Sumitomo Chemical Company Limited's Efforts towards Chemical Management and Risk Communication

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The greatest feature of Sumitomo Chemical's chemical management system is comprehensiveness based on our broad knowledge and technical ability as a chemical manufacturer. Furthermore, in order to practice risk communication, we are proactively holding dialogue with, and releasing information to, our diverse range of stakeholders, keeping in mind our motto "It is a mission for enterprises to grow together with the local community". In February 2007 such efforts were finally acknowledged, when Sumitomo Chemical received the 2006 PRTR Grand Prize, the first time for a chemical company. Our company's approach to chemical management and risk communication will be outlined in this document.

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Introduction

Responsible care (RC) is an activity unique to each enterprise for maintaining the environment, safety, health and product quality over the whole life cycle of its products and to deepen the trust and understanding received from other members of society, and at Sumitomo Chemical Company Limited, we believe it is one of the most important pillars of our CSR management activities which extends to all of our factories and research centers in Japan and also to all Sumitomo group companies both within Japan and overseas.

Particularly with the management of chemical substances, furthering the tasks of risk management and risk communication is a central part of our policy of RC activity, and we are continually working on effective planning and development of specific measures to implement this policy. And in addition to these RC activities, we also give the fullest consideration to the interests of society and economic needs by developing responsible technologies and products which are born through the practical application of "Sustainable Chemistry" in order to increase the value of our company and to provide people with a more fruitful and rewarding lifestyle, and also to provide solutions to problems facing our society and the global environment. We hope that continually promoting better CSR management activities will help us contribute to building more secure and sustainable development of society.

Continuous Improvements in Proper Management of Chemical Substances

1. Risk Management for Chemical Substances

We collect data and information on various types of chemical substances over the whole of their life cycle, from research into and development of chemical products through to the manufacturing, distribution, consumption and disposal of these products, and we use this data and information to thoroughly implement the necessary risk management (**Fig. 1**).

2. Complementing RC activities through corporate research

The range of RC activities covers a diverse scope including environmental protection, safety and disaster prevention, occupational health and safety, chemical safety and product quality assurance. A high level of technological know how and specialization backing up our chemical technology is required in order to accurately carry out management of chemical substances over such a wide range of areas. In order to achieve

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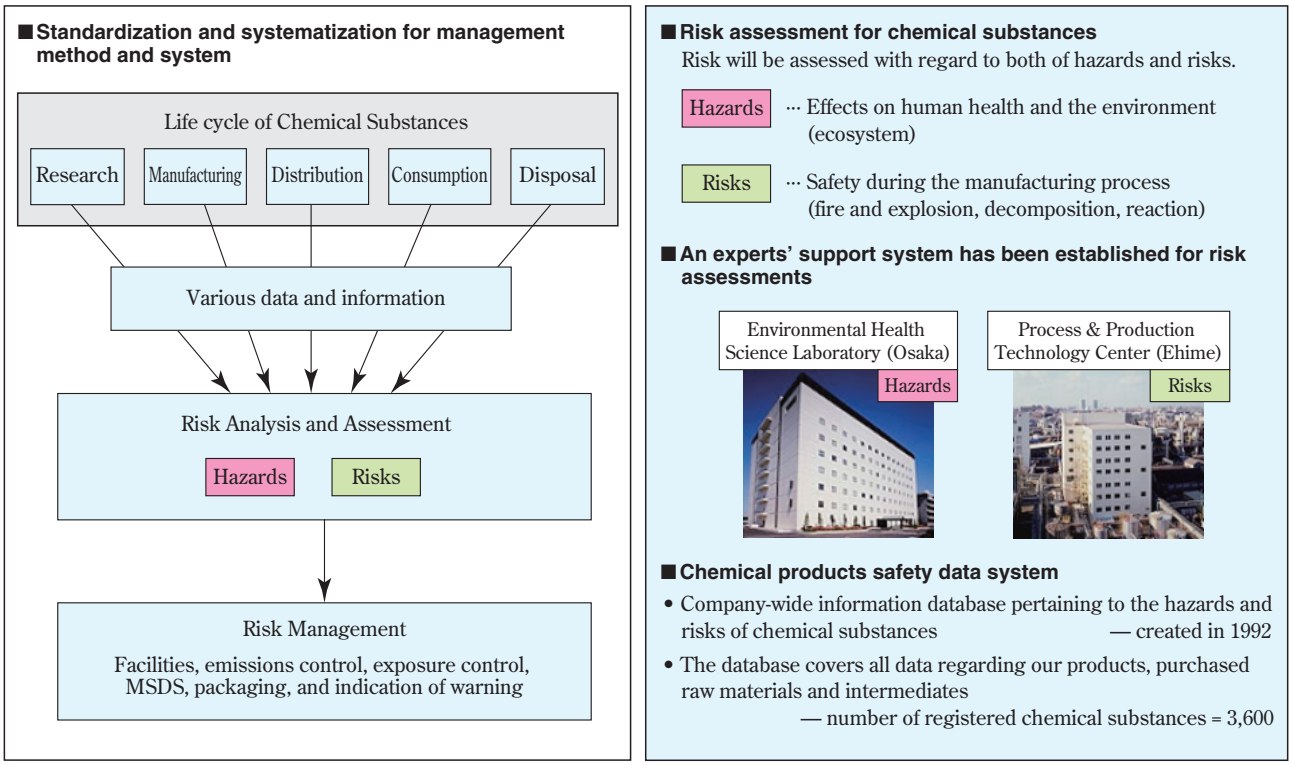


Fig. 1 Risk Management for Chemical Substances

this, we have established two research centers to carry out safety testing and assessment for chemical substances and chemical processes from the point of view of both risks and hazards for all companies in our group. These two centers are the Environmental Health Science Laboratory and the Process & Production Technology Center. These two research centers support conservation of the environment and maintaining of safety by providing comprehensive technological backup for all of our products, processes and facilities (Fig. 1).

3. Creation of a company-wide chemical product safety database system

In 1992, we established a chemical products safety database system as a basic database of risk and hazard information for our products (both products manufactured by us and products for resale), purchased raw materials and intermediates. This database was computerized and placed online into our company-wide computer network. Since the database was created and first used in 1992, it has grown until it currently holds information on approximately 3600 registered chemical substances. This online database contributes greatly to our ability to provide information quickly and accurately throughout the company, and it is also a useful basic resource that can be used when compiling material safety data sheets (MSDS) and other educational materials for use within the company (Fig. 1).

