TRAINING MANUAL FOR CUSTOMS OFFICERS

SAVING THE OZONE LAYER:

Phasing Out Ozone Depleting Substances in Developing Countries

United Nations Environment Programme
Division of Technology, Industry & Economics

Multilateral Fund for the Implementation of the Montreal Protocol

Environment Canada

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World Customs Organisation

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OzonAction Programme

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Foreword

The ozone layer, high in the stratosphere, is vital to life on Earth. It acts as a shield to prevent harmful UV-radiation from reaching the Earth. In the 1970s scientists discovered that a number of man-made chemicals damage the ozone layer. These chemicals include CFCs, HCFCs, methyl bromide, halons, carbon tetrachloride and methyl chloroform.

In September 1987, nations around the world concerned about the depletion of the ozone layer signed the "Montreal Protocol on Substances that Deplete the Ozone Layer", a landmark agreement that identified the major ozone-depleting substances (ODS) and established a timetable for the reduction and eventual elimination of their production and consumption world-wide.

In July 1999, the first phase-out obligation applicable to developing countries came into effect. These countries had to freeze their consumption of the five main CFCs at their average consumption level during the years 1995-97. During the following years further reductions will be required for the CFCs as well as other controlled substances, such that the majority will have disappeared by 2010.

Developing countries are now undertaking tremendous efforts to comply with or even to exceed the phase-out schedules of the Montreal Protocol and its amendments. Phase-out can best be achieved and remain sustainable through an overall strategy that integrates national and regional technical, regulatory and policy measures.

Compliance with the ODS phase-out provisions requires action to address both supply and demand. The supply of ODS will decrease once the major production plants are closed down and effective trade controls are in place. The demand for ODS will be reduced through the application of good practices in the servicing sector, retrofitting of existing equipment in the end-user sector, changing manufacturing plants to ozone-friendly products and applying import restrictions to ODS-containing products.

The challenge is to reduce the supply and demand for ODS in a co-ordinated manner. The risk of illegal trade arises where there is over-supply on the world market and/or scarcity on the local markets. In some countries, the black market for ODS has become the second most profitable after drug smuggling. In the future, customs authorities will need to play an increasingly prominent role in the prevention of illegal trade of ODS.

The success of all international environmental agreements, including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Basel Convention on the Control of Trans-boundary Movements of Hazardous Waste and their Disposal and the Rotterdam Convention on the Prior Informed Consent Procedure for Hazardous Chemicals and Pesticides in International Trade, will also depend on the continued support of the world's customs authorities and other key stakeholders (e.g. the World Customs Organisation, World Trade Organisation, Interpol and NGOs).

Therefore, UNEP is promoting participatory and integrated approaches for customs training in order to involve all key stakeholders and to create synergies for the customs authorities. We are extremely grateful for the support received for this work from all partners.

Customs officers using this training manual should keep in mind that the protection of the ozone layer is a long-term issue and that you can play a vital role in helping your country to comply with the Montreal Protocol and its amendments. It is worth remembering that the ozone layer can only recover by the middle of this century and the incidence of skin cancer decline towards "normal" levels by the end of the century if all countries comply with their phase-out obligations.

The "UNEP Customs Training Manual" is part of a series of self-help guides produced by UNEP's OzonAction Programme under the Multilateral Fund, in order to assist developing countries to implement the Montreal Protocol. They should be read and followed in conjunction with other similar publications prepared by the OzonAction Programme, specifically:

- Resource Module on Policy Design and Setting Up of Legislation - ODS Import/Export Licensing Systems, UNEP, 1998
- Regulations to Control Ozone-Depleting Substances - A Guidebook, UNEP, 1996
- Elements for Establishing Policies, Strategies and Institutional Framework for Ozone Layer Protection, UNEP, 1995

More information can be found on the World Wide Web at:
http://www.uneptie.org/ozonaction.html.

We hope you enjoy this publication and find it useful. Please send me your comments and suggestions.

Ms. Jacqueline Aloisi de Larderel, Assistant Executive Director
Director, Division of Technology, Industry & Economics (DTIE)
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Table of contents

Common abbreviations

ARI	Air-conditioning & Refrigeration Institute of United States
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers
CAS	Chemical Abstracts Service
CCC	Customs Co-operation Council, also named the World Customs Organisation (WCO)
CEN	Customs Enforcement Network
CFC	Chlorofluorocarbon
CTC	Carbon tetrachloride
EU	European Union
HBFC	Hydrobromofluorocarbon
HC	Hydrocarbon
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HS	Harmonised Commodity Description and Coding System (known as the "Harmonised System", the international customs coding system)
ISO	International Standards Organisation
MB	Methyl bromide
MCF	Methyl chloroform
MF	Multilateral Fund for the Implementation of the Montreal Protocol on Substances that Deplete the Ozone Layer
MOP	Meeting of the Parties to the Montreal Protocol
MP	Montreal Protocol
NGO	Non-governmental organisation
NOU	National Ozone Unit
ODS	Ozone depleting substances (=chemicals controlled under the Montreal Protocol)
ODP	Ozone depleting potential
RMP	Refrigeration Management Plan (strategy to phase out the use of ozone depleting refrigerants)
UN	Untied Nations
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNEP DTIE	UNEP's Division of Technology, Industry & Economics
UNIDO	United Nations Industrial Development Organisation
WB	World Bank
WCO	World Customs Organisation
WTO	World Trade Organisation

Guide to the reader

Why was this training manual written ?

All Parties to the Montreal Protocol must eliminate the production and consumption of ozone depleting substances (ODS). Most developing countries are net importers and do not produce any ODS themselves. In order to control and monitor the amount of ODS entering or leaving a country, an import/export licensing system must be established. The successful operation of any licensing system depends on properly trained customs and enforcement officers.

This training manual provides the necessary guidance and information to conduct training programmes for customs officers in developing countries. It should be used together with the complementary "Country Handbook on ODS Regulations and Import / Export Licensing System". This country-specific handbook describes the national regulations and the operational details of the licensing system.

How do you conduct the training programme ?

The training programme is designed to be implemented in three phases:

- Phase I: Train-the-customs-trainers,
- Phase II: Train-the-customs-officers, and
- Phase III: Monitoring & evaluation.

What is the scope of the manual ?

The training manual is meant to be used for any Montreal Protocol related customs training in developing countries, which have customs training approved as part of their Refrigerant Management Plans.

These countries consume relatively small amounts of ODS (low-volume-ODS-consuming countries) and most of the ODS is used as CFC refrigerant in the refrigeration & air-conditioning servicing sector. Usually, these countries do not produce any ODS themselves and fully depend on ODS imports.

The manual is designed for multi-phase training programmes which follow the train-the-trainers approach. It supports Phase I – the train-the-customs-trainers phase and Phase II – the train-the-customs-officers phase.

The manual focuses on the identification of ODS, ODS-containing mixtures, products containing ODS and equipment whose continuous functioning relies on the use of ODS and the various smuggling schemes.

ODS include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), halons, hydrobromofluorocarbons (HBFC), methyl bromide, carbon tetrachloride, methyl chloroform, and bromochloromethane.

Specific emphasis has been put on CFCs which account for the majority of ODS consumed in developing countries.

Who should use the manual ?

Implementing and bilateral agencies under the Multilateral Fund for the Implementation of the Montreal Protocol should use the manual to prepare and conduct Phase I of the training programmes for customs officers – the training of customs trainers. The manual provides generic workshop elements including concept note, programme agenda, evaluation questionnaire and overheads.

The international customs trainers should use the manual as training material for Phase I of the customs training programme in conjunction with the "Country Handbook on ODS Regulations and Import/Export Licensing System".

The trained customs trainers should use the manual as resource document to design a country-specific training module for Phase II of the training programme - the training of the remaining customs and enforcement officers in the country.

The final target group of the training programme includes customs trainers, customs and enforcement officers and other relevant stakeholders involved in the operation and enforcement of the import/export licensing system for ODS.

What is contained in the manual ?

Chapter 1 provides an introduction on what the ozone layer is, which substances are ozone-depleting substances and their uses, and what is the effect of ozone layer depletion on human health and the environment.

Chapter 2 explains the history of the Ozone Treaties and the phase-out obligations and schedules for Parties to the Protocol and its Amendments, the exempted uses of ODS and the ban on trade with non-Parties to the Montreal Protocol as well as cross-cutting issues with other international environmental agreements.

Chapter 3 describes the national strategies to achieve phase-out of ODS and the refrigeration sub-sectors relevant for use of ODS, the Refrigerant Management Plan and the roles of the stakeholders involved in the enforcement of the national ODS regulations and the import/ export licensing system for ODS.

Chapter 4 provides information on ODS safety for customs officers and contains a checklist for customs officers concerning the handling, transport, analysis and storage of ODS refrigerants.

Chapter 5 discusses illegal trade, the different smuggling schemes and how to prevent illegal trade in ODS. It contains a checklist for customs officers.

Chapter 6 focuses on the identification of ODS, ODS containing mixtures, and ODS products based on names, labelling, and packaging, including the harmonised customs codes, CAS, ASHRAE and UN numbers as well as colour codes.

Chapter 7 describes the various testing methods used to identify ODS, including refrigerant identifiers, the temperature/pressure test, leak detectors and sampling.

Chapter 8 provides guidance to the local customs trainers on how to organise Phase II of the customs training, which training materials to use and how to be an effective trainer. The chapter also explains the training concept and the roles of the organisers and local trainers.

The **Annexes** contain further useful background and resource materials including generic training materials such as concept notes, agendas and case studies as well as overheads to be used during the Phase II training. They also include ODS safety cards.

How to use the additional learning tools ?

Video resources

Three videos are available to complement specific sections of the training manual:

- Video 1: UNEP's video "Saving the Ozone Layer - Every Action Counts",
- Video 2: US EPA's video "Protecting the Ozone Layer and the Illegal Importation of CFCs",
- Video 3: Canadian Broadcast Corporation's video "Contraband Cool".

The video icons in the margin indicate which video can be used to supplement a specific topic discussed in the manual. The contact addresses to obtain these videos are included in Annex H.

Customs poster

The poster is part of the manual and can be used to raise awareness among customs officers. It is also a useful tool to remember the role of customs officers (customs checklist), the safety aspects and the different labelling possibilities for ODS including colour codes for refrigerant cylinders.

Case studies for customs officials

The case studies are included in Annex D.8 and can be adapted to each country to include proper names, places and organisations.

Overheads
Overheads are included in Annex E and are an important visual tool for the training.

Demonstration materials
Examples of ODS, refrigerant cylinders and packaging as well as ODS products and equipment are available during the training for display and for the practical exercises.

Document display
Further relevant reference documents are displayed for information.

Evaluation questionnaire
The questionnaire once returned to the trainer or to UNEP DTIE will provide the opportunity to improve the training materials and the organisation of the workshop itself.

Terminology
Each new term is in **bold face** type where it is first introduced and defined. Abbreviations are explained in the introductory section and definitions are included in Annex A.

Knowledge check
Each chapter ends with a set of key questions that will aid the reader in testing his or her knowledge of the issues presented in the relevant chapter.

Diskettes
Specific sections of the training manual such as the generic training elements and the list of trade names, CAS, ASHRAE and UN numbers can be made available upon request by interested persons.

WWW & CD-ROM OASIS
The final version of this training manual will be made available in PDF format through the Web site of UNEP DTIE's OzonAction Programme. It will also be included in UNEP's CD-ROM OASIS.

1. The ozone layer & ODS

What is ozone ?

Ozone molecule

Ozone is a gas composed of ozone molecules (O_3) which consist of three atoms of oxygen. The oxygen molecules (O_2) contained in the air we are breathing consist of only two atoms of oxygen. Ozone molecules are created in a photochemical reaction, which can be described in a simplified way as follows:

$$3\ O_2 \leftrightarrow 2\ O_2 + 2\ O^{\cdot} \leftrightarrow 2\ O_3$$

Reaction process

Oxygen molecules react to form ozone molecules and at the same time ozone molecules react to form oxygen molecules. If the number of ozone molecules being created is the same as the number of ozone molecules being broken down, the reaction is in its dynamic equilibrium.

What is the ozone layer ?

The **ozone layer** is a term used to describe the presence of ozone molecules in the stratosphere. The layer stretches around the entire globe of the Earth like a bubble and acts as a filter for the harmful ultraviolet radiation (UV-B). **UV-B radiation** is a highly energetic light that originates from the sun and which has severe impacts on human health and the environment.

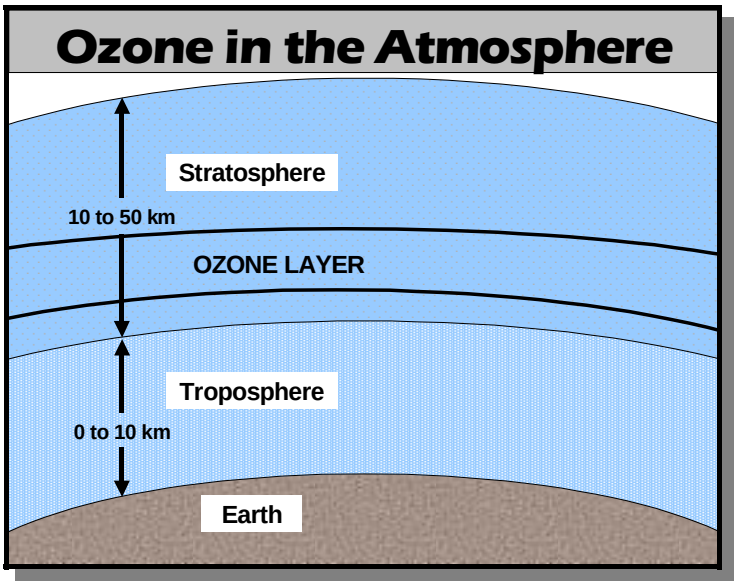


Figure 1: Ozone in the atmosphere

The stratosphere is that part of atmosphere, which follows the troposphere. It starts at 10-20 km above ground level and continues up to 40-50 km height. Figure 1 shows the different layers of the earth's atmosphere.

Stratospheric ozone is different from ground level ozone:
Ground level ozone results from industry and traffic emissions in combination with specific weather conditions. It is part of photochemical smog and as an irritating gas it may cause respiratory health problems especially for older people and young children as well as plant damage.

Figure 2: Definition of ground level ozone

Why is the ozone layer so important ?

Filter for UV-B radiation

The ozone layer is vital to life on the planet's surface. It acts as a filter and prevents the harmful ultraviolet radiation (UV-B) from reaching the Earth.

UV-B exposure

If ozone molecules are depleted faster than they can be replaced by new ozone molecules that nature produces the result is what could be called an ozone deficit. The depletion of the ozone layer will lead to a reduction of its shielding capacity and thus an increased exposure to UV-B radiation.

Types of UV radiation

Scientists classify UV radiation into three types or bands—UV-A, UV-B, and UV-C. UV-C does not reach the Earth's surface. UV-B is partially filtered by the ozone layer. UV-A is not filtered at all by the ozone layer. However, it is the UV-B radiation which mainly is responsible for health damages and negative impacts on the environment.

What are the effects of ozone layer depletion on human health and the environment ?

Video 1 & 3

The major effects of increased exposure to UV-B radiation are:

Human health

Suppression of the immune system by damaging the DNA. This results in increased incidents and occurrence of infectious diseases as well as possible adverse effects on the inoculation programmes. UV-B radiation is known to cause skin cancers - both non-melanoma (the less dangerous) and the virulent cutaneous malignant melanoma. Increased UV-B also causes damage to the eyes including eye cataracts, which in many countries are a major cause of blindness.

Video 1: UNEP Video "Every Action Counts"

Video 3: Canadian Broadcast Corporation Video "Contraband Cool"

Plants & trees

Ozone layer depletion causes serious adverse effects on agriculture and damage to forests. The ultraviolet radiation causes changes in the chemical composition of several species of plants. Experiments on crops have shown that the ones most vulnerable to UV-B include melons, mustard and cabbage. Increased UV-B radiation also reduces the quality of certain types of tomatoes, potatoes, sugar beets and soybeans. Tests have also shown that seeds of conifers are also adversely affected.

Aquatic organisms

Damage to aquatic organisms, in particular to the small creatures such as plankton, aquatic plants and fish larvae, shrimp and crabs - all of which form the essential base of the aquatic and marine food web. Hence, damage to fisheries result.

Materials

Materials used in buildings, paints, rubbers, wood and plastics are degraded by UV-B radiation, particularly plastics and rubbers used outdoors. Damage would be severe in the tropical regions where the effects are enhanced by high temperatures and levels of sunshine. Such damages could run into billions of dollars each year.

Ground level smog

UV-B radiation results in increased ground level smog, especially in the cities where car and industry emissions provide the basis for photochemical reactions. This has its own adverse effects on human health and the environment.

How thick is the ozone layer ?

Concentration of ozone molecules

The ozone molecules are dispersed in the stratosphere and therefore the physical thickness of the ozone layer is tens of kilometres. However, the pressure and thus the concentration of molecules in the stratosphere is already very small compared to those at ground level.

Accordingly, the concentration of stratospheric ozone molecules is so small that if all ozone molecules were extracted from the stratosphere and spread around the Earth at ground level, they would form a layer of ozone gas of a couple of millimetres thick.

How is the ozone layer measured ?

Dobson unit

This theoretical thickness of the ozone layer at ground level is used as a measure for the amount of ozone molecules in the stratosphere and measured in Dobson Units (DU). Each Dobson Unit corresponds to 0,01 millimetre, therefore 300 Dobson Units correspond with a calculated thickness of the ozone layer of 3 millimetres.

What is the ozone hole ?

Antarctic ozone hole

In the 1970s scientists discovered that the released ODS damage the ozone layer. The ozone concentration over Antarctica diminished between the 1970s and the 1990s by up to 70% of the concentration normally found over Antarctica. This large-scale phenomenon is usually referred to as the ozone hole. Scientists have observed declining ozone concentrations over the whole globe.

Arctic ozone hole

Recent observations show that the upper atmospheric conditions in the Northern Hemisphere are becoming similar to those of the Antarctic. The loss of ozone and the greenhouse effect are causing the upper atmosphere to become colder, which facilitates ozone destruction. The result of this could be the formation of an "Arctic Ozone Hole" or "low ozone event" within the next 20 years.

Millions of people potentially affected

The alarming difference is that there are millions of people that live in the area that will be exposed to the resulting increased UV-B radiation. An Arctic "low ozone event" could easily be blown south by high-altitude winds, and appear over populated areas of the United States, Canada, Europe and Asia. Figure 3 shows the area that may be affected by the formation of the Arctic ozone hole. More information can be found at the Solcomhouse Website: http://www.solcomhouse.com/ArcticOzone.

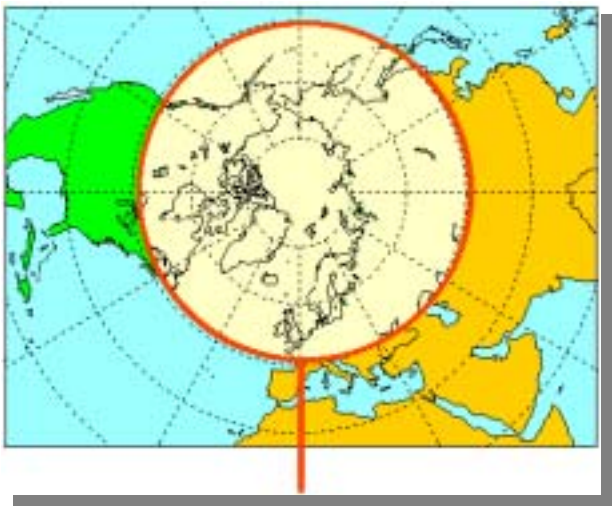


Figure 3: Illustration of arctic ozone hole (Source: Solcomhouse Website http://www.solcomhouse.com/ ArcticOzone)

Ozone depletion is different from climate change & global warming:

Global warming & climate change is caused by the emission of greenhouse gases, which trap the outgoing heat from the Earth causing the atmosphere to become warmer. Greenhouse gases include carbon dioxide, methane, CFCs, HCFCs and halons. The global warming potential (GWP) is the contribution of each greenhouse gas to global warming relative to carbon dioxide whose GWP is defined as 1. It usually refers to a time span of 100 years (GWP 100).

The impacts of global climate change may include sea level rise resulting in loss of valuable coastal areas and intrusion of seawater further inland as well as unpredictable effects on eco-systems and natural disasters.

Some ODS are also greenhouse gases.

Figure 4: Definition of climate change & global warming

How is ozone destroyed ?

Dynamic equilibrium

The dynamic equilibrium between creating and breaking down ozone molecules depends on temperature, pressure, energetic conditions and molecule concentrations. The equilibrium can be disturbed for instance by other molecules reacting with the ozone molecules, and thereby destroying them. If this destruction process is fast and the creation of new ozone molecules is too slow to replace the destroyed ozone molecules, the equilibrium will get out of balance. As a result, the concentration of ozone molecules will be reduced.

Destruction mechanism

Under the Montreal Protocol, a number of ***ozone depleting substances (ODS)*** have been identified and their production and use controlled. Their destructive potential is huge because they react in a photochemical chain reaction with ozone molecules. After one ozone molecule has been destroyed, the ODS is available to destroy further ozone molecules.

Lifetime of ODS

The destructive lifetime of ODS may range between 100 – 400 years depending on the type of ODS. Therefore, one molecule of ODS may destroy hundred of thousands of ozone molecules. The process through which CFCs deplete ozone is illustrated in Figure 5.

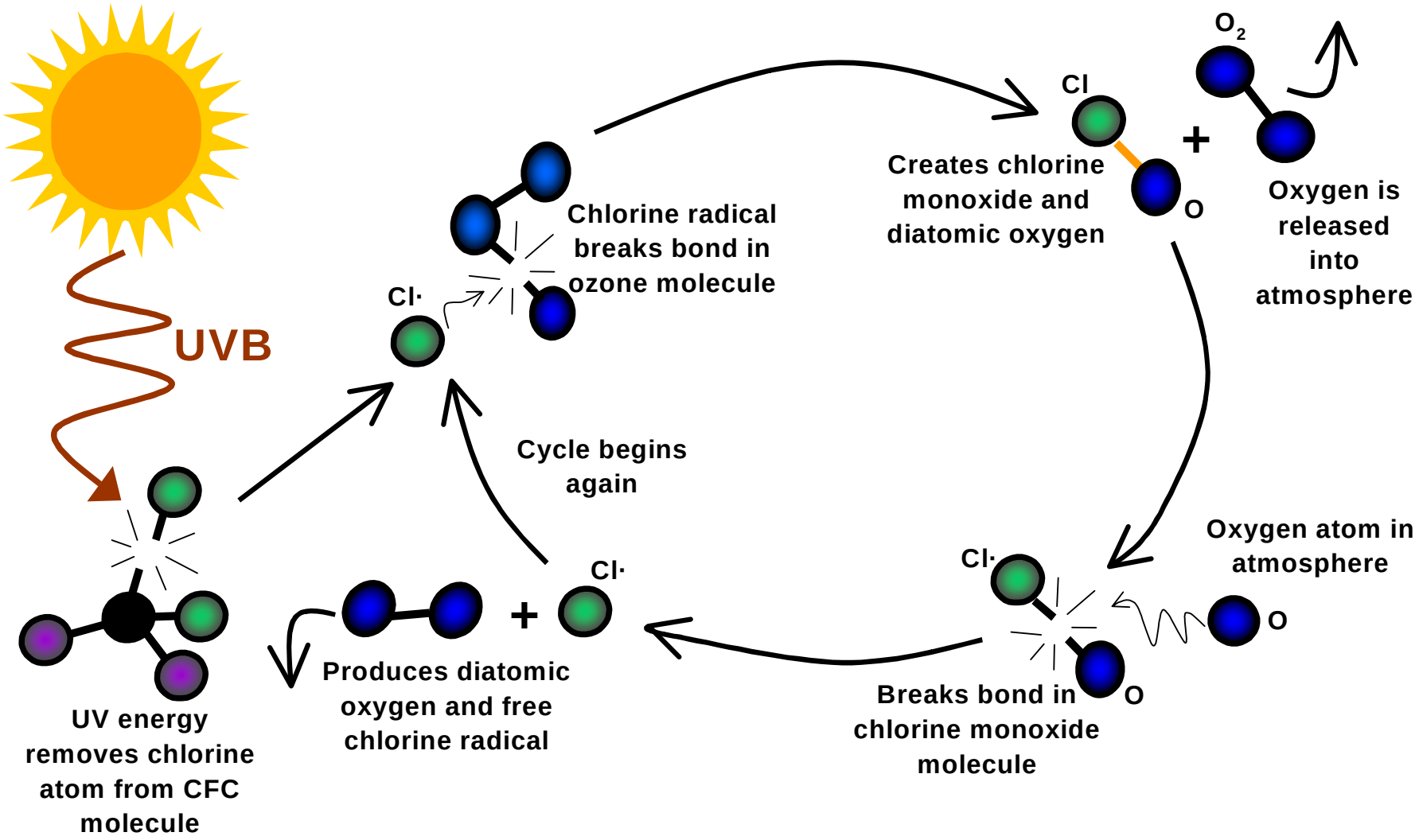


Figure 5: Destruction of ozone by CFCs

What are ozone depleting substances ?

Ozone depleting substances (ODS) are chemical substances that have the potential to react with ozone molecules in the stratosphere. ODS are basically chlorinated, fluorinated or brominated hydrocarbons and include:

- chlorofluorocarbons (CFCs),
- hydrochlorofluorocarbons (HCFCs),
- halons,
- hydrobromofluorocarbons (HBFCs),
- bromochloromethane,
- methyl chloroform,
- carbon tetrachloride, and
- methyl bromide.

Some ODP examples:	
CFC-11	1.0
CFC-12	1.0
Halon-1301	10.0
Carbon tetrachloride	1.1
Methyl chloroform	0.1
HCFC-22	0.055
HBFC-22B1	0.74
Bromochloromethane	0.12
Methyl bromide	0.6

Figure 6: Examples of ODP values of selected ODS

Ozone-depleting potential

The ability of these chemicals to deplete the ozone layer is referred to as the **ozone depletion potential (ODP)**. Each substance is assigned an ODP relative to CFC-11 whose ODP is defined as 1. The ODP of the different ODS are described in Annex B.

What are the common uses of ODS ?

In most developing countries, the largest remaining sector in which ODS are still used is the refrigeration and air-conditioning servicing sector, where CFCs and HCFCs are used as refrigerants for the cooling circuits.

ODS are also used as blowing agents for foam applications, as cleaning solvent in the electronics industry, as propellants in aerosol applications, as sterilants, as fire fighting agents, as fumigants for pest and disease control and for feedstock applications.

Use as refrigerants

ODS are used as refrigerants in refrigeration & air-conditioning and heat pump systems. CFC refrigerants are gradually being replaced by the less ozone damaging HCFC refrigerants (ODP&GWP>0), HFC refrigerants (ODP=0 but GWP>0) and hydrocarbon refrigerants (ODP&GWP=0).

Many domestic refrigerators use CFC-12. Commercial refrigeration systems used for display and storage of fresh and frozen food may use CFC-12, R-502 (blend of CFC-115 and HCFC-22) or HCFC-22 as

refrigerant. Transport refrigeration and air-conditioning systems used in road and rail transport containers and cargo & passenger ships may contain CFC-11, CFC-12, CFC-114, HCFC-22 or the CFC containing mixtures R-500 (mixture of CFC-12 & HFC-152a) and R-502 (mixture of CFC-115 and HCFC-22).

Air-conditioning and heat pump systems for buildings may contain large amounts of HCFC-22, CFC-11, CFC-12 or CFC-114 as refrigerants. Most old vehicles often use CFC refrigerants for their air-conditioning systems. Many drop-in substitutes for CFC-12 refrigerants are based on mixtures containing HCFC.

Use as blowing agent

Prior to regulatory controls, CFC-11 was the most common foam-blowing agent for the manufacture of polyurethane, phenolic, polystyrene, and polyolefin foam plastics. Foams are used in a wide variety of products and for insulation purposes. CFC-11 is progressively being replaced by HCFC-141b or non-ODS alternatives.

Use as cleaning solvent

CFC-113 has been widely used as cleaning solvent in electronic assembly production processes, precision cleaning and general metal degreasing during manufacture. It is also used for dry-cleaning and spot cleaning in the textile industry. Other ozone depleting solvents include methyl chloroform and carbon tetrachloride.

Use as propellants

CFC-11 and CFC-12 were widely used as aerosol propellants because they are non-flammable, non-explosive and have non-toxic properties. CFC-114 was used to dispense products containing alcohol. CFC-113 is and has been used in aerosols for cleaning purposes. They could be produced in a highly pure form and they are good solvents.

The products dispensed by aerosols include lacquers, deodorants, shaving foam, perfume, insecticides, window cleaners, oven cleaners, pharmaceutical products, veterinary products, paints, glues, lubricants, and oils.

In the mid-1970s, the use of CFC propellants in aerosol products accounted for 60 percent of all CFC-11 and CFC-12 used worldwide. By the end of the 1970s, countries were beginning to ban or restrict the use of CFCs in aerosol products.

Use as sterilants

Mixtures of CFC-12 and ethylene oxide are used for medical sterilisation purposes. The CFC-compound reduces the flammability and explosive risk from ethylene oxide. The most common mixture contains 88 per cent CFC-12 by weight and is commonly known as 12/88. Ethylene oxide is particularly useful for sterilising objects that are sensitive to heat and moisture, such as catheters and medical equipment, which use fibre optics.

Use as fire extinguishers

Halons and HBFC were largely used as fire extinguishers and are in many instances replaced by foams or carbon dioxide.

Use as fumigant

Methyl bromide has been and is widely used as a pesticide for soil fumigation in order to protect crops and to prevent pests. It is also used for the exempted quarantine and pre-shipment applications.

Use as feedstock

HCFC and carbon tetrachloride are commonly used as feedstock in chemical synthesis. Carbon tetrachloride is also used as a process agent. ODS used for feedstock applications are usually not released to the atmosphere and therefore do not contribute to ozone layer depletion.

How are ODS released into the stratosphere ?

ODS are released to the atmosphere in a variety of ways including the:

- traditional use of cleaning solvents, paint, fire extinguishing equipment and spray cans;
- venting and purging during servicing of refrigeration and air-conditioning systems;
- use of methyl bromide in soil fumigation and for quarantine and pre-shipment applications;
- disposal of ODS-containing products and equipment such as foams or refrigerators; and
- leaking refrigerant circuits.

Once released into the atmosphere the ODS gets diluted into the ambient air and can reach the stratosphere through air currents, thermodynamic effects and diffusion. Because of their long lifetime, most ODS will reach the stratosphere at some point.

When will the ozone layer recover ?

Recovery of the ozone layer

There are no exact forecasts for when the ozone layer will recover. Scientists assume that the concentration of ozone molecules in the stratosphere will reach "normal" levels by the middle of this century, if all Parties to the Montreal Protocol and its amendments comply with their phase-out obligations. This is partly due to the long lifetime of ODS and the chain-type reaction which destroys the ozone molecules.

"Normal" levels of skin cancer & eye cataracts

Incidences of skin cancer and eye cataracts are expected to decline towards "normal" levels with a delay of 20-50 years by the end of the century. Regardless their skin type, individuals should apply effective skin and eye protection to prevent health damages. This is especially important for babies and children.

Interlinkage with global warming

It is possible that the effects of global warming will slow down the recovery process of the ozone layer. Therefore, attention should also be given to greenhouse gas emissions. Recent research suggest that the melting ice in Antarctica will release significant amounts of ODS and greenhouse gases.

What is being done to save the ozone layer ?

Twenty years ago, the world community was not aware of stratospheric ozone layer depletion and its negative effects on human health and the environment. Today the importance of ozone layer protection is recognised in developed as well as developing countries worldwide and more than 175 countries have ratified the Montreal Protocol. The following chapter focuses on the international efforts and treaties for the protection of the ozone layer.

Knowledge check:

1. What is the ozone layer?
2. Why is the ozone layer important?
3. What are the effects of ozone layer depletion?
4. What is the ozone hole?
5. What are ozone depleting substances?
6. What are the common uses for ODS?

2. International response

Video 1

International treaties for the protection of the ozone layer

1985 Vienna Convention for the Protection of the Ozone Layer

The **Vienna Convention**, held under the auspices of UNEP in 1985, was the first attempt to provide the framework for co-operative activities related to the protection of the ozone layer. The convention was signed by 21 states, including the European Union, in March 1985. Parties to the Convention agreed to co-operate with each other in scientific research in order to improve understanding of atmospheric processes, to share information on ODS production and emissions and to implement preventive measures to control ODS emissions.

1987 Montreal Protocol on Substances that Deplete the Ozone Layer

In 1987 governments adopted the **Montreal Protocol** to reduce and eventually eliminate the emissions of man-made ozone depleting substances. The Protocol contained a list of controlled ODS – 5 CFCs (Annex A Group I) and 3 Halons (Annex A Group II) and defined the control measures to reduce production and consumption of these ODS. The Protocol entered into force on 1 January 1989 and today more than 175 countries world-wide have committed themselves under the Protocol to phase-out the consumption and production of ODS.

Precautionary principle

The **Montreal Protocol** is based on the "precautionary principle" that enables the world community to take actions to address a major global environmental problem even before all scientific, economic and technical questions have been fully resolved.

Evolvement of the treaty

To reflect this approach, the Parties to the Protocol have agreed to a procedure for the treaty itself to evolve over time to reflect the latest findings on the state of the ozone layer, science of ozone layer depletion and the progress toward development and implementation of alternative technologies. This evolutionary feature is the regular and comprehensive assessment of the control measures adopted under the Montreal Protocol followed by amendments or adjustments of the Protocol.

Video 1: UNEP Video "Saving the Ozone Layer-Every Action Counts"

Assessment of control measures

The legal basis for this assessment process is Article 6 of the Montreal Protocol, which states that *"Beginning in 1990, and at least every four years thereafter, the Parties shall assess the control measures provided for in Article 2 and Article 2A to 2I on the basis of available scientific, environmental, technical and economic information".*

International assessment panels

To undertake these regular assessments, the Parties established three international panels of experts and/or scientists from industries, research academies, governments and non-governmental organizations. The panels are the Scientific Assessment Panel, the Environmental Effects Assessment Panel, and the Technology and Economic Assessment Panel.

Amendments & adjustments

In the dynamic history of the Montreal Protocol, four amendments and five adjustments have been agreed to ensure that the Protocol continues to reflect improved scientific and technical understanding.

Amendments and adjustments

Adjustments of the Montreal Protocol itself may modify the phase-out schedules of already controlled substances as well as ODP values of controlled substances based on new research results. They are automatically binding for all countries that have ratified the Protocol, or the relevant amendment, which introduced the controlled substance. The adjustments can change the text of the Protocol. In addition, the Parties can also take decisions that do not change the text but interpret the text.

Amendments to the Montreal Protocol may introduce control measures for new ODS. Each amendment is binding only after ratification by the signatories. For example, countries, which have not ratified a certain amendment, are considered to be non-Parties with regard to the new ODS introduced by that amendment. For further information, see the section on the ban on trade with non-Parties.

Figure 7: Definition of amendments and adjustments

1990 London Amendment & Adjustments

The Second Meeting of the Parties listed additional CFCs, carbon tetrachloride and methyl chloroform as controlled substances and introduced control measures for these substances. It accelerated existing phase-out schedules and adopted additional control measures for Annex A CFCs and halons for both developing and developed countries. The Parties decided to establish a Multilateral Fund to provide technical and financial assistance to developing countries.

Article 5 and non-Article 5 countries
Article 5 countries are developing countries using less than 0.3 kg ODP tonnes per capita per year of Annex A controlled ODS. **Non-Article 5 countries** or Article 2 countries are all other Parties to the Montreal Protocol, mainly developed countries.

