

> Sustainability Report 2004  
**DATA BOOK**

## Cosmo Oil Group Sustainability Report 2004

# D A T A B O O K

<b>Cosmo Oil Group Corporate Activity Guideline</b>	2
<b>History</b>	3
<b>Quality Improvement of Petroleum Products</b>	5
<b>Environmentally Friendly Technology and Products</b>	7
<b>Environmental Performance</b>	9
<b>Environmental Accounting</b>	13
<b>Social Performance</b>	17
<b>Site Data</b>	19
<b>Chiba Refinery</b>	19
<b>Yokkaichi Refinery</b>	21
<b>Sakai Refinery</b>	23
<b>Sakaide Refinery</b>	25
<b>Cosmo Matsuyama Oil Co., Ltd.</b>	27
<b>Cosmo Oil Co., Ltd. Research &amp; Development Center</b>	29
<b>Cosmo Oil Lubricants Co., Ltd./Cosmo Oil Co., Ltd. Head Office and Branches</b>	30
<b>Vis-a-vis Guidelines</b>	31
<b>Glossary</b>	33

### ➤ Scope of this report

- This Data Book has been prepared in order to provide the reader with a deeper understanding of the contents of the Cosmo Oil Group Sustainability Report 2004. The scope of the Report is the Cosmo Oil Group. Please see page 1 of the Report proper for the scope of the Group.
- The environmental, social and economic performance indicators and environmental accounting indicators have been independently reviewed by AZSA Sustainability Co., Ltd. Independent review by AZSA Sustainability is available on p. 52 of the Report.

# Cosmo Oil Group Corporate Activity Guidelines

In carrying on its business activities, the Cosmo Oil Group is striving for harmonious symbiosis of the earth, human beings and society, and aiming at sustainable development for a future expansion growth without limit (for our vision, please see p. 3 of the Report). The Cosmo Oil Group Corporate Activity Guideline consolidates the promises of the Group's officers and employees not just to comply with the law, but also to act fairly and honestly as members of society when carrying on the Group's business. Established as the central pillar of the Group's ethical standards/codes, these guidelines

must be followed not only by officers and employees, but also by clerical assistants, temporary and part-time staff. The Cosmo Oil Group Corporate Ethics Committee was established in order to promote, implement and audit these guidelines, and is committed to establishing and putting into practice the group's corporate ethics.

The contents of the guidelines, together with the main relevant laws and regulations and internal standards/codes are as follows. For more detail, please see our home page at: <http://www.cosmo-oil.co.jp/company/corpo/guideline.html>

## ➤ Chapter 1: Relation with consumer/user

- **Development and providing with good quality product and service**
- **Quality maintenance of product and safety securing**  
Related law: Product liability law  
Related regulations: Quality assurance provision, quality claim management regulations, and product liability law (Product Liability Law) guides
- **Proper dealings with consumer**  
Related law: Law for Preventing Unjustifiable Extra or Unexpected Benefit and Misleading Representation and consumer contracts law  
Related regulations: Law for Preventing Unjustifiable Extra or Unexpected Benefit and Misleading Representation compliance manual
- **Customer information management**  
Related law: Act for Protection of Computer Processed Personal Data held by Administrative Organs  
Related regulations: Information management regulations

## ➤ Chapter 2: Relation with customers and the profession

- **Relation with special agent and cooperation company**
- **Compliance of Antimonopoly Law**  
Related law: Antimonopoly Law  
Related regulations: Antimonopoly Law compliance manual
- **Proper dealings with purchase destination**  
Related law: Antimonopoly Law and the Subcontracting Law  
Related regulations: Antimonopoly Law compliance manual and purchase business management regulations
- **Respect for others' confidential information and intellectual property right**  
Related law: Unfair Competition Prevention Law, Copyright Law, Patent Law, and Trademark Law
- **Entertainment and exchange gifts**

## ➤ Chapter 3: Relation with stockholder and investor

- **Disclosing of corporate information**
- **Prohibition of insider dealings**  
Related law: Securities and Exchange Law  
Related regulations: Insider dealings prevention regulations
- **Prohibition of payoff**  
Related law: Commercial Code

## ➤ Chapter 4: Relation to the society

- **Development of local society**
- **Safety operation**  
Related regulations: Safety environmental protection regulations and integrated safety task force regulations
- **Environmental preservation activity**  
Related regulations: Safety environmental protection regulations and global environment committee regulations
- **Social contribution activity**
- **Information disclosure**
- **Security export management**  
Related law: Foreign exchange and foreign trade law  
Related regulations: Security export management regulations
- **Relation rupture from anti-social power and group**  
Related law: Anti-Gangs Measures Law
- **Activity in foreign countries**
- **Human rights respect**

## ➤ Chapter 5: Relation with politics and the administration

- **Construction of healthy, normal relation**  
Related law: Ethics-in-government law
- **Compliance of political donation restriction**
- **Bribery prohibition**  
Related laws: Bribery charge and Unfair Competition Prevention Law (Bribery prevention agreement to foreign civil servant)

## ➤ Chapter 6: Relation with the employee

- **Human rights respect and discrimination prohibitions**
- **Respect for freedom of association and the right to collective bargaining**
- **Forced labor/Child labor prohibitions**
- **Compliance of law related to labor**
- **Achievement of workplace environment where they can work safely and comfortably**
- **Respect for individuality**

## ➤ Chapter 7: Relation with company and company property

- **Proper accounting treatment**  
Related regulations: Accounting regulations
- **Appropriate management and use of company property**
- **Protection of intellectual property right**
- **Management of trade secret**  
Related regulations: Information management regulations
- **Appropriate management and use of information system**  
Related regulations: Information system management regulations
- **Evasion of conflict of interests**

## Environmental Activities — Milestones

FY	The Cosmo Oil Group
1986	<ul style="list-style-type: none"> <li>• Cosmo Oil Co., Ltd. established</li> <li>• <i>Regulations on Environment and Safety Management</i> and <i>Regulations for the on Comprehensive Safety Action Headquarters</i> enacted</li> </ul>
1987	<ul style="list-style-type: none"> <li>• FCC exhaust gas desulfurization unit at Sakai Refinery completed</li> </ul>
1989	
1990	<ul style="list-style-type: none"> <li>• Cogeneration facilities at Yokkaichi Refinery completed</li> </ul>
1991	<ul style="list-style-type: none"> <li>• The Cosmo Oil Group dispatches oil spill prevention expert team to the Persian Gulf</li> </ul>
1992	<ul style="list-style-type: none"> <li>• Atmospheric distillation flue gas denitrification unit installed at Sakai Refinery</li> </ul>
1993	<ul style="list-style-type: none"> <li>• The Cosmo Oil Group's <i>Global Environment Action Program</i> submitted to Japan Ministry of International Trade and Industry</li> <li>• Establishes Global Environment Committee, adopts committee regulations</li> </ul>
1994	<ul style="list-style-type: none"> <li>• First annual Global Environment Committee meeting held, eight subcommittees created</li> <li>• Starts setting environmental targets annually, based on "Global Environmental Initiatives" document</li> <li>• Diesel fuel desulfurization unit at Chiba Refinery completed</li> </ul>
1995	<ul style="list-style-type: none"> <li>• Cogeneration facilities at Sakai Refinery completed</li> <li>• Sakai Refinery receives National Resources and Energy Agency's Director-General's Award for excellence in industrial energy management</li> </ul>
1996	<ul style="list-style-type: none"> <li>• Environmental Action Plan Follow-Up Report submitted to Ministry of International Trade and Industry</li> <li>• Cogeneration facilities at Chiba Refinery completed</li> <li>• Diesel fuel deep desulfurization unit at Sakai Refinery completed</li> </ul>
1997	<ul style="list-style-type: none"> <li>• Establishes Nakhodka Oil Spill Support Team in response to major oil spill on the coast of the Sea of Japan caused by Russian tanker Nakhodka</li> <li>• Sakaide Refinery obtains ISO14001 certification</li> <li>• Environmental impact assessments begin at Cosmo Oil's Yokkaichi Kasumi Electric Power Plant (IPP)</li> <li>• Sakaide Refinery receives Energy Conservation Center's Chairman's Prize</li> </ul>
1998	<ul style="list-style-type: none"> <li>• Introduces double-hulled tankers on regular routes</li> <li>• Chiba, Yokkaichi, and Sakai refineries and Cosmo Matsuyama Oil Co. obtain ISO 14001 certification</li> <li>• Gasoline benzene reduction unit completed</li> <li>• No. 2 atmospheric distillation flue gas denitrification unit completed at Chiba Refinery</li> </ul>
1999	<ul style="list-style-type: none"> <li>• Sales launch of "Terra Series" biodegradable lubricating oil</li> <li>• Sales launch of "Shinsei" chlorine-free diesel engine oil</li> </ul>
2000	<ul style="list-style-type: none"> <li>• Sakaide Refinery receives National Resources and Energy Agency's Director-General's Award</li> <li>• Cosmo Customer Center opened</li> <li>• The Cosmo Oil Group "Industrial Waste Management Regulations" established</li> </ul>
2001	<ul style="list-style-type: none"> <li>• Cosmo Oil Environmental Report 2001 published</li> <li>• Chiba Refinery receives commendation from Minister of Health, Labour and Welfare</li> <li>• Receives the Award for Excellent Companies in the 11th Grand Prize for the Global Environment Award</li> <li>• Yokkaichi Refinery receives Fire Defense Agency's Director-General's Award at Convention on Hazardous Materials</li> </ul>
2002	<ul style="list-style-type: none"> <li>• Cosmo The Card (Eco) issued</li> <li>• Awarded the 5th Prize for Excellence in Environmental Reporting (jointly hosted by TOYO KEIZAI INC. and the Green Reporting Forum)</li> <li>• Commence sales of diesel with sulfur content of 50ppm</li> <li>• Succeed in development of production of liquid fuel from natural gas (GTL)</li> </ul>
2003	<ul style="list-style-type: none"> <li>• Succeed in reduction of volume of excess sludge generated by refinery</li> <li>• Yokkaichi Refinery 2nd cogeneration plant comes into operation</li> <li>• Cosmo Oil Yokkaichi Kasumi Power Plant opens for IPP business (wholesale supply of electric power)</li> <li>• Succeed in production of hydrogen for fuel cell cars using GTL</li> </ul>

## Japan and the world • Oil industry

- Completes unleading of premium gasoline
  - Provisional Measures Law Relating to Imports of Specified Oil Products comes into effect
- 
- Montreal Protocol (of the international Convention for the Protection of the Ozone Layer) adopted
- Exxon Valdez runs aground, causes huge oil spill off the coast of Alaska
- Gulf Crisis began • Massive oil spills in the Persian Gulf
- Keidanren adopts “Keidanren Global Environmental Charter”
- Sulfur content in diesel reduced to less than 0.2%
  - United Nations Framework Convention on Climate Change adopted • United Nations Conference on the Environment and Development (Earth Summit)
  - Japan’s Ministry of International Trade and Industry requests companies to prepare Voluntary Environmental Plans
- Japan’s Basic Environment Law enacted
- United Nations Framework Convention on Climate Change (UNFCCC) enters into force
  - Cabinet decision approves Japan’s Basic Environment Plan
- First Session of the Conference of the Parties (COP1) to the UNFCCC (Berlin)
  - The Great Hanshin-Awaji Earthquake
- Petroleum Association of Japan (PAJ) formulates Voluntary Plan for Control of Hazardous Air Pollution Substances
  - Benzene content in gasoline reduced to less than 5 vol % • Provisional Measures Law Relating to Imports of Specified Oil Products abolished
  - ISO 14001 (international standard for environmental management systems) created • COP2 of the UNFCCC (Geneva)
  - Japan’s Law on the Quality Control of Gasoline and Other Fuels enters into force • Keidanren Appeal on Environment is formulated (Declaration on Voluntary Action of Japanese Industry Directed at Conservation of Global Environment in the 21st Century)
- Sulfur content in diesel reduced to less than 0.05%
  - PAJ formulates Oil Industry Voluntary Plan of Conduct for Environmental Conservation
  - Nakhodka oil spill • Amendment of Law concerning the Rational Use of Energy • Amendment of Waste Disposal and Public Cleansing Law
  - Environmental Impact Assessment Law enacted, followed by amendment of Electric Utilities Industry Law • COP3 of the UNFCCC (Kyoto)
- Lifting on the ban on self-service service stations
  - Law Concerning the Promotion of Measures to Cope with Global Warming enacted
  - Cabinet decision adopts national Guideline of Measures to Prevent Global Warming
  - COP4 of the UNFCCC (Buenos Aires)
- First Follow-up of Keidanren Voluntary Action Plan on the Environment • PRTR Law (on pollutant release and transfer registers) promulgated
  - Law Concerning Special Measures against Dioxins promulgated • COP5 of the UNFCCC (Bonn)
- Benzene content in gasoline reduced to less than 1 vol %
  - COP6 of the UNFCCC (the Hague) • Basic Law for Establishing a Recycling-Based Society is promulgated in Japan
  - Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities is promulgated
  - Waste Disposal and Public Cleansing Law is amended
- Maximum summer gasoline vapor pressure reduced to 72kPa
  - COP7 of the UNFCCC (Marrakech)
  - Law Concerning Special Measures against PCB Waste is promulgated
  - Central Environment Council (Japan’s top government advisory body on the environment) issues recommendation on soil conservation methods
- Framework Convention on Climate Change COP8 held in New Delhi
  - Soil Contamination Countermeasures Law comes into effect • Energy Saving Law amended
  - Automobile Recycling Law comes into partial effect
  - Japanese government ratifies Kyoto Protocol • Iraq war
- Ministry of the Environment establishes Business Practice Research Council Relating to Trading of Emission Volumes of Greenhouse Gases
  - Partial amendment of Permitted Limits on Characteristics of Automobile Fuel and Permitted Limits on Volumes of Substances Included in Automobile Fuel
  - Framework Convention on Climate Change COP9 held in Milan
  - Ministry of the Environment prepares Low Pollution Car Guidebook 2003

## Improving quality for the sake of reducing the environmental impact

The biggest impact on the environment during the lifecycle of petroleum products is generated at the time of use of the products. In order to prevent air pollution due to SO<sub>x</sub> in urban areas during the 1960s, the oil industry invested heavily in desulfurization units and so forth in an effort to reduce such environmental impact.

Furthermore in response to community demand, the industry has also been grappling with the problem of reducing the im-

pact of gasoline and diesel air pollution arising on account of the rapid growth of motorization since the 1970s.

As we move into the future, the industry is also committed to raising the quality of petroleum products for the sake of conserving the air that surrounds us.

### ➤ Reducing the environmental impact of gasoline

In order to reduce the environmental impact of gasoline, the Japanese oil industry has promoted measures for no lead, low benzene and low sulfur, as follows:

#### Reduction of lead and benzene, which could harm the body

- Regular gasoline become unleaded in 1975, and premium in 1986.
- In January 2000, the maximum permitted volume of benzene in gasoline was reduced from 5% to 1%.

#### Reduction of evaporation gas, cause of photochemical smog

In 2001 the maximum permitted summer vapor pressure of gasoline was reduced from 78Pa to 72Pa, and is planned to be further reduced to 65Pa in 2005.

#### Reduction of sulfur content of gasoline

- At the same time as reducing atmospheric pollution, lowering sulfur content maximizes the effectiveness of an automobile's exhaust gas cleaning system.
- Until the end of 2004, by law the sulfur content of gasoline was limited to 50ppm, but the results for Cosmo Oil for FY 2003 were 31ppm (average) for regular and 5ppm (average) for premium.

### ■ History of Improvement of Gasoline Quality by the Japanese Oil Industry

1950	Commencement of production of gasoline
1970	The Shinjuku (Ushigome Yanagicho) lead pollution case
1975	Regular gasoline becomes lead-free
1986	Premium gasoline becomes lead-free
1987	Sales of 100-octane premium gasoline
1996	Amendment of JIS Maximum benzene reduced to 5 vol%, and sulfur to 100ppm
2000	Benzene limited to 1vol%

### ➤ Reduction of environmental impact of diesel fuel (reduction of sulfur content)

The Japanese oil industry has been striving as described below to lower sulfur content in order to reduce the environmental impact of diesel fuel.

#### Sulfur content: from 5,000ppm to 500ppm

- In line with the strengthening of exhaust gas restrictions in the 1990s, the maximum limit on sulfur content, which had been 5,000ppm, was lowered to 2,000ppm in 1992, and then to 500ppm in 1997.
- This reduction of sulfur content in diesel fuel was necessary in order to enable the smooth functioning of EGR (exhaust gas recycling) and exhaust gas cleaning systems using oxidizing catalysts, which were required in order to reduce the volume of NO<sub>x</sub> and PM (particulate matter) emitted by diesel vehicles.

#### Sulfur content: from 500ppm to 50ppm

- Having regard to the 2005 automobile exhaust limits, the installation of aftertreatment equipment such as DPF (diesel particulate filters) is becoming necessary, and it has been determined by central government regulation that by the end of 2004 the limit on sulfur content will be reduced from 500ppm to 50ppm.
- In response we have taken the voluntary action of commencing sales of 50ppm diesel from October 2002 in a number of areas, and from April 2003 nationwide (excepting Okinawa and outlying islands).

## when petroleum products are used.

### ➤ Making gasoline and diesel fuel sulfur-free

Cosmo Oil is pushing forward its preparations aimed at commencing supply of sulfur-free (sulfur content not exceeding 10ppm) gasoline and diesel fuel in 2005. Sulfur-free gasoline and diesel fuel not only decrease air pollution but also, because they can be used in the latest environmentally friendly cars, increase fuel economy and reduce CO<sub>2</sub>.