4. Advance examination system (management of chemical substances at each stage of development and manufacturing)

We have established an advance examination system as an integral part of our system for the management of chemical substances (**Fig. 2**). The scope of application for this system covers research, development and production of new products, as well as improvements to and rationalization of manufacturing processes for existing products (hereinafter referred to as development and production). General managers, production managers and project managers on an intra-company scale each hold a section of the responsibility for development and production. At each stage of the whole process starting from the basic research carried out into our products through to the actual manufacturing of these products, we assess the properties and also the risks and hazards of all materials, investigate whether they comply with applicable laws and standards, and also carry out a variety of other inspections and assessments in order to make sure that our management of chemical substances is completely thorough.

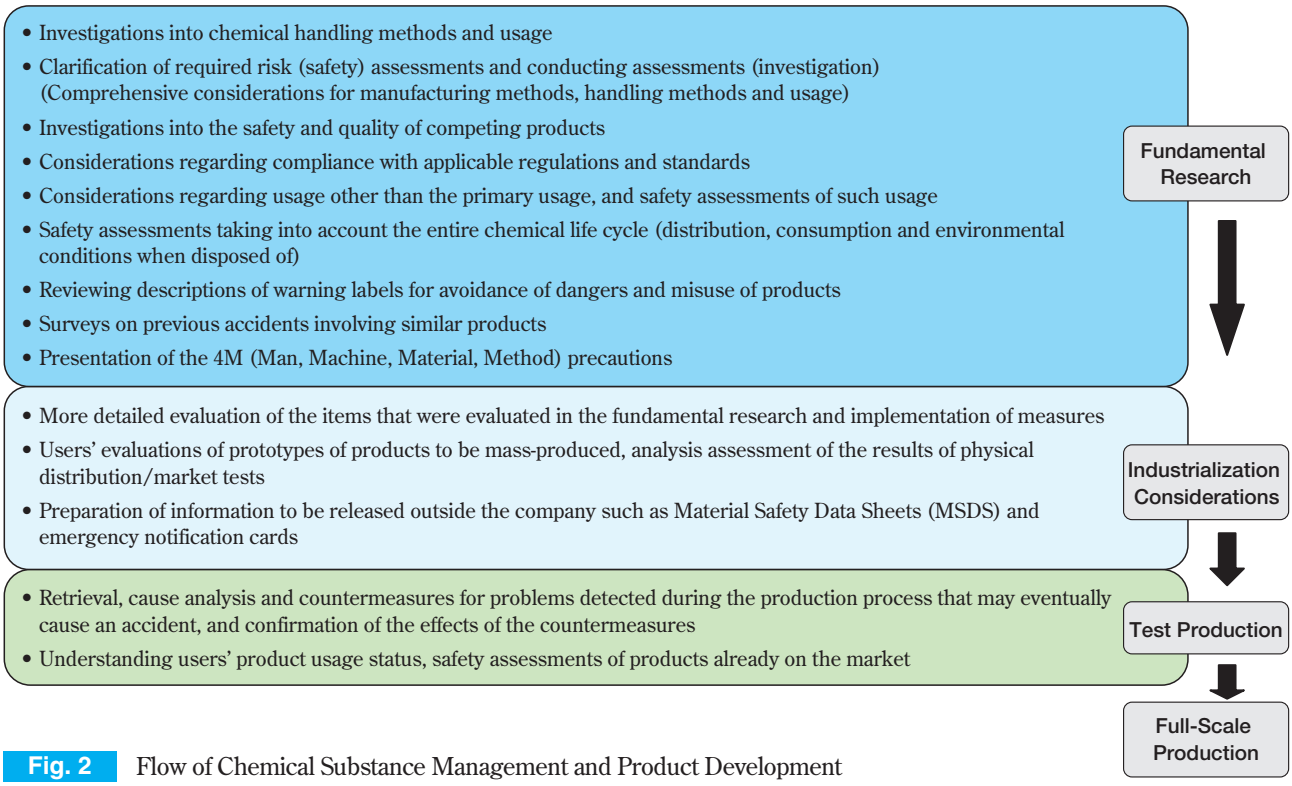


Fig. 2 Flow of Chemical Substance Management and Product Development

Furthermore, detailed methods and procedures for carrying out risk assessment regarding matters such as the risks of fire or explosion that relate to worker safety and effects on the environment as well as hazards that have been assessed as having a potential effect on human health or on the ecosystem have been standardized and put into document form, and these are used as intra-company regulations. Risk management methods and procedures that take into account all aspects of risk assessment are handled in the same way.

5. Two-stage assessment of new chemical substances

We use a two-stage process when carrying out risk assessment for assessing the effects of new chemical substances on humans and their health and also on ecosystems and the environment. Firstly a qualitative assessment is carried out, and after that a further detailed quantitative assessment is carried out for substances which are confirmed to have an effect which is at or above a certain level. Specifically, the substances are first assessed for the presence of toxicity, and if the substance is determined to be toxic, it is compared with the company's in-house determination criteria. Then, if the substances require a more detailed assessment, the degree of toxicity and the level of exposure is then assessed, and finally an assessment of the risk level is carried out (**Fig. 3**).

PRTR compliance

1. Company-Wide PRTR Calculation System

In 2002 we developed and implemented a company-wide PRTR calculation system involving the company's head office and all branch offices in a comprehensive network with the aim of improving the accuracy of input data and making the collection of statistics quicker and more efficient. Data obtained from the collection of substances which are necessary in order to calculate emission levels and movement amounts for this system is comprehensively recorded separately for each emission source, and this data is then utilized for a wide range of analysis and checking purposes. **Fig. 4** shows an example of the screen display for this system.

2. PRTR Strategy and Target Reduction Values

In the same year, as a means of strengthening the proper management of chemical substances in line with PRTR laws, we formulated "Sumitomo Chemical's PRTR Strategy" and from that time until now we have been engaged in reducing the planned levels of emissions of chemical substances into the environment over the medium to long term based on this strategy.

