

# Kuraray Environmental Activities Report

2002



## Message from Management: Our Commitment to Environmental Preservation



Masahiro Kaihara, Managing Director

Yasuaki Wakui, President

The twenty-first century, often dubbed the ‘Century of the Environment,’ requires that we work toward harmonizing business activities and environmental preservation across the planet. Our top management discusses the environmental initiatives and programs being undertaken by the Kuraray Group in its quest to be an Eco-friendly Enterprise with Unique Technology.

### Contributing More to Humankind and the Planet Earth through Businesses Designed to Achieve ‘Sustainable Social Development’

**Kaihara:** We see many examples in the world today of the increased changes needed to achieve ‘sustainable social development’ to preserve the natural environment. We at Kuraray too are facing these same important social challenges.

**Wakui:** We are now facing humanity’s most urgent issue to date: how to create a truly ‘recycling-oriented society for sustainable development.’ I would venture to say that only those enterprises that discover new opportunities within this context of increased global environmental awareness will survive and continue to grow in their respective industries. The employees of those enterprises can feel fulfilled as they share the joy of achieving their mission. At the Kuraray Group, our ultimate goal is to have every employee involved in this initiative, to contribute to the well-being of humankind and the entire globe by promoting the growth of truly responsible businesses.

**Kaihara:** To nurture that spirit among employees, we have strengthened our environmental preservation activities. In December 1991, we set up the *Philanthropy and Environment Committee* directly under the Executive Committee, to broaden the scope of our contributions to society and more actively address environmental issues. In February 1993, we established the *Kuraray Action Guidelines on the Global Environment*, which were eventually revised and expanded to encompass the entire Kuraray Group in February 2001. Since participating in the establishment of the Japan Responsible Care Council in 1995, we have widened the scope of these efforts, including autonomous activities in the areas of environmental preservation, disaster prevention, occupational safety and health, product safety, and product life cycle development, from a production liability standpoint.

### Aiming to be an Eco-Friendly Enterprise with Unique Technology through Active Use of LCA

**Wakui:** Actually, we were already launching environmental initiatives for the future long before there was any such thing as environmental consciousness. Fortunately, many of our products consist largely of carbon, hydrogen, and oxygen, with little chlorine or sulfur, which harm the environment when they are disposed of or incinerated. This is because many of our businesses started by mirroring natural processes through the application of chemical synthesis technology. I believe that by developing eco-friendly products like these, which incorporate our accumulated know-how, we will attain our corporate goal of moving toward an Eco-Friendly Enterprise with Unique Technology.

**Kaihara:** A method called life cycle assessment (LCA) has been introduced in Japan, the US and Europe to reduce environmental impact. Through LCA activities, we can evaluate the potential environmental impact of products over their entire life cycle from production to disposal. In January 2001, Kuraray designated Kurashiki Plant a model plant in preparation for the introduction of a group-wide LCA program. We are planning to make the most of LCA to develop eco-friendly products and processes.

### Beyond Eco-friendly Products – Focusing on Environment Businesses

**Wakui:** In addition to supplying eco-friendly products, it is imperative that we reduce the potential environmental impact of our business activities.

To achieve the first goal, we will foster environment-related businesses in which we can help reduce environmental impact both efficiently and effectively through our unique technology and products. For instance, our polyvinyl alcohol (PVA) gel and industrial membranes for water purification technology are attracting attention in the market, a fact we are determined to utilize in quickly transforming these businesses into strong earners for the Company. Some of our affiliated companies also

have other environmental businesses with great potential, such as Kuraray Chemical's activated carbon and Kuraray Engineering's water treatment systems. We want to be an eco-company that has significant environmental businesses both in terms of quality and quantity, making our presence enhanced in society.

We plan to achieve our other important goal, preserving the environment, through participation in Responsible Care initiatives and compliance with the *PRTR Law* (Pollutant Release and Transfer Register) and other recycling laws. Our ultimate goal is clear: to eventually reduce emissions generated by Kuraray to zero.

**Kaihara:** One such effort is our five-year Medium-Term Environmental Plan, which we launched in April 2001. The Plan sets out highly challenging numerical targets, such as a 90% reduction in emissions of substances specified by the *PRTR Law* and in the volume of industrial waste being processed externally, with fiscal 1999 set as the standard year. In fiscal 2002, each plant in Japan will formulate concrete action plans to achieve these targets and make a variety of technical improvements under the leadership of the *Technology Development Center* to reduce emissions. Further, to promote efficient reuse of industrial wastes, we will support the spread of thermal recycling systems using fluidized-bed combustion boilers, which went into operation at the Kurashiki Plant (Tamashima) in May 1998, for power generation. The boiler is capable of thermally recycling 24,000 tons of waste, but the current volume of wastes being processed stands at half capacity due to restrictions on the shapes and properties of the wastes to be processed. In fiscal 2002, we are planning to add technical modifications to the system and develop improved technology for pre-treating wastes that is currently used for landfill or simply incinerated, thereby expanding the volume of wastes incinerated in the boiler.

## Disclosure and Social Contributions – Two Key Requirements to Fulfill Our Responsibility to the Global Environment

**Wakui:** I firmly believe that in the future, we will not grow up without making appropriate contributions to the society. Fortunately, social contribution has been strongly established in our corporate culture since the days of our late founder Magosaburo Ohara, and this important principle has been passed on to the entire Kuraray Group. I hope each and every one of our employees is able to nurture this culture through participation in our philanthropic activities, organized at different levels of society, or events like the cherry blossom viewing parties and tours staged at each plant, so that we will be able to make even greater contributions to our host communities.

**Kaihara:** *The chemistry classes for boys and girls* will mark their 10th anniversary in 2002, having attracted a total of approximately 3,000 students. Through programs like this, something only chemical manufacturers can offer, we strive to deepen our ties to local communities. The number of community participants in plant tours has also grown every year: from about 1,400 in 1999, nearly 1,800 in 2000, and close to 2,000 in 2001. We believe it is important to let them know our efforts for environmental preservation. Since fiscal 1998, we have issued an annual Kuraray Environmental Activities Report to disclose the range of our initiatives. For the 2001 edition, we moved the release date up to June and disclosed more data, including group-wide initiatives and total emissions of major substances. The latest issue focuses on our efforts to reduce environmental impact and emissions to zero, conserve energy and practice green purchasing.

**Wakui:** I think we should start by assuring better communication through disclosure if we are to fulfill our responsibilities to the global environment. The Kuraray Group is committed to being a good corporate citizen, communicating as much information as possible.

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This report covers environmental initiatives by the Kuraray Group during the 2001 fiscal year, ended March 31, 2002. For the purpose of this report, 'Kuraray' refers to Kuraray Co., Ltd. and its 15 affiliated companies occupying the same premises, and 'the Kuraray Group,' to Kuraray Co., Ltd. and its 25 key affiliated companies in Japan.

Refer to the Corporate Data on page 35 for more details on the Kuraray Group.

All product names in quotation marks (" ") are trademarks of Kuraray Co., Ltd.

# The Kuraray Group is engaged in environmental preservation initiatives with the well-being of future generations in mind

In this contemporary age when globalization tests the real international competitiveness of an enterprise, no business can operate without proper consideration for the global environment. Guided by *the Principles for Business Conduct*, the Kuraray Group bases its business on the fulfillment of its responsibilities to future generations through corporate activities that are in harmony with the global environment and the local community. The Kuraray Group is also endorsing Responsible Care initiatives.

## The Kuraray Group Management Philosophy and Guidelines for Environmental Preservation



### Management Philosophy

#### Corporate Philosophy

Respect for Individuals

Cooperation in Shared Goals

Creating of Values

#### Guidelines for Action

Act on Customers' Needs.

Act on Ideas at Working Place.

Act on Your Own Initiative.

#### Principles for Business Conduct

We will develop and provide products and services, giving full consideration to safety.

We will conduct businesses in a free, fair and transparent manner.

We will maintain good communications and build a sound relationship with society.

We will strive to preserve and improve the global environment.



## Basic Approach to Responsible Care

### (1) Basic approach to global environmental issues

In line with the two Principles for Business Conduct that state, 'We will maintain good communications and build a sound relationship with society' and 'We will strive to preserve and improve the global environment,' our basic approach to global environmental issues is to fulfill our responsibilities to the well-being of future generations through corporate activities that are harmonized with the global environment and the local community.

### (2) Basic approach to disaster prevention and occupational safety

We will take drastic company-wide measures to prevent and contain any damage from disasters that could affect society in general, including explosions, fires, and leakage of hazardous substances.

### (3) Basic approach to product safety

We will endeavor to achieve an affluent, comfortable society by meeting customer needs through the supply of safe and reliable products.



### Responsible Care Initiatives

Responsible Care calls for companies that manufacture or handle chemicals to commit themselves to taking measures based on their own initiatives to prevent hazards to the environment, to safety, or to health during all stages of each chemical's life cycle – from product development through manufacturing, use, and disposal. Kuraray participated in the 1995 establishment of the Japan Responsible Care Council and has implemented autonomous in-house programs based on the organization's action guidelines.

## Kuraray Group Action Guidelines on the Global Environment

### Basic Guideline

**We will fulfill our responsibility to future generations through corporate operations that are in harmony with the global environment and the local community.**

**Kuraray will undertake the following actions to realize the above basic guideline.**

- (1) We will assign the highest priority to the environment and safety when undertaking corporate operations.
- (2) We will work to improve the global environment and ensure its sustainability.
- (3) We will develop technologies and products that contribute to the goal of improving the global environment.

### Action Principles

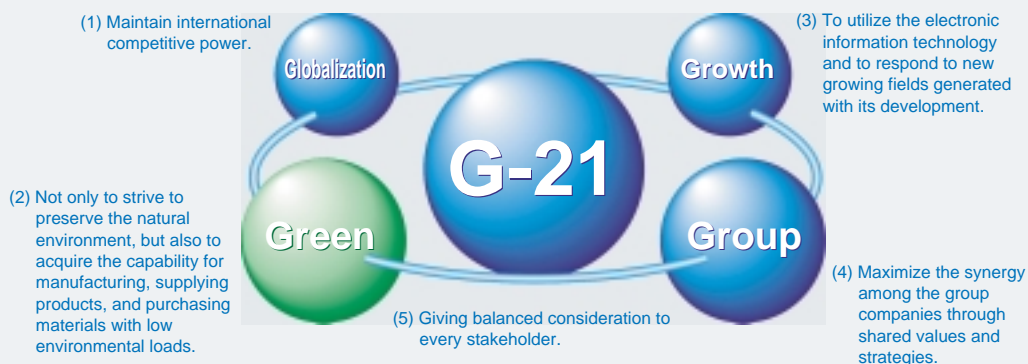
- (1) Continual reduction of emissions of specified chemical substances into the environment
- (2) Contribution to the prevention of global warming through the promotion of energy conservation
- (3) Promotion of conservation, reuse, and recycling of resources
- (4) Development and supply of technologies for improving the environment with products having low environmental impact
- (5) Utilization of environmentally friendly products
- (6) Public disclosure of environmental information and dialog with the community
- (7) Raising the level of environmental awareness and the level of environmental management

## G-21 Medium-Term Business Plan

### Targets for G-21

In its G-21 Medium-Term Business Plan, the Kuraray Group identified as its target corporate image 'an Eco-Friendly Enterprise with Unique Technology,' and set five fundamental conditions for surviving global competition and sustaining growth.

### The Five Fundamental Conditions of G-21



## Medium-Term Environmental Plan Green – One of the Four Key Words of G-21

The Kuraray Group will be actively engaged in environmental preservation activities as it seeks to be an 'Eco-Friendly Enterprise with Unique Technology.' In addition, we will expand businesses that supply products and services contributing to the maintenance and improvement of the environment (environment business areas), and businesses that supply products containing substitutes for materials with high environmental impact (eco-friendly areas).

### Key Issues

[Efforts to Reduce Environmental Impact]

- (1) Reducing the volume of specified chemical substances released into the environment
- (2) Reducing emissions of carbon dioxide by conserving energy
- (3) Achieving the goal of zero emissions
- (4) Expanding efforts for green purchasing as well as green distribution
- (5) Quantifying the environmental impact of Kuraray products  
Implementation of Life Cycle Assessment (LCA)
- (6) Development and supply of environmentally friendly products

[Improved Information Disclosure]

- (1) Enhanced environmental reporting
- (2) Enhanced environmental accounting
- (3) Strengthened risk communication system with the local community
- (4) Expanded environmental philanthropy initiatives

### Numerical Targets (Target year: Fiscal 2005)

\*Versus levels for fiscal 1999

- (1) Reduction of 90% in emissions, including substances specified by the PRTR Law
- (2) Reduction of 90% in volume of industrial waste being inefficiently processed externally (target: 1,500 tons/year)
- (3) Increase of 20 points or more in waste utilization efficiency (60% to 80%)
- (4) Increase of 6% in energy efficiency (1% increase/year)

### Measures

In order to put into practice the key issues and achieve the numerical targets above, we will designate a model plant for each issue. For further details, please refer to the Site Reports on pages 28-33.

## History of Environmental Preservation and Safety Assurance Initiatives

### The Kuraray Group always gives full regard to safety and the environment and aggressively pursues autonomous activities.

The Kuraray Group was among the first to launch a variety of autonomous programs designed to ensure environmental preservation and safety. We will strive to give proper consideration to the environment and ensure safety in order to harmony with the natural environment.