Figure 8: Definition of Article 5 and non-Article 5 countries

1992 Multilateral Fund

The Multilateral Fund for the implementation of the Montreal Protocol was created to help developing countries finance the costs of meeting the Protocol requirements and to promote the accelerated phase-out of ODS production and consumption. Funds from the Multilateral Fund help finance projects targeted at phasing out ODS from production and consumption. The Fund also helps Article 5 countries implement Country Programmes by establishing National Ozone Units, a regulatory framework and appropriate laws, and organising training. The implementing agencies of the Multilateral Fund are: The United Nations Environment Programme (UNEP), The United Nations Development Programme (UNDP), The United Nations Industrial Development Organization (UNIDO), the World Bank and bilateral agencies from donor countries.

1992 Copenhagen Amendment & Adjustment

The Fourth Meeting of the Parties listed methyl bromide, HBFCs and HCFCs as controlled substances. It introduced control measures for the production and consumption of methyl bromide and HBFCs, as well as for the HCFC consumption in developed countries. It advanced the phase-out schedules for CFCs, halons, carbon tetrachloride, and methyl chloroform in developed countries. It also set provisions for production and consumption for essential uses of ODS.

1995 Vienna Adjustment

The Seventh Meeting of the Parties introduced control measures for methyl bromide for both developing and developed countries. It also introduced HCFC consumption controls and HBFC production and consumption controls for developing countries. The Meeting also addressed the problem of non-compliance.

1997 Montreal Amendment & Adjustment

The Ninth Meeting of the Parties introduced additional control measures for methyl bromide applicable to developing countries and accelerated those for developed countries. It introduced a requirement for all Parties to establish import / export licensing systems for ODS.

1999 Beijing Amendment & Adjustment

The Eleventh Meeting of the Parties listed bromochloromethane as a controlled substance. It introduced production and consumption controls for bromochloromethane, production controls for HCFCs and reporting requirements for methyl bromide used for quarantine and pre-shipment applications.

Obligations for Parties to the Montreal Protocol and its amendments

Each Party to the Montreal Protocol and its amendments must comply with certain obligations. In practice, being a Party to the Montreal Protocol means that a country is a Party to the Protocol as well as each of the amendments ratified by this country. Therefore, a country may be a Party to the Protocol, but a non-Party with regard to any amendment which it has not yet ratified.

The two main obligations of the Parties are complying with the ODS freeze and phase-out schedules and banning trade with non-Parties to the Protocol.

ODS freeze & phase-out schedules

The freeze and phase-out obligations for Article 5 countries take into account that developing countries usually do not have easy access to alternative technologies, know-how and capital investment. Therefore their freeze and phase-out schedules are later than those for developed (non-Article 5) countries. This should allow sufficient time to provide technical and policy support to Article 5 countries in order to ensure a smooth transition to non-ODS technologies. Developing countries still use most ODS, in particular CFCs and halons.

Base level consumption for ODS:

The base level depends on a country's past consumption of certain ODS. In most cases, it is defined as the average consumption level during a certain reference period, during which consumption data were recorded.

For example, the first control measure in developing countries was the 1999 freeze concerning the consumption of Annex A CFCs. The freeze level was set at the base level which has been defined as a country's average consumption between 1995-1997. After the freeze date (1 July 1999), the country's annual consumption must not exceed its freeze level.

Figure 9: Definition of base level consumption

Figure 10 summarises the first control measures and the final phase-out dates for the different ODS, applicable to developing countries. It does not refer to the different production and use exemptions which may apply.

Annex	ODS type	First control measure for Article 5 countries	Final phase-out for Article 5 countries
A-I	CFC (5 main types)	1999 freeze	2010 phase-out
A-II	Halons	2002 freeze	2010 phase-out
B-I	Other CFCs	2003 reduction 20%	2010 phase-out
B-II	Carbon tetrachloride	2005 reduction 85%	2010 phase-out
B-III	Methyl chloroform	2003 freeze	2015 phase-out
C-I	HCFCs	2016 freeze	2040 phase-out consumption
C-II	HBFCs	1996 phase-out	1996 phase-out
C-III	Bromochloromethane	2002 phase-out	2002 phase-out
E	Methyl bromide	2002 freeze	2015 phase-out

Figure 10: First control measures & final phase-out for ODS in developing countries

Figure 11 summarises all control measures for the phase-out of the production and consumption of ODS applicable to both developing or developed countries, up to the 11th Meeting of the Parties to the Montreal Protocol held in Beijing in 1999.

The UNEP Ozone Secretariat maintains an up-dated Web page which reflects decisions taken at Meetings of the Parties to the Montreal Protocol: http://www.unep.org/ozone/control-measures.htm.

Phase-out schedule as agreed by the Parties to the Montreal Protocol at their 11th Meeting (Beijing 1999)

[**Article 5 countries are in bold** - non-Article 5 countries not, control measures in grey are already effective]

YEAR	CONTROL MEASURES (referring to production and consumption except for HCFC)	
1 July 1989	Annex A-I[1]	CFCs frozen at 1986 levels
1 January 1992	Annex A-II	Halons frozen at 1986 levels
1 January 1993	Annex B-I Annex B-III	CFCs[2] reduced by 20% from 1989 levels Methyl chloroform frozen at 1989 levels
1 January 1994	Annex A-I Annex A-II Annex B-I Annex B-III	CFCs reduced by 75% from 1986 levels Halons[3] phased out[6] CFCs reduced by 75% from 1989 levels Methyl chloroform reduced by 50%
1 January 1995	Annex B-II Annex E	Carbon tetrachloride reduced by 85% from 1989 levels Methyl bromide[9] frozen at 1991 levels
1 January 1996	Annex A-I Annex B-I Annex B-II Annex B-III Annex C-I Annex C-II **Annex C-II**	CFCs phased out[6] CFCs phased out[6] Carbon tetrachloride phased out[6] Methyl chloroform phased out[6] HCFC[5] consumption frozen at (1989 HCFC + 2.8% 1989 CFC) consumption levels HBFCs[4] phased out[6] (non-Article 5 countries) **HBFCs[4] phased out[6] (Article 5 countries)**
1 January 1999	Annex E	Methyl bromide[9] reduced by 25% from 1991 levels
1 July 1999	**Annex A-I**	**CFCs frozen at 1995-97 average levels[7]**
1 January 2001	Annex E	Methyl bromide[9] reduced by 50% from 1991 levels
1 January 2002	Annex C-III **Annex A-II** **Annex C-III** **Annex E**	Bromochloromethane phased out (non-Article 5 countries) **Halons frozen at 1995-97 average levels[7]** **Bromochloromethane phased out (Article-5 countries)** **Methyl bromide[9] frozen at 1995-1998 average levels**
1 January 2003	Annex E **Annex B-I** **Annex B-III**	Methyl bromide[9] reduced by 70% from 1991 levels **CFCs reduced by 20% from 1998-2000 average consumption[8]** **Methyl chloroform frozen at 1998-2000 average levels**
1 January 2004	Annex C-I Annex C-I	HCFC consumption reduced by 35% from base level HCFC production frozen at average of (1989 HCFC + 2.8% 1989 CFC production level) and (1989 HCFC + 2.8% CFC consumption level)[10]
1 January 2005	Annex E **Annex A-I** **Annex A-II** **Annex B-II** **Annex B-III** **Annex E**	Methyl bromide[9] phased out **CFCs reduced by 50% from 1995-97 average levels[7]** **Halons reduced by 50% from 1995-97 average levels[7]** **Carbon tetrachloride reduced by 85% from 1998-2000 average levels** **Methyl chloroform reduced by 30% from 1998-2000 average levels** **Methyl bromide[9] reduced by 20% from 1995-1998 average levels**
1 January 2007	**Annex A-I** **Annex B-I**	**CFCs reduced by 85% from 1995-97 average levels[7]** **CFCs reduced by 85% from 1998-2000 average levels[8]**
1 January 2010	Annex C-I **Annex A-I** **Annex A-II** **Annex B-I** **Annex B-II** **Annex B-III**	HCFC consumption reduced by 65% from base level **CFCs phased out** **Halons phased out** **CFCs phased out** **Carbon tetrachloride phased out** **Methyl chloroform reduced by 70% from 1998-2000 average levels**
1 January 2015	Annex C-I **Annex B-III** **Annex E**	HCFC consumption reduced by 90% from base level **Methyl chloroform phased out** **Methyl bromide[9] phased out**
1 January 2016	**Annex C-I**	**HCFC[5]s (production and consumption) frozen at average of 2015 production & 2015 consumption levels[10]**
1 January 2020	Annex C-I	HCFC consumption reduced by 99,5% from base level allowing for a service tail until 2030 for existing refrigeration and air-conditioning equipment
1 January 2030	Annex C-I	HCFC consumption phased out
1 January 2040	**Annex C-I**	**HCFC consumption phased out**

[1]Annex A: CFCs 11, 12, 113, 114, 115. [2]Annex B: CFCs 13, 111, 112, 211, 212, 213, 214, 215, 216, 217. [3]Halons 1211, 1301, 2402. [4]34 hydrobromofluorocarbons [5]40 hydrochlorofluorocarbons [6]With exemptions for essential uses. Consult the *Handbook on Essential Use Nominations* prepared by UNEP TEAP, 1994, 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. [9]Methylbromide quarantine and pre-shipment applications are exempted. [10] As per "Summary of control measures under the Montreal Protocol" from the Ozone Secretariat (Oz.Sec./UNEP/Oz.Pro/WG.1/20/INF/2/Rev.1)

Figure 11: Phase-out schedule for ODS

Exemptions for use and production of ODS

Essential use

Exempted uses of ODS include essential uses, use as feedstock and use as process agents. These uses do not count towards a country's ODS consumption. Countries can also apply for production allowances to satisfy basic domestic needs. The following sections describe the different types of exemptions.

Exemptions from the total phase out of controlled substances can be granted for certain essential uses, on a case-by-case basis, upon applications requiring the approval of the Meetings of the Parties (exempted category). This requires that the ODS is necessary for health, safety, or for the functioning of society and that no acceptable alternative is available. A global exemption has been granted for laboratory and analytical uses, but certain uses that belong to this category will be excluded from this global exemption starting 1 January 2002. If ODS is to be used for laboratory and analytical applications, specific requirements for containers, labelling and purity have to be met. Another exemption exists for the use of methyl bromide for quarantine and pre-shipment applications.

Feedstock

Controlled substances that are used in the manufacture of other chemicals and are completely transformed in the process are defined as feedstock. For example, carbon tetrachloride is commonly used in the production of CFCs. Amounts used as feedstock are exempted from controls (exempted category) but need to be reported to the Ozone Secretariat.

Process agents

Some ODS are used in the production of other chemicals, for instance to serve as catalysts or inhibitors of a chemical reactions. Under the Montreal Protocol, the use of specific process agents has been approved, but emission limits need to be observed.

Allowance for production to satisfy basic domestic needs

Article 5 countries are allowed a grace period as compared to non-Article 5 countries, to phase-out consumption and production of controlled substances in order to meet their domestic needs. However, Article 5 countries may not use this allowance to increase production of products containing ODS for export.

Exports of controlled substances in Annex A and Annex B to the Montreal Protocol from non-Article 5 Parties to meet the basic domestic needs of Article 5 Parties are permitted, but limited by the MP and due to be phased out according to an agreed schedule.

Control of trade with non-Parties

Article IV of the Montreal Protocol addresses control of trade with non-Parties. A **non-Party,** with regard to a particular ODS, is any country whose government has not ratified, accepted, approved, or accessed the Montreal Protocol, or the amendment which introduced this particular ODS as a controlled substance. Figure 12 lists the countries that have not yet ratified ozone treaties. The status of ratification of each Party for each amendment is located in Annex B of this manual.

Countries that have not yet ratified the ozone treaties as of June 2000		
African States	Asian States	Other States
Cape Verde	Afghanistan	Andorra
Eritrea	Bhutan	Holy See
Guinea-Bissau	Cambodia	San Marino
Rwanda	Cook Islands	
Sao Tome and Principe	Iraq	
Sierra Leon	Nauru	
Somalia	Niue	
	Palau	

Figure 12: Countries that have not yet ratified the ozone treaties as of June 2000

Figure 13 lists trade control measures with non-Parties. The Parties will consider extending dates for the application of trade measures of controlled substances during future Meetings of the Parties.

Products produced with ODS

At this stage, it is not feasible to impose a ban or restriction on the import of products produced with but not containing controlled substances, such as electronics washed in ODS solvents.

Exports of ODS technology & equipment

Each Party is also discouraged from exporting to non-Parties technology for producing and utilizing controlled substances in Annexes A, B, C, and E. An exception to this provision is the export of products, equipment, plants, or technology that improve the containment, recovery, recycling or destruction of controlled substances, promote the development of alternative substances, or otherwise contribute to the reduction of emissions of controlled substances in Annexes A, B, C, and E.

Ban on imports from and exports to non-Parties		
Annex	**Imports**	**Exports**
A	as of 1 January 1990	as of 1 January 1993
B (Non-Party* to London Amendment)	as of August 1992	as of August 1993
C I (Non-Party to Copenhagen & Beijing Amendment)	as of 1 January 2004	as of 1 January 2004
C II (Non-Party to Copenhagen Amendment)	as of June 1994	as of June 1995
C III (Non-Party to Beijing Amendment)	Not yet in force	Not yet in force
E (Non-Party to Copenhagen Amendment)	as of November 1999	as of November 2000
Products containing Annex A substances (listed in Annex D)	as of May 1992	No control measures as of yet

Figure 13: Ban on imports from & exports to non-Parties

Annex D*: A list of products containing controlled substances specified in Annex A**

1. Automobile and truck air conditioning units (whether incorporated in vehicles or not)

2. Domestic and commercial refrigeration and air conditioning / heat pump equipment***
   E.g.:
   - Refrigerators
   - Freezers
   - Dehumidifiers
   - Water coolers
   - Ice machines
   - Air conditioning and heat pump units

3. Aerosol products, except medical aerosols
4. Portable fire extinguisher
5. Insulation boards, panels and pipe covers
6. Pre-polymers

* This Annex was adopted by the 3rd Meeting of the Parties in Nairobi, 21 June 1991 as required by paragraph 3 of Article 4 of the Protocol.

** Though not when transported in consignments of personal or household effects in similar non-commercial situations normally exempted from customs attention.

*** When containing controlled substances in Annex A as a refrigerant and/or in insulating material of the product.

Figure 14: List of products containing controlled substances from Annex A (Source UNEP Handbook for International Treaties for the Protection of the Ozone Layer, 2000)

There is also a provision in the Protocol that permits non-Parties, which are determined by a Meeting of the Parties to be in full compliance with control measures for controlled substances, trade provisions, and data reporting requirements, to import and export controlled substances and products containing them as per the rules of the Montreal Protocol.

Control of trade with Parties

Since there are so few non-Parties to the Montreal Protocol, the issue of trade with Parties ultimately has a direct impact on progress towards the elimination of ODS and the protection of the ozone layer.

Parties have adopted a wide variety of restrictions on trade through policies and regulations to achieve reductions in consumption of ODS. These policies and regulations include:

- agreements with industry to phase out imports;
- product labelling;
- licensing of ODS trade;
- duty reductions for ODS substitutes and non-ODS technologies;
- excise taxes on ODS;
- quantitative restrictions and ban on imports of ODS;
- total or partial ban on import of ODS products or technologies.

Article 4B of the Montreal Protocol provides that by 1 January 2000 or within three months of the date of entry into force of this Article for it, each Party should establish and implement a system for licensing the import and export of new, used, recycled and reclaimed substances in Annexes A, B, C, and E.

Article 5 Parties may delay taking such actions for substances in Annex C until 1 January 2002, and for Annex E substances until 1 January 2005.

There are many steps required to implement the licensing system. The first step in developing an effective licensing system involves examining existing legislation and regulations to determine whether they can be adapted or whether new legal text needs to be drafted. Once appropriate legislation and regulations have been adopted, the legal basis for licensing production, imports and exports of ODS has been established. The collection of data on ODS trade should be facilitated by the licensing system.

Once the licensing system is in place, training and awareness raising programmes on illegal trade in ODS should be promoted. Co-operation among the Parties and the various stakeholders involved in the licensing system will be critical to controlling and limiting the trade in ODS .

The licensing system established by each Party will enable the monitoring of ODS trade and provide information for the reporting requirements under Article 7 of the Protocol. The licensing system should also aid in the prevention of illegal trafficking of ODS .

Export of ODS equipment

The issue of exporting or dumping obsolete ODS equipment has been addressed by the Meeting of the Parties. The Parties have recommended that:

- Each Party regulate (including labelling) the export and import of products, equipment, components and technology whose functioning relies on ODS or contain ODS included in Annexes A and B of the Protocol;

- Non-Article 5 Parties control the export of used (second hand) products and equipment whose functioning relies on ODS included in Annexes A and B of the Protocol; and

- Countries which do not want to receive products and equipment containing controlled substances included in Annex A and B of the Montreal Protocol may request to be included on a list of countries maintained by the Ozone Secretariat. Customs officers should be aware of whether their country is listed or not.

ODS contained in imported products or equipment, do not count as consumption of the importing country, but rather as the consumption of the manufacturing country.

Roles of different stakeholders

World Customs Organisation (WCO)

The World Customs Organization (WCO) is composed of 153 member customs administrations. The WCO's main objectives are to:

- secure the highest degree of uniformity in customs systems,
- study and improve customs technique and customs legislation in connection therewith, and
- promote cooperation between governments in customs matters.

The WCO has developed the Harmonized System, a multipurpose goods nomenclature, covering more than 98% of world trade. The Harmonized System is important for the monitoring and prevention of illegal traffic of ODS. Under this system, by establishing codes at national and international levels, countries can monitor the movement of ODS. The WCO has already introduced subheadings to this nomenclature for use at the international level (6 digit level) to identify certain ODS. It has also adopted a recommendation calling for the insertion in national statistical nomenclatures of subheadings for other pure ODS. Annex B of this manual reflects these decisions of the WCO.

The WCO is now exploring the possibility of identifying mixtures, as well as products and equipment containing ozone depleting substances under the Harmonized System, thereby facilitating the ability of customs officials to classify the whole range of ODS and ODS-based equipment according to their national customs tariffs based on the Harmonized System.

Customs Enforcement Network (CEN)

The WCO has also established the Customs Enforcement Network (CEN) to centralize and exchange information on matters such as drugs, commercial fraud, and ODS goods. The unit analyses, complements and disseminates enforcement information for use by all customs services. CEN is a customs enforcement, analysis, information and communication system to combat fraud.

The CEN's network of contact points has been set up in all parts of the world. It consists of: the central unit, Central Information System (CIS), and the Regional Intelligence Liaison Offices (RILOs) located in Western and Eastern Europe, North, West, Central, Eastern and Southern Africa, Middle East, Asia and Pacific region, Caribbean region, South America, and National Liaison Offices.

Through this network, CEN links customs administrations and enhances their efforts against organized crime at the international level. Specific functions of CEN include:

- maintaining a customs seizures and offences database to allow the analysis of illegal trafficking,
- maintaining a website for information and intelligence needs of customs services, and
- facilitating a communication network to allow international exchanges and contacts.

However, WCO would like to emphasize that they record no nominal data. Nominal data may be exchanged between national customs administrations, if they have a mutual assistance agreement but not through CEN.

World Trade Organisation (WTO)

The World Trade Organization (WTO) is the only international organization dealing with the rules of trade between nations. There are 138 WTO member countries. Its goal is to help producers of goods and services, exporters, and importers conduct their business. Many provisions take environmental concerns specifically into account.

The preamble of the Marrakesh Agreement Establishing the World Trade Organization includes, among its objectives, optimal use of the world's resources, sustainable development and environmental protection. The WTO supports these objectives in concrete terms through a range of provisions within the WTO's rules. Among the most important are umbrella clauses (such as Article 20 of the General Agreement on Tariffs and Trade) which allow countries to take actions to protect human, animal or plant life or health, and to conserve exhaustible natural resources.

Beyond the broad principles, agreements on specific subjects also take environmental concerns into account. Conflicts or overlaps may sometimes exist between WTO rules and environmental agreements, particularly with respect to specific trade provisions contained in some environmental agreements.

Interpol

The International Criminal Police Organisation, also known as Interpol, is an organisation composed of 178 member countries. Interpol was set up in 1914 and has its General Secretariat (headquarters) in Lyon, France. Interpol's purpose is to facilitate, co-ordinate, and encourage police co-operation as a means of combating international crime. This is accomplished through a worldwide network linking the police of the 178 countries that comprise the Interpol membership.

Environmental Investigation Agency (EIA)

The Environmental Investigation Agency (EIA) is an international campaigning organisation committed to investigating and exposing environmental crime. EIA has documented and exposed illegal trade in CFCs. In a series of innovative investigations, EIA has proven the existence of a thriving black market - in particular CFCs and halons - and named the major culprits. EIA's findings have been released across the world and brought this issue to the fore of the battle against environmental crime.

Crosscutting issues of other international environmental agreements

In addition to the Montreal Protocol, other international environment agreements seek to improve the environment. These agreements deal with environmental issues such as global warming, transboundary movement of hazardous waste, and the illegal trade of endangered

plant and animal species. There are interlinkages between these agreements, the different convention secretariats or implementing agencies may realise significant synergies in implementing customs training, developing training material and integrated strategies, or providing policy and technical advice. A brief description of each agreement is provided below.

Kyoto Protocol

On 11 December 1997 over 160 nations adopted the Kyoto Protocol to the United Nations Framework Convention on Climate Change. As of January 1999, 71 countries had signed the treaty. The most important provisions of the Protocol set binding limits on greenhouse gas emissions for developed countries, those most responsible for past and current levels of greenhouse gas emissions. At the same time, the Protocol creates significant incentives for developing countries to control their emissions as their economies grow.

Many ODS and some of their replacements are greenhouse gases. This fact is another important link between the Kyoto and Montreal Protocol.

Basel Convention

The Basel Convention on the "Control of Trans-boundary Movements of Hazardous Wastes and their Disposal" was adopted in 1989 and entered into force on 5 May 1992. The Convention is the response of the international community to the problems caused by the annual worldwide production of hundreds of millions of tons of wastes. This global environmental treaty strictly regulates the trans-boundary movements of hazardous wastes and provides obligations to its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner.

The Seventh Meeting of the Parties decided that international transfers of substances controlled by the Montreal Protocol, which are recovered but not purified to usable purity specifications set by international or national standards, should only occur if the recipient country has recycling facilities that can process the received controlled substances to these specifications, or has destruction facilities incorporating technologies approved for that purpose (Decision VII/31).

The Basel Convention is in the process of developing training for customs officers.

CITES

In effect since 1975, the Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES) is a treaty that regulates and monitors international trade in many species of wildlife and plants. 151 countries co-operate through a system of permits and certificates, similar to 'eco-labels', to confirm that trade in listed wildlife and plants, including parts and derived products, is legal and does not

threaten their survival in the wild. CITES is designed to prevent further decline of wild populations and ensure that trade is based on sustainable use and management of wild and captive populations. The Convention has been the largest and by some accounts, the most effective international wildlife conservation agreement. Some of its best practices may be applied to the Montreal Protocol and vice versa. CITES is also developing training for customs officers.

Rotterdam Convention

International concern over the risks resulting from uncontrolled trade in extremely hazardous chemicals and pesticides led to the adoption of the Rotterdam Convention on the Prior Informed Consent procedure in which 163 countries actively participate. The Convention establishes controls on trade of hazardous chemicals and aims to empower governments to monitor and control cross-border trade. However, since trade is only one avenue for the spread of highly dangerous substances further agreements are necessary in order to prevent dangerous chemicals, such as persistent organic pollutants (POPs), from being released into the environment where they pose a threat to people and wildlife. The Rotterdam Convention will also develop training for customs officers in the future.

Regional context - examples of trade agreements

At the regional level, trade agreements may impact Montreal Protocol implementation since Parties are at different stages of adopting the Harmonised System. Regional trade agreements may also play a role in whether an individual country may be able to introduce import taxes or other trade restrictions on ODS.

Customs officers should be familiar with the trade agreements in their respective regions and the main flows of goods and products including the trans-shipment harbours. Figure 15 provides a list of trade agreements or associations in different regions.

Trade agreements & associations

Africa

- Common Market for Eastern & Southern Africa (COMESA)
- Preferential Trade Area for Eastern and Southern African States (PTA)
- Southern Africa Development Community (SADC)
- The Southern African Customs Union (SACU)
- The East African Co-operation (EAC)
- Economic Community of Western African States (ECOWAS)
- West African Economic and Monetary Union (UEMOA)
- Economic Community of Central African States (UDEAC/CEMAC)
- The Indian Ocean Commission (IOC)

Asia

- ASEAN Free Trade Agreement (AFTA)
- Asia-Pacific Economic Cooperation (APEC)

West Asia

- Unified Economic Agreement (UEA)
- Framework co-operation Agreement between GCC states and the European Union
- Facilitation and Development Inter-Arab Trade Agreement

Latin America and Caribbean

- Latin American Integration Association (ALADI)
- Andean Community
- Caribbean Common Market (CARICOM)
- Common Market of the South (MERCOSUR)
- North American Free Trade Agreement (NAFTA)
- Central American Common Market (MCCA)

Figure 15: Trade agreements & associations in different regions

Knowledge check:

1. What is the Montreal Protocol?
2. What is the ODS phase-out schedule for Article 5 countries?
3. What is the difference between ODS and ODS-based products ?
4. What are the exemptions for use and production of ODS?
5. What are the limits of ODS trade with Parties?
6. What are the provisions for trade with non-Parties?
7. Who are the different international stakeholders in the Montreal Protocol?
8. What are the international environmental agreements that have crosscutting issues with the Montreal Protocol?

3. National strategies for ODS phase-out

This chapter focuses on the national policies, strategies and options for ODS phase-out in developing countries and describes the main elements of an import/export licensing system for ODS. The licensing system is mandatory for all Parties to the Montreal Protocol which have ratified the Montreal Amendment.

Please refer to the "Country Handbook on ODS Regulations and Import/ Export Licensing System" for more specific information concerning your particular country.

Refrigerant Management Plans

For low-volume-ODS-consuming (LVC) countries, national phase-out plans are essentially **Refrigerant Management Plans (RMPs)**, since these countries use almost all of their ODS as refrigerant in the refrigeration and air-conditioning servicing sector.

Low-volume-consuming country
Low-volume-ODS-consuming countries are Article 5 countries whose calculated level of ODS consumption is less than 360 ODP tonnes annually.

Figure 16: Definition of low-volume-ODS-consuming country

RMP strategy

The Multilateral Fund provides financial assistance to LVC countries in order to help them establish and implement RMPs. A RMP is a comprehensive strategy to phase-out the use of ozone-depleting refrigerants used for servicing and maintenance of refrigeration and air-conditioning systems. It may include actions to reduce ODS consumption and emissions, reduce the need for further servicing by controlling new installations and restricting imports of equipment which depend on ODS (in particular CFCs) for their functioning, and promote retrofitting and replacement of existing equipment. Regulations, economic incentives and disincentives, training, and public awareness activities are some of the tools used to achieve these goals.

Coordination of RMP activities

The successful implementation of RMPs requires the co-ordination of activities in different ODS-using sectors including the manufacturing, servicing, and end-users sectors, as well as regulatory and trade controls, economic incentives and disincentives, training on good practices in refrigeration for service technicians, training for customs officers, establishing recovery & recycling programmes, public awareness campaigns, etc.

The following section describes some of the sectors that can contribute to and assist in meeting the phase out requirements:

Production sector

With the eventual phase out of ODS, many ODS production plants will close or will begin producing ODS alternatives. The major ODS producing countries are listed in Chapter 5.

Recently, China, India and Russia, the largest CFC producing countries, agreed to close down their manufacturing plants according to a defined schedule. The challenge of ODS phase-out is to reduce the supply and the demand in a co-ordinated manner. The risk of illegal trade arises where there is over-supply on the world market and/or scarcity on the national markets.

Manufacturing sector

ODS may be used in the manufacturing sector during manufacturing processes (e.g. cleaning processes for electronics), or contained in manufactured products (e.g. paint, foams, aerosol cans) or equipment whose functioning relies on the continuous use of ODS (e.g. refrigerators, air-conditioners).

The conversion of manufacturing plants entails the re-design of manufacturing processes (including recovery & recycling) and products and equipment to allow the use of ODS alternatives.

Refrigeration servicing sector

The refrigeration servicing sector uses ODS for servicing and repairing refrigeration and air-conditioning equipment. Training on good practices in refrigeration has provided many servicing professionals with the skills to reduce emissions of CFCs. Such skills include recovery & recycling of ozone-depleting refrigerants, retrofitting to alternative refrigerants and how to introduce new technologies.

End-user sector

The end-user sector includes any user or operator of refrigeration and air-conditioning equipment. There are several options for the end-user sector to phase-out ODS use in their companies. In the refrigeration sector, ODS-based equipment can often be replaced with transitional refrigerants such as HCFCs, or alternative substances. The most commonly used non-ozone depleting refrigerants are HFCs (which have zero ODP, but contribute to global warming) and HCs (which have zero ODP and zero global warming potential).

Retrofitting is the replacement of the ODS refrigerant in a piece of equipment with an alternative. It may require replacing specific parts of the equipment. For older refrigeration & air conditioning systems, it may be more cost-effective to replace rather than retrofit, as new equipment will be more efficient in terms of cost and energy consumption.

Finally, import restrictions on ODS-based equipment is another means to reduce the dependency of end-users on ODS.

Import / export licensing systems

Most developing countries do not produce ODS and fully depend on ODS imports. Therefore, the monitoring and control of legal trade and the prevention of illegal trade with ODS is crucial for the gradual phase-out of ODS.

Maximum quantities allowed

Import/export licensing systems allow for monitoring and controlling the flow of ODS in and out of a country. The system facilitates the smooth transition towards non-ODS technologies by providing clear signals to importers, wholesalers and industry about the maximum quantities of ODS permitted to be imported each year until the final phase-out date. Trade controls may apply to :

- ozone-depleting substances,
- products and equipment containing ODS, and
- equipment whose functioning relies on the continuous use of ODS.

Licenses & permits

A licensing system typically requires that importers and exporters first apply for a license/permit to move ODS in or out of a country. These licenses permit the reduction of the overall amount of ODS entering the country (imports minus exports) in order to comply with the phase-out provisions of the Montreal Protocol and its Amendments. They also facilitate data collection on ODS and aid in the prevention of illegal trade of ODS.

Mandatory licensing systems

ODS import/export licensing systems are mandatory for all Parties which have ratified the Montreal Amendment. A country should establish a licensing system three months after the Amendment enters into force.

The following section describes the basic elements of an import/export licensing system for ODS. For more information, please refer to UNEP's resource module on ODS Import/Export Licensing Systems.

Legal basis, structure & functioning of the licensing system

Adjustments to national legislation may be required to provide for the establishment of import/export licensing systems. The Protocol requires that the licensing systems must apply to all ODS, including virgin, used (recovered), recycled, or reclaimed ODS, with some delays allowed for HCFCs and methyl bromide.

The registration of all ODS importers and exporters is ensured by the government agency in charge of licensing (ODS licensing agency). It is important to note that certain ODS may be regulated by different government agencies. For example, the Pesticide Board controls methyl bromide in many countries.

The general structure and functioning of the import licensing process is illustrated in Figure 17. The left column describes procedures the importer should follow and the middle column indicates procedures for the authority in charge of issuing the licenses. This authority can be the National Ozone Unit.

Import / export restrictions for ODS (quota, bans)

Imports and exports can be restricted, for instance, through quotas or bans. Bans are the complete prohibition of the import of a specific ODS and may also apply to ODS containing products and ODS based equipment. A quota can be transformed into a ban once a specific ODS is phased out.

In order to comply with the phase-out schedules for ODS, annual quotas for each type of ODS need to be defined and gradually reduced from year to year. The NOU may work with other agencies to define quota amounts for importers. Importers may apply for import allowances, which are usually granted based on their historic imports. All allowances for a specific ODS must not exceed the annual quota of the country.

Each time an importer wishes to import ODS, an import permit must be issued for the specified quantity. The importer must not exceed the granted allowance for a specific ODS.

Any Party may apply for exemptions for essential uses, uses as feedstock or uses as process agents as described in Chapter 2. Customs officers should be aware of such exemptions and how they are translated into import allowances and permits.

Export licensing

The licensing system also allows for the monitoring and control of ODS exports since exports reduce the calculated ODS consumption of a country. The monitoring of ODS exports will also help to prevent illegal exports such as exports of ODS to non-Party countries.

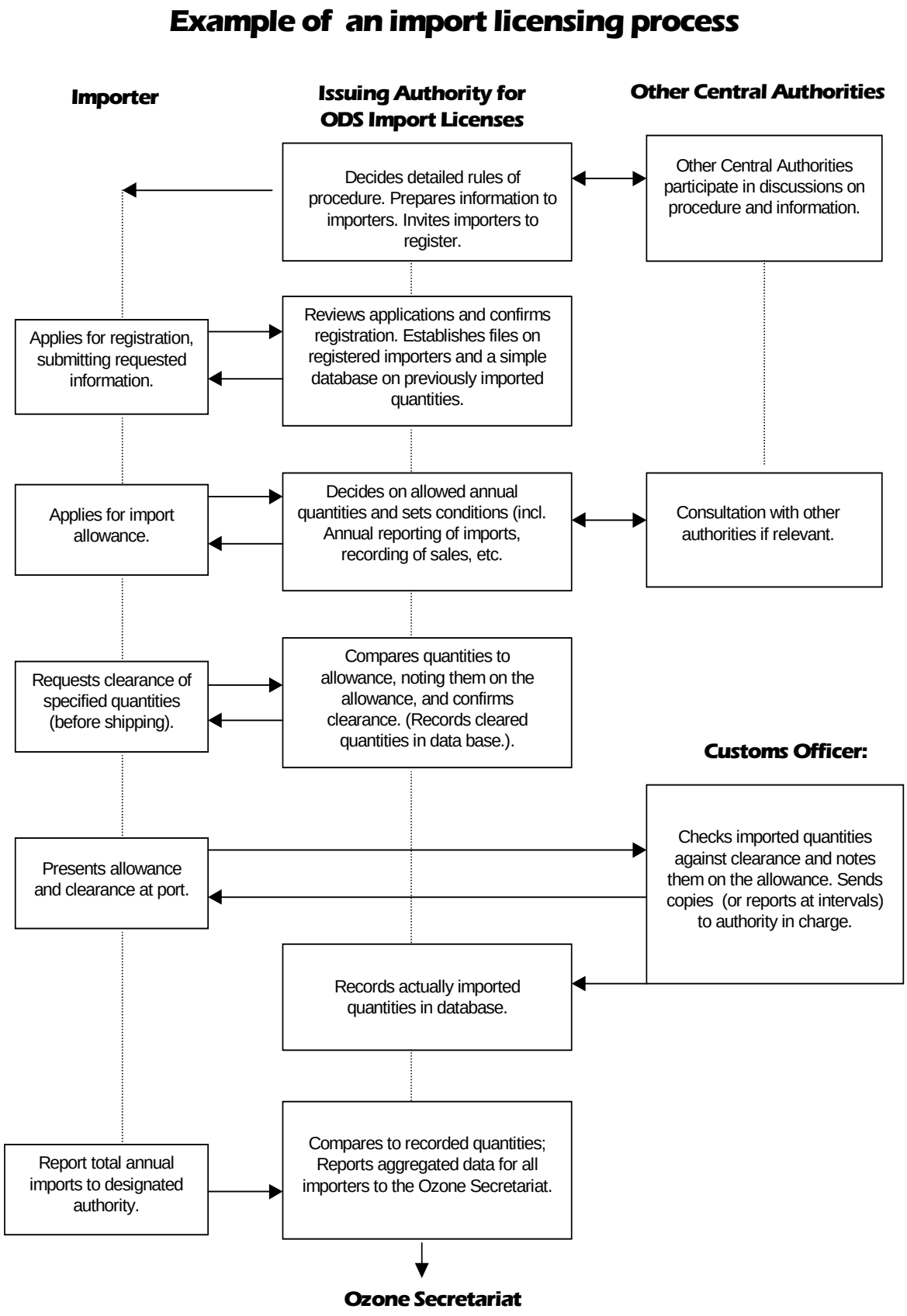


Figure 17: Example of an import licensing process (Source: UNEP ODS Import/Export Licensing Systems Resource Module, 1998)

Transhipments are not considered as imports or as exports and do not count towards a country's ODS consumption. However, transhipments should be closely monitored since ODS may be diverted and sold on the black market (see section on smuggling schemes in Chapter 5).