#### Cutting CO<sub>2</sub> by using sulfur-free gasoline

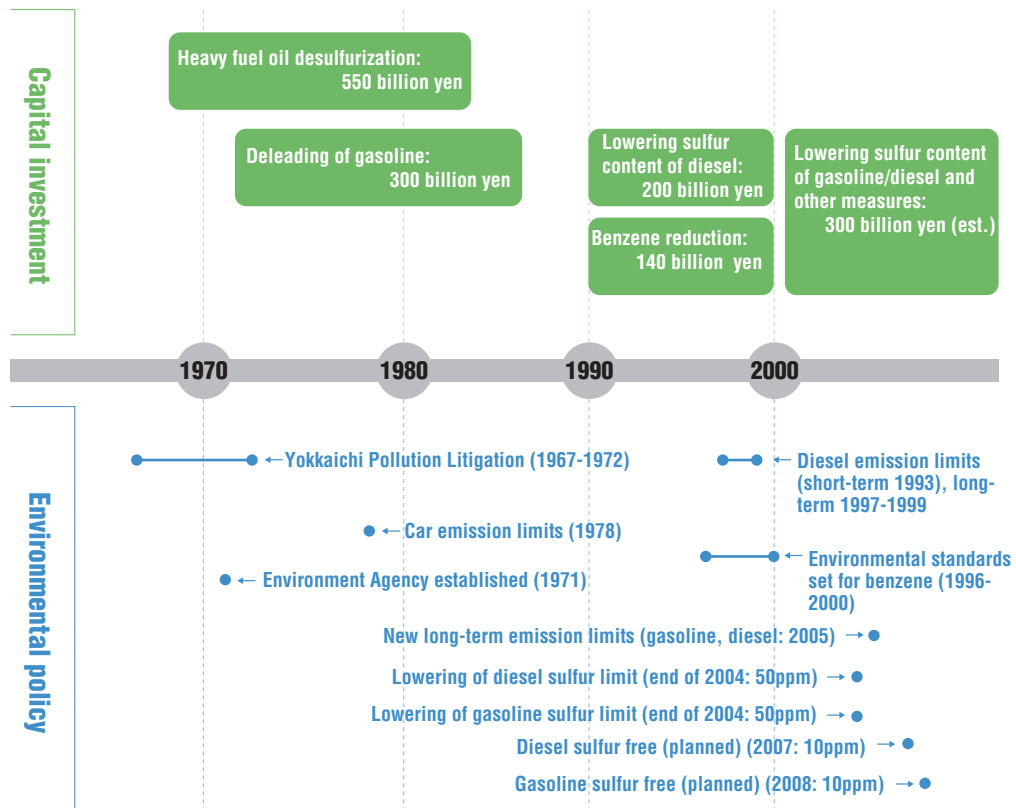
- An occlusion-type NO<sub>x</sub> reducing catalyst fitted in a lean-fuel burning engine such as a direct fuel injection engine or lean-burn engine, which is one type of technology for improving fuel economy, is liable to be poisoned by sulfur.
- If the sulfur content of the gasoline is lowered, the sulfur poisoning of the NO<sub>x</sub> reducing catalyst is suppressed, it becomes possible to expand the scope of the operation of the lean fuel combustion, and an improvement in the fuel economy of vehicles fitted with lean-burn engines can be anticipated.

#### Reducing NO<sub>x</sub> by using sulfur-free diesel fuel

- Since there are limits on what can be done in order to substantially reduce the NO<sub>x</sub> emissions by a diesel vehicle solely by improving the combustion control, it is essential to introduce an aftertreatment unit to process the reduction of NO<sub>x</sub>.
- Currently the car industry is pushing forward with development of such an aftertreatment unit, with the occlusion type NO<sub>x</sub> reducing catalyst being seen as hopeful.
- When the sulfur content of the diesel fuel is of the order of 50ppm, these technologies cannot demonstrate their full functions on account of poisoning of the catalyst, etc., and accordingly it is necessary to lower the sulfur content of diesel fuel further.

### ■ Environmental policy and capital investment (whole of Japanese oil industry)

Source: Petroleum Association of Japan



# Cosmo Oil Group environmental technology and products

## Automotive oil products (Cosmo Oil Lubricants Co.)



Cosmo LIO SL series



Kaisei

Oils for gasoline engines "Cosmo LIO SL(\*1) series"

Oil for diesel engines "Shinsei"

Eco Diesel "Kaisei"

Oil for natural gas engines "Cosmo CNG Oil"

## Oil products for other uses (Cosmo Oil Lubricants Co.)



Cosmo Underroll series

Biodegradable lubricants "Cosmo Terra series"

Hydraulic oil "Cosmo Super Epoch UF46"

Metal cutting oil "Cosmo Clean Cut Cool series"

Lubricating oil for food and drug processing machinery "Cosmo Underroll Series"

## Coating agents (Cosmo Trade & Service Co.)

Heat insulation coatings "Super Therm"

Concrete protector and strengthener "Ashford Formula"

## Plant facilities



Hydrocarbon vapor recovery unit



Chemical-free boiler water production unit



Excess sludge reduction unit

Hydrocarbon vapor recovery unit (Cosmo Engineering Co.)

Volatile organic compound (VOC) recovery unit (Cosmo Engineering Co.)

Chemical-free boiler water production unit\* (Cosmo Engineering Co.)

Excess sludge reduction unit (Cosmo Engineering)

Dioxin removal unit for wastewater (Cosmo Engineering Co.)

Wastewater treatment technology (Cosmo Engineering Co.)

Wastewater treatment system "Bioflora 01" (Cosmo Eco Support)

Benzene utilization (Cosmo Matsuyama Oil Co.)



Bioflora 01 unit



Aromatics extraction unit

## Natural gas fuels (Cosmo Oil Gas)

ECOWILL  
home-use LP gas engine/  
cogeneration system



Liquefied Petroleum Gas

LP gas engine cogeneration system for home use (ECOWILL)(\*3)

## Others (Cosmo Matsuyama Oil Co.)

Base material for neutrino detector, "Pseudocumene"



- \*1 SL: Refers to an international standard prescribed by the API (American Petroleum Institute).
- \*2 DPF: Refers to Diesel Particulate Filter, which removes soot from the exhaust of diesel cars.
- \*3 ECOWILL: is a brand name owned by the 3 city gas companies, used by Cosmo Oil Gas with the permission of Osaka Gas. The equipment is made by Honda Motor Co., Ltd.

These oils keep the engine clean, increase heat resistance, and reduce fuel consumption. They also help reduce engine oil consumption.

Chlorine content is one-tenth that of conventional oils. Extends engine life and mileage between oil changes.

For use in engines with DPF(\*2), this diesel engine oil increases heat resistance and reduces wear.

Special oil for natural gas and LP gas engines, with increased heat resistance, high-temperature detergency and lower wear. Extends engine life and mileage between oil changes.

This lubricating oil, which can be decomposed by microorganisms into carbon dioxide and water, has been certified as an Eco Mark (JEA: Japan Environment Association) product. Having a wide range of applications, including port industry equipment, construction and agricultural equipment, railway cars, outboard motors, chainsaws, and others.

This non-zinc group, high flash point, low wear hydraulic oil conserves electric power and reduces waste material generation (extended life).

This metal cutting oil is chlorine-free. Helps solve problems associated with chlorine in waste oil disposal and cleaning processes.

This lubricating oil meets the requirement of USDA/NSF H1. Has been used extensively at HACCP-certified food and medical product factories around the U.S., Europe and Japan.

A heat-insulating coating material first developed by NASA. We are developing a broad range of applications including insulation for railway cars, buses and trucks in addition to roofing and piping.

This product extends the life of concrete floors and suppresses concrete dust. Has applications at distribution centers, home improvement centers, and factories, etc. Imported from the U.S.

A unit for recovering hydrocarbon vapors from gasoline, etc., using our unique "Cosmo adsorption method." Now used at petroleum facilities not only of Cosmo Oil Group but also of other companies.

Recovery unit using the same technology as vapor recovery unit. Praised for its high recovery rate, space-saving size, and high level of safety, it is widely used in chemical, printing, and pharmaceutical industries.

Eliminates chemicals added to boiler supply water and cuts volume of blow\* water. This enables a matching reduction in fuel use, and contributes to prevention of global warming.

When installed in addition to the existing activated sludge unit, this unit reduces generation of excess sludge. By reducing excess sludge, which formerly was processed as industrial waste, by 90%, this contributes to the reduction of the volume of garbage.

Uses our own independently developed activated carbon for the treatment of wastewater contaminated with dioxins. Helps remove dioxins in wastewater from final treatment facilities and in the discharge from the dismantling of incinerators.

A technology that combines a high-efficiency activated sludge unit, denitrification and phosphorus removal units. It is being used for advanced treatment of effluent from not only oil refineries, but also pig farms and other facilities.

Using microorganisms, this product decomposes oil and organic materials in wastewater into water and carbon dioxide. No chemicals or filtration films are necessary.

Takes benzene generated from the benzene separation process at oil refineries and uses it as an ingredient for upgrading chemical products by processing it with equipment such as aromatics extractors.

Cosmo Oil Gas supplies LP gas, a clean energy that has low environmental impacts similar to natural gas. Also is working to boost demand for LPG by promoting advanced LPG -powered cars, basic LPG fueling stations, and LPG cogeneration for houses. We will work on other clean energies such as LNG and DME, promoting a stable supply of gas energies in harmony with the environment.

ECOWILL is generated using clean LP gas and the heat produced upon generation is used for water and room heating. Primary energy consumption is cut by 20%, and there is also a cut by some 30% of CO<sub>2</sub>, which is a cause of climate change. With an energy use rate of 85%, twice the energy efficiency of current electrical supply systems is achieved. In 2004 monitored sales were commenced in LP gas exclusive distributors, using as the showpiece the product's contribution to environmental conservation.

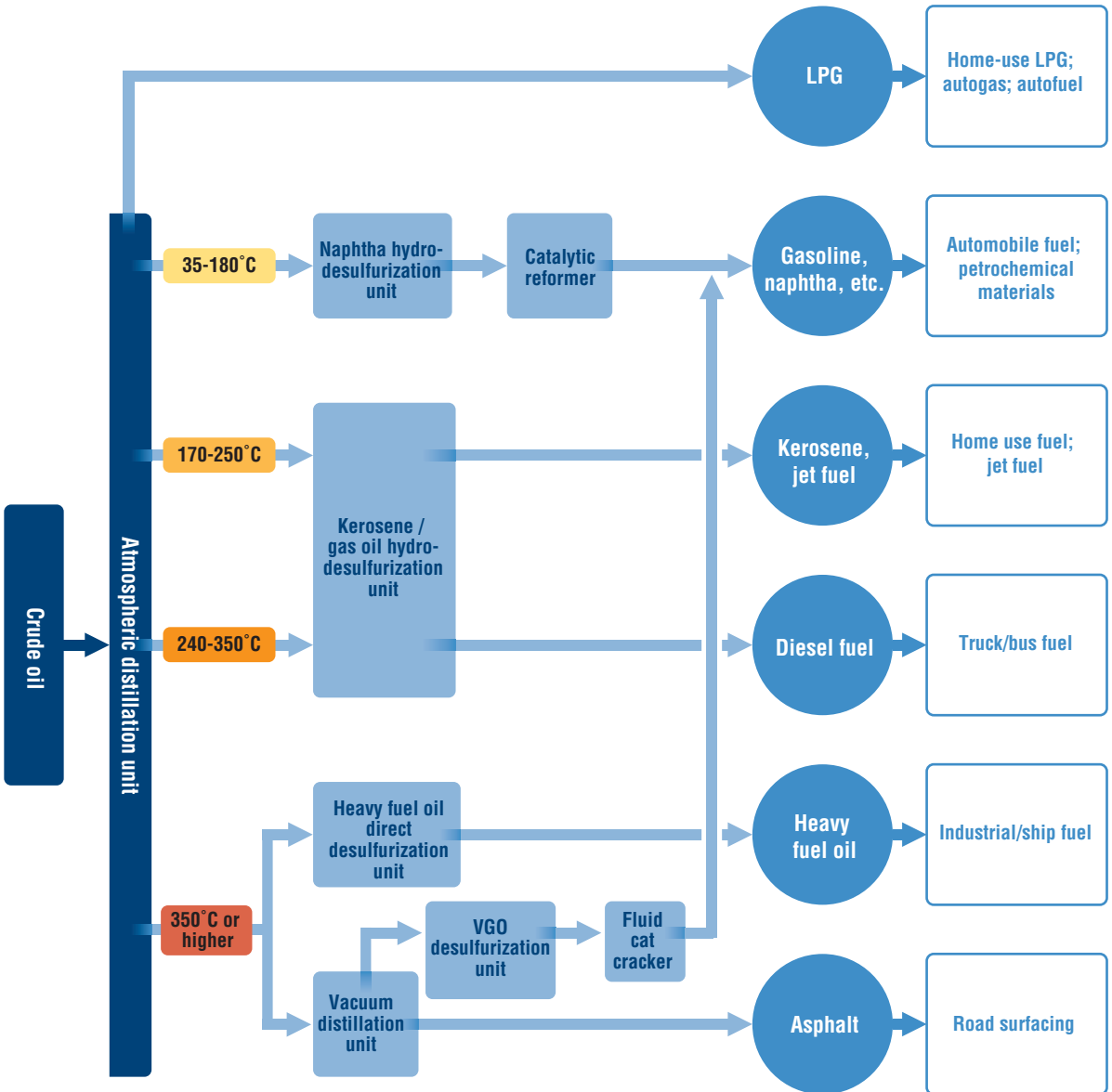
This product is used as a base material in a new method of neutrino detection at Kam LAND, a neutrino detection facility for a research project organized by Tohoku University.

# Production flow of petroleum products

Various petroleum products are produced when crude oil is refined in a refinery. Crude oil is a blend of hydrocarbons having a wide range of boiling points. Middle East oil, on which Japan is greatly dependent, has a high sulfur content.

In the refinery, crude is distilled in an atmospheric pressure distillation unit and separated into gas, naphtha, kerosene, diesel fuel and heavy fuel oil fractions. LP gas is produced from the gas fraction. After hydro-desulfurization, the naphtha fraction is processed by a catalytic reformer and converted into gasoline, etc., and the kerosene and diesel fuel fractions are processed into kerosene and die-

sel fuel. After hydro-desulfurization in a heavy fuel oil direct desulfurization unit, the heavy fuel oil fraction is extracted as heavy fuel oil, or is separated using a vacuum pressure distillation unit, with the light fraction being converted to gasoline by hydro-desulfurization in a VGO desulfurization unit and processing in a fluid cat cracker, and the heavy fraction being converted to asphalt. These processes in a refinery impact the environment in the form of atmospheric pollution, water contamination and waste materials, etc., but we take various actions to reduce these impacts.

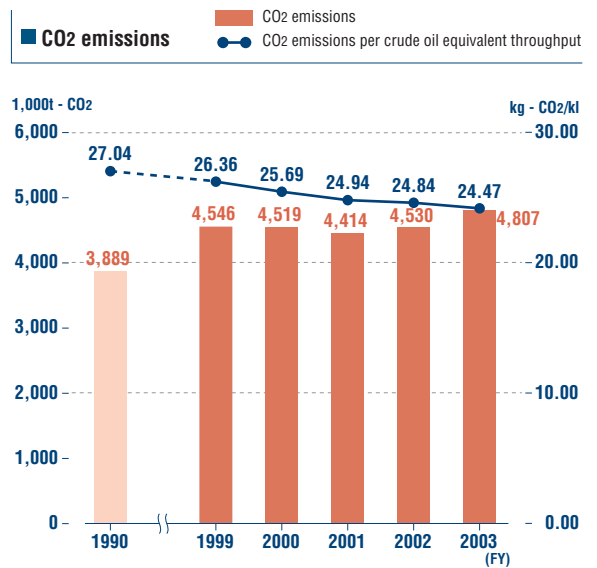
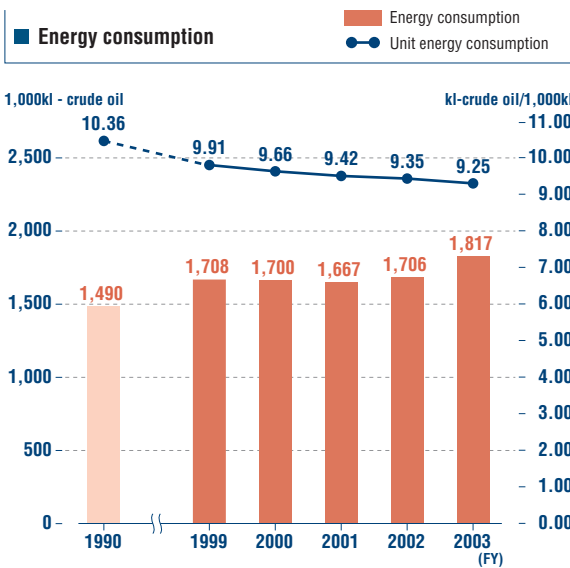


Notes:  
 • VGO stands for Vacuum Gas Oil.  
 • Environmental performance data (p 9-12) relates mainly to Cosmo Oil's 4 refineries and some of its offices.

# Prevention of climate change

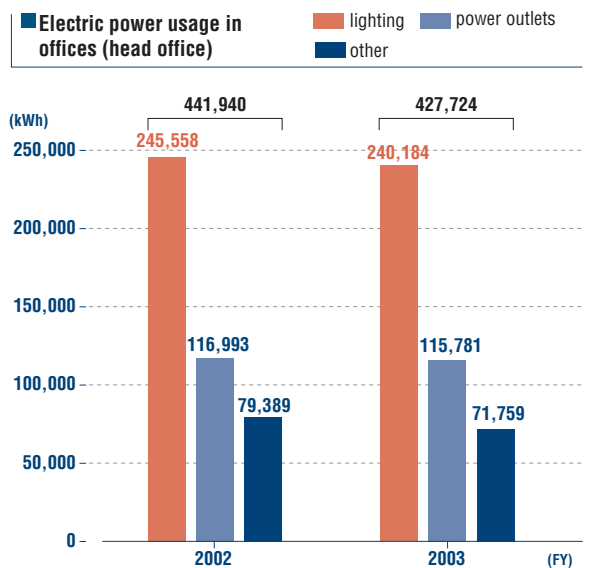
## Refineries

In our refineries, we strive to conserve energy by introducing high-efficiency equipment, reinforcing operating controls, etc. As a result of these efforts, the unit energy consumption load for FY 2003 (9.25kl of crude oil/thousand kl) was 10.7% down from the 1990 figure, above the target reduction (8.3%).