The Kuraray Group began environmental preservation and safety assurance early on through measures like the establishment in 1970 of specialized organizations responsible for environmental preservation and industrial safety at its head office and plants, and the establishment in 1977 of *Regulations for Environmental Control and Industrial Safety*. In 1991, Kuraray organized the *Philanthropy and Environment Committee* to enable more active engagement in global environmental issues. In 1993, the *Kuraray Action Guidelines on the Global Environment* were established as an in-house guide on environmental initiatives. In 1995, Kuraray began participating in Responsible Care initiatives aimed at maximizing environmental friendliness and safety throughout product life cycles, from product development through disposal. Kuraray began working to obtain ISO 14001 certification in 1998, and an environmental management system covering all Kuraray plants and research laboratories in Japan was completed in 2001. *The Kuraray Action Guidelines on the Global Environment* were revised in February 2001, and became to *the Kuraray Group Action Guidelines on the Global Environment*, which now covers the entire Kuraray Group. In October 2001, *Safety Audits* were developed into the *Responsible Care Initiatives Verification Meeting*, to cover a broader range of activities with greater emphasis on the PDCA (Plan-Do-Check-Act) cycle.

### Involvement in the Environment, Disaster Prevention, and Safety

- 1970 Specialized organizations responsible for environmental preservation and occupational safety established at head office and plants
- 1977 *Regulations for Environmental Control and Occupational Safety* established

### Building a Foundation for Environmental Preservation

- 1991 *Philanthropy and Environment Committee* (and *Ecology Subcommittee*) established
- 1993 *The Kuraray Action Guidelines on the Global Environment* established
- 1995 Participation in Responsible Care initiatives begun

### Stepping Up Environmental Preservation Activities

- 1998 Efforts begun to obtain ISO 14001 certification for all Kuraray plants and research laboratories
- 1999 The Kashima Plant and Techno Soft Co., Ltd. certified to ISO 14001
- Mar. 2000 The Okayama Plant and Nakajo Plant certified to ISO 14001
- Dec. 2000 The Kurashiki Plant, Kurashiki Plant (Tamashima), and Saijo Plant (now Kuraray Saijo Co., Ltd.) certified to ISO 14001
- Feb. 2001 *The Kuraray Group Action Guidelines on the Global Environment* revised to covers the entire Kuraray Group
- The Medium-Term Environmental Plan formulated
- Apr. 2001 *The Environmental, Industrial Safety and Quality Management Department* renamed as *the Environmental, Industrial Safety and Quality Management Center*, and its functions upgraded
- Oct. 2001 *Responsible Care Initiatives Verification Meeting* (formerly *Safety Audits*) inaugurated
- Dec. 2001 The Tsukuba Research Laboratories certified to ISO 14001, completing the process of obtaining certification for all Kuraray plants and research laboratories in Japan





## Topics

Having put environmental preservation and safety ahead of other managerial issues, the Kuraray Group is working to improve the global environment through research and development for environmental activities and the expansion of environment businesses.

### Research and Development for Environmental Preservation

To achieve environmentally friendly operations and preserve the environment, the Kuraray Group is working on the development of products with little impact on the environment and products that contribute to its maintenance and improvement.

#### R&D Projects in Fiscal 2001

##### 1) Development of substitutes for polyvinyl chloride (PVC) and vulcanized rubber

To strengthen Kuraray's thermoplastic elastomer business, which has experienced growing demand as a substitute for PVC and vulcanized rubber, we are expanding existing product lines and developing new elastomers. For example, we are set to develop improved materials with better oil and heat-resistant properties to meet customer needs. We have also developed a soft acrylic resin with no plasticizer used in its manufacture, so it can be recycled or incinerated as general waste. This 'clean' material is currently available on the market.

##### 2) Expansion of the water treatment business

Kuraray has developed a variety of industrial membranes for purifying water. In fiscal 2001, we developed a large-pore filtration membrane that effectively removes cryptosporidium, a microorganism that occurs in waterworks and presents a serious environmental issue. The market has responded enthusiastically to this large-pore membrane, which we plan to move ahead with bringing into full-scale operation. We are also involved in other developments, such as improvement of the functions of industrial membranes and the establishment of new wastewater purification and treatment technologies utilizing PVA gels.

##### 3) Special activated carbon

Projects are underway at the Kuraray Group, specifically at affiliate Kuraray Chemical Co., Ltd., to develop a high-performance activated carbon applicable to a broad range of environmental purification projects. In fiscal 2001, we developed a special activated carbon that adsorbs the mercury contained in crude oil and liquefied petroleum gas (LPG). By separating mercury from crude oil and LPG, this activated carbon prevents corrosion and the resulting accidents it can cause at petroleum plants.

##### 4) Programs to reduce environmental impact during the production process

To reduce the environmental impact of our production processes, we are developing adhesives that do not contain organic solvents. In fiscal 2001, we replaced the reinforcing materials for our "MAGIC TAPE" product with materials free of organic solvents. We are also developing organic solvent-free manufacturing processes for "CLARINO" man-made leather products, replacing them with water-based and other eco-friendly alternatives.

### Expansion of Environment-related Businesses

In the G-21 Medium-Term Business Plan, we have identified environment-related businesses as one of our strategic targets. In accordance with this, we are aiming to expand these by launching as many products as possible that contribute to environmental improvements. The environment-related business can be classified into two categories:

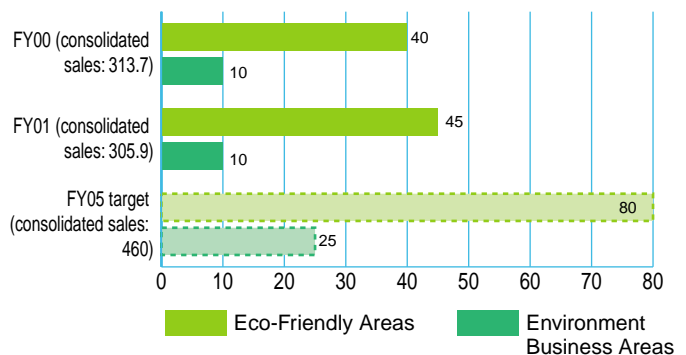
#### Eco-Friendly Areas

Developing low environmental impact substitutes for high impact substances (asbestos substitutes, gas barrier materials, PVC and vulcanized rubber substitutes, solvent-free products, etc.)

#### Environment Business Areas

Activities that contribute to the preservation and improvement of the environment (water treatment systems for purification and wastewater treatment)

Sales by category (billion yen)



## Eco-Friendly Products



### "SEPTON" and "HYBRAR" (Thermoplastic Elastomers)

"SEPTON" and "HYBRAR" are elastic like rubber, yet easily moldable like plastic, a property referred to as 'thermoplasticity.' Demand for them as a substitute for PVC and vulcanized rubber is growing. In addition, the products can be recycled, and the low specific gravity makes it suitable for applications where minimizing weight is important.



### Soft Acrylic Resin

This product is a soft resin with high transparency and weather resistance, properties unique to acrylic resin. The halogen-free, recyclable resin doesn't contain plasticizers, and is expected to serve as a substitute for soft PVC resin.



### "GENESTAR" (Heat-resistant Polyamide Resin)

Solder is indispensable for mounting electronic components on circuit boards. In recent years, there has been a move away from solder containing lead due to environmental concerns. Since lead-free solder has a higher melting point, however, the plastic used to manufacture electronic components needs to have greater heat resistance. Electronic components of "GENESTAR" feature high heat resistance, and can be mounted with lead-free solder.



## Programs by Model Plants

Kuraray designates model plants to promote environmental preservation activities, such as reducing to zero any emissions that impact the environment, reducing emissions and transport volumes of substances targeted by *the PRTR Law*, and using resources efficiently. Initiatives by the model plants during fiscal 2001 are featured in the Site Reports (pages 28-33). The Reports show that these initiatives are progressing as planned. They include: the introduction of LCA; a system to reduce surplus sludge to zero; and reduction and efficient use of waste for reducing emissions volumes to zero. In Fiscal 2002, we will expand and strengthen these initiatives, and share the results with other plants.

## Featured Initiatives during Fiscal 2001

At the Kuraray Group, we make sure we respond quickly to all developments in environmental legislation and create new internal systems for environmental protection. Some of the key initiatives we undertook during fiscal 2001 follow:

### PCB (polychlorinated biphenyl)

With the enforcement of *the Special Law for the Promotion of Appropriate Disposal of Polychlorinated Biphenyl Waste* in July 2001, we reported the status of the storage and use of that substance. The Law stipulates that all PCB waste be rendered harmless by July 2016, but Kuraray has set fiscal 2010 as its target.

### Soil Pollution

In May 2002, *the Law for Soil Pollution Control* came into force. In December 1995, it was discovered that groundwater in Nakajomachi, Niigata, had been polluted by chlorinated organic compounds. Following this incident, we started taking action against soil and groundwater pollution. In more concrete terms, we covered the process site with concrete, prevented leakage from drainage ducts, and treated the pipes against corrosion. We also replaced the soil at our storage location for idle equipment with residues of iron

blue. Although iron blue is harmless and will not dissolve in ordinary rainwater, it could decompose if put into a highly alkaline state, risking the production of free cyanide complexes. The soil at the site was dug up, removed, and incinerated.

### Endocrine-disrupting Substances

In August 2001, the Ministry of the Environment published its view that nonylphenol might affect the ecosystem by disrupting endocrine levels in fish. Kuraray uses nonylphenol compounds and nonylphenol ethoxylate compounds for production, and will in turn substitute them with alternatives.

### Responsible Care Initiatives Verification Meeting

*Safety Audits* were reorganized into *the Responsible Care Initiatives Verification Meeting*, where members from the head office and plants meet to identify issues related to environmental protection and occupational safety, while taking over the purpose of *Safety Audits*. Any issues identified will be continuously improved through the PDCA cycle.



### Activated Carbon

Activated carbon has the ability to adsorb and remove foul odors and impurities, and is used in a wide variety of applications, such as water purifiers and filters for air purifiers. The need for this substance continues to increase with the growing awareness of environmental preservation.



### PVA Gel

PVA Gel is made from polyvinyl alcohol (PVA). It consists of balls about 4mm in diameter permeated with a network of minute openings about 20 microns wide, leading from the surface to the interior. Each PVA Gel ball is home to up to one billion microorganisms capable of breaking down organic substances. When used in wastewater treatment, PVA Gel offers greater efficiency than conventional activated sludge methods, and also makes it possible to downsize wastewater treatment equipment.



### Industrial Membranes

Kuraray's filtration membranes (hollow fibers) are capable of separating micro particulates measuring 0.003 to 3 microns from liquid. Contributing to water quality conservation and to water recycling via separate purification by removing impurities from water, the membranes are put to a variety of industrial applications for water purification and wastewater treatment.



## Highlights of Kuraray's Initiatives

We are striving to achieve the action targets for fiscal 2005 laid out in the Medium-Term Environmental Plan. Environmental accounting data has been gathered in accordance with the Ministry of the Environment Guidelines on Environmental Accounting. We will improve these efforts in order to make our reporting crystal-clear.

### Progress with the Medium-Term Environmental Plan

The Medium-Term Environmental Plan provides numerical targets for fiscal 2005. In its first year, fiscal 2001, we were able to produce the following satisfactory results. One that merits particular mention is the substantial reduction in emissions and transport volumes of substances covered in the PRTR Law.

### Progress with the Medium-Term Environmental Plan

Targets			Unit	FY99 (base year)	FY01
Reduction of 90% in emissions (and transport volumes*), including substances specified by the PRTR Law	Kuraray	All substances covered	ton	4,913 (100%)	3,887 (79%)
		Substances covered by PRTR Law		1,816	871
	Affiliates	All substances covered	ton	1,055 (100%)	670 (64%)
		Substances covered by PRTR Law		612	120
	Total	All substances covered	ton	5,968 (100%)	4,557 (76%)
		Substances covered by PRTR Law		2,428	991
Reduction of 90% in volume of industrial waste being inefficiently processed externally	Kuraray	1,000 tons	9.6	3.9	
	Affiliates		5.0	2.7	
	Total		14.6 (100%)	6.6 (45%)	
Increase of 20 points or more in waste utilization efficiency (60% to 80%)	Kuraray	%	63	71	
	Affiliates		16	58	
	Total		60	70	
Increase of 6% in energy efficiency (1% increase/year)	Kuraray	%	-	3.1	

\*Beginning this year, emissions plus transport volumes are represented.

### Environmental Accounting

As part of our initiative to report environmental preservation activities, we started publishing investments in environmental preservation in 1999, and expenses for environmental preservation in 2000. Data is collected in accordance with the guidelines provided by the Ministry of the Environment, assuring comprehensive information and a broad scope of cost surveys.

