How the Hotel and Tourism Industry Can Protect the Ozone Layer

United Nations Environment Programme
Industry and Environment
OzonAction and Tourism Programmes

Multilateral Fund for the Implementation
of the Montreal Protocol

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Hotel cartoon used in the foreword is from the "*Environmental Action Pack for Hotels*."

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CONTENTS

ACRONYMS

CFC	chlorofluorocarbon
GWP	Global Warming Potential
HCFC	hydrochlorofluorocarbon
HFC	hydrofluorocarbon
LVC	low-volume ODS consuming countries
NOU	National Ozone Unit
ODP	Ozone Depletion Potential
ODS	Ozone Depleting Substance
UV	Ultraviolet

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FOREWORD

Emissions of man-made chemicals collectively known as ozone-depleting substances (ODS) are depleting the stratospheric ozone layer which protects life on Earth from harmful ultraviolet radiation from the sun. Depletion of the ozone layer is likely to affect food production, health and ecosystems worldwide.

The world's nations have taken action to solve the problem through the Montreal Protocol on Substances that Deplete the Ozone Layer (1987), an international treaty that requires countries to phase out their production and consumption of chlorofluorocarbons (CFCs) and other ODS according to precise deadlines. A Multilateral Fund was established under the Protocol to provide technical and financial assistance to help developing countries phase out ODS.

Hotels and the tourism industry use ODS in refrigerators in kitchens and mini-bars, air conditioning in guest rooms and public areas, aerosol sprays in cleaning products, fire-protection equipment, and foam mattresses. Since your establishment uses these chemicals, you and your staff have to be part of the solution.

The tourism and hotel industry is realizing that a healthy environment means good business. Many hotels and holiday centres are carrying out environmental management programmes and reaping the benefits. However, until now reducing the use of ODS has been given little attention in this sector. This guide is intended to fill that gap by:

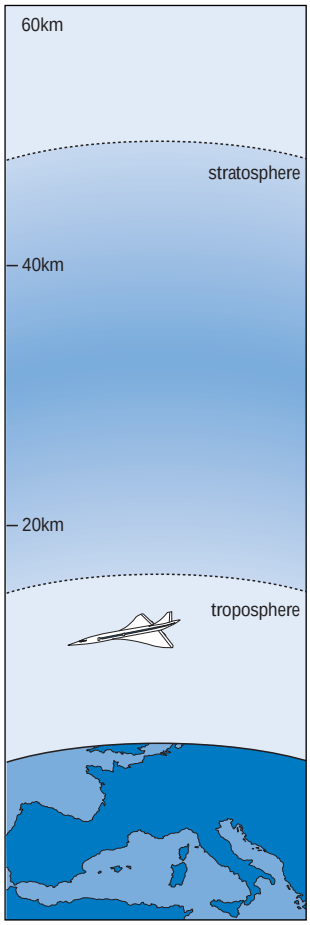
- explaining why you should be concerned about ozone depletion
- outlining how you should approach the problem
- providing information on how the use of ODS can be reduced and avoided
- providing examples of good practice to demonstrate how some tourism facilities have taken action to protect the ozone layer.

Technologies and chemicals that do not destroy the ozone layer are now available worldwide, and good servicing practices and other skills exist to reduce ODS emissions. Switching to new technologies and acquiring proper training can help your business improve operating efficacy, reduce costs in the medium term, and enhance its market image. Integrating technologies that do not deplete the ozone layer into facilities still at the planning and construction stage can save considerable time and money later on.

This guide is written for managers and staff in the hotel and tourism industry. Though the guide emphasizes medium and smaller units in developing countries, it can equally be used by facilities of all sizes in all countries, developing and developed. In addition, the guide will be of interest to all commercial and residential establishments, including accommodation units, shopping centres, visitor centres, office buildings and sports arenas. The guide also provides background information which is suitable for property designers and developers.

This guide was produced by UNEP IE's OzonAction Programme under the Multilateral Fund, as part of its information exchange services. The guide was developed in cooperation with the UNEP IE Tourism Programme, which has already published two titles on environmental management in the tourism sector.

PART I: ABOUT THE OZONE LAYER



Most atmospheric ozone is found in the stratosphere 12-50 km above the Earth

What is the ozone layer?

Ozone is naturally occurring gas, consisting of three oxygen atoms. Nearly 90 percent of all ozone is found in the upper atmosphere (or stratosphere), 12-50 km above the Earth's surface. This is referred to as the 'ozone layer'.

Together with ozone in the lower parts of the atmosphere, the ozone layer acts as a giant sunshade, absorbing the harmful wavelengths of the sun's ultraviolet (UV) radiation and preventing it from reaching the Earth's surface. Without ozone life could not have developed and flourished on the Earth.

Why is the ozone layer under threat?

When released into the air, some man-made chemicals containing chlorine and bromine eventually migrate into higher regions of the atmosphere, including the stratosphere. Though these chemicals are stable in the lower atmosphere, they are broken down into highly reactive forms of chlorine and bromine in the stratosphere by the high levels of UV solar radiation. These chemicals then take part in a series of chain reactions leading to ozone depletion (see illustration opposite).

Which chemicals destroy the ozone layer?

Chlorofluorocarbons (CFCs), the most widely-known ozone-destroying chemicals, were first synthesized in 1928. Because of their inflammability and low toxicity, they were used in applications as diverse as refrigerants in refrigerators and air conditioners, propellants in aerosol spray cans, blowing agents in the manufacture of foams, and cleaning agents for electronic equipment.

Hydrochlorofluorocarbons (HCFCs) were developed as substitutes for CFC refrigerants and blowing agents. Though less destructive than CFCs, the ozone-depleting potential (ODP) of these chemicals are too high to allow long-term use (see box opposite).

Two other chlorine containing chemicals, widely used as solvents for cleaning metals, have significant ODP. These are carbon tetrachloride and methyl chloroform (1,1,1-trichloroethane).

The main bromine-containing chemicals that destroy ozone are called halons. These are used in fire-extinguishing equipment. Some halons have an ODP ten times higher than that of the most potent CFCs!

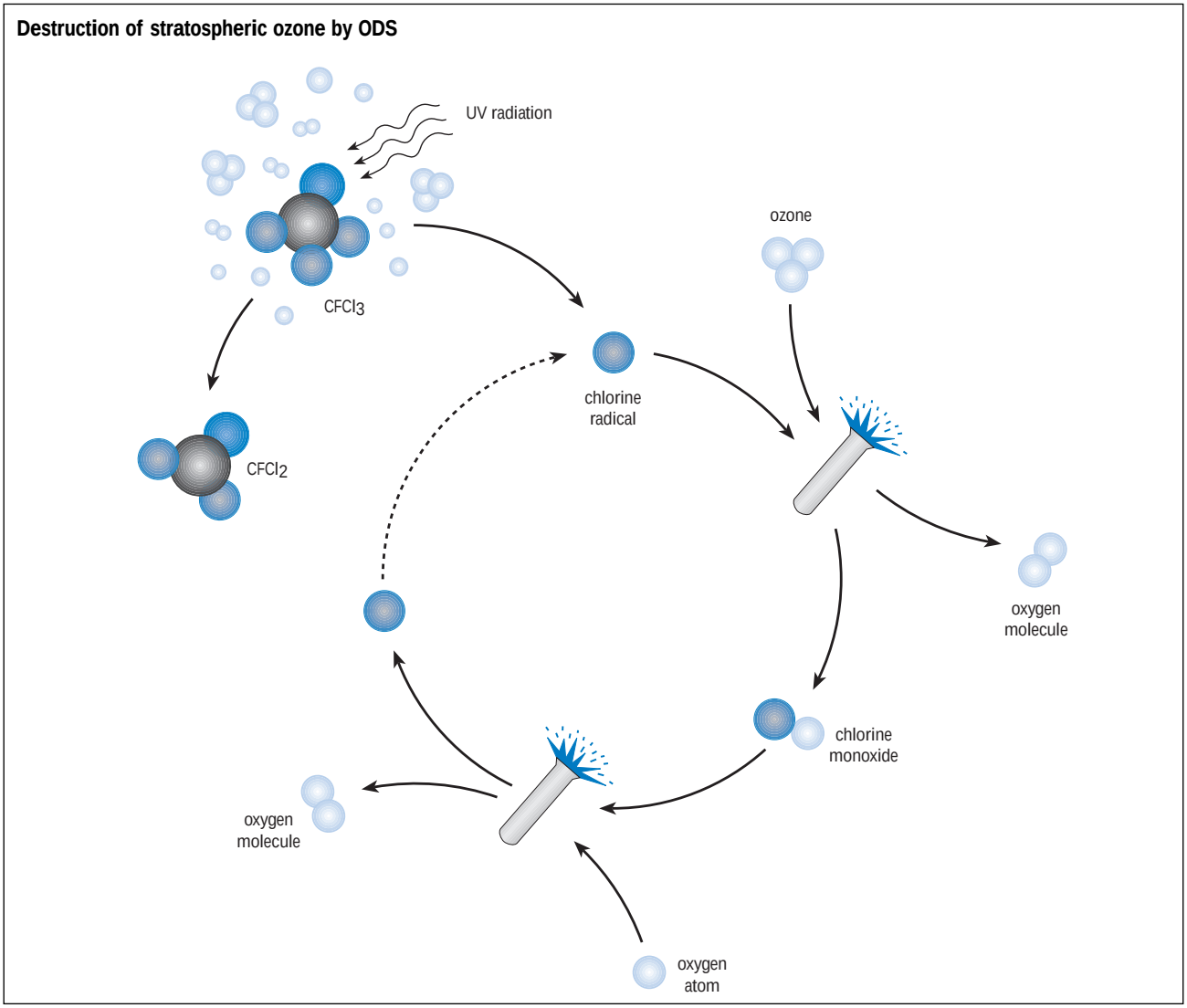
Another chemical with a high ODP is methyl bromide, mainly used as an agricultural pesticide and to fumigate agricultural commodities.

These chemicals are collectively known as ozone-depleting substances (ODS). They can be identified in a number of ways:

What is the difference between the ozone layer and ground level ozone?

Whereas stratospheric ozone shields the Earth from the Sun's harmful radiation, ground level ozone is a pollutant caused by the burning of fossil fuels and biomass. Ground level ozone is a component of urban smog and can cause respiratory problems.

Destruction of stratospheric ozone by ODS



How ozone is destroyed after ultraviolet radiation liberates a chlorine radical from an ozone-depleting substance. One chlorine atom alone can take part in as many as 100 000 ozone-destroying reactions.

- by their trade names (such as FREON™)
- by their refrigerant codes (such as CFC-113 or R-12)
- by their chemical names (such as 1,1,1-trichlorotrifluoroethane).

More details on ODS names are provided in Part V: Further information.

What is Ozone-depletion Potential (ODP)?

ODP is a measure of a substance's ability to destroy stratospheric ozone. It depends on the substance's atmospheric lifetime, stability, reactivity and the ozone-depleting elements it contains such as chlorine and bromine. All ODP values are expressed in relation to the baseline value of 1 for CFC-11.

What are the impacts of ozone-layer depletion?

