CFC Management Strategy of Japan

July 2001

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1. Background

Japan used to be one of the world's major producers and consumers of Chlorofluorocarbons (CFCs); CFCs were widely used in different applications ranging from the solvent sector, the foam sector, the refrigeration sector, the aerosol sector to other minor sectors and in 1988 the annual CFC production reached its peak of approx. 150,000 tonnes.

As the internationally coordinated efforts for the protection of the ozone layer accelerated and took shape in the March 1985 adoption of the Vienna Convention for the Protection of the Ozone Layer (hereinafter referred to as the Vienna Convention) and the September 1987 adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer (hereinafter referred to as the Montreal Protocol), Japan enacted "the Law concerning the Protection of the Ozone Layer through the Control of Specified Substances and Other Measures" (hereinafter referred to as the Ozone Layer Protection Law) in May 1988 and since then has implemented measures to phase out the production of ozone-depleting substances (ODS) and to prevent releases/emissions of ODS from equipment.

In its efforts towards the complete phase-out of CFC production, non-CFC technologies have been adopted in those sectors which had previously depended upon CFCs, steadily replacing the CFCs with Hydrochloro-fluorocarbons (HCFCs), Hydrofluorocarbons (HFCs) and other substitutes.

Whereas those efforts have resulted in considerable success marked by the complete phase-out of CFC production in non-Article 5 countries, large amounts of CFCs that were produced in the past years are still used, as is the case in the refrigeration sector. The Parties to the Montreal Protocol, recognizing the need for further strengthening the measures to prevent emission while servicing as well as prior to disposal, decided at its 11th meeting to request that each non-Article 5 Party develops and submits to the Ozone Secretariat, by July 2001, a strategy for the management of CFCs (Decision XI/16). It is in response to this decision that this CFC Management Strategy of Japan has been prepared.

2. Principles of CFC Management of Japan

Japan's CFC management has been conducted on the basis of the Ozone Layer Protection Law and the Guidelines for Emissions Reduction and Rationalized Use of Specified Substances (hereinafter referred to as the Guidelines for Emissions Reduction and Rationalization) with substantial assistance from industry, local governments and many other stakeholders. However, recognizing the need for further efforts in the light of the fact that large amounts of CFCs remain in use in the refrigeration sector and also the foam sector in Japan, the National Government of Japan shall apply the following principles for further promotion of on-going efforts – through committ

ed enforcement of the Law for the Recycling of Specified Domestic Appliances (hereinafter referred to as the Domestic Electrical Appliances Recycling Law), which entered into force in April 2001 – and early and appropriate implementation of a new legal instrument, i.e. the Law for ensuring the Implementation of Recovery and Destruction of Fluorocarbons* concerning Specified Products (hereinafter referred to as the Fluorocarbon Recovery and Destruction Law), which was promulgated as recently as in June 2001:

(1) To minimize the releases/emissions of CFCs from existing and out-of-service products and equipment containing CFCs in each stage of their lifecycle from production, servicing through disposal;

(2) To reduce CFC use by encouraging conversion to alternative technologies and substitutes which are acceptable from the standpoints of environmental protection while taking into consideration their technological and economic feasibility; and

(3) To obtain information for appropriate understanding and analysis of the complex and diverse situations in which production, usage and destruction of CFC-containing products and equipment are being undertaken and thereupon to make sure that each stakeholder fulfills its role, in an appropriate and responsible manner, in recovering, storing and destroying CFCs from existing or out-of-date products and equipment containing CFCs. In pursuit of the recovery/destruction system, when a recycling system exists or is to be introduced, the establishment of the recovery/destruction system shall be integrated into the recycling system, taking into consideration its practicability and efficiency.

Recycling/reclamation of recovered fluorocarbons should be limited to a minimum and needs to be carefully evaluated from the standpoints of technological and economical feasibility and effective resource uses. The scope of acceptable practical applications for CFC recycling/reclamation shall be explored in this view as well as in adequate understanding and evaluation of the current situation of on-going uses of recovered fluorocarbons.

*fluorocarbon : CFC, HCFC, HFC

3. National Overview and CFC Management Efforts

3.1 CFC Use in Japan

Japan completed the phase-out of its CFC production by the end of 1995, successfully implementing the Ozone Layer Protection Law; however, CFCs that had been theretofore produced are still used in large quantities in Japan, mainly in the refrigeration sector.

The estimated amount of CFCs which remain in refrigeration products and equipment is approx. 22,000 tonnes as at the end of the year 2000; that of residual CFCs in insulation foams is approx. 40,000 tonnes by calculation based on the methodology of the 1996 IPCC (Intergovernmental Panel on Climate Change) guidelines. The amount of CFC stockpiles in the solvent and aerosol sectors is estimated to be negligibly small compared to the above-mentioned two sectors.

3.2 CFC Management Efforts

3.2.1 Legislative Framework

Japan has been implementing laws in relation to CFC management as follows:

Production Restriction and Emissions Prevention

(1) Ozone Layer Protection Law (promulgated in May 1988)

The purpose of this law is to ensure the appropriate and smooth implementation of the Vienna Convention and the Montreal Protocol in Japan by introducing quantitative regulations on ODS production and requiring ODS users to undertake efforts for emissions reduction and rationalized utilization. In compliance with the provisions of this law, CFC production in Japan had been completely phased out by the end of 1995. In 1989, the Guidelines for Emissions Reduction and Rationalization were published in order to encourage ODS users in making spontaneous efforts towards the fulfillment of the law's purposes.