### Environmental Preservation Costs (Yen in millions)

Category		Investments	Expenses	Descriptions
Costs within operating premises	Anti-pollution costs	934	1,856	Changeover of fuel from heavy oil to natural gas Making gas emissions from generating equipment clean Operating costs of environmental equipment
	Global environment preservation costs	299	133	Building new warehouses to reduce transport distances Improving blades of generator turbines
	Resource recycling costs	54	665	Turning waste plastics into solid fuels, volume reduction and recycling of industrial waste
	Total	1,287	2,654	
Upstream and downstream costs			180	Improving container packaging, collection and reuse of packaging materials
Administration costs			496	ISO 14001, environmental monitoring, environmental education
R&D costs			1,431	Developing eco-friendly products
Community activity costs			15	Forestation, beautification, communicating environmental data to local residents
Environmental damage recovery cost			211	Monetary assessment costs related to SOx emissions
Total		1,287	4,988	

Total amount invested during the term: · 14.5 billion (calculation based on the scope of environmental accounting)

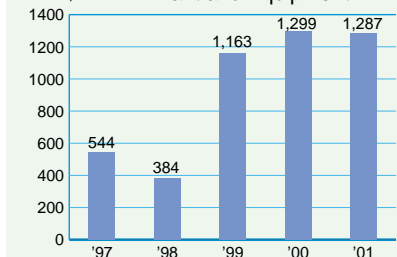
Total amount of R&D spending during the term: · 10.8 billion (ditto)

FY05	Initiatives in FY01	Pages
492 (10%)	Installing acetaldehyde catalytic combustion equipment and drying-adsorbing filters Installing formaldehyde exhaust gas combustion systems, adding anti-leak seals Substituting methyl ethyl ketone adhesives for toluene adhesives Installing vinyl acetate recovery condensers at exhaust openings Installing exhaust gas combustion systems for toluene, dimethylformamide (DMF), etc.	20
182		
105 (10%)		
61		
597 (10%)		
243		
1.0	Promoting recycling of waste through more rigorous separation Promoting recycling of materials through exhibits of waste Thermal recycling by turning waste plastics into solid fuels Using incinerator ash in materials for improving soft soil	22
0.5		
1.5 (10%)		
-		
-		
80	Improving performance of generator turbines by remodeling blades Collecting heat and water for recycling Switchover to high-efficiency electric equipment	16, 17
6		

## Environmental Preservation Effect

Category		Unit	FY00	FY01	Difference	Pages
Anti-pollution initiatives	SOx emissions	1,000 tons	2.7	2.4	▲0.3	15, 16
	NOx emissions	1,000 tons	2.0	2.1	0.1	
	Soot and dust	ton	150	150	0	
	COD emissions	ton	930	760	▲170	
Global environment conservation initiatives	Energy consumption	1,000 kL (crude oil equivalent)	450	460	10	17
	CO <sub>2</sub> emissions	1,000 tons	380	390	10	
Resource recycling initiatives	Externally processed waste	1,000 tons	8.7	3.9	▲4.8	22
	Total wastewater emissions	1 million m <sup>3</sup>	81.4	80.4	▲1.0	

(Yen in millions)  
Environment-related Investment in Plant and Equipment



- Preconditions for aggregating environmental accounting  
Period: April 1, 2001 — March 31, 2002  
Scope: Kuraray
- Basis for calculation
  - Depreciation: Straight-line method
  - Allocation method for multiple costs: In principle, only costs 100% for environmental preservation are charged, but some are divided proportionally.
- Calculation method for environmental preservation effect  
Calculations are made by comparison with total environmental impact during the previous year. Figures are not adjusted by production volume, but are a simple comparison with those of the previous year.
- Calculation method for economic effects brought about by environmental preservation programs  
Real effect (income from recycling, etc.) is included in environmental conservation costs (deducted).

### Future Initiatives

This marks the fourth announcement of our environmental accounting. Though the accuracy of the data is increasing, there are still things that need to be improved. At present, calculations of effects only include quantitative unit effectiveness and the economic effect of income from recycling. We will attempt to monitor other economic effects like cost reduction, and consider converting the environmental preservation effects into a monetary figure. We are also creating a system for quickly and accurately aggregating environmental accounting, so environmental accounting will serve as an efficient management tool for gauging environmental performance.



# Environmental Management

We are revamping and strengthening the environmental management system to enable a more active approach to environmental initiatives.

## Environmental Management System

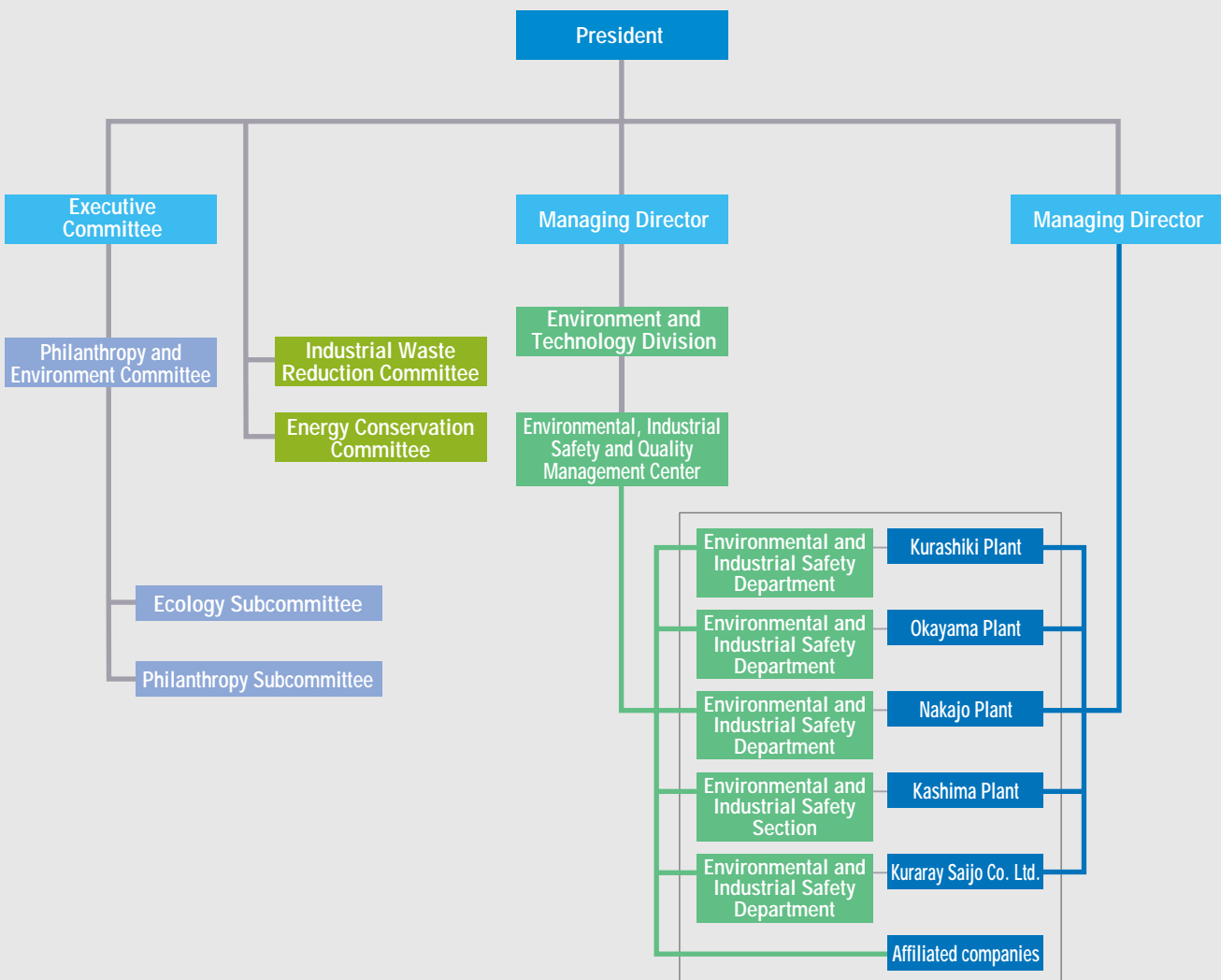
### Environmental Management based on Responsible Care Initiatives

Kuraray has participated in the Japan Responsible Care Council since its establishment in 1995. We have worked for improved measures to preserve the environment and ensure safety, and have developed initiatives aimed at ensuring that such measures achieve results throughout the entire Kuraray Group. We are also endeavoring to improve our environmental management system based on the ISO 14001 standard to efficiently advance the reduction of environmental impact.

## Promotional Structure

To tackle environmental preservation initiatives from a mid- and long-term viewpoint, we have placed the *Philanthropy and Environment Committee* (the *Ecology Subcommittee* and the *Philanthropy Subcommittee*) under an Executive Committee, and have an *Environmental, Industrial Safety and Quality Management Center* (Osaka, Tokyo) and *Environmental and Industrial Safety Departments or Sections* (plants), which specialize exclusively in environmental preservation and industrial safety. To achieve the numerical targets laid out in the Mid-Term Environmental Plan, we established two cross-organizational committees (the *Industrial Waste Reduction Committee* and the *Energy Preservation Committee*) in fiscal 2000.

Kuraray's Environmental Administration System (as of June 2002)





## Promotional Systems

### Responsible Care Initiatives Verification Meeting

To ensure the steady advance of Responsible Care Initiatives including environmental preservation activities, we kicked off *the Responsible Care Initiatives Verification Meeting* in fiscal 2001. At the Meeting, a managing Director for the Environmental and Technology Division, plant manager, and representatives from the head office and plants gathered for a whole day to discuss the status of the PDCA cycle for the annual key themes set at the start of the fiscal year. Action plans are prepared and implemented, based on a schedule to offer solutions to themes that are judged important either for individual plants or the entire Group.



Responsible Care Initiatives Verification Meeting

### ISO 14001 Certification

To promote environmental preservation activities in line with *the Action Guidelines on the Global Environment*, Kuraray in 1998 began working to obtain the International Organization for Standardization (ISO) environmental management certification known as ISO 14001 for all of its plants and research laboratories. Consequently, all of its plants and research laboratories in Japan were certified by December 2001. Among Kuraray's affiliated companies, Techno Soft Co., Ltd. was certified in 1999, and Kuraray Chemical Co., Ltd., Kuraray Plastics Co., Ltd., and others are currently working toward that goal. In the years ahead, we plan to continue our efforts to reduce the environmental impact of the operations of the entire Kuraray Group by implementing a comprehensive environmental management system based on the ISO 14001 standard.



General manager of Tsukuba Research Laboratories Displaying a Certificate

### ISO 14001 Certification

Site	Date obtained
Kashima Plant	1999. 3. 12
Techno Soft Co., Ltd.	1999. 12. 10
Okayama Plant	2000. 3. 24
Nakajo Plant	2000. 3. 31
Kurashiki Plant (Tamashima)	2000. 12. 8
Saijo Plant (now Kuraray Saijo Co., Ltd.)	2000. 12. 15
Kurashiki Plant	2000. 12. 22
Tsukuba Research Laboratories	2001. 12. 21



