning the driver. Initial driver feedback has been positive and we hope to eventually roll these out globally.

Benefits to Society

Chemicals play a vital role in all aspects of our lives and the industry relies on safe and sustainable transportation across the globe. For Shell Chemicals, this means that most of our products are moved by pipeline, vessel or rail tank car, leaving only up to 15% of our volume delivered by road. This helps significantly to reduce the risks associated with transportation.

Adopting industry best practices, eliminating non-standard operations and utilising new technologies have been key to the continuous improvement in the safety performance of our logistics activities. As a result of these efforts we have seen progressively fewer incidents.

Shell Chemicals are proud that we have been operating our business for the last five years without any fatal incidents on the road. However, safety is something that we can never take for granted. We therefore work – both internally and with our industry partners – to continually review and improve how we operate, whether that be through new technologies, process or our people, to deliver chemicals safely and efficiently to our customers.



Distribution and Use Case Study 9

HERA (Human and Environmental Risk Assessment)

**“Give consumers’ clear information, not confusion”
says chemicals and detergents industries.**

Regulators and the general public are rightly demanding to know more about the potential risks of the chemicals used in everyday products. For its part, the chemical industry believes it is essential to provide such information in a transparent and scientific manner, ideally in collaboration with its industrial customers. This way, consumers can take a balanced view and be reassured that industry is behaving responsibly.

The idea for the HERA project came from the downstream users of chemicals who were engaged in formulating Household Detergents and Cleaning products already in the late nineties. Leading companies wanted to ensure that risk assessment should continue to be regarded as the core tool for chemicals management.

The HERA project is a unique European partnership which was established in 1999 between the manufacturers of cleaning products (A.I.S.E.) and the chemical industry (Cefic).

It aimed to:

- Demonstrate to authorities with real examples that the Risk Assessment process can provide relevant safety information and evaluation in an efficient, effective and transparent way.
- Provide relevant information to consumers about the safety of household cleaning products.
- Contribute to the debate on EU chemical policy by demonstrating that such a targeted risk assessment approach can be used in a fast, effective and valid way.
- Contribute to the development and refinement of a risk-based approach for chemical legislation.

Our Experience

The household detergent ingredients were evaluated in two phases.

Phase 1 focused on the development and refinement of Targeted Risk Assessment methodology focussing on the most relevant exposure scenarios of the consumer use phase and the post-use discharge to the environment. This methodology was then applied to a number of model substances to test its validity and to establish the feasibility of the process for industry and authorities.

Phase 2 of the programme applied the methodology to assess a wide range of household cleaning product ingredients.



“HERA aims to encourage a wider understanding and acceptance of the risk-based approach to managing chemicals and encourages industry to be more transparent in sharing its data and decision-making processes.”

Risk assessments for significant number of detergent chemicals were assessed by industry under this program and have already been published on the HERA public website.

The assessments have lead to additional information to consumers and also to a change in product concepts.

HERA has introduced a standard industry framework for assessing household cleaning chemicals in this way and reporting the results. A guidance document on this methodology was developed and is widely used in industry.

As an exercise in scientific risk assessment, HERA aimed to encourage a wider understanding and acceptance of the risk-based approach to managing chemicals. It has also intended to lend support to risk-based legislation.

For more information and published risk assessments, see www.heraproject.com.

Our Best Practices

HERA was established to develop risk assessments for human health and the environment for all substances used in household cleaning detergents if their properties or usage were of sufficient interest to merit completion of an assessment or if their risk was not yet assessed elsewhere. HERA is to be considered as a model of risk assessment processes.

Benefits to Society

To Business

Industry was able to provide information about the potential risks posed by chemicals, and not just hazards, in order to provide its customers and consumers with a balanced perspective and reassurance that industry is behaving responsibly. By bringing together the main data holders (supplier companies) and experts in the products and how they are used (formulator companies), industry has succeeded in speeding up the process and deepen the general understanding of the scientific basis of risk assessments.

