Green Purchasing

To promote the reuse of resources, the Yokogawa Group places priority on purchasing goods and services which have less impact on the environment. In close partnership with suppliers and subcontractors based on the Yokogawa Group proprietary guidelines, we are expanding the scope of green purchasing.

1. Green Purchasing

Based on the philosophy that purchasing environmentally friendly products is essential for supplying environmentally friendly products, the Group has issued its Green Purchasing Guideline in 2000 and has been carrying out "green" purchasing activities with the help of suppliers and subcontractors.

In fiscal 2001, we chose those vendors that account for the top 70% of the total amount of purchases and surveyed the environmental protection activities of 58 materials and parts suppliers thus selected from 1,305 suppliers and for 35 machining subcontractors from 343. The surveys assessed the companies' corporate structure and use of substances that have impacts on the environment, and classified them into three ranks (A, B, or C). Excluding the A-ranked vendors which were found to be satisfactorily contributing to environmental protection, we took the following measures for those ranked B or C as well as new vendors, in order to reduce environmental impact.

● Environmental Impact Reduction Measures

Materials and parts suppliers	Rank B: We sent a letter requesting them to acquire ISO14001 certification or institute an ISO14001-equivalent management system. Rank C: In addition to the above, we sent a letter requesting cooperation and early improvement in environmental protection.
Machining subcontractors	Rank B: We sent a letter requesting cooperation and early improvement in environmental protection. Rank C: In addition to the above, we visited them and gave advice on environmental protection.

In fiscal 2001, we requested C-ranked and 9 new materials and parts suppliers to make early improvements, and visited C-ranked and 23 new machining subcontractors and gave advice. These activities are not intended to eliminate C-ranked vendors, but to build close partnerships with vendors and raise their level.

2. Green Purchasing of Stationery, Paper, and Office Equipment

We reviewed the green purchasing criteria and drew up a green purchasing guideline for indirect-material products such as stationery and office equipment in December 2001, thus encouraging the purchase of green materials and indirect materials. We are also using a new purchasing system which allows registered purchase goods to be visually confirmed on the Internet, and are thus promoting corporate-wide green purchasing activities.

The strategy of the Green Purchasing Guideline is twofold: (1) Give priority to purchasing goods and services that have less impact on the environment; and (2) Give priority to transactions with more environmentally-aware suppliers. The scope of applicable goods and services complies with the List of Regulated Procurement Items (covering 101 items in 14 categories) stipulated under the Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Law on Promoting Green Purchasing) of Japan.

By enforcing the Eco-goods Criteria drawn up based on the Green Purchasing Guideline and using the Vendor Selection Criteria in check sheet format, for each product we select vendors which are striving to reduce environmental burden. And by selecting a vendor for each item, unit prices have been aligned and waste eliminated.

We defined the green purchasing ratio as follows:

$$\text{Green purchasing ratio} = \frac{\text{Total amount of purchases of registered eco-goods and eco-services}}{\text{Total amount of purchases of indirect-material goods and services}}$$

The green purchasing ratio at the three model sites (Headquarters, the Kofu plant, and the Akiruno plant) in fiscal 2001 was 71.6%.

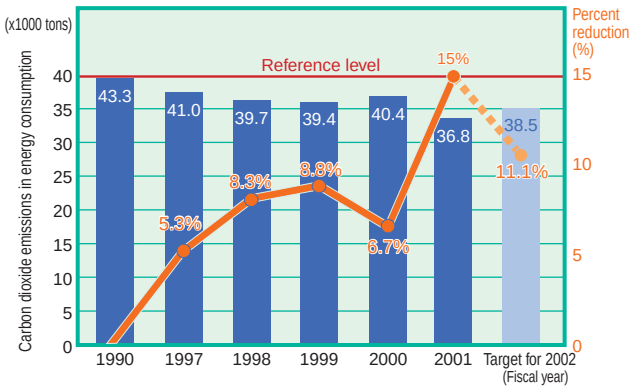
Green Purchasing Guideline (booklet)
Green Purchasing Guideline for Indirect-material Products (booklet)

Energy Efficiency

Following ratification of the Kyoto Protocol, measures to combat global warming have become increasingly important. The Yokogawa Group is therefore not only forging ahead with resource recycling-based operations, but also raising the energy efficiency of its activities.

1. Carbon Dioxide Emissions in Energy Consumption

The graph below shows the trend of total carbon dioxide emissions in energy consumption at 18 sites. Our exhaustive energy controls resulted in a 15% reduction in fiscal 2001 compared with 1990, thus exceeding the target for 2001 of a 7.6% reduction.