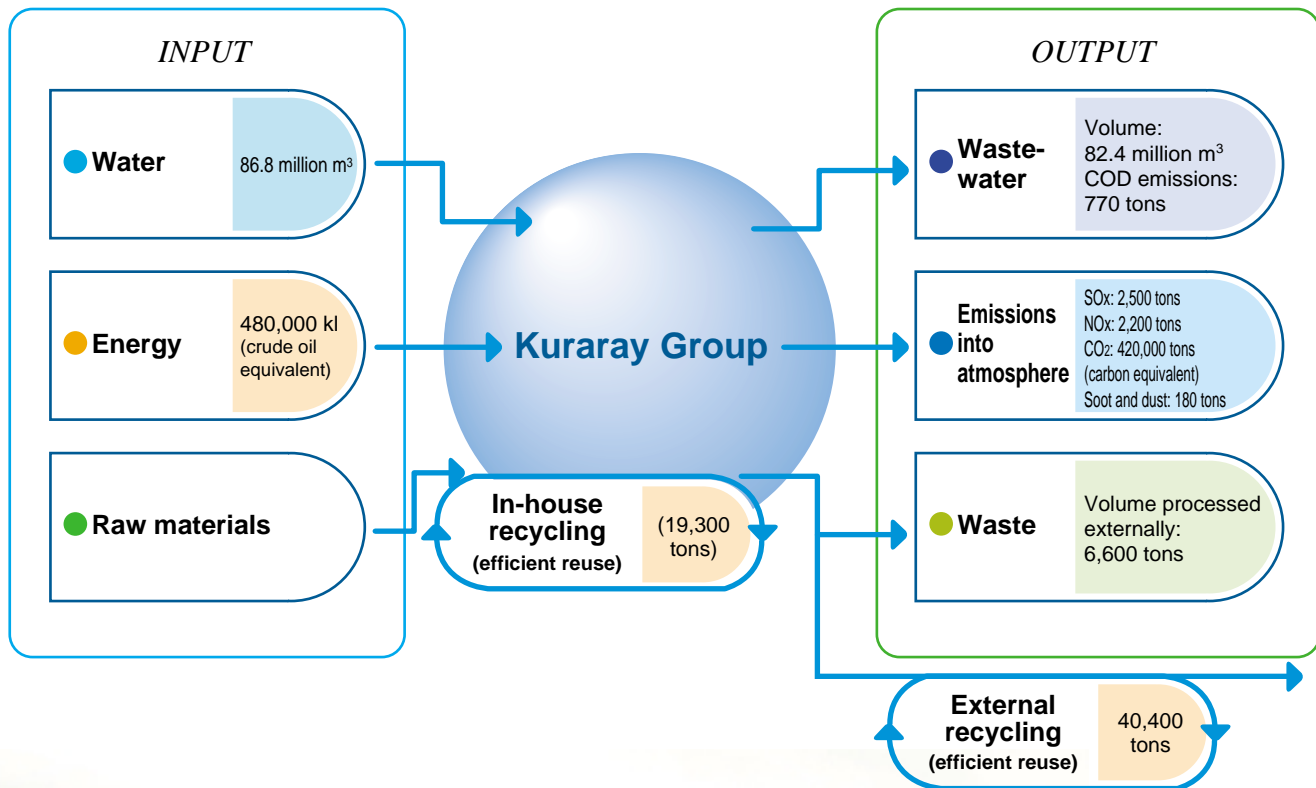


## Environmental Performance

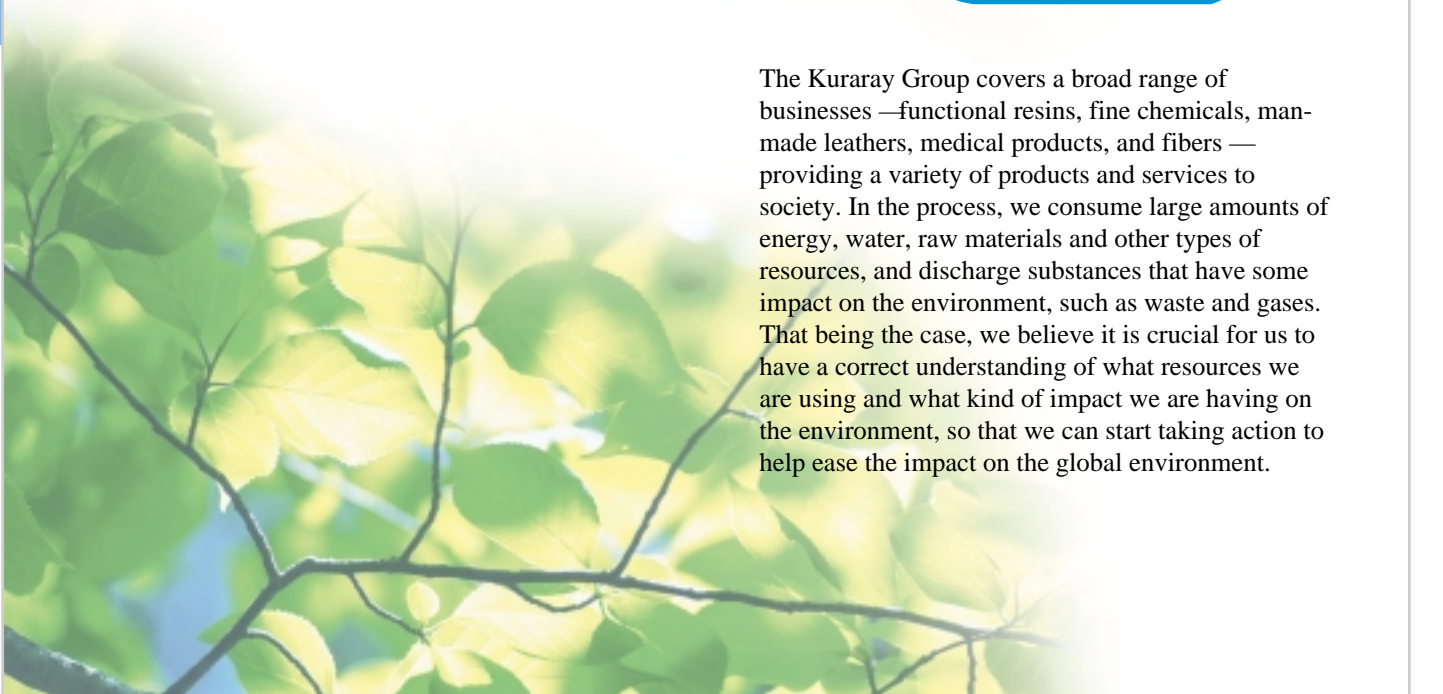
Autonomous initiatives by enterprises play a key role in evolving a sustainable, recycling society. The Kuraray Group is endeavoring to reduce the environmental impact of our business operations by preventing air, water and soil pollution.

Guided by the *Principles for Business Conduct*, the Kuraray Group is contributing to the preservation of the global environment. Programs during fiscal 2001 include: reducing the resources (raw materials) that we use by increasing yields to save more energy, preserving energy, reducing fossil fuel use by turning waste plastics into fuels, reducing the amount of waste generated and efficiently reusing waste materials. We are also attempting to reduce CO<sub>2</sub> and SO<sub>x</sub> emissions by switching from heavy oil to natural gas.

### Overall Environmental Impact



The Kuraray Group covers a broad range of businesses —functional resins, fine chemicals, man-made leathers, medical products, and fibers — providing a variety of products and services to society. In the process, we consume large amounts of energy, water, raw materials and other types of resources, and discharge substances that have some impact on the environment, such as waste and gases. That being the case, we believe it is crucial for us to have a correct understanding of what resources we are using and what kind of impact we are having on the environment, so that we can start taking action to help ease the impact on the global environment.





## Environmental Performance Working to Reduce Environmental Impact

### Efforts to prevent air pollution

#### Principle

The *Air Pollution Control Law* designates 234 hazardous air pollutants as having negative impact on health from long-term exposure even at low concentrations, and has classified 22 of these as priority substances. The Kuraray Group uses nine of the priority substances (see tables). To focus its efforts to reduce the high volume of emissions of two of these substances - acetaldehyde and formaldehyde—we have designated them high priority. We are also controlling emissions of SO<sub>x</sub> (sulfur oxide) and NO<sub>x</sub> (nitrogen oxide).

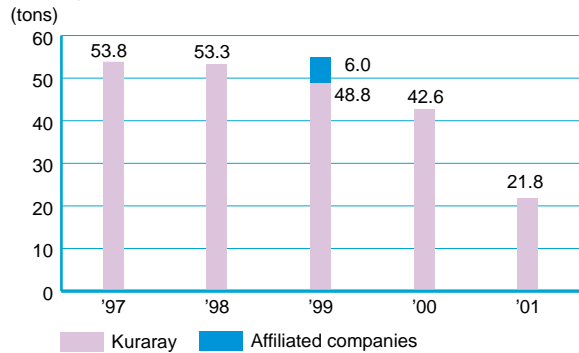
#### Concrete Programs

In fiscal 2001, we introduced catalytic combustion equipment and drying-adsorbing filters for acetaldehyde, and introduced exhaust gas combustion systems and strengthened anti-leakage measures for formaldehyde. As a result, the total emissions and transport volumes of the nine priority substances was reduced 48% over the previous year to 21.8 tons. Emissions and transport volumes of dioxins also registered a sharp drop due to the decrease in the amount incinerated in-house following the greater efficient reuse of waste.

Emissions of SO<sub>x</sub> are on the decline of late, thanks to our efforts to control them through the introduction of flue gas desulfurization equipment and use of low-sulfur fuels. Beginning in fiscal 2002, the Nakajo Plant will stop using heavy oil and start using natural gas for its boiler fuels. This should substantially lower our SO<sub>x</sub> emissions.

Since it is necessary to control NO<sub>x</sub> generation in a boiler, we are striving to maintain highly-efficient combustion by remodeling heavy oil combustion burners and tightening combustion control. NO<sub>x</sub> emissions had been flat for several years, but they showed a slight increase in fiscal 2001. We will, off course, make every change and improvement possible to reduce emission levels.

Total Emissions and Transport Volumes of the Nine Priority Substances

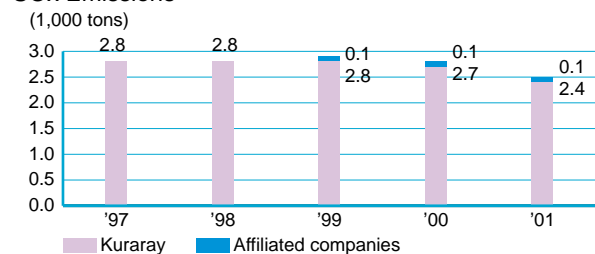


	(tons)	
	FY00	FY01
Acetaldehyde	22.1	2.4
Formaldehyde	9.2	2.0
Chloroform	7.2	8.5
Nickel compounds	2.5	7.7
Dichloromethane	1.6	1.0
1,3-butadiene	0.0	0.1
Benzene	0.0	0.0
Tetrachloroethylene	0.0	0.0
<b>Total</b>	<b>42.6</b>	<b>21.8</b>

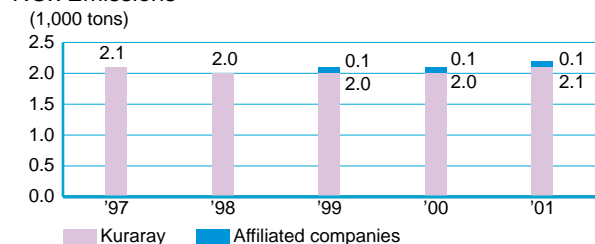
  

	(mg-TEQ)	
PCDDs (polychlorinated-dibenzo-p-dioxins)	193.3	123.4

SO<sub>x</sub> Emissions



NO<sub>x</sub> Emissions





## Efforts to prevent water pollution

### Principle

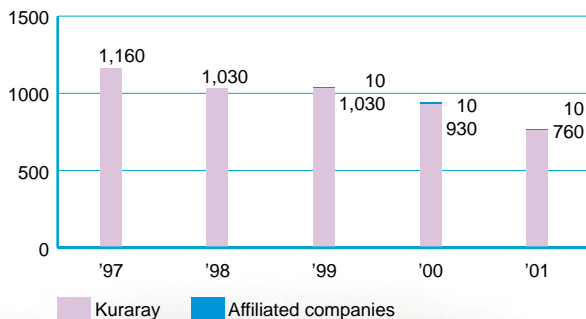
The *Water Pollution Control Law* provides restrictions on chemical oxygen demand (COD) and pH in water discharged from plants to public waters. The Kuraray Group not only abides by local governments' 'strict standards' but has voluntarily set even stricter standards to doubly ensure the prevention of water pollution.

### Concrete Programs

We have installed additional measuring instruments to tighten drainage monitoring, and introduced neutralization and suspended matter collection equipment to reduce the environmental impact of the wastewater. We use our PVA gel to increase the efficiency of wastewater treatment systems, and are reducing surplus sludge to zero by adding complete oxidization systems that employ a membrane separation method.

Our COD emissions in fiscal 2001 were 770 tons, a reduction of some 170 tons (18%) over the previous year. We will make a continued commitment to the development of technology for preventing water pollution.

COD Emissions (ton)



## Efforts to combat global warming

### Principle

Kuraray established the *Energy Conservation Committee* in 1999 to give momentum to increased energy efficiency and control of CO<sub>2</sub> emissions. Its Medium-Term Environmental Plan establishes a specific energy conservation target of increasing energy utilization efficiency by at least 1% annually. With Japan's ratification of the *Kyoto Protocol* in June 2002, measures laid out in the *Principles for the Promotion of Global Warming Countermeasures* (revised in March 2002) will be put into practice. Kuraray will review its guidelines and plans in accordance with these Principles.

### Concrete Programs

At the Kurashiki Plant (Tamashima), waste plastics collected from outside are recycled into fuels, reducing the volume of coal consumption and CO<sub>2</sub> emissions. In fiscal 2001, we used 10,900 tons of waste plastics as fuel, resulting in a reduction of 7,500 tons of CO<sub>2</sub> emissions (carbon equivalent).

Other energy-saving programs include improving the performance of generating turbines, collecting waste heat, changing over to high-efficiency electric equipment, and introducing more inverter-operated electric motors. In the daily workplace, too, we are reducing CO<sub>2</sub> emissions by setting air-conditioner thermostats higher during summer and switching lights off during breaks.

Thanks to these initiatives, our energy consumption was reduced by 5,000 kl in crude oil equivalent, or 3,600 tons of CO<sub>2</sub> in carbon equivalent. Due to a change in product mix, however, total CO<sub>2</sub> emissions increased 5% over the previous year to 420,000 tons in carbon equivalent.





In fiscal 2001, we started a survey into the greenhouse gases other than CO<sub>2</sub>.

We expect the volume of greenhouse gases we handle will increase due to: 1) an increase in the volume of methane handled with the increase in natural gas consumption; and 2) a switchover of freezer refrigerants from CFC-11 (ozone layer depleting substance) to HFC-134a (greenhouse gas). We will try our best not to increase the emissions of these into the atmosphere.

### Outline of the Principles for the Promotion of Global Warming Countermeasures (Revised)

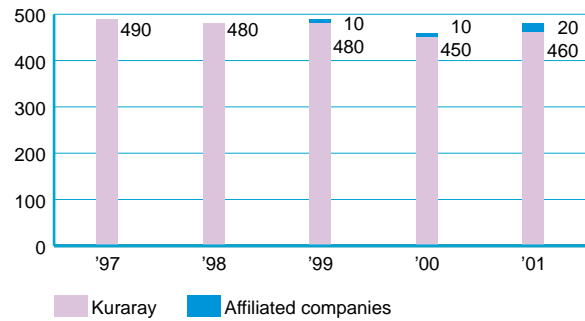
To achieve the pledge in the Kyoto Protocol (6% reduction vs. 1990), the Principles give an overall picture of the measures and describe targets, measures, and a schedule for each type of greenhouse gas and other classifications.

(Classified targets between 2008 and 2012)

- (1) Energy-sourced CO<sub>2</sub>: -0.0% vs. 1990
- (2) Non-energy-sourced CO<sub>2</sub>, methane, nitrous oxide: -0.5% vs. 1990
- (3) Innovative technology development and promotion of global warming prevention campaigns by people from all circles: -2.0% vs. 1990
- (4) Three CFC substitutes (HFC, PFC, SF<sub>6</sub>): +2.0% vs. 1995
- (5) Maintaining absorption by forests: -3.9% vs. 1990

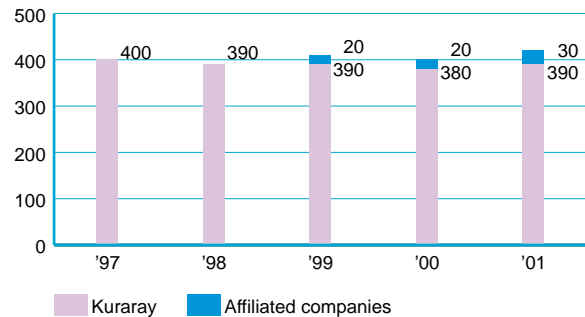
### Energy Consumption

(crude oil equivalent, 1,000 kl)



### CO<sub>2</sub> Emissions

(carbon equivalent, 1,000 tons)



### Emissions of Greenhouse Gases Other than CO<sub>2</sub> (FY01)

	Emissions (tons)	Heat-trapping coefficient	Tonnage in CO <sub>2</sub> equivalent
Methane (CH <sub>4</sub> )	4.9	21	102.9
Nitrous oxide (N <sub>2</sub> O)	0.0	310	0.0
Hydrofluorocarbons (HFCs)	0.0	140 ~ 11,700	0.0
Perfluorocarbons (PFCs)	0.0	6,500 ~ 9,200	0.0
Sulfur hexafluoride (SF <sub>6</sub> )	0.0	23,900	0.0
Total	4.9		102.9





## Environmental Performance Working to Reduce Environmental Impact

### Management of ozone layer depleting substances

#### Principles

Under the *Law Concerning the Protection of the Ozone Layer through Regulation, etc. of Specified Substances*, chlorofluorocarbons (CFCs), halon, and other ozone layer depleting substances were designated 'specified substances,' and their production and consumption is regulated. The Kuraray Group has long used CFC-11, one of the specified substances, as a refrigerant for freezers, and will in turn switch to CFC substitutes. In June 2001, the *Law Concerning Collection of CFCs from Specified Products and Destruction of the Products* was established, obliging proper collection and destruction when disposing of appliances. We will manage and dispose of CFC-11 produced as a result of the switch to CFC substitutes in accordance with the Law.