Recovery and Destruction

(1) Fluorocarbons Recovery and Destruction Law (promulgated in June 2001)

This law prohibits arbitrary environmental releases of CFCs, HCFCs and HFCs to the environment, which are used as refrigerants in commercial refrigerators/air-conditioners and mobile air-conditioners. It also requires appropriate recovery and destruction of those substances prior to disposal of the relevant equipment. This being a rather fresh legislation of June 2001, implementing ministries and agencies are currently working for the smooth implementation.

The provisions of this law prescribe the responsibility of manufactures of ODS or ODS-containing equipment to make due efforts to develop substitutes or alternative technologies and the responsibility of the National Government to take immediate actions to encourage research and development of fluorocarbon recovery and destruction technologies in relation to insulation foams.

(2) Low for Recycling of Specified Kinds of

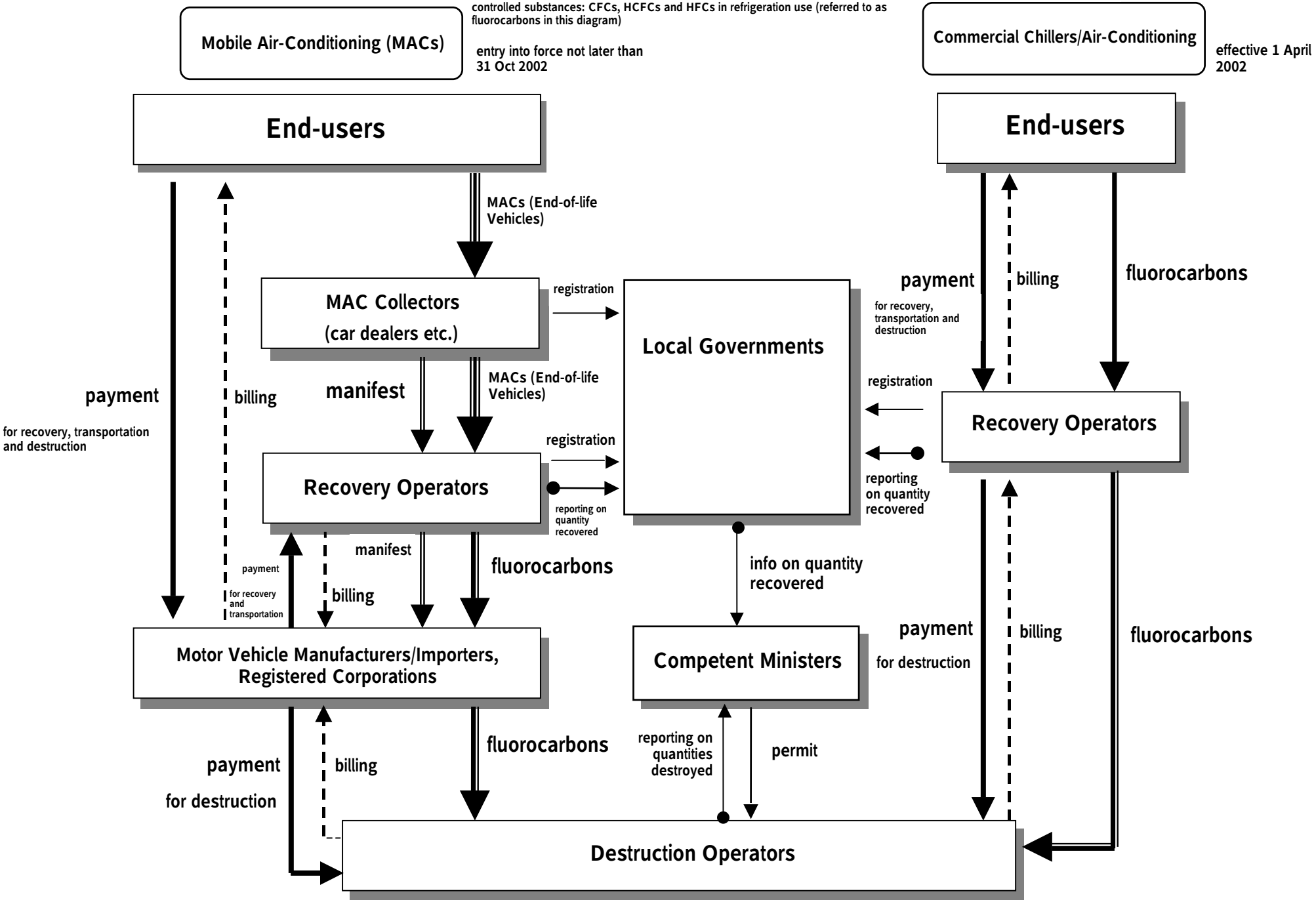
Home Appliances (promulgated in June 1998)

This law requires domestic appliances manufacturers to recycle their products for the purposes of appropriate waste disposal and wise resource uses. Being in effect since April 2001, the law requires CFCs, HCFCs and HFCs which are used as refrigerants in domestic refrigerators/air-conditioners to be recovered in the recycling process. The statement of basic policies for the implementation (June 1999) calls for the need for technologies and facilities for appropriate and efficient recovery, re-use and destruction as regards ODS used for insulation.

(3) Law for the Promotion of Utilization of Recycled Construction Materials (promulgated in May 2000)

This law provides for recycling of construction materials for the purposes of appropriate waste disposal and wise resource uses. The statement of basic policies for the implementation (January 2001) calls for establishment of measures for fluorocarbon recovery from commercial refrigerators/air-conditioners and technological and economic study/evaluation of insulation foam issues as well as development of technologies and facilities for appropriate and efficient methods for insulation foam collection and fluorocarbon recovery and treatment.