As the ozone layer thins, higher doses of UV-B radiation reach the Earth's surface. This would have widespread effects on human health, agriculture and ecosystems in general. These effects include:

- human skin: more sunburn and skin cancers
- human eye: more cases of cataract, snow blindness (actinic karatitis) and other chronic eye diseases.
- immune systems: reduced human and animal resistance to infections and diseases including cancers and allergies, and diseases such as malaria, leishmaniasis and herpes where the body's major defence system is the skin

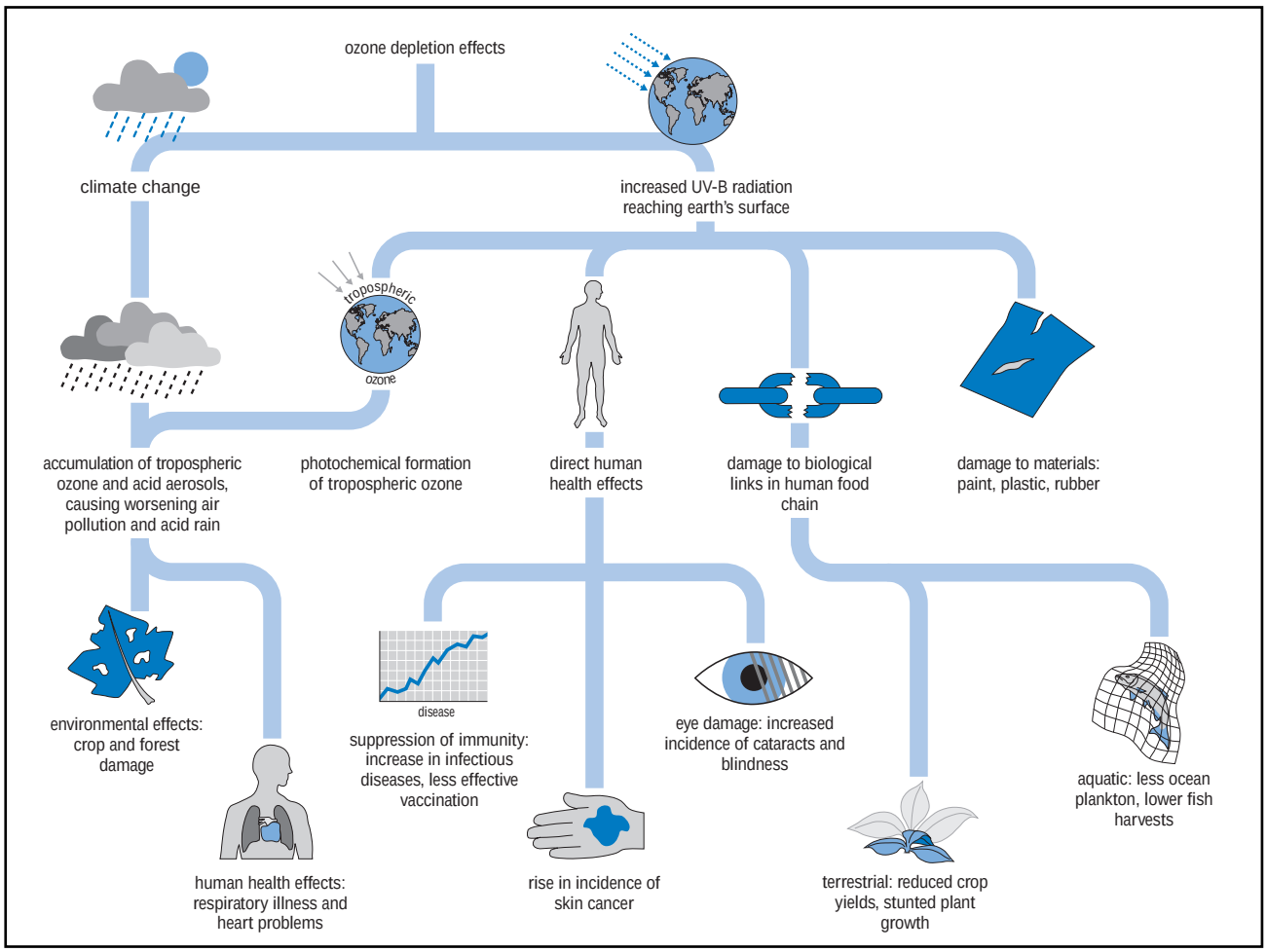
- crops: smaller plants, lower yields, potential reductions in nutritional value, need to search for UV-B resistant crops
- natural ecosystems: altered plant forms and changes in competitive balance between plants, the animals that eat them, and plant pathogens and pests
- marine and aquatic life: reduced production of phytoplankton, zooplankton, juvenile fish, crabs and shrimps which will in turn threaten all marine life and reduce fisheries productivity
- man-made materials: faster degradation of certain materials including many paints and plastics
- increased global warming and climate change.

The combined effects of extra UV-B radiation on life on Earth are shown in the chart below.

Over the past 20-30 years, sufficient ODS have been released into the atmosphere to cause serious damage to the ozone layer; peak ozone depletion is expected over the next few years. Over the northern mid-latitudes, cumulative ozone loses of 12-13 percent are predicted in winter and spring, while 6-7 percent losses are expected in the summer and autumn. Over the southern mid-latitudes, cumulative ozone losses are predicted to be around 11 percent all year round.

The tourism and hotel industry uses ODS in variety of applications, and must therefore be a part of the process to halt the depletion of the ozone layer.

Major effects of increased levels of UV-B resulting from damage to the ozone layer



How has the international community responded?

Since 1991, UNEP IE's OzonAction Programme in Paris has been strengthening the capacity of National Ozone Units and industry in developing countries to make informed decisions on technology and policy options that will result in cost-effective ODS phase-out activities with minimal external intervention. The Programme provides those target groups with a range of need-based services, including information exchange, training, Networking of ODS Officers, Country Programme assistance and Institutional Strengthening projects.

When the first evidence of the Antarctic ozone 'hole' was published in 1985, nations concerned about the impending crisis caused by this artificial 'thinning' of the ozone layer entered into global negotiations which led to the adoption in September 1987 of the Montreal Protocol on Substances that Deplete the Ozone Layer. This Protocol identified the major ODS and established a timetable and legal basis for phasing them out.

The Protocol entered into force in January 1989; it required Parties to the Protocol to reduce and then eliminate ODS production and consumption through the development of chemical substitutes, alternative manufacturing processes, recycling, recovery and reclaiming procedures. By the end of 1997, more than 160 countries, of which two-thirds are developing countries, had ratified the Montreal Protocol.

The original Protocol established control measures for eight ODS, known as 'controlled substances', which included five CFCs and three halons. At further meetings, held in London in 1990 and Copenhagen in 1992, the controls were extended to require developed countries to phase out 15 CFCs, 3 halons, 34 HBFCs, carbon tetrachloride and methyl chloroform. At the 7th meeting of the Parties in Vienna in 1995, a longer-term reduction schedule leading to a complete phase out of 40 HCFCs was agreed, and methyl bromide was added to the list of controlled substances (see Part V: Further information).

The Protocol made special provisions for developing countries, with their recognized need for economic development and relatively low use of CFCs, giving them an extra ten years to implement the required reduction and phase-out measures. Furthermore, the Protocol provides technical and financial assistance through a "Multilateral Fund" to ODS programmes in these countries, which are called 'Article 5' countries (see Part V: Further information).

More than US$ 600 million has been allocated to Article 5 countries under the Protocol as of December 1997. This assistance will reach US$ 1 billion by the end of 1999 as pledged by the developed countries (i.e. non-Article 5 countries). As a result of this assistance, 20,000 tonnes a year of ODS have been phased out in developing countries by projects under the Multilateral Fund, and a further 80,000 tonnes will be phased out once all approved projects are implemented. Additionally, the Fund has supported the preparation of national ODS phase-out plans and the establishment of National Ozone Units (NOUs) in nearly 90 Article 5 countries. The NOU's responsibilities include monitoring Multilateral Fund projects in their country and assisting businesses (including the Tourism Industry) with the phase out of ODS. Contact your country's NOU to determine what assistance is available.

The Parties to the Protocol agreed to reduce and eliminate the use of ODS even before substitutes and alternative technologies became available. This strategy has proven successful. It has encouraged industry to develop alternative substances and technologies for most if not all the former uses of ODS. As a result, CFCs, halons, carbon tetrachloride and methyl chloroform have already been phased out in developed countries, and the growth rates of CFCs and methyl chloroform in the stratosphere have slowed down. This positive trend will continue as more businesses in Article 5 countries, such as yours, join the ODS phase out process.

Why should the hotel and tourism industry be concerned?

Tourism operations have a direct impact on the environment. This starts with the construction of new developments and continues during daily management and operations. Tourism facilities are resource intensive: they are large consumers of water and energy, and generate significant volumes of waste, emissions and effluent. What is not often realized is that they also consume and emit ODS.

Refrigeration, air conditioning, fire-fighting equipment, foam insulation, solvents zand aerosol propellants all contain ODS and are widely used in the hotel and tourism industry.

The tourism industry has a greater vested interest than most in protecting the global environment. Tourism destinations rely on a clean and healthy environment for the long-term quality and viability of the 'product'; without such environmental quality, much tourism would disappear. Unless all tourism operators, large and small, take action to maintain and enhance environmental quality, the future of the industry is in jeopardy.

Tourists, especially those who set out to enjoy the pleasures of the 'open air', will be some of the first to be concerned about the impacts of excessive UV radiation. By taking early action to phase out ODS, you demonstrate to your customers – guests or tour operators – that you are a responsible operator.

The days when people sunbathe for long periods may well be numbered as the risks of such exposure become widely known. This will have serious consequences for many tourism products and their operators.

What are the benefits of managing ODS?

There are good reasons for addressing ODS phase out at an early stage:

- production of ODS-containing products may no longer be allowed under international regulations
- all countries that have ratified the Montreal Protocol have developed (or will develop) and will enforce regulations to control ODS consumption
- ODS chemicals may become more expensive as existing stocks become scarce — ODS-containing equipment and chemicals may also become difficult to find in advance of a total ban
- alternatives that are less harmful to the environment are already on the market, and some of them are cheaper and more energy efficient
- ODS phase out provides financial benefits which will off-set some of the investment required — cost savings will arise from preventing leakages of chemicals (and this avoiding expensive replacement) and from the improved energy efficiency offered by many of the newer, zero-ODP alternatives
- publicizing your efforts to reduce the use of ODS may improve your market image.

Proactive solutions, taking action in advance of regulations, makes good business sense. To realize the full benefits, ODS management is best implemented as part of an overall environmental management programme. For information on environmental management, consult the *Environmental Action Pack for Hotels* and *Case Studies on Good Environmental Practice in Hotels* (see Part V: Further Information).

PART II: WHAT IS AN ODS MANAGEMENT PROGRAMME?

An ODS management programme is a preventative strategy and action plan to reduce, replace and eliminate ODS use throughout your operation. Action should be taken as a part of routine maintenance and service, where it should contribute towards an overall increase in operating efficiency.

How can ODS use be reduced and avoided?

ODS management covers three approaches:

Containment and Conservation

- 'good housekeeping' measures to avoid leakage or loss of existing ODS during equipment operation and maintenance
- recovery and re-use of original refrigerant after equipment dismantling for servicing.

Retrofitting

- converting existing equipment to utilize low ODP or zero-ODP chemicals — this generally requires replacement of existing equipment parts and/or a change of lubricating oil; in some instances, it may be possible to use a 'drop-in' replacement instead of a complete retrofit (a drop-in replacement, as it name suggests, entails replacing ODS with low- or non-ODP substitutes without modifying the equipment).

Replacement

- purchasing new equipment that uses zero-ODP chemicals when the service life of the original equipment is over or the original chemicals are no longer available and retrofitting is not possible.

Where are ODS used in the hotel and tourism industry?