#### Concrete Programs

In fiscal 1997, the Kuraray Group started changing the refrigerants in freezers from CFC-11 to CFC substitutes (HCFC-123 or HFC-134a). In fiscal 1996, we used 11.3 tons of CFC-11, 2.6 tons of which was later substituted. We will make continued efforts to increase the use of CFC substitutes.

### Reducing environmental impact during transport

#### Principles

With a view to reducing emissions (CO<sub>2</sub>, NO<sub>x</sub>, etc.) resulting from the transport of products, Kuraray has implemented a number of measures to enhance transport efficiency. These include switching to other transport options with higher energy efficiency such as sea and rail, as well as programs to reduce transport distances and increase transport efficiency. In March 2002, we drew up *Green Purchasing Standards* to promote environmental preservation initiatives through collaboration with business partners, and these were launched in April 2002. The Standards are applied to logistics service businesses as well as materials manufacturers. They require 'measures to improve physical distribution' as one of the criteria for selecting business partners, and favor businesses that improve packaging specifications and increase transport efficiency to save energy and resources and cut gas emissions. With the Standards put in place, we will further reduce environmental impact during transport as we work hand in hand with our partners.

#### Concrete Programs

In fiscal 2001, 321 tons of CO<sub>2</sub> (carbon equivalent) and 4.8 tons of NO<sub>x</sub> were reduced over the previous year. This is due primarily to greater use of the ports nearby plants, efficient transport through the introduction of the cross-docking system, and reduction of transport to and from neighboring warehouses through the use of on-premise space in plants.

#### CO<sub>2</sub> and NO<sub>x</sub> Emissions during Transport (tons)

	FY00	FY01
CO <sub>2</sub>	7,708	7,387
NO <sub>x</sub>	112.1	107.8

CO<sub>2</sub> emissions (carbon equivalent) = weight (tons) x distance (km) x per-unit emissions

NO<sub>x</sub> emissions = weight (tons) x distance (km) x per-unit emissions

\*The above data includes emissions resulting from transport of products shipped from Kuraray's plants, and does not include those resulting from transport of products shipped from sales office warehouses and processing sites, non-products, and raw materials.

Emissions of Primary Ozone Layer Depleting Substances (FY2001)

	Emissions (tons)	Ozone layer depleting coefficient	CFC equivalent (tons)
Hydrochlorofluorocarbon (HCFC-123)	0.93	0.02	0.02
Chlorofluorocarbon (CFC-11)	0.50	1.00	0.50
Carbon tetrachloride	0.01	1.10	0.01
1,1,1-trichloroethane (methylchloroform)	0.00	0.10	0.00
Three specified halons	0.00	3.0 ~ 10.0	0.00
Hydrobromofluorocarbons	0.00	0.1 ~ 14.0	0.00
Ethyl bromide	0.00	0.60	0.00
Total	1.44		0.53



(1) Increased use of nearby ports

We are using with greater frequency ports nearby plants to ship exports. The Okayama Plant and Kurashiki Plant (Tamashima), for instance, are using Mizushima Port more frequently (see below).

Loading Ports Used by Okayama Plant and Kurashiki Plant (Tamashima)

	FY00	FY01
Kobe Port	93.7%	80.4%
Mizushima Port	6.3%	19.6%
Total	100%	100%

Distance to the ports:

From Okayama Plant to Kobe Port 150 km

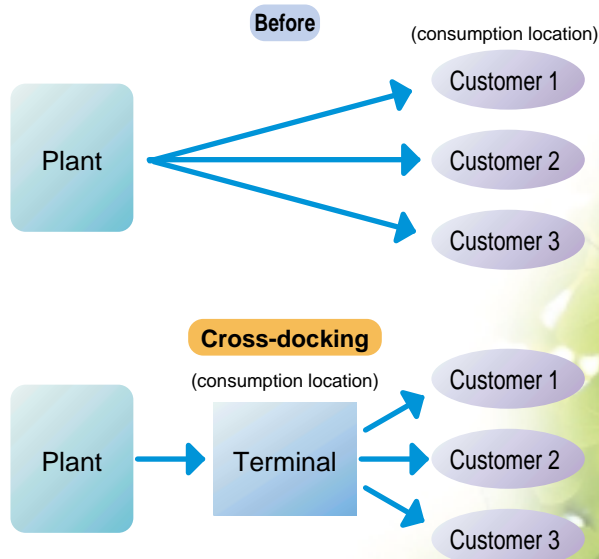
to Mizushima Port 35 km

From Kurashiki Plant (Tamashima) to Kobe Port 180 km

to Mizushima Port 3 km

(2) Greater efficiency in vehicle operations through the cross-docking system

The introduction of the cross-docking system has made it possible to transport mixed cargoes of small-lots to consumption locations. This system helps increase each transport load, increasing transport efficiency. The use of the system at the Okayama Plant and Kurashiki Plant (Tamashima) reached 18.3% in fiscal 2001, a rise of 16.5 points over the previous year.



(3) Greater use of space on plant premises

With the establishment of new warehouses within plants and the use of idle facilities as warehouses, extra transport to neighboring warehouses was reduced. In fiscal 2001, a total of 11,000m<sup>2</sup> of space at the Okayama, Kurashiki (Tamashima), Nakajo, and Kashima Plants was turned into warehouses.



Warehouses at the Okayama Plant



## Environmental Performance Environmental Risk Management

### Management of chemicals

#### Principles

The Kuraray Group ensures the safe management of chemicals in the spirit of the following laws:

- *PRTR Law*
- *The Special Law Concerning Countermeasures against PCDDs*
- *The Special Law Concerning the Promotion of Appropriate Disposal of Polychlorinated Biphenyl Waste.*

We are also making voluntary efforts for better management of chemicals through active participation in voluntary Pollutant Release and Transfer Register (PRTR) activities and High Production Volume (HPV) programs organized by the Japan Chemical Industry Association (JCIA).

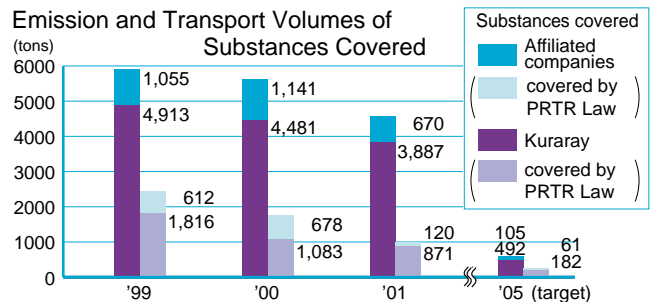
#### Concrete Programs

##### Present state of initiatives to reduce emissions and transport volumes

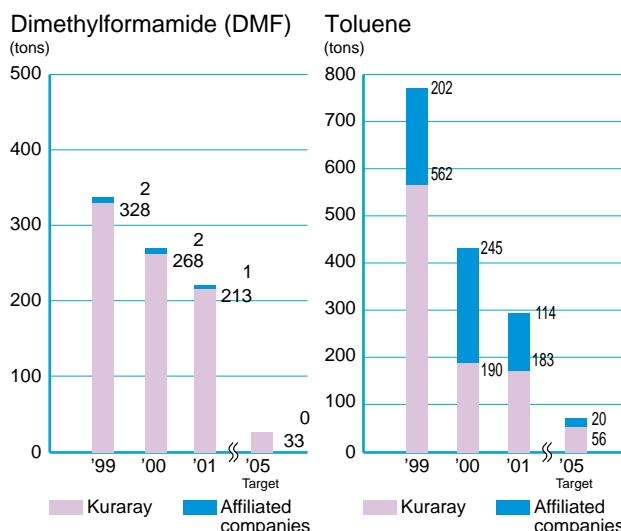
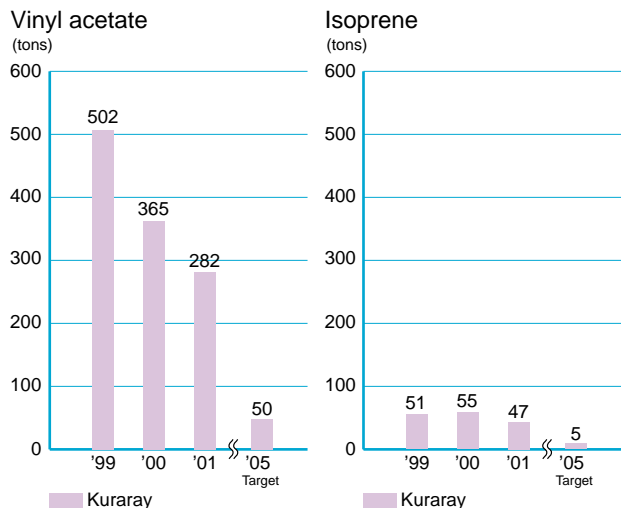
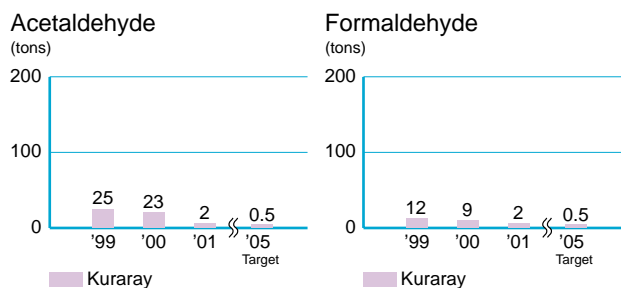
The Kuraray Group has participated in voluntary activities by JCIA member companies to reduce emissions and transport volumes of designated chemical substances. The Kuraray Group handled 75 (48 covered by the *PRTR Law*) of the 480 (354 covered by the *PRTR Law*) substances designated for reduction by the JCIA in fiscal 2001. In the Medium-Term Environmental Plan, we set a target to reduce emissions and transport volumes of those substances by 90% by fiscal 2005 (vs. fiscal 1999). Emissions and transport volumes in fiscal 2001 decreased 24% from the base year (fiscal 1999) to 4,557 tons. We also designated 12 substances (six covered by the *PRTR Law*) as priority for their hazardousness and emissions volume. As shown in the charts on the right, emissions and transport volumes of all six of the substances covered by the *PRTR Law* among the 12 on our priority list are declining steadily. To successfully implement the Medium-Term Environmental Plan, the Kuraray Group designated the Kashima Plant a model plant for positive *PRTR Law* implementation, as part of our efforts to monitor what our plants and competitors are doing. This way, we make sure that we can share best practices throughout the Group, thereby accelerating our efforts at reduction.

Substances Covered by the PRTR Law and the JCIA Voluntary Management Program

	Number of substances covered	Kuraray Group (FY01)	Priority substances
Covered by the JCIA voluntary management program	480	75	12
Covered by the PRTR Law	354	48	6



Priority substances — Six substances designated by the PRTR Law





### • Dioxins management

With the amended *Enforcement Ordinance for the Waste Disposal and Public Cleansing Law* that came into force in December 1997, the standards for structural requirements and maintenance of incinerators were tightened to control dioxin generated in waste incinerators. Kuraray did a survey of all its incinerators, drafted programs for each of the five years after the Law took effect, and has taken action accordingly. In fiscal 2001, besides reviews of the yearly programs, we moved more incineration to large-sized facilities both in and outside of the company, partly for efficient use of waste, and suspended operations of three small incinerators.

### • PCB management

The enforcement in July 2001 of *the Special Law Concerning the Promotion of Appropriate Disposal of Polychlorinated Biphenyl Waste* obliged the notification of the volume and state of PCB waste storage and the completion of disposal by July 2016 (15 years after the Law took effect). Accordingly, Kuraray reported the state of storage and use of the substance in August 2001, and is aiming at completing disposal by fiscal 2010. We are currently reviewing the replacement of equipment that uses PCBs and the disposal of PCB waste.

### • Alternatives for endocrine-disrupting substances

Substances that are suspected of causing hormonal disruption include PCDDs, PCB, and bisphenol. In August 2001, the Ministry of the Environment published its view that nonylphenol might affect the ecosystem by disrupting endocrine levels in fish. Kuraray uses nonylphenol compounds and nonylphenol ethoxylate compounds for production, and will in turn substitute them with alternatives as soon as possible.

### • HPV Programs

The HPV (High Production Volume) Program was initiated in 1992 by the Organization for Economic Cooperation and Development (OECD) with the aim of collecting the hazard data necessary to evaluate the risks associated with chemical substances that are presently manufactured in large quantities. Manufacturers of those chemicals are now working together to gather that hazard data. The Kuraray Group's independent efforts in this regard focus on seven chemical substances: four PRTR substances, including isophytol, linalool, prenil, and isoprene; and sulfuric acid, acetic acid, and tertiary butanol.

## Legal compliance

We established documented procedures within the ISO 14001 environmental management system for each plant to comply with laws and regulations on environmental preservation. These procedures provide guidelines on how to specify information channels on the related laws and regulations, check for the establishment of and amendments and alterations to the laws and regulations, communicate new and altered provisions, and review the way each department implements them, in order to ensure that there is no discrepancy in legal compliance. Minor problems and unexpected situations at a plant could lead to impact on the external environment, resulting in noncompliance. To prevent this from happening, we have set up standard values for autonomous management of emissions into the atmosphere and water that are stricter than the laws and regulations. There was no incident that might violate laws and regulations during fiscal 2001.

## Dealing with emergencies

Kuraray is doing its utmost to prevent emergencies from occurring in its operations, and has drawn up contingency plans.

Each plant follows clear-cut guidelines on emergency measures, stipulated in *the Regulations on Preparations and Measures against Emergency* within the ISO 14001-certified system. Specific emergency measures include: assessment of possibilities for accidents and emergencies; review of emergency procedures; establishment of preventive and mitigating measures; testing of the measures; and evaluation of the need to review the measures.