To Regulators

Companies that carried out assessments on their products often use individual standards. HERA has provided a common industry response to a society which increasingly demands that industry be more transparent in sharing its data and decision-making processes.

To the General Public

Data has been made available to the public by various means, the internet being an important one (through www.heraproject.com). Furthermore, the companies formulating and manufacturing household cleaning products have taken into account the HERA risk assessments in their risk management for their future developments.

End-of-Life Case Study 10

Bayer MaterialScience



“At Bayer MaterialScience, it is our core belief that safety, environmental protection, product and process quality as well as commercial efficiency are factors of equal importance in achieving our corporate objectives. In this sense, Product Stewardship adds value to our business, adds value to our customers’ businesses and is a major contribution to sustainable development” says Patrick Thomas, CEO Bayer MaterialScience.

Our Experience

We follow the ICCA Global Product Strategy and Global Product Stewardship Guidelines in implementing Product Stewardship. Experience has shown that a targeted approach is the key to successful Product Stewardship. Global goals need to be transposed into targeted actions and communication, addressing local conditions, languages and laws. This is particularly true for our targeted supply chain outreach programs with customers, which address the actual situation and challenges to promote safe distribution, logistics, handling, use and recovery/disposal of our products, including the packaging.

We channel our communication on Product Stewardship to our customers and other stakeholders through the BayCare-Online platform. This platform was originally established in 2000, and has been reorganized to include a worldwide section as well as specific regional resources for North America in English and South America in Spanish to address the needs of our stakeholders. For example, the North America region pages direct customers to recycling companies able to take-back plastics waste or provide recycled materials, and provide information resources which also cover the safe disposal of packaging. Further regional resources with appropriate content and in the languages of those regions will be added as we drive our implementation of the ICCA Global Product Strategy forward.

Our Best Practices

The purpose of packaging in the chemical industry is to enable the safe distribution, handling and storage of the packaged product until it can be safely used by the customer. This serves not only to reduce both potential health and environmental risks of the product through accidents or leakage, but also to protect the product itself from contamination through contact with its surroundings. The packaging is therefore of high quality and has value. In some cases it may be reusable, for example the reconditioning of Composite Intermediate Bulk Containers (CIBC).

“The take-back system for industrial packaging is a step towards reducing potential health and environmental risks”

Due to the dangers of contamination, Flexible Intermediate Bulk Containers (FIBC) for hazardous chemicals are not generally reused, but instead thermally disposed. In 2005, we then began a project to investigate the possibility of extending the life-phase of FIBCs for packaging certain products manufactured in Thailand. A cleaning process was developed to remove contamination and thereby enable their reuse for the same product supplied. As a consequence, a higher quality FIBC has to be employed in order to withstand the cleaning process and repeated reuse, and a bar code is affixed to track the number of times each FIBC has been reused. Following trial runs and dialogue with the customers, we made agreements to take-back FIBCs sold to major customers in Thailand, which constitutes the overwhelming majority of those originating from our Thailand plant. For safety reasons, we also added a label to the FIBCs in 5 languages (English, Thai, Chinese, Japanese and Korean), so that all customers receiving the FIBCs, even those outside Thailand, are informed. Final implementation in the whole process was completed in 2007, with each FIBC being used and then reused a further four times. On return for the fifth time, the FIBC is cleaned, shredded and sent for safe thermal disposal.

Benefits to Society

The take-back system in Thailand is a step towards reducing potential health and environmental risks through the misuse of unclean FIBC. At the same time, reuse enables us to save up to 20000 new FIBCs per year, which constitutes not only an increase in resource efficiency, but also represents a financial saving. Additionally, the customer also benefits by having less packaging waste to dispose. Nevertheless, the success of this scheme does not imply that a general reuse of all FIBC for hazardous chemicals would be possible: thermal disposal after single use may still be the preferred route to prevent potential contamination.



**For more information, please contact ICCA
or any of the companies represented in this
brochure.**

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