Enforcement & penalties

Customs officials, the environment agency, and the prosecuting agency usually enforce import/export licensing systems. Penalties are used to discourage persons from illegally importing or exporting ODS, ODS containing products or ODS-based equipment. The penalties are subject to the national laws relating to the import/export licensing system.

Seized ODS & ODS-based products / equipment

National laws and the provisions of the import/export licensing system prescribe what happens to seized ODS or ODS-containing products.

The decision matrix on the following page presents options for seized ODS and ODS-based products/equipment. The bold fields indicate the environmentally preferable options. However, the most appropriate option will depend on country specific situations and costs.

Approved destruction technologies for ODS

Destruction technologies will play a role in the terminal stages of the compliance period. However, the destruction of ODS is not the most cost-effective and environmentally preferable option as shown in Figure 19. The following destruction technologies for ODS have been approved by the Meeting of the Parties and must fulfil certain requirements concerning the contents of toxic substances in the off-gases.

Approved destruction technologies for ODS	
Thermal oxidation category	**Plasma destruction category**
• Liquid injection incineration • Reactor cracking • Gaseous/fume oxidation • Rotary kiln incinerators • Cement kilns • Municipal solid waste incinerator for foams including ODS)	• Radio frequency plasma destruction technology

Figure 18: Approved destruction technologies for ODS

Recording of data, data management & reporting

Other important aspects of import/export licensing systems are the recording of data, data management and reporting. The National Ozone Unit, ODS licensing agencies, and customs department usually collaborate on the collection and management of data. The National Ozone Unit is in charge of data reporting to the UNEP Ozone Secretariat.

Seized ODS & ODS-based products / equipment decision matrix

Options	Ozone-depleting substances, e.g. CFC refrigerants, methyl bromide, etc.	Products containing ODS, e.g. aerosol cans, foams, paint, etc.	Equipment based on ODS, e.g. refrigerators, air-conditioners, etc.
Re-export to the country of origin or to any country that is legally entitled to import the seized goods and wishes to do so.	Cost for re-export to be born by importer • risks to be smuggled again • if auctioning off and disposal are not possible	Cost for re-export to be born by importer • risks to be smuggled again • if disposal is not possible	Cost for re-export to be born by importer • risks to be smuggled again • if retrofitting and disposal are not possible
Auctioning off to a licensed importer and deducting the quantity from the importer's allowance	**If the import of ODS is not banned** **• replaces legal imports**	If the import of ODS-containing products is not banned • usually there are no allowances for imports of products containing ODS • to be avoided	If the import of ODS-based equipment is not banned • usually there are no allowances for imports of equipment based on ODS • increases the country's dependency on ODS • to be avoided
Mandatory retrofitting of ODS-based equipment by certified service company	Not applicable	Not applicable	**Cost for retrofitting to be born by illegal importer or by licensed importer who bought the equipment from Customs**
Disposal or destruction of the seized goods • cost to be born by illegal importer or customs • proper waste management practices should be applied	If Montreal Protocol approved destruction technologies are available • if auctioning off is not possible	**Recover ODS before disposal for re-use or disposal (not possible for paints or foams)**	Recover ODS and other working fluids before disposal for re-use or disposal • if retrofitting is not possible
Long-term storage Intermediate option which is costly for customs and requires final solution	If re-export, auctioning or disposal is not possible • to be avoided	If re-export, auctioning or disposal is not possible • to be avoided	If re-export, auctioning, retrofitting or disposal is not possible • to be avoided

Note: ODS contained in imported products or equipment does not count towards a country's ODS consumption since it already counted towards the consumption of the exporting / producing country.

Figure 19: Seized ODS & ODS product / equipment decision matrix

The collection of data is handled differently in each country. Please refer to the "Country Handbook on ODS Regulations and Import/Export Licensing System" for specific procedures. UNEP's "Handbook on Data Reporting" also provides guidance on the collection of data

Monitoring & evaluation

The ODS licensing agency will monitor the actual use of import/export licenses and should collect data on the functioning and performance of the licensing system including the incidence of infractions, seizures and penalties, the quantities of imported and seized goods etc. Based on these data, the agency and the NOU (if different) will evaluate the effectiveness of the licensing system. In consultation with the relevant stakeholders, corrective measures may be introduced.

An effective monitoring system will provide an appropriate basis for policy decisions, design of regulations, planning of training activities, and public awareness campaigns, etc.

Institutional set-up & role of stakeholders

This section explains the roles of the National Ozone Unit and the Customs Department in the implementation of the RMP and the enforcement of national ODS regulations to monitor and control legal trade and to prevent illegal trade of ODS, ODS-containing products or ODS-based equipment.

In general, the NOU co-ordinates the implementation of the RMP in co-operation with an Implementing Agency of the Multilateral Fund. Often, the NOU is part of an environment agency, trade and industry agency or meteorological service, but this is not the case in all countries. The Customs Department is often part of the Ministry of Finance.

Other important stakeholders involved in the operation and enforcement of the licensing system may include the licensing agency (if different from the NOU), police and coast guard, Pesticides Board, Bureau of Standards, Government Laboratory, industry and trade representatives or associations, as well as the general public.

Each country has a different division of responsibilities among its institutions and other players, but all stakeholders must share the common goal of phasing out ODS. A brief description of a NOU is provided below. The "Country Handbook on ODS Regulations and Import/Export Licensing System" will provide more country-specific information.

National Ozone Unit

The **National Ozone Unit** (NOU) is the central national unit, usually part of the Environmental Agency or Department of Natural Resources, responsible for co-ordinating a country's efforts with respect to ozone protection and facilitating ODS phase-out. The main responsibilities of the NOU include:

- Country Programme and Institutional Strengthening Programme implementation ;
- RMP implementation often including recovery & recycling programmes and training programmes for refrigeration technicians and customs officers;
- Preparation of proposals for policies, strategies, laws, regulations, incentives, agreements with the private sector, and other measures for national ODS phase-out;
- Consultation and co-ordination with stakeholders and organisation of stakeholder meetings as necessary;
- Advice and support to industry, servicing sector and end–users on the different phase-out options for ODS;
- Promotion of public awareness programs;
- Data reporting, as required by the Montreal Protocol.

Government officials in these agencies are well trained on issues pertaining to the Montreal Protocol, but may have little knowledge of custom's operations. It is important that the ozone officers and customs officials meet early on in the implementation of the phase-out program and regularly thereafter, and that each agency has a clear understanding of its respective role in implementing import and export controls. Close co-operation is essential to establish a successful control regime.

Customs officers

Systematic monitoring of all ports of entry into the country helps control legal imports and prevent illegal imports of ODS by identifying mislabelling or other false documentation. Inspections of imports, belonging to persons known to import ODS for sale or for their own use, should be mandatory in order to verify compliance with the regulations. The environment agency, licensing agency and customs department should aim for compliance by monitoring imports and exports of controlled substances through border and document checks.

As the enforcement officers responsible for monitoring borders and all points of entry for cargo, customs officers have the leading role in examining documents and cargo. This initial examination is the simplest way to identify shipments of ODS and to distinguish between legal and illegal shipments of ODS.

Verify paperwork

Paperwork can be verified with a supervisor and the environmental protection agency. Customs officers should contact the NOU or appropriate national office when illegal imports are suspected. The checklist for customs officers in Chapter 6 of this manual is a helpful tool to assist in verification of ODS paperwork.

Verify allowances

Customs officers should request that importers verify possession of sufficient allowances to import the quantity of ozone depleting substances in question and whether the specific shipment has been authorised through an import permit.

Register of allowances & permits

If the customs officer has no direct online access to the register of import allowances and import permits granted or to the actual imports of each importer, the customs officer must contact the NOU or licensing agency to check the data. The importer must have sufficient allowances granted and valid import permits for the specific shipment of ODS.

Check for mislabelling

Officers should inspect and analyse the goods if the shipment papers are suspect or incomplete, ODS is labelled as recycled refrigerant or if there is any other indication of mislabelling.

Screening for ODS

Trained and authorised customs officers may screen for ODS refrigerants by using refrigerant identifiers, the temperature/pressure method or leak detectors as described in Chapter 7.

Chemical analysis

If chemical analysis in an accredited laboratory is required, for instance in order to prepare court cases, a specially trained and authorised technical expert from the government laboratory should be consulted. Smaller refrigerant cylinders can be transported directly to the laboratory. Mass spectroscope and gas chromatograph are common methods of analysis.

Licensing agencies

The licensing agency may be different from the NOU. Two or three different agencies may be responsible for licensing ODS. For example, the Ministry of Trade may licence CFCs, while the Pesticide or Toxic Chemicals Board may licence methyl bromide. The appropriate licensing agency or agencies will offer or deny licences to importers or exporters of ODS.

Ministry of Trade, Industry or Commerce

The Ministry of Trade, Industry or Commerce is a key stakeholder in the implementation of the licensing system. This Ministry often requires a licence to import goods. This licence may be one of many required by the licensing system. Under national law, the Ministry has certain powers to limit or ban the import or export of certain goods. This may include establishing a "negative list" of goods not allowed to enter the country.

Pesticides Board

The Pesticide Board may issue licences for the import of methyl bromide. Depending on national regulations, the Pesticide Board may also issue a "negative list" to ban the import of specified goods. They may ban the use of certain pesticides or prescribe safety precautions, specific modes of use, or storage requirements.

Bureau of Standards

The Bureau of Standards may check imports for proper labelling. Under national law the Bureau of Standards may have the authority to specify compulsory labelling standards for virgin, recovered, recycled or reclaimed ODS, ODS-based equipment or retrofitted equipment.

Ministry of Justice

The Ministry of Justice or Attorney General is another key stakeholder in the enforcement of the licensing system. This Ministry works in conjunction with other agencies to prosecute and sentence illegal traders.

Government Laboratory

The Government Laboratory provides scientific analysis of evidence in cases of suspect ODS shipments. Such evidence is required for court cases. Their trained staff may take samples when ODS cylinders cannot be transported to the laboratory. There may be other accredited laboratories which can validate evidence.

Police & Coast Guard

The police and coast guard may be part of the ODS enforcement team. Working in conjunction with other agencies, they can gather intelligence information and conduct inspections of suspicious shipments in co-operation with the Customs Department.

Industry & trade representatives or associations

Industry associations may inform the licensing authority if the black market for ODS is increasing, consequently diminishing their legal sales. The customs broker association, air-conditioning and refrigeration technicians association or other similar groups are others who may be helpful in ensuring the effective operation of the licensing system. The support and co-operation of industry should be ensured by involving it early in the process. Industry may play a role on how to deal with seized products and ODS, be involved in public awareness raising, or disseminating information to importers, service technicians and end-users. Industry networks of contacts may be extremely helpful.

National ozone or climate committees

Many developing countries have established national committees to discuss and agree on appropriate policies, strategies and actions to protect the ozone layer and to combat climate change. These committees include relevant stakeholders from the public and private sectors who meet regularly to review progress and make new proposals. An important function of these committees is to serve as a platform for discussion and decision-making to ensure the involvement and support of relevant stakeholders.

General public

The general public can also be a useful ally in the effective operation of the ODS import/export licensing system. If the public is educated about ozone issues, consumers may be less likely to bring ODS-based refrigerators and air conditioners into the country. As educated consumers they may choose to retrofit to ODS alternatives and not to purchase old ODS equipment.

Knowledge check:

1. What is a RMP?
2. What is an import/export licensing system designed to do?
3. What is the difference between a quota and an allowance ?
4. What is the role of customs officers in the import/export licensing system?
5. Who are the stakeholders involved in the operation of an import/ export licensing system?

4. Safety & ODS

ODS include a wide range of chemicals with different chemical and physical properties. Most of them pose a risk to human health and the environment if handled, stored, transported or used without proper safety precautions. National safety regulations must be observed.

International Chemical Safety Cards

The International Chemical Safety Card for CFC-12 containers is included on page 56 as an example. Further safety cards are included in Annex C or can be found at the website of the World Health Organisation and the European Union: http://www.cdc.gov/niosh/ipcs/icstart.html.

These safety cards provide important information on the potential risks of these substances, the preventive measures required and the first aid measures in case of an accident.

These safety cards may not reflect in all cases all of the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

ASHRAE safety classification of refrigerants

ASHRAE Standard 34-1997 on "Number Designation and Safety Classification of Refrigerants" classifies commonly used refrigerants depending on their toxicity and flammability.

Example of ASHRAE refrigerant safety group classifications: B3
There are 6 safety groups defined depending on the flammability and toxicity of a refrigerant – A1, A2, A3, B1, B2 and B3. The "A" signifies lower toxicity and "B" higher toxicity. "1" signifies no flame propagation, "2" lower flammability and "3" higher flammability. Therefore B3 indicates a refrigerant with higher toxicity and higher flammability.

Figure 20: Definition of ASHRAE refrigerant safety group classifications: B3

ASHRAE safety groups for the most common ozone-depleting refrigerants are included in Annex B1.

Use of refrigerant identifiers/analysers

Only trained and designated customs officers should use refrigerant identifiers, the temperature / pressure method or leak detectors to check the contents of refrigerant containers. Local safety regulations must be observed. Chapter 7 focuses on identification of ODS.

Sampling for chemical analysis

If chemical analysis in an accredited laboratory is required, for instance to prepare court cases, a specially trained and authorised technical expert from the Government or other designated laboratories should be consulted. **Customs officers should not take samples.**

Smaller refrigerant cylinders can be transported directly to the laboratory.

Inspection

When inspecting the compressors of refrigeration & air-conditioning systems for labels to determine the refrigerant type and charge, the power supply should be disconnected. For example, refrigerators should be unplugged and vehicle motors turned off .

Safety checklist for customs officers

Handling, transport, storage and identification of ODS refrigerants

DOs

- Do observe local regulations and industry-recommended procedures for the handling, transport and storage of virgin, recovered, recycled or contaminated refrigerants.
- Do use protective clothing, including safety goggles and cold-insulating gloves when handling refrigerants. Refrigerants can cause frostbite and other damaging effects to the skin and eyes.
- Do equip storage areas with appropriate fire extinguishing systems to reduce the risk of fire. CFC refrigerants are not combustible but produce irritating or toxic fumes in a fire.
- Do use electronic leak detectors to inspect storage areas and access valves for leakage.
- Do check the contents of refrigerant cylinders using the temperature / pressure method or electronic refrigerant identifiers - but only if you are trained and authorised to do so under local regulations.
- Do inspect access valves for leaking glands and effective gaskets. Protective caps should prevent valve damage.

- Do secure storage areas for ODS and ensure that they are only accessible by authorised personnel & that they are protected against theft.
- Do properly label ODS and storage areas and show appropriate warnings if necessary.
- Do store seized ODS until further legal action determines what will be done with the substances. They should be clearly labelled and safely stored. The Country Handbook on ODS Regulations should detail storage requirements for seized ODS.
- Do disconnect the power supply when inspecting or testing equipment, e.g. refrigerators should be unplugged and vehicle motors turned off.
- Do respect local requirements and standards for pressure vessels with low- and high-pressure refrigerants. In many countries safety inspections are mandatory.
- Do store and transport ODS cylinders carefully in an upright position (this does not apply to ISO containers) and prevent dropping them.

DON'Ts

- Do not eat, drink or smoke in storage areas or near ODS or ODS products/equipment.
- Do not vent ODS into the atmosphere knowingly. Do not dispose of any ODS by using methods other than R&R, reclaim, reuse, adequate storage or approved destruction methods.
- Do not handle or store ODS in confined spaces which lack ventilation since some ODS can accumulate in confined spaces. This increases the risk of inhalation and may cause unconsciousness or suffocation resulting in death. Use breathing protection if appropriate.
- Do not store ODS cylinders in direct sun light or near hot surfaces. A rise in temperature will cause an increased pressure with the risk of bursting.
- Do not take samples of ODS – this should be done by trained and authorised technicians or personnel of accredited Government laboratories.
- Do not use open flames in storage areas or near any refrigeration & air-conditioning system to reduce the risk of fire. Do not use the "halide torch method" (flame test) for leak testing.
- Do not handle chemicals or ODS if you are not trained and familiar with the necessary safety precautions.

Figure 21: *Safety checklist for customs officers concerning the handling, transport, storage and identification of ODS refrigerants.*

DICHLORODIFLUOROMETHANE: CFC-12 (cylinder)			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep cylinder cool by spraying with water.
INHALATION	Confusion. Drowsiness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
SPILLAGE DISPOSAL: Ventilation. NEVER direct water jet on liquid.			
STORAGE: Separated from metals (see Chemical Dangers). Cool. Ventilation along the floor.			
PACKAGING & LABELLING: Special insulated cylinder. UN Hazard Class: 2.2			
PHYSICAL STATE; APPEARANCE: Colourless compressed liquefied gas, with characteristic odour.			
PHYSICAL DANGERS: The gas is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.			
CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming corrosive and very toxic fumes (hydrogen chloride, ICSC # 0163; phosgene, ICSC # 0007; chlorine, ICSC # 0126; hydrogen fluoride, ICSC # 0283). Reacts violently with metals such as calcium, magnesium, potassium, sodium, zinc and powdered aluminium. Attacks magnesium and its alloys.			
ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.			
INHALATION RISK: On loss of containment this gas can cause suffocation by lowering the oxygen content of the air in confined areas.			
EFFECTS OF SHORT-TERM EXPOSURE: The liquid may cause frostbite. Exposure could cause cardiac arrhythmia and asphyxiation. See Notes.			
PHYSICAL PROPERTIES: Vapour pressure, kPa at 20°C: 568, Relative vapour density (air = 1): 4.2			
ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to air.			
NOTES: To physicians: adrenergic agents are contraindicated. High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. Freon 12, Frigen 12, Halon 12 are trade names.			

Figure 22: International Chemical Safety Card for CFC-12 (cylinder) Source: World Health Organisation & the European Union, http://www.cdc.gov/niosh/ipcs/icstart.html.

Knowledge check:

1. Why should customs officers take safety precautions when handling ODS?

2. Why shouldn't customs officers handle ODS in confined spaces?

3. How should sampling be conducted ?

5. Prevention of illegal trade

The primary driving force for illegal trade of ODS is the high profit margin which can be made due to the low priced ODS on world markets and the rising prices of ODS within national markets with import restrictions. Alternatives to ODS are often more expensive thus creating further demand for ODS and increasing the risk of illegal trade. Trade restrictions between Parties to the Montreal Protocol and its Amendments and non-Parties are another source of illegal trade. In some countries, ODS have become the most profitable illegally traded good after drugs.

The following section describes the main smuggling schemes and the corresponding methods to detect illegal trade.

Smuggling scheme I: Mislabelling as non-ODS

ODS may be imported in mislabelled containers/cylinders or their cardboard packaging may be mislabelled. Mislabelled CFC refrigerants may be falsely declared and labelled as non-controlled substances such as hydrocarbons (propane, butane) or hydrofluorocarbons (HFC-134a). In some cases, they may be labelled as hydrochorofluorocarbons (HCFC-22) which are controlled substances, but whose first phase-out obligation applicable to developing countries is the freeze in 2016.

Photos 1-4 show refrigerant containers which were seized by customs authorities in 1997. The containers were declared as a HFC-134a shipment. Small quantities of HFC134a were contained in small cylinders which only became visible when the main containers were cut open. The main containers were filled with CFC-12.

These photos were taken by Mr. Duncan Brack and Mr. Rajendra Shende, Chief of UNEP DTIE's Energy & OzonAction Programme with the authorisation of the customs authorities of the country concerned.

Video 2: US EPA video, Protecting the Ozone Layer and the Illegal Importation of CFCs

Example of screening for producer countries

A shipment of CFC-12 was declared as HFC-134a. Customs detected the illegal shipment because the country of origin was a CFC-producer, but not a HFC-producer.

Photo 1: The access points to the main CFC-12 container only become visible after cutting open the double layered container.

Photo 2: View of the small HFC-134a cylinders after removal of the CFC-12 refrigerant and cutting open the main containers.

Photo 3: View of the seized CFC-12 containers declared and labelled as HFC-134a.

Photo 4: View to the access valves of the small HFC-134a containing cylinder.

Smuggling scheme II: Mislabelling as recovered ODS

Imports of recovered (including recycled and reclaimed) ODS do not count towards a country's ODS consumption. Therefore virgin ODS may falsely be claimed as recovered ODS. However, very little recovered ODS exists on world markets and recovered ODS is usually re-used in the same country where it was recovered. Virgin ODS is often cheaper as a result of developed countries having already phased-out their consumption of most ODS.

Check your "Country Handbook on ODS Legislation and Import/Export Licensing System" for regulations governing the importation of recovered, recycled or reclaimed ODS.

Smuggling scheme III: Concealment & double layering of ODS

ODS may be hidden with other cargo or disguised as non-regulated substances. For example, ODS may be transported in propane cylinders. Small quantities may be concealed in cars, trucks, etc. This is a common method at land points of entry. Small cylinders of CFC refrigerant may be concealed in outer cartons of HCFC or HFC refrigerants.

Photos 5-8 were supplied by Mr. George White, Senior Special Agent of the US Customs Service. They show a seizure of CFC-12 cylinders made in Southern Florida. The refrigerant was smuggled into the United States via a private boat.

Double layering is another method of concealing ODS. Materials listed on the shipping documents are loaded close to the door of the trailer or cargo container and the ODS is hidden behind it. At first glance, the paperwork appears correct.

Smuggling scheme IV: Diverting ODS from transhipment harbours and ODS produced for export

Transhipment of ODS does not count towards a country's ODS consumption since the ODS is not considered to be entering or leaving the country. However, at transhipment harbours, ODS containers may be diverted and replaced by empty ones, or their ODS contents may be removed. The ODS is then sold on the black market and false export documents are filed with customs.

Case study on concealed ODS

A shipment of ninety 30-pound cylinders of CFC-12 was hidden in a private boat, illegally imported and seized by customs.

Nothing in these pictures is intended to suggest that any of the companies whose products are shown is involved in any illegal trading activity.

Photo 5: Ninety 30 lbs. Cylinders of CFC-12 were hidden on this boat.

Photo 6: Cylinders hidden in storage compartments within boat.

Photo 7: Back of boat filled with CFC-12 cylinders.

Photo 8: Seized CFC-12 cylinders

ODS produced for export does not affect a country's ODS consumption since the amount of ODS produced in the country is nullified by the amount of ODS exported. However, only few developing countries produce ODS.

Containers designated for transhipment or for export should be stored separately from other containers in a specifically protected area. Any transhipment of ODS and non-ODS refrigerants should be examined and their contents determined with refrigerant identifiers.

Screening methods

Screening for importers which are not licensed to import ODS refrigerants

Any bonafide importer of non-ODS refrigerants is also likely to be an importer of ODS refrigerants and will thus be a licensed importer. Any import declared as non-ODS by a company whose name does not figure in the list of licensed importers of ODS refrigerants is cause for close examination.

The business address of any importer should be checked to see whether it actually exists.

Screening documentation for consistency of codes & names

Carefully check the shipping documents such as freight papers, shipping manifests and bills of lading. The paperwork may contain false CAS- or ASHRAE-numbers, trade names, HS customs codes or fictitious importers, businesses and addresses.

The HS customs codes may not be applied correctly because the use-related codes are often wrongly attributed to the ODS instead of those based on the classification of the actual chemical substance. Customs codes are further discussed in Chapter 6.

Screening by quantity of import

Trade with refrigerants is only profitable in huge quantities – therefore watch for large quantities of refrigerants. In most developing countries, the consumption of non-ODS refrigerants (e.g. HFC or HC refrigerants) is small compared to that of CFC and HCFC refrigerants. Any unusually large imports of non-ODS refrigerants should be cause for close examination. The same applies to unusually large imports of HCFC refrigerants, whose first control measure applicable to Article 5 countries is the freeze in 2016. Only inspection of the containers will provide certainty as to their real contents.

A country's ODS and non-ODS consumption and import data from the previous two years and the current year's total licensed quantity of ODS (e.g. CFC and HCFC) imports may serve as useful reference.

Screening by producer countries

Screening by ODS producing countries is a simple method used to identify shipments which may potentially be illegal. Any shipment from an ODS-producing country, even if declared as non-ODS, is cause for close examination.

The main producing countries for different ODS are summarised in Figure 23. For Annex A-I CFCs, the countries producing 1,000 tons or more are listed in order of production quantity. The production of other controlled substances is listed in order of production as well. The list of countries may need periodic up-dating as several countries are in the process of closing their production plants.

Main ODS producing countries		
Annex	**ODS type**	**Countries**
A-I	CFCs	China[2], India[2], Russian Federation[1,2], Netherlands, Brazil, Republic of Korea, Italy, Spain, Mexico, Venezuela, United Kingdom
A-II	Halons	China, Republic of Korea, Russian Federation
B-I	CFCs	Russian Federation, China
B-II	Carbon tetrachloride	India, Brazil, Ukraine, Romania
B-III	Methyl chloroform	Japan, United States, France, China
C-I	HCFCs	United States, France, Japan, China, United Kingdom, Netherlands, Spain, India
C-II	HBFCs	Currently there are no producers.
C-III	Bromochloro-methane	No data available at publication time.
E	Methyl bromide	United States, Israel, Japan, France, China, Romania, India

[1] The Russian Federation was scheduled to stop CFC production from 1 July 2000 but could not comply with its obligation due to economic difficulties

[2] China, India and Russia, as the main CFC producing countries, agreed to close down their manufacturing plants following a pre-determined time schedule.

Figure 23: Main ODS producing countries in 2000

Screening by transhipment harbours

Screening for known ODS transhipment harbours is another useful way to identify ODS smuggling. Customs officers should be aware of the major transhipment harbours in their respective regions.

Any transhipment of ODS and non-ODS refrigerants should be examined and their contents determined with refrigerant identifiers, as they may have been diverted and often the country of origin is not known.

Screening by recovered or recycled ODS shipments

Any imports/exports of recovered or recycled ODS should be closely examined. It is possible to differentiate virgin from recovered/recycled ODS through laboratory analyses, but it is more difficult to differentiate it from reclaimed ODS which fulfils similar quality standards as virgin ODS.

Screening by country with recycling capacity

Virgin ODS is sometimes deliberately contaminated in order to make it resemble recovered or recycled ODS. Countries which import recycled ODS should request detailed information from the importer concerning the origin of the chemicals which are claimed to be recovered and recycled, including the name and location of the recycling facility.

The import of recovered/recycled ODS is an indication of illegal trade if the country does not have any recycling capacity, or if the consumption of ODS is already phased out. If this is the case, the refrigerant should be analysed and the origin further investigated.

A list of countries with recycling and reclamation capacities may be requested from the Ozone Secretariat. Use refrigerant identifiers/ analysers to identify any doubtful refrigerant imports.

Physical examination of containers & packaging

The appearance of refrigerant containers may indicate mislabelling if they have been painted, if they show signs of tampering, or if they have a paper label. Most gas cylinders have a silk-screened or spray-painted label. If a cylinder has been repainted, then a closer examination is warranted.

Refrigerant cylinders containing virgin refrigerants usually have a shrink wrapped valve. If the shrink wrap is damaged or missing, the cylinder contents should be analysed.

Screening containers & packaging for consistency of codes & names

ASHRAE numbers, CAS numbers, trade names, product labels and product packaging should be checked for consistency. A smuggler may change one of these numbers without changing the other numbers accordingly. Or ODS-containers may be packaged in non-ODS cardboard boxes. Refer to Annex B for a list of ASHRAE numbers, CAS numbers, trade names and HS customs codes.

Consistency check of ISO container labelling

If a container designed for pressurised gases is labelled to contain liquid refrigerants, its contents should be analysed. CFCs shipped in ISO containers include liquids and compressed gases. IMO 1 containers contain liquid refrigerants such as R-11 and R-113. IMO 5 containers hold compressed gases such as R-12 and R-114.

Some ODS are gases at room temperature and transported and stored

Consistency check of container type and labelling

as liquefied compressed gases in pressurised cylinders. Other ODS are liquids at room temperature and contained in drums, barrels, bottles or other standard containers as they are used for all types of liquid chemicals.

Figure 24 indicates examples of liquefied compressed ODS gases and ODS which are liquid at room temperature. Their physical state at room temperature is indicated by their International Chemical Safety Cards or can be deducted from the temperature-pressure charts (see Annex B. 8).

Examples of liquified compressed gases & liquid ODS		
Physical state	**T/p chart**	***Examples***
Liquefied compressed gas	At room temperature, the vapour pressure is above the standard atmospheric pressure at sea level	R-12, R-13, R-22, R-115, halon 1211, halon 1301, methyl bromide
Liquid	At room temperature, the vapour pressure is below the standard atmospheric pressure at sea level	R-11, R-113, carbon tetrachloride, methyl chloroform

Figure 24: Examples of liquified compressed gases & liquid ODS

Reusable refrigerant cylinders can be refilled with any type of refrigerant and may contain mislabelled ODS. They should be examined and the refrigerant identified with refrigerant identifiers. Refilled refrigerant cylinders may not have a shrink wrapper and may be leaking. Therefore, leak detectors may be able to detect concealed reusable cylinders which contain ODS.

Consistency check on flammability of refrigerants

HC refrigerants should be marked flammable and CFC refrigerants not flammable. Any refrigerant cylinder labelled as HC refrigerant without a warning that it contains flammable gases should be examined.

Refrigerant cylinders containing flammable gases are equipped with left-hand valves. Any cylinder labelled as HC refrigerants or flammable gases should be equipped with left-hand valves. If it is not, the contents of the cylinder should be examined.

Check cylinder valves

Mobile air-conditioning (MAC) systems have different access valves depending on the type of refrigerant used. There are no international standards and the valve types used may differ from region to region.

US manufacturers use standard access valves and the following table specifies which access valves are used for which type of refrigerant. The table may be useful to check whether the valve type and labelling match.

Valve Type for US Cylinders	**Possible Refrigerants in MAC Sector**	**Action**
¼'' right hand flare fitting (clock wise)	CFC-12 HCFC	Check labelling & analyse if necessary
½'' right hand flare fitting (clock wise)	HCFC HFC-134a	Check labelling & analyse if necessary
Quick fittings	HCFC Retrofitted to non-ODS Non-ODS	Check labelling & analyse if necessary
½'' or other left hand flare fitting	Hydrocarbon (flammable)	Safety precautions
Damaged tubes may look like a retrofitting, but may not necessarily be so	ODS refrigerant Non-ODS refrigerant	Check labelling & analyse if necessary

Figure 25: Valve types used in the US for different types of refrigerants

Suspect especially the ¼'' right hand flare fitting – the MAC system will contain CFC or HCFC refrigerant.

Be careful with left hand flare fittings – these systems contain flammable gas.

Direct identification & analysis

Any doubtful refrigerant import should be identified or analysed by an authorised Government laboratory, or by means of electronic refrigerant identifiers/analysers or the temperature/pressure method.

Educating stakeholders & information exchange

Other initiatives which may help to prevent illegal trade include the education of stakeholders as well as co-operation and information exchange at national, regional and international levels.

Educating stakeholders

Custom departments should educate/inform importers, wholesalers and the public that the illegal import of ODS is unlawful and may be prosecuted and result in penalties. They should explain why such import restrictions are necessary. The display of educational signs and posters in strategic locations will reach the general public. Simply asking the question "Are you carrying any ozone depleting substances ?" at the port of departure and at the port of entry may help to reduce smuggling.

Information exchange

Information exchanged between customs posts at national, regional and international levels, and the establishment of a database of relevant data will allow to improve tracking of the routes of illegal shipments, to identify the major trans-shipment harbours in the region and the existing smuggling schemes, and to check whether exports from a specific country of origin match with the imports into the country of destination.

Customs checklist

The initial examination of documents should be the first step taken to identify potential discrepancies.

✓	Compare the packing list, bill of entry, and the country of origin to make sure they match.
✓	Ensure the customs code on the entry matches the description on the invoice.
✓	Compare the invoice and the bill of lading to the outward bound ship manifest.
✓	Verify the country of origin. Is the country a Party to the Montreal Protocol and its amendments?
✓	Verify that the importer and place of business actually exist.
✓	Contact the licensing agency to verify that importer is licensed to import that specific material.
✓	Note the quantity, source, and destination of ODS. These will serve as important clues that may provide indicators to prohibit illegal importations.
✓	Verify that the container number actually exists. Discovery of fictitious container numbers have led to the disclosure of illegal trade.
✓	Review all the necessary documents, if there is something that doesn't match, it may be an illegal shipment.
✓	Inspect the merchandise.
✓	Check packaging, size and shape, and label on container.
✓	Identify the name and description of the chemical, which should match ALL paperwork.
✓	Seize the material if the importer does not have an import/export license.
✓	Coordinate this seizure with the customs officer, environment agency, and the prosecution agency. Anyone involved with the seizure may be called to testify in court, so take good notes.

Figure 26: Checklist for customs officers

Knowledge check:

1. What are the basic smuggling schemes used to traffic ODS?

2. What is the first thing a customs officer should verify with respect to a shipment of ODS?

3. What are the screening methods for paperwork related to an ODS shipment ?

4. What are the screening methods used in the physical inspection of ODS?

5. Why should customs officers educate their stakeholders?

6. Why should customs officers establish an ODS information exchange system?

6. Names, labelling & packaging of ODS

There are no international standards which require uniform naming, labelling or packaging of ODS or ODS products/equipment. Therefore, there are many identifiers or labels that customs officers need to be familiar with.

This chapter will address Harmonised System customs codes, chemical names, trade names, CAS, ASHRAE and UN numbers, ARI colour codes, labels and packaging. Annex B contains these "identifiers" for the most commonly used ODS as far as they are specified.

Harmonised System (HS) customs codes

The most common way of identifying goods for customs officers is the use of HS customs codes. The HS coding system of the WCO provides uniform codes that are used around the world to facilitate trade.

The WCO and UNEP Ozone Secretariat co-operate to classify ODS and mixtures containing them and to assign HS codes to the different groups of ODS, ODS mixtures as well as ODS products/equipment.

Overview of HS codes

HS codes are represented with six digits at the international level. The first four digits represent the heading and the next two digits the sub-heading.

CFC-12 HS code: - - 2903.42

With reference to the HS codes indicated in Annex B – HS codes that contain one or two dashes are international codes, and are directly applicable by all the Parties to the HS Convention. Countries that are not Party to the HS Convention are welcome to use the HS codes too.

When a HS code contains three dashes, the national authorities of the Parties to the HS Convention may create their own codes under the international code by adding some digits for each one of the chemicals or groups of chemicals listed in the table. Again, countries that are not Party to the HS Convention are welcome to use these codes too.

ODS discussion group of the UNEP Ozone Secretariat

In response to the request of the Tenth Meeting of the Parties, the UNEP Ozone Secretariat has set up an ODS discussion group of interested experts to advise the Secretariat on possible amendments to the HS system, and on the issue of allocating separate HS customs codes for ODS by the World Customs Organisation (WCO).

The Secretariat has set up an electronic discussion forum to facilitate the discussions of the group of experts. The Web site of the discussion group contains an archive with all HS code related discussions and acts as a reference point for those seeking to find more about the current status of customs codes allocation under the HS. The Web site address is: http://www.unep.org/ozone/ods-customs-codes.

Currently, the expert group is working to accommodate ODS-containing mixtures in the HS coding system, which are "of importance in trade" and that do not fall under any previous HS subheading. The Eleventh Meeting of the Parties requested the group of experts to conduct further work on recommendations relating to the HS codes for mixtures and products containing ODS in collaboration with the WCO.

Figure 27: ODS discussion group of the UNEP Ozone Secretariat

The next steps for Parties (as well as non-Parties, if they so wish) are to introduce the recommended HS codes into their national customs systems and then make their customs authorities use them.