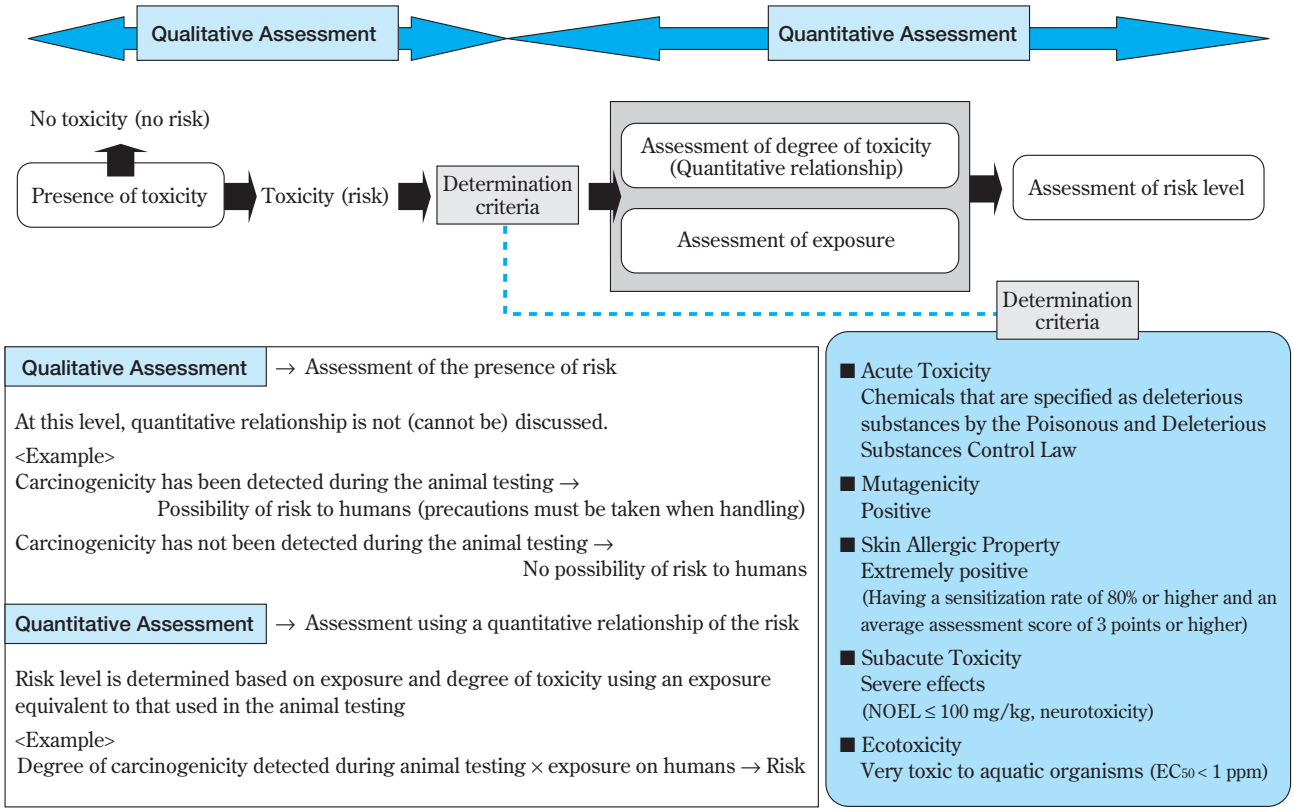


Fig. 3 Management of New Chemical Substances (Two-Step Assessment)

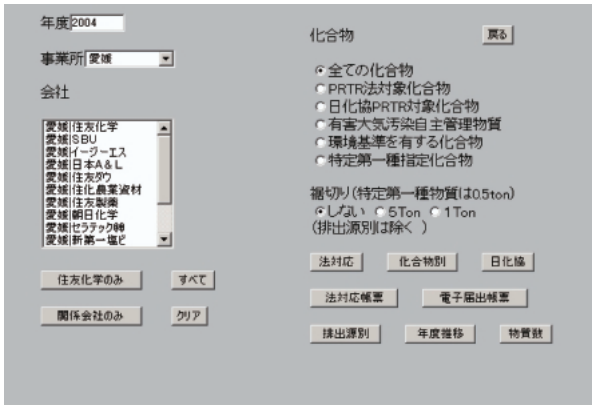


Fig. 4 Example Display of Company-Wide PRTR Calculation System

1. Risk management based on environmental risks
2. Emissions management based on the emission amount ranking assessment
3. Emissions management conducted in collaboration with the industry and local community
4. Emissions management using the integrated environmental load method

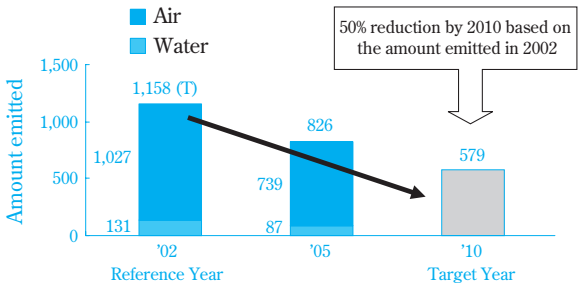


Fig. 5 PRTR Strategy and Target Values

The PRTR strategy consists of four investigation items, of which the central item is "Risk management based on environmental risks". Furthermore, systems of emission management have also been introduced to complement risk management. This emission management consists of additional items including management based on emission amount ranking assessment, management in collaboration with industry and local communities, management using an integrated environmental load method. The results of these various assessments are used in order to establish specific target values such as 'a 50% reduction in emission levels of chemical substances covered by the PRTR laws (into both air and water) by 2010 based on the amount emitted in 2002' (**Fig. 5**).

The driving force behind the achievement of these target values is the PRTR strategy itself.

3. Details of the PRTR Strategy (Table 1)

As part of the risk management based on environmental risks, we set our own target environmental concentrations (with separate concentrations for air and water) for all chemical substances which are handled independently of the actual emission amounts, and then monitoring data and simulation data are compared in order to assess toxicity and the results of this are then reflected in the emission reduction plan. All necessary risk assessments are carried out to their completion. The emission amount ranking assessment is carried out during every year period at all production plants to assess the worst emission ranking, and the results of this are also reflected in the emission reduction plan according to the company's in-house determination criteria in the same way.

In the process of emission management conducted in collaboration with industry and local communities, voluntary emission reduction targets were established for self-managed hazardous air pollutants and emission levels have been greatly reduced. Emission management using a new concept of the integrated environmental load method is currently continuing with a diverse range of inspection and assessment tasks being carried out, and the details will continue to be examined in depth to quantify reduction amounts, and these will also be reflected in the emission reduction plan.