Some of the things we are doing to prevent environmental accidents are: patrols to pipelines and facilities where dangerous substances are handled; use of oil fences when unloading heavy oil; and environmental education in line with ISO 14001. To minimize contamination of the air, water, and soil in the event of an emergency, and to prevent the spread of damage, Kuraray has installed the following equipment designed to prevent and contain environmental disasters.

For air quality: sensors to monitor smokestack emissions  
For water quality: heavy oil leak-detectors and wastewater monitors

For soil quality: paving the ground under liquid pipelines with concrete liquid barriers



Oil Fence



## Efforts to reduce emissions to zero

### Principles

The concept of 'zero emissions' was first proposed in 1994 by the United Nations University (one of the committees established by the UN General Assembly) in its plan for waste-free industry, which is designed to reduce waste to zero by finding new applications for it, thereby creating a new resource-recycling industrial society. To reduce industrial waste emissions to zero, Kuraray is improving production processes and developing waste treatment technology with a view to reducing, reusing, and recycling materials.

In 1995, we set ourselves the target of cutting in half the volume of industrial waste processed outside the company by fiscal 2000. We succeeded in achieving our target through improvement of production processes and thermal recycling of waste plastics by fluidized-bed combustion boilers at the Kurashiki Plant (Tamashima). The Medium-Term Environmental Plan started in fiscal 2001 establishes the targets for fiscal 2005 of reducing the volume of externally processed industrial waste by 90% and increasing waste utilization efficiency by 20 points or more, both compared to the base year of fiscal 1999. *The Industrial Waste Reduction Committee* provides a basic course for the Group's waste reduction programs, based on which concrete programs are designed and implemented.

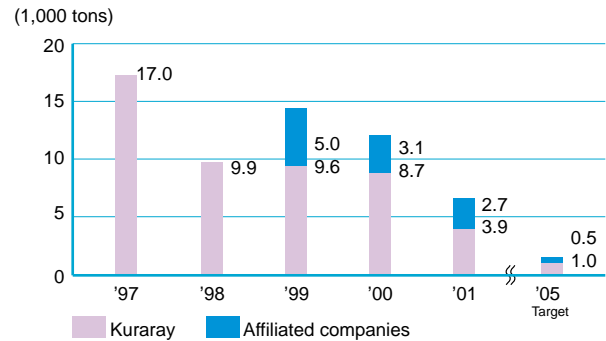
### Concrete Programs

We are implementing the following to achieve the targets laid out in the Medium-Term Environmental Plan:

- ¥ Promoting the reuse of waste through more rigorous separation;
- ¥ Promoting recycling of materials through exhibits of waste;
- ¥ Thermal recycling by turning waste plastics into solid fuels;
- ¥ Efficient utilization of waste through use of outside facilities; and
- ¥ Merchandizing incinerator ash generated by fluidized-bed combustion boilers at the Kurashiki Plant (Tamashima) (soft soil improver).

In fiscal 2001, the volume of industrial waste processed by outside contractors for Kuraray was 6,600 tons, a 55% reduction from the fiscal 1999 base year level. Through measures such as heat collection and recycling, the effective reuse ratio (recycling ratio) for waste, both in-house and externally, reached 70%, an increase of 10 points over the base year. As a step for waste treatment in the future, we participated in the establishment of a resource-recycling waste treatment facility in Kurashiki City. We will remain committed to further reduction and efficient use of waste to achieve the goal of 'zero emissions.'

Volume of Industrial Waste Processed by Outside Contractors



## Efforts to conserve resources

### Principles

To conserve resources, it is necessary to put them to efficient use and eliminate any waste. This requires a variety of initiatives, such as efficient use of raw materials, reduction in water consumption, promotion of reuse and recycling, extension of product life cycles, and reduction of packaging materials. Initiatives by the Kuraray Group here include: increasing production yields; improving production processes so defective and semi-finished products can be recycled into materials; developing longer-life products; collection of packaging materials for recycling; and recycling of spent water.

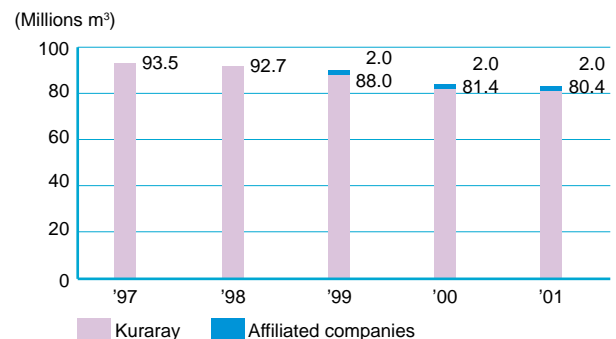
### Concrete Programs

At the Nakajo Plant, we made a detailed inspection of the heat balance in the heat exchangers. As a result, water consumption at the Kuraray Group in fiscal 2001 was 86.8 million m<sup>3</sup>, a reduction of 1.8 million m<sup>3</sup> over the previous year. We are also doing everything we can to improve yields, an issue common to all product lines.

Water Consumption (Million m<sup>3</sup>)

Category		FY00	FY01	Difference
Water consumption	Kuraray	86.6	84.7	▲1.9
	Affiliated companies	2.0	2.1	0.1
	Total	88.6	86.8	▲1.8

Wastewater Emissions





## Environmental Performance Green Purchasing

### Principles

Taking effect in April 2001, *the Green Purchasing Law* mandates placing priority on purchasing products and services with low impact on the environment. Enterprises are required to opt as far as possible for eco-friendly products and services. Kuraray is enthusiastically expediting green purchasing through its own *Green Purchasing Guidelines* established in October 2001.

### Concrete Programs

**Paper** Copier paper and business cards were switched to recycled paper in April and July 2001 respectively. Corporate brochures, in-house publications, and other printed matter for the whole organization are printed on 100% recycled paper.

**Stationery** An Internet-based purchasing system was introduced in the 2nd half of fiscal 2001 to increase the green purchasing ratio.

**OA equipment, lighting** The green purchasing ratio in fiscal 2001 reached 100% after a changeover in stages to more energy-efficient products that began in the 2nd half of fiscal 2000.

**Automobiles** In fiscal 2001, we purchased 11 low-polluting vehicles and vehicles with good fuel economy. Due to their restricted variety and higher cost compared to ordinary vehicles, however, the green purchasing ratio remained at 30%.

### ¥Status of Green Purchasing (FY2001)

Category		Item	Amount purchased (Yen in millions)	Green purchasing ratio
1	Paper (recycle)	5 items Copier paper, forms, print paper, sanitary paper, business cards	51	100%
2	Stationery (recycle)	47 items Mechanical pencils, ballpoint pens, markers, pencils, etc.	10	80%
3	Furnishings (reuse)	8 items Chairs, desks, shelves, cabinets, low partitions, bulletin boards, chalkboards, whiteboards	10	80%
4	OA equipment (energy-saving)	4 items PCs, printers, copiers, facsimile machines	270 (lease payment)	100%
5	Appliances (energy-saving)	4 items Refrigerators, air-conditioners, TVs, VCRs	9	80%
6	Lighting (energy-saving)	2 items Fluorescent lighting apparatus, fluorescent tubes	10	100%
7	Automobiles (reducing pollutants)	1 item Automobiles	79 (lease payment)	30%
8	Uniforms and work dresses (recycle)	2 items Uniforms, work dresses		
9	Work gloves (recycle)	1 item Work gloves	4	0%

The Kuraray Group has so far concentrated green purchasing on general purchase items, but is extending it to producer's goods like raw materials for production. For this, the Kuraray Group established *the Green Purchasing Standards* in March 2002, which were put into effect in April 2002. Based on the awareness that purchasing of materials with little impact on the environment is necessary and important for truly eco-friendly business activities, the Standards provide guidelines for the promotion of environmental preservation activities through cooperation with business partners. We will refer to the Standards to evaluate our partners and will give higher priority to environmentally conscious partners.





## Safety Assurance Initiatives

The Responsible Care Initiatives Verification Meeting was kicked off in fiscal 2001, as a replacement for 'safety audits,' for the purpose of preventing environmental, safety, and industrial accidents and providing continuous improvements to disaster management systems.

### Occupational safety and health

#### Principles

Guided by *the Principles for Business Conduct*, everyone in the Kuraray Group is working hard to improve occupational safety and health, to completely eliminate industrial accidents.

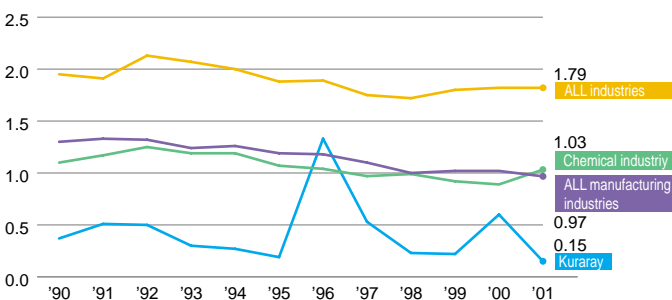
Under the initiative of supervisors, all the staff are making constant efforts to eliminate dangers in the workplace in order to minimize the possibility of industrial accidents and mishaps in the workplace. *The Kuraray Safety Convention* has been staged since 1985, with the participation of the president, managing director and staff of the Kuraray Group, to enhance safety awareness. Back at their workplaces, the top managers and leaders are expected to expedite safety initiatives by sharing what they have learned with coworkers. In fiscal 2002, *the Kuraray Safety Convention* will be renamed *the Kuraray Group Environment and Safety Convention* and start addressing environmental themes as well.

#### Concrete Programs

As the chart below shows, Kuraray's occupational safety performance had been improving gradually until fiscal 1996, when we experienced an extraordinarily large number of industrial accidents. To combat this, we launched a new initiative called the Total Productive Maintenance (TPM) protocol in order to reform employees' safety awareness, make equipment essentially safe, and visualize dangers by expressing degrees of danger as numerical values, marking problematic equipment with different colors, and indicating dangerous points with illustrations. The Saijo Plant is doing a preliminary evaluation of a new Occupational Health and Safety Management System (OHSMS), laying the groundwork for the expansion of the system throughout the Group. Kuraray will continue its efforts toward assuring the highest level of occupational safety, realizing its goal of eliminating dangers in the workplace altogether.

### Occupational Safety Performance

(Lost work injury frequency)



Lost work injury frequency: Number of injuries per one million work hours

$$= \frac{\text{Number of injuries}}{\text{Number of hours actually worked}} \times 1,000,000$$

### Disaster prevention

#### Principles

Kuraray has adopted *Equipment Safety Design Guidelines and Safety Inspection Standards* to facilitate substantive improvement in the safety of its facilities and equipment. These standards mandate three stages of safety inspection preceding the installation of new equipment, modification of existing equipment, or major changes in operating conditions. The Standards also stipulate an additional safety inspection after the startup of the equipment. In addition, existing equipment is also checked for safety, to ensure the prevention of accidents and disasters arising from existing equipment and facilities.

#### Concrete Programs

Some of the issues discussed of the fiscal 2001 *Responsible Care Initiatives Verification Meeting* include: the need to provide skills and techniques training; improve equipment diagnosis techniques; and review pipe inspection standards. We have drafted action plans for each of these, and are constantly making disaster prevention initiatives in accordance with the PDCA cycle. We are also striving to improve the level of safety through evacuation drills at night, industrial accident simulation drills, and training in the prevention of industrial accidents. An annual suspension of operation to overhaul high-pressure gas equipment, 'boilers and Category 1 pressure vessels' has been made mandatory. However, items of equipment deemed to satisfy the legal requirements for safety control and equipment control may be operated for two years or longer, provided they are inspected while in operation. Accordingly, our Okayama Plant has obtained certification for their high-pressure gas equipment, and Kurashiki, Kashima, Saijo, and Okayama Plants, for their 'boilers and Category 1 pressure vessels,' and the equipment and vessels are being operated continuously for two years. The Kashima Plant has begun preparations to obtain certification for its high-pressure gas equipment.



Rescue drill



## Quality assurance, product safety

### Principles

Kuraray has laid down the following basic policy and action guidelines on product safety assurance.

#### ¥Product safety basic policy

We will endeavor to achieve an affluent, comfortable society by meeting customer needs through the supply of safe and reliable products.

#### ¥Action guidelines for product safety (excerpts)

1. Supply products meeting the level of safety expected by society in accordance with safety-related laws and regulations and the latest technological levels
2. Maintain an appropriate quality management system to ensure that all products meet required quality and safety standards
3. Provide accurate product information to customers and users to prevent accidents due to inappropriate use and handling
4. Endeavor to develop new products and improve technology for product safety

### Concrete Programs

The *Product Liability (PL) Committee* has been formed to promote product safety initiatives for the Kuraray Group. The people in charge of quality and PL meet to report to the Committee. The *Quality Management Group of the Environmental, Industrial Safety and Quality Management Center* is placed under the head office in order to supervise quality assurance initiatives exclusively, and a *Quality Control Section* is established at each plant.

#### ¥Evaluating product safety at the R&D stage

For the development of new products, we established the *Product Safety Management Standards for the R&D Stage* and *Product Safety Management Standards up to Market Launch*. These Standards consider the possible effects the products will have on the environment and on human health and safety at every stage of their life cycle, from R&D through to eventual disposal once the product has fulfilled its purpose. We are studying ways to solve possible problems as early as possible by, for example, changing raw materials or production processes to reduce the impact on the environment where potential issues have been foreseen.

#### ¥Switchover to ISO 9001

In the hope of ensuring product safety and accurately meeting customer demand for quality, Kuraray introduced a quality management system early on. In fiscal 2001, we switched from a 1994 version to a 2000 version, thus completing the process of meeting the requirements of ISO 9001. One of the requirements in the 2000 version is 'evaluation of customer satisfaction.' We want to take advantage of this opportunity to improve customer satisfaction.

#### ¥Introduction of the Material Safety Data Sheet (MSDS) System

The MSDS is a data sheet which must be delivered when a business supplies designated chemicals to other businesses to prevent accidents arising from chemical products. Kuraray has compiled a database of

accumulated MSDS, which is registered with the in-house computer system so employees can have access to it at any time. The development of a search system that encompasses affiliated companies is being planned.