HS codes for ODS-containing mixtures

ODS that are traded as mixtures, which is common with regard to solvents and refrigerants, are not easily caught by the HS codes, as the codes for mixtures are based on the function of the product. The current HS coding system does not allow monitoring trade with certain mixtures containing ODS, such as mixtures containing HCFCs.

ODS-containing mixtures, which are "of importance in trade", are currently being reviewed for HS classification. The ODS discussion group may recommend that the Secretariat of the HS Convention assign HS codes for ODS-containing mixtures.

Assigning HS codes is a complex and time-consuming process. First, the HS Convention will check whether any codes have already been assigned, as is the case for R-500 and R-502 whose HS code is (- - 3824.71). Then, the HS Secretariat will prepare a draft recommendation to be discussed and approved by the Parties of the HS Convention. After approval, the codes become recommended customs codes under the HS coding system.

Annex B contains the list of zeotrope, azeotrope and unnamed mixtures and their compositions. Each mixture may have several trade names.

HS codes for ODS products

Some products designed for ODS use include air-conditioners, refrigerators, freezers, water coolers, ice machines, heat pumps, compressors, cars and car parts, fire extinguishers, dry cleaning machinery, and aerosols. These products may be imported as new or used products. The HS does not distinguish between used and new goods, provided that the goods can still be used for their original purposes.

The types of products which are primarily relevant to identify and control are various types of refrigeration and air-conditioning equipment (and fire extinguishers) as they tend to prolong the demand for CFCs (and halons) in the importing country.

It must be stated that aerosols are only of interest with regard to imports from Non-Party countries and are therefore not a priority to control, taken that very few countries are not Party to the original Montreal Protocol.

Annex B identifies the various chapters and codes relevant to products designed for use of ODS. These product classifications may be found in Chapters 33, 34, 38, 84, 85, 87, 93, and 94 of the Harmonized System.

Overview of ODS names

There are a variety of names for ODS. There are short chemical and complete chemical names, trade names, CAS numbers, UN numbers, and ASHRAE numbers. The table in Annex B lists all of these names and identifying numbers. Chemical and trade names are generally used to describe the contents of a shipment in import/export documents. They do not directly indicate whether a substance is ozone depleting or not. Additional identifiers may be used such as CAS numbers and UN numbers.

In the US and many other countries, US standards are used to label specifically refrigerants (ASHRAE number) and refrigerant containers (ARI colour assignments for refrigerant containers). ASHRAE also provides a system of classifying refrigerants into different safety groups according to their flammability and toxicity.

Chemical names

Chemical names provide an indication of the molecular structure of a substance and the type, number and position of the atoms contained. Often, it is more practical to use short formulas, which may still indicate the structure of a molecule, or formulas which only indicate the type and number of the atoms contained. However, these short formulas are not any more substance specific.

Example of chemical name: "1,1,1-trichloroethane"
"1,1,1-trichloroethane" indicates an ethane structure of 2 carbon atoms (H_3C-CH_3) where 3 hydrogen atoms have been replaced by 3 chlorine atoms connected at 1 position. This means that all chlorine atoms are connected to the same carbon atom (H_3C-CCl_3). Shorter formulas for "1,1,1-trichloroethane" are (H_3C-CCl_3), also indicating the molecular structure, and ($C_2H_3Cl_3$) which only indicates the type and number of atoms contained.

Figure 28: Example of chemical name: "1, 1, 1-trichloroethane"

In these short formulas, "C" stands for carbon atoms, "F" for fluorine atoms, "Cl" for chlorine atoms, "Br" for bromine atoms and "H" for hydrogen atoms. The subscript numbers indicate the number of each type of atom contained in the molecule.

Trade names

Trade names are the names that companies call their products. Examples of trade names are Freon-12, Genetron-11 and Algofrene-11. The ASHRAE number of a certain chemical often appears in the trade name like 11 or 12; this means that they are CFC-11 or CFC-12.

Trade names of the commercially relevant ozone-depleting refrigerants are presented in Annex B5 and will also be included in the accompanying diskette available on request from UNEP DTIE. The diskettes allow sorting of the table by trade name, company, or chemical name etc.

CAS numbers

The CAS registry number (CAS No) is a number assigned by the United States Chemical Abstracts Service to identify a chemical. The CAS number is specific for single chemicals and for some mixtures. It contains 5 to 9 digits separated into three groups by hyphens. The first group, starting from the left, has up to 6 digits, the second group always has 2 digits, the third group always has 1 digit.

This number, which has the format [123456-78-9], consisting of up to nine digits, has no chemical significance other than to unambiguously identify a particular substance, particularly in computerised literature retrieval systems. For example, the CAS No. for CFC-12 is 75-71-8.

UN numbers

The United Nations Substance Identification Number (UN SIN or UN number) is a four-digit international standard number which identifies a particular chemical or group of chemicals, e.g. CFC-12's UN number is 1028. The UN numbering system provides a unique identification number to each chemical substance. This number is commonly used throughout the world to aid in the quick identification of the materials

Example of ASHRAE number: R-123

Using R-123 as an example, "R" stands for refrigerant, the first digit on the right indicates the number of fluorine atoms (3 atoms), the second digit from the right indicates one more than the number of hydrogen atoms (2-1=1 atom), the third digit from the right indicates one less than the number of carbon atoms (1+1=2 atoms). If the third digit from the right is zero it indicates 1 carbon atom and can be omitted.

The number of chlorine atoms is found by subtracting the number of fluorine (3) and hydrogen (1) atoms from the total number of atoms, which can be connected to carbon atoms. One carbon atom can be connected with 4 other atoms, 2 saturated carbon atoms can be connected to 6 other atoms. Therefore R-123 contains 6-3(F)-1(H)=2 chlorine atoms. R-123 stands for dichlorotrifluoroethane or $C_2HCl_2F_3$.

Figure 29: Example of ASHRAE number: R-123

contained within bulk containers (such as rail cars, semi-trailers and intermodal containers).

ASHRAE numbers

The ASHRAE number for refrigerants is defined in ASHRAE standard 34-1997 on "Number Designation and Safety Classification of Refrigerants". The number designation of hydrocarbon and halocarbon refrigerants is systematic and allows the determination of the chemical composition of the compounds from the refrigerant numbers.

Labelling and packaging of ODS

Disposable containers

There are a variety of containers that ODS may be stored, transported and sold in. Some refrigerants are packaged in disposable containers. Disposables are manufactured in sizes from 1 to 50 pound capacities and should never be refilled.

Pressurised containers

Some ODS are gases at room temperature and must be stored in pressurized containers (cylinders).

Pressure-less drums, cans, bottles

Other ODS are liquids at room temperature and can be stored and transported in drums, cans, barrels, bottles, etc. Refrigerants packaged in small cans are expensive and are usually not imported in huge quantities. Therefore customs officers should be suspicious of huge quantities of cans being imported and declared as non-ODS refrigerants.

Often, cylinders as well as drums, cans, and bottles are protected by transport packaging as the following photos illustrate.

Nothing in these pictures is intended to suggest that any of the companies whose products are shown is involved in any illegal trading activity.

Photo 9: Cardboard packaging & 30 lb. cylinder

Photo 10: Cardboard packaging for 30 lb. cylinder

Photo 11: 1 lb. Canisters & cardboard packaging

Photo 12: Cardboard packaging for 30 lb. cylinder

Photo 13: Cardboard packaging for 30 lb. cylinder, top view

Photo 14: Pallet of CFC-12

Photo 15: Pallet of CFC-12

Photo 16: Traditional reusable cylinders

Photo 17: Example of CFC-12 cylinder, dichlorodi-fluoromethane

Photo 18: "Recovered" R-502, mixture of 49% HCFC-22 & 51% CFC-115, cylinder

Photo 19: Various low pressure containers

Photo 20: 50 & 30 lb. Reusable cylinders; 30 lb. disposable cylinder

Photo 21: Modern reusable cylinders

Photo 22: Various sizes of recoverable containers

Photo 23: Stacked ISO containers

Photo 24: ISO tanks allow for multimodal transport of large quantities of refrigerants.

Photo 25: Front end of an ISO tank

ISO tank labelling

a. CXCU 505808-6	unique container number
b. TARE 2894 KG	weight of container w/o product
TARE 6380 LB	weight of container w/o product
c. MAX PAYLOAD 27586 KG	amount of product
MAX PAYLOAD 60820 LB	amount of product
d. MAX GROSS 30480 KG	Tare + max payload
MAX GROSS 67200 LB	Tare + max payload
e. CHEMICAL NAME	Trichlorotrifluoroethane R-113

Figure 30: Example of ISO tank labelling

Photo 26: Barrel of halon 1301 (bromotrifluoromethane)

Photo 27: Cylinder of Bromochlorodi-fluoromethane

Labelling of products and equipment

Voluntary labelling

Some countries have introduced voluntary labelling schemes for ozone-friendly technology at the national level. Companies who wish to use such ozone-friendly labels on their products need to comply with certain criteria. Such labelling is usually referred to as positive labelling. Currently, there is no labelling requirement for ODS-based technology.

Some major companies have created their own positive labelling schemes in order to gain a competitive advantage. Such labels are company-specific and may indicate "ozone friendly", "CFC-free" or "environmentally friendly".

Equipment labelling

Equipment labelling usually indicates the manufacturer, the power supply, some basic technical data and the type and quantities of the working fluids. Therefore, refrigeration, air-conditioning systems, and compressors should usually have a label indicating the type and quantity of the refrigerant charge. There are no international standards specifying how retrofitted systems should be labelled. UNEP's "Guidebook for Implementation of Codes of Good Practices" suggests a format for a retrofitting report.

There are also no standards specifying the locations for labelling, which make it difficult for customs officers to find them.

Refrigerator labels

For example, refrigerator labels can be found in various locations. The cardboard box containing the refrigerator may have a label that specifies the refrigerant. The user instructions may also provide this information. Labels are often on the side, the back or sometimes hidden on the ceiling of the cooling compartment, or on the backside of the refrigerator. If no label or user manual can be found, then the compressor should be inspected, which may require removing the back cover. **Attention: Inspection of the compressor should never be done when the refrigerator is plugged in.**

Vehicle air-conditioning labels

Vehicle air-conditioners may have labels under the hood, on the chassis, on equipment in the engine, or on the compressor. **Attention: Inspection of the motor compartment should never be done with the motor running.**

ASHRAE safety groups for refrigerants

The ASHRAE safety groups for refrigerants standard classifies commonly used refrigerants depending on their toxicity and flammability. The standard defines 6 safety groups – A1, A2, A3, B1, B2 and B3 where "A" signifies lower toxicity, "B" higher toxicity, "1" signifies no flame propagation, "2" lower flammability, and "3" higher flammability.

Therefore "B3" signifies a refrigerant with higher toxicity and higher flammability. ASHRAE safety groups for the most common ozone-depleting refrigerants are included in Annex B1 and are also described in Chapter 4 on Safety & ODS.

ARI colour codes

The ARI colour assignments for refrigerant containers are described in more detail in ARI guideline N. Examples of the colour assignments can be found in Annexes B6 and B7 and on the inserted customs poster.

ARI Guideline N is a voluntary US industry guideline for the uniform assignment of colours for containers used for new or reclaimed refrigerants that meet ARI Standard 700 purity specifications.

Containers used to store recovered refrigerants do not fall under the scope of ARI Guideline N. The colour for all refrigerant recovery containers is grey with a yellow top shoulder or cap as specified in ARI Guideline K.

Refrigerant container colour assignment assist in quickly distinguishing refrigerants within containers. However, a container's colour should not replace positive verification of its contents from nameplates or other identifying markings. The same colour may be assigned to different refrigerants provided those refrigerants are in different classes.

As defined in ARI Guideline N, the refrigerant classes are:

- Class I - low pressure refrigerants,
- Class II - medium pressure refrigerants,
- Class III - high pressure refrigerants, and
- Class IV - flammable refrigerants.

Containers used for storage of flammable refrigerants should also have a red coloured band around its top shoulder or cap.

The tables in Annex B include the refrigerant container colour assignments as per ARI Guideline N, firstly sorted by ASHRAE refrigerant number (Annex B6) and secondly sorted by colour codes following the Pantone® Matching System (PMS) specifications (Annex B7). Descriptions of colours are only for general reference. More information can be found at ARI's Web site "ARI Coolnet" under http://www.ari.org/.

The UNEP customs poster, which is inserted into this training manual, shows examples of colour assignments for selected refrigerants.

The colour codes used for marking ODS containers vary from country to country. Colour codes often vary within the country. For example, the military may have different colour codes for ODS containers than industry.

Knowledge check:

1. What HS codes are being developed to better monitor ODS trade?
2. Describe the various ODS names.
3. Describe the different containers and packaging for ODS.
4. Describe the location of labelling for refrigerators and vehicle air conditioners.

7. Identifying ODS

This chapter focuses on the different methods of identifying and analysing chemical substances, which are potentially mislabelled ODS or illegal ODS imports. The different smuggling schemes and methods to detect illegal trade are described in Chapter 5. The checking of labelling is described in Chapter 6. Customs officers should be trained in the use of ODS-identifying equipment.

Random testing/sampling is advised to verify the contents of both large and small containers of all types of gas and chemicals as well as ODS equipment and products.

The following section lists the various ODS-identifying equipment available and their limitations to correctly identifying ODS.

Safety precautions checklist for ODS testing

- Only specially trained and authorised technicians or personnel of the accredited Government Laboratory should take samples for chemical analysis. Local regulations should be respected.
- Only trained and authorised customs officers should use refrigerant identifiers/analysers, leak detectors and perform the pressure-temperature test. Local regulations should be respected.
- The "halide torch method" (flame test) for leak testing or open flames should be avoided because some substances are flammable.
- When inspecting or testing equipment, the power supply should be disconnected, e.g. refrigerators unplugged or vehicle motors turned off.
- Respect the safety precautions explained in Chapter 4 and respect the local safety regulations.

Figure 31: Safety precautions checklist for ODS testing

Where can ODS be found ?

ODS can be found in containers and also in equipment and products. The container will vary depending on the type of ODS. For example, liquefied compressed gases are contained in pressurised cylinders. Liquid ODS are contained in pressure-less drums, barrels, bottles or other standard containers as they are used for all types of liquid chemicals.

ODS may also be contained in the following products and equipment:

- Vehicle air-conditioning systems,
- Refrigerators,
- Freezers,
- Dehumidifiers,
- Water coolers,
- Ice machines,
- Air conditioning & heat pump units,
- Compressors,
- Aerosol products,
- Portable fire extinguishers,
- Insulation boards, panels and pipe covers,
- Foams, and
- Pre-polymers.

Photo 28: Refrigerant identifier (please note that R-134a is not an ODS)

Refrigerant identifiers/analysers

Refrigerant identifiers/analysers are small portable units and allow the reliable identification of certain ODS and non-ODS. The more sophisticated models detect CFCs, HCFCs, HFCs and hydrocarbons and are able to also analyse composition, water content, and purity.

Portable identifiers/analysers are connected to the cylinder or equipment and do not require taking samples. Therefore any trained customs personnel familiar with the use of refrigerant identifiers/analysers can test the refrigerant charge of cylinders, refrigerators and stationary and mobile air-conditioning systems.

Access valves for equipment containing ODS vary. Specialised equipment may be needed to test refrigerators, compressors and mobile and stationary air–conditioners, as many of these have sealed metal valves. Access valves for vehicle air-conditioners are located on the compressor. Safety precautions need to be observed when testing.

Pressure/temperature test

Photo 29: Conducting a temperature/ pressure test

It is likely that smugglers will attempt to smuggle pure and not contaminated refrigerants. The vapour pressures of pure refrigerants, measured at a certain temperature, are sufficiently distinct for most refrigerants and provide a good indication of the refrigerant type. Exceptions are CFC-12/HFC-134A and CFC-11/HCFC-123 whose vapour pressures are too similar to allow clear identification of the substances.

In order to measure the pressure, a manifold gauge has to be connected to the cylinder/equipment. The pressure and temperature should be measured at the same time. If the cylinder/equipment is stored at a constant temperature, the ambient temperature will be identical with that of the ODS. The location of the access valves is described in the above section on refrigerant identifiers/ analysers. Using the pressure/temperature relationships in Annex B8, the type of ODS can be determined.

This method can be ineffective if nitrogen or other gases are put into the cylinder/equipment. This will alter the temperature/pressure relationship.

Leak detectors

Photo 30: Example of leak detector

Leak detectors do not identify or analyse a specific refrigerant. They indicate the presence of certain atoms (e.g. chlorine or fluorine atoms) in the air that would be present only if the cylinder is leaking.

New cylinders with virgin refrigerant usually do not leak. Refilled containers may leak and can be mislabelled.

Storage areas for refrigerants should be regularly inspected for leaks for safety reasons.

The "soap bubble method" is another simple method to locate leaks. This method does not require any testing equipment, other than liquid soap.

Sampling

Chemical analyses of the contents of large containers or tanks, which are required to prepare court cases, requires samples to be taken by specially trained and authorised technicians or personnel of the accredited government laboratory. Smaller refrigerant cylinders can be transported to the laboratory without taking samples.

Customs officers should not take samples, unless they are specially trained technicians and authorized to do so. The government laboratory may be able to provide specialised training to technicians.

If refrigerant identifiers/analysers are not available at the point of entry, then the government laboratory should analyse the contents of any suspicious shipments.

Both mass spectrometers and gas chromatographs are commonly used to analyse chemicals. Such equipment is not available in all countries because of the high cost. Staff using this equipment must be highly trained to interpret the results of the analysis.

The contact information of qualified refrigeration technicians or trained and authorised staff of the government laboratory should be made available to customs officers should they need their help in taking samples.

Knowledge check:

1. Where can ODS be found?

2. Describe the Temperature/ Pressure test.

3. What are the prescribed methods for sampling?

8. Preparation of Phase II customs training

Phase I of the customs training – the train-the-customs-trainers phase — in combination with the UNEP customs training manual and the "National Handbook on ODS Regulations and Import / Export Licensing System" has provided all the necessary information to plan and conduct Phase II of the customs training – the train-the-customs-officers phase. The Phase I training includes a specific session on the planning of Phase II.

The trained customs trainers, in close co-operation with the National Ozone Unit, will organise Phase II of the training programme. This chapter details the tools and some useful strategies for planning the Phase II training. Generic training elements such as agendas, concept note, evaluation questionnaire, participation certificate and overheads can be found in Annexes D and E.

Training tools

When developing the training materials for Phase II, you should consider using the training tools from the Phase I training as well as adapting them or creating new tools such as the desk book for customs officers.

- **Deskbook for customs officers**

Consider the preparation of a deskbook for customs officers, which provides the customs officers with the essential information needed for effective enforcement of the ODS regulations and the prevention of illegal trade. Figure 32 offers a sample outline of what could be included in this deskbook.

- **Video resources**

Select relevant segments of the videos to support your presentations and to visualise the specific subject areas. The videos should be available with the NOU.

Deskbook for customs officers outline

I. Health and environmental effects of ozone depletion

II. Customs officers' role
- Customs checklist

III. Laws and regulations to stop ozone depletion
- Montreal Protocol
- Import/export licensing system (national laws)

IV. National background on ODS trade
- Consumption information
- List of known importers
- Supplier countries

V. Common smuggling schemes

VI. Identification of ODS
- HS Codes
- ODS names
- CAS, UN, ASHRAE numbers

Figure 32: Sample deskbook for customs officers outline

- **Customs poster**

Show the poster to customs officers, Government representatives and other stakeholders in order to raise awareness. This is an awareness tool for customs officers to keep in mind the main issues concerning ODS, the customs checklist, the safety checklist, the ARI colour codes, trade names, chemical names, HS codes, CAS and UN numbers, as well as ODPs and GWPs for selected refrigerants. The customs poster is inserted in this UNEP customs training manual.

- **Case studies for customs inspectors**

Adapt the generic case studies to the conditions in your country to include proper names, places and organisations. Use them for an interactive group session. If you decide to create your own case studies, the answers should also be prepared. The generic case studies are included in Annex D.8.

- **Overheads**

Complement the overheads included in Annex E with your own overheads as appropriate. Overheads should not be too loaded with text. Some keywords may guide your presentations.

- **Demonstration materials**

Borrow demonstration materials such as ODS, refrigerant cylinders and packaging as well as ODS products and equipment from a local refrigeration servicing company for display and for the practical exercises. Customs officers should examine the labelling, packaging and containers, then determine whether they potentially contain ODS.

Borrow further reference documents for display from the NOU.

- **Document display**

Adapt the evaluation questionnaire and request that all participants complete it. This is a simple feedback mechanism in order to ensure and improve the quality of the training.

- **Evaluations questionnaire**

Explain basic terms used in presentations (see Annex A).

- **Terminology**

Wrap up each session by asking a set of key questions. This allows the trainer and the participants to assess their knowledge and to ask questions.

- **Knowledge check**

Copy generic training elements from the diskettes in order to save time. The diskettes will also contain some key tables, such as the trade names list, CAS, ASHRAE and UN numbers. The diskettes can be made available upon request by interested persons.

- **Diskettes**

The final version of this training manual will be made available in PDF format on the UNEP DTIE's OzonAction Programme website . This website also contains other relevant resource documents. The manual will also be included in UNEP's CD-ROM OASIS, which is available from the NOU.

- **WWW & CD-ROM OASIS**

Monitoring & evaluation

Any successful customs training requires monitoring of the major performance indicators on a regular basis. Specific and measurable performance indicators should be defined for Phase I and Phase II of the training programme as well as for the continuous customs operations under the ODS import/export licensing system. For each of the performance indicators, realistic targets should be defined and corrective measures should be taken if necessary.

Performance indicators for Phase I training

- Country Handbook on ODS Regulations and Import/Export Licensing System
- Relevant topics covered in workshop agenda
- Number of customs trainers and stakeholders trained
- Evaluation by participants and feedback (e.g. questionnaire)
- Workshop report including the workshop recommendations
- Creation of a network of relevant stakeholders

Performance indicators for Phase II training

- Local training materials for Phase II training
- Country specific deskbook for customs officers
- Number of customs officers trained
- Evaluation by participants and feedback (e.g. questionnaire)
- Sustainability of the training programme through inclusion of a Montreal Protocol related training module in the ongoing training curricula for customs personnel
- Coverage of ports of entry with trained customs officers
- Coverage of ports of entry with refrigerant identifiers
- Workshop recommendations from Phase I implemented

Performance indicators for customs operations under the ODS import/export licensing system

- Data collection on legal imports of ODS and ODS-based products and equipment
- Number of illegal imports detected and seizures
- Number of suspect shipments specifically checked for ODS
- Use of refrigerant analysers
- Co-operation with neighbouring countries
- Co-operation with relevant stakeholders (network of relevant stakeholders).

Figure 33: Performance indicators for Phase I training, Phase II training & for customs operations under the ODS import/ export licensing system.

Checklist for workshop preparation

The organisation of a successful training programme is a complex task and requires dedication and organisational skills. The following sections provides a non-exhaustive checklist of activities which need to be addressed during the preparation of training workshops in general:

Design and approach

- The overall timeframe, objective, scope, target group and approach for Phase II of the training programme should be defined.
- The training may be designed as a day, evening or weekend course. It may be training on the job, training as part of ongoing refresher courses, or training integrated in training programmes for new customs officers. The duration of each training should be defined.
- The planning should take into account the different ports of entry, the number of training workshops to be held, and the number of participants to be trained. The potential locations for the training should be determined – whether the training should be held in the capital or in the different ports of entry.
- Consult and co-ordinate with the resource persons, participants and other relevant stakeholders.
- Determine appropriate milestones and deadlines such as recruiting the presenters, selecting the participants, providing the venue, preparation and reproduction of training materials, media briefing, etc.
- The financial, human and physical resources available should be determined and the necessary resources for the training organisation estimated. Compromises may need to be made to accommodate the required resources within the available funding.
- The contents and agenda of the training module should be defined and the necessary training materials and tools identified. The training materials need to be reproduced. Examples of generic agendas, concept note and other training elements are included in Annex D.
- The concept note should summarise the objective, scope, target group, approach and contents of the training programme. It should also explain the organisational arrangements and indicate the training location and dates. This concept note is useful to inform presenters and participants and can also be used as a training announcement and briefing material for the media.
- The planning should consider local habits such as festivity seasons or peaks of workload, as well as the usual working time of the participants, which differs from country to country. Local traffic conditions should also be considered.

Trainers and local resource persons

- Appropriate trainers who participated in Phase I of the training programme should be contracted and their terms of reference and delivery schedule defined. Additional local resource persons may be invited as appropriate. The available budget should be respected.

Participants

- A register of potential participants should be prepared and criteria defined to determine which customs officers should be trained with priority and which should be authorised to use identifying equipment. Each port of entry should have at least some trained customs officers authorised to use the equipment.
- Participants should be invited well in advance. Participants who do not confirm their participation should be replaced with participants from the reserve list. The careful selection of the right participants is crucial for a successful workshop.
- Prior to the training, participants should receive a preliminary agenda and some background information regarding the training programme.
- The registration form, preliminary list of participants, participation certificates, etc. should be prepared in advance. The participation certificates should be signed by a Government representative and the trainer.
- Each participant must complete the registration form with their full name, function, contact address, fax, phone, email, etc. before the workshop starts.
- Training materials, nameplates, badges and other workshop information should be handed over to the participants during registration. All papers should be contained in one folder.
- The list of participants should be circulated during the workshop to verify the contact data.
- The list of attendance should be completed for every workshop day.
- Participants who successfully attend all workshop days should receive a participation certificate at the end of the workshop.
- Participants should be included in the register of trained officers.

Training material

- The folders containing the workshop information and training materials should be prepared in advance. This may include photocopying of the concept note, training agenda, country handbook, and other documents.
- The training materials should be handed over during registration and should be explained at the beginning of the workshop.
- Further reference materials should be displayed at a separate table, e.g. near the entrance of the classroom.

Media briefing

- Local media should be informed about the training programme and receive the concept note and other relevant information materials. If possible, radio and TV interviews should be arranged and local newspapers invited to attend the introductory presentations.

Support personnel

- There should be sufficient support personnel for registration, photocopying, preparation and distribution of papers (list of participants, workshop recommendations etc), local transport, lunch and coffee arrangements, etc.

Logistics

- Inform all participants and presenters of logistical arrangements, such as location, travel arrangements, meal arrangements, materials, etc.
- If possible, lunch should be arranged at the training site in order to save time. The participants need to be informed about the lunch arrangements.

Venue

- The classrooms should be prepared well in advance and equipped with all necessary equipment, e.g. chairs, tables, overhead projectors, television, video, slide projectors, screen, extension cables, etc.
- All electrical equipment should be connected and checked in advance.
- A table for displaying examples of ODS containers & packaging, ODS containing products and ODS-based equipment, as well as additional reference materials should be arranged.
- ODS-related posters may be placed on the walls of the classroom.
- The practical sessions should be held in a well-ventilated workshop facility equipped with basic tools, power, adapters, extension cables etc. All electric equipment should be safe to use.

Equipment

- The refrigerant identifiers need to be available for the practical hands-on sessions. In case no identifiers are provided through the training, they should be borrowed for the training if possible.
- The practical identification exercises require different types of ODS containers and ODS- based equipment, for example a refrigerator, a stationary air-conditioning unit, an air-conditioned car and compressor.
- Additionally, products typically found in the local market and potentially containing ODS should be displayed for discussion. These may include paints, aerosol cans, solvents etc.
- Any products with ODS-free labels may also be very useful for customs officers.

Evaluation

- Distribute and collect the evaluation questionnaires during the last day of the train-the-trainers workshop. The questionnaires may follow the model of those for Phase I of the training.
- There should also be short feedback session on the effectiveness of the different sessions and how to improve future training.

Follow-up

- The NOU will monitor and evaluate the results of the training programs and prepare a follow-up report.
- The performance indicators as described in the previous section may be applied or additional indicators defined.

Figure 34: Checklist for preparation of customs training workshops

Interactive training techniques

Interactive training programmes include a variety of activities that demand active involvement from both participants and presenters. Using the following suggestions can enhance facilitation of sessions. However, it is important to note that not all groups will respond in the same manner to the different techniques. *Flexibility* is key to working with groups and changing approaches may be required until one is found that best meets participants' needs.

A number of techniques are available to trainers to increase the involvement of and the interaction between the participants, ranging from asking key questions, using examples, using visual aids, and facilitating group work and action planning. It is important to first develop training objectives, define the audience and then decide which tool is most appropriate to meet the programme goals.

When incorporating these interactive tools into a training programme the following are some key questions to consider:

- What are the goals of the programme?
- Why is this information relevant to the customs inspectors?
- How will customs investigators apply this information on the job?

Using questions

Asking questions is a way to encourage participants to share ideas and experiences with each other, and to foster participant interest in the training content. Sharing ideas and information through group discussion can be a useful device throughout the training programme. Discussion can be started through questions posed by the facilitator. In designing the programme, the facilitator should be prepared with suggested questions that he or she may use to induce the lively exchange of ideas.

Using examples

Use examples as much as possible to illustrate points made during the training experience. These can be used to demonstrate a point that has been discussed in a previous session, or as a starting point for key elements in a discussion. An example drawn from a situation that involved the topics discussed in the training or recent newspaper article on an event related to the programme topic is a good type of example to use.

Using visual aids

Clear visual aids such as overheads, slides, video presentations and flip charts should be used to enhance the learning experience. Participants rely on these visual aids to understand key points of the presentation. These materials should highlight the most important concepts and

information in the technical sessions and serve as reference material for the participants once they return to their jobs.

Group work

Group work is another way to encourage participants to focus their thinking and to reach consensus on a particular issue. Group work increases the involvement and ownership by the participants. By dividing the large group into small discussion groups of 4-6 people, the groups can respond to questions posed to them.

A group leader should be selected by each group to take notes and present the group's conclusions to the larger group at a designated time in the schedule. Time for sharing of conclusions may be scheduled either at the end of the small group discussion session, or after a series of discussion sessions, depending on the size of the groups, the programme topics and the flow of the schedule.

Checklist to be an effective trainer

The trainer's role is to promote the learning process by taking into account the challenges faced by customs inspectors at their workplace, and the challenges of the material presented in the training itself. There is no set way to facilitate a programme, however some tasks performed by effective trainers are listed below:

- Check audio-visual equipment in the classroom before the workshop starts.
- Introduce programme presenters to participants and let the participants introduce themselves.
- Initiate discussions by asking questions and ensuring that participants' questions are addressed in the session or raised again in a more appropriate, subsequent session.
- Highlight examples and participants' concerns that presenters can reference in their sessions.
- Link session content and key points to subsequent or previous sessions.
- Help participants ask questions that they are too afraid or uncomfortable to ask on their own.
- Collect additional reference materials from presenters that they agree to locate for participants once they return to their offices after delivering a session.
- Clarify for participants their responsibilities for learning activities once assignments for session activities have been presented to them and they are working in small groups.
- Observe groups and be aware of occasions when participants become confused, disillusioned, fatigued or saturated so that programme discussions can be clarified, interrupted for a break, or shortened.
- Understand and articulate participants' needs to connect them with appropriate people, ensuring that the participants are able to leave the programme satisfied and as fully empowered to address their challenges.
- Listen to in-session and outside-session discussions to assess how the programme is proceeding and identify ways to address participants' emerging needs and/or concerns.
- Listen to and acknowledges all ideas.
- Praise participants' ideas when appropriate.
- Allow other members in the group to attempt to answer questions raised by participants.
- Write down participants' ideas on a board in front of the group to show that their ideas are valid and valuable.
- Remind participants of points made previously in the training to show an inter-relation among concepts.

- Refer to presenters by name when referencing points they made during their technical discussions so they become familiar to the participants.
- Point out positive behaviours displayed by participants and their effect.
- Reinforce group compliments to an individual and elaborate upon them.
- Ask for examples from the group's own experiences.
- Share own experiences.
- Diffuse arguments and avoid expressing judgement on what may be considered "right" or "wrong" in discussing different options.
- Spend additional time with participants and presenters during breaks and before and after the day's sessions to learn more about their background, training needs, assessment of training experience and expectations.
- Focus on the participants' concerns and always try to address them.
- Give complete instructions when advising the participants on the schedule and/or activities and explain why requests are important.
- Take notes and fulfil promises to provide assistance or additional information.
- Begin and end sessions on time
- Give constructive feedback and build behaviours through positive reinforcement.

Figure 35: Checklist to be an effective trainer

Knowledge check:

1. Describe the various tools needed for training during Phase II.
2. Why is monitoring and evaluation of the training program important?
3. What are the different interactive training techniques?

Annexes

Annex A: Definitions

Adjustment	Adjustments are changes to the Protocol with regard to the phase-out timetable for existing controlled substances as well as ODP values of controlled substances based on new research results. They are automatically binding for all countries, which have ratified the Protocol, or the relevant amendment, which introduced the controlled substance. Adjustments can change the text of the Protocol. In addition, the Parties can also take Decisions, which do not change the text but interpret the text.
Amendment	Amendments are other more significant changes to the Protocol, such as adding new substances to the list of controlled substances, or new obligations. Parties are not bound by these changes to the Protocol unless and until they ratify the Amendment. Amendments have to be ratified in the chronological they were agreed. Countries, which have not ratified a certain amendment, will be considered as a non-Party with regard to new substances or obligations introduced by that amendment.
Annex A substance	Ozone depleting substance listed in Annex A of the Montreal Protocol: Group I: CFCs 11, 12, 113, 114 and 115. Group II: Halons 1211, 1301 and 2402.
Annex B substance	Ozone depleting substance listed in Annex B of the Montreal Protocol: Group I: ten "other CFCs" (most of them not in commercial use) Group II: carbon tetrachloride Group III: 1,1,1-trichloroethane (methyl chloroform)
Annex C substance	Ozone depleting substance listed in Annex C of the Montreal Protocol: Group I: 40 HCFCs (some 5-10 in commercial use) Group II: 33 HBFCs (most of them not in commercial use) Group III: bromochloromethane (added by Beijing Amendment in 1999)
Annex D product	List of products containing controlled substances specified in Annex A of the Montreal Protocol which may not be imported from countries that are not Parties to the Protocol.
Annex E substance	Ozone depleting substance listed in Annex E of the Montreal Protocol: Methyl bromide.
ARI colour assignments	ARI Guideline N is a voluntary industry guideline for the uniform assignment of colours for containers used for new or reclaimed refrigerants that meet ARI Standard 700 purity specifications.
Article 5 countries	Developing countries which are Party to the Montreal Protocol with an annual calculated level of consumption less than 0.3 kg per capita of the controlled substances in Annex A, and less than 0.2 kg per capita of the controlled substances in Annex B. These countries are permitted a 10 year grace period for most substances compared with the phase-out schedule for developed countries.

ASHRAE number	The ASHRAE number applies to refrigerants and is defined in ASHRAE standard 34-1997 on "Number Designation and Safety Classification of Refrigerants". The number designation of hydrocarbon and halocarbon refrigerants is systematic and allows determining the chemical composition of the compounds from the refrigerant numbers.
Azeotrope	A constant-boiling mixture. A unique mixture of two or more chemicals that distils at a certain constant temperature and has a constant composition at a given pressure. An azeotrope behaves like a pure fluid.
Beijing Amendment	Refers to the amendments decided by the Eleventh MOP which introduced HCFC production controls, the listing of bromochloromethane as a controlled substance, and the reporting of methyl bromide uses for the exempted quarantine and pre-shipment applications.
Carbon-tetrachloride (CTC)	A chlorocarbon solvent (CCl_4) with an ODP of approximately 1.1 that is controlled under the Montreal Protocol. It is considered toxic and a probable human carcinogen as classified by the International Agency for Research on Cancer. Its use is strictly regulated in most countries and it is used primarily as a feedstock material for the production of other chemicals.
CAS number	The CAS registry number (CAS No) is a number assigned by the United States Chemical Abstracts Service to identify a chemical. The CAS number is specific for single chemicals and for some mixtures. It contains from 5 to 9 digits separated into three groups by hyphens. For example, the CAS No. for CFC-12 is 75-71-8.
Cataract	Damage to the eye in which the lens is partly or completely clouded, impairing the vision and sometimes causing blindness. Exposure to ultraviolet radiation can cause cataracts.
Chlorofluoro-carbon (CFC)	A family of organic chemicals composed of chlorine, fluorine and carbon. These fully halogenated substances are commonly used in refrigeration, foam blowing, aerosols, sterilants, solvents cleaning and a variety of other applications. CFCs have the potential to destroy ozone molecules in the stratosphere and are one of the main causes of ozone depletion.
Consumption	The Montreal Protocol defines the consumption of a controlled substance as production plus imports minus exports. Most Article 5 countries are importing all ODS which is used in the country.
Copenhagen Amendment	Refers to amendments decided by the fourth meeting of the Parties to the Montreal Protocol in Copenhagen 1992 whereby controls on Annex C and E substances were added. At this meeting, the phase-out schedules for Annex A and B substances were also accelerated.
Country Handbook	Country Handbook on ODS Regulations and import/export licensing system discusses the national regulations and the operational details of the licensing system.