Trend of Total Carbon Dioxide Emissions in Energy Consumption

2. Representative Activities in Individual Sites

(1) Headquarters

The Energy Efficiency Subcommittee at Headquarters had drawn up a plan to slash power consumption by 342 MWh for fiscal 2001, but actually attained a reduction of 370 MWh. Key efforts in this success included energy efficiency measures for clean rooms. Specifically, operation control has been improved such as by reviewing the air-conditioner operating time, refining temperature settings, and changing the induction fans to inverter-driven ones to lower the maximum speeds. Other measures included changing the factory air-compressors to inverter-driven ones, changing the heat source, and installing package energy-efficient equipment.

(2) Kofu Plant

a. Solar-electric power generation system

As a joint development project with the New Energy and Industrial Technology Development Organization, Japan, a new type of solar-electric power generation system was installed on the rooftop of the Technical Center in the Kofu plant, and the system was completed on February 26, 2002. This new light-through system has achieved high power generation efficiency, adequate lighting, water-tightness, and low costs. The photovoltaic cells incorporate high-efficiency single-crystal modules to which a light-through feature has been added for the first time in Japan by using transparent film as the back sheet. The benefits of this system include:

- Clean energy generation: 40 MWh per year
- Reduction of global-warming carbon dioxide emissions: 15 tons CO_2 per year
- Rooftop lighting ratio: Approx. 20%
- Power supply at demand peaks during summertime: 20 to 30 kW available
- Reduction in construction costs: Approx. 10 million yen

b. Total environment monitoring system

An environmental burden monitoring system that enables the environmental burden of electric power on water quality, the atmosphere, and so on to be monitored and analyzed on the Web was completed in March 2001. The Kofu plant was chosen as a model site, and the new system measures and monitors the environmental burden of the entire plant. In particular, the power monitoring made it possible to reduce energy consumption, such as by changing the plating line heater start-up time. (See page 26 for details.)

In addition, we reviewed the control of clean room

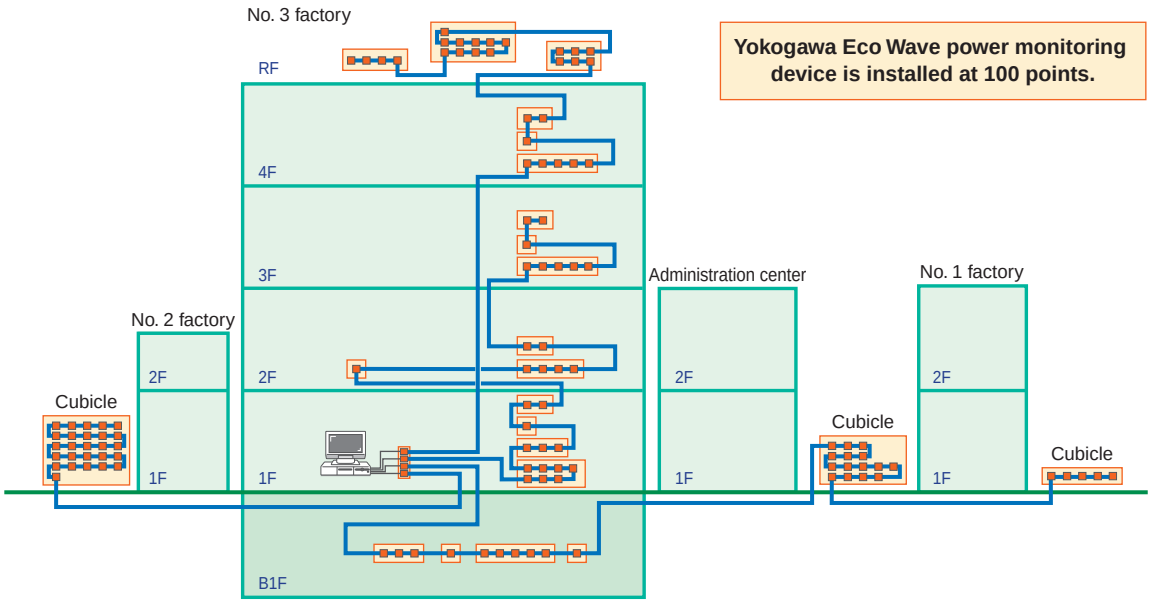
Solar-electric Power Generation System on Rooftop of Technical Center

operations to reduce wastes and improve energy efficiency, and drew up improvement rules. And our waste alkali concentration system using plant waste heat, which started operating in March 1998, won the Minister of Education, Culture, Sports, Science and Technology of Japan award in April 2001 for its excellent energy-efficiency performance.