(1) Risk management based on environmental risks

Target environmental concentrations for all chemical substances which are manufactured and used are set based on our own management criteria, and they are set separately for air and water emissions. For air emissions, atmospheric concentrations at factory site boundaries are used as the control points, and for water emissions, effluent concentrations at final effluent exists are used as the control points. Our aim is to meet the target environmental concentrations at these respective control points (**Fig. 6**).

Target environmental concentrations are determined based on standard values from trustworthy organizations both within Japan and overseas. As specific examples, these are set based on toxicity assessments centering on the effects on human health in the case of

Table 1 Details of the PRTR Strategy

The company-wide policy to thoroughly undertake the emission reduction measures by specifying chemical substances for which the amount emitted should be reduced with consideration for both the amount emitted and environmental risks

Item	Purpose	Details	Results
Risk management based on environmental risks	To avoid risks to human health and the ecosystem	• Our own target concentrations for all chemical substances handled will be set. • The amount to be reduced by will be estimated using simulation data. Results will be confirmed by measurements.	Completion of risk assessments of all chemical substances ↓ The results will be reflected in the emission reduction plan.
Emissions management based on the emission amount ranking assessment	To ease the anxiety of residents in areas near factories by improving the emission amount ranking assessment	• Our own determination criteria have been devised in order to assess the emission amount ranking of each chemical substance classified into two categories: nationwide and by prefecture.	Implementing the ranking assessment of all chemical substances (annual) ↓ The results will be reflected in the emission reduction plan.
Emissions management conducted in collaboration with the industry and local community	To contribute to achieving environmental quality standards values (environmental indicators) by accomplishing the "Reduction Targets for Self-Managed Hazardous Air Pollutants" and the "Reduction Targets for Benzene Emissions"	• Hazardous air pollutants (total of 9 chemical substances) Our voluntary reduction plan will be devised. (In collaboration with the Japan Chemical Industry Association) • Our voluntary benzene reduction plan will be devised. (In collaboration with 12 iron, chemicals and petroleum businesses in the Tokyo and Chiba coastal central region)	Accomplishing our voluntary reduction plans (achieving the targets) ↓ The results will be reflected in the emission reduction plan.
Emissions management using integrated environmental load method	To promote a comprehensive environmental load reduction plan by devising a cost effective action plan through the selection of high priority chemical substances having high environmental loads	• Integration of various environmental loads will be examined. • Factory-by-factory relationship between "production efficiency" and "environmental efficiency" or "cost efficiency of reducing environmental loads"	Continuing the assessment ↓ Now examining the quantification of the "Targets for improving the environment efficiency" (The result will be reflected in the emission reduction plan.)

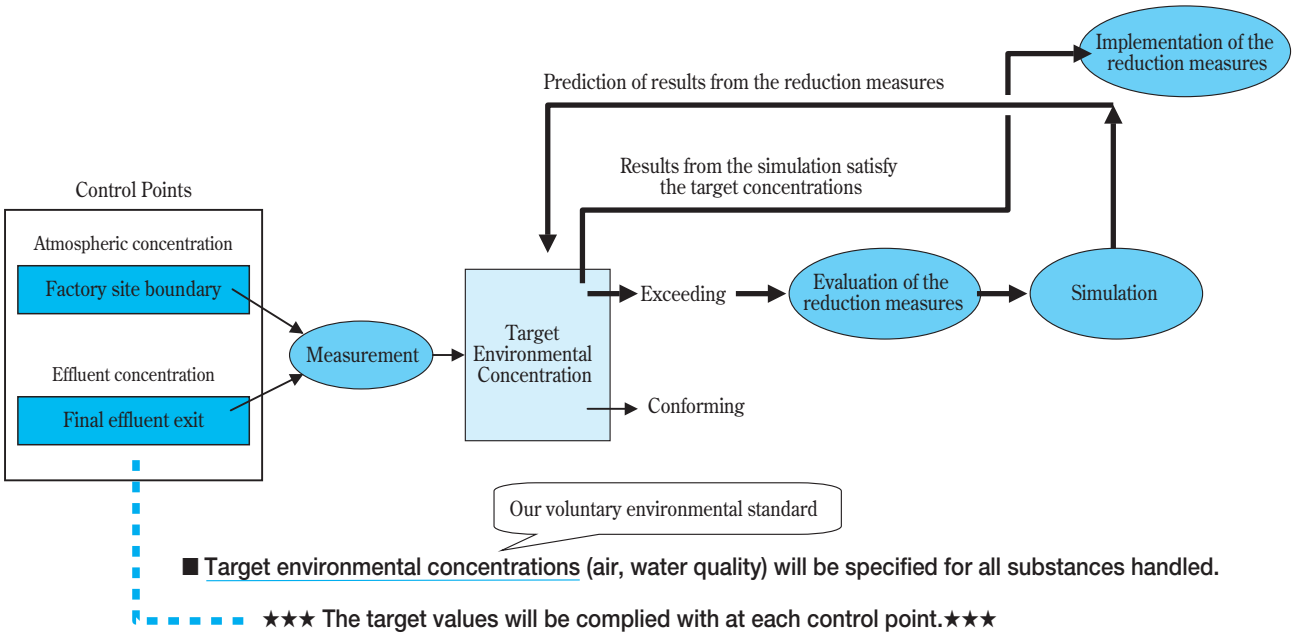


Fig. 6 Risk Management Based on Environmental Risks

Table 2 Setting Target Environmental Concentrations

1. Air ··· Target concentrations will be specified by evaluating reliable toxicity data pertaining mainly to the effects against human health.

Calculation Method	• Japanese standards exist	→ The Japanese reference values will be adopted.
	• No Japanese standards exist	→ Of the reference values stipulated by the World Health Organization (WHO) and US safety standards, the stricter value will be adopted
	• No standards exist in Japan, the US or the WHO	→ Paying attention to labor reference values in both Japan and the US, target values will be calculated by multiplying the safety factor by the stricter reference value of that stipulated by the US and that stipulated by the Japanese standards

2. Water Quality ··· Target concentrations will be specified by evaluating reliable toxicity data for aquatic organisms.

Calculation Method	• Of the reference values stipulated by the Japanese standards and that stipulated by the Organization for Economic Cooperation and Development (OECD), the stricter value will be adopted.

atmospheric concentrations, and on the predicted no-effect concentration for aquatic organisms in the case of water concentrations. Setting the target environmental concentrations is done by inspections and procedures carried out under the responsibility of our company experts in risk assessment (**Table 2**).