The most important uses are in:

Refrigeration
refrigerators, food and drinks, cold storage, display cabinets, freezers, ice machines and mini-bars

Air conditioning in buildings
general amenity areas, conference and meeting facilities, individual room units

Air conditioning in vehicles
mobile units in cars and buses

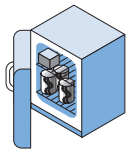
Dry cleaning and degreasing
solvents used in dry cleaning and special cleaning applications

Aerosols
spot cleaning, bathroom and other surface cleaners, small area paints, adhesives, insecticides and pesticides

Foams
food packaging, trays and containers, pipe insulation, seat and back cushions, head rests, bedding and other upholstery uses, carpet underlay, car and bus interiors, protective packaging for a wide variety of goods

Fire extinguishers
halons are used in fixed and portable fire extinguishers

Examples of trade names under which ODS are sold are listed in Part V: Further information.



Refrigeration: uses in the hotel and tourism industry

Food and drinks cold storage, display cabinets, freezers, ice machines, vending machines and mini-bars.

Refrigeration

CFCs, the main ozone-destroying chemicals, are used as the refrigerants in domestic and commercial refrigerators, enclosed cold storage spaces, ice machines and mini-bars.

Most older commercial refrigerators contain CFC-12. However, some equipment also uses R-502, which was introduced in the 1960s. The most common CFC refrigerants and their substitutes are shown in the tables below.

Table 1 Common refrigerants

Symbol	Refrigerant*	Name/composition	ODP**
CFC-11	R-11	trichlorofluoromethane	1.0
CFC-12	R-12	dichlorofluoromethane	1.0
CFC-114	R-114	1,2-dichlorotetrafluoroethane	1.0
	R-500	Blend of CFC-12 and HFC-152a	0.74
	R-502	Blend of HCFC-22 and CFC-115	0.34

* Refrigerant nomenclature established by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE)

** Ozone-depleting potential relative to CFC-11

Table 2 Key substitutes for common refrigerants

Symbol	Refrigerant*	Name/composition	ODP**
HCFC-22	R-22	chlorordifluoromethane	0.05
HCFC-123	R-123	2,2-dichloro-1,1,1-trifluoroethane	0.020
HFC-134a	R-134a	1,1,1,2 tetrafluoroethane	0
	R-401A	blend of HCFCs 22/124 and HFC-152a (53/34/13 weight %)	0.036
	R-401B	blend of HCFCs 22/124 and HFC-152a (61/28/11 weight %)	0.040
	R-402A	blend of HCFC 22, HFC 125 and propane (38/60/2 weight %)	0.021
	R-402B	blend of HCFC 22, HFC 125 and propane (60/38/2 weight %)	0.033
	R-404A	blend of HFCs 125/134a/143a (44/4/52 weight %)	0
	R-406A	blend of HCFCs 22/142b and isobutane (55/41/4 weight %)	0.057
	R-407A	blend of HFCs 32/125/134a (20/40/40 weight %)	0
	R-407C	blend of HFCs 32/125/134a (23/25/52 weight %)	0
	R-408A	blend of HCFC-22 and HFCs 125/143a (47/7/46 weight %)	0.026
	R-409A	blend of HCFCs 22/124/142b (60/25/15 weight %)	0.048
	R-507	blend of HCFC-125 and HFC-143a (50/50 weight %)	0
	R-717	ammonia	0
	R-600a	isobutane	0
	R-290	propane	0

* Refrigerant nomenclature established by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE)

** Ozone-depleting potential relative to CFC-11

The latest non-ODS equipment uses HFC-134a or blends of hydrochlorofluorocarbons (HCFCs) and/or hydrofluorocarbons (HFCs). HCFCs are a transitional solution (although one that will be available for many years in developing countries) while HFCs with zero ODP are long-term substitutes. The phase out schedule for HCFCs and other ODS can be found in Part V: Further Information

Considerable progress has been made in the use of hydrocarbons both as pure refrigerants and in mixtures, mainly of propane and isobutane. The technology is now widely used in domestic refrigeration and a promising beginning has been made in the commercial refrigeration sector.

Options for action

Containment and Conservation

At one time, venting refrigerants to the air during equipment service was a standard practice. With the need to limit the environmental impact of emissions, refrigerant conservation is now a major consideration in system design, installation and service.

Refrigerant conservation has three basic elements:

- proper design and installation of new equipment to minimize leaks;
- leak tightening of existing equipment to reduce emissions where CFCs continue to be used or where equipment has been retrofitted with HCFCs or HFCs;
- improved service practices, including refrigerant recovery, which allows continued system operation and reduces the need to 'top-up'.

The best environmental and business option in the short term is to ensure that existing equipment is serviced by trained personnel who know how to prevent losses during maintenance and to re-use the refrigerants. Specialist recovery equipment is available to help reduce losses during servicing. Unless you or your staff are thoroughly conversant with the latest service techniques, you should have the equipment serviced by professional engineers. The saving on possible wastage of chemicals and continued efficient operation of the equipment should more than offset the cost of service.

Good Practice Tip: evaluating ODP and Global Warming Potential (GWP)

Some substitute refrigerants are 'greenhouse gases' which contribute to global warming. Much of the global warming contribution of refrigerators and air conditioners, however, comes from the CO_2 produced during the generation of the electricity needed to run them. When choosing an alternative refrigerant, you need to evaluate its ODP, GWP and energy efficiency so that you minimize the equipment's contribution to ozone depletion and global warming. This will also have a direct impact on your fuel bills. A balance must therefore be struck and this is one of the factors to select the use of substitutes.

Regular checks to ensure there are no leaks in the system during operation will help to conserve existing refrigerants and avoid the need to 'top-up' or recharge. Checks should preferably be done using electronic leak detectors. However the simple 'soap solution' also works: leaks can be detected by applying soapy water to refrigerant coils and hoses (bubbles will appear where there are leaks).

If you are operating equipment containing ODS, be aware that replacing the refrigerants will become more difficult and expensive as these chemicals are phased out.

If you are already using low- or zero-ODP refrigerants, make sure that equipment is regularly maintained to prevent losses. Stringent maintenance practices will ensure that 'top-up' or recharging within the service life of the equipment will not be necessary.

Recycling

Refrigerants removed from a system may be returned to the same system at the end of the service operation. Where the equipment is to be replaced, the refrigerant should be stored for re-use in other equipment on the same site or offered to a local recycling centre for re-use elsewhere. In this way, maximum use can be made of the chemical. It may be necessary to 'reclaim' the refrigerant before it is used in another system to make sure that there are not excessive quantities of contaminants which might impair the operation of the alternative equipment.

Make sure different refrigerants are not mixed during service operations.

Retrofitting

If the original refrigerant is unavailable or too expensive to 'top up', it may be possible to replace the chemical with an alternative without completely replacing the equipment (see Table 2 above).

Some retrofitting techniques may require replacement of equipment parts and/or change of lubricating oil. Ask your supplier about developing a retrofit and/or replacement programme.

Replacement

If your equipment has reached the end of its service life or if substitute refrigerants do not work in your existing equipment, you should consider purchasing new equipment with alternative refrigerants. Check the availability and costs of zero- and low-ODP refrigerants like HCFCs. Plan ahead so that you don't have to replace all equipment at the same time. In this way you can spread the cost over a longer period, depending on the local availability of refrigerants and their phase-out schedules.

Vapour absorption systems

Some refrigeration systems do not rely on mechanical compressors and CFCs for the cooling cycle but on a system that depends on electric heating and a gas such as ammonia. Such vapour absorption systems are quieter and are often found in small units such as mini-bars. They offer a viable alternative to CFC-based equipment when it needs to be replaced. However, they are often less efficient than modern HFC-compression cycle equipment.

Air conditioning in buildings: uses in the hotel and tourism industry

General amenity areas, conference and meeting rooms, individual room units.

Air conditioning in buildings

Two kinds of air-conditioning systems are used in buildings.

Air-cooled systems

include ducted and non-ducted systems, 'stand-alone' room air conditioners and commercial single and multi-zone packaged air conditioners which operate by cooling and dehumidifying air circulated by a fan. Nearly all these systems use HCFC-22 as the refrigerant.

Water-cooled systems

cool water or a water/glycol/brine mixture which is then pumped through a heat exchanger in an air-handler to cool and dehumidify the air. CFC-11 and CFC-12 were used in large centrifugal chillers until recently. Now HCFC-22 is used in large chillers with centrifugal compressors as well as in small chillers with positive displacement compressors.

Alternative systems

Some industrial air-conditioning systems have been adapted to larger hotels. An example is the lithium bromide vapour absorption system, normally installed in hospitals and other situations where there is waste heat, often steam. It is less suitable for smaller operations, except where larger new developments or entire building complexes are to be refitted.

Options for action

■ Containment and Conservation

As with refrigeration, the best procedure is to extend the service life of existing equipment as long as possible by correct maintenance and regular checking for leaks. Follow the advice for conservation and recycling of refrigerant given in the preceding section.

▲ Retrofitting

It may be possible to replace the original CFC-11 or CFC-12 refrigerant, when this is unavailable, with one of the substitutes (HCFC-123 or HFC-134a) — check with your supplier.

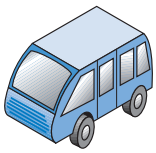
In water-chilled systems, HCFC-123 is being used as a retrofit substitute for CFC-11 and HFC-134a as a retrofit for CFC-12.

Retrofits for HCFC-22 in room air conditioners (i.e. "unitary systems") are under development and are being used in limited cases.

● Replacement

Once the service life of equipment is over and/or the CFC refrigerant is no longer available, you will have to buy new equipment. New equipment has been introduced in which HCFC-123 is used as a replacement for CFC-11 and HFC-134a for CFC-12.

Zero-ODP blends such as R-404A are also being introduced in new equipment. As with refrigeration equipment, if you plan ahead with your supplier you can spread the expense over time.



Vehicle air conditioning: uses in the hotel and tourism industry

Mobile units in cars, buses and other hotel transport.

Air conditioning in vehicles

The most common ODS used in older vehicle systems is CFC-12.

Options for action

■ Containment and Conservation

The best option for existing vehicles based on CFC-12 is to reduce leakage and loss during maintenance, and to ensure that the air-conditioning system remains operational throughout the service life of the vehicle. Ensure all piping nuts are regularly tightened to prevent loss of refrigerant through engine vibration.

Many garages are equipped to recover and re-use the CFC refrigerant when servicing vehicle systems. They can also recover refrigerant from scrapped vehicles, thus extending local availability of the refrigerant. Check with your vehicle supplier and/or service agent before vehicles are serviced.

▲ Retrofitting

Even when HFC-134a is compatible with the original equipment, it is usually too expensive to be used for retrofitting older systems.

● Replacement

Most new vehicles will be equipped with the most appropriate refrigerant/system, based on international and local regulations, and the local availability of refrigerants and service facilities. HFC-134a is being used as an alternative in many new vehicles.

Make sure that the air-conditioning system can be serviced with its original refrigerant and/or retrofitted with newer alternatives during its service life.

As part of your overall environmental strategy, ask whether your vehicles require air conditioning. Vehicles without air conditioning are cheaper to buy and to run.

Dry cleaning and degreasing: uses in the hotel and tourism industry

Dry cleaning of clothes and fabrics.

Good practice tip

Eliminate smaller units, and combine loads into larger units. You could also contract out dry cleaning operations to specialist cleaners that can benefit from economies of scale and can therefore invest in newer and cleaner technologies.

Dry cleaning and degreasing

The principal ODS used in the dry cleaning of clothes and fabrics is CFC-113. Another ODS, methyl chloroform, is used in certain adhesives, aerosol products, paints and pesticides. However, the use of these materials in hotels is minimal.