(3) Energy-efficient Building, No. 3 Factory in Akiruno Plant

Worthy of special note in fiscal 2001 is the fact that the No. 3 Factory in Akiruno Plant went into full-scale operation. This energy-efficient building was designed specifically to protect the global environment and efficiently use energy, and is a model factory that showcases the global environmental protection activities of the Yokogawa Group. Specific energy-efficiency measures include:

a. High thermal insulation: The frame pack technique that offers superb thermal insulation capability was employed in folded-plate roofing structures.
b. Thermal zoning: Thermal buffering by arranging small rooms to the south side and so on.
c. Lighting: Heat-reflecting glass windows are equipped with a small canopy and blind to decrease sunlight penetration.
d. High-frequency, illumination-controlled lighting equipment: High-frequency fluorescent lamps and high-frequency inverters are adopted, raising the consumption efficiency by 58% in comparison to the traditional rapid-start lighting equipment.
e. Power monitoring (with Eco Waves): Yokogawa Eco Wave power monitoring devices are allocated elsewhere inside the building for efficient use of power and energy.
f. Human presence sensors: Infrared sensors detect the presence of humans for efficient turning on and off of lighting.
g. Latent heat recycle hot-water boiler: A new combustion system employing ceramic burners and a low-nitrogen oxides emission boiler and greatly increased energy efficiency.
h. Ice-forming thermal storage: Generating ice using cheap nighttime electricity reduced the power expenditure during the daytime by nearly 50%.
i. Metasys integrated building management system: Johnson Controls Metasys control system performs integrated air-conditioning control, monitoring of cooling/heating water temperatures, and temperature and humidity control of clean rooms, thus help reducing costs.



No. 3 Factory in Akiruno Plant

Protection of Atmosphere and Water Quality

Protection of the atmosphere and water quality is the basis of environmental protection activities. But we believe it is important not merely to meet the regulations, but to voluntarily establish and meet stricter limits. The Yokogawa Group has thus established and continues to meet its own voluntary control limits.

1. Voluntary Control Limits

Voluntary control limits have been set to ensure that environmental protection activities are implemented. At the Headquarters of Yokogawa Electric Corporation, the voluntary limits are set in four levels from class 1 to class 4 as follows, and the appropriate class is selected for each item.

Class	Voluntary Limit
1	Control for not exceeding legal limit × 0.95
2	Control for not exceeding legal limit × 0.8
3	Control for not exceeding legal limit × 0.5 To be applied to the setpoint when peaks in the trend are stabilized equal to or below 50% of the legal limit.
4	Control for not exceeding the corresponding reference value defined in the Basic Environment Law of Japan The references are defined for atmospheric pollution, water pollution, soil pollution, and noise pollution levels. (For example, the reference environmental criterion for water quality is approximately ten times smaller than the corresponding legal limit. This is the ultimate goal of our voluntary efforts.)

2. Reductions of Emissions to Atmosphere

(1) Phase-out of HCFCs

The Montreal Protocol decided that freon substitute hydrochlorofluorocarbons (HCFCs) must be phased out by 2020 since they are potent ozone layer-depleting substances. HCFCs had been used for cleaning printed boards and machined parts at six sites of the Yokogawa Group, but in fiscal 2001 they were completely eliminated from the Headquarters and Kofu plant of Yokogawa Electric Corporation and Yokogawa Rental & Lease Corporation by establishing a cleaning-free soldering method and a substitute cleaning system for machine parts. HCFCs are to be completely eliminated at the other three sites within fiscal 2002.

(2) Phase-out of Trichloroethylene and Tetrachloroethylene

Trichloroethylene and tetrachloroethylene, which are specified as Class 2 regulated chemicals which may pollute ground water, had been used for cleaning at five sites of the Yokogawa Group. However, they were completely eliminated from three sites in fiscal 2000, and from one site (the Mie plant) in fiscal 2001. In the Nagano plant, the amount used has been decreased by 93% from that in fiscal 1998 (exceeding the target of 80% reduction). The Group continues to work toward complete removal from the entire Group.