## Offices

At our head office we have implemented energy conservation activities such as having separate air conditioning on each floor, the no-necktie movement and dimming lights at lunchtime. Consequently electric power usage by our head office in FY 2003 was 428,000kWh, down 3.2% from 2002. In FY 2004, with the goal "5% less than 2003" we are surveying each of our workplaces and striving for further energy conservation.



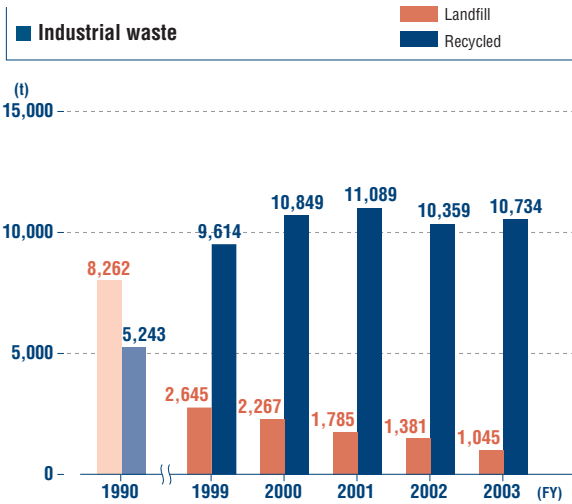
# Reduction of industrial waste

## Refineries

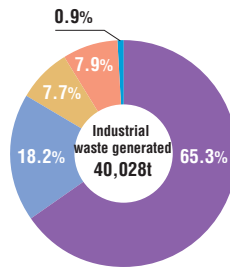
Our refineries are endeavoring to reduce the final disposal (landfill) amount of industrial waste arising from the oil refinery process. Our efforts include reduction of the volume of waste generated, and separation of the waste that does arise. We also choose waste disposal methods that are conducive to

recycling.

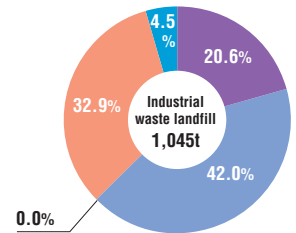
As a result of these efforts, the total amount of final disposal from all of our four oil refineries for FY 2003 was 1,045 tons, an 87.4% reduction from the 1990 level, over the target of an 81% reduction for the second year in a row.



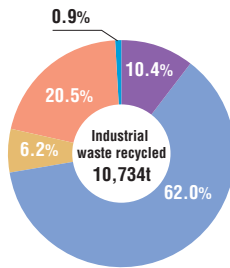
Breakdown of industrial waste generated in FY2003



Breakdown of industrial waste landfill in FY2003



Breakdown of industrial waste recycled in FY2003



Generation:	40,028t	100.0%
Reduction:	28,249t	70.6%
Recycled:	10,734t	26.8%
Landfill:	1,045t	2.6%

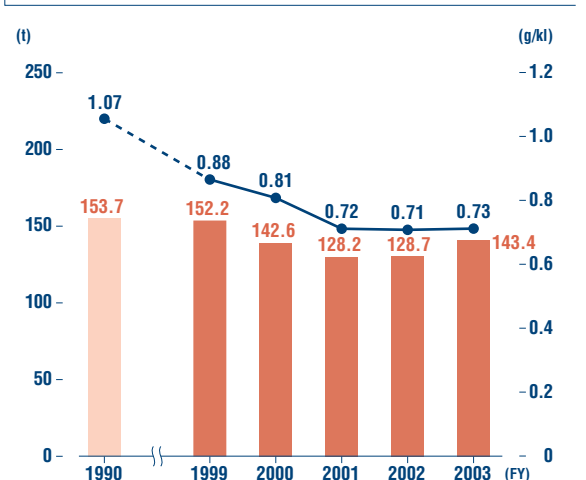
# Prevention of water pollution

A large volume of seawater or industrial water is used in the oil refining process at our oil refineries, mainly for cooling, and also for cleaning and boilers.

As oil content, etc may mix into wastewater that was used in the cleaning process in oil refining, we endeavor to prevent water pollution by removing oil content using an oil-water separation unit and other appropriate treatment such as activated sludge process treatment, before the water is released.

As a result of these efforts, all of our refineries' wastewater levels are under the limits set by their respective regions.

COD discharge



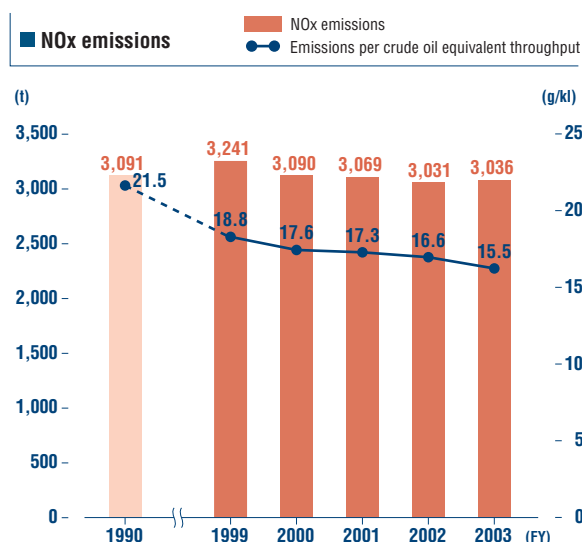
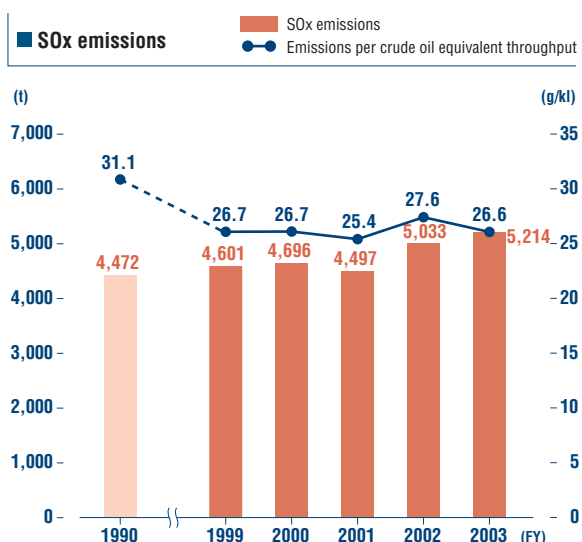
# Prevention of air pollution

## SOx (Sulfur Oxides) and NOx (Nitrogen Oxides)

The refining process involves emissions, such as SOx and NOx from heating furnaces and boilers.

Our refineries are endeavoring to choose fuels with lower sulfur and nitrogen levels for heating furnaces and boilers. We introduce low NOx burners to reduce the generation of thermal NOx, a substance generated when nitrogen reacts with oxygen at combustion. We al-

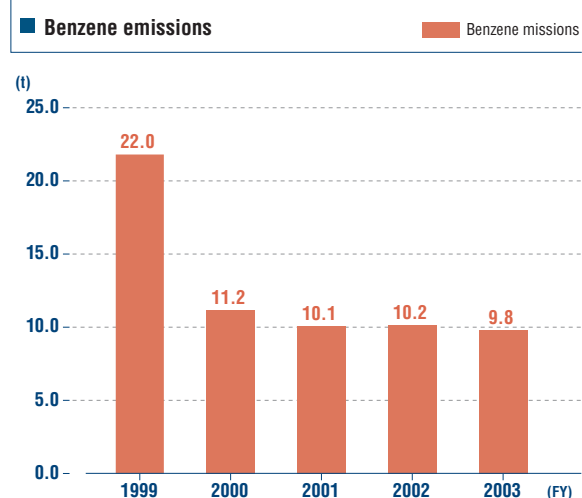
so introduce flue gas desulfurization and denitrification equipment to remove generated SOx or NOx from exhaust gas. In addition, we remove small particles in exhaust fumes using electrostatic precipitators. As a result of these efforts, all of our four oil refineries' emission levels are under the local legal limits.



## Hydrocarbons and benzene

Some petroleum products such as gasoline contain volatile components. To handle such products, we traditionally store them in a floating roof tank in order to control evaporation, and have also installed equipment that collects the hydrocarbons that evaporate when we ship the products.

Benzene, specified as a hazardous air pollution substance, is a hydrocarbon. Through the measures described above, we are endeavoring to reduce the benzene content in gasoline as well as to control its emission.



Note: includes emissions from oil storage depots

# Our activities for environmental accounting and future issues

The Cosmo Oil Group began compiling environmental accounts from FY 2000; so this is our 4th year. Our Group, which is striving to become an environmentally advanced company, aims to use environmental accounting for internal decision making and as an aid in carrying out our accountability for stakeholders. We can cite as hallmark concerns of the oil industry the need to provide countermeasures for environmental pollutants when customers use products and the need to produce petroleum products from Middle Eastern crude oil, which is high in sulfur content. From this environmental perspective, so far the Cosmo Oil Group has been investing a large amount (please see the graph "Movements in year-end acquisition costs"). In preparing environmental accounting, we use the "Environmental Accounting Guidelines 2002" and "Guidebook for Environmental Conservation Cost Classifications 2003" issued by the Ministry of the Environment as references to summarize environmental conservation costs and environmental conservation benefits\*. In our accounting, as in the past, we covered all the accounting items used in financial accounting. Our group drew up the Mid-Term Environmental Plan "Blue Earth 21" in FY 2002 and since then, all of our companies have been working on environmental conservation as one. In response to this, we have introduced an environmental accounting system to improve transparency and comprehensiveness, added new websites and increased the number of

disclosed items. Moreover, we continuously calculate and disclose environmental indicators.

## Measures taken and issues remaining for the future

The collection of environmental accounting data was conducted using an environmental accounting system that we independently developed starting in 2003. In collecting data, while taking issues from previous year into account, we aimed to improve the system's accuracy, transparency and comprehensiveness so that it would be helpful in carrying out our accountability.

Additionally, as for the use of collected data for making internal decisions, we used cost data as a contract related calculation base. In FY 2002, we positioned "Development and effective usage of environmental accounting system" in our medium-term environmental plan and continued its development. Data collection using the system was conducted at our four refineries starting in April 2003, and from July 2003 when Yokkaichi Kasumi Power Station began commercial operation. We achieved improved data accuracy and efficiency without sacrificing transparency and comprehensiveness. In future, we will aim at examining data collection using the corresponding items of the medium-term environmental plan and improving the comprehensiveness of disclosed items.

## Period and scope of data collection (calculations)

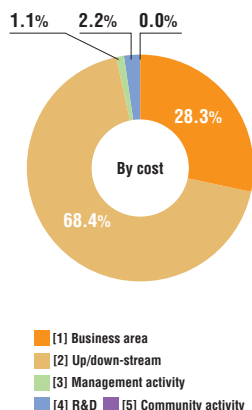
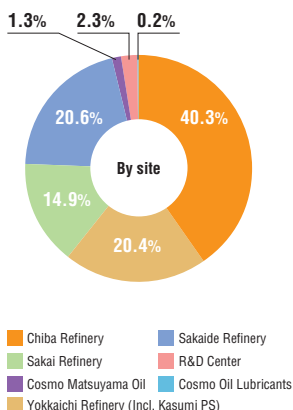
**Calculation period:** FY 2003 (April 1, 2003 to March 31, 2004)

**Scope of calculation:** 4 refineries owned by Cosmo Oil, Yokkaichi Kasumi Power Station, Head Office, branch offices, R&D Center, affiliate Cosmo Matsuyama Oil Co., Ltd. and Cosmo Oil Lubricants Co., Ltd. For affiliates, only those costs and benefits which are closely related to our refineries are extracted and collected.

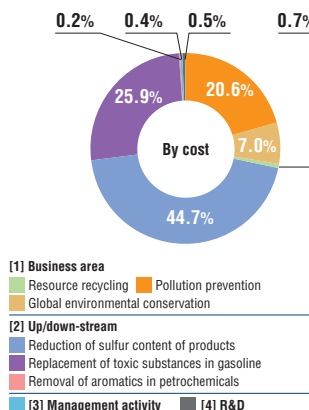
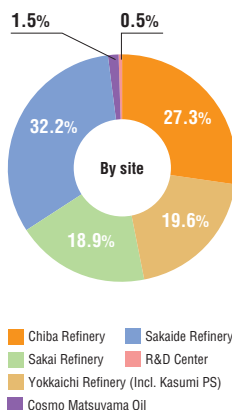
**Counting by respective sites:** Site-by-site data are shown on pages 19 through 30 for 4 refineries of Cosmo Oil, R&D Center, Head Office, branch offices, Cosmo Matsuyama Oil Co., Ltd. and Cosmo Oil Lubricants Co., Ltd. (Yokkaichi Refinery's data includes some data of Yokkaichi Kasumi Power Station.)

Subject companies and sites	
<b>Cosmo Oil Co., Ltd.</b>	Chiba Refinery; Yokkaichi Refinery: Sakai Refinery; Sakaide Refinery; Yokkaichi Kasumi PS*1: Head office; Branch offices*2; R&D Center*3
	*1 Added starting with this calculation following new establishment in FY2003 *2 Recycled paper purchase only at some locations. *3 Invested amount and year-end acquisition cost have been newly added.
<b>Cosmo Matsuyama Oil Co., Ltd.</b>	
<b>Cosmo Oil Lubricants Co., Ltd.</b>	Chiba Plant; Yokkaichi Plant: Note: Green purchase cost of lubricant raw material (other than this are included in the figures of Cosmo Oil Chiba and Yokkaichi Refineries)

### Environmental conservation cost (amount)



### Year-end acquisition costs



- [1] Business area
  - Resource recycling
  - Pollution prevention
  - Global environmental conservation
- [2] Up/down-stream
  - Reduction of sulfur content of products
  - Replacement of toxic substances in gasoline
  - Removal of aromatics in petrochemicals
- [3] Management activity
- [4] R&D

### ▣ Changes made since last year — Increase in counted items and sites

Following the commencement of commercial operation of Yokkaichi Kasumi Power Station in July 2003, costs and benefits have been added as new activity areas within the scope of environmen-

tal accounting. Benefits of gypsum sales and the ammonia recycling facility establishment have been added to the economic benefits of the Kasumi Power Station.

### ▣ Aggregate results

The aggregate results of FY 2003 environmental accounting showed that as environmental conservation cost, 11,402 million yen was spent on investments and 47,005 million yen on expenditures. Compared to the previous fiscal year, there is an increase of 9,167 million yen in investments and 3,162 million yen in expenditures. Year-end acquisition amount was 148,006 million yen, which is an increase of 10,319 million yen over the previous fiscal year. These are due to capital investment for the installation of pollution prevention equipment in conjunction with the completion of construction of Yokkaichi Kasumi Power Station and its commencement of operation, together with the second cogeneration unit at Yokkaichi Refinery, an environmental conservation measure. As for the benefits within business area (physical bene-

fits), which records the aggregate benefits of environmental conservation benefits corresponding to the benefits within the business area, despite decreased demand for heating fuel due to the warm winter, there was an increased impact on the environment on account of the steady progress in demand for gasoline and heavy fuel oil C and the start-up of a new site (Yokkaichi Kasumi Power Station). On the other hand, in almost all items, environmental impact per processed crude oil equivalent has been reduced, bettering in benefits the previous year's reduction. Likewise, upstream/downstream benefits (physical benefits) show an increased environmental impact due to the steady demand noted above; however, the benefits for concentration/unit load show a reduction benefit better than that for the previous year for most items.

### ▣ Integration of environmental indicators and environmental productivity

To further improve our environmental accounting, we have been working on integration of environmental indicators and environmental productivity since FY 2001.

Integration of environmental indicators involves weighting coefficients established using the EPS system, which was developed by a Swedish research institution. In this procedure, a comprehensive assessment of total indicators is carried out by multiplying the environmental impact of each item and weighting coefficients. The CO<sub>2</sub> conversion value of the 2003 environmental indicator within business area increased by 329,000t-CO<sub>2</sub> compared to the previous year, due to the increase in processed crude oil equivalent, upgraded refining, addition of a new site (Yokkaichi Kasumi Power Station) and other contributing factors. As for products, because of the increase in heavy fuel oil C shipments, it recorded an increase of 3,972,000t - CO<sub>2</sub> overall.

Environmental productivity is determined by calculating productivity per integrated environmental indicators and the bigger value indicates that higher production was made possible with less environmental impact.

$$\text{Environmental productivity} = \frac{\text{Production volume}}{\text{Integrated environmental indicators}}$$

FY 2003 environmental productivity decreased within business area in comparison to the previous year due to factors such as the upgrading of refining. On the other hand, as environmental productivity of products with a higher environmental impact within the business area remained the same as the previous year, environmental productivity overall remained of a par with the previous year.

#### ■ Integrated environmental indicators

Unit: 1,000t-CO<sub>2</sub> equiv.

Item (weighting coefficient)	CO <sub>2</sub> conversion by EPS		
	FY2003 result	Year-on-year comparison	
Business area	SOx (30.3)	192	-10
	NOx (19.7)	65	-1
	Benzene (33.8)	0	0
	COD (0.00935)	0	0
	CO <sub>2</sub> (1)	4,997	-318
	Subtotal	5,254	-329
Product use	Potential SOx (30.3)	5,524	-134
	CO <sub>2</sub> emissions (1)	75,170	-3,509
	Subtotal	80,694	-3,643
<b>Total</b>	<b>85,948</b>	<b>-3,972</b>	

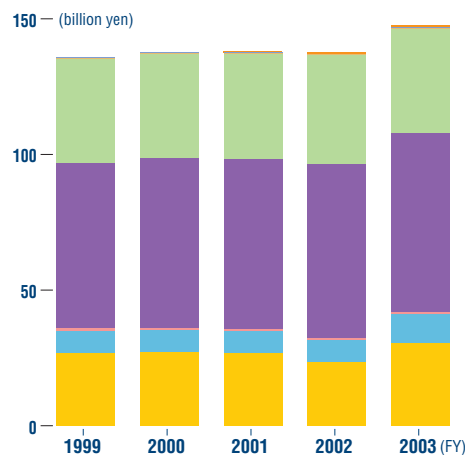
#### ■ Environmental productivity

Unit: kt/CO<sub>2</sub> equiv.