Options for action

■ Containment and Conservation

Problems may arise with older equipment prone to leakage and loss of chemical. Newer dry cleaning machines have systems for recovery and reuse of the solvent. Provided there are no leaks, dry cleaning solvents are not a major threat to the ozone layer, and you can continue to use them until the end of their service life — normally 12–15 years. However, problems will arise if the solvent requires topping up as a result of leakage or loss during service, and supplies are no longer available. In order to avoid premature replacement of equipment, ensure that the machine is well maintained and checked frequently for leaks.

▲ Retrofitting

Older dry cleaning machines often use only one solvent and it may not be easy to convert them to operate with alternatives.

● Replacement

Alternative chemicals for replacing CFC-113 in dry cleaning include perchloroethylene and white spirit (Stoddard solvent). However, the use of perchloroethylene to replace CFC-113 in dry cleaning has given rise to health and safety concerns.

When replacing or purchasing new equipment, consider some of the newer technologies including ‘wet’ cleaning as an alternative to conventional dry cleaning.

Aerosols: uses in the hotel and tourism industry

Spray cans containing spot-cleaning liquids, bathroom and other surface cleaners, small area paints, adhesives, pest and other plant sprays.

Aerosols

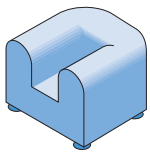
Many aerosol cans use CFCs such as CFC-11, CFC-12 and CFC-114 as the propellant to convert the liquid ingredient into a fine spray.

Options for action

- Replacement

The main alternative non-CFC propellants are based on hydrocarbons (propane, butane and pentane), dimethyl ether and compressed gases such as carbon dioxide. Non-CFC propellants tend to be clearly labelled as such. If in doubt, ask your supplier.

Non-aerosol products, such as pump-dispensers, are also available for some applications. Many are equally effective, less environmentally damaging and cheaper. Some (such as room and bathroom cleaning products) may be refilled from bulk containers thus reducing packaging waste and producing additional savings. Where no such alternative exists, specify non-CFC aerosols for all purchases.



Foams: uses in the hotel and tourism industry

Food packaging, trays and containers; pipe insulation; seat and back cushions, head rests, bedding and other upholstery uses; carpet underlay; car and bus interiors; protective packaging for goods.

Foams

A number of CFCs, including CFC-11, CFC-113, CFC-12, and CFC-114, are used as 'blowing' agents in the manufacture of plastic foam products. In 'open cell' foams, the CFCs are released during manufacture; in 'closed cell' foams, the CFCs are released slowly over a period of time. Other types, including insulating foam in refrigerators and freezers, release CFCs only when the equipment is broken up at the end of its service life.

Options for action

- Replacement

When purchasing new materials, specify products that have been produced without CFCs, or with lower ODP alternatives. Ensure that products are disposed of correctly after use.

You can also switch to alternatives, particularly where local and/or natural components are available, for example in upholstery and furnishings. Non-plastic products for food and other purchases may be cheaper and produce less waste.

Fire-fighting equipment: uses in the hotel and tourism industry

Hand-held fire extinguishers in buildings and vehicles; automatic systems in buildings.

Fire extinguishers

The most commonly used ODS used in fire-fighting applications are the halons shown in the table below.

Hand-held halon-based fire extinguishers, normally containing halon-1211 or -2402, have been specified in areas housing electrical equipment, in computer rooms, and in vehicles. Halon-1301 may be specified for 'total flooding' systems in enclosed rooms storing sensitive equipment.

Table 3 Halons used in fire fighting

Name	ODP*
halon-1211	3.0
halon-1301	10.0
halon-2402	6.0

* Ozone-depleting Potential relative to CFC-11

Many countries have established 'halon banks' to recover halons from decommissioned or redundant equipment . They then make the recovered halon available for 'essential uses' such as fire protection in aircraft.

Options for action

■ Containment and Conservation

Halon-containing fire extinguishers are no danger to the ozone layer while not in use, providing they do not leak. Once discharged, their contents are released into the atmosphere and they need to be recharged. Recharging appliances will become increasingly difficult as phase out proceeds despite local programmes to recover and recycle halons from non-essential equipment.

Check regularly for leakages (for hand-held devices this is normally done by checking the contents meter if one is fitted or by weighing and referring to the original supplied weight). Also ensure that appliances are neither discharged accidentally, nor used during routine fire practice.

● Replacement

Replace with non-halon alternative equipment at the end of service life, or sooner if your supplier will take equipment back for recycling.

Alternative extinguishers, which use dry powder, carbon dioxide and foam, are now available. Specialist applications, such as automatic fire suppression in computer rooms, can also be converted to carbon dioxide or fine water mist, with corresponding oxygen reduction alarms. Consult a fire protection specialist for the most suitable type in each fire-fighting situation. Never take the risk of having inadequate or incorrect equipment.

PART III: HOW TO CARRY OUT AN ODS MANAGEMENT PROGRAMME

Action on ODS is best taken as a part of an overall environmental programme. If you have an environmental programme already in place, you will recognize much of the following general advice for achieving success. If you do not, this may be an ideal opportunity to begin one. Additional information on environmental management can be found in another publication, *Environmental Action Pack for Hotels* (see Part V: Further information).

An outline of an ODS management programme is given below. A detailed discussion on each step follows.

Preparation

- make the commitment
- appoint a team
- check the regulations
- identify areas where ODS are used
- register equipment and products
- determine priority actions
- determine budget

Action

- refrigeration
- air conditioning in buildings
- air conditioning in vehicles
- dry cleaning and degreasing
- aerosols
- foams
- fire extinguishers

Support measures

- inform and train staff
- inform clients about your achievements
- report to stakeholders

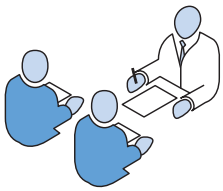
Suppliers

- inform them about your ODS management programme
- inquire about substitutes

Review progress

- identify and solve problems
- keep informed

Preparation



Make a commitment

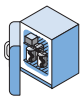
The success of your programme depends on the personal commitment of top management. ODS phase out may already feature in your environmental policy statement. If it doesn't, incorporate it now as a simple statement such as:

> 'We will seek to minimize or eliminate the effects of all our operations on the stratospheric ozone layer'.

Appoint a team

Appoint someone to be responsible for the programme. It could be the owner or manager in a smaller establishment. Larger establishments may select a core team of people from key departments to coordinate the programme. There may already be a team in place for your overall environmental management programme.

The ODS management programme will involve the collaboration of staff from different departments, as shown in the following table.

	 refrigeration	 air conditioning	 dry cleaning	 aerosols	 foams	 fire extinguishers
housekeeping		✔	✔	✔	✔	✔
maintenance	✔	✔	✔	✔	✔	✔
purchasing	✔	✔	✔	✔	✔	✔
transport		✔				✔
food and beverage	✔				✔	
front desk and office administration						✔

Check the regulations

You should be aware of national regulations on the phase out of ODS.

The Montreal Protocol controls ODS at the international level and countries that are Party to the Protocol establish national regulations that conform, or exceed, the Protocol's requirements (see Part V: Further information). Many national and local authorities have therefore established phase-out policies, and your action programme must conform, as a very minimum, to these local controls.

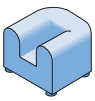
Refer to the appropriate government authority, your National Ozone Unit or your Chamber of Commerce. If you do not know to whom to speak, contact the UNEP IE OzonAction Programme.

Identify areas where ODS are used

Decide which areas of your operations to include in the programme by completing the following preliminary checklist. This will be a good preparation for more detailed analysis in the next phase of the programme.

Preliminary checklist

If you answer yes or 'don't know' to the following questions, you should investigate further.

	Sector	Note	Yes	No	Don't know
	Refrigeration and air conditioning				
	Do you have refrigerators and freezers that use ODS as the refrigerant?	Each appliance should have the refrigerant type printed on the specification plate along with such information as the model and serial numbers, and power rating			
	Do you have air conditioners in buildings that use ODS as the refrigerant?	Each appliance should have the refrigerant type printed on the specification plate along with such information as the model and serial numbers, and power rating			
	Do you have air conditioners installed in vehicles that use ODS as the refrigerant?	Details can be found in the vehicle registration book			
	**Dry cleaning and degreasing**				
	Are any of the cleaning fluids used for dry cleaning or other degreasing operations based on ODS?	The chemicals should be stated on the product labels			
	**Aerosols**				
	Do you use spray cans that contain CFCs? Look for the type of propellant used.	The contents of the spray can are usually printed on the can label. Non-ODS aerosol products often carry a 'safe for the ozone layer' label			
	**Foams**				
	Do you purchase furniture and bedding products that contain plastic foam manufactured using CFCs?	Ask your supplier for details about whether the products contain CFCs			
	**Fire extinguishers**				
	Does any of your appliances contain halons?	If cylinders are yellow or green, or marked as BCF, BTM, 1211 or 1301, they probably contain halons			

Register equipment and products

After the preliminary checklist, draw up a register of all equipment and products used in the areas identified for action. The register should include:

- the types of chemicals used
- the supplier
- the age of the equipment
- the service record.

If in doubt, refer to the instruction manual or contact the manufacturer or supplier.

This register will be very useful in the next action phase.

An example of an equipment register is shown below.

Table 4 ODS equipment register

Type of unit	Cold store	Packaged air conditioner	Fire extinguisher
Supplier Name	Refrigeration Solutions, Ltd.	Heating & Air Conditioning, Ltd.	National Fire, Inc.
Location	Main kitchen	Conference room	Front reception
Chemical type	R-12	R-22	halon-1301
Approx. contents when full (g)	4500	2000	7700
Date purchased	1985	1990	1987
Hours run	52 000	23 100	na
Normal service life due to end	2015	2010	2005
Date last serviced	1/98	sealed unit - no servicing	5/97
Top-up at last service (g)	50	-	Total recharge

Define priority action areas

Having completed the preliminary checklist and equipment register, you will now be able to determine the best areas for action. Defining where to begin will vary from one country and from one facility to another, and will depend on:

- the number of appliances in operation
- the service life of these appliances
- the ODP of the chemical product in use
- national ODS phase-out regulations
- the alternatives available and related costs.

'Good housekeeping' measures such as regular servicing and maintenance should be the first priority. Next, look into the 'no-cost, low-cost' options such as purchasing alternatives for ODS-based aerosol spray cans, and foam packaging materials.

Decisions on retrofitting and replacing must be taken based on the remaining service life of the equipment, the options and costs of retrofitting with low-ODP, and the costs of new zero-ODP equipment. These were discussed under 'What is an ODS Management Programme'.

Determine Budget

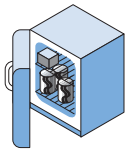
The budget should consist of:

- forecast of expenditure on low or zero-ODP alternatives, new equipment and installation costs
- estimated savings on operation costs and maintenance for new and retrofitted equipment
- staff and management time.

Many of the examples of good practice include a reference to the expenditure and pay-back periods for their ODS management programmes.

Action

Use the following flow charts to guide you through the options available.



Refrigeration: uses in the hotel and tourism industry

Food and drinks cold storage, display cabinets, freezers, ice machines, vending machines and mini-bars.

Refrigeration

CHECK		ACTION
Does the unit contain CFC-12?	YES	**Immediate:** Inspect for leaks and repair. Establish routine servicing schedule to prevent future losses and extend operating life of equipment as long as possible. **Medium term:** Discuss with supplier possible retrofitting with R-401A or B when original refrigerant is no longer available for topping up. **Long term:** Replace failed units with new equipment containing zero-ODP refrigerants such as HFC-134a, hydrocarbons or ammonia.
NO		
Does the unit contain R-502 ?	YES	**Immediate:** Inspect for leaks and repair. Establish routine servicing schedule to prevent future losses and extend operating life of equipment as long as possible. **Medium term:** Discuss with supplier possible retrofitting with R-404A as replacement for R-502 when original refrigerant is no longer available for top-up. **Long term:** Replace failed units with new equipment containing zero-ODP refrigerants such as HFC-134a, R-404A, R-404C, R-507, hydrocarbons or ammonia.
NO		
Does the unit contain HFC-134a, blends such as R-404A, R-407C, R-507, propane, isobutane or ammonia?	YES	**Immediate:** Your equipment does not contain ODS but inspect for leaks. Establish routine servicing schedule to prevent future leaks. **Medium term:** No replacement needed.
NO		
Discuss system characteristics with supplier to determine if specification requires action as above. Alternatively, contact your National Ozone Unit or other local sources of information.		