(3) Procedure for Decommissioning Facilities Using Fluorocarbons

Before the Fluorocarbons Recycle and Destruction Law took effect in Japan, we defined the Procedure for Decommissioning Facilities Using Fluorocarbons in fiscal 2000, and has ensured that this procedure is observed at all firms of the Group in fiscal 2001. This procedure defines facilities using fluorocarbons (freon) and prescribes the procedure to prevent leakage of freon and its influence on the environment when decommissioning a facility and its freon. The procedure also prescribes what signs are to be posted at each facility using freon, the line of communication to the person in charge of environmental management, receipt of reclamation certificates and destruction certificates from recycling vendors, and so on.

3. Protection of Water Quality

Chemicals and heavy oil are transported by road tankers and fed into tanks. If a chemical or heavy oil leaks from a road tanker en route, or during unloading such as due to a broken hose, the substance may flow into storm drains and pollute rivers. We have been conducting emergency drills for such accidents and identifying points to be improved. At the Kofu plant, gabions were specified to be used to dam a spilled liquid, but these were found to be inadequate for blocking a leakage completely. Spill prevention pits were therefore installed on the periphery of the premises, and if the pH value inside a pit falls below 4 or rises above 9, an alarm sounds. At the Nagano plant, drainage shutoff valves were installed to stop any chemical or oil that spills into a gutter. These valves are shut when a road tanker enters the premises to avoid any accidental spillage outside the premises.

Spill-out Prevention Pit
(in Kofu plant)

Drainage Shutoff Valve
(in Nagano plant)

Total Control of Chemicals

Chemicals are invaluable for improving production technologies and products, but they can easily cause damage to the flora and fauna including human beings. To prevent this, the Yokogawa Group is using a system to control and reduce the amounts of chemicals it uses.

1. Chemicals Control System

For central control of chemicals, the Group built a chemicals control system in fiscal 2000 and placed it in operation from fiscal 2001. This system maintains a register of chemicals such as those that have undergone a chemical registration review described below, as well as all information about the chemicals, including the material safety data sheets (MSDSs) and data relevant to the Pollutant Release and Transfer Registers (PRTRs). This information is accessible from each workplace.

2. Chemical Registration Review Program

This program applies to all chemicals that are used in our activities, whether directly or indirectly, and for which the manufacturer issues an MSDS, and requires the approval of an examining committee before any new chemical can be used. A person wishing to use a chemical must check via the parts information system whether the chemical has already been registered, and apply for registration to the examining committee. On the application form, data such as the purpose of use of the chemical, location of use, annual usage amount, applicable legal regulations and control limits, and manufacturer information must all be included. The examining committee reviews the application, and in case of giving approval, writes on the application form the obligations of the corresponding section (e.g., measurement of working environment, health checks, safety education, and entry/retrieval management) and returns it to the applicant.

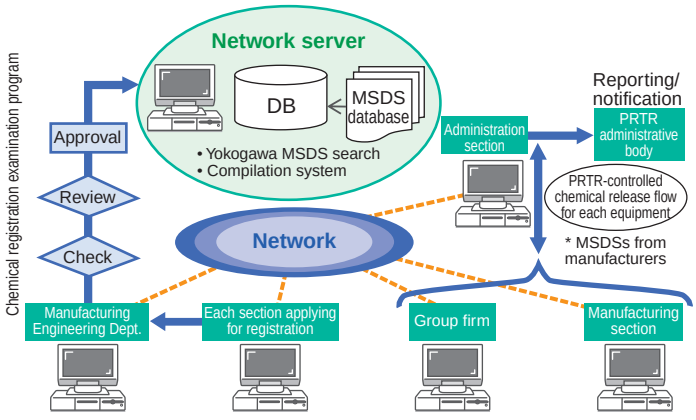
We are also making efforts to register chemicals that are already in use, encompassing a broad range of areas including not only chemical treatment lines and manufacturing engineering laboratories but also machining lines and assembly lines. As of March 2002, some 400 chemicals including conventional ones have been registered.