Item	Productivity per integrated environmental indicators	
	FY2003 result	Year-on-year comparison
Business area	5.735	-0.096
Product use	0.373	0.001
<b>Total</b>	<b>0.351</b>	<b>0.000</b>

- [1] Business area costs
  - Pollution prevention
  - Global environmental conservation
  - Resource recycling
- [2] Up/down-stream costs
  - Reduction of sulfur content of products
  - Replacement of hazardous substances in gasoline
  - Removal of aromatics from petrochemicals
- [3] Management activity costs
- [4] Research and Development costs

#### ■ Movements in year-end acquisition costs



# Definitions of terms used in accounting

## Methods of compiling environmental costs

**Investments:** Capital investment for depreciable assets acquired for the purpose of environmental conservation

**Expenditures:** Expenditures during the period associated with environmental conservation activities (includes depreciation)

### 1 Business area

#### Pollution prevention costs

- Air pollution prevention costs (Sulfur recovery equipment, nitrogen oxide control equipment, etc.)
- Water pollution prevention costs (Wastewater treatment equipment, sour water treatment equipment, etc.)
- Levies under the Law Concerning Pollution-Related Health Damage Compensation and Other Measures

#### Global environmental conservation costs

Costs associated with establishment of energy conservation equipment such as cogeneration facilities

#### Resource recycling costs

Costs associated with waste treatment and recycling

### 3 Management activity

Costs associated with environmental education for employees, management and maintenance of the environment management system, plant maintenance and beautification of offices and monitoring and assessment of environmental impact.

Note: Following the integration of data compilation method among refineries, management activity costs for FY 2002 has been modified from 432 million yen to 436 million yen.

### 5 Community activity

Costs associated with non-business activities, such as afforestation.

### 2 Up/Down-stream

Costs associated with the provision of products with low environmental impact to customers.

#### Reducing sulfur content of products

Costs associated with reducing sulfur content in products to reduce sulfur oxide emitted when products are in use.

#### Replacement of toxic substances in gasoline

Costs associated with reduction and refinery of toxic substances in gasoline such as benzene and lead.

#### Reduction of aromatic substances of petrochemical products

Costs associated with removal of aromatics and olefins from raw materials used in petrochemical products

### 4 Research and development

Costs associated with environment conservation R&D activities.

Notes: From FY 2003, we have partially modified R&D related accounting method.

- Expenditures: As we place importance on the counting credibility, we decided that expenses such as management department expense which have been included within indirect cost and calculated as cost should not be calculated as cost and modified the record from previous FY year accordingly.
- Investments: We decided to include investment within the scope of accounting and modified the results from past years (including year-end acquisition costs).

As a result, research and development costs for FY 2002 is changed from 1,751 million yen to 1,050 million yen.

In addition, investment amount is changed from 0 to 76 million yen.

## Environmental conservation costs (reference)

Item	Costs (million yen)	
	FY 2003	Change
Purchase cost of recycled paper (whole amount booked)	13	-1
Environment related donations	34	2
Environmental report production costs	45	8

Note: Regarding the environment related donations, counting method of FY 2002 has been integrated with that of FY 2003 and costs have been modified from 31 million yen to 32 million yen.

## Environmental accounting

Item	Environmental costs (million yen)			
	Investments		Expenditures	
	FY 2003	Change	FY 2003	Change
[1] Business area costs				
Pollution prevention costs	7,119	7,095	5,015	911
Global environmental conservation costs	2,555	2,555	7,598	654
Resource recycling costs	19	19	700	55
[2] Upstream/downstream costs				
Geen purchasing	0	0	77	-15
Reducing environmental impact of products	1,520	-616	32,057	1,487
Reducing sulfur content of products	1,272	-633	23,418	1,551
Replacement of toxic substances in gasoline	248	25	8,527	-60
Reduction of aromatics in petrochemical product	0	-8	112	-4
[3] Management activity costs	135	135	497	61
[4] Research and development costs	54	-22	1,060	10
[5] Community activity costs	0	0	1	-1
<b>Total</b>	<b>11,402</b>	<b>9,166</b>	<b>47,005</b>	<b>3,162</b>



## Counting method of environmental benefits

Amounts and benefits of reduction: Value in FY 2002 - Value in FY 2003

### 1 Business area benefits

#### Concentration/unit values

Environmental impact per crude oil equivalent throughput.

#### Environmental impact

Environmental impact originated from business area.

Note: Yokkaichi Kasumi Power Station and Cosmo Matsuyama Oil Co., Ltd. are excluded from concentration/unit values calculation of environmental conservation benefits, as crude-based processing volume estimation is impossible with these facilities where crude process is not carried out.

#### Environmental impact

- Potential environmental impact expected to occur from product use.
- Low-sulfur products: environmental impact value obtained by multiplying average sulfur content of products with production volume.
- Replacement of hazardous substances in gasoline (low-benzene): value obtained by multiplying average benzene concentration of gasoline with production volume.
- Reduction of aromatics in petrochemical products: volume of aromatics in petrochemical products eliminated in business area.
- CO2 emissions from product use: value obtained by multiplying per unit CO2 emissions of each product with production volume.

### 2 Up/Down-stream benefits

Benefits through technological upgrading of refining process.

#### Concentration/unit

- Low-sulfur products: sulfur contents in products.
- Replacement of toxic substances in gasoline (low-benzene): benzene concentration in gasoline.
- CO2 emissions from product use: value obtained by dividing the environmental impact (see below) by petrochemical product volume.

#### Notes:

- We do not take into account SOx reduction obtained by desulfurization equipment during customers' use; therefore actual SOx emissions of heavy oils, etc. is lower than potential SOx.
- As we select the optimum production method based on the relationship between cost and environmental conservation, the sulfur content value in each product is lower than JIS specification.
- Naphtha is used as petrochemical raw material and fertilizer raw material and does not emit SOx or CO2 directly; however it is included in the value.
- We have modified our method of calculating CO2 emissions, including the values for the preceding fiscal year, in accordance with the "Guidelines for calculation of green house gas emitted by business (draft)" published by the Ministry of the Environment in July 2003.
- There was a discrepancy in the counting of reduction benefits of aromatics in petrochemical products; therefore value for FY 2002 has been changed from 3,468kl to 4,500kl.

#### ■ Economic benefits

Energy conservation	2,571	Savings by cogeneration = Savings by steam generation + savings in electricity – fuel costs (LPG, heavy fuel oil, etc.)
Catalyst recycling	0	Purchase cost of new catalysts saved by recycled catalysts in oil refining, plus disposal costs of waste catalysts.
Gypsum sales	117	Sales proceeds of gypsum, a by-product of fuel-gas desulfurization at Yokkaichi Kasumi Power Station.
Ammonia recycling	76	Purchase price of ammonia saved by recycled ammonia at Yokkaichi Kasumi Power Station plus disposal costs of waste alkali.
R&D	49	Income received for royalty, and cost savings realized through R&D activities.
Electricity conservation	3	Savings, in year-on-year change, at the head office and other facilities.
<b>Total</b>	<b>2,816</b>	(million yen)

	Item	Environmental benefits			
		Investments		Expenditures	
		FY 2003	Change	FY 2003	Change
[1] Business area benefits					
Resources input into business activities					
Energy input	0.10 (kl•crude/1,000kl)	9.25 (kl•crude/1,000kl)	-4,933 (TJ)	73,292 (TJ)	
Water input	1 (kg/kl)	188 (kg/kl)	-5,240 (1,000t)	42,148 (1,000t)	
Reduction in emissions and waste generation					
Emission to air: CO2	0.37 (kg-CO2/kl)	24.47 (kg-CO2/kl)	-318 (1,000t-CO2)	4,997 (1,000t-CO2)	
SOx	1.0 (g/kl)	26.6 (g/kl)	-346 (t)	6,343 (t)	
NOx	1.2 (g/kl)	15.5 (g/kl)	-68 (t)	3,292 (t)	
Benzene	0.00 (g/kl)	0.03 (g/kl)	0.17 (t)	10.02 (t)	
Emission to water: COD	-0.02 (g/kl)	0.73 (g/kl)	-15.2 (t)	146.3 (t)	
Industrial waste: Generated	23 (g/kl)	204 (g/kl)	-1,278 (t)	43,237 (t)	
Recycled	2 (g/kl)	55 (g/kl)	-3,023 (t)	13,899 (t)	
Landfill	3 (g/kl)	5 (g/kl)	354 (t)	1,069 (t)	
[2] Up/Down-stream benefits					
Reducing sulfur content of products	(sulfur: mass %)	(sulfur: mass %)	(potential SOx emissions: t)	(potential SOx emissions: t)	
High octane gasoline	0.0000	0.0005	2	8	
Regular gasoline	-0.0001	0.0031	-14	245	
Naphtha	-0.0060	0.0344	-57	880	
Jet fuel oil	0.0106	0.0107	157	308	
Kerosene	0.0007	0.0021	38	119	
Diesel fuel	0.0204	0.0030	1,675	256	
Heavy fuel oil A	0.0185	0.4318	494	28,178	
Heavy fuel oil C	0.0731	1.5443	-6,719	152,321	
LPG	0.0001	0.0004	1	4	
Total	0.0068	0.3882	-4,423	182,319	
Low-benzene gasoline	0.0587 (vol %)	0.4969 (vol %)	2,713 (t)	29,476 (t)	
Reduction of aromatics in petrochemical products			-390 (kl)	4,890 (kl)	
Reduction of CO2 emission from products in use	-0.0089 (t-CO2/kl)	2,5495 (t-CO2/kl)	-3,509 (1,000t-CO2)	75,170 (1,000t-CO2)	

## Training related data (actual result at the end of FY 2003)

### Training scheme by ranking\*<sup>1</sup>

#### For managers

	Hours conducted	Attendees
For new managers	34.0	36
For new selected managers	14.5	43
Total	48.5	79
Total number of managers		747

#### For general employees

	Hours conducted	Attendees
For core employees	34.0	49
For new 3rd-level employees	50.0	46
For new employees	352.5	19
Total	436.5	114
Total number of management candidates		568

**Note:** Apart from the above, we have various trainings such as departmental training and participation in outside training.

### Career support training\*<sup>1</sup>

#### Pre-retirement and second career trainings (10 hours/person)

Sessions held	Total eligible persons	Attendees	
		Pre-retirement	Second career
3	161	158	100

#### Life design training (15 hours/person)

Sessions held	Total eligible persons	Attendees
3	212	78

### Human rights education\*<sup>2</sup>

	Sessions held	Attendees
Scheme by ranking	4	189
Training in subject sites/companies	12	713

#### Training themes

- *Violation of human rights in corporate environment– Power harassment (for top management)*
- *Sexual harassment (for ranks excl. top management, and at branch trainings)*

**Note:** Ranking categories are new employee, new manager, new selected manager, and top management.

### Corporate ethics (compliance) training\*<sup>2</sup>

	Sessions held	Attendees
Scheme by ranking	3	109
Training in subject sites/companies	15	855

#### Training themes

- *Need for corporate ethics and social trend of their promotion*
- *Explanation on promotion structure, regulations and workability maintenance measure (i.e. helpline)*
- *Detailed explanation of corporate activity guideline tailored to each subject branch and explanation of antimonopoly law related issues if required.*

## Human resources

### Labor union\*<sup>1</sup>

<b>Number of union members (at the end of FY 2003)</b>	<b>2,799</b>
--	--------------

#### Major discussions held with the management in FY 2003

- Management council (1) – mutual affirmation on managerial policies
- Labor-management conference (6) – shunto (spring offensive); workplace improvement

### Employment situation of alternative persons\*<sup>1</sup>

<b>Alternative persons employed</b>	<b>40</b>
-------------------------------------	-----------

<b>Employment ratio of alternative persons</b>	<b>1.63%</b>
--	--------------

**Note:** Data as of June 1, 2004; two more prospective employees for FY 2005.

### Equal opportunity\*<sup>1</sup>

<b>Number of female directors</b>	<b>One (Two in managerial positions)</b>
-----------------------------------	--

### Welfare system\*<sup>1</sup>

Our welfare system surpasses the Labor Standards Law stipulations in working hours, holidays, various allowances/compensations, etc.

Systems (example)	Cosmo Oil	Labor Standards Law
Paid holiday	21 days (seniority: 3 years or more)	20 days (6.5 years or more)
Nominal hours	37.5 hours/week	40.0 hours/week

**Note:** In addition to the paid holidays, we provide "Reserved leaves" (21 days maximum) which can be used for sick leaves, childcare or nursing.

Special leave systems for child care, nursing care, and Camp Waku Waku (participation in volunteer activities) are also provided.

	Employees used the systems
Child care leave	Total 10 (9 females and 1 male)
Nursing care leave	0 (no applicant during subject period)

\*<sup>1</sup> Subject: Cosmo Oil employees and loaned employees \*<sup>2</sup> Subject: Entire workforce of the group including Cosmo Oil employees and loaned employees

## Results of Cosmo Survey (Employees' satisfaction survey)

**Conducted in:** December 2002

**Conducted in:** Personnel Department

**Subjects (number of responses):**

2,390 employees (valid responses out of \*1 of page 17)  
 Managers: 453  
 General employees: 1,937  
 (2,199 males; 191 females)

**Items and number of questions**

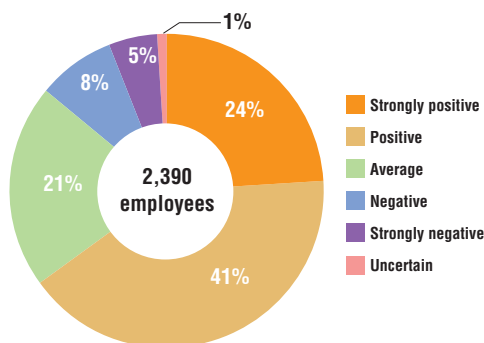
Satisfaction in terms of quality/quantity of work and sense of achievement ..	12
Workplace environment in own department .....	5
Liaison with superiors .....	6
Future vision and career development .....	8
Self declaration/setting goals (assessment) .....	7
Interview implementation .....	4
Degree of understanding regarding various systems .....	5
Others (sexual harassment, etc.) .....	1

**Publishing method :** Posting on the corporate Intranet

### Sample question and response

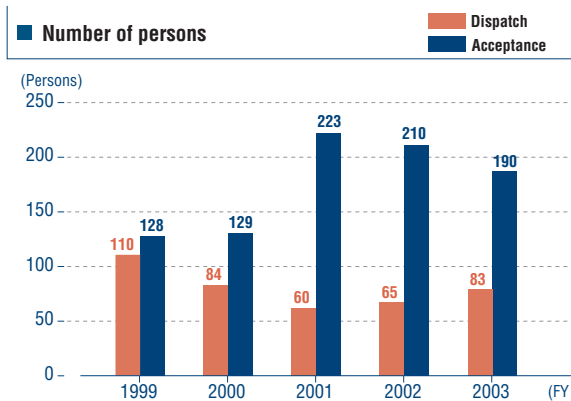
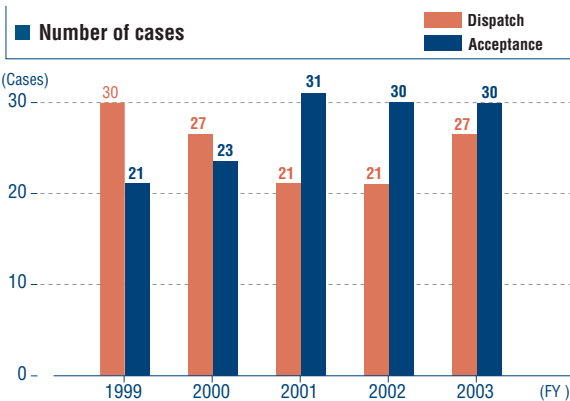
**Do you get a sense of satisfaction in your job?**

(Satisfaction in terms of quality/quantity of work and sense of achievement)



## Overseas cooperation: State of technical support by specialists

### Acceptance of trainees and dispatch of trainers



**Countries:** UAE, Qatar, Oman, Saudi Arabia, Iran, Bahrain, Yemen, Pakistan, Thailand, Vietnam, Indonesia, Malaysia, South Korea, China, Mexico.

## Safety related data

### Number of accidents

	2002	2003
Accidents which resulted in lost-time injuries	1	0
Accidents which did not result in lost-time injuries	4	1
Frequency rate of accident	0.43	0

**Notes:**

- As of December 2003 (at four refineries of Cosmo Oil)
- Frequency rate: Number of accidents which resulted in lost-time injuries per 1 million total working hours.

### No accident hours recorded

Refinery	Total hours (1,000 hours)
Chiba Refinery	15,702
Yokkaichi Refinery	6,829
Sakai Refinery	1,140
Sakaide Refinery	680
Cosmo Matsuyama Oil Co., Ltd.	6,553

**Note:** As of December 2003

# Chiba Refinery

as of March 31, 2004

<b>Address:</b>	2 Goi-Kaigan, Ichihara-shi, Chiba-ken
<b>Start-up:</b>	February 1963
<b>Total area:</b>	1,202,841m <sup>2</sup>
<b>Employees:</b>	353
<b>Capacity:</b>	240,000 barrels/day
<b>ISO 9001:</b>	December 25, 1996
<b>ISO 14001:</b>	March 13, 1998



## ➤ About Chiba Refinery

Chiba Refinery commenced its operation in 1963, in early years of Keiyo Industrial Area construction. Nowadays, this area has become one of the Japanese leading mega industrial areas. Here, as a pivotal factory of Chiba Petrochemical Federation, as well as our largest supply base in eastern Japan, the refinery has been through reinforcement and modernization and become one of the largest domestic refineries.