MSDS (Material Safety Data Sheet)

## Safety in logistics

### Principles

The Kuraray Group has established *Distribution Safety Management Standards* in order to make sure that safety is assured when shipping chemicals. Items containing specified substances and all items in liquid form are subject to safety management procedures based on these guidelines whenever they are shipped, stored, loaded or unloaded.

### Concrete Programs

To ensure distribution safety, we conduct training and education as necessary to ensure the safe handling of chemicals for Kuraray staff as well as the people contracted to transport the chemicals.

To improve safety when handling chemicals, we supply an MSDS to all distribution contractors. In addition, drivers transporting chemicals from our premises are handed Yellow Cards (below) that list essential information in the event of an accident, such as where and how to report accidents, and details of any emergency procedures that should be undertaken.

#### Yellow Card (Emergency Response Card)

Yellow Cards contain information on the chemical properties and potential dangers of and safe management precautions for the items being transported, as well as emergency procedures and whom to contact should a problem occur. If an accident does occur, the driver or other personnel can follow the instructions on the card to take immediate appropriate action, thereby preventing the damage from spreading.





## Communications

The Kuraray Group is committed to employee training on environmental preservation and the timely disclosure of environmental information. We are also organizing a variety of programs with host communities, including our tenth year of Chemistry Classes for Boys and Girls.

### Education and training

#### Programs aimed at raising safety awareness in every employee

Kuraray believes it is people who maintain the environment and safety and reduce risk. In line with this, we design and offer various training programs for our employees. The in-house publication Kuraray Times is a vehicle to enhance our employees' environmental awareness. For example, a series of articles titled 'Toward an Eco-Friendly Company' gives detailed accounts of what we are doing to protect the environment. Each plant organizes training programs in line with EMS Training Regulations (required in the ISO 14001 system) and encourages employees to obtain the necessary qualifications.



#### • Initiatives by regional PR teams

The General Affairs and Environmental Safety Departments of the Nakajo Plant have formed a joint regional PR team with the General Affairs Department of Nakajo Town that meets regularly to facilitate disclosure on the PRTR Law and other programs and contingency measures in case an accident should occur. Focusing on how to cooperate mutually when accidents do break out and contain the impact on the communities, they deepen mutual understanding as they discuss the government's regional disaster management plan and the Nakajo Plant's counterpart plan.

#### • Environmental Activities Report

Since 1998, Kuraray has been publishing an annual Environmental Activities Report (Japanese/English) to help people understand our programs and our commitment to environmental protection. Beginning with the fiscal 2001 edition, the report has been posted on our website. Each plant prepares brochures to introduce their particular initiatives.



### Social contributions

#### Multifaceted programs designed to achieve harmony with our host communities

#### • Chemistry Classes for Boys and Girls

In 1992, Kuraray started supporting *chemistry classes for boys and girls*. Aimed at the higher grades, these classes strive to foster an interest in chemistry among children. Activities center around demonstrations, and relate chemistry to familiar themes. In recent years, classes have been organized in surrounding cities. Celebrating its 10th anniversary this year, the program has provided a total of 88 classes for 2,985 children (as of March 2002), and was awarded the Fiscal 1999 *Recognition of Meritorious Achievement in Outstanding Corporate Consumer Outreach Activities* by the Ministry of International Trade and Industry (now the Ministry of Economy, Trade and Industry).



### Disclosure

#### Aggressive disclosure of environmental data

#### • Plant tours

As part of our initiatives for risk communication, we organize plant tours for residents in host communities. In fiscal 2001, some 2,000 people visited our plants for briefings on the environmental initiatives going on there.

#### • Briefings for host communities

To facilitate communication about environmental issues with the residents of neighboring communities, our plants meet with them for briefings on our environmental improvement plans and their progress, and invite them to voice their requests. In fiscal 2001, the Okayama Plant conducted Phase I of the construction work for improving flue gases from boiler chimneys. At the completion of the work, they invited representatives from local communities to briefings on the improvements and invited them to inspect the site.





### • Study Session for School Children

On December 17, 2001, approximately 200 6th graders from the Kurashiki Municipal Nakasu Elementary School visited the Kurashiki Plant for a special study session on the environment. The session was part of the research activities the students are participating in under the theme 'The Global Environment and Human Beings,' which is a component of the 'integrated study' program being conducted by the school. During the session, the plant's *Environmental and Industrial Safety Department* presented a lecture entitled 'Nine Concerns Now Facing the Earth,' including waste treatment and global warming, citing related issues the children are familiar with. Presentations followed on the Kuraray Group's initiatives for environmental conservation and eco-friendly products. The program also featured quizzes on environmental topics. This was a wonderful opportunity for the children to deepen their understanding of what they can do in their everyday lives, as well as the importance of environmental protection, while at the same time enjoying themselves.



### • Open Lecture Meetings

To make plants open to host communities through greater communication, Kuraray often offers open lectures. The lecture on 'The History and World of the Ohara Museum of Art' in November 2001 was attended by an audience of some 250 people, who listened attentively to the stories about the museum and its collection.



### • Flower Viewing Parties



Each year the Saijo Plant opens its grounds to the public for a cherry blossom viewing party. This provides a pleasant opportunity for plant personnel to socialize with local residents.

### • Clean-ups in Surrounding Areas



As part of the environmental beautification campaign, our plants conduct regular clean-ups in the areas surrounding them.

### • Sports Meets

Kuraray sponsors sports meets, including a boy's soccer tournament and a tennis tournament, held at its gymnasiums or athletic fields. In this manner, we hope to make ourselves an open and familiar presence to our neighbors in the local community.



### • Rainbow House Kuraray Workshop

The Nakajo Plant supports the participation in society of 15 mentally handicapped people at its 'Rainbow House Kuraray Workshop.' They undertake a variety of recycling activities, including the removal of masking from acrylic resin boards.



### • Communicating with the Physically Handicapped

The Tokyo Head Office organizes a variety of opportunities to communicate with students from the schools for the deaf, the blind, and the handicapped in the Kanto region, providing exhibitions of artwork, shows and spot-sales of crafts, and study tours and practical training at the Company.



### • Volunteer programs

Kuraray supports initiatives by volunteer groups from its plants (visits to homes for the handicapped and the elderly in local communities), and provides recognition for programs that individual employees are involved in outside of work, such as the volunteer fire corps and coaching boys' sports teams, through its 'Social Contribution Award.'





## The Kashima Plant



### 1. Profile

- (1) Address: 36, Oaza-higashiwada, Kamisu-machi, Kashima-gun, Ibaraki Prefecture
- (2) Site area: 408,000m<sup>2</sup>
- (3) Employees (as of March 2002): 379 (Kuraray Group total)
- (4) ISO 14001: Certified on March 12, 1999  
Certification No. JQA-EM0364
- (5) Main products: Isoprene monomer, "SEPTON" and "HYBRAR" (thermoplastic elastomers), Industrial cleaner, Tertiary butylalcohol

### 2. Pledges for environmental conservation

The Kashima Plant handles a large volume of chemical substances and energy. All the staff at the Plant are constantly committing themselves to making environmental improvements, such as the promotion of energy and resource conservation and the reduction of emissions.

### 3. State of environmental initiatives

Formaldehyde emissions into the atmosphere were reduced from 1.4 tons to less than 0.2 tons a year, thanks to the installation of combustion equipment at the formaldehyde absorption tower. A drastic remodeling of an existing liquid waste incinerator is planned to comply with *the Waste Disposal and Public Cleansing Law*. The Plant will invite employees' ideas on ways to make the plant free of offensive chemical odors, while increasing their environmental awareness.

### 4. Model plant activities for implementation of the PRTR Law

To give a strong push to PRTR Law compliance measures for the entire Group, in March 2002 *the first Kuraray Group Review Meeting on the Reduction of Emissions of Hazardous Chemical Substances* was organized, where the status of PRTR Law compliance at each plant was reported and the course of issues the meetings should take up were discussed. The Plant will organize a Group-wide review meeting twice a year to ensure legal compliance and set a model for other plants.

### 5. Substances covered in the emission and transport volumes reduction program

Substance	Emission/transport volumes (tons)		Key reduction measures
	FY01 (results)	FY05 (target)	
Formaldehyde	0.1	0.4	(1) Scrubber to be installed to reduce isoprene (2) Connect vent pipe to flare to reduce cyclohexane, install exhaust gas treatment facility in the drying process (3) Connect tank vent pipe to flare to reduce n-hexane (4) Scrubber installed in berth tank to reduce methanol
Isoprene	34.0	4.0	
Cyclohexane	321.6	30.0	
n-hexane	190.2	15.0	
Methanol	38.6	2.6	
Other	45.2	4.5	
Total	629.7	56.5	

### 6. Industrial waste

	FY01 (results)	FY05 (target)	Measures to reduce waste and put waste to efficient use
Volume generated (tons)	10,741	13,122	
Treatment method	Efficient use (tons)	732	(1) Using waste heat from waste liquid incinerator
	In-house simple treatment (tons)	9,799	(2) Tighten separate collection of waste oil for recycling
	Outside simple treatment (tons)	210	(3) Volume lowered by reducing waste liquid

(Simple treatment: incineration, landfill)



## The Okayama Plant



### 1. Profile

- (1) Address: 1-2-1, Kaigandori, Okayama City, Okayama Prefecture
- (2) Site area: 692,000m<sup>2</sup>
- (3) Employees (as of March 2002): 1,771 (Kuraray Group total)
- (4) ISO 14001: Certified on March 24, 2000  
Certification No. JQA-EM0796
- (5) Main products: "KURALON," "KURALON K-II," "CLARINO" (man-made leather), Poval resin, "EVAL" resin and film, "KURAFLEX" (dry-laid non-woven fabric)

### 2. Pledges for environmental conservation

In the Medium-Term Environmental Plan, the Okayama Plant was designated a model plant for zero emissions and energy preservation. The plant is making efforts to expedite the reduction, recycling and efficient use of waste, and eventually reducing the volume of waste processed outside to zero. It is also actively promoting measures as a base for energy preservation. Aware of its social responsibility to achieve harmony with the natural environment and local communities, the Okayama Plant intends to work hard to improve the environment.

### 3. State of environmental initiatives

In fiscal 2001, Phase I of the installation work for a wet electrical dust precipitator to prevent trailing stack gas from a generation boiler was completed, and Phase II work is currently underway. A feasibility study has been started on the introduction of a high-efficiency wastewater treatment facility using self-developed PVA gel.

### 4. Model plant activities for zero emission and energy preservation

To achieve zero emissions, the Okayama Plant is promoting efficient use of waste through rigorous separated collection and reducing surplus sludge using the wastewater treatment PVA gel. In fiscal 2001, 85% of waste was put to efficient use, and all the waste-plastic incinerators on the premises ceased operating by October 31.

Programs for energy preservation include: collection and reuse of heat, reuse of wastewater, and introduction of high-efficiency electric equipment, in addition to plans to improve production process, streamline facilities, and increase facility efficiency.

### 5. Substances covered in the emission and transport volume reduction program

Substance	Emission/transport volumes (tons)		Key reduction measures
	FY01 (results)	FY05 (target)	
Acetaldehyde	0.3	0.5	(1) Introduction, remodeling and increase of condenser and absorption tower (2) Installation of emission-gas combustion equipment (3) Equipment enclosures (4) Changeovers to alternatives (5) Prevention of evaporation from storage tank
Formaldehyde	1.8	0.5	
Toluene	151.7	51.4	
Dimethylformamide	204.8	32.2	
Vinyl acetate	244.2	47.4	
Other	877.7	131.5	
Total	1,480.5	263.5	

### 6. Industrial waste

	FY01 (results)	FY05 (target)	Measures to reduce waste and put waste to efficient use
Volume generated (tons)	30,673	29,200	
Treatment method	Efficient use (tons)	25,200	(1) Strict separate collection of waste (2) Putting more incombustible waste to efficient use (3) Reducing volume of activated sludge using PVA gel (4) Greater use of outside gasification melting furnaces (Simple treatment: incineration, landfill)
	In-house simple treatment (tons)	4,000	
	Outside simple treatment (tons)	350	



## The Nakajo Plant



### 1. Profile

- (1) Address: 2, Kurashiki-machi, Nakajo-cho, Kitakambara-gun, Niigata Prefecture
- (2) Site area: 924,000m<sup>2</sup>
- (3) Employees (as of March 2002): 1,140 (Kuraray Group total)
- (4) ISO 14001: Certified on March 31, 2000  
Certification No. JQA-EM0801
- (5) Main products: Methacrylic resin and molded methacrylic resin, Poval resin, Aroma chemicals, Pharmaceutical and agrochemical intermediates

### 2. Pledges for environmental conservation

The Nakajo Plant, Kuraray's only inland plant, discharges wastewater into a river, and is located in an area where there is no other large plant but there are private homes. To achieve harmony with the local community, the Plant is systematically reducing the impact of its waste on the river and atmosphere.

### 3. State of environmental initiatives

The operation of general incinerators within the Plant has been suspended, but, thanks to greater recycling, the volume of waste processed by outside contractors has not increased. Since power boilers discharge a large volume of SO<sub>x</sub>, the Plant had considered using flue gas desulfurization equipment. However, it was decided to stop using heavy oil and start using natural gas as boiler fuel in July 2002. This should lower SO<sub>x</sub> emissions by 95%.

### 4. Model plant activities for early adoption of regulations for total mass of wastewater COD

The activated sludge treatment equipment, put into operation in December 2000, has achieved its initial goal of purifying wastewater, and has eliminated the need to use contractors for sludge processing by applying a volume-reduction technique to the treatment of the surplus sludge generated. Kuraray's PVA gel has been fed to the wastewater treatment equipment since July 2001 to test its performance.