Chemical Categories

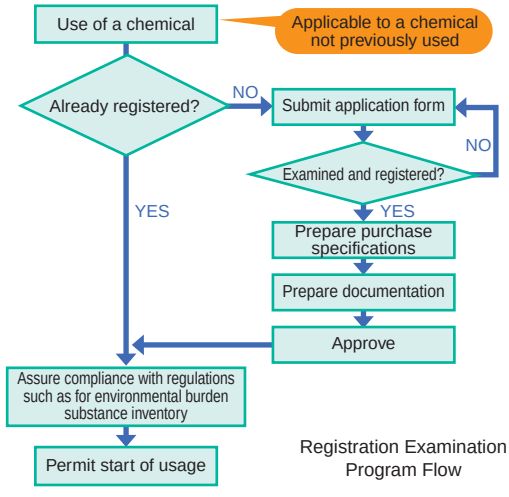
Control Category	Applicable Substances
Prohibited chemicals	Class 9 chemicals defined by the Ministry of the Environment, Japan (specific potent-odor-generating flame retardants, carbon tetrachloride, etc.)
Primarily controlled chemicals	Class 12 chemicals defined by the Ministry of the Environment, Japan (trichloroethylene, tetrachloroethylene, hexahydric chromium compounds, etc.)
Reduction-susceptible chemicals	Class 37 chemicals defined by the Ministry of the Environment, Japan (organic phosphorous compounds, phthalate, hydrogen fluoride, etc.)

3. Pollutant Release and Transfer Registers (PRTRs)

The Yokogawa Group has been controlling chemicals in line with the Pollutant Release and Transfer Registers (PRTRs) since 1998. Among the Group's Japanese sites, nine sites use PRTR-controlled chemicals but none of these uses more than five tons per year (as an interim measure, the PRTR Law of Japan prescribes that each site using five tons or more of a controlled chemical during the first two years of enforcement must report its releases and transfers to the government).



Conceptual Diagram of Chemicals Control System



Registration Examination Program Flow

Zero Emissions

To help achieve a sustainable society, the Yokogawa Group must reduce its manufacturing emissions closer to zero. These "zero-emissions" activities were begun in 1998 and are expanding throughout the Group.

1. Measures for Zero Emissions

The Group defines "zero emissions" as reclaiming and reusing 99% or more of the total amount of waste generated. The waste that cannot be reclaimed into resources is classified into refuse for landfill (metal-plastic mixture debris, and so on), refuse for incineration (domestic garbage, waste oil, and so on), and chemical treatment wastewater (waste acid, waste alkali, and so on). As the first step towards zero emissions, we embarked on an initiative for "zero landfill refuse" and attained it at Headquarters in fiscal 2000 and at the Kofu plant and the Akiruno plant in fiscal 2001, by manual disassembly, thorough segregated disposal, recycling of plastic into solid fuel, and recycling of all metal-containing debris with a gasification melting furnace.

Our next step is to achieve "zero incineration refuse and reduction of chemical treatment wastewater." For example, to eliminate incineration refuse, a rule was enforced at Headquarters from August 2001 that cigarette butts, which had been discarded directly into water in a large container, must be extinguished in a small water bottle attached to a container, and then discarded into the container. This measure decreased the total amount of butts and ash water (incineration refuse) from 20 tons to 6 tons per year. For chemical treatment wastewater, we will reduce the amount used, prolong the usage lives of liquids, and increase the concentration.

Yokogawa Group's Definition for Zero Emissions

Reclaim as 'circulating resources' 99% or more of the total amount of waste generated.

Classification		Process	Legal Classification (Japan)	Type of waste
Total amount of waste generated	Amount of waste reclaimed into circulating resources	Circulating resources	General refuse	Paper, packing materials (cardboard)
				Domestic garbage, packing materials (wood)
			Industrial waste	Metals
				Manufacturing debris
				Glass
			Specially controlled refuse	Toxic substances (mercury, solder debris, etc.)
	Amount of waste emissions	Chemical treatment wastewater	Specially controlled refuse	Toxic substances (waste acid, waste alkali, etc.)
		Refuse for incineration	General refuse	Domestic garbage (cigarette butts, fallen leaves, etc.)
				Packing materials (debris containing wood)
			Specially controlled refuse	Fats and fatty oils (waste oil), others (infectious refuse)
		Refuse for landfill	Industrial waste	Debris containing metal
				Debris containing plastic
			Specially controlled refuse	Waste asbestos

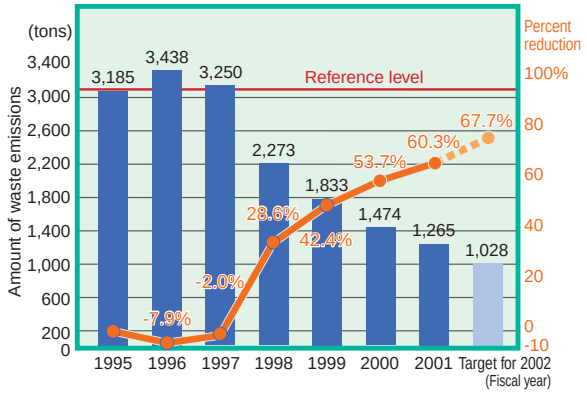
Note 1: From the definition, the remaining 1% is waste that would pose a significant burden on the environment if reclaimed into circulating resources, and waste that is difficult to reclaim into circulating resources, such as infectious refuse, asbestos, and fluorescent lamps.
Note 2: Temporarily stored polychlorinated biphenyl (PCB) will be counted in the amount of waste emissions when it is discarded.