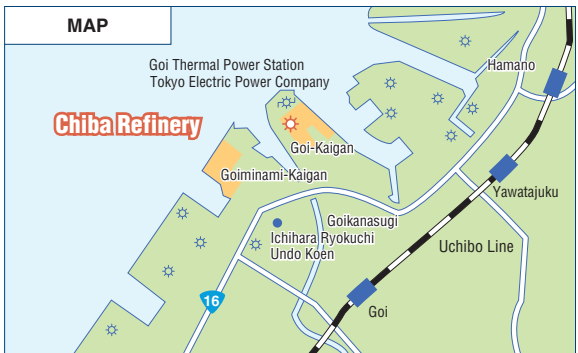
Under this situation, as a refinery recognized as a social existence, its operation would be inconceivable without “symbiosis with local community”. In order to realize this, it is essential for us “to be trusted by local community”. For this purpose, we consider it necessary to secure safe operation and encourage mutual understanding through communication. We facilitate dialogues through various local activities by hosting Hien cup youth baseball tournaments, which has been held for more than 30 years, sponsoring “Rinkai Festival”, which has become a major festival of Ichihara city, cleaning national roads voluntarily as a part of community clean-up campaign, organizing refinery visits for elementary and junior high school students and visiting special care facilities and others.



**Takashi Yashima**  
Director  
Chiba Refinery

## ➤ Communication activity

- Exchanges with local fire-fighting teams (participated by 5 teams and 10 corporations)
- Exchanges with officials of local neighborhood associations
- Ichihara city youth baseball tournaments, Ichihara junior high school tennis tournaments (co-hosted with Maruzen Petrochemical Co., Ltd.)
- Goi Rinkai festival, Goi Rinkai bon festival dance (sponsored by 6 local neighborhood associations in special industrial area and nearby 10 corporations)
- Visits to a special care facility “Heiwa-En” (organized using donations from employees), etc.



Number of refinery visitors in FY2003	<b>36 times, 473 visitors</b>
No accident record (total hours, as of Dec. 2003)	<b>15,702,000 hours</b>
PCB custody	<b>High pressure condenser: 62</b> <b>High voltage transformer: 17</b> <b>Others</b>

## ➤ Number of staff holding environmental qualifications

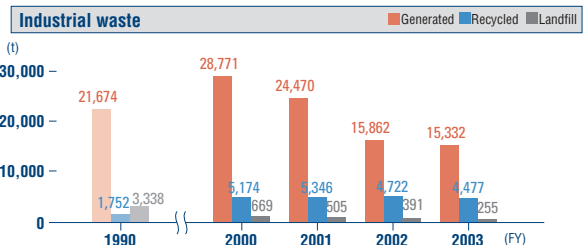
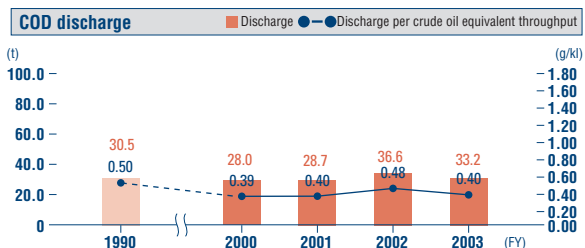
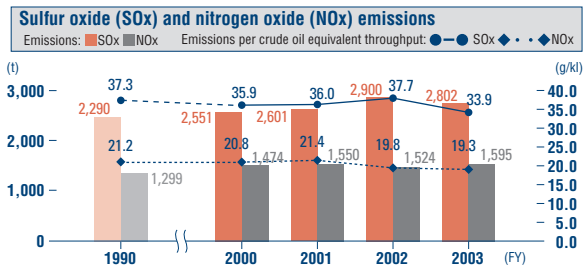
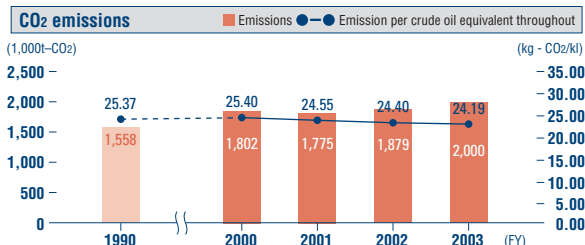
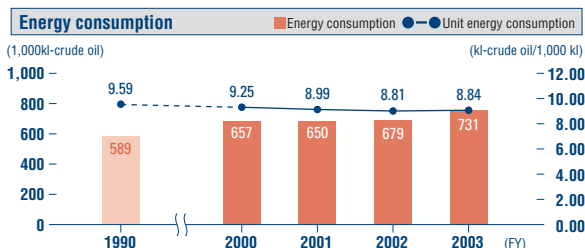
Air pollution control manager	16
Water pollution control manager	21
Noise pollution control manager	4
Dioxin pollution control manager	2
Hazardous materials officer (Class A & B)	575
High-pressure gas production safety manager (Class A & B)	268
Qualified person for heat management	19
Qualified person for electricity management	6
Specially controlled industrial waste manager	3
Engineering manager for disposal facilities of industrial waste	2
Boiler operator (Special grade)	4
Boiler operator (1st & 2nd grade)	330

Regulated pollutants

Air pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
	NOx (m <sup>3</sup> N/hour; total pollutant load control)	141.1	111.7	91.5
	SOx (m <sup>3</sup> N/hour; total pollutant load control)	189.7	148.1	111.7
	Particulate (boiler; g/m <sup>3</sup> N)	0.07	0.031	0.019

Water pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
	COD (kg/day; total pollutant load control)	223	142.9	90.8
	COD (mg/L)	25	3.9	3.3
	SS (mg/L)	50	9.6	6.0
	Oil Content (mg/L)	3	0.8	0.7
	Nitrogen (mg/L)	10	2.1	1.9
	Phosphorus (mg/L)	1	0.1	0.07
	Phenols (mg/L)	0.5	Below measurement threshold	

Environmental performance (energy, etc.)



Environmental performance (PRTR)

PRTR listed substances		Releases				Transfers
		Air	Water	Soil	Total	
2-aminoethanol	kg/year	0	0	0	0	0
Ethyl benzene	kg/year	300	0	0	300	0
Xylene	kg/year	1,300	0	0	1,300	0
Cresol	kg/year	0	0	0	0	0
Cobalt and its compounds	kg/year	0	0	0	0	1,100
1,3,5-trimethylbenzene	kg/year	26	0	0	26	0
Toluene	kg/year	5,500	0	0	5,500	0
Nickel compounds	kg/year	0	0	0	0	70,000
Nonylphenol	kg/year	0	0	0	0	0
Hydrazine	kg/year	0	0	0	0	0
Benzene	kg/year	760	0	0	760	0
Molybdenum and its compounds	kg/year	0	0	0	0	86,000
Cyclohexylamine	kg/year	0	0	0	0	0
Dioxins	mg-TEQ/year	0	29	0	29	0

Environmental accounting

Environmental costs (million yen)		FY 2003	
Item		Investment	Expenditure
Business area	Pollution prevention	84	1,340
	Global environmental conservation	4	2,783
	Resource circulation	19	346
Up/Down-stream	Green Purchasing	0	0
	Reduction of environmental impact of products	998	14,317
	Sulfur reduction of products	965	12,307
	Substitution of toxic substances in gasoline	33	2,010
Management activity		7	176
Research and development		0	0
Social activity		0	1
<b>Total</b>		<b>1,112</b>	<b>18,963</b>

Purchasing recycled paper: 1 million yen

Economic benefits (million yen)		FY 2003	
Item			
Costs saved through energy conservation (cogeneration)			937
<b>Total</b>			<b>937</b>

Environmental benefits		FY 2003	
Item		Reduction (year-on-year)	
		Concentrations/unit value	Impact
Business area			
Reduced resources input into business activities			
Energy input	-0.03 (kl-crude/1,000kl)		-2,019 (TJ)
Water input	-14 (kg/kl)		-1,891 (1,000t)
Reduced emissions and waste generation			
Emissions to air:			
CO <sub>2</sub>	0.21 (kg-CO <sub>2</sub> /kl)		-121 (1,000t-CO <sub>2</sub> )
SOx	3.8 (g/kl)		98 (t)
NOx	0.5 (g/kl)		-71 (t)
Benzene	0.00 (g/kl)		0.11 (t)
Emissions to water:			
COD	0.4 (g/kl)		69 (t)
Industrial waste:			
Generation	21 (g/kl)		530 (t)
Recycled	7 (g/kl)		245 (t)
Landfill	2 (g/kl)		136 (t)
Up/Down-stream benefits			
Reduced environmental impact of products			
Reduced sulfur content in products	(sulfur content: mass %)		(potential SOx: t)
High octane gasoline	0.0001		1
Regular gasoline	0.0000		1
Naphtha	-0.0004		-41
Jet fuel oil	0.0094		97
Kerosene	0.0010		31
Diesel fuel	0.0191		675
Heavy fuel oil A	0.0315		1,473
Heavy fuel oil C	0.0004		-5,801
LPG	-0.0001		0
Total	-0.0087		-3,564
Reducing benzene in gasoline	0.0774 (vol %)		1,464 (t)
CO <sub>2</sub> emissions from product use	-0.0136 (t-CO <sub>2</sub> /kl)		-1,528 (1,000t-CO <sub>2</sub> )

# Yokkaichi Refinery

as of March 31, 2004

<b>Address:</b>	1-1 Daikyo-cho, Yokkaichi-shi, Mie-ken
<b>Start-up:</b>	July 1943
<b>Total area:</b>	1,188,075m <sup>2</sup>
<b>Employees:</b>	321
<b>Capacity:</b>	155,000 barrels/day
<b>ISO 9001:</b>	February 18, 1997
<b>ISO 14001:</b>	March 20, 1998



## About Yokkaichi Refinery

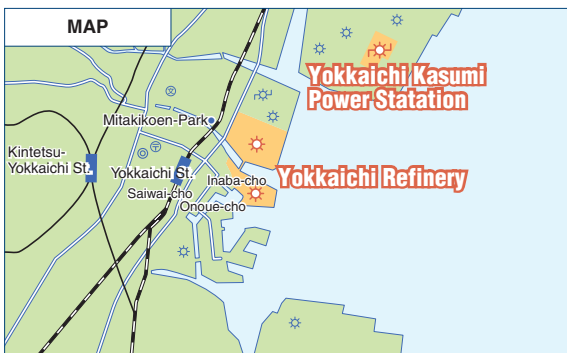
Yokkaichi Refinery is located in the center of Chukyo industrial area and plays a significant role as an important base in energy supply to cover a wide area including Chubu, Hokuriku and Kinki regions, as well as being Cosmo's only lubricating oil production base. From July 2003, Kasumi Power Station has been in operation and we made inroads into IPP business. Accordingly, we are a part of company's business expansion plan to become an integrated energy company. On the other hand, its location is blessed with nature, overseeing the Suzuka Mountain Range and the Bay of Ise. With residential areas nearby, we act with *environmental conservation of the community and earth* in mind and put efforts into symbiosis with local community. When constructing the Kasumi Power Station, we conducted an environmental assessment for four years and realized conservation of rare flora and fauna, as well as non-expansion of environmental impact. We put our best efforts into global environmental conservation. Apart from monthly voluntarily clean-ups, through hosting junior soccer school for local junior high school students, mothers' volleyball tournaments and other events for the local community association, we maintain close communication with the local community and operate as a refinery loved by the community.



**Masatoshi Sawada**  
Director  
Yokkaichi Refinery

## Communication activity

- Regular maintenance briefings (participated by the local community associations and Chubu Region Citizens' Center)
- Hashikita district pollution/disaster prevention liaison meeting (participated by Hashikita district local community association, Hashikita District Citizens' Center and two Umaokoshi district corporations)
- Fishery cooperative and Cosmo Oil liaison meetings regarding IPP business and environmental conservation
- Community activities participated by employees: Mount Takahama Bishamon temple spring festival, mothers' volleyball tournaments, Inaba town grand golf tournaments, Hashikita district cultural festival, Kinsa Inari New Year's day festival and others



## Award

Received an award from Mie prefecture high-pressure gas safety association for contribution to safety of high-pressure gas.

Number of refinery visitors in FY2003	<b>69 times, 701 visitors</b>
No accident record (total hours, as of Dec. 2003)	<b>6,829,000 hours</b>
PCB custody	<b>High pressure condenser: 59</b>

## Number of staff holding environmental qualifications

Air pollution control manager	17
Water pollution control manager	16
Noise pollution control manager	4
Vibration pollution control manager	3
Dioxin pollution control manager	3
Hazardous materials officer (Class A & B)	432
High-pressure gas production safety manager (Class A & B)	288
Qualified person for heat management	21
Qualified person for electricity management	5
Specially controlled industrial waste manager	6
Engineering manager for disposal facilities of industrial waste	6
Boiler operator (Special grade)	8
Boiler operator (1st & 2nd grade)	244

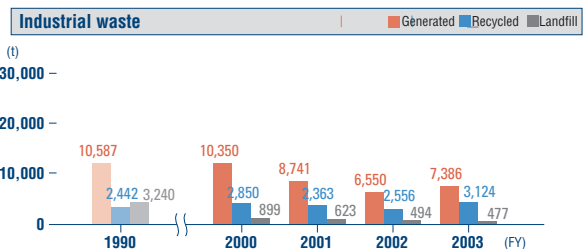
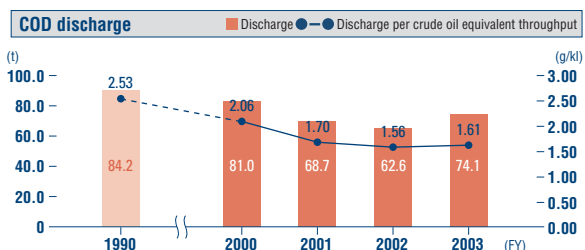
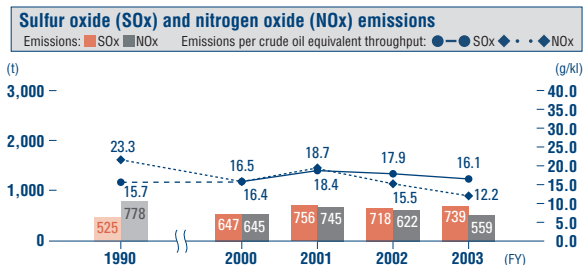
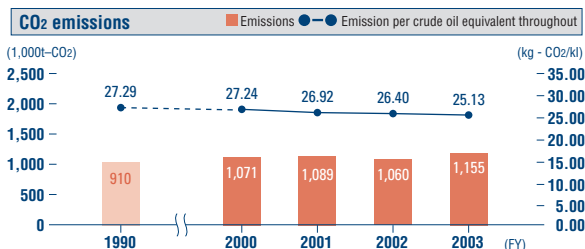
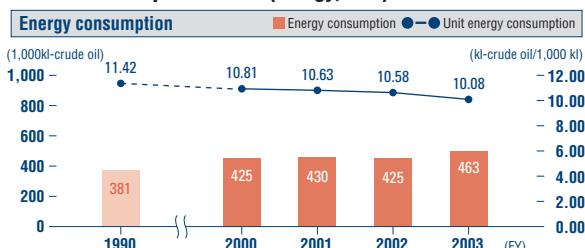


Regulated pollutants

Pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
Air pollutants	NOx (m <sup>3</sup> N/hour; total pollutant load control)	80.8	57.4	34.7
	SOx (m <sup>3</sup> N/hour; total pollutant load control)	109.48	59.0	32.5
	Particulate (boiler; g/m <sup>3</sup> N)	0.049	0.047	0.024
Water pollutants	COD (kg/day; total pollutant load control)	535	405.2	203.3
	COD (mg/L)	160 (120)	10.0	4.6
	SS (mg/L)	200 (150)	8.0	6.0
	Oil Content (mg/L)	1	Below measurement threshold	
	Nitrogen (mg/L)	15	Below measurement threshold	
	Phosphorus (mg/L)	1.5	0.08	0.05
	Phenols (mg/L)	1	0.10	0.10

Values in ( ) are daily average.

Environmental performance (energy, etc.)



Environmental performance (PRTR)

Data includes Yokkaichi Kasumi Power Station

PRTR listed substances		Releases				Transfers
		Air	Water	Soil	Total	
2-aminoethanol	kg/year	0	0	0	0	0
Ethyl benzene	kg/year	360	0	0	360	0
Xylene	kg/year	1,500	0	0	1,500	0
1,3,5-trimethyl benzene	kg/year	1.5	0	0	1.5	0
Toluene	kg/year	4,500	0	0	4,500	0
Nickel compounds	kg/year	0	0	0	0	15,000
Hydrazine	kg/year	0	0	0	0	0
Benzene	kg/year	1,500	0	0	1,500	0
1,2-dichloroethane	kg/year	0	0	0	0	0

Kasumi PS environmental performance

Air pollutants	Substance	Emissions	Industrial waste	Generated (t/year)	2,923
	NOx (t/year)	68		Recycled (t/year)	2,923
	SOx (t/year)	77		Sent to landfill (t/year)	0
Water pollutants	Substance	Emissions	Energy consumption	10,000kl-crude oil/year	
	COD (t/year)	0.3	Carbon dioxide emissions	30,000t-CO <sub>2</sub> /year	

Environmental accounting

Data includes Yokkaichi Kasumi Power Station

Environmental costs (million yen)		FY 2003	
Item		Investment	Expenditure
Business area	Pollution prevention	6,969	2,235
	Global environmental conservation	2,551	2,678
	Resource circulation	0	174
Up/Down-stream	Green Purchasing	0	0
	Reduction of environmental impact of products	269	4,394
	Sulfur reduction of products	113	2,638
	Substitution of toxic substances in gasoline	156	1,756
Management activity		128	125
Research and development		0	0
Social activity		0	0
<b>Total</b>		<b>9,917</b>	<b>9,606</b>

Purchasing recycled paper: 1 million yen

Data includes Yokkaichi Kasumi Power Station

Economic benefits (million yen)		FY 2003	
Item			
Costs saved through energy conservation (cogeneration)		855	
Gypsum sales income		117	
Benefits of ammonium recycle facility establishment		76	
<b>Total</b>		<b>1,048</b>	

Data includes Yokkaichi Kasumi Power Station

Environmental benefits		FY 2003	
Item		Reduction (year-on-year)	
		Concentrations/unit value	Impact
<b>Business area</b>			
<b>Reduced resources input into business activities</b>			
Energy input	0.50 (kl-crude/1,000kl)		-1,915 (TJ)
Water input	50 (kg/kl)		-2,691 (1,000t)
<b>Reduced emissions and waste generation</b>			
<b>Emissions to air:</b>			
CO <sub>2</sub>	1.26 (kg-CO <sub>2</sub> /kl)		-125 (1,000t-CO <sub>2</sub> )
SOx	1.8 (g/kl)		-99 (t)
NOx	3.3 (g/kl)		-4 (t)
Benzene	0.00 (g/kl)		0.00 (t)
<b>Emissions to water:</b>			
CO <sub>2</sub>	-0.05 (g/kl)		-11.8 (t)
<b>Industrial waste:</b>			
Generated	2 (g/kl)		-3,759 (t)
Recycled	-4 (g/kl)		-3,491 (t)
Landfill	2 (g/kl)		17 (t)
<b>Up/Down-stream benefits</b>			
<b>Reduced environmental impact of products</b>			
Reduced sulfur content in products	(sulfur content: mass %)		(potential SOx: t)
High octane gasoline	0.0000		0
Regular gasoline	-0.0001		-7
Naphtha	0.0000		24
Jet fuel oil	0.0000		-1
Kerosene	0.0001		-4
Diesel fuel	0.0255		419
Heavy fuel oil A	0.0109		-316
Heavy fuel oil C	-0.0210		-136
LPG	0.0002		1
Total	0.0294		-20
Reducing benzene in gasoline	0.0010 (vol %)		-483 (t)
CO <sub>2</sub> emissions from product use	-0.0011 (t-CO <sub>2</sub> /kl)		-900 (1,000t-CO <sub>2</sub> )

\* Environmental Impact is increased in most of items; one of the reasons for this is that environmental impact from Yokkaichi Kasumi Power Station is added to FY2003 loading figure (Concentration/unit is calculated without the environmental impact of Yokkaichi Kasumi Power Station).