Air conditioning in buildings: uses in the hotel and tourism industry

General amenity areas, conference and meeting rooms, individual room units.

Air conditioning in buildings

CHECK

Does the unit/system contain CFC-11 or CFC-12 (some large water-chilled systems)?

YES → **Immediate:** Inspect for leaks and repair. Establish routine servicing schedule to prevent future losses and extend operating life of equipment as long as possible.

Medium term: Discuss with supplier possible retrofitting with HCFC-123 or HFC-134a with any necessary change of mechanical parts leakage of original refrigerant occurs and when original refrigerant is no longer available for topping up.

Long term: Replace failed units with new equipment containing zero-ODP refrigerants such as HFC-134a.

NO

Does the unit/system contain HCFC-22 (most smaller commercial unitary systems, small water chillers and very large chillers with centrifugal compressors)?

YES → **Immediate:** Inspect for leaks and repair. Establish routine servicing schedule to prevent future losses and extend operating life of equipment as long as possible.

Long term: Replace failed units with new equipment containing zero-ODP refrigerants such as HFC blends when HCFC-22 equipment is no longer available and/or if HCFC-22 is phased out during the expected service life of the new equipment.

NO

Non ODS
Does the unit/system contain HFC-134a or HFC blends?

YES → **Immediate:** Your equipment does not contain ODS but inspect for leaks. Establish routine servicing schedule to prevent future leaks.

Medium term: No replacement needed.

NO

Discuss system characteristics with supplier to determine if specification requires action as above. Alternatively, contact your National Ozone Unit or other local sources of information.

Vehicle air conditioning: uses in the hotel and tourism industry

Mobile units in cars, buses and other hotel transport.

Air conditioning in vehicles

CHECK

Does the system contain CFC-12?

YES → **Immediate:** Ensure that the vehicle system is serviced only by qualified personnel so that leaks can be identified and losses prevented during routine maintenance operations.

Medium term: In the event of leakage of original refrigerant, discuss with qualified service agent possible retrofitting with an appropriate blend, if remaining service life of vehicle justified the expense.

Long term: Purchase only vehicles with systems based on HFC-134a.

NO

Does the system contain HFC-134a ?

YES → **Immediate:** Your equipment does not contain ODS but ensure that the vehicle system is serviced only by qualified personnel so that leaks can be identified and losses prevented during routine maintenance operations.

Medium term: No replacement needed.

NO

Discuss system characteristics with supplier to determine if specification requires action as above. Alternatively, contact your National Ozone Unit or other local sources of information.

ACTION

Dry cleaning and degreasing uses in the hotel and tourism industry

Dry cleaning of clothes and fabrics.

Dry cleaning and degreasing

CHECK

Do your operations use CFC-113 or methyl chloroform?

YES →

Immediate: Eliminate leakages and follow proper maintenance procedures to ensure that solvent recovery and recycling systems are operational. Consider alternatives such as white spirit (Stoddard solvent).

Future: Consider contracting out dry cleaning to specialist cleaners who employ the latest techniques that do not use ODS. Where loads justify installation of new equipment, purchase only zero-ODP systems, including newer technologies such as 'wet cleaning'.

NO ↓

Discuss system characteristics with supplier to determine if specification requires action as above. Alternatively, contact your National Ozone Unit or other local sources of information.

ACTION

Aerosol uses in the hotel and tourism industry

Spray cans containing spot-cleaning liquids, bathroom and other surface cleaners, small area paints, adhesives, pest and other plant sprays.

Aerosols

CHECK

Do the spray cans contain CFCs? (refer to product label)

YES →

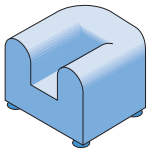
Immediate: If possible cease using existing stock and check with supplier if there is a system in place locally for the return and safe disposal of contents.

Future: Change purchasing specifications to non-CFC alternatives or non-aerosol products altogether. Discuss with supplier alternative bulk purchasing of products which can make use of refillable containers, including pump-action dispensers.

NO ↓

No action required

ACTION



Foam use in the hotel and tourism industry

Food packaging, trays and containers; pipe insulation; seat and back cushions, head rests, bedding and other upholstery uses; carpet underlay; car and bus interiors; protective packaging for goods.

Foams

CHECK

Do any of the products in these areas make use of CFCs in manufacture?

YES →

ACTION

Immediate: No action for existing stocks. Ensure proper disposal of products (such as refrigerator cabinets) using 'closed-cell' foam insulation. Don't burn any foams during disposal operations.

Future: Change purchasing specifications for all new stock. Consider non-plastic alternatives, including local natural products.

NO

No action required

Fire-fighting equipment used in the hotel and tourism industry

Hand-held devices in buildings and vehicles; automatic systems in buildings.

Fire extinguishers

CHECK

Do any of the appliances contain halons (1211,1301 or 2402)?

YES →

ACTION

Immediate: These do not pose a threat to the ozone layer as long as they remain unused. Check regularly for possible leakages. Ensure they are not accidentally discharged nor used during routine fire practices.

Future: When appliances have been discharged or reach the limit of their service life, discuss with your specialist supplier possible alternative systems with equal fire-extinguishing capability, including CO_2, dry powder and foam. Ensure that redundant appliances are returned so that their contents can be recycled through a local halon bank. Check with NOU.

NO

No action required

Support measures

Inform and train staff

Inform and train staff

The success of your ODS management programme depends of the participation of your staff. Make staff aware from the beginning of what you plan to do, why you need to do it, and how they can participate to achieve the desired results.

Good practice tip

Some hotels organize competitions, and reward the staff members with the best 'green' ideas for environmental improvement. Many tourism companies have included their environmental programme on staff induction agendas, and give bonus points for active participation in environmental activities during performance evaluation.

Most people respond positively to changes in the work place relating to environmental issues, especially if they understand the importance of their own contribution, and that they are supporting international action on a global environmental issue.

Arrange training for all staff involved in new operating methods, using new equipment and chemicals. Suppliers of new equipment can usually provide on-site or remote 'distance' training programmes.

Give all staff regular progress reports to maintain their interest and support through:

- information bulletins on notice boards
- staff meetings
- articles in the staff newsletter.

This will encourage staff to participate actively in the programme and will also boost staff morale — staff will see how their actions contribute to environmental improvement. Your employees are often your best ambassadors — in constant contact with your clients and the outside world. They will spread the good news (and the bad!) Make sure you keep them informed.

Inform clients about your achievements

Good practice tip

Some hotels provide their visitors with an environmental newsletter which covers their environmental programme, local environmental news and issues, and sometimes, a 'did you know' column or quiz.

Once your environment and ODS management programme is underway, it is important to tell your client your efforts and the results achieved. Many of your clients will appreciate your proactive approach, and reward you for your efforts. The hotel and tourism industry has been surprised by the positive feedback received by its clients on their environmental activities.

Larger tour operators may have begun environmental management programmes themselves, and will respond positively to your efforts. Some tour operators are in the process of identifying 'green' facilities, and giving them special coverage in their destination brochures.

Information of your ODS management programme can be communicated through guest information brochures, videos, in-house television, special notices on ozone layer friendly appliances (such as air conditioners and mini-bars) in guest rooms.

Do's and don'ts in communication

- Do refer to your environmental actions in promotional literature and other such materials.
- Do include environmental information in guest room and front desk information. Unlike energy efficiency or water conservation, your clients cannot participate in the ODS management programme, but they will certainly be impressed with the steps you have taken to 'save the ozone layer.
- Do participate in local seminars and meetings, and invite local schools and colleges to become involved by using your management programme as a 'case study'.
- Do keep your communication simple.
- Don't be tempted to 'go public' about what you intend to do, but rather, on what you have already done. Remember actions speak louder than words.
- Don't indulge in 'green washing' — making claims about your programmes which cannot be substantiated or which are merely based on superficial actions.

Report to stakeholders

Depending on the size of your business, you may have a wide audience of interested parties, or 'stakeholders', that includes your bank and insurers, local authorities, the local community and local environmental groups. They each have an interest in your environmental performance and may be more positive towards your operations if they know about your achievements.

For example, you may find it easier to secure bank loans and preferential rates of insurance. Local authorities may look more favourably on business expansion plans if your establishment is environmentally responsible. Local communities and environmental groups may also view your operation more positively.

Suppliers

As reiterated throughout this guide, ODS management requires active dialogue and collaboration with your suppliers. Inform them of your ODS management policy, and ask them for advice on alternatives. For example, ask them to provide samples of aerosol products and items containing foams for testing.

Also, inquire about replacements to HCFCs if you are already using them or if you are considering HCFCs as a possible substitute for CFCs.

Did you know that you can encourage suppliers to make environmentally-friendly alternatives more accessible on the market? Several tourism facilities have found that their environmental purchasing policies have prompted suppliers to develop a range of competitive, environmentally-friendly products and services. These are now being bought not only by the hotel and tourism industry but also by several other commercial and residential establishments.

Review progress

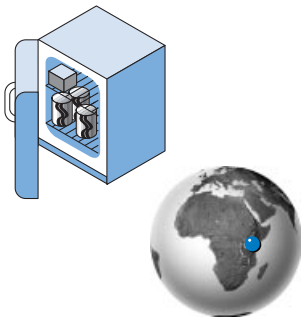
Keep your ODS management programme under continuous review. This will help identify areas where corrective measures are needed, and make certain that the objectives are being realized. Maintain records on immediate containment and retrofitting; they will be useful when purchasing new equipment and when expanding operations.

Keep informed of on-going changes in the phase out of the ODS used in your establishment. Remember that regulations will be reviewed as more alternatives become available. Contact your National Ozone Unit to receive regular advice and updates on your country's national strategy.

PART IV: EXAMPLES OF GOOD PRACTICE

Most of the following examples of successful ODS management programmes were selected from applications to the International Hotels & Restaurants Association's (IH&RA) annual 'Green Hotelier' Environmental Award. Some were also taken from case studies provided by DuPont and Elf Atochem.

UNEP IE welcomes submissions of further examples, especially from smaller establishments and those in developing countries, to be included in future editions of this publication.



Refrigeration

Hotel Intercontinental, Nairobi, Kenya

In the early 1990s, even before the introduction of national ODS regulations, the hotel initiated an ODS management programme. This was principally led by the need to upgrade the cold storage equipment which was frequently breaking down.

ODS management began by replacing half of the existing CFC-12 based systems with **HCFC-22**, and replacing the remaining 50 percent over the next five years.

The decision to switch to HCFC-22 was taken for two reasons:

- it was expected that HCFC-22 would be available until 2025, beyond the service life of the new equipment
- HCFC-22 was readily available in Kenya and cheaper than HFC-134a.

At the same time, technical improvements were made both to existing and new equipment to prevent vibration and thereby lessen the risk of pipe fracture and resulting refrigerant leakages.

The hotel calculated that the pay-back period for the first phase would be just under four years, taking into consideration the previous cost of food spoilage, refrigerant replacement and repair costs. By the time the second phase replacements were completed, increases in equipment costs had raised the pay-back period to five years.