2. Amount of Waste Emissions and Waste Reclamation Ratio

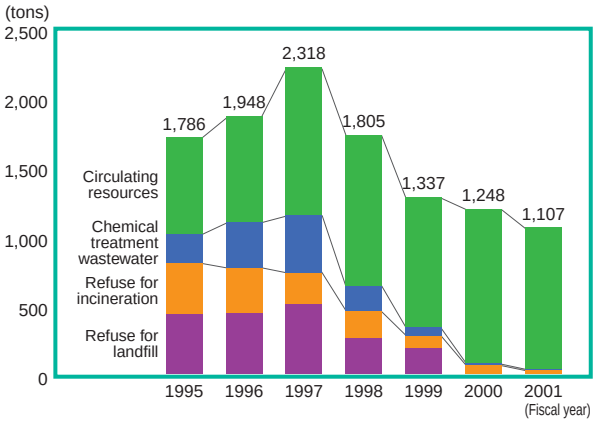
The target for fiscal 2001 was to reduce waste by 58% from that in fiscal 1995, which we exceeded by attaining a reduction of 60.3%. The waste reclamation ratio overall was 74.9%, while that at Headquarters was an astounding 96.7%.

3. Charging for Waste

At Headquarters, a charge is now made for household and office appliances as well as measuring instruments



Trend of Amount of Waste Emissions versus Waste Reclamation Ratio



Trend of Waste Reclamation (at Headquarters)

brought into the Recycle Center for scrapping, to encourage repair and reuse rather than disposal, and so reduce scrapping. It costs the same as the legally prescribed (in Japan) collection fees for general household and office appliances, 3,000 yen for a copy machine, 2,000 yen for a personal computer, 1,000 yen for an electric fan, and so on. These fees must be borne by each section that asks for scrapping. Yokogawa Foundry Corporation* performs the wrecking and material segregation for the appliances brought into the Recycle Center.

* An affiliated company founded under special regulations prescribed in the Japanese Law for Employment Promotion under the Employment Quota System for Persons with Disabilities and the Levy and Grant System for Persons with Disabilities,.

4. Leader in Achieving "Zero Emissions" Industrial Park

Our Kofu plant, which is located in the Kokubo industrial park in Yamanashi Prefecture, has been leading the recycling-based "zero-emissions" activities of a consortium at the park. The consortium has already built a system for minimizing waste (source reduction) and centralized systems for recycling waste to promote reuse and recycling. At present, the fifth step (see the diagram below) of energy and resource recovery with a gasifying fusion furnace to eliminate emissions is under study, and discussions with Yamanashi Prefecture are now in progress. The consortium's ultimate goal is to include facilities for reclamation, separation (wrecking), reuse, and recycling of used products shipped from the industrial park.

Recycling System of Kokubo Industrial Park

Physical Distribution

Physical distribution has a significant impact on the environment, due to the carbon dioxide and atmospheric pollutants produced by transportation trucks and the dumping of packing materials. The Yokogawa Group strives to reduce the environmental burden incurred in physical transportation through an efficient transportation system, improved packing materials, packing-free delivery, and other means.

1. Reduction of On-demand Trucks

On-demand transportation trucks had been run in addition to scheduled trucks, but since their use not only reduces transportation efficiency but also incurs a significant environmental burden, the Akiruno plant, Ome plant, and Hachioji plant have reduced usage of on-demand trucks. A total of 67 such trucks run at the three plants in fiscal 2000 was decreased to 1, reducing costs by over 3 million yen.

2. "Green" Packing

(1) Film Cushions

Film cushions are made of rugged, elastic, non-slip sheets of film stuck to a cardboard frame. A product is supported by two sheets of film that absorb shock, and floats in the package. Film cushions are greatly helping reduce the use of Styrofoam, and are now used for 43 products including 15 products added in fiscal 2001.

(2) Returnable Tote Boxes

Each returnable tote box (container) consists of a transparent plastic box with a lid and is used with cushions (a flat bottom cushion and rod cushions). Transportation fees for recovery of returnable tote boxes are borne by the Yokogawa Group.

Returnable Tote Box