# Sakai Refinery

as of 31 March, 2004

<b>Address:</b>	3-16 Chikko-Shin-machi, Sakai-shi, Osaka-fu
<b>Start-up:</b>	October 1968
<b>Total area:</b>	1,254,603m <sup>2</sup>
<b>Employees:</b>	193
<b>Capacity:</b>	80,000 ballels/day
<b>ISO 9001:</b>	March 14 1997
<b>ISO 14001:</b>	March 20, 1998



## ■ About Sakai Refinery

Although its crude oil processing capacity of 80,000 barrels/day appears to be small in scale, Sakai Refinery assumes responsibility for a stable supply of products throughout the Kinki region, predominately to the Kyoto-Osaka-Kobe area. With the slogan of aiming to be a green factory, the refinery is actively engaged in reducing the environmental impact resulting from its business activities. This includes reducing emission of sulfur oxide and nitrogen oxide through the use of gaseous fuel within the site, reducing waste disposed from business activities through practices of highly developed 3Rs, and reducing emission of greenhouse gas through thorough practice of energy conservation. These practices have been highly evaluated externally, as illustrated by our being awarded the Director-General's Award from the Agency of Natural Resources and Energy.

As we value relationships with the local community, we have carried out a number of social contribution activities. This includes holding tennis schools coached by our employees, giving free access to our playground to the local boys' baseball team, and conducting clean-ups of surrounding public roads. In the local neighborhood associations' papers, we have announced our new project to distribute to children approximately 1,000 wild medaka fish (killifish) raised on the refinery site, on the occasion of the Bon Festival Dance held in the precincts of the historic Iwatsuta Shrine. We continue to make efforts so that our refinery can remain safe, environmentally-friendly, and loved by the local community, and so that we can maintain a stable supply of environmentally-friendly products.



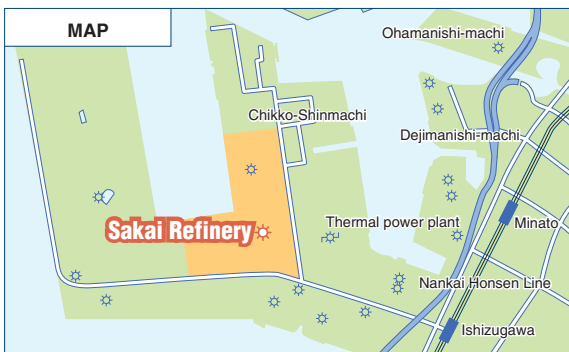
**Hajime Marukawa**  
Director  
Sakai Refinery

## ■ Communication activity

- Holds explanatory sessions on the refinery's new works for local community associations
- Holds information exchange sessions with other corporations in Sakai Rinkai industrial area
- Organizes tennis schools twice yearly
- Conducts the off-site clean-ups (e.g., in front of the Ishizugawa Station and the area surrounding site, etc.)

## ■ Award

- Received the Energy Conservation Center Chairman's Award at the national convention for successful energy-saving cases in FY 2003
- Commended by the Director-General of the Kansai Bureau of Economy, Trade and Industry as an excellent high-pressure gas business site.
- Sakai LPG base was commended by Mayor of Osaka as a good-standing high-pressure gas business establishment.



## ■ Number of staff holding environmental qualifications

Air pollution control manager	17
Water pollution control manager	13
Hazardous materials officer (Class A & B)	276
High-pressure gas production safety manager (Class A & B)	172
Qualified person for heat management	16
Qualified person for electricity management	4
Specially controlled industrial waste manager	2
Environmental Certified Measurer	4
Boiler operator (Special grade)	3
Boiler operator (1st & 2nd grade)	190

Number of refinery visitors in FY2003	<b>32 times, 263 visitors</b>
No accident record (total hours, as of Dec. 2003)	<b>1,140,000 hours</b>
PCB custody	<b>High pressure condenser: 12 Others</b>



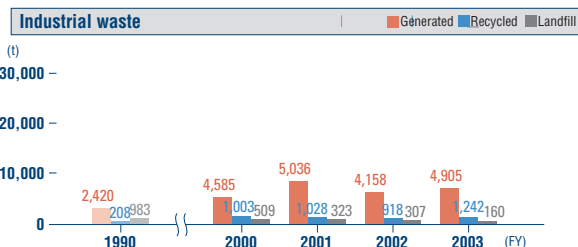
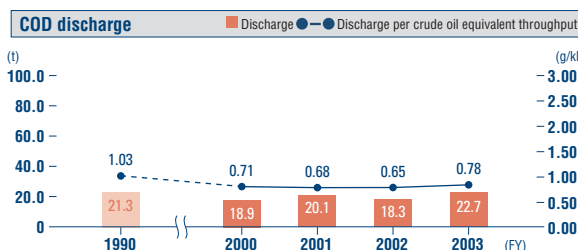
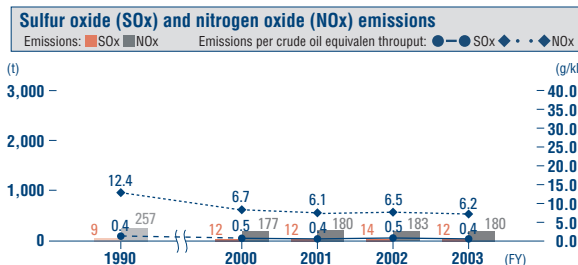
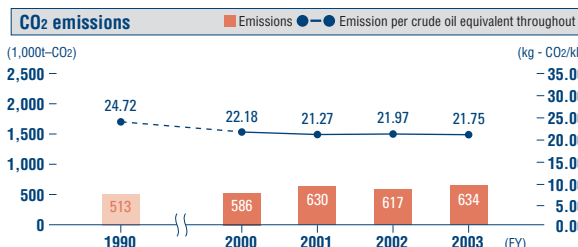
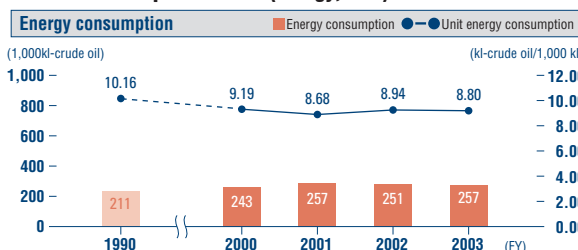
Regulated pollutants

Air pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
	NOx (m³N/hour; total pollutant load control)	48.822	12.53	10.0
	SOx (m³N/hour; total pollutant load control)	45.639	12.68	0.4
	Particulate (boiler; g/m³N)	0.03	0.004	0.004

Water pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
	COD (kg/day; total pollutant load control)	186.8	98.31	62.06
	COD (mg/L)	15(10)	9.9	7.5
	SS (mg/L)	40(30)	Below measurement threshold	
	Oil Content (mg/L)	2	Below measurement threshold	
	Nitrogen (mg/L)	35	4.0	3.0
	Phosphorus (mg/L)	1.5	0.167	0.070
	Phenols (mg/L)	2	Below measurement threshold	

Values in ( ) are daily average.

Environmental performance (energy, etc.)



Environmental performance (PRTR)

PRTR listed substances	Releases				Transfers
	Air	Water	Soil	Total	
2-aminoethanol	0	0	0	0	0
Ethyl benzene	100	0	0	100	0
Xylene	520	0	0	520	0
1,3,5-trimethyl benzene	0.3	0	0	0.3	0
Toluene	1,400	0	0	1,400	0
Nickel compounds	0	0	0	0	1,300
Hydrazine	0	0	0	0	0
Benzene	560	0	0	560	0
Zinc compounds (water soluble)	0	1,100	0	1,100	0
Antimony and its compounds	0	0	0	0	1,200
Tetrachloroethylene	0	0	0	0	0

Environmental accounting

Environmental costs (million yen)		FY 2003	
Item		Investment	Expenditure
Business area	Pollution prevention	33	589
	Global environmental conservation	0	2,137
	Resource recycling	0	88
Up/Down-stream	Green Purchasing	0	0
	Reduction of environmental impact of products	68	4,078
	Sulfur reduction of products	19	2,189
	Substitution of toxic substances in gasoline	49	1,889
Management activity		0	94
Research and development		0	0
Social activity		0	0
<b>Total</b>		<b>101</b>	<b>6,986</b>

Purchasing recycled paper: 1 million yen

Economic benefits (million yen)

Item	FY 2003
Costs saved through energy conservation (cogeneration)	779
<b>Total</b>	<b>779</b>

Environmental benefits

Item	FY 2003	
	Reduction (year-on-year)	
	Concentrations/unit value	Impact
<b>Business area</b>		
<b>Reduced resources input into business activities</b>		
Energy input	0.14 (kl-crude/1,000kl)	-214 (TJ)
Water input	4 (kg/kl)	-114 (1,000t)
<b>Reduced emissions and waste generation</b>		
<b>Emissions to air:</b>		
CO <sub>2</sub>	0.22 (kg-CO <sub>2</sub> /kl)	-17 (1,000t-CO <sub>2</sub> )
SOx	0.1 (g/kl)	2 (t)
NOx	0.3 (g/kl)	3 (t)
Benzene	0.01 (g/kl)	0.16 (t)
<b>Emissions to water:</b>		
COD	-0.13 (g/kl)	-4.4 (t)
<b>Industrial waste :</b>		
Generation	-20 (g/kl)	-747 (t)
Recycled	-10 (g/kl)	-324 (t)
Landfill	6 (g/kl)	147 (t)
<b>Up/Down-stream benefits</b>		
<b>Reduced environmental impact of products</b>		
Reduced sulfur content in products	(sulfur content: mass %)	(potential SOx: t)
High octane gasoline	0.0001	1
Regular gasoline	0.0000	0
Naphtha	-0.0147	-25
Jet fuel oil	0.0111	48
Kerosene	0.0008	5
Diesel fuel	0.0233	281
Heavy fuel oil A	-0.0112	-114
Heavy fuel oil C	0.1142	3,449
LPG	0.0000	0
Total	0.0556	3,645
Reducing benzene in gasoline	0.0857 (vol%)	829 (t)
CO <sub>2</sub> emissions from product use	0.0088 (t-CO <sub>2</sub> /kl)	79 (1,000t-CO <sub>2</sub> )

# Sakaide Refinery

as of 31 March, 2004

<b>Address:</b>	1-1 Bannosu Midori-machi, Sakaide-shi, Kagawa-ken
<b>Start-up:</b>	October 1972
<b>Total area:</b>	847,943m <sup>2</sup>
<b>Employees:</b>	216
<b>Capacity:</b>	120,000 ballels/day
<b>ISO 9001:</b>	May 10, 1996
<b>ISO 14001:</b>	June 18, 1997



## About Sakaide Refinery

Sakaide Refinery, the westernmost of the Cosmo refineries, serves as a supply base for oil products in Shikoku and other parts of western Japan. When Kakinomoto Hitomaro, a poet represented in the Man-yoshu (8th Century collection of poems), drifted ashore on the coast of Sanuki (Kagawa), he is said to have composed the poem: "Jeweled seaweed, the Province of Sanuki; Is it your nature that the sight of you never tires me; Or is it your god's nature?" Sakaide Refinery is located near a monument commemorating this poem, and looks out on the Setonaikai national park, which still continues to provide that magnificent, panoramic and scenic view. To protect this beautiful scenery and environment, to build a harmonious relationship with the local community, and to earn a reputation as a responsible refinery, each and every one of our employees strives for environmental conservation and safety. We engage in locally based activities to strengthen our tie with the local community; for example, we clean streets near the refinery and participate in a softball competition along with local community associations. Most notably, our employees, together with a neighborhood association, have taken part as reinforcements in the Athletic program of the Shamijima elementary/junior high school, which has only seven pupils. As this example shows, we consider it particularly important to have heartwarming exchanges with local residents. We are, as a member of the local community, committed to running a safe, trusted refinery well into the future.



**Yoshikatsu Suematsu**  
Director  
Sakaide Refinery

## Communication activity

- Information exchange sessions with businesses in the Bannosu area in relation to safety and environment;
- Lending of facilities to local sport enthusiast groups (53 times, 785 people in FY 2003);
- Cleaning of commuter streets (4 times in FY 2003, with 80 participants in total), etc.

## Award

- Received an award from the Director-General of the Fire and Disaster Management Agency as an outstanding business treating hazardous articles.



Number of refinery visitors in FY2003	<b>22 times, 370 visitors</b>
No accident record (total hours, as of Dec. 2003)	<b>680,000 hours</b>
PCB custody	<b>None</b>

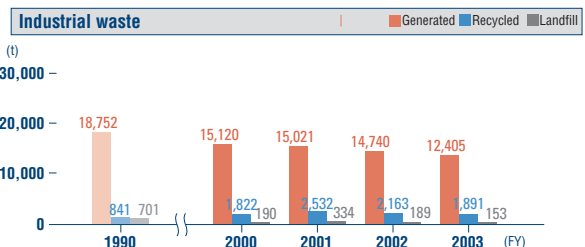
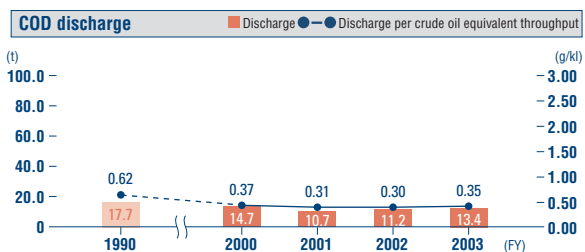
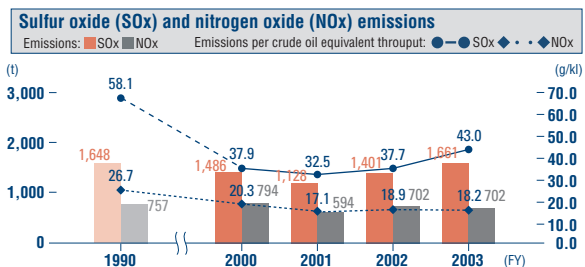
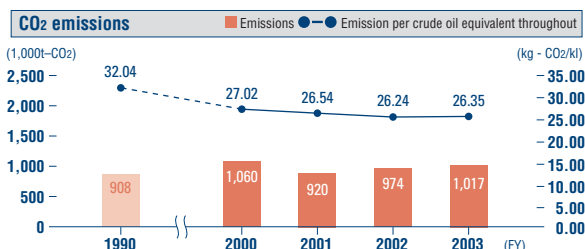
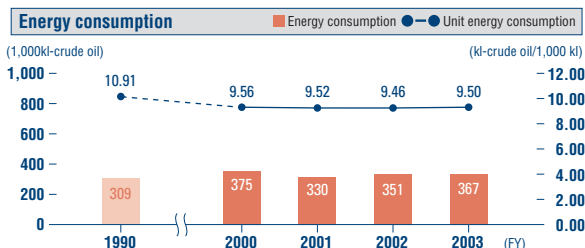
## Number of staff holding environmental qualifications

Air pollution control manager	9
Water pollution control manager	10
Noise pollution control manager	1
Hazardous materials officer (Class A & B)	224
High-pressure gas production safety manager (Class A & B)	175
Qualified person for heat management	12
Qualified person for electricity management	5
Specially controlled industrial waste manager	2
Engineering manager for disposal facilities of industrial waste	2
Boiler operator (Special grade)	2
Boiler operator (1st & 2nd grade)	210

Regulated pollutants

	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
Air pollutants	NOx (m³N/hour; total pollutant load control)	190.0	50.0	39.0
	SOx (m³N/hour; total pollutant load control)	164.0	89.2	66.2
	Particulate (boiler; g/m³N)	0.05	0.005	0.005
Water pollutants	COD (kg/day; total pollutant load control)	120.0	63.6	36.5
	COD (mg/L)	15 (10)	7.0	3.9
	SS (mg/L)	15 (10)	7.0	4.0
	Oil Content (mg/L)	2	Below measurement threshold	
	Nitrogen (mg/L)	120 (60)	1.7	1.5
	Phosphorus (mg/L)	16 (8)	0.05	0.04
	Phenols (mg/L)	1	Below measurement threshold	
			Values in ( ) are daily average.	

Environmental performance (energy, etc.)