Essential use	Countries may request essential use exemptions on behalf of individual enterprises if the specific ODS is either necessary for health, safety or for the functioning of society and no acceptable alternative is available. The Meetings of the Parties decides on such requests on a case-by-case basis. A global exemption has been granted for laboratory and analytical uses. Exempted use of a controlled substances does not count towards a country's consumption.
Feedstock	Controlled substances that are used in the manufacture of other chemicals and are completely transformed in the process are defined as feedstock. For example, carbon tetrachloride is commonly used in the production of CFCs. Amounts used as feedstock are exempted from controls (exempted category) and need to be reported.
Global warming	Global warming & climate change is caused by the emission of greenhouse gases that trap the outgoing heat from the Earth causing the atmosphere to become warmer. Greenhouse gases include carbon dioxide, methane, CFCs, HCFCs and halons. The global warming potential (GWP) is the relative contribution of each greenhouse gas to global warming relative to carbon dioxide whose GWP is defined as 1. It usually refers to a time span of 100 years (GWP 100).
Greenhouse gas	A gas that traps heat in the Earth's atmosphere, contributing to global warming.
Ground level ozone	Photochemical pollution, car and industry emissions provide the basis for photochemical reactions. Has adverse effects on human health and the environment.
Halon	Brominated chemicals related to CFCs that are used in fire fighting and have very high ODPs.
Hydrobromo-fluorocarbon (HBFC)	A family of hydrogenated chemicals related to halons, but with lower ODP.
Hydrocarbon (HC)	A chemical compound consisting of one or more carbon atoms surrounded only by hydrogen atoms. Examples of hydrocarbons are propane (C_3H_8, HC-290), propylene (C_3H_6, HC-1270) and butane (C_4H_{10}, HC-600). HCs are commonly used as a substitute for CFCs in aerosol propellants and refrigerant blends. The hydrocarbons have an ODP of zero. Hydrocarbons are volatile organic compounds, and their use may be restricted or prohibited in some areas. Although they are used as refrigerants, their highly flammable properties normally restrict their use as low concentration components in refrigerant blends.
Hydrochloro-fluorocarbon (HCFC)	A family of hydrogenated 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.
Hydrofluoro-carbon (HFC)	A family of chemicals related to CFCs, which contain hydrogen, fluorine and carbon, but no chlorine, and therefore do not deplete the ozone layer.
ISO container	Used for bulk liquid shipments. ISO container provides the flexibility of using various transportation modes such as truck, rail, and ship.

London Amendment	Refers to amendments decided by the Second MOP, whereby controls on Annex B substances were added. At this meeting, the phase-out schedules for Annex A substances were also accelerated and the Interim Multilateral Fund was established to assist developing countries in their efforts in phasing out ODS.
Manifest	A written document required to be carried by merchant vessels, containing an account of the contents, value, origin, carrier, and destination of the goods to be shipped or warehoused. It also includes a list of passengers.
Methyl bromide (MB)	A chemical composed of carbon, hydrogen, and bromine, which is used mainly as an agricultural pesticide and fumigant, and has a significant ODP.
Methyl chloroform (MCF)	Also known as 1,1,1-trichloroethane; a chemical composed of carbon, hydrogen, and chlorine, which is used as a solvent and blowing agent and has an ODP about a tenth that of CFC-11.
Montreal Amendment	Refers to amendments decided by the Ninth MOP in Montreal, whereby, inter alia, requirements on import and export licensing systems were introduced. At the same meeting, phase-out schedules for methyl bromide were accelerated.
Montreal Protocol (MP)	The Protocol to the Vienna Convention, signed in 1987, which commits Parties to take concrete measures to protect the ozone layer by freezing, reducing and phasing-out the production and consumption of controlled substances.
Ozone depletion	The process by which stratospheric ozone molecules are destroyed by man-made chemicals, leading to a reduction in its concentration.
Ozone-depleting substance (ODS)	Any substance which is controlled under the Montreal Protocol and its amendments. ODS include CFCs, HCFCs, Halons, carbon tetrachloride, methyl chloroform, hydrobromofluorocarbons, bromochloromethane and methyl bromide. ODS have ozone-depleting potentials greater than 0 and can deplete the stratospheric ozone layer.
ODS-based product/ equipment	Product or equipment which contains ODS, including equipment whose continuous functioning relies on the use of ODS.
Ozone layer	A term used to describes the presence of ozone molecules dispersed in the stratosphere. The stratosphere is that part of the Earth's atmosphere, which follows the troposphere. It starts at 10-20 km above ground level and continues up to 40-50 km height. The ozone layer acts as a filter against the ultraviolet radiation (UV-B) coming from the sun and protects life on Earth from the damaging effect of increased UV-B exposure.
Ozone-depletion potential (ODP)	A measure of a substance's ability to destroy stratospheric ozone, based on its atmospheric lifetime, stability, reactivity and content of elements that can attack ozone, such as chlorine and bromine. All ODPs are based on the reference measure of 1 for CFC-11.

Ozone molecule	Molecules containing three atoms of oxygen, and whose presence in the stratosphere constitutes the ozone layer.
Non-Article 5 (Article 2) country	All other Parties to the Montreal Protocol which are not Article 5 countries (mainly developed countries).
Non-Party	Any country, whose government has not ratified, accepted, approved or accessed the Montreal Protocol or one or more of its specific amendments is a non-party to the Protocol or to that particular amendment.
Party	A country that has signed and ratified the Montreal Protocol and its amendments. Being a Party to the Montreal Protocol means in practice for any country being a Party not only to the Montreal Protocol, but also to each of the amendments ratified by this country. Therefore, a country may be a Party to the Montreal Protocol, but a non-Party to a particular amendment to the Protocol.
Perhaloge-nated hydrocarbons	A chemical compound consisting of one or more carbon atoms surrounded only by halides. Examples of perhalogenated hydrocarbons are all controlled substances in Annex A and Annex B Groups 1 & 2 of the Montreal Protocol.
Phase-out	When the production and consumption of a controlled ODS is zero. In this context, consumption means the national production plus imports minus exports.
Process agent	Controlled substances used in the production of other chemicals (e.g. as a catalyst or an inhibitor of a chemical reaction) without being consumed as feedstock. Some uses of process agents are exempted under the Montreal Protocol. Please refer to Ozone Secretariat website for further information http://www.unep.org/ozone.
Reclaim	Re-processing used refrigerant to the product specification of new refrigerant. Chemical analysis of the refrigerant is required to determine that the appropriate specifications are met. The identification of contaminants and the required analysis must be specified in national or international standards for new product specifications.
Recovery	Removal of a refrigerant in any condition (vapour, liquid or mixed with other substances) from a system and to store it in an external container (ISO 11650 definition).
Recycling	Reduction of contaminants in used refrigerants by separating oil, removing condensables and using devices such as filter dryers to reduce moisture, acidity and particulate matter (ISO 11650 definition).
Retrofitting	The procedure when replacing CFC-refrigerants in existing refrigeration, air-conditioning and heat pump plants with non-ODS refrigerants. This procedure usually requires modifications such as change as lubricant, replacement of expansion device or compressor. Drop-in replacements do not require major modifications.
Stratosphere	A region of the upper atmosphere between the troposphere and the mesosphere, ranging from about 10-20 up to 40-50 km above the Earth's surface.

Ultraviolet radiation	Radiation from the sun with wavelengths between visible light and X-rays. UV-B (280-320 nm) is one of three bands of UV radiation and increased exposure to UV-B radiation can cause damage to human health and the environment.
UN number	The United Nations Substance Identification Number (UN SIN or UN number) is a four-digit international standard number which identifies a particular chemical or group of chemicals; e.g. CFC-12's UN No. is 1028.
Vienna Adjustments	Refers to adjustments decided by the Seventh MOP with regard to HCFCs and methyl bromide. The problem of non-compliance was tackled and the phase-out schedules for HCFCs were slightly advanced.
Vienna Convention	The international agreement made in 1985 to set a framework for global action to protect the stratospheric ozone layer. This convention is implemented through its Montreal Protocol.

Annex B: ODS information

Annex B.1: Controlled ODS and their identifiers

This list contains the ozone depleting substances (ODS) controlled under the Montreal Protocol and its amendments. It was compiled from UNEP's "Handbook for the International Treaties for the Protection of the Ozone Layer", an information paper of the UNEP Ozone Secretariat on the use of HS codes for pure ODS, the "ARI Guideline N" for colour assignments for refrigerant containers, the "ASHRAE standard 34-1997" on number designation and safety classification of refrigerants as well as other sources.

The different labelling information such as formulas, ASHRAE numbers for refrigerants, CAS numbers, UN numbers, HS codes, ARI colour assignments for refrigerants containers. The ASHRAE safety groups are defined in Chapter 4 on safety related issues. The ODP values are included as reference.

Name /Group	Chemical name	Formula	ASHRAE #	CAS #	UN #	HS code	ARI colour assignments for refrigerant containers	ASHRAE safety group	ODP
	Halogenated derivatives of hydrocarbons					2903			
Annex A Group I (CFC)	**Halogenated derivatives of acyclic hydrocarbons containing two or more different halogens**					**--2903.40**			
CFC-11	Trichlorofluoromethane	$CFCl_3$	R-11	75-69-4	1017	--2903.41	Orange	A1	1.0
CFC-12	Dichlorodifluoromethane	CF_2Cl_2	R-12	75-71-8	1028	--2903.42	White	A1	1.0
CFC-113	Trichlorotrifluoroethanes	$C_2F_3Cl_3$	R-113	76-13-1		--2903.43	Dark purple (violet)	A1	0.8
CFC-114	Dichlorotetrafluoroethanes	$C_2F_4Cl_2$	R-114	76-14-2	1958	--2903.44	Dark blue (navy)	A1	1.0
CFC-115	Chloropentafluoroethane	$CClF_2CF_3$	R-115	76-15-3	1020	--2903.44		A1	0.6
Annex A Group II (Halon)	**Halogenated derivatives of acyclic hydrocarbons containing two or more different halogens**					**--2903.40**			
Halon-1211	Bromochlorodifluoromethane	CF_2BrCl	R-12B1	353-59-3	1974	--2903.46			3.0
Halon-1301	Bromotrifluoromethane	CF_3Br	R-13B1	75-63-8	1009	--2903.46			10.0
Halon-2402	Dibromotetrafluoroethane	$C_2F_4Br_2$	R-114B2	124-73-2		--2903.46			6.0
Annex B Group I (CFC)	**Other derivates perhalogenated only with fluorine and chlorine**					**--2903.45**			
CFC-13	Chlorotrifluoromethane	CF_3Cl	R-13	75-72-9		--2903.45	Light blue (sky)	A1	1.0
CFC-111	Pentachlorofluoroethane	C_2FCl_5	R-111	354-56-3		--2903.45			1.0
CFC-112	Tetrachlorodifluoroethane	$C_2F_2Cl_4$	R-112	76-12-0		--2903.45			1.0
CFC-211	Heptachlorofluoropropane	C_3FCl_7		422-78-6		--2903.45			1.0
CFC-212	Hexachlorodifluoropropane	$C_3F_2Cl_6$		3182-26-1		--2903.45			1.0
CFC-213	Pentachlorotrifluoropropane	$C_3F_3Cl_5$		2354-06-5		--2903.45			1.0

Name /Group	Chemical name	Formula	ASHRAE #	CAS #	UN #	HS code	ARI colour assignments for refrigerant containers	ASHRAE safety group	ODP
CFC-214	Tetrachlorotetrafluoropropane	$C_3F_4Cl_4$		29255-31-0		- -2903.45			1.0
CFC-215	Trichloropentafluoropropane	$C_3F_5Cl_3$		1599-41-3		- -2903.45			1.0
CFC-216	Dichlorohexafluoropropane	$C_3F_6Cl_2$		661-97-2		- -2903.45			1.0
CFC-217	Chloroheptafluoropropane	C_3F_7Cl		422-86-6		- -2903.45			1.0
Annex B Group II	*Saturated chlorinated derivatives of acyclic hydrocarbons*					- -**2903.10**			
	Tetrachlormethane or carbon tetrachloride	CCl_4		56-23-5	1864	- -2903.14		B1	1.1
Annex B Group III	*Other*					- -**2903.19**			
	1,1,1-trichloroethane or methyl chloroform	$C_2H_3Cl_3$ [1]	R-140a	71-55-6	2831	- -2903.19			0.1
Annex C Group I (HCFC)						- -**2903.49**			
HCFC-21	$CHFCl_2$		R-21			- -2903.49			0.04
HCFC-22	CHF_2Cl		R-22	75-45-6	1018	- -2903.49	Light green		0.055
HCFC-31	CH_2FCl		R-31			- -2903.49			0.02
HCFC-121 [3]	Tetrachlorofluoroethanes	C_2HFCl_4				- -2903.49			0.01-0.04
HCFC-122 [3]	Trichlorodifluoroethanes	$C_2HF_2Cl_3$				- -2903.49			0.02-0.08
HCFC-123	Dichlorotrifluoroethanes	$C_2HF_3Cl_2$	R-123	306-83-2		- -2903.49	Light blue-grey		0.02-0.06
HCFC-123	2,2-dichloro-1,1,1-trifluoroethane	$CHCl_2CF_3$				- -2903.49			0.02
HCFC-124	Chlorotetrafluoroethanes	C_2HF_4Cl				- -2903.49			0.02-0.04
HCFC-124 [3]	2-chloro-1,1,1,2-tetrafluoroethane	$CHFClCF_3$	R-124	2837-89-0		- -2903.49	Deep green (DOT green)		0.022
HCFC-131	Trichlorofluoroethanes	$C_2H_2FCl_3$				- -2903.49			0.007-0.05
HCFC-132	Dichlorodifluoroethanes	$C_2H_2F_2Cl_2$				- -2903.49			0.008-0.05
HCFC-133	Chlorotrifluoroethanes	$C_2H_2F_3Cl$				- -2903.49			0.02-0.06
HCFC-141	Dichlorofluoroethanes	$C_2H_3FCl_2$				- -2903.49			0.005-0.07
HCFC-141b [3]	1,1-dichloro-1-fluoroethane	CH3CFCl2	R-141b	1717-00-6		- -2903.49			0.011
HCFC-142	Chlorodifluoroethanes	$C_2H_3F_2Cl$				- -2903.49			0.008-0.07
HCFC-142b	1-chloro-1,1-difluoroethane	CH_3CF_2Cl	R-142b			- -2903.49		A2	0.065
HCFC-151	Chlorofluoroethanes	C_2H_4FCl				- -2903.49			0.003-0.005
HCFC-221	Hexachlorofluoropropanes	C_3HFCl_6				- -2903.49			0.015-0.07
HCFC-222	Pentachlorodifluoropropanes	$C3HF_2Cl_5$				- -2903.49			0.01-0.09
HCFC-223	Tetrachlorotrifluoropropanes	$C_3HF_3Cl_4$				- -2903.49			0.01-0.08
HCFC-224	Trichlorotetrafluoropropanes	$C_3HF_4Cl_3$				- -2903.49			0.01-0.09
HCFC-225	Dichloropentafluoropropanes	$C_3HF_5Cl_2$				- -2903.49			0.02-0.07
HCFC-225ca [3]	1,1-dichloro-2,2,3,3,3-pentafluoropropane	$CF_3CF_2CHCl_2$	R-225ca			- -2903.49			0.025
HCFC-225cb [3]	1,3-dichloro-1,2,2,3,3-pentafluoropropane	CF_2ClCF_2CHClF	R-225cb			- -2903.49			0.033
HCFC-226	Chlorohexafluoropropanes	C_3HF_6Cl				- -2903.49			0.02-0.10
HCFC-231	Pentachlorofluoropropanes	$C_3H_2FCl_5$				- -2903.49			0.05-0.09
HCFC-232	Tetrachlorodifluoropropanes	$C_3H_2F_2Cl_4$				- -2903.49			0.008-0.10

Name / Group	Chemical name	Formula	ASHRAE #	CAS #	UN #	HS code	ARI colour assignments for refrigerant containers	ASHRAE safety group	ODP
HCFC-233	Trichlorotrifluoropropanes	$C_3H_2F_3Cl_3$				--2903.49			0.007-0.23
HCFC-234	Dichlorotetrafluoropropanes	$C_3H_2F_4Cl_2$				--2903.49			0.01-0.28
HCFC-235	Chloropentafluoropropanes	$C_3H_2F_5Cl$				--2903.49			0.03-0.52
HCFC-241	Tetrachlorofluoropropanes	$C_3H_3FCl_4$				--2903.49			0.004 -0.09
HCFC-242	Trichlorodifluoropropanes	$C_3H_3F_2Cl_3$				--2903.49			0.005-0.13
HCFC-243	Dichlorotrifluoropropanes	$C_3H_3F_3Cl_2$				--2903.49			0.007-0.12
HCFC-244	Chlorotetrafluoropropanes	$C_3H_3F_4Cl$				--2903.49			0.009-0.14
HCFC-251	Trichlorotetrafluoropropanes	$C_3H_4FCl_3$				--2903.49			0.001-0.01
HCFC-252	Dichlorodifluoropropanes	$C_3H_4F_2Cl_2$				--2903.49			0.005-0.04
HCFC-253	Chlorotrifluoropropanes	$C_3H_4F_3Cl$				--2903.49			0.003-0.03
HCFC-261	Dichlorofluoropropanes	$C_3H_5FCl_2$				--2903.49			0.002-0.02
HCFC-262	Chlorodifluoropropanes	$C_3H_5F_2Cl$				--2903.49			0.002-0.02
HCFC-271	Chlorofluoropropanes	C_3H_6FCl				--2903.49			0.001-0.03
Annex C Group II (HBFC)	**Derivates of methane, ethane or propane halogenated only with fluorine and bromine**					**--2903.49**			
		$CHFBr_2$				--2903.49			1.0
HBFC-22B1	Bromodifluoromethane	CHF_2Br	R-22B1			--2903.49			0.74
		CH_2FBr				--2903.49			0.73
		C_2HFBr_4				--2903.49			0.3 - 0.8
		$C_2HF_2Br_3$				--2903.49			0.5 - 1.8
		$C_2HF_3Br_2$				--2903.49			0.4 - 1.6
		C_2HF_4Br				--2903.49			0.7 - 1.2
		$C_2H_2FBr_3$				--2903.49			0.1 - 1.1
		$C_2H_2F_2Br_2$				--2903.49			0.2 - 1.5
		$C_2H_2F_3Br$				--2903.49			0.7 - 1.6
		$C_2H_3FBr_2$				--2903.49			0.1 - 1.7
		$C_2H_3F_2Br$				--2903.49			0.2 - 1.1
		C_2H_4Br				--2903.49			0.07 - 0.1
		C_3HFBr_6				--2903.49			0.3 - 1.5
		$C_3HF_2Br_5$				--2903.49			0.2 - 1.9
		$C_3HF_3Br_4$				--2903.49			0.3 - 1.8
		$C_3HF_4Br_3$				--2903.49			0.5 - 2.2
		$C_3HF_5Br_2$				--2903.49			0.9 - 2.0
		C_3HF_6Br				--2903.49			0.7 - 3.3
		$C_3H_2FBr_5$				--2903.49			0.1 - 1.9
		$C_3H_2F_3Br$				--2903.49			30.2 - 5.6
		$C_3H_2F_4Br_2$				--2903.49			0.3 - 7.5
		$C_3H_2F_5Br$				--2903.49			0.9 - 1.4
		$C_3H_3FBr_4$				--2903.49			0.08 - 1.9
		$C_3H_3F_2Br_3$				--2903.49			0.1 - 3.1
		$C_3H_3F_3Br_2$				--2903.49			0.1 - 2.5
		$C_3H_3F_4Br$				--2903.49			0.3 - 4.4
		$C_3H_4FBr_3$				--2903.49			0.03 - 0.3
		$C_3H_4F_2Br_2$				--2903.49			0.1 - 1.0
		$C_3H_4F_3Br$				--2903.49			0.07 - 0.8
		$C_3H_5FBr_2$				--2903.49			0.04 - 0.4

Name / Group	Chemical name	Formula	ASHRAE #	CAS #	UN #	HS code	ARI colour assignments for refrigerant containers	ASHRAE safety group	ODP
		$C_3H_5F_2Br$				- -2903.49			0.07 - 0.8
		C_3H_6FBr				- -2903.49			0.02 - 0.7
Annex C Group III	***Derivates of methane, ethane or propane, halogenated only with bromine and chlorine***					- -**2903.49**			
	Bromochloromethane[3]	CH_2BrCl				- -2903.49			0.12
Annex E Group I	***Fluorinated, brominated or iodinated derivates of acyclic hydrocarbons***					- -**2903.30**			
MB	Methyl bromide	CH_3Br		74-83-9	1062	- -2903.30			0.6

Notes:

1. This formula does not refer to 1,1,2-trichloroethane.

2. Identifies the most commercially viable substances with ODP values listed against them to be used for the purposes of the Protocol.

3. Bromochloromethane was recently introduced by the Beijing Amendment.

HS codes: Codes that contain one or two dashed are international codes, and they are directly applicable. When a code contains three dashes, the national authorities may create their own codes under the cited international code, for each one of the chemicals or group of chemicals listed.

Annex B.2: HS classification codes for equipment relying on ODS for its functioning

HS classification of air-conditioners

Primarily under Chapter 84. **Nuclear reactors, boilers, machinery and mechanical appliances; parts hereof.**

-84.15 *Air-conditioning machines, comprising a motor-driven fan and elements for changing the temperature and humidity,*

- **- - 84.15.10** *Window or wall types, self-contained*
- **- - 84.15.20** *Of a kind used for persons, in motor vehicles*
- **- - 84.15.80** *Other: ..*
- **- - 84.15.90** *Parts*

Might also be found in:

-94.06 *Prefabricated buildings (includes air-conditioners as built in equipment)*

HS classification of refrigerators, freezers, water coolers, ice machines & heat pumps

Also primarily under Chapter 84.

Mainly
-84.18: **Refrigerators, freezers** *and other refrigerating or freezing equipment, electric or other;* **heat pumps** *other than air-conditioning equipment of heading 84.15*

Might also be found under:

-84.15 *Air-conditioning machines,*
-84.19 **Machinery**, *plant or laboratory equipment for treatment of materials by a process* **involving a change of temperature** *such as* **condensing or cooling, other than** *machinery or plant used* **for domestic purposes**; ...
-85.09 *Electro-mechanical domestic appliances, with self-contained electric motor*
-87.16 *Trailers and semi-trailers; other vehicles, not mechanically propelled; parts hereof.*

HS Classification of Compressors

Also primarily under Chapter 84:

Mainly:
-84.14. **air or other gas compressors** *and fans, ...*

- **- 84.14.20.** *Compressors used in refrigerating equipment*
- **- 84.14.90** *Parts*

Might also be found under:

-84.11 *Turbo-jets, turbo-propellers and other gas turbines*
-84.12 *Other engines and motors*
-84.15 *Air-conditioning machines, ...*
-84.18 *Refrigerators, freezers and other refrigerating or freezing equipment, ...; heat pumps other than air-conditioning equipment of heading 84.15*
-84.24 *Mechanical appliances, ...*
-84.25 *Pulley tackle and hoists ...*
-84.30 *Other moving, ... machinery, ...*

See also Chapter 87. Vehicles other than railway ...

HS Classification of Cars and Car Parts

Chapter 87. Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof.

-87.01 *Tractors*
-87.02 *Motor vehicles for ten or more persons*
-87.03 *Motor cars and other motor vehicles designed for transport of persons*
-87.04 *Motor vehicles for transport of goods*
-87.05 *Special purpose vehicles*
-87.08 *Parts and accessories*

HS Classification of Fire Extinguishers

Also Chapter 84.

-84.24 *Mechanical appliances for projecting, dispersing or spraying liquids or powders; fire extinguishers, whether or not charged; ...*

- -84.24.10 Fire extinguishers, whether or not charged (Preparations and charges under 38.13)

HS Classification of Dry Cleaning Machinery

Also Chapter 84.

-84.50 ***Household*** *or laundry-type washing machines, including machines which both wash and dry.*

-84.51 *Machinery (**other** than pf heading 84.51) for washing, cleaning, wringing, drying, ...*

- - 8451.10 Dry cleaning machines

HS Classification of Aerosols

Under ***several HS headings****, depending on intended use. For instance:*

-33.05	*Preparations for use on the* ***hair****;*
-33.07	*Pre-shave, shaving or after-shave preparations, personal deodorants, etc. perfumery,* ***cosmetic or toilet*** *preparations; prepared room deodorisers;*
-34.03	***Lubricating*** *preparations (including cutting-oil preparations, bolt or nut release preparations, anti-rust or anti-corrosion preparations and mould release preparations, based on lubricants), etc.;*
-38.08	***Insecticides****, rodenticides, fungicides, herbicides, etc;*
-38.14	*Organic composite* ***solvents*** *and thinners, not elsewhere specified or included; prepared paint or varnish removers;*
-38.24	*Chemical products and preparations of the chemical or allied industries,* ***not elsewhere*** *specified or included; residual products of the chemical or allied industries, not elsewhere specified or included; and*
-93.04	*Aerosol spray cans containing* ***tear gas****.*

Annex B.3: Status of ratification/accession/acceptance/ approval of the ozone treaties as of November 28, 2000

The Vienna Convention for the Protection of the Ozone Layer (1985); The Montreal Protocol on Substances that Deplete the Ozone Layer (1987); The London Amendment to the Montreal Protocol (1990); The Copenhagen Amendment to the Montreal Protocol (1992); The Montreal Amendment to the Montreal Protocol (1997); and The Beijing Amendment to the Montreal Protocol (1999).

Information provided by the Depositary, the United Nations Office of Legal Affairs, New York, as of November 28, 2000. No further information has been received since. Any ***bold*** *information has been received most recently. Please visit the Ozone Secretariat Website for updates at* http://www.unep.org/ozone/ratif.htm

Country	Signature Vienna Convention	Signature Montreal Protocol	Ratification Vienna Convention	Ratification Montreal Protocol	Ratification London Amendment	Ratification Copenhagen Amendment	Ratification Montreal Amendment	Ratification Beijing Amendment
Albania			8.10.1999|Ac|	8.10.1999|Ac|				
Angola			**17.5.2000 (Ac)**	**17.5.2000(Ac)**				
Algeria			20.10.1992|Ac|	20.10.1992|Ac|	20.10.1992|Ac|	**31.5.2000(R)**		
Antigua & Barbuda			3.12.1992|Ac|	3.12.1992|Ac|	23.2.1993|Ac|	19.7.1993|Ac|	10.2.2000|R|	
Argentina	22.3.1985	29.6.1988	18.1.1990|R|	18.9.1990|R|	4.12.1992|R|	20.4.1995|Ac|		
Armenia			1.10.1999|Ac|	1.10.1999|Ac|				
Australia		8.6.1988	16.9.1987|Ac|	19.5.1989|R|	11.8.1992|Ap|	30.6.1994|Ac|	5.1.1999|At|	
Austria	16.9.1985	29.8.1988	19.8.1987|R|	3.5.1989|R|	11.12.1992|R|	19.9.1996|Ap|	**7.8.2000(R)**	
Azerbaijan			12.6.1996|Ac|	12.6.1996|Ac|	12.6.1996|Ac|	12.6.1996|Ac|	**28.9.2000 (Ap)**	
Bahamas			1.4.1993|Ac|	4.5.1993|Ac|	4.5.1993|Ac|	4.5.1993|Ac|		
Bahrain			27.4.1990|Ac|	27.4.1990|Ac|	23.12.1992|Ac|			
Bangladesh			2.8.1990|Ac|	2.8.1990|Ac|	18.3.1994|R|	**27.11.2000 (At)**		
Barbados			16.10.1992|Ac|	16.10.1992|Ac|	20.7.1994|At|	20.7.1994|At|		
Belarus	22.3.1985	22.1.1988	20.6.1986|At|	31.10.1988|At|	10.6.1996|R|			
Belgium	22.3.1985	16.9.1987	17.10.1988|R|	30.12.1988|R|	5.10.1993|R|	7.8.1997|R|		
Belize			6.6.1997|Ac|	9.1.1998|Ac|	9.1.1998|Ac|	9.1.1998|Ac|		
Benin			1.7.1993|Ac|	1.7.1993|Ac|	**21.6.2000 (R)**	**21.6.2000(R)**		
Bolivia			3.10.1994|Ac|	3.10.1994|Ac|	3.10.1994|Ac|	3.10.1994|Ac|	12.4.1999|Ac|	
Bosnia and Herzegovina			6.3.1992|Sc|	6.3.1992|Sc|				
Botswana			4.12.1991|Ac|	4.12.1991|Ac|	13.5.1997|Ac|	13.5.1997|Ac|		
Brazil			19.3.1990|Ac|	19.3.1990|Ac|	1.10.1992|At|	25.6.1997|R|		
Brunei Darussalam			26.7.1990|Ac|	27.5.1993|Ac|				
Bulgaria			20.11.1990|Ac|	20.11.1990|Ac|	28.4.1999|R|	28.4.1999|R|	24.11.1999|R|	
Burkina Faso	12.12.1985	14.9.1988	30.3.1989|R|	20.7.1989|R|	10.6.1994|R|	12.12.1995|R|		
Burundi			6.1.1997|Ac|	6.1.1997|Ac|				
Cameroon			30.8.1989|Ac|	30.8.1989|Ac|	8.6.1992|Ac	25.6.1996|Ap|		
Canada	22.3.1985	16.9.1987	4.6.1986|R	30.6.1988|R	5.7.1990|Ac	16.3.1994|R|	27.3.1998|R	
Central African Republic			29.3.1993|Ac	29.3.1993|Ac|				
Chad			18.5.1989|Ac	7.6.1994|R				
Chile	22.3.1985	14.6.1988	6.3.1990|R|	26.3.1990|R|	9.4.1992|Ac|	14.1.1994|R|	17.6.1998|R|	**3.5.2000(R)**
China			11.9.1989|Ac|	14.6.1991|Ac|	14.6.1991|Ac|			
Colombia			16.7.1990|Ac|	6.12.1993|Ac|	6.12.1993|Ac|	5.8.1997|At|		
Comoros			31.10.1994|Ac|	31.10.1994|Ac|	31.10.1994|Ac|			
Congo		15.9.1988	16.11.1994|Ac|	16.11.1994|Ac|	16.11.1994|Ac|			
Congo, Democratic Republic of			30.11.1994|Ac|	30.11.1994|Ac|	30.11.1994|Ac|	30.11.1994|Ac|		
Costa Rica			30.7.1991|Ac|	30.7.1991|Ac|	11.11.1998|R|	11.11.1998|R|		
Cote d'Ivoire			5.4.1993|Ac|	5.4.1993|Ac|	18.5.1994|R|			
Croatia			8.10.1991|Sc|	8.10.1991|Sc|	15.10.1993|R|	11.2.1997|R|	**8.9.2000(R)**	
Cuba			14.7.1992|Ac|	14.7.1992|Ac|	19.10.1998|R|	19.10.1998|Ap|		
Cyprus			28.5.1992|Ac|	28.5.1992|Ac|	11.10.1994|Ac|			
Czech Republic			1.1.1993|Sc|	1.1.1993|Sc|	18.2.1996|Ac|	18.2.1996|Ac|	5.11.1999|Ap|	
Denmark	22.3.1985	16.9.1987	29.9.1988|R|	16.12.1988|R|	20.12.1991|Ac|	21.12.1993|Ap|		
Djibouti			30.7.1999|Ac|	30.7.1999|Ac|	30.7.1999|Ac|	30.7.1999|Ac|	30.7.1999|Ac|	
Dominica			31.3.1993|Ac|	31.3.1993|Ac|	31.3.1993|Ac|			
Dominican Republic			18.5.1993|Ac|	18.5.1993|Ac|				
Ecuador			10.4.1990|Ac|	30.4.1990|Ac|	23.2.1993|R|	24.11.1993|Ap|		
Egypt	22.3.1985	16.9.1987	9.5.1988|R|	2.8.1988|R|	13.1.1993|R|	28.6.1994|R|	**20.7.2000 (R**	
El Salvador			2.10.1992|Ac|	2.10.1992|Ac|				
Equatorial Guinea			17.8.1988|Ac|					
Estonia			17.10.1996|Ac|	17.10.1996|Ac|	12.4.1999|R|	12.4.1999|R|		
Ethiopia			11.10.1994|Ac|	11.10.1994|Ac|				