Figure 1. Explanatory Diagram of Japan's Fluorocarbons Recovery and Destruction Law



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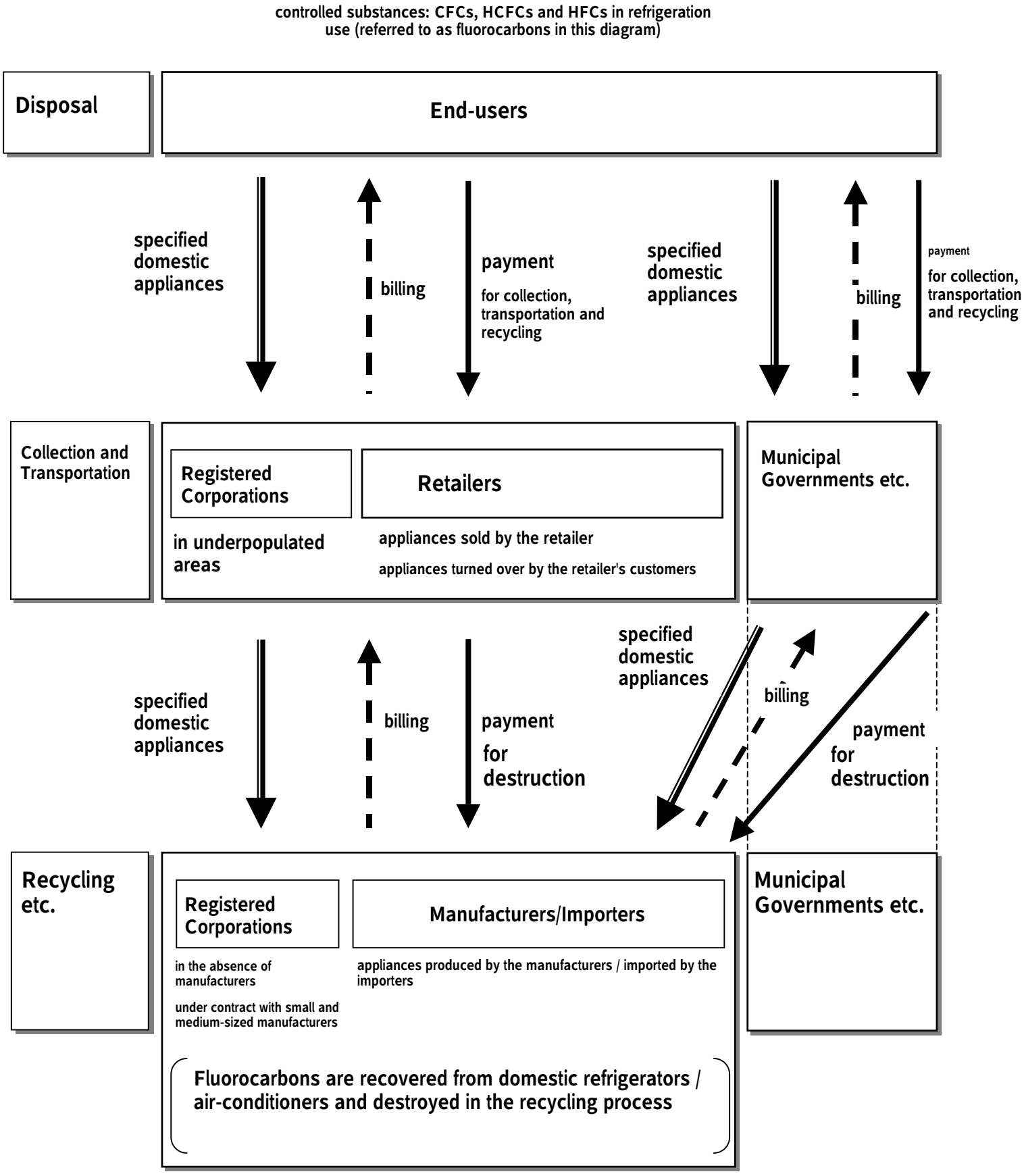

Data Reporting

(1) Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements in Their Management (promulgated in July 1999)

The purpose of this law is to improve management of chemical substances and to prevent environmental damage from chemical substances.

The law requires businesses who deal with hazardous chemicals to report to the National Government the quantitative data on emission, etc. of those chemicals and to provide the transferee with information on properties and handling of those. Major CFCs are included on the list of "the class 1 designated chemical substances", which are controlled under the law since April 2001 businesses who deal with these CFCs have been obliged to record the quantities of emission, etc.

3.2.2 Cooperative Work of Competent National Agencies

The measures for the protection of the ozone layer – including public awareness raising, development and promotion of alternative technologies and substitutes, and emissions reduction and industrial rationalization – often involve several ministries/agencies for their effective implementation. In order that the national agencies involved in the ozone issues, *inter alia*, CFC recovery, re-use and destruction, could work in a concerted manner for smooth, comprehensive and aggressive implementation of their responsibilities, the Governmental Conference for the Protection of Ozone Layer was established in April 1994. As a result, the discussions at the conference regarding CFC recovery, re-use and destruction have been uniformly incorporated into measures taken by different ministries and agencies.

3.2.3 Development of Alternative Technologies and Substitutes

(1) Development of New Refrigerants etc. by the National Government

A project for development of new substitutes , starting in FY* 1994 and scheduled to be completed in FY 2001, is currently underway. The project aims at developing substitutes with low GWPs and no ODPs, which can especially be used for applications which have been slow in converting to non-fluorocarbon technologies owing to safety concerns.

(2) Research and Development by Private Sector

Private corporations have also been active in developing and placing on the market alternative technologies and CFC substitutes. For example, water-blown technologies are already in use for the production of rigid polyurethane foams (building insulation); air-conditioning equipment which uses hydrocarbons as refrigerant and chillers which use ammonia (NH_3) as refrigerant are commercially available.