Simulations are carried out using a variety of different computer software programs, and they are useful in predicting the results of environmental improvements that occur due to emission reductions. **Fig. 7** shows an example of this with a simulation of atmospheric concentrations of vinyl acetate dispersed through the air from a factory emission source. The atmospheric concentration at the control points along the factory site boundary were kept to within the target environmental concentrations.

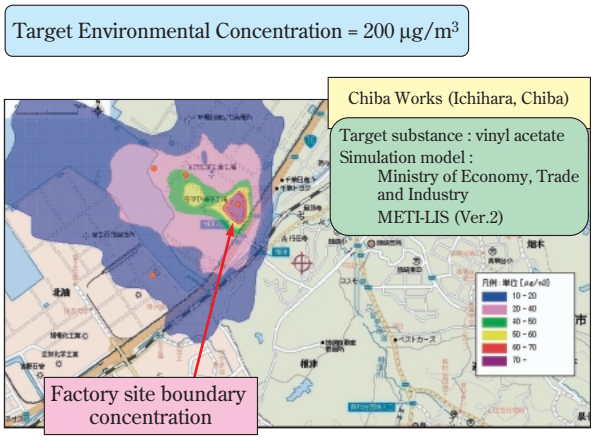


Fig. 7 Example of Air Simulation

(2) Emission management based on the emission amount ranking assessment

We have established determination criteria for emission amount ranking assessment (nationwide and by prefecture) which apply to the whole company. The determination criteria are separated into four different approaches (A to D) as shown in **Table 3**. The application of these criteria is done in a priority order, starting with the one which is ranked highest alphabetically.

(3) Emission management conducted in collaboration with industry and local communities

Sumitomo Chemical has also set voluntary reduction targets for reducing the emission volumes for a total of

Table 3 Emissions Management Based on Emission Amount Ranking Assessment

- Measures will be undertaken based on the determination criteria for emission reductions
  Order of Priority : A > B > C > D

Determination Criteria

A. The substance has been ranked as one of the worst 10 by the all-Japan emission ranking assessment
   - The amount emitted and the number of companies handling the substance shall not be taken into account.

B. The amount emitted is over 100 tons and the substance has been ranked as one of the worst 10 by the prefectural emission ranking assessment
   - The number of companies handling the substance shall not be taken into account.

C. The amount emitted is more than 1 ton and less than 100 tons, and the substance has been ranked as one of the worst 10 by the prefectural emission ranking assessment.
   - However, the number of companies handling the substance must be at least 2.

D. The amount emitted is less than 1 ton, and the substance has been ranked as the worst by the prefectural emission ranking assessment.
   - However, the number of companies handling the substance must be at least 10.

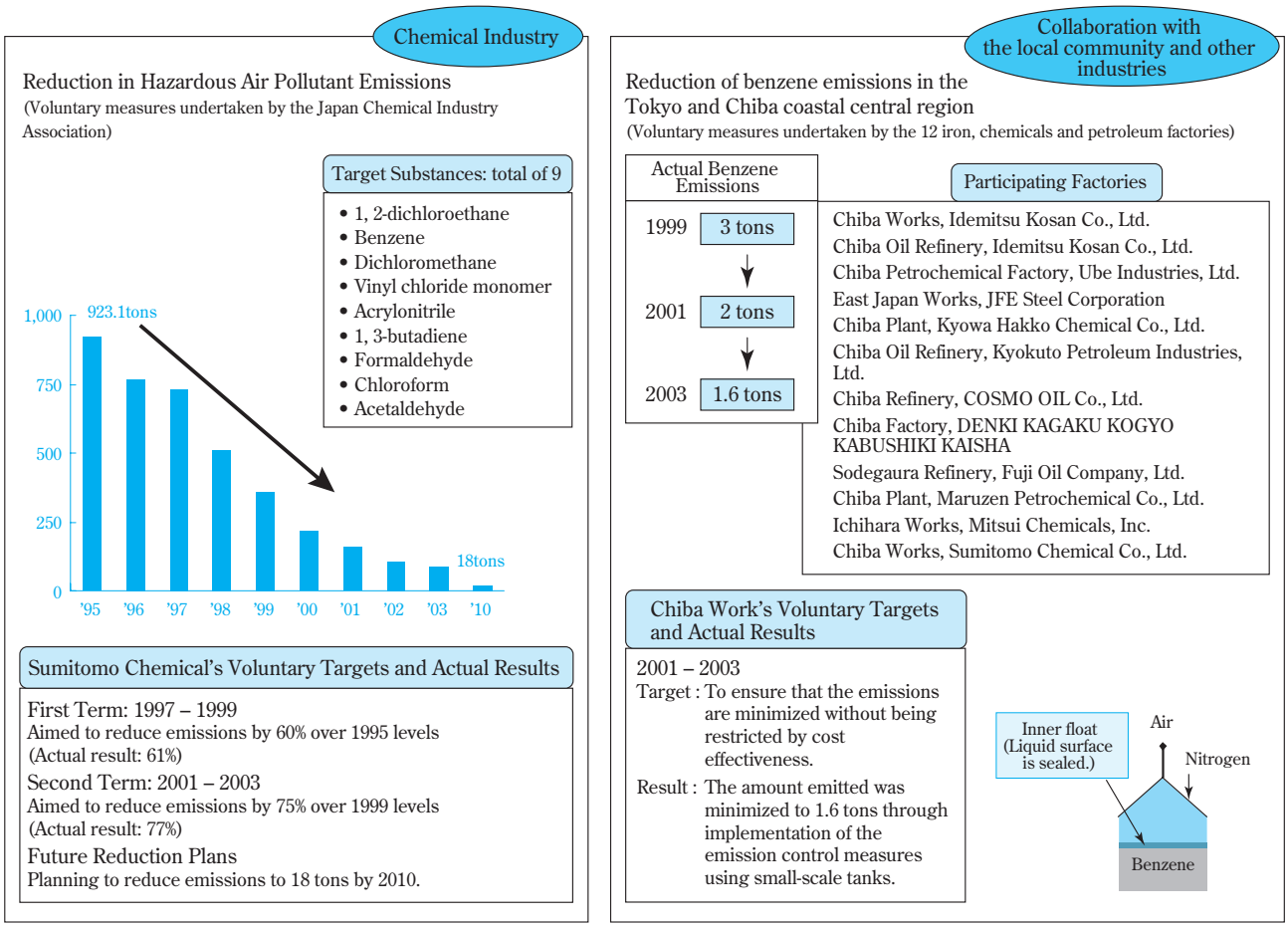


Fig. 8 Emissions Management Conducted in Collaboration with the Industry and Local Community

nine different hazardous air pollutants stipulated by the emission reduction policies of the Japan Chemical Industry Association, and these targets have been substantially achieved. In the same way, we have been taking part in a cooperative effort among 12 different companies in the steel, chemical and petroleum industries to achieve a reduction of benzene emissions in the Tokyo and Chiba coastal central region based on national government notices and policies, and we have succeeded in reducing our own benzene emissions to the absolute minimum (**Fig. 8**).