	Signature Vienna Convention	Signature Montreal Protocol	Ratification Vienna Convention	Ratification Montreal Protocol	Ratification London Amendment	Ratification Copenhagen Amendment	Ratification Montreal Amendment	Ratification Beijing Amendment
European Community	22.3.1985	16.9.1987	17.10.1988|Ap|	16.12.1988|Ap|	20.12.1991|Ap|	20.11.1995|Ap|	**17.11.2000 (Ap)**	
Federated States of Micronesia			3.8.1994|Ac|	6.9.1995|Ac|				
Fiji			23.10.1989|Ac|	23.10.1989|Ac|	9.12.1994|Ac|	**17.5.2000 (Ac)**		
Finland	22.3.1985	16.9.1987	26.9.1986|R|	23.12.1988|R|	20.12.1991|Ac|	16.11.1993|At|		
France	22.3.1985	16.9.1987	4.12.1987|Ap|	28.12.1988|Ap|	12.2.1992|Ap|	3.1.1996|Ap|		
Gabon			9.2.1994|Ac|	9.2.1994|Ac|				
Gambia			25.7.1990|Ac|	25.7.1990|Ac|	13.3.1995|R|			
Georgia			21.3.1996|Ac|	21.3.1996|Ac|	**12.7.2000 (Ac)**	**12.7.2000 (Ac)**	**12.7.2000 (Ac)**	
Germany	22.3.1985	16.9.1987	30.9.1988|R|	16.12.1988|R|	27.12.1991|R|	28.12.1993|R|	5.1.1999|R|	
Ghana		16.9.1987	24.7.1989|Ac|	24.7.1989|R|	24.7.1992|R|			
Greece	22.3.1985	29.10.1987	29.12.1988|R|	29.12.1988|R|	11.5.1993|R|	30.1.1995|R|		
Grenada			31.3.1993|Ac|	31.3.1993|Ac|	7.12.1993|Ac|	20.5.1999|Ac|	20.5.1999|Ac|	
Guatemala			11.9.1987|Ac|	7.11.1989|Ac|				
Guinea			25.6.1992|Ac|	25.6.1992|Ac|	25.6.1992|Ac|			
Guyana			12.8.1993|Ac|	12.8.1993|Ac|	23.7.1999|At|	23.7.1999|At|	23.7.1999|At|	
Haiti			**29.3.2000 (Ac)**	**29.3.2000(Ac)**	**29.3.2000 (Ac)**			
Honduras			14.10.1993|Ac|	14.10.1993|Ac|				
Hungary			4.5.1988|Ac|	20.4.1989|Ac|	9.11.1993|Ap|	17.5.1994|Ac|	26.7.1999|R|	
Iceland			29.8.1989|Ac|	29.8.1989|Ac|	16.6.1993|Ac|	15.3.1994|R|	8.2.2000|R|	
India			18.3.1991|Ac|	19.6.1992|Ac|	19.6.1992|Ac|			
Indonesia		21.7.1988	26.6.1992|Ac|	26.6.1992|R|	26.6.1992|Ac|	10.12.1998|Ac|		
Iran, Islamic Republic of			3.10.1990|Ac|	3.10.1990|Ac|	4.8.1997|At|	4.8.1997|At|		
Ireland		15.9.1988	15.9.1988|Ac|	16.12.1988|R|	20.12.1991|Ac|	16.4.1996|At|		
Israel		14.1.1988	30.6.1992|Ac|	30.6.1992|R|	30.6.1992|R|	5.4.1995|R|		
Italy	22.3.1985	16.9.1987	19.9.1988|R|	16.12.1988|R|	21.2.1992|Ap|	4.1.1995|R|		
Jamaica			31.3.1993|Ac|	31.3.1993|Ac|	31.3.1993|Ac|	6.11.1997|R|		
Japan		16.9.1987	30.9.1988|Ac|	30.9.1988|At|	4.9.1991|Ac|	20.12.1994|At|		
Jordan			31.5.1989|Ac|	31.5.1989|Ac|	12.11.1993|R|	30.6.1995|R|	3.2.1999|R|	
Kazakhstan			26.8.1998|Ac|	26.8.1998|Ac|				
Kenya		16.9.1987	9.11.1988|Ac|	9.11.1988|R|	27.9.1994|R|	27.9.1994|R|		
Kiribati			7.1.1993|Ac|	7.1.1993|Ac|				
Korea, Democratic People's Republic of			24.1.1995|Ac|	24.1.1995|Ac|	17.6.1999|Ac|	17.6.1999|Ac|		
Korea, Republic of			27.2.1992|Ac|	27.2.1992|Ac|	10.12.1992|Ac|	2.12.1994|At|	19.8.1998|At|	
Kuwait			23.11.1992|Ac|	23.11.1992|Ac|	22.7.1994|Ac|	22.7.1994|Ac|		
Kyrgyzstan			**31.5.2000 (Ac)**	**31.5.2000(Ac)**				
Lao People's Democratic Republic			21.8.1998|Ac|	21.8.1998|Ac|				
Latvia			28.4.1995|Ac|	28.4.1995|Ac|	2.11.1998|At|	2.11.1998|At|		
Lebanon			30.3.1993|Ac|	31.3.1993|Ac|	31.3.1993|Ac|	**31.7.2000 (Ac)**	**31.7.2000 (Ac)**	
Lesotho			25.3.1994|Ac|	25.3.1994|Ac|				
Liberia			15.1.1996|Ac|	15.1.1996|Ac|	15.1.1996|Ac|	15.1.1996|Ac|		
Libyan Arab Jamahiriya			11.7.1990|Ac|	11.7.1990|Ac|				
Liechtenstein			8.2.1989|Ac|	8.2.1989|Ac|	24.3.1994|R|	22.11.1996|Ac|		
Lithuania			18.1.1995|Ac|	18.1.1995|Ac|	3.2.1998|R|	3.2.1998|R|		
Luxembourg	17.4.1985	29.1.1988	17.10.1988|R|	17.10.1988|R|	20.5.1992|R|	9.5.1994|R|	8.2.1999|R|	
Madagascar			7.11.1996|Ac|	7.11.1996|Ac|				
Malawi			9.1.1991|Ac|	9.1.1991|Ac|	8.2.1994|Ap|	28.2.1994|Ac|		
Malaysia			29.8.1989|Ac|	29.8.1989|Ac|	16.6.1993|Ac|	5.8.1993|Ac|		
Maldives		12.7.1988	26.4.1988|Ac|	16.5.1989|R|	31.7.1991|R|			
Mali			28.10.1994|Ac|	28.10.1994|Ac|	28.10.1994|Ac|			
Malta		15.9.1988	15.9.1988|Ac|	29.12.1988|R|	4.2.1994|Ap|			
Marshall Islands			11.3.1993|Ac|	11.3.1993|Ac|	11.3.1993|Ac|	24.5.1993|Ac|		
Mauritania			26.5.1994|Ac|	26.5.1994|Ac|				
Mauritius			18.8.1992|Ac|	18.8.1992|Ac|	20.10.1992|Ac|	30.11.1993|R|		
Mexico	1.4.1985	16.9.1987	14.9.1987|R|	31.3.1988|At|	11.10.1991|At|	16.9.1994|At|		
Moldova			24.10.1996|Ac|	24.10.1996|Ac|				
Monaco			12.3.1993|Ac|	12.3.1993|Ac|	12.3.1993|Ac|	15.6.1999|At|		
Mongolia			7.3.1996|Ac|	7.3.1996|Ac|	7.3.1996|Ac|	7.3.1996|Ac|		
Morocco	7.2.1986	7.1.1988	28.12.1995|R|	28.12.1995|R|	28.12.1995|R|	28.12.1995|Ac|		
Mozambique			Portugal[8, 16]	9.9.1994|Ac|	9.9.1994|Ac|	9.9.1994|Ac|		
Myanmar			24.11.1993|Ac|	24.11.1993|Ac|	24.11.1993|Ac|			
Namibia			20.9.1993|Ac|	20.9.1993|Ac|	6.11.1997|R|			
Nepal			6.7.1994|Ac|	6.7.1994|Ac|	6.7.1994|Ac|			
Netherlands	22.3.1985	16.9.1987	28.9.1988|Ac|	16.12.1988|At|	20.12.1991|Ac|	25.4.1994|Ac|	21.2.2000|At|	

	Signature Vienna Convention	Signature Montreal Protocol	Ratification Vienna Convention	Ratification Montreal Protocol	Ratification London Amendment	Ratification Copenhagen Amendment	Ratification Montreal Amendment	Ratification Beijing Amendment
New Zealand	21.3.1986	16.9.1987	2.6.1987|R|	21.7.1988|R|	1.10.1990|Ac|	4.6.1993|R|	3.6.1999|R|	
Nicaragua			5.3.1993|Ac|	5.3.1993|Ac|	13.12.1999|R|	13.12.1999|R|		
Niger			9.10.1992|Ac|	9.10.1992|Ac|	11.1.1996|Ac|	8.10.1999|R|	8.10.1999|R|	
Nigeria			31.10.1988|Ac|	31.10.1988|Ac|				
Norway	22.3.1985	16.9.1987	23.9.1986|R|	24.6.1988|R|	18.11.1991|R|	3.9.1993|R|	30.12.1998|R|	
Oman			30.6.1999|Ac|	30.6.1999|Ac|	5.8.1999|Ac|	5.8.1999|Ac|		
Pakistan			18.12.1992|Ac|	18.12.1992|Ac|	18.12.1992|Ac|	17.2.1995|R|		
Panama		16.9.1987	13.2.1989|Ac|	3.3.1989|R|	10.2.1994|R|	4.10.1996|Ac|	5.3.1999|R|	
Papua New Guinea			27.10.1992|Ac|	27.10.1992|Ac|	4.5.1993|Ac|			
Paraguay			3.12.1992|Ac|	3.12.1992|Ac|	3.12.1992|Ac|			
Peru	22.3.1985		7.4.1989|R|	31.3.1993|Ac|	31.3.1993|Ac|	7.6.1999|Ac|		
Philippines		14.9.1988	17.7.1991|Ac|	17.7.1991|R|	9.8.1993|R|			
Poland			13.7.1990|Ac|	13.7.1990|Ac|	2.10.1996|Ac|	2.10.1996|Ac|	6.12.1999|R|	
Portugal		16.9.1987	17.10.1988|Ac|	17.10.1988|R|	24.11.1992|R|	24.2.1998|R|		
Qatar			22.1.1996|Ac|	22.1.1996|Ac|	22.1.1996|Ac|	22.1.1996|Ac|		
Romania			27.1.1993|Ac|	27.1.1993|Ac|	27.1.1993|Ac|	**28.11.2000(At)**		
Russian Federation	22.3.1985	29.12.1987	18.6.1986|At|	10.11.1988|At|	13.1.1992|Ac|			
Saint Kitts & Nevis			10.8.1992|Ac|	10.8.1992|Ac|	8.7.1998|Ac|	8.7.1998|R|	25.2.1999|R|	
Saint Lucia			28.7.1993|Ac|	28.7.1993|Ac|	24.8.1999|Ac|	24.8.1999|Ac|	24.8.1999|Ac|	
Saint Vincent and the Grenadines			2.12.1996|Ac|	2.12.1996|Ac|	2.12.1996|Ac|	2.12.1996|Ac|		
Samoa			21.12.1992|Ac|	21.12.1992|Ac|				
Saudi Arabia			1.3.1993|Ac|	1.3.1993|Ac|	1.3.1993|Ac|	1.3.1993|Ac|		
Senegal		16.9.1987	19.3.1993|Ac|	6.5.1993|R|	6.5.1993|R|	12.8.1999|Ac|	12.8.1999|Ac|	
Seychelles			6.1.1993|Ac|	6.1.1993|Ac|	6.1.1993|Ac|	27.5.1993|Ac|		
Singapore			5.1.1989|Ac|	5.1.1989|Ac|	2.3.1993|Ac|	**22.9.2000 (Ac)**	**22.9.2000 (Ac)**	
Slovakia			28.5.1993|Sc|	28.5.1993|Sc|	15.4.1994|Ap|	9.1.1998|Ac|	3.11.1999|Ap|	
Slovenia			6.7.1992|Sc|	6.7.1992|Sc|	8.12.1992|At|	13.11.1998|At|	15.11.1999|R|	
Solomon Islands			17.6.1993|Ac|	17.6.1993|Ac|	17.8.1999|Ac|	17.8.1999|Ac|	17.8.1999|Ac|	
South Africa			15.1.1990|Ac|	15.1.1990|Ac|	12.5.1992|Ac|			
Spain		21.7.1988	25.7.1988|Ac|	16.12.1988|R|	19.5.1992|Ac|	5.6.1995|At|	11.5.1999|At|	
Sri Lanka			15.12.1989|Ac|	15.12.1989|Ac|	16.6.1993|Ac|	7.7.1997|Ac|	20.8.1999|Ac|	
Sudan			29.1.1993|Ac|	29.1.1993|Ac|				
Suriname			14.10.1997|Ac|	14.10.1997|Ac|				
Swaziland			10.11.1992|Ac|	10.11.1992|Ac|				
Sweden	22.3.1985	16.9.1987	26.11.1986|R|	29.6.1988|R|	2.8.1991|R|	9.8.1993|R|	12.7.1999|R|	
Switzerland	22.3.1985	16.9.1987	17.12.1987|R|	28.12.1988|R|	16.9.1992|R|	16.9.1996|R|		
Syrian Arab Republic			12.12.1989|Ac|	12.12.1989|Ac|	30.11.1999|Ac|	30.11.1999|Ac|	30.11.1999|Ac|	
Tajikistan			6.5.1996|Ac|	7.1.1998|Ac|	7.1.1998|Ac|			
Tanzania, United Republic of			7.4.1993|Ac|	16.4.1993|Ac|	16.4.1993|Ac|			
Thailand		15.9.1988	7.7.1989|Ac|	7.7.1989|R|	25.6.1992|R|	1.12.1995|R|		
The Former Yugoslav Republic of Macedonia			10.3.1994|Sc|	10.3.1994|Sc|	9.11.1998|R|	9.11.1998|R|	31.8.1999|Ac|	
Togo		16.9.1987	25.2.1991|Ac|	25.2.1991|R|	6.7.1998|At|	6.7.1998|At|		
Tonga			29.7.1998|Ac|	29.7.1998|Ac|				
Trinidad and Tobago			28.8.1989|Ac|	28.8.1989|Ac|	10.6.1999|R|	10.6.1999|R|	10.6.1999|R|	
Tunisia			25.9.1989|Ac|	25.9.1989|Ac|	15.7.1993|Ac|	2.2.1995|Ac|	19.10.1999|R|	
Turkey			20.9.1991|Ac|	20.9.1991|Ac|	13.4.1995|R|	10.11.1995|R|		
Turkmenistan			18.11.1993|Ac|	18.11.1993|Ac|	15.3.1994|Ac|			
Tuvalu			15.7.1993|Ac|	15.7.1993|Ac|	**31.8.2000(At)**	**31.8.2000(At)**	**31.8.2000(At)**	
Uganda		15.9.1988	24.6.1988|Ac|	15.9.1988|R|	20.1.1994|R|	22.11.1999|Ac|	23.11.1999|Ac|	
Ukraine	22.3.1985	18.2.1988	18.6.1986|At|	20.9.1988|At|	6.2.1997|R|			
United Arab Emirates			22.12.1989|Ac|	22.12.1989|Ac|				
United Kingdom	20.5.1985	16.9.1987	15.5.1987|R|	16.12.1988|R|	20.12.1991|R|	4.1.1995|R|		
United States of America	22.3.1985	16.9.1987	27.8.1986|R|	21.4.1988|R|	18.12.1991|R|	2.3.1994|R|		
Uruguay			27.2.1989|Ac|	8.1.1991|Ac|	16.11.1993|R|	3.7.1997|Ac|	16.2.2000 |Ac|	
Uzbekistan			18.5.1993|Ac|	18.5.1993|Ac|	10.6.1998|Ac|	10.6.1998|Ac|		
Vanuatu			21.11.1994|Ac|	21.11.1994|Ac|	21.11.1994|At|	21.11.1994|At|		
Venezuela		16.9.1987	1.9.1988|Ac|	6.2.1989|R|	29.7.1993|R|	10.12.1997|R|		
Viet Nam			26.1.1994|Ac|	26.1.1994|Ac|	26.1.1994|Ac|	26.1.1994|Ac|		
Yemen			21.2.1996|Ac|	21.2.1996|Ac|				
Yugoslavia			16.4.1990|Ac|	3.1.1991|Ac|				
Zambia			24.1.1990|Ac|	24.1.1990|Ac|	15.4.1994|R|			
Zimbabwe			3.11.1992|Ac|	3.11.1992|Ac|	3.6.1994|R|	3.6.1994|R|		
	Vienna Convention	Montreal Protocol	Vienna Convention	Montreal Protocol	London Amendment	Copenhagen Amendment	Montreal Amendment	Beijing Amendment
Total	28	46	**176**	**175**	**142**	**113**	**46**	**1**

Notes: R: Ratification Ac: Accession At: Acceptance Ap: Approval Sc: Succession
Visit the UNEP Ozone Secretariat Website for updates & the full text of footnotes: http://www.unep.org/ozone/ratif.htm

Annex B.4: ODS containing blends and their composition *

Zeotrope mixtures								
Refrigerant number (Trade name)	Component 1		Component 2		Component 3		Component 4	
R401a (MP 39)	HCFC-22	53%	HFC1-52a**	13%	HCFC-124	34%		
R401b (MP 66)	HCFC-22	61%	HFC-152a**	11%	HCFC-124	28%		
R401c (MP 52)	HCFC-22	33%	HFC-152a**	15%	HCFC-124	52%		
R402a (HP 80)	HFC-125**	60%	HC-290**	2%	HCFC-22	38%		
R402b (HP 81)	HFC-125**	38%	HC-290**	2%	HCFC-22	60%		
R403a (69S)	HC-290**	5%	HCFC-22	75%	FC-218**	20%		
R403b (69L)	HC-290**	5%	HCFC-22	56%	FC-218**	39%		
R405a (G2015)	HCFC-22	45%	HFC-152a**	7%	HCFC-142b	42.5%	C318	5.5%
R406a (GHG-12)	HCFC-22	55%	HC-600a**	4%	HCFC-142b	41%		
R408a (FX55)	HFC-125**	7%	HFC-143a**	46%	HCFC-22	47%		
R409a (FX56)	HCFC-22	60%	HCFC-124	25%	HCFC-142b	15%		
R409b (FX 57)	HCFC-22	65%	HCFC-124	25%	HCFC-142b	10%		
R411a (G2018A)	HC-1270**	2%	HCFC-22	88%	HFC-152a**	11%		
R411b (G2018B)	HC-1270**	3%	HCFC-22	94%	HFC-152a**	3%		
R412a (TP5R)	HCFC-22	70%	FC-218**	5%	HCFC-142b	25%		
R414b (Hotshot)	HCFC-22	50%	HCFC-124	39%	HCFC-142b	9.5%	HC-600a**	1.5%

Azeotrope mixtures *				
Refrigerant number	Component 1		Component 2	
R500	CFC12	74%	HFC152a**	26%
R501	HCFC22	75%	CFC12	25%
R502	HCFC22	49%	CFC115	51%
R503	HFC23**	40%	CFC13	60%
R504	HFC32**	48%	CFC115	52%
R505	CFC12	78%	HCFC31	22%
R506	HCFC31	55%	CFC114	45%
R507	HCFC124	50%	HFC143a**	50%
R509	HCFC22	44%	FC218**	56%

Unnamed mixtures								
Trade Name	Component 1		Component 2		Component 3		Component 4	
FX-20	HFC-125**	45%	HCFC-22	55%				
FX-10	HCFC-22	60%	HCFC-142b	40%				
Di36	HCFC-22	50%	HCFC-124	47%	HC-600a**	3%		
Daikin Blend	HFC-23**	2%	HFC-32**	28%	HCFC-124	70%		
FRIGC	HCFC-124	39%	HFC-134a**	59%	HC-600a**	2%		
Free Zone	HCFC-142b	19%	HFC-134a**	79%	Lubricant	2%		
GHG-HP	HCFC-22	65%	HCFC-142b	31%	HC-600a**	4%		
GHG-X5	HCFC-22	41%	HCFC-142b	15%	HFC-227ca	40%	HC-600a**	4%
NARM-502	HCFC-22	90%	HFC-152a**	5%	HFC-23**	5%		
NAF-S-III****	HCFC-22	82%	HCFC-123	4.75 %	HCFC-124	9.5 %	$C_{10}H_{16}$	3.75%
NAF-P-III****	HFC-134a**	10%	HCFC-123	55%	HCFC-124	31%	HC	4%

Methyl bromide containing mixtures				
Trade Name	Component 1		Component 2	
Methyl bromide with chloropicrin	Methyl bromide	67%	Chloropicrin**	33%
Methyl bromide with chloropicrin***	Methyl bromide	98%	Chloropicrin**	2%

* A more extensive list of trade names for mixtures and pure substances is included in Annex B.5

** Not ozone depleting substances

*** Should be classified under the customs code of pure methyl bromide according to the WCO clarification

**** A halon alternative

Annex B.5: ODS and ODS-containing blends sorted by trade names

Depending on the need for information, the following table may be more useful if sorted by company, by trade name, by composition or ASHRAE number. It will therefore be contained in a separate diskette, which can be requested from UNEP DTIE's OzonAction Programme as mentioned in the Section "Guide to the Reader". The soft-copy will allow for different sorting.

The information presented in this list has been made available to UNEP at the time of publication. It cannot be comprehensive and information will change rapidly. UNEP therefore welcomes your comments and additions.

The columns in the table indicate:

- name of the company that produces the ODS or ODS containing mixture,
- trade name or commercial name,
- composition,
- ASHRAE code (if applicable),
- whether the product has been discontinued by its manufacturer (for ODS only).

The composition of ODS containing mixtures is indicated as follows:

- in brackets as demonstrated for Freon 502 for which all compounds are known. CFC-115/ HCFC-22 (51/49) indicates that the mixture is composed of 51% CFC-112 and 49% HCFC-22;
- in brackets as demonstrated for Freon MCA for which only the main compound is known. CFC-113 (63) indicates that the mixture contains 63% CFC-113; and
- for other mixtures only the name of the compounds is known but not their quantities as demonstrated for Genetron 503 which is a blend of CFC-13 and HFC-23.

The following table includes ODS and ODS containing blends and is sorted in alphabetical order, which allows customs officers to check whether a specific trade name is included in this list and to find out what is the composition of the substance in question.

Note: All products mentioned in this list are trademarks of their respective companies. Empty boxes mean no information was available from source.

Trade name	Company	Composition	ASHRAE	Product stopped
111 Tri	Vulcan	TCA		
69 S	National Refrigeration Inc.			
A C Delco Fabric	Chem-Tek America	TCA		
Aerolex	National Chemsearch America	TCA		
Aerothene (R) TA Solvent	Dow Chemical	TCA		Yes
Aerothene (R) TT Solvent	Dow Chemical	TCA Aerosol Grade		Yes
Algofrene 11	Ausimont	CFC-11	R-11	
Algofrene 113	Ausimont	CFC-113	R-113	
Algofrene 114	Ausimont	CFC-114	R-114	
Algofrene 115	Ausimont	CFC-115	R-115	
Algofrene 12	Ausimont	CFC-12	R-12	
Algofrene 12	Montefluos S.P.A.	CFC-12	R-12	
Algofrene 22	Montefluos S.P.A.	HCFC-22	R-22	
Algofrene 502	Ausimont	CFC-115 / HCFC-22 (51/49)	R-502	
Aquadry 50	Asahi Chemical Industry Co. Ltd.	TCA (94)		
Arcton 11	ICI	CFC-11	R-11	
Arcton 114	ICI	CFC-114	R-114	
Arcton 115	ICI	CFC-115	R-115	
Arcton 12	ICI	CFC-12	R-12	
Arcton 123	ICI		R-123	
Arcton 124	ICI		R-124	
Arcton 13	ICI	CFC-13	R-13	
Arcton 22	ICI	HCFC-22	R-22	
Arcton 402a	ICI	HCFC-22 / HFC-125 / HC-290 (38/60/2)	R-402a	
Arcton 402b	ICI	HCFC-22 / HFC-125 / HC-2907(60/38/2)	R-402b	
Arcton 408a	ICI	HCFC-22 / HFC-125 / HFC-143a (47/7/46)	R-408a	
Arcton 412a	ICI	HCFC-22 / FC-218 / HCFC-142b (70/5/25)	R-412a	
Arcton 509	ICI	HCFC-22 / FC-218 (44/56)	R-509	Yes
Arcton TP5R	ICI	HCFC-22 / FC-218 / HCFC-142b (70/5/25)		Yes
Arcton TP5R2	ICI	HCFC-22 / FC-218 (44/56)	R-509	
Arcton-502	ICI	HCFC-22 / CFC-115 (48.8/51.2)	R-502	Yes
Ardrox D495A Developer	Brent(Asia) PTE	TCA		
Ardrox K410C Remover	Brent (Asia) PTE	TCA		
Arklone AM	ICI	CFC-113 (94.2)		Yes
Arklone AMD	ICI	CFC-113 (94.1)		Yes
Arklone AS	ICI	CFC-113 (96)		Yes
Arklone EXT	ICI	CFC-113 (64.7)		Yes
Arklone K	ICI	CFC-113 (75)		Yes
Arklone L	ICI	CFC-113 (97.1)		Yes
Arklone P	ICI	CFC-113 (100)	R-113	Yes
Arklone PSM	ICI	CFC-113 (100)	R-113	Yes
Arklone W	ICI	CFC-113 (91.5)		Yes
Arrow C190 LEC	Arrow Chemicals	TCA		
Asahifron R-11	Asahi Glass Co. Ltd.	CFC-11	R-11	
Asahifron R-113	Asahi Glass Co. Ltd.	CFC-113	R-113	
Asahifron R-114	Asahi Glass Co., Ltd	CFC-114	R-114	
Asahifron R-115	Asahi Glass Co., Ltd.	CFC-115	R-115	
Asahifron R-12	Asahi Glass Co. Ltd.	CFC-12	R-12	
Asahifron R-13	Asahi Glass Co. Ltd.	CFC-13	R-13	
Asahifron R-152a	Asahi Glass Co. Ltd.	HFC-152a	R-152a	
Asahifron R-22	Asahi Glass Co. Ltd.	HCFC-22	R-22	
Asahifron R-500	Asahi Glass Co. Ltd.	CFC-12 / HFC-152a (73.8/26.2)	R-500	
Asahifron R-502	Asahi Glass Co. Ltd.	CFC-115 / HCFC-22 (48.8/51.2)	R-502	
Asahiklin AK-123	Asahi Glass Co. Ltd.	HCFC-123	R-123	
Asahiklin AK-124	Asahi Glass Co. Ltd.	HCFC-124	R-124	
Asahiklin AK-141b	Asahi Glass Co. Ltd.	HCFC-141b	R-141b	
Asahiklin AK-142b	Asahi Glass Co. Ltd.	HCFC-142b	R-142b	
Asahiklin AK-225	Asahi Glass Co. Ltd.	HCFC-225		
Asahiklin AK-225AE	Asahi Glass Co. Ltd.	HCFC-225 / ethanol		
Asahiklin AK-225AES	Asahi Glass Co. Ltd.	HCFC-225 / ethanol		
Asahiklin AK-225DH	Asahi Glass Co. Ltd.	HCFC-225 / surfactant		
Asahiklin AK-225DW	Asahi Glass Co. Ltd.	HCFC-225 / surfactant		

Trade name	Company	Composition	ASHRAE	Product stopped
Asahitriethane	Asahi Glass Co. Ltd.	TCA (96)		
Asahitriethane ALS	Asahi Glass Co. Ltd.	TCA (93)		
Asahitriethane BS	Asahi Glass Co. Ltd.	TCA (92)		
Asahitriethane EC Grade	Asahi Glass Co. Ltd.	TCA (96)		
Asahitriethane LS	Asahi Glass Co. Ltd.	TCA (96)		
Asahitriethane UT	Asahi Glass Co. Ltd.	TCA (96)		
Asahitriethane V5	Asahi Glass Co. Ltd.	TCA (91)		
Autocure Electro Contact Cleaner	Releasall-Targe			
Autofrost	Monroe Air Tech			
Baltane	Elf Atochem	TCA		
Blitz III	North American Fire Guardian	HCFC-123 / proprietary additive		
B-Lube	National Chemsearch America	TCA		
C-60	Sprayway Inc.	TCA		
Carbon Tetrachloride	Kureha Chemical Industry Co.	CTC (99.95)		
Carbon Tetrachloride	Mitsui Toatu Chemicals	CTC (99.9)		
Carbontetrachloride	Riedelde Haen AG.	CTC		
CB-046 mold releasing agent	Asahi Glass Co. Ltd.	HCFC- 141b	R-141b	
CG Triethane F	Central Glass Co.Ltd.	TCA(97)		
CG Triethane N	Central Glass Co.Ltd.	TCA (97)		
CG Triethane NN	Central Glass Co.Ltd.	TCA (96)		
CG Triethane NNA	Central Glass Co.Ltd.	TCA (94)		
CG Triflon	Central Glass Co.Ltd.	CFC-113 (100)	R-113	
CG Triflon A	Central Glass Co.Ltd.	CFC-113 (87.5)		
CG Triflon C1	Central Glass Co.Ltd.	CFC-113 (98.7)		
CG Triflon CP	Central Glass Co.Ltd.	CFC-113 (90)		
CG Triflon D3	Central Glass Co. Ltd.	CFC-113 (99.4)		
CG Triflon DI	Central Glass Co. Ltd.	CFC-113 (99.5)		
CG Triflon E	Central Glass Co. Ltd.	CFC-113 (96)		
CG Triflon EC	Central Glass Co. Ltd.	CFC-113 (85.5)		
CG Triflon EE	Central Glass Co. Ltd.	CFC-113 (92)		
CG Triflon ES	Central Glass Co. Ltd.	CFC-113 (95.5)		
CG Triflon FD	Central Glass Co. Ltd.	CFC-113 (78)		
CG Triflon M	Central Glass Co. Ltd.	CFC-113 (50.5)		
CG Triflon MES	Central Glass Co. Ltd.	CFC-113 (93.3)		
CG Triflon P	Central Glass Co. Ltd.	CFC-113 (65)		
CG Triflon WI	Central Glass Co. Ltd.	CFC-113 (91.2)		
Chemlok 252	Lord Corporation	TCA		
Chem-Slich	National Chemsearch America	TCA		
Chlorothene (R)	Dow Chemical	TCA		Yes
Chlorothene (R) NU	Dow Chemical	TCA		Yes
Chlorothene (R) SL	Dow Chemical	TCA		Yes
Chlorothene (R) SM	Dow Chemical	TCA		Yes
Chlorothene (R) VG	Dow Chemical	TCA		Yes
Chlorothene (R) XL	Dow Chemical	TCA		Yes
Codepak	York			
CRC Lectra Clean	CRC Chemicals Australia Pty.	TCA		
Codepak	York			
CRC Lectra Clean	CRC Chemicals Australia Pty.	TCA		
CRC226	CRC Chemicals Australia Pty.	TCA		
D 136	Ausimont	HCFC-22	R-22	
Daiflon 11	Daikin	CFC-11	R-11	Yes
Daiflon 114	Daikin	CFC-114	R-114	
Daiflon 115	Daikin	CFC-115	R-115	
Daiflon 12	Daikin	CFC-12	R-12	Yes
Daiflon 13	Daikin	CFC-13	R-13	
Daiflon 142b	Daikin	HCFC-142b	R-142b	Yes
Daiflon 22	Daikin	HCFC-22	R-22	Yes
Daiflon 500	Daikin	CFC-12 / HFC-152a (74/26)	R-500	
Daiflon 502	Daikin	CFC-115 / HCFC-22 (51/49)	R-502	
Daiflon S3	Daikin	CFC-113 (100)	R-113	Yes

Trade name	Company	Composition	ASHRAE	Product stopped
Daiflon S3-A	Daikin	CFC-113 (87.5)		Yes
Daiflon S3-E	Daikin	CFC-113 (96)		Yes
Daiflon S3-EN	Daikin	CFC-113 (86)		Yes
Daiflon S3-ES	Daikin	CFC-113 (95.3)		Yes
Daiflon S3-HN	Daikin	CFC-113 (90)		Yes
Daiflon S3-MC	Daikin	CFC-113 (50.5)		Yes
Daiflon S3-P35	Daikin	CFC-113 (65)		Yes
Daiflon S3-W6	Daikin	CFC-113 (91.5)		Yes
Delifrene 113	Ausimont	CFC-113	R-113	
Di 24	Ausimont	HCFC-124 / HFC-134a / butane (39/59/2)		
Di 36	Ausimont	HCFC-22 / HCFC-124 / butane (50/47/3)		
Di 44	Ausimont	HFC-125 / HFC-143a / HCFC-22 / propane (42/6/50/2)		
Dional 11	Hoechst[2]	CFC-11	R-11	Yes
Forane 114	Elf Atochem	CFC-114	R-114	
Forane 115	Elf Atochem	CFC-115	R-115	
Forane 12	Elf Atochem	CFC-12	R-12	
Forane 123	Elf Atochem	HCFC-123	R-123	
Forane 124	Elf Atochem	HCFC-124	R-124	
Forane 13	Elf Atochem	CFC-13	R-13	
Forane 141b	Elf Atochem	HCFC-141b	R-141b	
Forane 142b	Elf Atochem	HCFC-142b	R-142b	
Forane 22	Elf Atochem	HCFC-22	R-22	
Forane 408a	Elf Atochem	HCFC-22 / HFC-143a / HFC-125 (47/46/7)	R-408a	
Forane 409a	Elf Atochem	HCFC-22 / HCFC-124 / HCFC-142b (60/25/15)	R-409a	
Forane 500	Elf Atochem	CFC-12 / HFC-152a (74/26)	R-500	
Forane 502	Elf Atochem	HCFC-22 / CFC-115 (48.8/51.2)	R-502	
Forane FX 10	Elf Atochem	HCFC-22 / HFC-143a / HFC-125 (47/46/7)	R-408a	
Forane FX 20	Elf Atochem	HCFC-22 / HFC-143a		
Forane FX 55	Elf Atochem	HCFC-22 / HCFC-142b (60/40)		
Forane FX 56	Elf Atochem	HCFC-22 / HCFC-124 / HCFC-142b (60/25/15)	R-409	
Forane FX 57	Elf Atochem	HCFC-22 / HCFC-124 / HCFC-142b (65/25/10)	R-409	
Formacel S	DuPont-Misui Fluoro-chemicals Co. Ltd.	HCFC-22	R-22	
Free Zone	Refrigerant Gases, Inc.	HCFC-142a / HFC-134a (19/79)		
Freezone	Patriot Consumer Prod-ucts	HCFC blend D		
Freon MCA	Dupont	CFC-113 (62.8)		Yes
Freon MCA	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (63)		Yes
Freon PCA	Dupont	CFC-113 (100)	R-113	Yes
Freon SMT	Dupont	CFC-113 (69)		Yes
Freon SMT	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (69.1)		Yes
Freon TA	Dupont	CFC-113 (88.9)		Yes
Freon TA	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (88.9)		Yes
Freon T-B1	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (98.6)		Yes
Freon T-DA35	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (99.7)		Yes
Freon T-DA35X	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (99.6)		Yes
Freon T-DEC	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (93.5)		Yes
Freon T-DECR	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (64.5)		Yes
Freon T-DF	Dupont	CFC-113 (99.9)		Yes
Freon T-DFC	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (99.9)		Yes
Freon T-DFCX	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (99.9)		Yes
Freon TE	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (95.5)		Yes
Freon T-E35	DuPont-Misui Fluoro-chemicals Co. Ltd.	CFC-113 (65)		Yes

Trade name	Company	Composition	ASHRAE	Product stopped
Freon T-E6	DuPont-Misui Fluorochemicals Co. Ltd.	CFC-113 (94)		Yes
Freon TES	Dupont	CFC-113 (95.2)		Yes
Freon TES	DuPont-Misui Fluorochemicals Co. Ltd.	CFC-113 (95.2)		Yes
Freon TF	Dupont	CFC-113 (100)	R-113	Yes
Freon TF	DuPont-Misui Fluorochemicals Co. Ltd.	CFC-113 (100)	R-113	Yes
Freon TMC	Dupont	CFC-113 (50.5)		Yes
Freon TMC	DuPont-Misui Fluorochemicals Co. Ltd.	CFC-113 (50.5)		Yes
Freon TMS	DuPont-Misui Fluorochemicals Co. Ltd.	CFC-113 (94.0)		Yes
Freon TMS solvents	Dupont	CFC-113 (94.05)		Yes
Freon TP35	Dupont	CFC-113 (64.7)		Yes
Freon T-P35	DuPont-Misui Fluorochemicals Co. Ltd.	CFC-113 (64.7)		Yes
Freon TWD 602	Dupont	CFC-113 (91.5)		Yes
Freon T-WD602	DuPont-Misui Fluorochemicals Co. Ltd.	CFC-113 (91.5)		Yes
Freon-11	DuPont	CFC-11	R-11	Yes
Freon-114	DuPont	CFC-114	R-114	Yes
Freon-115	DuPont	CFC-115	R-115	Yes
Freon-12	DuPont	CFC-12	R-12	Yes
Freon-13	DuPont	CFC-13	R-13	Yes
Freon-22	DuPont	HCFC-22	R-22	
Freon-502	DuPont	CFC-115 / HCFC-22 (51/49)	R-502	Yes
FRIGC	Intermagnetics General	HCFC-124 / HFC-134a / butane (39/59/2)		
Frigc FR-12	Clean-Air Conditioning		R-12	
Frigen 11	Hoechst[2]	CFC-11	R-11	Yes
Frigen 113	Hoechst[2]	CFC-113	R-113	Yes
Frigen 114	Hoechst[2]	CFC-114	R-114	Yes
Frigen 115	Hoechst[2]	CFC-115	R-115	Yes
Frigen 12	Hoechst[2]	CFC-12	R-12	Yes
Frigen 13	Hoechst[2]	CFC-13	R-13	Yes
Frigen 22	Hoechst[2]	HCFC-22	R-22	Yes
Frigen 500	Hoechst[2]	CFC-12 / HFC-152a (74/26)	R-500	Yes
Frigen TR 113	Hoechst[2]	CFC-113	R-113	
Friogas 12	Galco S.A.	CFC-12	R-12	
Fronsolve	Asahi Glass Co. Ltd.	CFC-113 (100)	R-113	
Fronsolve AD-17	Asahi Glass Co. Ltd.	CFC-113 (83)		
Fronsolve AD-7	Asahi Glass Co. Ltd.	CFC-113 (99.5)		
Fronsolve AD-9	Asahi Glass Co. Ltd.	CFC-113 (99.5)		
Fronsolve AD-I9	Asahi Glass Co. Ltd.	CFC-113(82)		
Fronsolve AE	Asahi Glass Co. Ltd.	CFC-113 (96)		
Fronsolve AES	Asahi Glass Co. Ltd.	CFC-113 (96)		
Fronsolve AM	Asahi Glass Co. Ltd.	CFC-113 (50.5)		
Fronsolve AMS	Asahi Glass Co. Ltd.	CFC-113 (94)		
Fronsolve AP	Asahi Glass Co. Ltd.	CFC-113 (65)		
Fronsolve R-113	Nagase & Co, Japan	CFC-113	R-113	
G Triflon E35	Central Glass Co. Ltd.	CFC-113 (65)		
G12	AlliedSignal[1]	CFC-12	R-12	
G2015	China Sun	HCFC / HFC / fluoroalkane Blend A		
G2015	GU/Greencool	HCFC-22 / HFC-152a / HCFC-142b / RC318 (45/7/5.5/42.5)	R-405a	
G2018a	GU/Greencool	R-1270 / HCFC-22 / HFC-152a (1.5/87.5/11)	R-411a	
G2018b	GU/Greencool	R-1270 / HCFC-22 / HFC-152a (3/94/3)	R-411b	
G2018c	Greencool			
Genesolv 2000	Allied Signal[1]	HCFC-141b blend		
Genesolv 2004	Allied Signal[1]	HCFC-141b / methanol		
Genesolv 2123	Allied Signal[1]	HCFC-123	R-123	
Genesolv 2127	Allied Signal[1]	HCFC-123 / methanol / nitromethane		
Genetron 11	Allied Signal[1]	CFC-11	R-11	
Genetron 113	Allied Signal [1]	CFC-113	R-113	
Genetron 114	Allied Signal [1]	CFC-114	R-114	
Genetron 115	Allied Signal [1]	CFC-115	R-115	
Genetron 12	Quimbasicos S.A.	CFC-12	R-12	
Genetron 123	Allied Signal [1]	HCFC-123	R-123	