As a further encouragement to such movement in the private sector, this type of development has been rendered eligible for tax deduction.

* FY: Japanese Fiscal Year. Starts on April 1 and ends on March 31. For example, FY 2001 starts on April 1, 2001 and ends on March 31, 2002.

4. Description by Sector

4.1 CFC Production and Imports

Japan introduced regulative measures against ODS production in 1989 under the Ozone Layer Protection Law and succeeded in the complete phase-out of CFC production by the end of 1995 (Japan has also stopped production for the basic domestic needs of Parties operating under Article 5 of the Montreal Protocol, which can be approved until 2010 according to the Montreal Protocol procedures.)

CFCs are subjected to the import quota under Article 52 of the Foreign Exchange and Foreign Trade Control Law (hereinafter referred to as the Foreign Exchange Law). The import quota has been set zero except for CFC-based metered dose inhalers (MDIs), which are currently exempted from the control of the Montreal Protocol as essential use. The amount of imported CFC-based MDIs is strictly checked below the limit approved at the annual meeting of the Parties to the Montreal Protocol. As regards imports for feedstock uses and laboratory and analytical uses, which are also exempted from the control of the Montreal Protocol, the Foreign Exchange Law requires the confirmation of applications/usage.

4.2 Refrigeration Sector

4.2.1 Overview of National/Local Government and Industrial Sectors Efforts

(1) National Government

The Governmental Conference for the Protection of the Ozone Layer formulated the policies for the promotion of ODS recovery, re-use and destruction in 1997, on the basis of which each relevant ministry and agency has been implementing those policies and requesting local governments and relevant private corporations to take cooperative actions.

The Ministry of the Environment (MOE) has been supporting the establishment of fluorocarbon recovery/destruction systems at regional levels through a series of "Model Projects for the Establishment of Fluorocarbon Recovery System" since FY 1993. In 2000, the MOE published "the Handbook for Fluorocarbon Recovery" for the purpose of disseminating information upon efficient and safe technologies for refrigerant recovery.

The Ministry of Economy, Trade and Industry

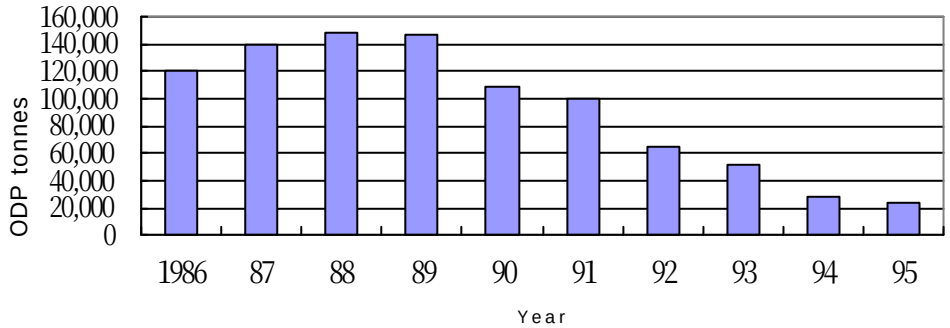

Figure 3. CFC Production in Japan (1986-1995)

(METI) drew up its "Programme for the Promotion of Recovery of Specified Fluorocarbons" in 1997. The METI, showing the program to relevant industry associations, requests them to break down the programme into the voluntary plans to achieve the targets.

The Ministry of Land, Infrastructure and Transport (MLIT) has been taking measures to implement proper recovery/destruction of CFCs contained in chillers installed at the national government buildings. The MLIT requests the relevant industry associations to cooperate in establishing a recovery system and raising awareness of their clients.

The Ministry of Agriculture, Forestry and Fisheries (MAFF) requests the relevant associations to cooperate in promoting ODS recovery and raising awareness of end-users.

Other ministries and agencies have also been working strenuously in converting products and equipment which function on CFCs at their facilities to alternatives and facilitated appropriate management and recovery of CFCs.

Financial measures which have been set up in this sector include a subsidy for constructions of recovery facilities and a tax deduction, to be in effect during FY 2001, for recovery operators' purchasing recovery facilities or destruction facilities.

(2) Local Governments and other Public Organizations

Twelve local governments have by-laws concerning fluorocarbon recovery. And more local governments provide financial supports to those involved in recovery and destruction operations through subsidy grants or loans.

By the end of 1999, every prefectural government and every designated city have established a "Fluorocarbon Recovery Promotion Board", generally consisting of members not only from government but also from industry, consumer groups and academia, whose roles are to establish a system for fluorocarbon recovery and to manage it in a consensus-building manner. Until now, these boards have been engaged in fluorocarbon recovery/destruction projects and other activities including an incentive campaign in which cooperative shops, recovery operators and transportation operators are designated as "Fluorocarbon Recovery Cooperators" and advertised as such with the aim of raising awareness of owners of fluorocarbons-containing equipment and recovery operators.

(3) Private Sector

In response to the METI's "Programme for the Promotion of Recovery of Specified Fluorocarbons", industry associations have prepared the voluntary plans for fluorocarbon recovery and accordingly have been working to establish/improve the system for fluorocarbon recovery.

4.2.2 Commercial Refrigeration (Chillers/Air Conditioning)

(1) Present State

In the commercial refrigeration sector of Japan, equipment such as centrifugal chillers, cold food displays, transportation refrigeration units, vending machines is used in various types of facilities ranging from government facilities to chemical plants, food processing plants, food retailer stores,

railway facilities, warehouses etc. Large refrigeration systems like centrifugal chillers are functioning upon, from kilos to tons of refrigerant per unit, and can remain serviceable for a long period of time (the service life of a typical centrifugal chiller is 25 years). Currently approx. 20,000 CFC-based centrifugal chillers are operating in Japan. Large amounts of CFC refrigerant (stockpiled products or reclaimed CFCs) are used mainly to refill them.