Environmental performance (PRTR)

PRTR listed substances		Releases				Transfers
		Air	Water	Soil	Total	
2-aminoethanol	kg/year	0	0	0	0	0
Ethyl benzene	kg/year	580	0	0	580	0
Xylene	kg/year	2,400	0	0	2,400	0
Cobalt and its compounds	kg/year	0	0	0	0	2,700
1,3,5-trimethyl benzene	kg/year	0.4	0	0	0.4	0.0
Toluene	kg/year	8,800	0	0	8,800	0
Nickel compounds	kg/year	0	0	0	0	34,000
Benzene	kg/year	2,500	0	0	2,500	0
Molybdenum and its compounds	kg/year	0	0	0	0	46,000
Zinc compounds (water soluble)	kg/year	0	1,800	0	1,800	0
Cyclohexylamine	kg/year	0	0	0	0	0

Environmental accounting

Environmental costs (million yen)		FY 2003	
		Investment	Expenditure
Business area	Pollution prevention	33	770
	Global environmental conservation	0	0
	Resource recycling	0	90
Up/Down-stream	Green Purchasing	0	0
	Reduction of environmental impact of products	182	8,762
	Sulfur reduction of products	175	6,284
	Substitution of toxic substances in gasoline	7	2,478
Management activity		0	63
Research and development		0	0
Social activity		0	0
<b>Total</b>		<b>215</b>	<b>9,685</b>

Purchasing recycled paper: 1 million yen

Economic benefits (million yen) 0 million yen

Item	FY 2003	
	Reduction (year-on-year)	
	Concentrations/unit value	Impact
<b>Business area</b>		
<b>Reduced resources input into business activities</b>		
Energy input	-0.04 (kl-crude/1,000kl)	-600 (TJ)
Water input	-10 (kg/kl)	-492 (1,000t)
<b>Reduced emissions and waste generation</b>		
<b>Emissions to air:</b> CO2	-0.11 (kg-CO2/kl)	-43 (1,000t-CO2)
SOx	-5.3 (g/kl)	-260 (t)
NOx	0.7 (g/kl)	0 (t)
Benzene	0.01 (g/kl)	0.00 (t)
<b>Emissions to water:</b> COD	-0.05 (g/kl)	-2.2 (t)
<b>Industrial waste :</b> Generation	76 (g/kl)	2,335 (t)
Recycled	9 (g/kl)	272 (t)
Landfill	1 (g/kl)	36 (t)
<b>Up/Down-stream benefits</b>		
<b>Reduced environmental impact of products</b>		
Reduced sulfur content in products (sulfur content: mass %)		(potential SOx: t)
High octane gasoline	-0.0001	0
Regular gasoline	-0.0003	-8
Naphtha	0.0056	-19
Jet fuel oil	0.0008	0
Kerosene	0.0003	6
Diesel fuel	0.0165	301
Heavy fuel oil A	0.0427	-571
Heavy fuel oil C	-0.0059	-4,003
LPG	-0.0002	0
Total	-0.0207	-4,294
Reducing benzene in gasoline	0.0765 (vol%)	860 (t)
CO2 emissions from product use	-0.0066 (t-CO2/kl)	-1,096 (1,000t-CO2)

# Cosmo Matsuyama Oil Co., Ltd.

as of 31 March, 2004

<b>Address:</b>	3-580 Okaga, Matsuyama-shi, Ehime-ken
<b>Start-up:</b>	February 1944
<b>Total area:</b>	663,049m <sup>2</sup>
<b>Employees:</b>	104
<b>ISO 9001:</b>	November 14, 1997
<b>ISO 14001:</b>	December 28, 1998



## ▣ About Cosmo Matsuyama Oil Co., Ltd.

Located in a coastal district of West Shikoku by Seto inland sea, proud of its beautiful archipelagic view, our company is venturing into unique lines of business such as tank lease business, provision of electricity and steam to the nearby corporations, real estate lease business, golf practice range business and land-based abalone farming. With “coexistence with nature and local community” as our main operational target, our company is endeavoring to contribute to the prosperity of the local economy and paying attention to the environment and safety issues. Aiming to become a corporation loved by the local people and companies, we are endeavoring to contribute to the local development and revitalization. For this, we have built good relationships with seven local groups through cooperation and participation in local regular annual events such as festivals, athletic meet, recreational meeting for the aged, year-end party, etc. and with five member groups of the local fisheries cooperative association through regular information exchanges in light of the basic concept of coexistence and coprosperity. We are also implementing various activities at the factory level. For example, our factories are participating in “Adopt a road program”, which is promoted by the government, and regularly implementing clean-up activities on the nearby roads. We will continue endeavoring to reinforce our corporate social responsibility (CSR) management as well as to become an environmentally advanced member of Cosmo Oil group.



**Shoji Yoshida**  
President  
Cosmo Matsuyama Oil

## ▣ Communication activity

- Exchanges with local corporations (10 corporations)
- Exchanges with the local fisheries cooperative association
- Cherry blossom viewing party (April), Bon festival dance (August)
- Clean-up campaign around Imabari castle (October)
- “Ehime fureai road campaign” (Clean-up of the prefectural roads around our head office, 4 times in the year), etc.



Number of refinery visitors in FY2003	<b>2 times, 87 visitors</b>
No accident record (total hours, as of Dec. 2003)	<b>6,553,000 hours</b>
PCB custody	<b>None</b>

## ▣ Number of staff holding environmental qualifications

Air pollution control manager	12
Water pollution control manager	13
Noise pollution control manager	1
Vibration pollution control manager	1
Hazardous materials officer (Class A & B)	115
High-pressure gas production safety manager (Class A & B)	94
Qualified person for heat management	8
Qualified person for electricity management	2
Engineering manager for disposal facilities of industrial waste	3
Boiler operator (Special grade)	2
Boiler operator (1st & 2nd grade)	92

Regulated pollutants

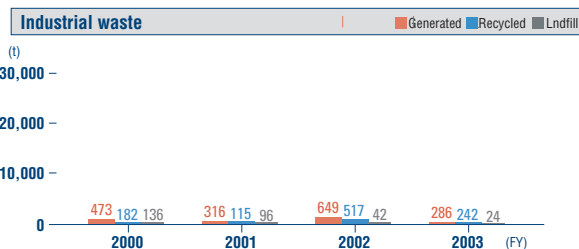
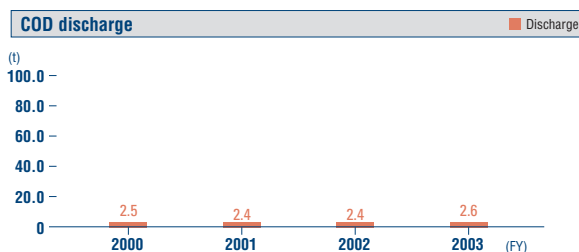
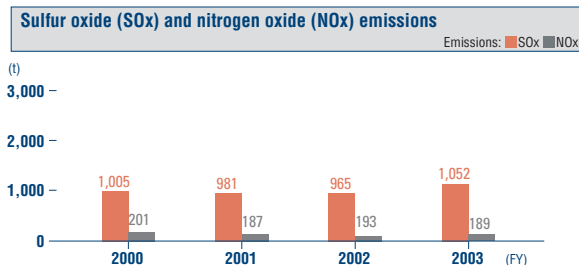
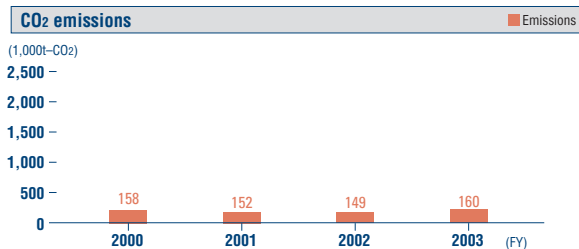
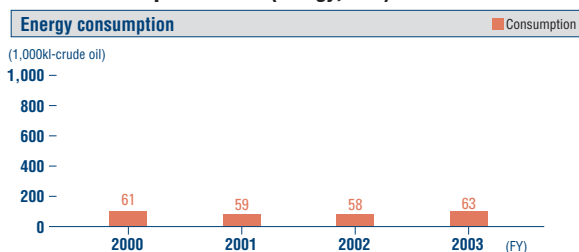
Air pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
	NOx (m³N/hour)	-	16.20	12.60
	SOx (m³N/hour; total pollutant load control)	208	66.81	50.17
	Particulate (boiler; g/m³N)	0.17	0.04	0.04

Water pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
	COD (kg/day; total pollutant load control)	363.3	25.1	7.1
	COD (mg/L)	15 (10)	6.0	2.6
	SS (mg/L)	20	7	3
	Oil Content (mg/L)	2	Below measurement threshold	
	Nitrogen (mg/L)	120 (60)	0.99	0.60
	Phosphorus (mg/L)	16 (8)	0.18	0.12
	Phenols (mg/L)	0.3	Below measurement threshold	

Values in ( ) are daily average.

Environmental performance (energy, etc.)



Environmental performance (PRTR)

PRTR listed substances		Releases				Transfers
		Air	Water	Soil	Total	
Ethyl benzene	kg/year	2,300	0.5	0	2,301	0
Xylene	kg/year	11,000	3	0	11,003	0.1
1,3,5-trimethyl benzene	kg/year	290	22	0	312	0.3
Toluene	kg/year	20,000	13	0	20,013	0
Benzene	kg/year	4,700	0	0	4,700	0
Ethylene glycol	kg/year	75	0	0	75	0
1,2-dichloroethane	kg/year	5,300	0	0	5,300	0
Phenol	kg/year	68	0	0	68	0

Environmental accounting

**Environmental costs (million yen)**

Item	FY 2003	
	Investment	Expenditure
<b>Business area</b>		
Pollution prevention	0	81
Global environmental conservation	0	0
Resource recycling	0	2
<b>Up/Down-stream</b>		
Green Purchasing	0	0
Reduction of environmental impact of products	3	506
Sulfur reduction of products	0	0
Substitution of toxic substances in gasoline	3	394
Reducing aromatics in petrochemical products	0	112
<b>Management activity</b>	0	39
<b>Research and development</b>	0	0
<b>Social activity</b>	0	0
<b>Total</b>	3	628

Purchasing recycled paper: 0 million yen

**Economic benefits (million yen)** 0 million yen

**Environmental benefits**

Item	FY 2003	
	Reduction (year-on-year)	
	Impact	
<b>Business area</b>		
<b>Reduced resources input into business activities</b>		
Energy input		-184 (TJ)
Water input		-53 (1,000t)
<b>Reduced emissions and waste generation</b>		
<b>Emissions to air:</b> CO2		-12 (1,000t-CO2)
SOx		-87 (t)
NOx		4 (t)
Benzene		-0.10 (t)
<b>Emissions to water:</b> COD		-0.20 (t)
<b>Industrial waste :</b> Generation		363 (t)
Recycled		275 (t)
Landfill		18 (t)
<b>Up/Down-stream benefits</b>		
<b>Reduced environmental impact of products</b>		
Reduced sulfur content in products		(potential SOx: t)
High octane gasoline		0
Regular gasoline		0
Naphtha		4
Jet fuel oil		13
Kerosene		0
Diesel fuel		-1
Heavy fuel oil A		22
Heavy fuel oil C		-228
LPG		0
Total		-190
Reducing benzene in gasoline		42 (t)
Reducing aromatics in petrochemical products		-390 (kl)
CO2 emissions from product use		-64 (1,000t-CO2)

# Cosmo Research & Development Center

as of 31 March, 2004

**Address:** 1134-2 Gongendo, Satte-shi, Saitama-ken

**Start-up:** April 1969

**Total area:** 86,200m<sup>2</sup>

**Employees:** 104



## About Cosmo Research and Development Center

Cosmo Research and Development Center is uniquely located between Satte city, Saitama Prefecture and Goka town, Ibaraki Prefecture. 104 employees are engaged in R&D and commercialization of fuel oils, oil refining catalysts, new energy sources, environmental technology, etc. As the site is located between two prefectures, we are endeavoring to maintain good relationships with the hazardous material safety associations and police friendship clubs in the both prefectures. In relation with hazardous materials and high-pressure gases, we have been operating without a single accident since its establishment in 1969.

As a *Sainokuni Eco-up* declaration business site, which is promoted by Saitama Prefecture, we are also actively implementing global environmental activities including reduction of emissions of CO<sub>2</sub> and industrial wastes.

Satte city is famous for its Sakura-Zutsumi (an embankment with cherry trees). Its cherry blossoms, field mustards and blue sky form a beautiful contrast of colors and many tourists visit there to enjoy the scenery. Our employees are contributing to the local clean-up activities by cleaning up the areas around the embankment twice a year before the cherry blossom festival and in late autumn.

In near future, there will be a park around Miyukiko lake, which is located next to Sakura-Zutsumi. We will pay even more attention to waste water, noise and gas emissions and are committed to symbiosis with the local community.



**Mitsugu Yumoto**  
Director  
Research &  
Development Center

## Regulated pollutants

Water pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Maximum	Average
	COD (mg/L)	160 (120)	16.4	9.5
	Suspended Solids (mg/L)	60 (50)	9	6
	Oil Content (mg/L)	5	1	1
	Nitrogen (mg/L)	120 (60)	7	6
	Phosphorus (mg/L)	16 (8)	0.9	0.8
	Phenols (mg/L)	1	Below measurement threshold	

Values in ( ) are daily average.

## Environmental accounting

### Environmental costs (million yen)

Item	FY 2003	
	Invest.	Spending
<b>Business area</b>		
Pollution prevention	0	0
Global environmental conservation	0	0
Resource recycling	0	0
<b>Up/Down-stream</b>		
Green Purchasing	0	0
Reduction of environmental impact of products	0	0
<b>Management activity</b>	0	0
<b>Research and Development</b>	54	1,060
<b>Social activity</b>	0	0
<b>Total</b>	54	1,060

Purchasing recycled paper: 1 million yen

### Economic benefits (million yen)

Item	FY 2003
Benefits of research and development (royalty, etc.)	49
<b>Total</b>	49



## Number of staff holding environmental qualifications

Air pollution control manager	4
Water pollution control manager	5
Dioxin pollution control manager	1
Hazardous materials officer (Class A & B)	80
High-pressure gas production safety manager (Class A & B)	36
Qualified person for heat management	1
Specially controlled industrial waste manager	1
Engineering manager for disposal facilities of industrial waste	1
Environmental Certified Measurer	1
Boiler operator (1st & 2nd grade)	8

# Cosmo Oil Lubricants Co., Ltd.

as of 31 March, 2004

**Address:** 4-9-25, Shibaura, Minato-ku, Tokyo

**Start-up:** April 1998

**Employees:** 191

## Number of staff holding environmental qualifications

<b>Shimotsu Plant:</b>	Water pollution control manager	1
<b>Osaka Plant:</b>	Air pollution control manager	2
	Water pollution control manager	2

## Regulated pollutants

Air pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Max.	Ave.
	NOx (m <sup>3</sup> N/hour)	180	38	34
	SOx (m <sup>3</sup> N/hour)	0.035*1	0.0093	0.0093
	Particulate (boiler; g/m <sup>3</sup> N)	0.15	0.0055	0.0037

\*1 K-value 1.17 (0.035m<sup>3</sup>N/hour)

Water pollutants	Pollutant	Standard	Actual Performance in FY 2003	
			Max.	Ave.
	Consumption of iodine (mg/L)	220	1.3	1.3

## Newly ISO certified factories

Business site	Location	Standard	Certified by	Reg. No.	Date
Shimotsu Plant	Wakayama	ISO 14001	JQA	JQA-EM3251	27-Jun-03
Shimotsu Plant	Wakayama	ISO 9001	JQA	JQA-1677	31-Mar-97
Osaka Plant	Osaka	ISO 14001	JQA	JQA-EM3435	17-Oct-03
Osaka Plant	Osaka	ISO 9001	JQA	JQA-1724	9-May-97

## Environmental accounting

### Environmental costs (million yen)

Item	FY 2003	
	Invest.	Spending
<b>Business area</b>		
Pollution prevention	0	0
Global environmental conservation	0	0
Resource recycling	0	0
<b>Up/Down-stream</b>		
Green Purchasing	0	77
Reduction of environmental impact of products	0	0
<b>Management activity</b>	0	0
<b>Research and Development</b>	0	0
<b>Social activity</b>	0	0
<b>Total</b>	0	77

### Economic benefits (million yen)

0 million yen

# Cosmo Oil Co., Ltd.

## Head office and branch offices

as of 31 March, 2004

**Address:** 1-1-1, Shibaura, Minato-ku, Tokyo

**Employees:** 681 (head office and branch offices)

## Environmental accounting

### Environmental costs (million yen)

Item	FY 2003
Cost of purchasing recycled paper	8
Donations related to environmental activities	34
Cost of making environmental report	45

### Economic benefits (million yen)

Item	FY 2003
The amount of electricity saving at head office	3



## Comparison with Environmental Reporting Guidelines (FY2003 version) by the Ministry of the Environment

Report Content		Pages	
		Report	Databook
<b>Basic Heading</b>	CEO's statement	7-8	-
	Foudation of reporting(Reporting organisation,time period,fields)	2, Back cover	1, Back cover
	Summary of the nature of the business	1, 45-46	3-4, 19-30
<b>Summary of Policies,Targets, Achievements in Environmental Conservation</b>	Business policies regarding environmental conservation	3-6	(19-30)
	Summary of plans,targets, and achievements in environmental conservation	13-16	-
	Material Balance	17-18	(19-30)
	Summary of environmental accounting information	16	13-16
<b>State of Environmental Management</b>	State of environmental management system	(31)	19-30
	State of supply-chain management for environmental conservation	15, 20, 25-26	-
	State of reserch and development of technologies for environmental conservation and environment-conscious products/services	9-12, 27-28	5-8
	State of the disclosure of environmental information and communication	47-50	-
	State of compliance with environmental regulations	-	(19-30)
	State of social contribution related to environment	39-44, 49-50	(19-30)
<b>State of Activities for Reduction of Environmental Burden</b>	State of total energy input, and mitigation measures	10, 17-18, 21, 24	10, 16, 19-28
	State of amount of material input, and mitigation measures	17-18	-
	State of volume of water resource input, and mitigation measures	17-18	16
	State of GHG emission, and mitigation measures	10, 17-18, 21, 24	10, 16, 19-28
	State of emmissions and removal of chemical substaces, and mitigation measures	(16), 17-18, 22, 23, (26)	12, 16, 19-28
	Production volume or sales volume	17-18	-
	Total amount of waste, amount finally disposed of waste and mitigation measures	15, 17-18, 21	11, 16, 19-28
	Total amount of waste water, and mitigation measures	17-18, 23	11, 16, 19-29
	State of environmental burdens from transportation, and mitigation measures	17-18, 25	-
	State of green purchase, and promotion measures	15	-
	State of environmental burdens on whole life cycle of products and servises	17-18	16
<b>State of social activities</b>	Information of Labour,Health and Safety	33-34	18, 19-28
	Information of Human Rights and Employment	35-36	17-18
	Information related to community involvement	-	19-30
	State of the disclosure and communication with community ,not related to environmental information	49-50	19-30
	Information of related to consumer protection safety of products	38	(2)
	Information of related to politics and morals	-	(2)
	Information of related to personal information protection	32	(2)