The CFC-12 based mini-bars were replaced with new **ammonia absorption units**. These consume 60 percent less power and pose no threat to the ozone layer.

Intercontinental Hotels has begun a company-wide environmental management programme. The Nairobi hotel has implemented a comprehensive environmental programme, with special emphasis on energy efficiency. Investment in the ODS management programme benefited from financial savings made through the overall environmental programme.

The Regional Engineer assists other smaller establishments in the region by sharing his experiences and publishing practical guides on environmental management in hotels.

The Fairmont Hotel, San Jose, California, United States

The hotel has retrofitted a large medium-temperature CFC-12 chiller with **R-409A (Forane®409A)** which services both walk-in coolers and under-the-counter coolers. R-409a is compatible with mineral and alkylbenzene oils, and no oil change was required. In this way the hotel has extended the life of the original equipment, saving on the cost of replacement. Further costs savings were achieved because R-409a was cheaper than CFC-12.

Welcomgroup Maurya, Sheraton Hotel & Towers, New Delhi, India

All guest room CFC-12 mini-bars have been replaced by new units based on **vapour absorption**. The resultant savings in electricity amounted to 50 000 kilowatt-hours a year, equivalent to US$7000, with a pay-back period of six years.

The Regent Hotel, Sydney, Australia

As part of its overall energy-saving programme, the hotel purchased new refrigerators. As compressors became faulty on existing equipment, the hotel converted all medium-temperature systems based on CFC-12 to **R-401A (SUVA™ MP39)** and all low-temperature systems based on R-502 to **R-404A (SUVA™ HP80)**.

The retrofitting required a change of compressors and lubricating oil but considerably increased the efficiency of the equipment. The conversion of the equipment caused no disruption to the hotel's operations.

The Granary Restaurant (Forte plc, now Granada), Gatwick Airport, London

The cold store is equipped with a duplex refrigeration system comprising two Prestcold MALQ 20X B1-75 condensing units. A single thermostat maintains a cold room temperature of -22 °C.

The refrigeration plant, originally commissioned with R-502, was first retrofitted to **R-404A and EMKARATE™ 32S polyolester**. It was later converted to **R-407A (KLEA™ 407A)** as a more viable long-term option.

The only change to the system was routine replacement of the dryer. The original compressor oil was reused.

Hotel DuPont, Wilmington, Delaware, United States

The hotel retrofitted all 45 refrigeration units in its main kitchens as part of a company-wide CFC phase-out programme. The project involved removing CFC-12 and R-502 refrigerants, and recharging with HCFC/HFC blends including **R-401A**, **R-401B**, **R-402A and R-402B**.

During the retrofit, no system flushing was needed as the replacement refrigerants are compatible with the alkylbenzene mineral oils used for all the compressors. Of the 45 units retrofitted, only 3 required adjustments to the thermostatic expansion valves.

The hotel estimates that the retrofit has reduced electricity consumption by the compressors by 35 percent, with a pay-back period of less than four years. The high level of energy efficiency can be attributed to the hotel's intensive maintenance

programme which includes cleaning and inspecting each compressor and its associated water-cooling equipment at least once a month. Nevertheless, retrofits of this type can reduce electricity consumption by 15–20 percent as a result simply of more efficient compressor operation.

Emil Villa's Hick'ry Pit Restaurants, California, United States
This is a popular chain of 12 restaurants in the San Francisco Bay area. It has converted all equipment based on CFC-12 (walk-in coolers, freezers, display cabinets and counters, ice makers and drink coolers), averaging 9-12 units per restaurant, to **R-401A (SUVA™ MP39)** for medium-temperature equipment, and to **R-401B ((SUVA™ MP66)** for low-temperature equipment.

Other low-temperature systems based on R-502 have been converted to **R-402A (SUVA™ HP80)**.

The retrofits were easy to perform. It was necessary only to change the oil in the compressors from mineral oil to an alkylbenzene lubricant. The CFCs removed were returned to the manufacturer for recycling.

The new equipment operates more efficiently and has resulted in energy savings. The units reach their target temperatures more quickly, even on very hot days.

Welcomgroup Park Sheraton Hotel and Towers, Madras, India
The hotel originally operated eight cold storage and freezer units served by two reciprocating chiller plants based on HCFC-22. After 15 years of operation there were frequent refrigerant leakages and mechanical breakdowns. Obtaining parts for these models had also become difficult. As capacity was inadequate and energy consumption was excessive, the hotel decided to replace all the equipment.

The original 8 units were replaced with 11, all based on **R-404A**. The total cost of the replacement equipment was US$200 000. As a result of greater energy efficiency and reduced food spoilage, the hotel expects to save almost US$40 000 per year in operating costs, giving a pay-back period of five years.

The CFC-12 mini-bars have been replaced with **vapour absorption** models giving a 34 percent saving in energy consumption.

Manele Bay Hotel, Lana'i, Hawaii, United States
Three walk-in cold stores were converted from CFC-12 to **R-401A (SUVA™ MP39)** without major technical modifications. Lubricating oil was changed from mineral oil to alkylbenzene. A switch from R-401A to **R-406A** for future CFC-12 conversions will eliminate the need to change from the standard lubricating oil.

A number of smaller refrigeration units were similarly converted from CFC-12 to **R-401B (SUVA™ MP66)** and from R-502 to **R402A (SUVA™ HP80)**.

Three Manitowoc '1200' ice machines were changed from R-502 to **R-402B (SUVA™ HP81)** resulting in a 10 percent increase in ice production and reduced energy costs.

Hotel Nikko, Hong Kong, China

The hotel currently uses a range of refrigeration and air-conditioning units, containing R-11, R-12, R-22 and R-502. The remaining service life of these units is approximately eight years. The hotel therefore decided to continue operating the existing equipment with greater emphasis on a **containment policy**. This includes systematic maintenance to prevent leakages, and optimization of operating efficiency. This policy will enable the equipment to be operated during its remaining service life with the refrigerants that were originally specified.

Towards the end of this period, the equipment will be replaced in phases. The hotel plans to **recover the refrigerant** from the replaced units and to use it to keep the remaining units operational.

This strategy is possible because current legislation controls only the production of CFCs, not their use. The strategy is regularly reviewed, taking into consideration age of equipment, operational problems and changes to ODS phase-out regulation.

The hotel has a comprehensive environmental management programme for which it was awarded the IH&RA Corporate 'Green Hotelier' of the Year Award, 1995. The programme includes water and energy efficiency initiatives which produced savings of 30 percent in water consumption, 6 percent in electricity and 9 percent in fuel oil. In association with the Hong Kong Polytechnic University, the General Manager published a guide called *Energy and Water Conservation in Hotels*. It contains methodologies for environmental audits, based on experiences of auditing hotels in Hong Kong.

The staff are trained to apply good housekeeping measures during their daily tasks. Special training is also given to engineering and maintenance staff who are involved in improving the operating efficiency of all equipment.

The Imperial Queen's Park Hotel, Bangkok, Thailand

Four HVAC air-conditioning units using CFC-11 have been converted to **HCFC-123**.

Sanga Saby Conference and Study Centre, Svartsjo, Sweden

The centre's heat pump system has been renovated, changing from CFCs to more efficient pumps based on **propane**.

Air conditioning

Hotel Intercontinental, Nairobi, Kenya

When the hotel was expanded from 220 to 440 rooms in 1976, no provision was made for a corresponding increase in air-conditioning capacity. This led to numerous complaints. In 1992, the 20-year old CFC-12 systems were replaced with equipment using **HCFC-22**. All the new chillers were fitted with computer controls to provide optimum energy efficiency, a key feature throughout the hotel. The replacement has increased cooling efficiency and guest satisfaction.

The hotel is in the process of installing an **infra-red leak detection system** in the air-conditioning and refrigeration machine rooms at a cost of US$7500.

ODS management is also a part of routine staff training

ANA Hotel, Singapore

As a part of its 'Green & Cool' programme, the hotel invested S$1.8 million (about US$1.15 million) in new cooling towers and centralized air-conditioning chillers, based on **HFC-134a**. These systems are 20-25 percent more efficient than the older ones, and the hotel expects to save S$30 000 (about US$19 000) a year in reduced energy bills.

The 'Green & Cool' programme includes energy-saving rest rooms, 'green suites' containing air and water filtration systems, biodegradable bathroom amenities, recycling of waste products and reuse of laundry rinse water. The hotel was the winner of the Greening of Business Tourism Awards at 10th EIBTM Exhibition in 1997.

Welcomgroup Maurya, Sheraton Hotel & Towers, New Delhi, India

A lithium bromide vapour absorption system has been installed as a replacement for the original reciprocating compressor system based on CFC-12.

This has resulted in savings in electricity consumption of 1.6 million kilowatt-hours a year, equivalent to more than US$200 000. At this rate, pay back is expected in less than 1.5 years.

Sheraton Fiji Resort, Fiji

As part of a company-wide programme, the hotel has eliminated CFC refrigerants from its two air-conditioning chillers. This involved a retrofit from CFC-12 to **R-134a** with a corresponding change of lubricating oil and recovery of the original refrigerant for return to the manufacturer for recycling. The retrofit took three weeks per chiller at an overall cost of US$70 000 each. This compares with a purchase price for new equipment of US$200 000 per chiller.

The Regent Hotel, Sydney, Australia
The hotel retrofitted its 14-year-old CFC-based HVAC air conditioning system to **HCFC-123**. The refurbished chillers are now managed through an Integrated Systems Network which has helped maximize efficiency, control and accuracy, enabling staff to react faster to temperature changes, and made possible remote monitoring of the plant's operation. The retrofit has led to a significant reduction in energy costs, and the hotel estimates the pay-back period will be eight years.

To reduce CFC, HCFC and HFC emissions, the hotel has installed a sensing and alarm system to detect refrigerant losses. The system uses a Spectroline HVAC **Fluorescent Leak Detector** that can locate the source of every air-conditioning and refrigeration leak, making servicing faster, cleaner and easier. The system is effective with all commonly used refrigerants, including R-134a.

Aerosols

Welcomgroup Park Sheraton Hotel and Towers, Madras, India
The hotel has completely phased-out aerosols using CFC propellants. Room fresheners have been changed from pressurized units to **pump action dispensers**.

Sheraton Abu Dhabi Resort & Towers, Abu Dhabi, United Arab Emirates
Plastic bottles have replaced aerosols wherever possible. For example, the hotel now uses Diversey R5A air fresheners.

Fire extinguishers

Welcomgroup Park Sheraton Hotel and Towers, Madras, India

All halon-based fire extinguishers in offices have been replaced with extinguishers using **CO_2 or dry powder**.

Welcomgroup Maurya, Sheraton Hotel & Towers, New Delhi, India

Portable hand-held extinguishers based on halon-1211 have been replaced by extinguishers using **dry powder**.

Manele Bay Hotel, Lana'i, Hawaii, United States

The computer room at 'central services' has been converted from the existing halon system to an **'Inergen' system** using nitrogen, argon and CO_2. This gas mixture is cheaper than halon.

The Imperial Queen's Park Hotel, Bangkok, United States

Fire extinguishers in hotel guest rooms have been switched from halon-1211 to **dry powder**.

Sheraton Abu Dhabi Resort & Towers, Abu Dhabi, United Arab Emirates

Halon fire extinguishers have been phased out in favour of **CO_2** appliances.

Hotel contacts

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PART V: FURTHER INFORMATION

Glossary

Article 5 countries — Parties to the Montreal Protocol that are considered developing countries. Article 5 countries are eligible to receive technical and financial assistance from the Multilateral Fund to phase out consumption of ODSs.

Carbon tetrachloride — CCl_4, used as a cleaner and in the production of CFCs, a substance controlled under the Montreal Protocol.