Small and medium-sized refrigeration units like cold food displays are functioning upon, from some hundreds of grams to thousands of grams per unit and can last about 10 years. It is estimated that approximately 2,800,000 units are operating in Japan and surveys conducted by some end-user groups indicate that CFC-based equipment is still widely in use.

The amount of CFCs remaining in commercial refrigeration equipment is estimated at approx. 8,000 tonnes as at the end of the year 2000.

(2) Prevention of Environmental Releases during Servicing

In compliance with the Guidelines for Emissions Reduction and Rationalization, commercial refrigeration manufacturers and other operators in the industry have been taking measures to reduce emissions through improvement in structure and material choice for their products.

In addition, specified large refrigeration systems are subjected to periodical inspections under the Law concerning Safe Operation of High Pressure Gas; from these machines occurrences of environmental releases are thus prevented.

A handbook on good practices in equipment maintenance that would help to reduce risks of environmental releases during servicing was also published by an industry association. And many private corporations conduct training/education programmes for their servicing engineers.

(3) Conversion to Alternative Technologies and Substitutes

CFC-based centrifugal chillers and transportation refrigeration units are being converted to HCFC-based or HFC-based technologies. Non-ODS technologies such as NH_3-based systems have been introduced as well, though on a small scale yet.

The trend of the industry is in favor of continued placing on the market of HFC-based equipment while evaluating non-fluorocarbon alternatives from the standpoint of safety and other aspects.

CFC-to-HCFC/HFC retrofitting treatment has been applied to certain types of centrifugal chillers in an effort to recover CFCs in an early stage without damaging the serviceability of the equipment itself.

The National Government provides financial support through accelerated depreciation and loans for those who purchase commercial centrifugal chillers, cold displays, transportation refrigeration units and other commercial refrigeration equipment that function upon non-ODS.

(4) Destruction of Recovered Fluorocarbons

Disposal of commercial refrigeration products and equipment is the responsibility of end-users under the legal framework of Japan. Recovery of fluorocarbons prior to disposal is also conducted under the same principle and end-users are responsible for ensuring that recovery operation is appropriately undertaken by manufacturers,

installation engineers or waste treatment operators.

The commercial refrigeration industry of Japan has been working according to the voluntary plan of 1997 for establishing or improving a system for recovery, reclamation and destruction; they also have institutionalized a registration system for refrigerant recovery facilities and recovery operators for the purpose of securing safe operations of fluorocarbon recovery.

At regional levels, they are contributing to the establishment of recovery/reclamation/destruction system through the works of the Fluorocarbon Recovery Promotion Boards.

The actual amount of CFCs recovered in 1999 through these activities is 651 tonnes and the estimated recovery rate (the ratio of the actual amount of recovery to the estimated total amount of recoverable CFCs which is obtained after recovery efficiency and leakage loss are taken into account) is 56 %.

The National Government of Japan promulgated the Fluorocarbon Recovery and Destruction Law in June 2001 and is currently proceeding with preparatory works to ensure recovery operations of the substances controlled under the law (CFCs, HCFCs and HFCs) are started and conducted in an appropriate manner after the law has entered into force.

The Fluorocarbons Recovery and Destruction Law provides in relation to the commercial refrigeration, *inter alia*:

- Arbitrary releases of controlled substances from commercial refrigerators/air-conditioners into the atmosphere shall be prohibited;
- Recovery operators shall be registered with the governors of local governments;
- End-users of a commercial refrigerator/air-conditioner who are disposing the equipment must ensure that the registered recovery operators recover the controlled substances. The recovery operators must transfer the recovered substances to destruction operators unless they are to be re-used;
- Recovery operators must observe the technical codes of operational practice when undertaking recovery and other related operations and must report the quantities of recovered controlled substances;
- The costs for recovery, transportation and destruction of the controlled substances from commercial refrigerators/air-conditioners shall be paid by the end-users of the equipment;
- These provisions shall be effective in April 2002.

In order to encourage efficient recovery operations in small-sized enterprises which cannot afford recovery equipment, a "mobile" recovery service at regional levels and other measures, as appropriate, are being considered for realization.

As regards centrifugal chillers and other large refrigeration systems, which are expected to remain in industrial use for a time being, there is a need for a management system which continually follows up-to-date conditions.

4.2.3 Mobile Air Conditioning (MACs)

(1) Present State

The number of registered motor vehicles in Japan is approx. 70,000,000, of which 90 per cent are equipped with mobile air-conditioners. Judging

from the fact that the average time in which one motor vehicle is put to use is about 10 years, many CFC-based MACs are still widely in operation.

The amount of CFCs remaining in MACs is estimated at 10,000 tonnes as at the end of the year 2000.

(2) Prevention of Emission during Servicing

In compliance with the Guidelines for Emissions Reduction and Rationalization, MAC manufacturers and other operators in the industry have been taking measures to reduce emissions through improvement in the structure of the products and materials they use for hoses or compressor sealing.* At the same time, the absolute amount of refrigerant necessary for running a MAC unit has been reduced through improvement in heat exchangers' efficiency.

A handbook on good practices in maintenance operations was published, which provides vehicle servicing engineers instructions such as to charge only the supplemental quantity instead of replacing all the refrigerant when there is any need to make up for any shortage caused by leaks.

(3) Conversion to Alternative Technologies and Substitutes

Conversion of CFCs to HFCs has been conducted since 1992 whereas the MACs installed in the vehicles produced after the end of 1994 are all functioning on non-CFCs.