Trade name	Company	Composition	ASHRAE	Product stopped
Genetron 124	Allied Signal [1]	HCFC-124	R-124	
Genetron 13	Allied Signal [1]	CFC-13	R-13	
Genetron 141b	Allied Signal [1]	HCFC-141b	R-141b	
Genetron 142b	Allied Signal [1]	HCFC-142b	R-142b	
Genetron 22	Allied Signal [1]	HCFC-22	R-22	
Genetron 408a	Allied Signal [1]	HCFC-22 / HFC-125 / HFC-143a	R-408a	
Genetron 409a	Allied Signal [1]	HCFC-22 / HCFC-124 / HCFC-142b	R-409a	
Genetron 500	Allied Signal [1]	CFC-12 / HFC-152a (74/26)	R-500	
Genetron 502	Allied Signal [1]	CFC-115 / HCFC-22 (51/49)	R-502	
Genetron 503	Allied Signal [1]	CFC-13 / HFC-23	R-503	
Genetron HP80	Allied Signal [1]	HCFC-22 / HFC-125 / propane		
Genetron HP81	Allied Signal [1]	HCFC-22 / HFC-125 / propane		
Genetron MP39	Allied Signal [1]	HCFC-22 / HFC-152a / HCFC-124		
Genetron MP66	Allied Signal [1]	HCFC-22 / HFC-152a / HCFC-124		
Genklene A	ICI	TCA (96.5)		Yes
Genklene LV	ICI	TCA (95.2)		Yes
Genklene LVJ	ICI	TCA (95.2)		Yes
Genklene LVS	ICI	TCA (95.7)		Yes
Genklene LVX	ICI	TCA (90.7)		Yes
Genklene N	ICI	TCA (95.4)		Yes
Genklene P	ICI	TCA (99.7)		Yes
Genklene PT	ICI	TCA (99.9)		
GEX	National Chemsearch America	TCA		
GHG	Monroe Air Tech	HCFC-22 / HCFC-142b / isobutane (55/41/4)	R-406a	
GHG12	Indianapolis	HCFC-22 / iso-butane / HCFC-142b (55/4/41)	R-406a	
Halon 1211	Hanju Chemical Co.	Halon 1211		
Halon 1301	Hanju Chemical Co.	Halon 1301		Yes
Halotron 1	American Pacific			
Halotron 1	North American Fire Guardian	HCFC-123 blend		
Halotron I	Halotron	HCFC-123 / propane		
Halotron-1	Buckeye Fire Equipment Co.			
HCFC-141b	Central Glass Co. Ltd.	HCFC-141b	R-141b	
HCFC-141b	Daikin	HCFC-141b	R-141b	
HCFC-141b MS	Daikin	HCFC-141b	R-141b	
HCFC-142b	Daikin	HCFC-142b	R-142b	
HCFC-22	Daikin	HCFC-22	R-22	
HCFC-225	Daikin	HCFC-225	R-225	
HCFC-225 ES	Daikin	HCFC-225	R-225	
HyperClean Circuit Cleaner	Micro Care	HCFCs / alcohol		
ISCEON 11	Rhone-Poulenc [3]	CFC-11	R-11	
ISCEON 113	Rhone-Poulenc [3]	CFC-113	R-113	
Methyl Chloroform Low Stabilized	Dow Chemical	TCA		
Molybkombin UMFT4 Spray	Kluber Lubrification	TCA		
MP 39	CJ Smith Refrigeration			
MS-136N/CO2	Miller Stephenson Chemical Co.	TCA		
MV3	Rocol Ltd.	TCA		
NAF P III	Safety Hi-Tech	HCFC-123 / HCFC-124 / HFC-134a (55/31/10)		
NAF S III	Safety Hi-Tech	HCFC blend A		
NAF-P-III	North American Fire Guardian	HCFC-123 / HCFC-124 / HFC-134a / proprietary additive		
NAF-S-III	North American Fire Guardian	HCFC-22 / HCFC-123 / HCFC-124 / organic (82/4.75/9.5/3.75)		
NC-123	National Chemsearch America	TCA		
New Dine T	Yokoyama	TCA		
Nicrobraz Cement 500RTS	Wall Colmonoy	TCA		
Nilos Solution TLT70	Nilos Hans Ziller KG	TCA		
Norchem ACC 572 Air Cooler Cleaner	Goldcrest International	TCA		
Oxyfume 12	Allied Signal [1]	CFC-12 / ethylene oxide		

Trade name	Company	Composition	ASHRAE	Product stopped
Oxyfume 2000	Allied Signal [1]	HCFC-124 / ethylene oxide		
Oxyfume 2002	Allied Signal [1]	HCFC-124 / HCFC-22 / ethylene oxide		
Penngas 2	Pennsylvania Engineering	HCFC blend A		
Polioi Poliuretano ICI	ICI	HCFC-141b	R-141b	
Prelete*(R)	Dow Chemical	TCA		
Proact* (R)	Dow Chemical	TCA		
Propaklone	ICI	TCA (89.6)		Yes
R-406a	Environment	HCFC-22 / HCFC-142b / isobutane (55/41/4)	R-406a	
Rust Inhibator No. B007	Crown Industrial Products	TCA		
S.E.M.I. Grade	Dow Chemical	TCA		
Safety Solvent No. 8060	Crown Industrial Products	TCA		
Sercon 22	Technical		R-22	
Shine Pearl	Toagosei	TCA (94)		
SIENKATANSO	Kanto Denka Kogyo	CTC (99.9)		
Solkane 123	Solvay	HCFC-123	R-123	
Solkane 141b	Solvay	HCFC-141b	R-141b	
Solkane 141b CN	Solvay	HCFC-141b / solvent		
Solkane 141b DH	Solvay	HCFC-141b / dewatering additive		
Solkane 141b MA	Solvay	HCFC-141b / methanol		
Solkane 141b WE	Solvay	HCFC-141b / water / emulsifier		
Solkane 142b	Solvay	HCFC-142b	R-142b	
Solkane 22	Solvay	HCFC-22	R-22	
Solkane 22/142b	Solvay	R-22 / R-142b		Yes
Solkane 406a	Solvay		R-406a	
Solkane 409a	Solvay	HCFC-22 / HCFC-124 / HCFC-142b (60/25/15)	R-409a	
Solvethane	Solvay	TCA (95.0)		
SS-25	National Chemsearch America	TCA		
Sunlovely	Asahi Glass Co. Ltd.	TCA (95)		
Super solution	Pang Rubber Company	TCA		
Suva 123	DuPont	HCFC-123	R-123	
Suva MP39	DuPont	HCFC-22 / HCFC-124 / HFC-152a (53/34/13)	R-401a	
Suva MP52	DuPont	HCFC-22 / HCFC-124 / HFC-152a (33/52/15)	R-401c	Yes
Suva MP66	DuPont	HCFC-22 / HCFC-124 / HFC-152a (61/28/11)	R-401b	
Swish	National Chemsearch America	TCA		
Suva 124	DuPont	HCFC-124	R-124	
Suva 125	DuPont	HFC-125	R-125	
Suva Centr-LP	DuPont	HCFC-123	R-123	
Suva Chill MP	DuPont	HFC-125	R-125	
Suva HP80	DuPont	HCFC-22 / HFC-125 / propane (38/60/2)	R-402a	
Suva HP81	DuPont	HCFC-22 / HFC-125 / propane (60/38/2)	R-402b	
Tafclen	Asahi Chemical Industry Co. Ltd.	TCA (90)		
Taisoton 12	Formosa Plastics	CFC-12	R-12	
Taisoton 22	Formosa Plastics	HCFC-22	R-22	
TCTFE	Solvay	R-113 (for feedstock use)	R-113	
Tempilaq	Tempil Division	TCA		
Three Bond 1802	Three Bond Technologies	TCA		
Three One-A	Toagosei	TCA (95)		
Three One-AH	Toagosei	TCA (95)		
Three One-EX	Toagosei	TCA (90)		
Three One-F	Toagosei	TCA (95)		
Three One-HS	Toagosei	TCA (95)		
Three One-R	Toagosei	TCA (96)		
Three One-S	Toagosei	TCA (95)		
Three One-S(M)	Toagosei	TCA (95)		
Three One-T	Toagosei	TCA (95)		
Three One-TH	Toagosei	TCA (95)		
Toyoclean AL	Tosoh	TCA (95)		
Toyoclean ALS	Tosoh	TCA (91)		

Trade name	Company	Composition	ASHRAE	Product stopped
Toyoclean EE	Tosoh	TCA (97)		
Toyoclean EM	Tosoh	TCA (96)		
Toyoclean HS	Tosoh	TCA (96)		
Toyoclean IC	Tosoh	TCA (91)		
Toyoclean NH	Tosoh	TCA (96)		
Toyoclean O	Tosoh	TCA (100)		
Toyoclean SE	Tosoh	TCA (84)		
Toyoclean T	Tosoh	TCA (97)		
Trane Centrifugal Chillers	Trane			
Triodide	Newhouse International	FIC-1311		
Vertrel 423	DuPont-Misui Fluorochemicals Co. Ltd.	HCFC-123		

[1] Allied Signal is now Honeywell Flourine Products.

[2] Hoechst no longer exists, as Solvay has purchased it July 1, 1996.

[3] Rhone-Poulenc has changed to Rhodia Organique Fine Ltd. There may still be cylinders existing with the names Rhone-Poulenc, ISC Chemicals, or RTZ Chemicals.

Annex B.6: ARI Refrigerant container colour assignments sorted by ASHRAE number

(Source: ARI Coolnet at http://www.ari.org/er/guide-n.html)

ASHRAE number	PMS number	Assigned colour (ARI Guideline N)
R-11	**021**	**Orange**
R-12	**-**	**White**
R-13	**2975**	**Light Blue (Sky)**
R-13B1	177	Pinkish-Red (Coral)
R-14	**124**	**Yellow-Brown (Mustard)**
R-22	**352**	**Light Green**
R-23	428	Light Blue-Grey
R-32	* F	Unassigned
R-50	* F	Unassigned
R-113	**266**	**Dark Purple (Violet)**
R-114	**302**	**Dark Blue (Navy)**
R-115	*****	**Unassigned**
R-116	424	Dark Grey (Battleship)
R-123	**428**	**Light Blue-Grey**
R-124	**335**	**Deep Green (DOT Green)**
R-125	465	Medium Brown (Tan)
R-134a	2975	Light Blue (Sky)
R-141b	*****	**Unassigned**
R-142b	*** F**	**Unassigned**
R-143a	* F	Unassigned
R-152a	* F	Unassigned
R-170	* F	Unassigned
R-218	*	Unassigned
R-225	*****	**Unassigned**
R-236fa	*	Unassigned
R-245fa	*	Unassigned
R-290	* F	Unassigned
R-401a	177	Pinkish-Red (Coral)
R-401b	124	Yellow-Brown (Mustard)
R-401c	3268	Blue-Green (Aqua)
R-402a	**461**	**Light Brown (Sand)**
R-402b	**385**	**Green-Brown (Olive)**
R-403a	*****	**Unassigned**
R-403b	*****	**Unassigned**
R-404a	021	Orange
R-405A	*****	**Unassigned**
R-406a	*** F**	**Unassigned**
R-407a	368	Lime Green
R-407b	156	Cream
R-407c	471	Medium Brown
R-407e	*	Unassigned
R-408a	**248**	**Medium Purple**
R-409a	**465**	**Medium Brown (Tan)**
R-409b	*****	**Unassigned**
R-410a	507	Rose
R-410b	194	Maroon
R-411a	**226 F**	**Dark Purple (Violet)**
R-411b	**326 F**	**Blue-Green (Teal)**
R-412a	*** F**	**Unassigned**
R-413a	* F	Unassigned
R-414a	*	Unassigned
R-414b	**2995**	**Medium Blue**
R-416a	381	Yellow-Green (Lime)
R-500	**109**	**Yellow**
R-501	*****	**Unassigned**
R-502	**251**	**Light Purple (Lavender)**
R-503	**3268**	**Blue-Green (Aqua)**
R-504	*****	**Unassigned**
R-505	*****	**Unassigned**
R-506	*****	**Unassigned**
R-507a	326	Blue-Green (Teal)
R-507b	*	Unassigned
R-508a	*	Unassigned
R-508b	302	Dark Blue (Navy)
R-509	*****	**Unassigned**
R-509a	*	Unassigned
R-600	* F	Unassigned
R-600a	* F	Unassigned
R-717	* F	Unassigned
R-1140	* F	Unassigned
R-1150	* F	Unassigned
R-1270	* F	Unassigned

Notes:

* These refrigerants are not produced in sufficient quantities to qualify for their own colour or a producer has not requested a colour assignment. Containers with these refrigerants are assigned PMS# 413 (light green-grey).

F These refrigerants are flammable. Containers for flammable refrigerants should also be painted with a red band around its top shoulder or cap.

ASHRAE - The American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, GA.

Bold/grey – these are or contain ODS.

Annex B.7: ARI refrigerant container colour assignments sorted by PMS number

(source: ARI Coolnet under http://www.ari.org/er/color-a.html)

PMS number	Assigned colour	Class I	Class II	Class III	Class IV
None	**White**		**R-12**		
Black C	Black (Print Black)				
021	**Orange**	**R-11**		**R-404a**	
109	**Yellow**		**R-500**		
124	**Yellow-Brown (Mustard)**		**R-401b**	**R-14**	
156	Cream			R-407b	
177	Pinkish-Red (Coral)		R-401a	R-13B1	
185	Red (DOT Red)				Note 1
194	Maroon			R-410b	
248	**Medium Purple (Purple)**			**R-408a**	
251	**Light Purple (Lavender)**		**R-502**		
266	**Dark Purple (Violet)**	**R-113**			**R-411a**
302	**Dark Blue (Navy)**		**R-114**	**R-508b**	
326	**Blue-Green (Teal)**			**R-507a**	**R-411b**
335	**Deep (DOT) Green**			**R-124**	
352	**Light Green**		**R-22**		
368	Lime Green			R-407a	
381	Yellow-Green (Lime)		R-416a		
385	**Green-Brown (Olive)**			**R-402b**	
413	Light Green-Grey	Note 2	Note 2	Note 2	Note 2
424	Dark Grey (Battleship)			R-116	
428	**Light Blue-Grey**	**R-123**		**R-23**	
450	Dark Brown (Chocolate)			R-407d	
461	**Light Brown (Sand)**			**R-402a**	
465	**Medium Brown (Tan)**		**R-409a**	**R-125**	
468	Light Tan		Reserved		
471	Medium Brown (Brown)			R-407c	
507	Rose			R-410a	
2975	**Light Blue (Sky)**		**R-134a**	**R-13**	
2995	Medium Blue (Blue)		R-414b		
3268	**Blue-Green (Aqua)**		**R-401c**	**R-503**	

Notes:

1. *Reserved for red band marking of containers for flammable refrigerants. Containers for flammable refrigerants (Class IV) should also have a red band painted around its top shoulder or cap.*
2. *Reserved for refrigerants that are not assigned a colour.*

ASHRAE - The American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, GA.
Bold/Grey – these are or contain ODS.

Annex B.8: Temperature - pressure chart for refrigerant identification (^{0}C/^{0}F/psi)

Temp °C	Temp °F	R-11 VP	R-12 VP	R-113 VP	R-114 VP	R-500 VP	R-502 VP	R-22 VP	R-123 VP	R-134a VP	R-404A (FX-70) LP	R-408A (FX-10) LP	R-409A (FX-56) LP	R-409A (FX-56) VP	R-407C LP	R-407C VP
-45.6	-50	**28.9**	**15.4**		**27.1**	**12.8**	**0.2**	**6.2**	**29.2**	**18.7**	0.6	**1.6**	**12.4**	**17.2**	**2.9**	**11.4**
-42.8	-45	**28.7**	**13.3**		**26.6**	**10.3**	1.9	**2.7**	**29.0**	**16.9**	2.7	1.1	**9.7**	**15.2**	0.4	**8.5**
-40	-40	**28.4**	**11.0**		**26.0**	**7.6**	4.1	0.5	**28.9**	**14.8**	5.0	3.3	**6.8**	**13.1**	2.5	**5.2**
-37.2	-35	**28.1**	**8.4**		**25.4**	**4.6**	6.5	2.6	**28.7**	**12.5**	7.6	5.6	**3.5**	**10.7**	4.8	**1.5**
-34.4	-30	**27.8**	**5.5**	**29.3**	**24.6**	**1.2**	9.2	4.9	**28.4**	**9.8**	10.4	8.2	0.0	**8.1**	7.3	1.3
-31.7	-25	**27.4**	**2.3**	**29.2**	**23.8**	1.2	12.1	7.4	**28.1**	**6.9**	13.4	11.0	2.0	**5.1**	10.1	3.6
-28.9	-20	**27.0**	0.6	**29.1**	**22.9**	3.2	15.3	10.1	**27.8**	**3.7**	16.8	14.1	4.1	**1.9**	13.1	6.1
-26.1	-15	**26.5**	2.4	**28.9**	**21.8**	5.4	18.8	13.2	**27.4**	**0.1**	20.5	17.5	6.5	0.8	16.5	8.8
-23.3	-10	**26.0**	4.5	**28.7**	**20.6**	7.8	22.6	16.5	**27.0**	1.9	24.5	21.2	9.0	2.8	20.1	11.9
-20.6	-5	**25.4**	6.7	**28.5**	**19.3**	10.4	26.7	20.0	**26.5**	4.1	28.8	25.2	11.8	4.9	24.0	15.2
-17.8	0	**24.7**	9.1	**28.2**	**17.8**	13.3	31.1	23.9	**25.9**	6.5	33.5	29.5	14.8	7.2	28.3	18.9
-15	5	**23.9**	11.8	**27.9**	**16.2**	16.4	35.9	28.2	**25.3**	9.1	38.6	34.2	18.1	9.7	33.0	22.9
-12.2	10	**23.1**	14.6	**27.6**	**14.4**	19.7	41.0	32.8	**24.6**	11.9	44.0	39.3	21.7	12.5	38.0	27.3
-9.4	15	**22.1**	17.7	**27.2**	**12.4**	23.3	46.5	37.7	**23.7**	15.0	49.9	44.8	25.5	15.4	43.5	32.0
-6.7	20	**21.1**	21.0	**26.8**	**10.2**	27.2	52.5	43.0	**22.8**	18.4	56.2	50.7	29.6	18.7	49.3	37.2
-3.9	25	**19.9**	24.6	**26.3**	**7.8**	31.5	58.8	48.7	**21.8**	22.1	63.0	57.0	34.0	22.2	55.7	42.7
-1.1	30	**18.6**	28.4	**25.8**	**5.2**	36.0	65.6	54.9	**20.7**	26.0	70.3	63.7	38.7	26.0	62.5	48.7
1.7	35	**17.2**	32.5	**25.2**	**2.3**	40.8	72.8	61.5	**19.5**	30.3	78.1	71.0	43.8	30.1	69.8	55.2
4.4	40	**15.6**	36.9	**24.5**	0.4	46.0	80.5	68.5	**18.1**	35.0	86.4	78.7	49.2	34.5	77.6	62.1
7.2	45	**13.9**	41.6	**23.8**	2.0	51.6	88.7	76.0	**16.6**	40.0	95.2	87.0	54.9	39.2	86.0	69.5
10	50	**12.0**	46.7	**22.9**	3.8	57.5	97.4	84.0	**15.0**	45.4	104.7	95.8	61.0	44.3	94.9	77.5
12.8	55	**10.0**	52.0	**22.2**	5.8	63.9	106.6	92.5	**13.1**	51.1	114.7	105.1	67.6	49.8	104.5	86.0
15.6	60	**7.8**	57.7	**21.0**	7.9	70.6	116.4	101.6	**11.2**	57.3	125.3	115.1	74.5	55.6	114.6	95.1
18.3	65	**5.4**	63.7	**19.9**	10.1	77.8	126.7	111.2	**9.0**	63.9	136.6	125.6	81.8	61.9	125.4	104.8
21.1	70	**2.7**	70.2	**18.7**	12.6	85.4	137.6	121.4	**6.6**	71.0	148.6	136.8	89.5	68.6	136.9	115.2
23.9	75	0.0	76.9	**17.3**	15.2	93.4	149.1	132.2	**4.0**	78.6	161.2	148.7	97.7	75.8	149.1	126.2
26.7	80	1.5	84.1	**15.8**	18.0	101.9	161.2	143.6	**1.2**	86.6	174.6	161.2	106.4	83.4	162.1	137.8
29.4	85	3.2	91.7	**14.3**	20.9	111.0	174.0	155.7	0.9	95.1	188.8	174.4	115.5	91.5	175.8	150.2
32.2	90	4.9	99.7	**12.5**	24.1	120.5	187.4	168.4	2.5	104.2	203.7	188.4	125.2	100.2	190.2	163.4
35	95	6.8	108.2	**10.6**	27.5	130.5	201.4	181.8	4.2	113.8	219.4	203.1	135.3	109.4	205.5	177.4
37.8	100	8.8	117.1	**8.6**	31.1	141.1	216.2	195.9	6.1	124.1	235.9	218.7	146.0	119.2	221.6	192.1
40.6	105	10.9	126.5	**6.4**	35.0	152.2	231.7	210.7	8.1	134.9	253.4	235.0	157.2	129.6	238.5	207.8
43.3	110	13.2	136.4	**4.0**	39.1	164.0	247.9	226.3	10.3	146.3	271.7	252.1	169.0	140.6	256.4	224.4
46.1	115	15.6	146.7	**1.4**	43.4	176.3	264.9	242.7	12.6	158.4	290.9	270.2	181.4	152.3	275.1	241.9
48.9	120	18.3	157.6	0.7	48.0	189.2	282.7	259.9	15.1	171.1	311.1	289.1	194.4	164.7	294.7	260.5
51.7	125	21.0	169.0	2.2	52.8	208.8	301.4	277.9	17.7	184.5	332.3	308.9	208.0	177.8	315.2	280.1
54.4	130	24.0	180.9	3.7	58.0	217.0	320.8	296.8	20.6	198.7	354.5	329.7	222.3	191.6	336.7	300.9
57.2	135	27.1	193.5	5.4	63.4	231.9	341.2	316.5	23.6	213.6	377.8	351.5	237.2	206.3	359.2	322.9
60	140	30.4	206.5	7.2	69.0	247.4	362.6	337.2	26.8	229.3	402.2	374.3	252.9	221.8	382.6	346.2
62.8	145	34.0	220.2	9.2	75.0	263.7	385.0	358.8	30.2	245.7	427.7	398.1	269.3	238.2	407.0	370.8
65.6	150	37.7	234.5	11.2	81.3	280.7	408.4	381.5	33.8	263.0	454.4	423.0	286.4	255.5	432.4	396.9

VP= Vapour Pressure , LP= Liquid Pressure **Bold Numerals** - PSI Below 1 Atmosphere

Annex C: International Chemical Safety Cards

These safety cards may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

The following safety cards are included in this annex:

Source: World Health Organisation and the European Union
Web site: http://www.cdc.gov/niosh/ipcs/icstart.html.

Annex C.1: TRICHLOROFLUOROMETHANE: CFC –11

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep drums, etc., cool by spraying with water.
INHALATION	Confusion. Drowsiness. Shortness of breath. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Ventilation. If in liquid form, allow to evaporate. NEVER direct water jet on liquid.

STORAGE: Separated from metals (see Chemical Dangers). Cool. Ventilation along the floor.

PHYSICAL STATE; APPEARANCE: Colourless gas or highly volatile liquid, with characteristic odour.

PHYSICAL DANGERS: The gas is heavier than air. The vapour is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming corrosive and very toxic fumes (hydrogen chloride, ICSC # 0163; phosgene, ICSC # 0007; chlorine, ICSC # 0126; hydrogen fluoride, ICSC # 0283). Reacts violently with metals and various powdered metals, such as aluminium, barium, calcium, magnesium and sodium.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: On loss of containment this liquid evaporates very quickly causing supersaturation of the air with serious risk of suffocation when in confined areas.

EFFECTS OF SHORT-TERM EXPOSURE: The liquid may cause frostbite. Exposure could cause cardiac arrhythmia and asphyxiation. See Notes.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis.

PHYSICALPROPERTIES Vapour pressure, kPa at 20°C: 89.0 , Relative vapour density (air = 1): 4.7 , Relative density of the vapour/air-mixture at 20°C (air = 1): 4.4.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to water and air.

NOTES: To physicians: adrenergic agents are contraindicated. High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. Freon 11, Frigen 11, Halon 11 are trade names.

Annex C.2: DICHLORODIFLUOROMETHANE: CFC-12

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep cylinder cool by spraying with water.
INHALATION	Confusion. Drowsiness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Ventilation. NEVER direct water jet on liquid.

STORAGE: Separated from metals (see Chemical Dangers). Cool. Ventilation along the floor.

PACKAGING & LABELLING: Special insulated cylinder. UN Hazard Class: 2.2.

PHYSICAL STATE; APPEARANCE: Colourless compressed liquefied gas, with characteristic odour.

PHYSICAL DANGERS: The gas is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming corrosive and very toxic fumes (hydrogen chloride, ICSC # 0163; phosgene, ICSC # 0007; chlorine, ICSC # 0126; hydrogen fluoride, ICSC # 0283). Reacts violently with metals such as calcium, magnesium, potassium, sodium, zinc and powdered aluminium. Attacks magnesium and its alloys.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: On loss of containment this gas can cause suffocation by lowering the oxygen content of the air in confined areas.

EFFECTS OF SHORT-TERM EXPOSURE: The liquid may cause frostbite. Exposure could cause cardiac arrhythmia and asphyxiation. See Notes.

PHYSICAL PROPERTIES Vapour pressure, kPa at 20°C: 568, Relative vapour density (air = 1): 4.2.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to air.

NOTES: To physicians: adrenergic agents are contraindicated. High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. Freon 12, Frigen 12, Halon 12 are trade names.

Annex C.3: CHLOROTRIFLUOROMETHANE: CFC-13

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Heating will cause rise in pressure with risk of sting.	NO contact with hot surfaces.	
EXPLOSION			In case of fire: keep cylinder cool by spraying with water.
INHALATION	Confusion. Dizziness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes.
EYES	(See Skin).	Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Ventilation. NEVER direct water jet on liquid. In case of large spillage, extra personnel protection: complete protection with self-contained breathing apparatus.

STORAGE: Fireproof if in building.

PACKAGING & LABELLING: UN Hazard Class: 2.2.

PHYSICAL STATE; APPEARANCE: Colourless liquefied gas, with characteristic odour.

PHYSICAL DANGERS: The gas is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: The substance decomposes on burning or on contact with hot surfaces producing toxic and corrosive fumes including hydrogen chloride, hydrogen fluoride and phosgene. Incompatible with certain metal powders (aluminium, zinc, beryllium).

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: On loss of containment this gas can cause suffocation by lowering the oxygen content of the air in confined areas.

EFFECTS OF SHORT-TERM EXPOSURE: The substance may cause effects on the cardiovascular system , resulting in impaired functions. Exposure could cause lowering of consciousness. See Notes.

PHYSICAL PROPERTIES:
Relative vapour density (air = 1): 3.6.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to its impact on the ozone layer.

NOTES: High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. Physician should give special attention to the drugs used in treatment because of the effects of the substance on cardiac rhythm. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Arcton 13, FCC 13, Freon 13, Frigen 13, Genetron 13 and Isceon 13 are trade names.

Annex C.4: CHLORODIFLUOROMETHANE
Monochlorodifluoromethane: HCFC-22 Cylinder

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep cylinder cool by spraying with water.
INHALATION	Confusion. Drowsiness. Unconsciousness.	Ventilation, local exhaust, or breathing	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes.
EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Ventilation. NEVER direct water jet on liquid.

STORAGE: Separated from powdered metals such as aluminium and zinc. Cool. Ventilation along the floor.

PACKAGING & LABELLING: Special insulated cylinder. UN Hazard Class: 2.2.

PHYSICAL STATE; APPEARANCE: Colourless compressed liquefied gas, with characteristic odour.

PHYSICAL DANGERS: The gas is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming corrosive and very toxic fumes (hydrogen chloride, ICSC # 0163; phosgene, ICSC # 0007; chlorine, ICSC # 0126; hydrogen fluoride, ICSC # 0283). Reacts violently with powdered metals such as aluminium and zinc, causing fire and explosion hazard. Attacks magnesium and its alloys.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: On loss of containment this gas can cause suffocation by lowering the oxygen content of

EFFECTS OF SHORT-TERM EXPOSURE: The liquid may cause frostbite. Exposure could cause cardiac arrhythmia and asphyxiation. See Notes.

PHYSICAL PROPERTIES:
Vapour pressure, kPa at 20°C: 908.
Relative vapour density (air = 1): 3.0.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to the air.

NOTES: To physicians: adrenergic agents are contraindicated. High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. Freon 22, Frigen 22, Halon 22 are trade names.

Annex C.5: 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE/ Trichlorotrifluoroethane: CFC-113

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep drums, etc., cool by spraying with water.
INHALATION	Confusion. Cough. Drowsiness. Unconsciousness.	Ventilation, local exhaust, or breathing	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	Redness. Pain.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL: Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place (extra personal protection: self-contained breathing apparatus).

STORAGE: Separated from metals and alloys (see Chemical Dangers). Cool.

PHYSICAL STATE; APPEARANCE: Colourless volatile liquid, with characteristic odour.

PHYSICAL DANGERS: The vapour is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming corrosive and very toxic fumes (carbonylfluoride; hydrogen chloride, ICSC # 0163; phosgene, ICSC # 0007; chlorine, ICSC # 0126; hydrogen fluoride ICSC0283). Reacts violently with calcium, potassium, sodium and powdered metals such as aluminium, beryllium, magnesium and zinc, causing fire and explosion hazard. Attacks alloys containing more than 2% magnesium.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: On loss of containment this gas can cause suffocation by lowering the oxygen content of the air in confined areas.

EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes and the respiratory tract. The substance may cause effects on the central nervous system in high concentrations , resulting in lowering of consciousness. Exposure could cause cardiac arrhythmia and asphyxiation.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis.

PHYSICAL PROPERTIES
Vapour pressure, kPa at 20°C: 36. , Relative vapour density (air = 1): 6.5.
Relative density of the vapour/air-mixture at 20°C (air = 1): 3.0.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to water.

NOTES: To physicians: adrenergic agents are contraindicated. High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Freon 113, Frigen 113, Halon 113 are trade names.

Annex C.6: CHLOROPENTAFLUOROETHANE 1-Chloro-1,1,2,2,2-pentafluoroethane : CFC-115 (cylinder)

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Heating will cause rise in pressure with risk of bursting. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			In case of fire: keep cylinder cool by spraying with water.
INHALATION	Suffocation (see Notes).	Ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
EYES	See Skin.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Ventilation. NEVER direct water jet on liquid. (extra personal protection: chemical protection suit including self-contained breathing apparatus).

STORAGE: Fireproof if in building. Cool.

PACKAGING & LABELLING: UN Hazard Class: 2.2.

PHYSICAL STATE; APPEARANCE: Odourless, colourless, compressed liquefied gas.

PHYSICAL DANGERS: The vapour is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming toxic fumes including hydrogen chloride and hydrogen fluoride.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

EFFECTS OF SHORT-TERM EXPOSURE: Rapid evaporation of the liquid may cause frostbite.

PHYSICAL PROPERTIES:
Vapour pressure, kPa at 20°C: 797.
Relative vapour density (air = 1): 5.3.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to its impact on the ozone layer.

NOTES: High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. Arcton 115, Freon 115, Frigen 115, Genetron 115, Kaltron 115, and Refrigerant R 115 are trade names.

Annex C.7: BROMOCHLORODIFLUOROMETHANE Freon 12 B 1 / R 12 B 1: Halon 1211 (cylinder)

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Heating will cause rise in pressure with risk of bursting. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
INHALATION	Drowsiness. Unconsciousness.	Ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
EYES	ON CONTACT WITH LIQUID: FROSTBITE.	Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Ventilation. Do NOT let this chemical enter the environment.

STORAGE: Fireproof if in building.

PACKAGING & LABELLING: UN Hazard Class: 2.2.

PHYSICAL STATE; APPEARANCE: Liquified compressed gas, with characteristic odour.

PHYSICAL DANGERS: The gas is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: The substance decomposes on contact with open flames or very hot surfaces, producing toxic gases including phosgene, hydrogen fluoride, hydrogen chloride, hydrogen bromide.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: On loss of containment this liquid evaporates very quickly causing supersaturation of the air with serious risk of suffocation when in confined areas.

EFFECTS OF SHORT-TERM EXPOSURE: Rapid evaporation of the liquid may cause frostbite. The substance may cause effects on the cardiovascular system , resulting in cardiac disorders.

PHYSICAL PROPERTIES: Relative vapour density (air = 1): 5.7.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to its impact on the ozone layer.

NOTES: High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. Do NOT use in the vicinity of a fire or a hot surface, or during welding.

Annex C.8: BROMOTRIFLUOROMETHANE
Trifluorobromomethane Fluorocarbon-1301
Bromofluoroform (cylinder)

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Heating will cause rise in pressure with risk of bursting. Gives off irritating or toxic fumes		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			In case of fire: keep cylinder cool by spraying with water.
INHALATION	Dizziness. Headache. Unconsciousness.	Ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
EYES	Redness. See Skin.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Ventilation. NEVER direct water jet on liquid. (extra personal protection: chemical protection suit including self-contained breathing apparatus).

STORAGE: Fireproof if in building. Cool.

PACKAGING & LABELLING: UN Hazard Class: 2.2.

PHYSICAL STATE; APPEARANCE: Colourless compressed liquefied gas.

PHYSICAL DANGERS: The vapour is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen.

CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming toxic fumes including hydrogen bromide and hydrogen fluoride. Attacks plastic, rubber, and coatings.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation.

INHALATION RISK: A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes. Rapid evaporation of the liquid may cause frostbite. The substance may cause effects on the central nervous system.

PHYSICAL PROPERTIES: Vapour pressure, kPa at 20°C: 1434, Relative vapour density (air = 1): 5.1.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to its impact on the ozone layer.

NOTES: High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. Flugex 13B1, Freon 13B1, Halon 1301, Khladon 13B1, and Refrigerant 13B1 are trade names.