Chlorofluorocarbons — A family of chemicals that contains chlorine, fluorine and carbon, and which are used as refrigerants, aerosol propellants, cleaning solvents and in the manufacture of foam. One of the main causes of ozone depletion.

Dimethyl ether — A flammable propellant widely used in air refresher sprays, hair sprays and insecticides.

Environmental policy — A statement by a company of its principles and intentions in relation to its overall environmental performance. It establishes a framework for action and for setting environmental objectives and targets.

Environmental Management Programme — The actions steps, resources, schedules and responsibilities required to achieve environmental objectives.

Greenhouse gas — A gas that traps heat in the Earth's atmosphere, contributing to the greenhouse effect. CFCs and HCFCs are greenhouse gases.

Global warming — The theory that greenhouse gases emitted by human activities will warm the Earth's atmosphere, leading to climate change. CFCs and HCFCs contribute to the greenhouse effect.

Global Warming Potential — The potential impact on global warming of a chemical with reference to carbon dioxide, the GWP of which is defined as 1.0.

Halons — Brominated chemicals related to CFCs that are used in fire fighting, and have very high ODPs.

Hydrochlorofluorocarbons — HCFC. A family of chemicals related to CFCs, which contain hydrogen as well as chlorine, fluorine and carbon. The hydrogen reduces their atmospheric lifetime, making HCFCs less damaging than CFCs in the longer term.

Hydrofluorocarbons — A family of chemicals related to CFCs, which contain hydrogen, fluorine and carbon but no chlorine and which therefore do not deplete the ozone layer.

Hydrocarbons — Commonly used as a substitute for CFCs in aerosol propellants. Hydrocarbons are also volatile organic compounds, and their use may be restricted or prohibited in some areas.

Low-volume ODS consuming countries — Article 5 countries that consume less than 360 weighted tonnes a year of ODS.

Methyl bromide — A chemical composed of carbon, hydrogen and bromine, which is used mainly as an agricultural pesticide and fumigant, and has significant ODP.

Methyl chloroform — A chemical composed of carbon, hydrogen and chlorine, which is used as a solvent and blowing agent and has an ODP about one-tenth that of CFC-11.

Montreal Protocol	Signed in 1987, the Protocol commits Parties to take measures to protect the ozone layer by freezing, reducing or ending production and consumption of ODS.
National Ozone Unit	The government office responsible for implementing the national ODS phase-out strategy. The focal point should be able to provide additional information about technical and financial assistance. UNEP IE OzonAction Programme can provide you with the contact of your country's NOU.
Ozone	A gas whose molecular structure consists of three oxygen atoms. Ozone partially filters out certain wavelengths of UV light emitted by the sun. Ozone is a desirable gas in the stratosphere but it is toxic to living organisms at ground level.
Ozone depletion	The process by which stratospheric ozone is destroyed by man-made chemicals, leading to a reduction in its concentration.
Ozone Depletion Potential	A measure of a substance's ability to destroy stratospheric ozone, based on its atmospheric lifetime, stability, reactivity and its content of elements such as chlorine and bromine that attack ozone. All ODP are based on the reference measure of 1.0 for CFC-11. If a substance has an ODP of 0.5, a given weight of the substance in the atmosphere would, in time, deplete half the ozone that the same weight of CFC-11 would deplete.
Ozone Depleting Substance	Any chemical that can deplete the ozone layer. Most ODS are controlled substances under the Montreal Protocol.
Ozone layer	A layer in the stratosphere, at an altitude of approximately 10-50 km, where a relatively high concentration of ozone filters out harmful ultraviolet radiation before it reaches the Earth's surface.
Party	A country that signs and/or ratifies an international legal instrument, indicating that it agrees to be bound by the rules set out therein. Parties to the Montreal Protocol are countries that have signed and ratified the Protocol.
Perchloroethylene	A zero-ODS chlorinated solvent, an effective substitute for CFC-113 and methyl chloroform. However, there are potential health problems associated with its use, which makes it important to enact strict health and safety measures to prohibit excessive exposure to the chemical.
Phase out	The ending of all production and consumption of a chemical controlled under the Montreal Protocol.
Stratosphere	The portion of the atmosphere approximately 10-50 km above the Earth's surface where the bulk of atmospheric ozone resides.
Ultraviolet radiation	Radiation from the Sun with wavelengths between visible light and X-rays. UV-B (280–320 nm) is harmful to life on the Earth, and is mostly absorbed by the ozone layer.

Publications

UNEP IE publications can be ordered from:

SMI (Distribution Services) Ltd.
PO Box 119
Stevenage
Hertfordshire SG1 4TP
United Kingdom

fax: +44 1438 748844
e-mail: anthony@smibooks.com

Publications from the OzonAction Programme

General Awareness Materials

The OzonAction Newsletter

A quarterly newsletter dedicated to stratospheric ozone protection and the phase-out of ODS. The newsletter contains the most recent information on ozone protection activities such as industry updates, new products, ODS phase-out and success stories. UNEP IE. Available in Arabic, Chinese, English, French, Portuguese and Spanish.

Five Steps for Raising Awareness on Ozone Depletion: A Handbook for National Ozone Units

This handbook will help ODS Officers to plan focused efforts, aimed at the public and industry, to raise awareness on ozone-depletion issues. A five-step planning cycle is presented. Each step is illustrated by examples of awareness-raising activities on ozone depletion issues from developing countries. UNEP IE, 1996, 30 pp. Available in English, French and Spanish. US$25.

Saving the Ozone Layer — Every Action Counts: Video Booklet

This booklet accompanies *Saving the Ozone Layer: Every Action Counts*, an 18-minute video explaining why the stratospheric ozone layer is threatened, what the implications of ozone depletion are and what we can do to prevent it. The booklet is designed to help maximize the effectiveness of the video by providing material that can be used in a presentation before or after viewing, or in moderating a group discussion. UNEP IE, 1996, 30 pp. Available in English, French and Spanish. US$25 (price for booklet only).

Technical Brochures

Technical Brochures for Protecting the Ozone Layer are technical publications that help to identify alternatives to ODS, and explain how to use them to facilitate the phase out of ODS. These are easy to read summaries of the UNEP Technical Options Committee Reports. Available in English, French, Spanish and Chinese.

Protecting the Ozone Layer Volume 1: Refrigerants, 1992, UNEP IE, 40 pp. US$30

Protecting the Ozone Layer Volume 2: Solvents Coatings and Adhesives, 1992, UNEP IE, 40 pp., US$30

Protecting the Ozone Layer Volume 3: Fire Extinguishing Substances, 1992, UNEP IE, 40 pp., US$30

Protecting the Ozone Layer Volume 4: Foams, 1992, UNEP IE, 1994, 40 pp., US$30

Protecting the Ozone Layer Volume 5: Aerosols, sterilants, carbon tetrachloride and miscellaneous uses, 1992, UNEP IE, 50 pp., US$30

Training Manuals

Training Manual on Chillers and Refrigerant Management

This training manual is intended to be used by Ozone Offices in developing countries, in their continued efforts to train technical personnel in industry. Available in English. French, Spanish and Chinese versions, UNEP IE, 1994, US$85

Training Manual on Good Practices in Refrigeration

This training manual is intended to be used by technical managers and instructors from technical training institutes in developing countries, who will provide the training to unitary and mobile air conditioning and refrigeration practitioners. UNEP IE, 1994, available in English, French, Spanish and Chinese, US$80

Saving the Ozone Layer: Guidelines for UN Offices
Practical steps to phase out the use of ODS on United Nations premises. Includes a five-step action plan and a case study of the UN Offices in Nairobi, Kenya. Of potential use to managers in the hotel and tourism industry. UNEP IE, 1997, 24 pp.

Sourcebooks of Technologies for Protecting the Ozone Layer
Sourcebooks of Technologies for Protecting the Ozone Layer give information about where to obtain specific technologies, as well as guidance about how to select an appropriate alternative. Available in English only.

Sourcebook of Technologies for Protecting the Ozone Layer, Aerosols, Sterilants, Miscellaneous Uses and Carbon Tetrachloride, UNEP IE, 1996 update, US$85

Sourcebook of Technologies for Protecting the Ozone Layer, Flexible and Rigid Foams, UNEP IE, 1996 update, US$85

Sourcebook of Technologies for Protecting the Ozone Layer, Refrigeration, Air-conditioning and Heat Pumps, UNEP IE, 1996 update, US$100

Sourcebook of Technologies for Protecting the Ozone Layer, Specialized Solvent Uses, UNEP IE, 1996 update, US$70

Guidebooks and Guidelines
Practical Guide to Policy Guidelines for Industry on the Management of Phase Out of ODS
These guidelines will assist small and medium-size companies, government and other organizations in developing countries in identifying where ODS are found in the plant and give information on new alternative processes and technologies. They also provide information on where to get technical and financial assistance. UNEP IE, 1994, available in English only, US$45

Publications from the UNEP IE Tourism Programme:
Case Studies on Environmental Good Practice in Hotels
The publication features the environmental management programmes of 15 hotels, both independent hotels and international chains, in Africa, Asia, Europe and North America. Action areas include environmental policy, design and construction, water, energy, waste, emission, purchasing, staff training and communication. The case studies were selected from applicants to the IH&RA annual Environmental Award.
A UNEP/International Hotels & Restaurant Association (IH&RA) publication, 1997.
FF250/US$50, 52 pp. (order reference: UNEP IE T7)

Environmental Action Pack for Hotels
Complete with checklists, practical tips and examples, the *Environmental Action Pack for Hotels* is an essential guide for environmental management in hotels. It covers: how to perform environmental audits and identify the best areas for action; taking action under the focus areas (water, energy, solid waste, effluent and emissions, contractors and suppliers and monitoring progress); and how to integrate environmental action into daily operations.
A UNEP/International Hotels Association/International Hotels Environment Initiative publication, 1995. FF200/US$40, 64 pp. (order reference: UNEP-IE T5)

Contacts

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http://www.unep.org/unep/secretar/ozone/home.htm

Environmental management in the hotel and tourism industry

Information on environmental management in the hotel and tourism industry can be obtained from:

International Hotels and Restaurants Association
251 rue de Faubourg Saint-Martin
75010 Paris, France
fax: +33 1 40 36 73 30
e-mail: infos@ih-ra.com
http://www.ih-ra.com

International Hotels Environment Initiative
15-16 Cornwall Terrace, Regents Park
London NW1 4QP, United Kingdom
fax: +44 171 467 3620
e-mail: IHEI@pwblf.org.uk

EcoNETT (an environmental database for the tourism industry, a project of the World Travel and Tourism Council, supported by DG XXIII of the European Commission)
20 Grosvenor Place
London SW1X 7TT
United Kingdom
fax: +44 171 235 2445
e-mail: 106316.2226@compuserve.com
http://www.wttc.org

Countries operating under Article 5 of the Montreal Protocol

These countries (as of 31 December 1997) operate under Article 5 paragraph 1 of the Montreal Protocol and are therefore eligible to receive assistance under the Multilateral Fund. Each country has a National Ozone Unit (NOU) or other focal point that can assist businesses, including those in the hotel and tourism sector, with the phase out of ODS. If you do not know the NOU in your country, please contact the OzonAction Programme.