The MAC industry is currently studying non-fluorocarbon alternatives from the standpoint of safety and other aspects.

(4) Destruction of Recovered Fluorocarbons

Various types of operators are involved in the treatment of end-of-life vehicles - end-users, car dealers, used-car dealers, servicing engineers, dismantling operators and shredding operators.

The motor vehicle industry has been running a recovery/destruction system since 1998 in accordance with the voluntary plan in which car dealers have been operating recovery of fluorocarbons used as refrigerant.

Other operators such as local governments, Fluorocarbon Recovery Promotion Boards, motor vehicle dismantling operators are also preparing similar systems for recovery and destruction.

The actual amount of CFCs recovered and destroyed in 1999 is 202 tonnes and the estimated recovery/destruction rate (the ratio of the actual amount of recovery/destruction to the estimated total amount of treatable CFCs which is obtained after operation efficiency and leakage loss are taken into account) is 18 %.

In FY 2000, **METI** in cooperation with the motor vehicle industry provided financial support to motor vehicle dismantling operators who purchase CFC recovery equipment as part of the ministry's "Fluorocarbon Recovery Expansion Project".

MLIT conducted in FY 2000 "Practicability Evaluation Project for Mobile Recovery Systems in the MAC Sector", targeted for servicing engineers.

MOE is also working on "mobile" recovery service and other measures to encourage efficient recovery operation in small-sized enterprises which cannot afford recovery equipment.

* Refrigerant leakage is structurally inherent in MACs. Nevertheless, leak reducing techniques have been making steady progress since 1990; the leakage, which used to reach 50 grams per annum per unit, is now below 15 grams, nearly negating the need for making up for refrigerant loss in the lifetime of a motor vehicle except in the cases of car accidents or other troubles.

The National Government of Japan promulgated the Fluorocarbon Recovery and Destruction Law in June 2001 and is currently proceeding with preparatory works to ensure recovery operations of the substances controlled under the law (CFCs, HCFCs and HFCs) are started and conducted in an appropriate manner on the law's entry into force.

The Fluorocarbons Recovery and Destruction Law (refer to Figure 1) provides in relation to MACs, *inter alia*:

- Arbitrary releases of controlled substances from MACs into the atmosphere shall be prohibited;
- MAC collection operators and recovery operators involved in treatment of end-of-life vehicles shall be registered with the governors of local governments;
- End-users of a MAC in an end-of-life vehicle who are disposing the equipment must ensure that the MAC is collected by registered collection operators, who must ensure that registered recovery operators recover the controlled substances. The recovery operators then must transfer the recovered substances to motor vehicle manufacturers unless they are to be re-used. The motor vehicle manufacturers must transfer the recovered substances to destruction operators;
- Recovery operators must observe the technical codes of operational practice when undertaking recovery and other related operations and must report the quantities of recovered controlled substances;
- Payment of fees for relevant operations is separated from the process of fluorocarbon treatment itself. In principle, the costs for recovery, transportation and destruction of the controlled substances from MACs shall be paid by the end-users. Recovery operators and destruction operators will be paid for their operations by motor vehicle manufacturers, who are to charge the total cost on end-users;
- These provisions shall enter into force not later than 31 October 2002 (the exact date is to be announced in a government ordinance).

A motor vehicle recycling law, which is currently being prepared in the National Government of Japan, is to deal with the above-mentioned separated systems of fluorocarbon treatment and payment,.

4.2.4 Domestic Refrigeration

(1) Present State

The number of domestic refrigerators in Japan is estimated at 55,000,000. Judging from the fact that the average time in which one domestic refrigerator is put to use is about 12 years, it is indicated that many CFC-based domestic refrigerators are still widely in operation.

The amount of CFCs remaining in domestic refrigerators is estimated at 40,000 tonnes as at the end of the year 2000.

(2) Prevention of Emission during Servicing

The refrigeration systems of domestic refrigerators are highly closed systems allowing of no more than negligibly little leakage occurrences, negating the need for refilling supplemental refrigerant in the lifetime of the refrigeration system.

(3) Conversion to Alternative Technologies and Substitutes

In compliance with the Guidelines for Emissions Reduction and Rationalization, domestic appliances manufacturers of Japan took the initiative in converting CFCs to HFCs and started conversion as early as in 1993 – one of the earliest attempts in the world – and the domestic refrigerators produced after the end of 1995 are all functioning on non-CFCs.

The domestic refrigeration industry is now studying hydrocarbon-based alternative technologies from the standpoint of safety and other aspects.

(4) Destruction of Recovered Fluorocarbons

Before the enactment of the Domestic Electrical Appliances Recycling Law, recovery of refrigerant fluorocarbons was conducted by local governments and private waste treatment operators when domestic refrigerators are disposed as wastes.

The actual amount of CFCs recovered in 1999 is 98 tonnes and the estimated recovery rate (the ratio of the actual amount of recovery to the estimated total amount of recoverable CFCs which is obtained after recovery efficiency and leakage loss are taken into account) is 27 %.

Now that the Domestic Electrical Appliances Recycling Law (refer to Figure 2) is in effect since April 2001, domestic appliances manufacturers are legally responsible for recovery of refrigerant fluorocarbons from their products, which is actually conducted at appliances recycling plants.

The law is to be implemented appropriately so as to ensure that fluorocarbons are recovered in the process of recycling end-of-life domestic electrical appliances.

4.3 Foam Sector

4.3.1 Overview

CFC-based blowing technologies, which were dominantly used in the production of foams (e.g. motor vehicles' interior parts, building insulation and daily necessities) have been converted to alternative technologies functioning upon HCFCs, HFCs, hydrocarbons, water, CO2 and other substitutes in step with the phase-out of CFC production.