(4) Emission management using the integrated environmental load method (**Fig. 9**)

Since 2004, we have been trialing integration of environmental loads based on the JEPIX (Environmental Policy Priorities for Japan) method. With this method, the environmental efficiency is calculated and this is used to continuously investigate details of the relationship between production efficiency and the cost-effectiveness of reducing environmental loads and other factors. We expect that effective utilization of this JEPIX method in the future will be a means to effectively and efficiently promote the reduction of not only chemical substances covered by our PRTR strategy, but also other substances which place a load on the environment.

4. Examples of Emissions Reduction Efforts (Fig. 10)

Reduction of emissions into air and water is being carried out through a variety of extremely cost-effective measures including strengthening recovery by utiliza-

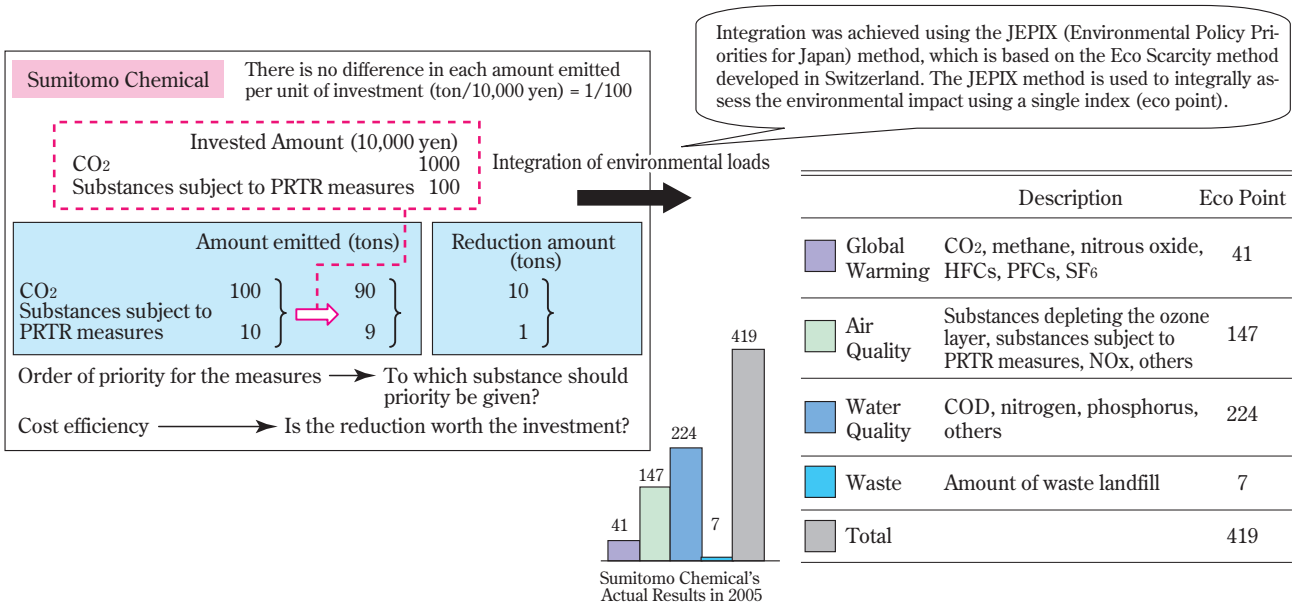


Fig. 9 Emissions Management Using the Integrated Environmental Load Method

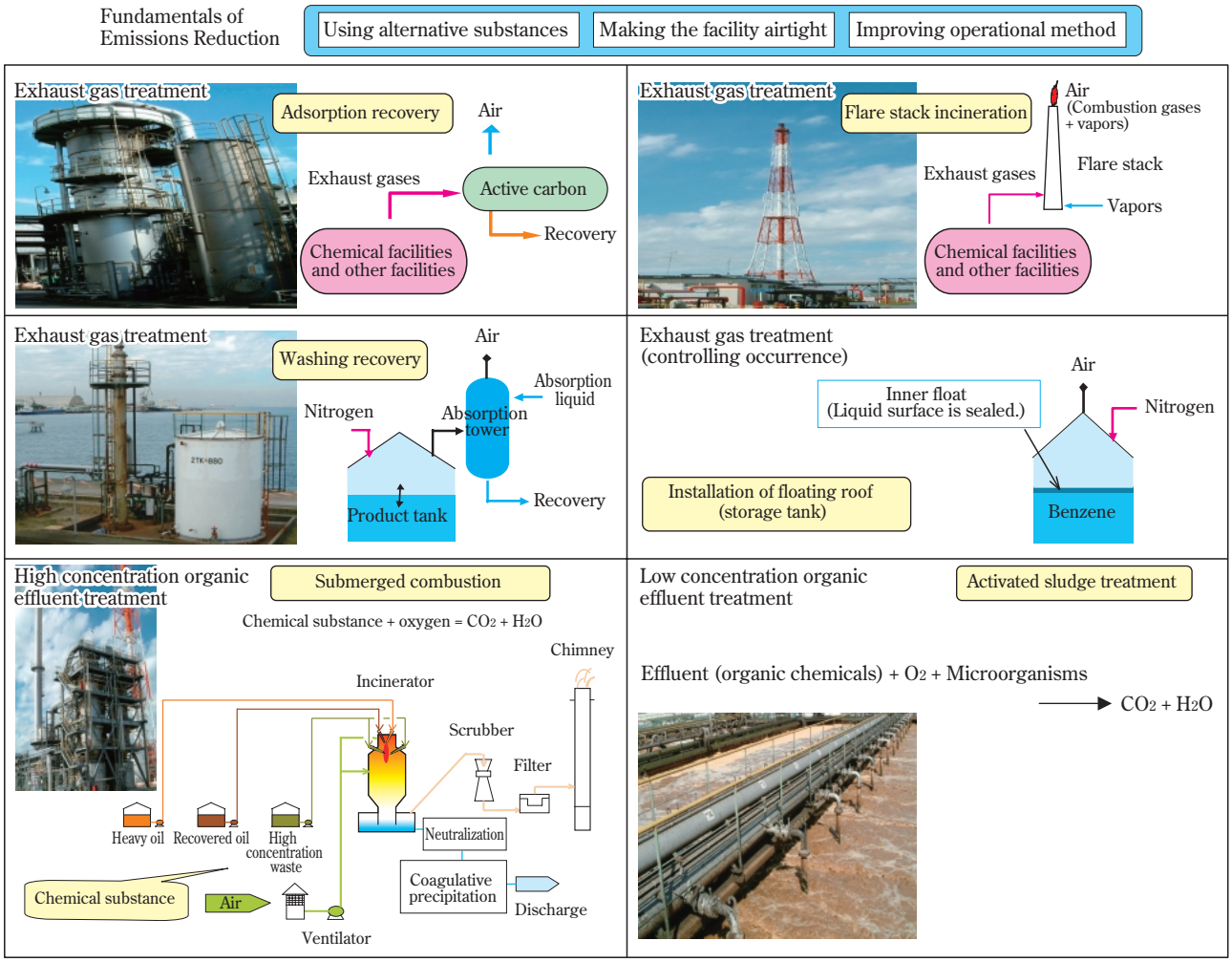


Fig. 10 Examples of Emissions Reduction Efforts

tion of adsorption agents and detergents and by gas cooling, installing floating roofs to storage tanks in order to control the generation of emissions, and also decomposition of emissions through combustion and activated sludge treatment, based on reducing emission losses through means such as making facilities airtight and improving operating methods.

Practical Sustainable Chemistry

Sumitomo Chemical is using its strengths and distinctive character as a chemical manufacturer to carry out process innovation through the development of high-performance catalysts and also in the development of fundamental production technology in order to boost its performance as a good corporate citizen and to minimize loads placed on the environment through the concept of "Sustainable Chemistry" (the development of "green" processes and the manufacturing of "clean" products) which is more economical and more efficient (by reducing energy consumption and use of natural resources).