Algeria
Antigua and Barbuda
Argentina
Bahamas
Bahrain
Bangladesh
Barbados
Benin
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Brunei Darussalam
Burkina Faso
Burundi
Cameroon
Central African Republic
Chad
Chile
China
Colombia
Comoros
Congo
Congo, Democratic Republic of
Cost Rica
Côte d'Ivoire
Croatia
Cuba
Cyprus
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Federated States of Micronesia
Fiji
Gabon
Gambia
Georgia
Ghana
Grenada
Guatemala
Guinea
Guyana
Honduras
India
Indonesia
Iran, Islamic Republic of
Jamaica
Jordan
Kenya
Kiribati
Korea, Democratic Peoples Republic of
Kuwait
Lebanon
Lesotho
Liberia
Libyan Arab Jamahiriya
Macedonia, Former Yugoslav Republic of
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Marshall Island
Mauritania
Mauritius
Mexico
Moldova
Mongolia
Morocco
Mozambique
Myanmar
Namibia
Nepal
Nicaragua
Niger
Nigeria
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Qatar
Republic of Korea
Romania
Saint Kitts & Nevis
Saint Lucia
Samoa
Saudi Arabia
Senegal
Seychelles
Singapore
Slovenia
Solomon Islands
Sri Lanka
St. Vincent and the Grenadines
Sudan
Suriname
Swaziland
Syrian Arab Republic
Tanzania, United Republic of
Thailand
Togo
Trinidad and Tobago
Tunisia
Turkey
Tuvalu
Uganda
United Arab Emirates
Uruguay
Vanuatu
Venezuela
Viet Nam
Yemen
Yugoslavia
Zambia
Zimbabwe

ODS phase-out schedule

The phase-out timetable for Article 5 and non-Article 5 countries agreed at the 9th Meeting of the Parties to the Montreal Protocol, Montreal, 15–17 September 1997.

Article 5 countries

1 July 1999	Freeze of Annex A CFCs at 1995-97 average levels[7]
1 January 2002	Freeze of halons at 1995-97 average levels[7] Freeze of methyl bromide at 1995-1998 average levels
1 January 2003	Annex B CFCs reduced by 20 percent from 1998-2000 average consumption[8] Freeze in methyl chloroform at 1998-2000 average levels
1 January 2005	Annex A CFCs reduced by 50 percent from 1995-97 average levels[7] Halons reduced by 50 percent from 1995-97 average levels[7] Carbon tetrachloride reduced by 85 percent from 1998-2000 average levels Methyl chloroform reduced by 30 percent from 1998-2000 average levels
1 January 2007	Annex A CFCs reduced by 85 percent from 1995-97 average levels[7] Annex B CFCs reduced by 85 percent from 1998-2000 average levels[8]
1 January 2010	CFCs, halons and carbon tetrachloride phased out methyl chloroform reduced by 70 percent from 1998-2000 average levels
1 January 2015	Methyl chloroform and methyl bromide phased out
1 January 2016	Freeze of HCFCs at base line figure of year 2015 average levels
1 January 2040	HCFCs phased out

Non-Article 5 countries

1 July 1989	Freeze of Annex A[1] CFCs
1 January 1992	Freeze of halons
1 January 1993	Annex B CFCs[2] reduced by 20 percent from 1989 levels Freeze of methyl chloroform
1 January 1994	Annex B CFCs reduced by 75 percent from 1989 levels Annex A CFCs reduced by 75 percent from 1986 levels Halons[3] phased out[6] Methyl chloroform reduced by 50 percent
1 January 1995	Carbon tetrachloride reduced by 85 percent from 1989 levels Methyl bromide frozen at 1991 levels
1 January 1996	HBFCs[4] phased out[6] Carbon tetrachloride phased out[6] Annex A and B CFCs phased out[6] Methyl chloroform phased out[6] HCFCs[5] frozen at 1989 levels of HCFC + 2.8 percent of 1989 consumption of CFCs (base level)
1 January 1999	Methyl bromide reduced by 25 percent from 1991 levels
1 January 2001	Methyl bromide reduced by 50 percent from 1991 levels
1 January 2003	Methyl bromide reduced by 70 percent from 1991 levels
1 January 2004	HCFCs reduced by 35 percent below base levels
1 January 2005	Methyl bromide phased out
1 January 2010	HCFCs reduced by 65 percent
1 January 2015	HCFCs reduced by 90 percent
1 January 2020	HCFCs phased out allowing for a service tail of up to 0.5 percent until 2030 for existing refrigeration and air-conditioning equipment

Notes

1 Annex A: CFCs 11, 12, 113, 114 and 115

2 Annex B: CFCs 13, 111, 112, 211, 212, 213, 214, 215, 216 and 217

3 halons 1211, 1301 and 2402

4 34 hydrobromofluoro-carbons

5 40 hydrochlorofluoro-carbons

6 With exemptions for essential uses. Consult the *Handbook on Essential Use Nominations* prepared by the Technology and Economic Assessment Panel, 1994, UNEP, for more information

7 calculated level of production of 0.3 kg/capita can also be used for calculation, if lower

8 calculated level of production of 0.2 kg/capita can also be used for calculation, if lower

Examples of Trade names of Annex A Substances

The CFCs included under Annex A of the Montreal Protocol together with their common trade names are detailed below. A complete list of ODS trade names can be obtained from UNEP IE.

Name	Chemical name	Common trade names
CFC-11	trichlorofluoromethane	Asahifron R-11™, Genetron 11™, Daiflon 11™, Freon-11™, Arcton 11™, Forane 11™, Mafron 11™, Korfron 11™
CFC-12	dichlorodifluoromethane	Algofrene 12™, Arcton 12™, Asahifron R-12™, Asahifron R-500™, Daiflon 12™, Floron 12™, Forane 12™, Freon-12™, Friogas 12™, Genetron 12™, Isceon 12™, Mafron 12™, Taisoton 12™
CFC-113	1, 1, 1-trichlorotrifluoroethane	Arklone L™, Arklone P™, Arklone
	1, 1, 2-trichlorotrifluoroethane	PSM™, Arklone K™, Arklone EXT™, Arklone AM™, Arklone AS™, Arklone W™, Arklone AND™, Asahifron R-113™, CG Triflon ES™, CG Triflon EE™, CG Triflon EC™, CG Triflon FD™, CG Triflon M™, CG Triflon Wl™, CG Triflon MES™, CG Triflon E35™, CG Triflon P™, CG Triflon™, CG Triflon E™, CG Triflon C1™, CG Triflon A™, CG Triflon D3™, CG Triflon CP™, CG Triflon Dl™, Daiflon S3-ES™, Daiflon S3-HN™, Daiflon S3-MC™, Daiflon S3-P35™, Daiflon S3-W6™, Daiflon S3-EN™, Daiflon S3™, Daiflon S3-A™, Daiflon S3-E™, Flon Showa FS-3MS™, Flon Showa FS-3A™, Flon Showa FS-3M™, Flon Showa FS-3P™, Flon Showa FS-3E™, Flon Showa FS-3™, Flon Showa FS-3D™, Flon Showa FS-3ES™, Flon Showa FS-3W™, Freon TES™, Freon TF™, Freon T-E35™, Freon T-E6™, Freon T-DFCX™, Freon TE™, Freon™C™, Freon™S™, Freon PCA™, Freon MCA™, Freon SMT™, Freon TA™, Freon T-P35™, Freon T-WD602™, Freon T-DFC™, Freon TF™, Freon TP35™, Freon TWD 602™, Freon™S™, Freon™C™, Freon T-DECR™, Freon TES™, Freon MCA™, Freon TDF™, Freon T-DEC™, Freon SMT™, Freon T-DA35X™, Freon T-DA35™, Freon TA™, Freon T-B1™, Fronsolve AES™, Fronsolve AM™, Fronsolve AMS™, Fronsolve AD-7™, Fronsolve AE™, Fronsolve AP™, Fronsolve™, Fronsolve AD-9™, Fronsolve AD-l9™, Fronsolve AD-17™, Magicdry MD 203™, Magicdry MD 202™, Magicdry MD-E35™, Magicdry MD 201™
CFC-115	monochloropentafluoroethane	Arcton 115™, Asahifron R-502™, Forane 502™, Freon-502™

A more extensive list is available on the Internet at

http://www.unepie.org/ozonaction.html

About UNEP IE's OzonAction and Tourism Programmes

The OzonAction Programme

Nations around the world are concerned about the emissions of man-made CFCs, halons, carbon tetrachloride, methyl chloroform, methyl bromide and other ODS that have damaged the stratospheric ozone layer — a shield around the Earth which protects life from dangerous ultraviolet radiation from the Sun. More than 160 countries have committed themselves under the Montreal Protocol to phase out the use and production of these substances. Recognizing the special needs of developing countries, the Parties to the Protocol also established a Multilateral Fund and appointed implementing agencies to provide technical and financial assistance to enable the developing countries to meet their commitments under the treaty. UNEP is one of the Fund's implementing agencies; the others are UNDP, UNIDO and the World Bank.

Since 1991, the UNEP IE OzonAction Programme in Paris has been strengthening the capacity of governments (especially National Ozone Units) and industry in developing countries to make informed decisions on technology and policy options that will result in cost-effective ODS phase-out activities with minimal external intervention. The Programme accomplishes this by delivering a range of need-based services, including:

Information Exchange
to enable decision makers to take informed decisions on policies and investments. Information and management tools already provided for developing countries include the OzonAction Information Clearinghouse (OAIC) diskette and World Wide Web site, a quarterly newsletter, sector-specific technical publications for identifying and selecting alternative technologies, and policy guidelines.

Training and Networking
that provide platforms for exchanging experiences, developing skills, and tapping the expertise of peers and other experts in the global ozone protection community. Training and network workshops build skills for implementing and managing phase-out activities, and are conducted at the regional level (support is also extended to national activities). The Programme currently operates seven regional and sub-regional Networks of ODS Officers comprising more than 80 countries, which have resulted in member countries' taking early steps to implement the Montreal Protocol.

Country Programmes and Institutional Strengthening
that support the development of national ODS phase-out strategies and programmes, especially for low-volume ODS-consuming countries. The Programme currently assists 74 countries in the development of their Country Programmes and implements Institutional-Strengthening projects for more than 50 countries.

Please contact us to learn more about our programme:
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About the UNEP IE Tourism Programme

The UNEP IE Tourism Programme helps decision makers in government and industry to develop and implement policies and strategies for environmentally sound tourism. It focuses on environmental management in tourism facilities, examples of good practices and development and management of tourism in sensitive areas.

Most activities are implemented in collaboration with international organizations, industry associations and non-governmental organizations. The programme works through the publication of guidelines and handbooks, the dissemination of successful experiences, workshops and seminars, and the query response service of UNEP IE.

Main current activities include a publication on ecolabels for tourism, an information package on ecotourism and an environmental training pack for hotel and tourism schools.

UNEP IE

UNEP established its Industry and Environment office (UNEP IE) in 1975 to bring industry and government together to promote environmentally-sound industrial development. UNEP IE is located in Paris. Its goals are:

- to encourage the incorporation of environmental criteria in industrial development plans;
- to facilitate the implementation of procedures and principles for the protection of the environment;
- to promote preventive environmental protection through cleaner production and other pro-active approaches; and
- to stimulate the exchange of information and experience throughout the world.

To achieve these goals, UNEP IE has developed the following main programme elements: Accident Prevention (APELL), Cleaner Production, Energy, OzonAction, Industrial Pollution Management and Tourism. UNEP IE organizes conferences and seminars, and undertakes training and cooperative activities backed by regular follow-up and assessment. To promote the transfer of information and the sharing of knowledge and experience, UNEP IE has developed three complementary tools: technical reports, the quarterly *Industry and Environment* review and a technical query-response service.

UNEP
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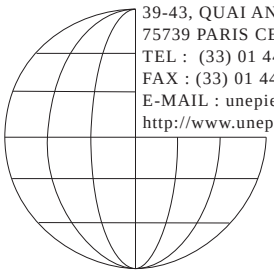
INDUSTRY AND ENVIRONMENT



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