Among foams produced by CFC-based blowing technologies, rigid polyurethane foams and extruded polystyrene foams, which are both used for insulation of buildings, refrigerators, plants, etc., could contain blowing gas, i.e. CFCs, inside their structures as their integral part.

The amount of residual CFCs remaining in insulation foams is provisionally estimated at 40,000 tonnes as at the end of the year 2000. (This information is to be refined through census surveys on users of insulation foams and measurements of residual fluorocarbons in existing foams.)

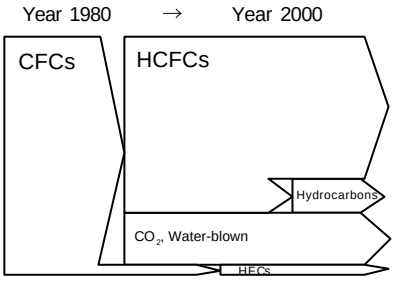

Figure 4. Conversion Trend in Foam Sector in Japan

4.3.2 Domestic Refrigerator/Freezer Insulation

(1) Present State and Conversion to Alternative Technologies and Substitutes

Rigid polyurethane foams are also used for insulation of domestic refrigerators. However, the blowing technologies have been converted to HCFC-based or hydrocarbon-based technologies since 1994. The rigid polyurethane foams produced after 1996 are all free from CFCs.

(2) Destruction of Recovered Fluorocarbons

The Domestic Electrical Appliances Recycling Law of 1998 does not request recovery of fluorocarbons including CFCs from insulation foams, reflecting the technological and economic difficulties in this sector at that time: there were few facilities that could recover fluorocarbons from insulation foams; the costs of building such facilities and undertaking recovery operations were preventively high, demanding too much financial sacrifice from end-users.

However, it does not mean that the National Government of Japan overlooked the issue of insulation foams; in 1999, it called for the need for technologies and facilities for appropriate and efficient recovery, re-use and destruction of fluorocarbons from insulation foams in the statement of basic policies for the implementation of the law.

An increasing number of recovery equipment units are being installed at recycling plants for domestic electrical appliances and being reviewed for practicability from the standpoint of cost-effectiveness and other aspects.

In FY 1998, MOE started its "Fluorocarbon Destruction Model Project", in which destruction technologies for domestic refrigeration insulation foams are explored. Since then MOE has been working for the development of environmentally acceptable technologies for recovery and destruction.

4.3.3 Construction Foams

(1) Present State and Conversion to Alternative Technologies and Substitutes

Rigid polyurethane foams and extruded polystyrene foams are dominantly used construction foams for insulation of domestic and commercial buildings, cold stores, food processing factories, etc. Rigid polyurethane foams produced in Japan are categorized into two types according to the production methods: factory-made polyurethane panels, which are processed in factories, and in-site processed foams, which are sprayed or injected on the construction site.

The blowing technologies used for the production of rigid polyurethane foams had been converted from CFCs-based technologies to HCFC technologies, hydrocarbon technologies, water-blown technologies and others by 1995; those for extruded polystyrene foams had been likewise converted to HCFC technologies by 1990.

As a result, newly produced foams in this sector are now free from CFCs.

(2) Destruction of Recovered Fluorocarbons

Since 2001, METI and MOE have been investigating the latest conditions concerning the use and disposal of insulation foams while also conducting measurements of the residual fluorocarbons trapped inside those foams in order to

get basic data for estimation of the total amount.

Based on those results, the National Government of Japan will continue to explore the development of technologies and establishment of systems for recovery and destruction of CFCs.

4.4 Solvent Sector

(1) Present State and Conversion to Alternative Technologies and Substitutes

CFC-based solvents used to be the dominant detergent for industrial cleaning applications – metal cleaning, electronics cleaning and precision cleaning – and dry cleaning of clothing; however, the phase-out of CFC production prompted conversion from CFC-based solvent in favor of chlorinated solvents, hydrocarbon solvents, aqueous solvents, fluorinated solvents, or no-clean alternatives in most applications. As a result CFC-based cleaning products have almost disappeared from the market with only a limited number of cleaner's using stockpiled CFC-based detergent for dry cleaning.

The amount of CFC-based solvent consumption in dry cleaning applications in FY 2000 is estimated at approx. 100 tonnes per annum based on questionnaire survey conducted by MOE; the amount of stockpiled CFC-based solvents and CFCs contained in existing equipment combined is estimated at approx. 240 tonnes as at the end of FY 2000.

Since FY 1988, the National Government of Japan has been providing financial support (tax deduction and loans) to those who purchase cleaning equipment to replace a CFC-based technology.

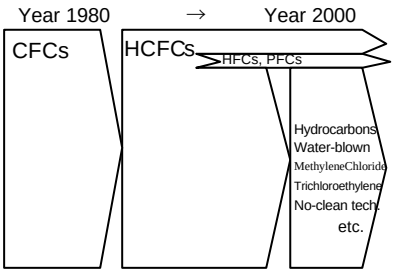

Figure 5. Conversion Trend in Solvent Sector in Japan

(2) Prevention of Emission during Servicing and Destruction of Recovered Fluorocarbons

In compliance with the Guidelines for Emissions Reduction and Rationalization, cleaning equipment manufacturers and other operators in the industry have been applying measures against leakage by, for instance, CFC-based dry cleaning equipment is given special airtightness, which by far surpasses that of other types of equipment.

The issue to be addressed in this sector is the disposal method of waste CFC-based detergents, which are currently treated together with waste oil of industrial origin in many cases. Necessary measures shall be taken to ensure that they are disposed in appropriate manners.