Examples of the development of such green processes are shown in **Fig. 11**.

These efforts are an important part of the overall effort in promoting good management of chemical substances, and they also contribute an important driving force toward building a continuing and sustainable society.

Promoting Information Disclosure and Risk Communication

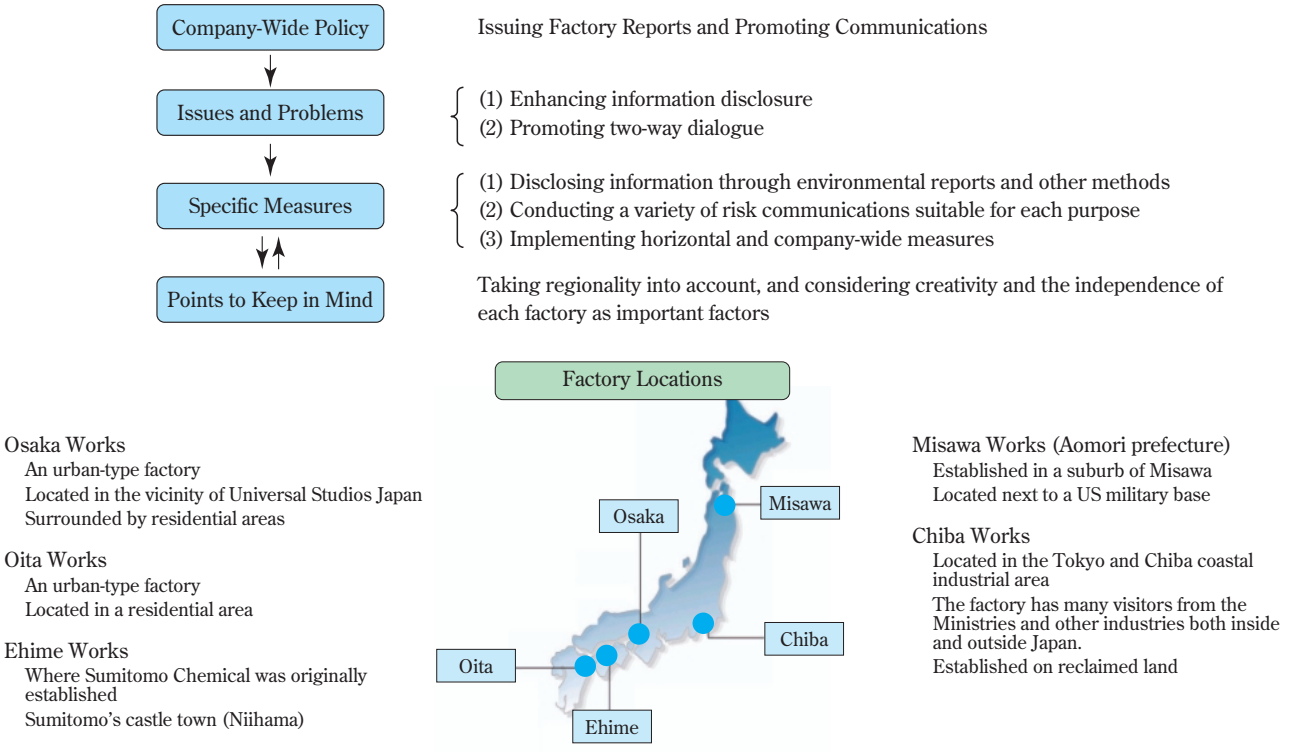
Promoting communication between company and society is an indispensable part of maintaining and strengthening the good management of chemical substances on a risk basis. Based on Sumitomo Chemical's company motto that it is a company's purpose is to develop together with local communities, it has been a continuing company policy to issue site reports and to

• Caprolactam Manufacturing Process Using the Gas Phase Method
The world's first manufacturing process that does not generate by-products has been developed through a combination of our proprietary gas phase Beckman rearrangement catalyst and ammonium oximation developed by EniChem (Italy).
(Plant construction was completed and operations began in February 2003)

• Propylene Oxide Single Manufacturing Process
A compact and energy-efficient manufacturing process using our proprietary catalyst has been developed. In this process, only the target product is manufactured, with no production of styrene monomer.
(Plant construction was completed and operations began in December 2002)

• Chlorine Manufacturing Process Using Oxidization of Hydrogen Chloride
A highly efficient Hydrogen chloride oxidization process using our proprietary catalyst has been developed. In this process, hydrogen chloride, which is a by-product of the process, is recovered in the form of chlorine.
(Plant construction was completed and operations began in January 2003)

Fig. 11 Examples of Green Process Development



(Note) Osaka includes the Okayama and Gifu Plants.