### 5. Substances covered in the emission and transport volumes reduction program

Substance	Emission/transport volumes (tons)		Key reduction measures
	FY01 (results)	FY05 (target)	
Vinyl acetate	28.2	3.0	(1) When transferring chemicals from storage tanks to trucks and container vents, gas is recycled completely. (2) Cooling and recovery of gases discharged from storage tank vents and equipment (3) Discharged gases guided from vent to incineration equipment (flare stack, etc.) for treatment
Isoprene	13.3	1.0	
Acetaldehyde	0.4	0.5	
Methanol	427.2	98.0	
Acetone	102.7	24.0	
Other	566.7	35.0	
Total	1,138.5	161.5	

### 6. Industrial waste

	FY01 (results)	FY05 (target)	Measures to reduce waste and put waste to efficient use
Volume generated (tons)	18,957	18,690	Solidify waste by controlling pH and separating solids from liquid for use as fuel for plant boilers
Treatment method	Efficient use (tons)	15,447	
	In-house simple treatment (tons)	1,854	
	Outside simple treatment (tons)	1,656	

(Simple treatment: incineration, landfill)

## The Saijo Plant (re-established as Kuraray Saijo Co., Ltd. since April 1, 2002)



### 1. Profile

- (1) Address: 892, Tsuitachi, Saijo City, Ehime Prefecture
- (2) Site area: 667,000m<sup>2</sup>
- (3) Employees (as of March 2002): 651 (Kuraray Group total)
- (4) ISO 14001: Certified on December 15, 2000  
Certification No. JQA-EM1185
- (5) Main products: Polyester filament, Polyarylate fiber, PET resin, PVA film, "GENESTAR" (heat-resistant polyamide resin), PVA gel, Melt-blown non-woven fabrics

### 2. Pledges for environmental conservation

Kuraray Saijo aims at achieving harmony with the local community through the prevention of environmental pollution and the improvement of the environment in the surrounding areas. To this end, continued efforts are made to improve its environmental management system for the production of fibers, resin, film, non-woven fabrics, PVA gel and incidental services.

### 3. State of environmental initiatives

In fiscal 2001, the Plant succeeded in reducing the amount of waste it generated by 30% and the volume of externally-processed waste by 60%, and improved the efficient use ratio by eight points over the previous year through the promotion of reuse and recycling of waste. Continued efforts will be made into fiscal 2002 to reduce environmental impact.

### 4. Model plant activities for zero residual sludge

A demonstration run of a system for high-efficiency wastewater treatment and reduction of surplus sludge to zero is underway: aerobic wastewater treatment equipment and complete oxidization systems are being installed that employ a membrane separation method using PVA gel developed and produced at the Plant.

### 5. Substances covered in the emission and transport volumes reduction program

Substance	Emission/transport volumes (tons)		Key reduction measures
	FY01 (results)	FY05 (target)	
Acetaldehyde	0.8	0.3	(1) Discharge into waters (ammonia, etc.): installation of anaerobic wastewater treatment facility, reinforcement of integrated wastewater treatment equipment (2) Discharge into the air (acetaldehyde, etc.): change of production items
Ethylene glycol	1.1	1.4	
Tetrahydrofuran	17.1	0	
Methanol	299.5	10.7	
Ammonia	21.8	0	
Total	340.3	12.4	

### 6. Industrial waste

	FY01 (results)	FY05 (target)	Measures to reduce waste and put waste to efficient use	
Volume generated (tons)	4,906	5,795		
Treatment method	Efficient use (tons)	4,231	5,696	(1) Waste reduction: changeover to production methods generating less waste and to products with longer lifespans (2) Increasing ratio of waste put to efficient use: promotion of efficient use through solidification and volume reduction of waste and other pretreatments
	In-house simple treatment (tons)	0	0	
	Outside simple treatment (tons)	675	99	

(Simple treatment: incineration, landfill)



## Site Report

### The Kurashiki Plant (including Kurashiki Research Laboratories/Analytical Research Center)



#### 1. Profile

- (1) Address: 1621, Sakazu, Kurashiki City, Okayama Prefecture
- (2) Site area: 668,000m<sup>2</sup>
- (3) Employees (as of March 2002): 1,047 (Kuraray Group total)
- (4) ISO 14001: Certified on December 22, 2000  
Certification No. JQA-EM1213
- (5) Main products: "CLEARFIL" (dental materials), Artificial kidneys, Blood purifiers, Contact lenses, Industrial membranes

#### 2. Pledges for environmental conservation

The Kurashiki Plant is committed to making the Planet Earth a comfortable place to live and the local community affluent through conservation of the global environment in its R&D and production.

#### 3. State of environmental initiatives

The key program in fiscal 2001 was a reduction in emissions of organic chemicals. By changing production methods, ethyl acetate and toluene emissions were reduced by nearly 100%. Further reduction is planned in fiscal 2002 through installation of gasification and combustion equipment and increases in production efficiency. Furthermore, waste separation in added segments led to a 10% reduction in the volume of externally processed waste. The efficient use of waste will also be continuously sought.

#### 4. Model plant activities for positive LCA promotion

Programs in this regard include: educational activities on LCA promotion, mastery of LCA methods using model themes, and a Group-wide case study presentation convention. Greater diffusion within the company will be sought through clarification of the objectives of and need for LCA.

#### 5. Substances covered in the emission and transport volumes reduction program

Substance	Emission/transport volumes (tons)		Key reduction measures
	FY01 (results)	FY05 (target)	
Acetone	132.7	83.5	(1) For acetone: revamping absorption equipment (2) For methanol: installing flue gas combustion equipment (3) For chloroform: improving production methods (4) For DMF: improving production methods (5) For dichloromethane: improving production methods
Methanol	103.6	96.2	
Chloroform	8.5	8.0	
Dimethylformamide (DMF)	8.1	2.1	
Dichloromethane	1.0	0.5	
Other	38.7	38.8	
Total	292.6	229.1	

#### 6. Industrial waste

	FY01 (results)	FY05 (target)	Measures to reduce waste and put waste to efficient use
Volume generated (tons)	898	885	
Efficient use (tons)	371	857	
In-house simple treatment (tons)	39	0	
Outside simple treatment (tons)	488	28	

(Simple treatment: incineration, landfill)



## The Kurashiki Plant (Tamashima)



### 1. Profile

- (1) Address: 7471, Tamashima-otoshima, Kurashiki City, Okayama Prefecture
- (2) Site area: 414,000m<sup>2</sup>
- (3) Employees (as of March 2002): 262 (Kuraray Group total)
- (4) ISO 14001: Certified on December 8, 2000  
Certification No. JQA-EM1168
- (5) Main products: Polyester staple

### 2. Pledges for environmental conservation

To fulfill its responsibility to future generations, all the staff at the Plant are eagerly and continuously involved in thermal recycling and other initiatives for improving the environment.

### 3. State of environmental initiatives

In fiscal 2001, gasification and combustion equipment helped reduce acetaldehyde emissions by more than 90% over the previous year. Further reduction is aimed for in fiscal 2002 by optimizing operating conditions for the equipment.

### 4. Model plant activities for ecology-related business promotion

The Plant has promoted thermal recycling using waste plastics, etc. as fuels for special fluidized-bed combustion boilers. In fiscal 2001, efficient use of waste was given a further push by increasing the capacity for the treatment of used fiber products and waste plastics from outside. The Plant plans to accept recyclable resources in greater volume in fiscal 2002. The Plant started merchandizing the incinerator ash generated by its fluidized-bed combustion boilers to produce a soft soil improver. More applications will be developed during fiscal 2002.

### 5. Substances covered in the emission and transport volumes reduction program

Substance	Emission/transport volumes (tons)		Key reduction measures
	FY01 (results)	FY05 (target)	
Acetaldehyde	0.9	0.5	Installation of chemical adsorption equipment
Total	0.9	0.5	

### 6. Industrial waste

		FY01 (results)	FY05 (target)	Measures to reduce waste and put waste to efficient use
Volume generated (tons)		12,541	8,285	
Treatment method	Efficient use (tons)	8,896	8,281	
	In-house simple treatment (tons)	2,770	0	
	Outside simple treatment (tons)	875	4	

(Simple treatment: incineration, landfill)



# Site Report

## The Tsukuba Research Laboratories



### 1. Profile

- (1) Address: 41, Miyukigaoka, Tsukuba City, Ibaraki Prefecture
- (2) Site area: 41,000m<sup>2</sup>
- (3) Employees (as of March 2002): 79
- (4) ISO 14001: Certified on December 21, 2001  
Certification No. JQA-EM2007
- (5) Main research areas: R&D in polymer materials

### 2. Pledges for environmental conservation

Tsukuba Research Laboratories conduct a broad range of R&D in polymer materials, from synthesis to processing. Aware of the close relationship between the R&D it carries out and the global environment, the Laboratories are pursuing environmental activities under the banner of 'creating eco-friendly polymer products and technology.'

### 3. State of environmental initiatives

Preparations for ISO 14001 certification began in fiscal 2001. It was received, as planned, before the end of the year. In fiscal 2002, continued efforts will be made in accordance with environmental preservation principles, goals and targets.

### 4. Substances covered in the emission and transport volume reduction program

Substance	Emission/transport volumes (tons)		Key reduction measures
	FY01 (results)	FY05 (target)	
Methanol	1.8	0.5	Identification of high-emission producing operations, study and implementation of concrete measures to reduce consumption
Toluene	1.5	0.5	
Acetone	0.9	0.5	
Total	4.2	1.5	

### 5. Industrial waste

	FY01 (results)	FY05 (target)	Measures to reduce waste and put waste to efficient use
Volume generated (tons)	66	60	Promoting efficient use through more rigorous separation of waste
Treatment method			
Efficient use (tons)	34	45	
In-house simple treatment (tons)	3	0	
Outside simple treatment (tons)	29	15	

(Simple treatment: incineration, landfill)

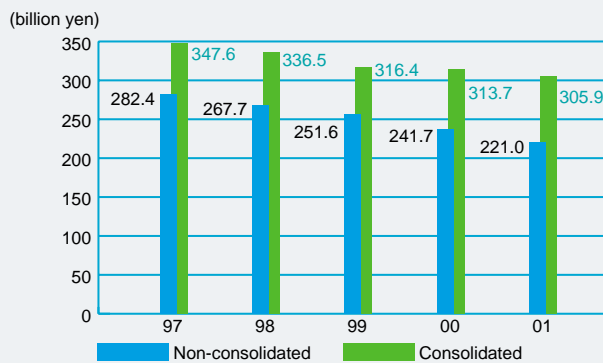


## Corporate Data

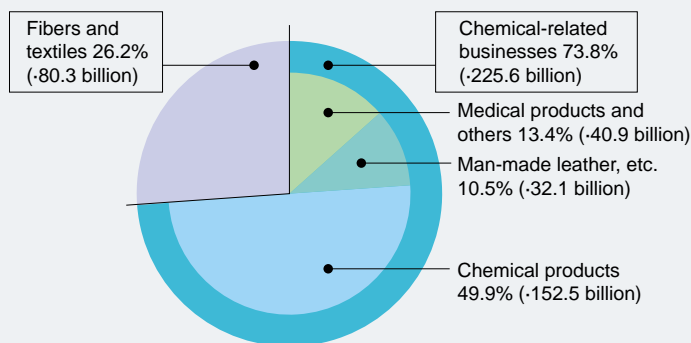
### Corporate Data

Company name	Kuraray Co., Ltd.
Established	June 24, 1926
Capital	89.0 billion yen (as of March 31, 2002)
Employees (consolidated)	7,115 (as of March 31, 2002)
Consolidated sales	305.9 billion yen (fiscal 2001)
Principal products	Functional resins, Fine chemicals, Man-made leather, Medical products, Synthetic fibers

### Sales



### Segment Sales (consolidated)



### Scope of This Report

Kuraray Co., Ltd.

- ■ Kuraray Engineering Co., Ltd.
- Kuraray Chemical Co., Ltd.
- Kuraray Trading Co., Ltd.
- Kuraray Plastics Co., Ltd.
- Kuraray Fudosan Co., Ltd.
- Kuraray Living Co., Ltd.
- Kuraray Techno Co., Ltd.
- Techno Soft Co., Ltd.
- Kuraray Interior Co., Ltd.
- ■ Kuraray Saijo Kiko Co., Ltd.
- Reihoku Textile Co., Ltd.
- ■ Kuraray Niigata Kasei Co., Ltd.
- ■ Kyosei Chemical Co., Ltd.
- ■ Kuraray Medical Inc.
- ■ Kuraray Saijo Co., Ltd.
- ■ Kuraray Techno Nakajo Co., Ltd.
- ■ Kuraray Techno Kashima Co., Ltd.
- ■ Kuraray Techno Okayama Co., Ltd.
- ■ Kuraray Techno Kurashiki Co., Ltd.
- ■ Kuraray Techno Saijo Co., Ltd.
- ■ Saijo Textured Yarn Co., Ltd.
- ■ Kuraray Okayama Spinning Co., Ltd.
- Magictape Co., Ltd.
- ■ Kuraflex Co., Ltd.
- ■ Nihonkai Acetylene Co., Ltd.

■ Consolidated subsidiaries

■ Equity-method subsidiaries

As of March 31, 2002, 39 subsidiaries are consolidated and 13 are equity-method based.

● Data on companies marked with a Red Circle is aggregated into Kuraray's data.



## KURARAY CO., LTD.

Shin-Hankyu Bldg., 1-12-39, Umeda, Kita-ku, Osaka 530-8611  
Kuraray Nihonbashi Bldg., 3-1-6, Nihonbashi, Chuo-ku, Tokyo 103-8254

Environmental, Industrial Safety and Quality Management Center

Tel: 81-6-6348-2812 Fax: 81-6-6348-2683

Corporate Communications Department

Tel: 81-3-3277-3360 Fax: 81-3-3277-3384

E-mail : [koho@kuraray.co.jp](mailto:koho@kuraray.co.jp)

URL : <http://www.kuraray.co.jp>



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