4.5 Aerosol Sector

(1) Aerosol Products

In the aerosol sector, CFCs are no longer used, replaced by liquefied petroleum gases (LPGs), dimethyl ether (DMEs), HFCs and other substitutes. As regards MDIs, which are currently exempted from the control of the Montreal Protocol and permitted to be imported for essential uses, approx. 40 tonnes of CFCs were imported in 1999 and 10 tonnes in 2000. The stockpiled amount is approx.180 tonnes as at the end of the year 2000.

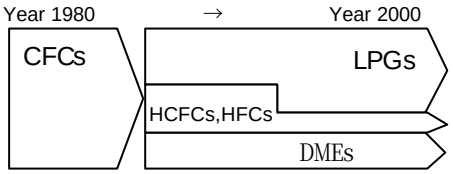

Figure 6. Conversion Trend in Aerosol Sector in Japan

(2) Conversion from CFC-based Metered Dose Inhalers (MDIs)

In compliance with Decision IX/19 of the 9th Meeting of the Parities to the Montreal Protocol of 1997, Japan developed and submitted in December 1998 to the Ozone Secretariat its initial national transition strategy concerning CFC-based MDIs.

In accordance with the targets expressed in the strategy – complete conversion of CFC-based MDIs to alternatives by 2005 – progress has been made in the development and introduction of HFC-based MDI products or dry powder inhalers (DPIs). As of the year 2000, the share of these alternatives in the whole MDI market in Japan reached about 40 per cent. Imports of CFCs for MDIs are continually reviewed taking into consideration the schedule of CFC-based MDI phase-out in order to keep the stockpiled amount in an appropriate level.

(3) Destruction of CFCs from MDIs

CFCs, which MDI manufacturers have recovered in the manufacturing process of MDI products or from returned defective products are transferred to destruction operators for appropriate destruction.

4.6 Destruction

(1) Present State

There are 40 fluorocarbon destruction facilities in operation in Japan as at the end of FY 1999.

Their total capacity for fluorocarbon destruction amounts to 4,500 tonnes per annum.

When categorizing those destruction facilities in Japan into mixed waste incinerators, in which fluorocarbons are treated together with other wastes, and dedicated incinerators, which are designed and used for fluorocarbons destruction only, the former – to be specific, rotary kiln incinerators – are the commonest of all the destruction facilities in Japan. Other mixed waste incinerators used for fluorocarbon destruction in Japan are municipal solid waste incinerators and cement kilns, whereas dedicated destruction facilities utilize plasma destruction technologies, enhanced combustion technologies and superheated steam technologies.

The amount of CFCs destroyed at these facilities in FY 1999 is approx. 510 tonnes.

(2) Destruction Facilities

In an effort to promote construction of more destruction facilities, the National Government of Japan started in FY 1999 a subsidy system for installation of destruction equipment and additionally in FY 2001 introduced accelerated depreciation. Some local governments are also providing subsidy grants or loans to those who

install destruction equipment.

Some fluorocarbon manufacturers have decided to newly install or expand destruction facilities as necessary.

(3) Appropriate Destruction Technologies

For the purpose of developing environmentally acceptable and efficient technologies of CFC destruction, MOE commissioned local governments to carry out Fluorocarbon Destruction Model Projects. Based on the results of these projects, MOE drew up standards for ODS destruction and good practices on operation and maintenance of destruction equipment and published "the Guidelines for CFC Destruction Operations" in 1996, which were reviewed and revised in 1999.

Since 1998, the focus of the Fluorocarbon Destruction Model Projects has been placed upon technologies to destroy ODS contained in insulation foams.

METI conducted technological researches on the radio frequency plasma method and the rotary kiln method from FY 1993 to FY 1998 in order to explore the methodology for appropriate destruction operations.

In 2000, METI published "the Handbook on the Specified Fluorocarbon Destruction Technologies", which gave a systematic description as to groups of destruction technologies with technical criteria and environmental consideration guideline for each group.

The Fluorocarbons Recovery and Destruction Law (refer to Figure 1) provides in relation to destruction, *inter alia*:

- Destruction operators shall be authorized with the Minister of the Environment and the Minister of Economy, Trade and Industry;
- Recovery operators and motor vehicle manufacturers must transfer to destruction operators the controlled substances recovered from commercial refrigerators/air-conditioners and MACs, respectively. The destruction operators must destroy the transferred controlled substances;
- Destruction operators must observe the technical codes of operational practice when undertaking destruction and other related operations and must report the quantities of destroyed controlled substances;
- These provisions shall be effective in April 2002.

5. Other Matters (Assistance and Information Provision to Article 5 Countries)

In efforts to assist Article 5 countries in phasing out CFCs by transferring useful information and technology which Japan has acquired through its past experiences, the National Government and industry of Japan have been hosting seminars in Article 5 countries in the Asian region since 1990 and inviting government officers of Article 5 countries who are engaged in ozone issues to training programmes in Japan.

In 1999, Japan started bilateral cooperation projects under the Multilateral Fund for the Implementation of the Montreal Protocol to facilitate Article 5 countries' conversion to alternative technologies and substances.

In addition, the introduction of an appropriate labelling/classification system which imposes on exporting countries is being discussed in the international context so that Article 5 countries can have effective measures to control the imports of CFCs in order to phase out CFCs. Japan is fully aware of the importance of such system and ready to respond to this development by, for instance, providing necessary information on labelling of products exported from Japan.

6. Follow-up

The Governmental Conference for the Protection of Ozone Layer will be requested to take awareness-raising measures to make this strategy known to the public.

Relevant ministries and agencies will conduct periodical surveys and collect data on the progress in each sector.

The Governmental Conference for the Protection of Ozone Layer will be requested to make those results available to the public and follow up on the developments in relation to this strategy. Furthermore, the Conference will be requested to review this strategy when necessary.