# Comparison with Global Reporting Initiative Sustainability Reporting Guidelines 2002

Report Content		Pages		
		Report	Databook	
Vision and strategy	Statement of the organisation's vision and strategy regarding its contribution to sustainable development	3-6	-	
	Statement from the CEO (or equivalent senior manager) describing key elements of the report	7-8	-	
Profile	Organisational Profile(Name of reporting organisation, number of employees, list of stakeholders)	1, 2, 30, 45-46	-	
	Report scope (Contact person(s) including e-mail and web addresses, Reporting period, specific limitations on the scope)	2, Back cover	1, Back cover	
	Report Profile (Decisions not to apply GRI protocols, Policy with regard to providing independent assurance, Means by which report users can obtain additional information)	2, 51-52, Back cover	(13-14, Back cover)	
Governance structure and Management systems	Structure and Governance(Governance structure of the organisation,Processes for management of economic,environmental,and social risks,Polices relevant to economic, social, environmental performance)	3-6, 31	-	
	Stakeholder Engagement(Basis for identification of stakeholder,Approaches to stakeholder consultation)	30, 38	-	
	Overarching policies and management systems (whether and how the precautionary approach or principle is addressed, Policies for supply chain management, Programmes and procedures pertaining to economic, environmental, and social performance,Status of certification pertaining to economic, environmental, and social management systems)	13-14, 15, 26, 37-38	(19-29)	
GRI Content Index		-	32	
Performance Indicators	Economic Performance Indicators	Customers	46	-
		Suppliers	(19)	-
		Employees	-	-
		Providers of Capital	-	-
		Public Sector	-	(15)
		Indirect Economic Impacts	-	-
	Environmental Performance Indicators	Materials	17-18	-
		Energy	17-18, 21	10, 19-28
		Water	17-18	16, 19-28
		Biodiversity	28	-
		Emissions, Effluents, and Waste	17-18, 21-22, 23	10, 11-12, 16, 19-30
		Suppliers	-	-
		Products and Services	17-18	-
		Compliance	-	-
		Transport	25	-
		Overall	16	13-16
	Social Performance Indicators	Labour Practices and Decent Work (Employment, Labour, Health and Safety, Training and Education)	35-36	17-18
		Human Rights (Non-discrimination, Freedom of Association)	35	17-18
		Society (Community, Bribery and Corruption)	30	21, 23, 25
Product Responsibility (Customer Health and Safety, Products and Services)		37-38	-	

## A

---

### ● Amino acid

Amino acid is a general term of organic compounds containing amino group (-NH<sub>2</sub>) and carboxyl group (-COOH) within its molecule. Most organic proteins consist of 20 types of amino acids. However, there are amino acids that are not included in proteins.

### ● AR and GA oilfields

“AR” refers to the Umm Al Ambar Oil Field, and “GA” to the Neewat Al Ghalan Oil Field. Abu Dhabi Oil and its affiliate Mubarraz Oil operate the AR, GA and Mubarraz Oil Fields, mix the crude produced by the 3 fields and ship it as “Mubarraz Blend”.

### ● Aromatics

Compounds that have benzene and benzene rings as part of their chemical structure. They may have two or more condensed aromatic rings, or the hydrogen atoms on the ring may be replaced by a member of the alkyl group (toluene, xylene, etc.)

### ● Associated gas

This refers to gas that emerges from an oil field during crude oil production. There are two types of associated gas, sweet and sour. Sour gas refers to natural gas containing more than trace amounts of acid gas such as carbon dioxide and hydrogen sulfide.

### ● Atmospheric distillation unit

Crude oil is composed of a variety of hydrocarbon compounds. The atmospheric distillation unit takes advantage of the different boiling points of these compounds to “crack” crude oil into separate fractions—gasoline, kerosene, diesel fuel, fuel oil and other components—under atmospheric pressure. In general, the scale of a refinery is defined by the process capacity of its atmospheric distillation unit.

## B

---

### ● Barrel

A unit for expressing oil volume, equivalent to approximately 159 liters.

### ● Benzene

Benzene has attracted concern for its hazardous effects on human health and has been classified by Japan’s Ministry of the Environment as a noxious air pollutant requiring priority action.

## C

---

### ● Catalytic reformer

A unit that raises the octane number of naphtha that has been cracked by the atmospheric distillation unit, producing a gasoline component. Hydrogen, a by-product of chemical reactions in this unit, is used in desulfurization.

### ● COD

Refers to chemical oxygen demand, an index of water pollution. Expresses the volume of oxygen required for oxidation of oxidizable substances (organic matter, etc.) in water.

### ● Cogeneration system

An energy supply system that uses heat emitted at the time of electricity generation to meet demand for heat for heating, cooling or hot water. This is expected to lead to an improvement in integrated energy efficiency.

- **Crude oil equivalent throughput**

Value used when calculating the unit energy consumption of a processing equipment, which is obtained by converting the volume of oil passing through it into an equivalent amount of crude oil processed by the atmospheric distillation unit. This value is meant to reflect the operating conditions of each equipment, offsetting discrepancies in the type and structure of facilities used in different refineries. The crude oil equivalent throughput of a processing equipment is derived by: [throughput volume] x [complexity factor]. The complexity factor of a given equipment is its construction cost per throughput, relative to the atmospheric pressure distillation unit (whose complexity factor is 1). The crude oil equivalent throughput of a refinery on the whole is the aggregated crude oil equivalent throughput values of its entire processing equipment fleet.

## D

---

- **Decentralized power source**

A small-scale power source utilized in a business or home, such as a cogeneration system, fuel cell or wind power generator. This has a number of advantages, such as that energy loss is reduced at the time of transmission as compared with electricity supply from a remote, large-scale power station.

- **Dioxins**

Refers to PCDD (polychlorinated dibenzodioxins), PCDF (polychlorinated dibenzofurans) and coplanar PCB (polychlorinated biphenyl) collectively. They are claimed to be toxic and carcinogenic.

- **Double-hulled tankers**

Ships fitted with a double-hulled structure to prevent oil spillage in case of accident.

- **DPF**

Stands for Diesel Particulate Filter, a filter that removes the soot from the exhaust gas of diesel automobiles.

## E

---

- **Electrostatic precipitator**

An electrostatic precipitator is a device that administer an electric charge to fine particles and liquid mist, etc. floating in gas and removes them using electrostatic energy. Highly efficient collection of even fine particles is possible with low pressure loss, so this equipment is widely used at large scale generating facilities such as thermal power stations.

- **Emissions trading**

Emissions trading often seems to be used with reference to trading in accordance with Kyoto Mechanisms under the Kyoto Protocol. Emissions trading is a mechanism allowing countries that have commitments to meet targets for greenhouse gas emissions reductions to acquire or assign portions of their emissions allowance.

Emissions rights, i.e. "rights to emit" or "credits for absorbing" greenhouse gases, are also being traded under various systems and contracts.

- **Environmental risk management**

Environmental risk is a possibility (threat) that environmental contamination or changes (environmental impact), which are generated by human activities, affect human health or ecosystem through environmental pathways under certain conditions. Environmental risk management is a process of confirming, evaluating, selecting and implementing of necessary measures in order to reduce the environmental risk.

- **EPS**

Stands for Environmental Priority Strategies In Product Design, a life cycle impact assessment method managed by the Centre for Environmental Assessment of Products and Material Systems, a research organ of Shalmas University of Technology in Sweden.

- **Exhaust gas denitrizer**

A device for removing NOx from exhaust gas. One method involves reduction NOx using ammonia and a catalyst, and another method involves having NOx absorbed by an absorbing liquid.

## F

---

### ● Fluid catalytic cracker

This unit uses a minute-particle catalyst to crack heavy fuel oil. The cracked oil is divided into LPG, gasoline, diesel fuel and heavy fuel oil. The gasoline component produced by this unit has a high octane number, and accounts for a high proportion of ingredients mixed in other products.

### ● FTSE

A joint venture company of the Financial Times and the London Stock Exchange which publishes various stock indices. In March 2003, Cosmo Oil was included as the first Japanese oil company on the FTSE4Good Global Index, an international socially responsible investment index.

## G

---

### ● Green purchasing

Green purchasing is purchasing of goods and services at which purchasers carefully examine the necessity of those and selectively purchase in order from those with the least environmental impact.

## H

---

### ● HCCI combustion

Stands for homogeneous-charge-compression-ignition combustion, a technology for igniting fuel without using a spark plug that can be used for developing a engine that can high efficiency matching that of a diesel engine, without emission of nitrogen oxide and soot, etc.

### ● Hydrocarbon vapor

Hydrocarbon vapor is a type of hydrocarbon steam generated by gasoline, benzene or toluene. In most cases it diffuses from oil storage depots, loading zones for oil tankers or distribution bases for chemical products. It is recognized as one of the causes of photochemical smog and malodor.

### ● Hydrodesulfurization unit

This unit uses a catalyst to make the sulfur compounds in the petroleum react with hydrogen, converting the sulfur to hydrogen sulfide, which is then removed. Desulfurization can be performed for each fraction, such as naphtha, kerosene, diesel fuel, and heavy fuel oil, etc. Industry has installed new gas oil desulfurization units to respond to tougher regulations on sulfur content and to meet voluntary targets. Heavy fuel oil desulfurization units are further divided into residue and vacuum gas oil (VGO) desulfurization units. The former removes sulfur from heavy oil fractions that have been cracked in an atmospheric distillation unit. The latter removes sulfur from heavy oil fractions after the asphalt fractions have been cracked in a vacuum distillation unit.

## I

---

### ● Immuno assay method

It is a method to measure target substance in a specimen making use of antibody's property of specifically combining with antigens.

### ● ISO 14001

International standards for environmental management systems, issued by the International Organization for Standardization, which prescribe standards for establishing measures for reducing the environmental impact of business activities, goods and services.

## J

---

### ● JHFC

The Japan Hydrogen & Fuel Cell Demonstration Project is a project implemented by the Ministry of Economy, Trade & Industry, composed of “Research and demonstration of fuel cell vehicles” and “Demonstration study of hydrogen fueling facilities for fuel cell vehicles.”

## K

---

### ● Kerosene heat pump air conditioner

A heat pump is a system for collecting heat from a low-heat object and transferring it to a high-heat object. A kerosene heat pump air conditioner involves the movement of a compressor using kerosene as fuel, repeating vaporization and liquefaction of the medium transmitting the heat and thus providing heating or cooling.

### ● Kyoto Mechanisms

With a target to stabilize the concentration of greenhouse gases, etc. in the atmosphere, the United Nations Framework Convention on Climate Change was signed in the Earth Summit 1992 in Rio de Janeiro. To achieve the specific targets of this treaty, the Kyoto Protocol was adopted at the COP3 (the Third Conference of the Parties). The Kyoto Protocol mandates developed nations to reduce greenhouse gas emissions (Japan 6%, US 7%, EU 8%) between 2008 and 2012 from the 1990 level. Kyoto Mechanisms are the economic means introduced aiming to achieve the targets more flexibly with higher cost/benefit rate.

Kyoto Mechanisms include three mechanisms; emissions trading, CDM (Clean Development Mechanism) and JI (Joint Implementation).

CDM is the mechanism to allow developed nations with reduction targets to obtain emission rights for the amount equivalent to the amount of greenhouse gas emissions reduced (absorbed) through their efforts implemented in developing nations that do not have reduction target. JI means transfers and acquisitions of the emission rights between developed nations that are obtained as a result of implementation of activities for reduction of greenhouse gas emissions and enhancement of absorption.

## L

---

### ● Life cycle inventory (LCI)

A quantitative and objective catalogue of the environmental impact of a product throughout all stages from the obtaining of raw materials through production, transportation, use, disposal, etc.

## N

---

### ● NOx (nitrogen oxide)

A collective term for nitrogen oxides, of which the principal air pollutants are nitrogen monoxide and nitrogen dioxide. Most factory smoke and automobile exhaust gas consist of nitrogen monoxide, which under the influence of ultra-violet rays, reacts with oxygen and ozone to form nitrogen dioxide. Nitrogen dioxide is the subject of air pollution controls based on health concerns. Nitrogen oxides are a cause of photochemical smog, and also of “acid rain” the same as sulfur oxides. Dinitrogen monoxide (nitrous oxide) is also a greenhouse gas.

**O****● Octane number**

The octane number is one gauge of motor gasoline quality. The higher the octane number, the less engine knocking will occur. JIS standards specify an octane number of at least 89.0 for regular gasoline, and at least 96.0 for premium gasoline.

**● Oil boom**

A boom to prevent oil from spreading on the surface of the sea. It is located on piers and is extended over the water surface by tugboats.

**P****● Particulate matter (PM)**

Particulate matter in the atmosphere. Suspended particulate matter (SPM) is held to be a cause of air pollution, and is defined as particulate matter suspended in the air with a particle diameter of 10 $\mu$ m or less. "Minute-particle matter", where the particle diameter is 2.5 $\mu$ m or less, is called PM<sub>2.5</sub>, and is regarded as a cause of asthma and bronchitis.

**● PCB**

Stands for Polychlorinated Biphenyl, an excellent thermostat and electrical insulator, having been used in transformers, condensers, heat transfer media and carbonless paper. However, PCBs are difficult to dissolve, accumulate in the body and are toxic, causing skin problems and damage to liver functions. Currently the manufacture and import of PCBs is in principle prohibited, and their storage and disposal is controlled by law.

**● PRTR**

Stands for Pollutant Release and Transfer Register. Businesses must keep track of, and report to the authorities the volumes of releases into the air, water and soil and the transfers outside their plant as waste material of prescribed chemical substances. Enacted in 1999, the system came into force in 2001.

**R****● "Research and Development of Petroleum Refining Pollutant Reduction Technology" Project.**

This is a project commissioned by NEDO (New Energy and Industrial Technology Development Organization) to PEC (Petroleum Energy Center) aimed at developing technologies for reducing environmental pollutants included in petroleum products, etc.

**S****● SL**

An international standard for gasoline engine oil prescribed by the API (American Petroleum Institute).

**● SO<sub>x</sub> (Sulfur oxide)**

A collective term for oxides of sulfur, of which the principal air pollutants are sulfur dioxide, sulfur trioxide and sulfur mist generated by the combination of the sulfur oxides with water in the air. When sulfur oxides react with water they show strong acidity, and are a cause of acid rain.

**● Stowage ratio**

The ratio of the actual stowage volume to the capacity of a tank.

- **Sulfur free fuel**

Automobile fuel having sulfur content not exceeding 10ppm. Planned to be introduced in Europe in 2009.

- **Sulfur recovery unit**

The unit collects sulfur from by-product gases containing hydrogen sulfide emitted from hydrodesulfurization unit or other oil refinery facilities.

Large quantity of sulfur oxide is emitted when gases containing hydrogen sulfide are directly used as fuel. Oil refineries therefore remove hydrogen sulfide from by-product gases before using them as fuel, and collect sulfur from the hydrogen sulfide.

- **Sour water treatment unit**

The wastewater discharged from hydrodesulfurization units and other refinery equipment contains hydrogen sulfide and other odorants. This unit uses steam injection to remove odorous materials. The hydrogen sulfide removed by this unit is then processed by the sulfur recovery unit.

## U

---

- **Unit energy consumption**

It is a value calculated when dividing total energy consumption at oil refinery by crude oil equivalent throughput. The unit is "kl-crude oil/1000kl". Total energy consumption is converted into crude oil, and the unit is "kl of crude oil".

## V

---

- **Vacuum distillation unit**

A unit that distills under reduced pressure. When oils with a high boiling point, such as heavy fuel oils, are heated, they may break down before vaporization can happen. By reducing the pressure in the unit, the boiling point of the oil is reduced, allowing for efficient cracking of fractions.

- **VOC (Volatile organic compounds)**

A collective term for organic compounds that are volatile at normal temperatures, covers a variety of substances including trichloroethylene, tetrachloroethylene and formaldehyde. VOCs easily spread out in the air and are a cause of photochemical smog. They not only cause pollution but also climate change.

## Z

---

- **Zero emissions**

Refers to a production system with "zero waste", using the waste generated by an industrial process as recycling material in another industry.



# COSMO OIL CO., LTD.

Toshiba Bldg., 1-1-1 Shibaura, Minato-ku  
Tokyo 105-8528, Japan  
Telephone: +81-3-3798-3211  
<http://www.cosmo-oil.co.jp/>

**For inquiry regarding the Sustainability Report 2004, contact:**

CSR & Environmental Affairs Office  
Cosmo Oil Co., Ltd.  
Telephone: +81-3-3798-3134  
Facsimile: +81-3-3798-3103  
<http://www.cosmo-oil.co.jp/>



	<p><b>30%</b> Minimum SGS-COC-1466</p> <p>At least 30% of the fiber used in the manufacturing process of this product comes from well-managed forest independently certified according to the rule of the Forest Stewardship Council.</p> <p><small>FSC Trademark © 1996 Forest Stewardship Council A.C.</small></p>
---	--