Fig. 12 Risk Communication

promote communication. Taking into consideration the creativity and the independence of each factory and also taking local regions into account, we are actively involved in distributing a variety of information and also in establishing unique two-way dialogs (risk communication) (**Fig. 12**).

In addition, we also make efforts to extend the unique excellences of each factory across the rest of the company in order to raise the overall level of the company's performance.

1. Information Disclosure (Fig. 13)

Sumitomo Chemical's website features a comprehensive selection of information covering many topics including the environment and safety. In addition, every year, we issue CSR reports (company-wide) and also environment and safety reports (from each factory) which give detailed accounts of our current RC activities among other topics. These environment and safety reports are regionally-based publications which are intended to supplement company-wide reports, but each factory can plan and present its report in any number of different ways as it chooses, so that the reports are unique demonstrations of each factory's self-assertiveness.

Another example of the prodigious volume of information that we disclose comes in the form of community bulletins which are issued by several factories in the form of newspaper inserts.

These bulletins are well received by people in the regions, and they play a great role in building and improving friendships and trusting relationships with local residents.

In addition to this, we also make the most of opportunities to release reports outside the company by holding lectures and seminars, and we pay particular attention to releasing information that deals with our chemical substance management practices and risk communication.

2. Risk Communication

The most important role of risk communication is to foster mutual understanding. Risk communication by itself is an very important and worthwhile exercise, but at Sumitomo Chemical we believe that it is more important than anything else to obtain complete trust in our company from society through deepening mutual understanding. Sumitomo Chemical's risk communication makes use of many different avenues to pro-

■ Issuing the Factory-Base Environment Report

Each factory creates its own unique booklet.

■ Issuing Community Bulletins

Contributing to the improvement in trusting relationships with local residents

Community bulletins are currently issued by 3 factories - Ehime, Osaka and Oita.

The community bulletin is issued a few times a year in a form of newspaper insert.

■ Giving lectures

Making the most of opportunities to release reports outside the company

Theme	Attendees	Date and Place
Sumitomo Chemical's Environment Report	Corporations	Dec., 2006 Tokyo and Osaka
Chemical industry's environmental measures	Students	Dec., 2006 Sagamihara
Sumitomo Chemical's chemical substance measures	Free	Sep., 2006 Osaka
Chiba Works' risk communication examples	Free	Apr., 2006 Chiba
Ehime Works' chemical substance management	NPOs, local residents, government organizations	Dec., 2005 Niihama
Corporate chemical substance measures	Government organizations	Dec., 2005 Tokorozawa
Osaka Works' risk communication examples	Corporations	Jan., 2005 Osaka

Examples of Released Reports Classified by Themes Such as Chemical Substance Management, Risk Communication and Environment Report

Fig. 13 Information Disclosure

Table 4 Examples of Implementation of Our Unique Risk Communications

Objective (Intention)	Activity	Points to Keep in Mind
Considering environmental risks on a community basis	• Participating in municipal risk communication model projects • Environmental communication in Chiba (environmental dialogue meeting) (Chiba) • Seino district chemical substance risk communication (Gifu)	Commitment to information sharing and mutual understanding
Environmental conservation in collaboration with local communities	• A dialogue system between local residents and environmental monitors (Oita) • Requesting local universities and technical colleges to conduct research into environmental issues (Ehime)	Making most of the community power based on trusting relationships with local communities
Supporting environmental conservation measures undertaken in overseas countries	• Supporting Korea's first area-wide total pollutant load control for water quality (Chiba) Providing full cooperation to the Korean Environment Agency's surveys and creation of their PR DVD • Providing education regarding air pollution measures to trainees from foreign countries (Osaka)	There are no borders in environmental conservation. (We will provide support as much as possible.)
Enhancing safety through communications with the US military base	• Creating a cooperative system with the fire brigade at the Misawa US Air Base (Misawa)	Promoting international exchange by making most of the territorial connections
Fulfilling our accountability	• Periodical briefing sessions regarding repairs • Briefing sessions regarding the construction of buildings (Conducted by each factory) • Briefing sessions regarding electromagnetic interference	Building trusting relationships with local communities by providing thorough explanations prior to production activities
Maintaining dialogues with local communities in collaboration with other companies	• Having local community dialogues in collaboration with the chemical industry (Chiba, Osaka, Oita) • Having mini local community dialogues in collaboration with neighboring companies (Oita) } (responsible care dialogue)	Having a collaborative relationship with local communities contributes to improvements in the performance of the entire community.

vide our stakeholders with a clear and accurate picture of the purpose of our RC activities. However as the majority of our products are intended for industrial use, even now many consumers and local residents do not have a clear idea of what our company manufactures. They do not see our public face. They have little interest in us. Or they may even think of us as a company with an image as a polluter of air and water. These are some examples of feedback that we hear from the community.

Through continuous efforts on a trial-and-error basis, Sumitomo Chemical hopes to continue promoting its risk communication efforts through continuous dialog in a two-way direction, and dialog which fosters mutual friendship and is not restricted by formalities.

Table 4 shows examples of implementation of our unique risk communication.

Conclusion

In February 2007, Sumitomo Chemical was awarded the 2006 PRTR Grand Prize by the Center for Environmental Information Science in recognition of our chemical substance management and risk communication efforts, the first time a diversified chemical manufacturer has been awarded this prize. The prize is awarded by the Center to recognize businesses and enterprises which have shown an understanding of PRTR systems and which have made positive efforts in communication in order to gain the understanding of citizens. This is the third time the prize has been awarded.

Sumitomo Chemical's being awarded this prize signifies that we have established a thorough system of chemical substance management founded on a company-wide risk base and that we have formulated specific system planning into practice, and that each of our factories' efforts to actively promote a range of risk communication have also been highly regarded. In other words, for Sumitomo Chemical, receiving this prize means that our system which is faithful to the basics has been widely recognized by society, and it gives us an opportunity to continue promoting our good chemical substance management and to devote further efforts to close communication with society.

PROFILE

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