Annex C.9: CARBON TETRACHLORIDE

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion (see Chemical Dangers).		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		AVOID ALL CONTACT!	
INHALATION	Dizziness. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Redness. Pain.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Redness. Pain.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Abdominal pain. Diarrhea (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL: Evacuate danger area! Consult an expert! Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: complete protective clothing including self-contained breathing apparatus).

STORAGE: Separated from metals (see Chemical Dangers), fluorine, food and feedstuffs. Ventilation along the floor.

PACKAGING & LABELLING: Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. T symbol. R: 23/24/25-40-48/23. S: 23-36/37/44. UN Hazard Class: 6.1. UN Packing Group: II. Marine pollutant.

PHYSICAL STATE; APPEARANCE: Colourless liquid, with characteristic odour.

PHYSICAL DANGERS: The vapour is heavier than air.

CHEMICAL DANGERS: On contact with hot surfaces or flames this substance decomposes forming toxic and irritating fumes (hydrogen chloride, ICSC # 0163; chlorine, ICSC # 0126; phosgene, ICSC # 0007). Reacts violently with some metals such as aluminium, barium, magnesium, potassium, sodium, with fluorine and other substances, causing fire and explosion hazard. Attacks copper, lead and zinc.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK: A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes. The substance may cause effects on the liver, kidneys and the central nervous system , resulting in unconsciousness. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES: Vapour pressure, kPa at 20°C: 12.2 , Relative vapour density (air = 1): 5.3, Relative density of the vapour/air-mixture at 20°C (air = 1): 1.5.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to water.

NOTES: Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Ascordin, Katarin, Tetracol, Chlorasol are trade names.

Annex C.10: 1,1,1-TRICHLOROETHANE
Methyl chloroform

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions. Heating will cause rise in pressure with risk of bursting. See Notes. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT GENERATION OF MISTS!	
INHALATION	Ataxia. Dizziness. Drowsiness. Headache. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
EYES	Redness.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
INGESTION	Diarrhea. Nausea. Vomiting (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL: Ventilation. Collect leaking and spilled liquid in sealable, suitable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment (extra personal protection: self-contained breathing apparatus).

STORAGE: Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs and incompatible materials (see Chemical Dangers). Cool. Dry. Ventilation along the floor.

PACKAGING & LABELLING: Do not transport with food and feedstuffs. Xn symbol. N symbol. R: 20-59. S: (2-)24/25-59-61. Note: F. UN Hazard Class: 6.1. UN Packing Group: III. Marine pollutant.

PHYSICAL STATE; APPEARANCE: Colourless liquid, with characteristic odour.

PHYSICAL DANGERS: The vapour is heavier than air.

CHEMICAL DANGERS: The substance decomposes on heating or on burning producing toxic and corrosive fumes including phosgene and hydrogen chloride. Reacts violently with aluminium, manganese and their alloys, alkalis, strong oxidants, acetone and zinc. Attacks natural rubber. Mixtures of 1,1,1-trichloroethane with potassium or its alloys are shock sensitive. Reacts slowly with water releasing corrosive hydrochloric acid.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its vapour and by ingestion.

INHALATION RISK: A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. The substance may cause effects on the heart and central nervous system, kidneys and liver , resulting in cardiac disorders and respiratory failure. Exposure at high level may result in death. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The liquid defats the skin. The substance may have effects on the liver.

PHYSICAL PROPERTIES: Vapour pressure, kPa at 20°C: 13.3, Relative vapour density (air = 1): 4.6, Flash point: see Notes°C, Auto-ignition temperature: 537°C, Explosive limits, vol% in air: 8-16.

ENVIRONMENTAL DATA: The substance is harmful to aquatic organisms. This substance may be hazardous to the environment; special attention should be given to air and ground water.

NOTES: Combustible vapour/air mixtures difficult to ignite, may be developed under certain conditions. The substance burns only in excess oxygen or if a strong source of ignition is present. Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. An added stabilizer or inhibitor can influence the toxicological properties of this substance, consult an expert. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Aerothene, Algylen, Trichloran, Chlorylen, Genklene, Chlorothene NU, Chlorothene VG, and Solvent 111 are trade names.

Annex C.11: METHYL BROMIDE (cylinder)

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with aluminium, zinc, magnesium or pure oxygen.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Risk of fire and explosion on contact with aluminium, zinc or magnesium.		In case of fire: keep cylinder cool by spraying with water.
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Dizziness. Headache. Abdominal pain. Vomiting. Weakness. Hallucinations. Loss of speech. Incoordination. Laboured breathing. Convulsions.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration if indicated. Refer for medical attention.
SKIN	MAY BE ABSORBED! Tingling. Itching. Burning sensation. Redness. Blisters. Pain. ON CONTACT WITH LIQUID: FROSTBITE (Further see Inhalation).	Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
EYES	Redness. Pain. Blurred vision. Temporary loss of vision.	Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Evacuate danger area! Consult an expert! Ventilation. NEVER direct water jet on liquid (extra personal protection: complete protective clothing including self-contained breathing apparatus).

STORAGE: Fireproof if in building. Separated from strong oxidants, aluminium and cylinders containing oxygen. Cool. Ventilation along the floor.

PACKAGING & LABELLING: T symbol. R: 23-36/37/38. S: (1/2-)15-27-36/37/39-38-45. UN Hazard Class: 2.3.

PHYSICAL STATE; APPEARANCE: Odourless and coulorless compressed liquified gas.

PHYSICAL DANGERS: The gas is heavier than air.

CHEMICAL DANGERS: The substance decomposes on heating and on burning producing toxic and corrosive fumes including hydrogen bromide, bromine and carbon oxybromide. Reacts with strong oxidants. Attacks many metals in presence of water. Attacks aluminium, zinc and magnesium with formation of pyrophoric compounds causing fire and explosion hazard.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and through the skin, also as a vapour!

INHALATION RISK: A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the eyes, the skin and the respiratory tract. Inhalation of the substance may cause lung oedema (see Notes). Rapid evaporation of the liquid may cause frostbite. The substance may cause effects on the central nervous system, kidneys and lungs. Exposure to high concentrations may result in death. The effects may be delayed.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: The substance may have effects on the nervous system, kidneys, heart, liver and lungs.

PHYSICAL PROPERTIES: Relative vapour density (air = 1): 3.3., Auto-ignition temperature: 537°C., Explosive limits, vol % in air: 10-16.

ENVIRONMENTAL DATA: This substance may be hazardous to the environment; special attention should be given to fish, mammals, plants, soil organisms.

NOTES: Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Immediate administration of an appropriate spray, by a doctor or a person authorised by him/her, should be considered. The odour warning when the exposure limit value is exceeded is insufficient. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state. Bromo-O-gas, Dowfume, Embafume, Halon 1001, Haltox, Meth-o-gas, Terabol and Terr-o-Gas 100 are trade names.

Annex C.12: METHYL BROMIDE (liquefied)

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Heating will cause rise in pressure with risk of bursting. See Notes.	NO open flames, NO sparks, and NO smoking. NO contact with strong oxidising agents. NO contact with hot surfaces.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with water spray. If extinguished, risk of explosive re-ignition. Fire fighters should wear complete protective clothing including self-contained breathing apparatus.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking hand tools. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
INHALATION	Abdominal pain, confusion, drowsiness, headache, digestive problems nausea. Symptoms may be delayed (see Notes).	Ventilation, local exhaust, or breathing protection.	Fresh air, rest, half-upright position, artificial respiration if indicated, and refer for medical attention.
SKIN	MAY BE ABSORBED! Redness, roughness, liquid causes skin burns, blisters.	Protective gloves.	Remove contaminated clothes, rinse skin with plenty of water or shower, and refer for medical attention.
EYES	Liquid splashes can cause redness, conjunctivitis, severe deep burns.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

SPILLAGE DISPOSAL: Evacuate danger area! Consult an expert! Ventilation. Eliminate ignition sources and stop flow of gas if possible (extra personal protection: complete protective clothing including self-contained breathing apparatus).

STORAGE: Separated from strong oxidants, aluminium, food and feedstuffs, rubbers. Cool. Store outside or in separate building.

PACKAGING & LABELLING: Do not transport with food and feedstuffs. T+ symbol. R: 26. S: 1/2-7/9-24/25-27-45. UN Hazard Class: 2.3. UN Subsidiary Risks: 6.1.

PHYSICAL STATE; APPEARANCE: Colourless compressed liquefied gas.

PHYSICAL DANGERS: The gas is heavier than air, and may travel along the ground; distant ignition possible.

CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts with strong oxidants, aluminium and rubber.

ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation and through the skin.

INHALATION RISK: A harmful concentration of this gas in the air will be reached very quickly on loss of containment. On loss of containment this gas can cause suffocation by lowering the oxygen content of the air in confined areas.

EFFECTS OF SHORT-TERM EXPOSURE: The substance irritates the respiratory tract. Inhalation of gas may cause lung oedema (see Notes). The substance may cause effects on the central nervous system, resulting in psychological disturbances. Exposure to the substance could cause lowering of consciousness. Exposure by inhalation may result in death.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: Repeated or prolonged contact with skin may cause dermatitis. Lungs may be affected by repeated or prolonged exposure resulting in bronchospasms. The substance may have effects on the central nervous system, liver and kidney, resulting in paralysis, psychological disorders, hallucinations, brain damage and impaired kidney and liver function.

PHYSICAL PROPERTIES Vapour pressure, kPa at 15°C: 53, Relative vapour density (air = 1): 3.36, Flash point: Flammable Gas, Auto-ignition temperature: 536.7°C, Explosive limits, vol% in air: 10.0-16.0.

NOTES: The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Do NOT use in the vicinity of a fire or a hot surface, or during welding.

Annex D: Workshop elements

Annex D.1: Generic concept note

1. Background

Upon the discovery that CFCs and other man-made substances are leading to a depletion of the ozone layer, the international community negotiated the Vienna Convention for the Protection of the Ozone Layer in 1985. Following this, the Montreal Protocol on Substances that Deplete the Ozone Layer was negotiated in 1997 with the objective of reducing and finally phasing out the use of ozone-depleting substances (ODS). **[Name of Country]** acceded to the Vienna Convention and its Montreal Protocol on [**Date].**

In most developing countries, the largest remaining sector in which ODS are used is the refrigeration and air-conditioning (RAC) servicing sector. In **[Year], [Name of Country]** consumed approximately **[XX]** metric tonnes of ODS which corresponds to **[XX]** ozone-depleting potential (ODP) tonnes. The RAC sector consumed **[XX]** metric tonnes of ODS, which translates to **[XX]** ODP tonnes. This is **[XX]**% of **[Country Name]**'s total consumption in ODP tonnes in **[Year**].

Since **[Name of Country]** does not produce nor export ODS, its consumption depends solely on imports. In addition, appliances containing CFCs are imported into the country either already assembled (e.g. refrigerators, air-conditioning units), or in parts for local assembly.

Any abrupt non-availability of CFC refrigerants will adversely impact on important sectors of the local economy. It is therefore essential for users of CFCs to be able to reduce and subsequently phase-out their consumption in a coordinated, planned and cost-effective manner in compliance with the commitments under the Montreal Protocol.

The Refrigerant Management Plan (RMP) of **[Name of Country]** was approved by the **[XX]** Meeting of the Executive Committee of the Multilateral Fund to be implemented by **[Name of Implementing Agency].** The RMP is a comprehensive approach to phase out the use of ODS in **[Name of Country**]'s RAC sector.

[**Name of Implementing Agency**]'s role is to coordinate the implementation of the following training elements of the RMP in cooperation with the National Ozone Unit (NOU):

1. Training programme on good practices in refrigeration, and
2. Training programme for customs officers on control and monitoring of ODS imports and exports.

One of the **[Name of Country**]'s obligations is to establish an import / export licensing system for ODS. The **[Name of Government Agencies**] are the agencies, which will manage this licensing system. But it is also necessary to enforce the licensing system. Therefore, the ability of customs, trade and standards officers to enforce controls over trade in ODS and ODS products / equipment is important for a successful and planned ODS phase-out.

2. Objectives

The main objective of this training programme is to provide the customs, trade and standards officers in **[Name of Country]** with the skills necessary to monitor and control the imports of CFCs and other ODS products / equipment. The detection and prevention of illegal trade is part of this effort. This will be achieved by:

1. Increasing awareness of ozone depletion issues.
2. Introducing the different types of ODS being used in the sector and for which applications they are used.
3. Introducing the provisions and phase-out schedules of the Montreal Protocol and its amendments.
4. Providing an understanding of the national RMP.
5. Providing an overview on the newly established licensing system for ODS and its implications for customs officers and other stakeholder agencies .
6. Presenting the revised customs codes which allow for the identification of ODS and ODS products / equipment containing them.
7. Refining and optimizing the establishment of the operational details of the monitoring and control system for ODS.
8. Providing an overview of customs regulations and monitoring and control systems for ODS in other countries in the region.
9. Training on the use of identification equipment for refrigerants.
10. Designing the concept, agenda, strategy and the time schedule for the training of the remaining customs officers in the country.

3. Expected results

The immediate result will be the availability of trained customs trainers and key stakeholders and the development of a training approach and recommendation for the subsequent Phase II training of customs and enforcement officers in **[Name of Country].**

A Montreal Protocol related training module will be included in the ongoing training programmes for new customs officers and will also be integrated in the refresher courses for experienced officers. Thus the sustainability of the training programme will be ensured.

The long-term result is to enhance awareness of ozone depletion issues among customs authorities and other relevant stakeholders as well as the achievements of the objectives as stated in Section 2.

In addition, synergies for the enforcement of other relevant international environmental agreements such as the Basel Convention, CITES, Rotterdam Convention and the Kyoto Protocol will be created. The success of most international environmental agreements will depend on the continued support of the world's customs authorities and other key stakeholders.

4. Participants

The train-the-trainers workshop is designed for approximately 20 participants. Half of them will be selected from the customs training section and other relevant customs sections. The other half should include the main stakeholders involved in the implementation and enforcement of the licensing system who will partly function as local resource persons. These key stakeholders should be drawn from the following participant groups and organizations:

- Customs trainers from the training unit,
- Customs officers from various ports of entry and customs sections (computer and data processing unit, document processing unit, administration unit, enforcement officers),
- Enforcement officers from police, coast guard, military,
- Ozone officer of the NOU,
- Local legal consultant who prepared the "Country Handbook",
- Local refrigeration expert to support practical session,

- Private sector representatives including importers, customs brokers, wholesalers,
- Bureau of Standards,
- Bureau of Statistics,
- Pesticides board,
- Ministry responsible for agriculture and pesticides,
- Government laboratory responsible for chemical analysis,
- Ministry responsible for trade and industry issues,
- Ministry responsible for financial issues and import duties,
- Ministry responsible for environmental protection,
- Environmental protection agency,
- Ministry responsible for legal affairs and prosecution,
- Industry and trade associations,
- National committee on climate change and ozone,
- Non-governmental organizations,
- National training institutes and academies,
- National institutes of science and research,
- Media and general public (during opening, closing and awareness sessions), and
- Any other agencies whose input and involvement will be necessary for the implementation of the licensing system.

The participants of Phase II of the training programme will be the remaining customs and enforcement officers in the country including representatives from **[Name of Organisations].**

5. Methodology

The training programme will be implemented in three phases:

Phase I: Train-the-trainers workshop for customs and other enforcement officers

The train-the-trainers workshop for customs and other enforcement officers in **[Name of Country]** is the **[Number of Workshop]** workshop of its kind in the world to be implemented as part of a national RMP. More than 40 similar workshops will be held in other developing countries.

The design of the programme requires that an ODS import/export licensing system and related ODS regulations are in place before the train-the-trainers workshop starts. The establishment of such licensing system was made mandatory by Decision IX/8 of the Ninth Meeting of the Conference of Parties to the Montreal Protocol.

The preparation of the workshop requires the development of the " **[Name of Country]** Handbook on ODS Legislation and Import / Export Licensing System" by the NOU and a local legal consultant. The Country Handbook complements the UNEP training manual "Customs Officer Training on Substances Depleting the Ozone Layer" by providing country-specific information and data.

The project preparation follows a participatory approach and will involve a number of local resource persons. Some case studies on smuggling schemes will be presented to test participants' knowledge of what they had learned throughout the workshop and four small working groups will be created during the break-out session in order to discuss specific topics. Each group will prepare a report with their findings and recommendations.

During group discussions, the participants will plan Phase II and III of the training programme and prepare detailed recommendations, a tentative concept note, agenda and implementation schedule.

A practical hands-on session is included in the programme to identify different types of refrigerants using the pressure-temperature method, leak detector and digital refrigerant identifier. Product and packaging labels will be checked. Refrigerant identifiers, leak-detectors as well as ODS, examples of ODS packaging and ODS products / equipment will be available for demonstration purposes.

Wrap-up sessions will be held at the end of every day and the participants will conduct a workshop evaluation and agree a final set of recommendations.

Each participant will receive a "Certificate of Participation" from the Government of **[Name of Country]** and become registered at the end of the workshop. It is proposed that this training and certification should become mandatory for all customs and enforcement officers.

The workshop report will be disseminated to all participants and members of the contact group on customs training. It will also be placed on UNEP's homepage at: http://www.uneptie.org/ozonaction.html.

Phase II: *Subsequent training of the remaining customs and enforcement officers in the country*

The remaining customs and enforcement officers in the country will be trained by the trained customs trainers who have participated in the Phase I training. Phase II of the training programme will take into account the recommendations from the train-the-trainers workshops and be based on the "UNEP Customs Training Manual".

A certain number of experienced customs officers may receive training on ozone-related issues as part of the continuous customs re-training programme.

The customs department will be expected to incorporate a Montreal Protocol training module on control and monitoring of ODS in its curriculum to ensure that future customs officers are trained on this aspect. This will be done within the ongoing training activities of the customs department.

The NOU, the customs department and the local legal consultant will be responsible for the implementation of Phase II training and for reporting of progress to **[Name of Implementing Agency].**

Phase III: Monitoring & evaluation

The NOU will co-ordinate, monitor and follow-up on the Phase I and II training and report progress in project implementation to **[Name of Implementing Agency].**

After completion of Phase II of the training programme, the NOU will evaluate the results of the training programme and prepare a follow-up & evaluation report. This report will be submitted to **[Name of Implementing Agency].**

6. Content and structure of the train-the-trainers workshop

The training materials and the workshop agenda are designed to ensure that the objectives set out for the training programme are achieved (see Section 2).

The workshop agenda includes the following sessions:

Session 1: *Ozone layer depletion,*
Session 2: *International response,*
Session 3: *National obligations and response,*
Session 4: *National import / export licensing system,*
Session 5: *Checking papers, forms and permits,*
Session 6: *Related international conventions,*
Session 7: *Global & regional context,*
Session 8: *Role of customs officers and other key stakeholders,*
Session 9: *Illegal trade with ODS and ODS-based products,*
Session 10: *Identification of ODS and ODS-based products ,*
Session 11: *Practical exercises on identification of ODS,*
Session 12: *Safe handling, transport and storage of ODS,*
Session 13: *Breakout Session on effective operation of ODS import / export licensing system and enforcement of ODS regulations,*
Session 14: *Action planning for Phase II and III of the customs training, and*
Session 15: *Workshop evaluation.*

Time will also be allocated for discussions among the participants and the presenters on the further implementation of the RMP and the implementation of Phase II and III of the training programme.

Each day a discussion session will be held to draw conclusions and make recommendations for adoption during the last day of the workshop.

7. Follow-up

This training programme is part of the **[Name of Country]***'s RMP. As such it will be accompanied by other training and policy related activities as defined in the RMP.*

The NOU will establish a monitoring mechanism to ensure that the objectives of the training programme are met and will produce a follow-up report on the status of implementation of the training programme.

The NOU will consider and, as far as possible, implement the workshop recommendations as adopted by the workshop participants. The recommendations should also be communicated to the relevant decision-makers and politicians.

Annex 1: List of national agencies and stakeholders with responsibility for ozone protection matters

(A short description of the role and responsibilities of each agency or stakeholder should be included).

Annex D.2: Generic agenda (3 days)

Day 1

8:30 Registration of participants

9:00 Opening ceremony and media briefing

- Welcome address and workshop objectives by Ozone Officer (10 min)
- UNEP DTIE's OzonAction Programme (10 min)
- The training team and workshop approach (5 min)
- Statements of special guests (5 min each)
- Workshop address by Customs representative (5 min)
- Workshop opening by Government representative (10 min)
- Answers and questions by the media (10 min)

10:00 Break

10:15 Introduction

- Expected output of the training programme for customs officers
- Training materials and display
- Self-introduction of participants including questions & answers

10:45 Session 1: Ozone layer depletion

- Environmental and human health consequences
- UNEP video: Every Action Counts
- Ozone layer science
- Discussion

11:15 Break

11:30 Session 2: International response

- International response - the Montreal Protocol and its Amendments
- Phase-out schedule and strategies for Article 2 and Article 5 countries
- Discussion

12:00 Session 3: National obligations and response (NOU)

- Overview of national ODS consumption pattern
- National phase-out obligations
- National response - Refrigerant Management Plan
- Discussion

13:00 Lunch

14:00 Session 4: National import/export licensing system (Legal Consultant, NOU)

- Institutional framework
- National ODS regulations
- Structure of national import/export licensing system
- Institutional arrangements and procedures to manage the system
- Import quotas and application for permits and allowances
- Information to importers, wholesalers and end-users
- Handling of seized ODS and ODS-containing equipment and goods
- Enforcement and penalties
- Forms introduced by the licensing system

- Discussion

15:45 Break

16:00 Session 5: Checking papers, forms and permits
- Logistics and data management
- Application forms, permit forms, freight papers, retrofit certificates etc.
- Practical exercise on checking freight papers and permits
- Discussion

17:00 Wrap-up sessions and workshop recommendations

Day 2

9:00 Session 6: Related international conventions:
- CITES (endangered species)
- Kyoto Protocol (global warming)
- Basel Convention (hazardous waste)
- Rotterdam Convention (prior informed consent)
- Lusaka Agreement (illegal trade in wild fauna and flora)
- Common features related to the control of trade and synergies for customs authorities for effective enforcement
- Discussion

9:45 Session 7: Global and regional context
- Global production and trade with ODS and ODS-containing products
- Transhipment harbours, production, disposal, reclaim facilities in the region
- Regional and global trade agreements
- Implementation of revised HS codes in the region (customs representative)
- Impact on trade and economy (trade representative)
- Discussion

10:15 Break

10:30 Session 8: Role of customs officers and other key stakeholders
- Key players in monitoring and control imports / exports of ODS and ODS-containing equipment and goods (customs, coast guard, police, court, chemistry laboratory, importers/wholesalers, end-users, NOU etc)
- Reporting legal and illegal trade with ODS and ODS-containing products
- Enforcing ODS legislation
- Checklist for customs officers
- Discussion

11:00 Session 9: Illegal trade with ODS and ODS-based products
- Legal and illegal trade with Parties and non-Parties
- Detecting legal and illegal trade at local, regional and international level
- Trade with recycled, recovered, reclaimed or contaminated refrigerants
- Causes and trends of illegal trade
- Methods of smuggling
- Prevention of illegal trade
- Case study on illegal trade
- Discussion

12:30 Lunch

13:30 Session 10: Identification of ODS and ODS-based products

- *Harmonised System codes for pure and mixed ODS*
- *Common trade names for ODSs, including CFCs, HCFCs, methyl bromide, halons, solvents, foams, aerosols etc.)*
- *CAS numbers, ASHRAE numbers, UN numbers etc.*
- *Examples of labelling for ODS and colour codes*
- *Examples of labelling of ODS-containing equipment and goods*
- *Detection of mislabelled ODS containers, cylinders etc.*
- *Identification of ODS-containing equipment and goods*
- *Use of refrigerant identifiers (theory)*
- *Discussion*

14:30 Session 11: Practical exercises on identification of ODS

- *Examples of ODS containers and cylinders and ODS-containing equipment and goods*
- *Hands-on work with CFC detection equipment if available*
- *Identification of ODS-containing equipment and goods*

16:00 Break

16:15 Introduction to break-out Session 13: Effective operation of ODS import / export licensing system and enforcement of ODS regulations

In addition to two key topics, participants may suggest 2 additional topics of interest:

- *Topic 1: How to effectively operate ODS import / export licensing systems*
- *Topic 2: How to effectively enforce ODS regulations*
- *Topic 3: To be suggested by participants*
- *Topic 4: To be suggested by participants*

17:00 Wrap-up session and workshop recommendations

Day 3

9:00 Session 12: Safe handling, transport and storage of ODS

- *ODS Chemical information relevant to customs officers*
- *Safe handling of ODS and ODS-containing products*
- *Safe transport and storage of ODS and ODS-containing products*
- *Safe sampling of ODS - who is allowed to take samples and to use refrigerant identifiers*
- *Discussion*

9:45 Break-out session 13: Effective operation of ODS import / export licensing system and enforcement of ODS regulations

- *Group moderators will co-ordinate the break-out sessions.*

11:15 Break

- *Group moderators will ensure the preparation of a short report and presentation of their findings including the group recommendations.*

11:45 *Break-out session 13: Presentation of findings of the group work to the plenary*
- *Hand-over of reports to the lead consultant*
- *Presentation of group recommendations to the plenary (10 min per group)*
- *Discussion and adoption of group recommendations (5 min per group)*
- *Feedback on the break-out session*

13:00 *Lunch*

14:00 *Session 14: Action planning for Phase II and III of the customs training*
- *How to design Phase II of the customs training (approach, duration, agenda, schedule, trainers, participants etc.)*
- *Which training materials should be used for Phase II of the customs training and what should be the key contents of the training*
- *How to ensure timely implementation, monitoring and reporting*
- *Discussion*

15:00 *Session 15: Workshop evaluation*
- *Completion of evaluation questionnaires*
- *General feedback and comments from participants and organisers*

15:45 *Break*

16:00 *Closing session and media briefing*
- *Conclusions and outlook by Ozone Officer (10 min)*
- *Closing statement by UNEP DTIE's OzonAction Programme (5 min)*
- *Closing remarks by the training team (5 min)*
- *Hand-over of participation certificates (15 min)*
- *Closing remarks by Customs representative (5 min)*
- *Conclusions on synergies on co-operation between related Conventions (5 min)*
- *Closing of workshop by Government representative (10 min)*
- *Answers and questions by the media (10 min)*

Note: *A site visit may be organised on a voluntary basis outside the official workshop hours, e.g. as an "Open Door" initiative after the workshop or in the evening if this is feasible. Alternatively, a short slide show could be prepared by customs.*

Annex D.3: Generic break-out session

1. Purpose of the Assignment:

By analysing the group work exercises, making and presenting recommendations, and discussing with your colleagues and resource speakers, you will have a chance to identify ways to effectively enforce and operate the ODS regulations and import/export licensing system, and to practice communicating the information you have acquired during the program.

2. Instructions:

a. The training team will proposes 2 topics for the mini groups during a break. Suggest 2 additional topics. Topics will be selected during introduction to break out sessions.
b. Inscribe to 1 mini group only on a "first comes first served" basis - 5 participants maximum per group. Participants may choose topics which are not related with their usual work area so they contribute their own fresh views and are exposed to alternative views. To be done during break.
c. Identify 1) the group leader to co-ordinate the group work and for the time management, 2) the group secretary to take notes and to fill in the report form and 3) the spokesperson that will present your recommendations. Not more than 5 minutes.
d. Read group work example and raise any questions you have. Not more than 15 minutes.
e. Discuss the questions posed for each topic and add your own questions. Also consider the information presented during the program sessions as you work through your assignment. Prioritise 3-4 questions. Time available as per agenda.
f. Complete the group activity form. One report from each group should be submitted to the workshop facilitator after each presentation. Plan at least 15 minutes.
g. Present your findings and recommendations to the class. Each team will have maximum 10 minutes.

3. Topics for the break-out session:

Topic 1: Effective operation of ODS import/export licensing systems

- How can the system be best implemented?
- Should there be a verification process for licenses?
- How will the system be evaluated?
- What are the difficulties with the system?
- How is communication accomplished in the system? How is information shared among relevant agencies?

Topic 2: Enforcement of ODS regulations

- Agency strategies for detecting illegal ODS?
- How is evidence gathered?
- What is the process for seized ODS (storage, monitoring)?
- How can bribes be discouraged?
- Are the penalties strict enough?
- Are there sufficient resources and equipment to enforce ODS regulations?
- What about regional co-operation? How are enforcement efforts co-ordinated with other countries in your area?
- How is intelligence gathering conducted for ODS?
- Should your country start an ODS taskforce with scheduled meetings for information exchange and strategic planning?

Topics 3 & 4: To be suggested by participants

Annex D.4: Generic break-out session report form

Your findings and recommendations will be part of the workshops results and be included in the workshop report. They will guide the preparation of Phase II of the customs training programme. Please write in ink and use the other side of this sheet if you need more writing space.

Session: Mini group:

Topic:

Participants:

_____ _____

_____ _____

_____ _____

Key issues / problem identification
Obstacles to achieving desired outcome

Key results of the discussion (consensus-disagreement)
Discussion notes:

Recommendations & lessons learned

Actions to be taken:

Resources required:

Summary & conclusions

Thank you for returning this form to the workshop facilitator.

Logo of Government of [Country]

Logo of [Training Institute]

CERTIFICATE OF PARTICIPATION

Government of [Country]

UNEP DTIE's OzonAction Programme

[Training Institute]

certify that

Mr./Ms._____

has participated in the

National Training Workshop for Customs Officers on Substances Depleting the Ozone Layer

[City], [Country], [Date]

This training is part of the Refrigerant Management Plan of [Country] for the phaseout of ozone-depleting substances and funded by the Multilateral Fund for the Implementation of the Montreal Protocol.

_____	_____	_____
Government of [Country]	*UNEP DTIE*	*[Training Institute]*

Annex D.6: Generic evaluation questionnaire

Please complete this questionnaire and indicate your personal evaluation by ticking the appropriate boxes (1 represents poor and 5 represents excellent):

1. *What is your overall evaluation of the course?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

2. *Did the course provide the information you expected?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

3. *Was communication between participants possible and useful?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

4. *Was the composition of the audience adequate?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

5. *As far as the contents of the presentation are concerned, did you find them adequate in explaining the following issues:*

   a) *Environmental and human health consequences of ozone layer depletion?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   b) *International response to ozone layer depletion (Montreal Protocol)?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   c) *National obligations and phase-out strategy (RMP)?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   d) *Regulatory framework for the national import/export licensing system?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   e) *Prevention of illegal trade of ODS?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   f) *Role of customs officers in enforcing the import/export licensing system?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   g) *Role of other stakeholders in implementing the import/export licensing system?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   h) *How to identify ODS and equipment containing ODS and the use of ODS identifying equipment?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   i) *Issues relating to safe storage and handling of ODS?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   j) *Data reporting requirements and procedures?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

   k) *Enforcement, penalties and prevention of illegal trade?*

   1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐

6. Can you think of any additional material that should be included in the "Training Manual for Customs Officers" to enable it to better achieve its goals?

7. Can you think of any additional material that should be included in the "Country Handbook" to enable it to better achieve its goals?

8. Please give additional comments about the quality of the course and how similar courses could be improved:

PLEASE INDICATE YOUR NAME, ORGANISATION AND PROFESSION AND RETURN THE COMPLETED QUESTIONNAIRE BEFORE LEAVING:

Name: _____

Organisation: _____

Profession: _____

Annex D.7: Generic agenda for Phase II (1 day)

8:45 Registration of participants

9:00 Introduction
- Expected output of the training programme for customs officers
- Training materials and display

9:15 Session 1: Ozone layer depletion
- UNEP video: Every Action Counts
- Environmental and human health consequences
- Ozone layer science
- Discussion

10:00 Session 2: International & national response
- International response - the Montreal Protocol and its Amendments
- Related international conventions
- Overview of national ODS consumption pattern
- National phase-out obligations
- National response - Refrigerant Management Plan
- Discussion

11:00 Session 3: National import/export licensing system
- Institutional framework
- National ODS regulations
- Structure of national import/export licensing system
- Institutional arrangements and procedures to manage the system
- Import quotas and application for permits and allowances
- Information to importers, wholesalers and end-users
- Handling of seized ODS and ODS-containing equipment and goods
- Enforcement and penalties
- Forms introduced by the licensing system
- Customs obligations to other agencies (e.g. reporting)
- Discussion

12:30 Lunch

13:30 Session 4: Global and regional context
- Global production and trade with ODS and ODS-based products
- Transhipment harbours, production, disposal, reclaim facilities in the region
- Discussion

13:45 Session 5: Illegal trade with ODS and ODS-based products
- Legal and illegal trade with Parties and non-Parties
- Detecting legal and illegal trade at local, regional and international level
- Trade with recycled, recovered, reclaimed or contaminated refrigerants
- Causes and trends of illegal trade
- Methods of smuggling
- Prevention of illegal trade
- Checklist for customs officers
- Discussion

15:00 Session 6: Local case studies on illegal trade

15:30 Break

15:45 Session 7: Identification of ODS and ODS-based products

- Harmonized System codes for pure and mixed ODS
- Common trade names for ODSs
- CAS numbers, ASHRAE numbers, UN numbers etc.
- Examples of labeling for ODS and color codes
- Examples of labeling of ODS-containing equipment and goods
- Detection of mislabeled ODS containers, cylinders etc.
- Identification of ODS-containing equipment and goods
- Use of refrigerant identifiers (theory)
- Discussion

16:45 Session 8: Safe handling, transport and storage of ODS

- ODS chemical information relevant to customs officers
- Safe handling of ODS and ODS-containing products
- Safe transport and storage of ODS and ODS-containing products
- Safe sampling of ODS - who is allowed to take samples and to use refrigerant identifiers
- Discussion

17:15 Session 9: Practical exercises on identification of ODS

- Examples of ODS containers and cylinders and ODS-containing equipment and goods
- Hands-on work with CFC detection equipment if available
- Identification of ODS-containing equipment and goods

18:00 Session 10: Workshop evaluation

- General feedback and comments from participants and organisers
- Hand-over of participation certificates

Annex D.8: Generic case studies for customs inspectors

These are case studies that should be adapted to each country to include the proper names of organisation and places.

1. *You are reviewing a paperless entry for a large shipment of gas cylinders on a ship that has just left Europe. The shipment is to be entered in at one port, but the consignee is in another area of the country. You notice that one of the country code numbers (on the entry documents) is from a known smuggling country. Whom do you call and what do you do?*

2. *You notice that several shipments of CFCs have been manifested in Transit (T&E Bond) from one location to another within your country to a neighbouring country. You have noticed this pattern before, and you question how much of this product is needed there. You also notice that company utilises a local address. Whom do you call and what you do?*

3. *You receive a telephone call from a Customs Investigator in a neighbouring country. She tells you that there is a suspicious shipment of supposedly "recycled Halon" headed to your country by vessel from (Country X). She said the shipment is suspicious because it was originally destined from Toronto, but is now scheduled to go by rail from your country to two other cities in her country. Whom do you call, what do you do?*

4. *An informant tells you that he can introduce you to a man who sells large quantities of Chinese CFCs wholesale. He tells you that a shipment of these CFCs is due to arrive this week from a major port. Whom do you call, and what do you do?*

5. *You have been working on an Environmental Crimes Task Force with the Attorney's Office . You have received information from an Agent, that an unnamed corporation with an extensive shipping record is shipping Freon into your country. Whom do you call and what do you do?*

6. *You are a Coast Guard Officer. During a ship search, you overhear a crewman telling another crew member about the last ship he was on and that that ship routinely carried CFC cylinders in a special hold. You are able to get the crewman's name but little else. Whom do you call, and what do you do?*

7. *You receive a request from an Investigator with another country's Custom Service about shipments of CFCs that have supposedly been destined for your country. The information is sketchy, but the shipments have allegedly been made over a long period of time. Whom do you call and what do you do?*

8. *You have noticed that every week Freon gas cylinders are being routinely shipped from a neighbouring country to a hospital in your country. Another load has just been entered electronically. Whom do you call and what do you do?*

Annex E: Overheads

Objectives of workshop

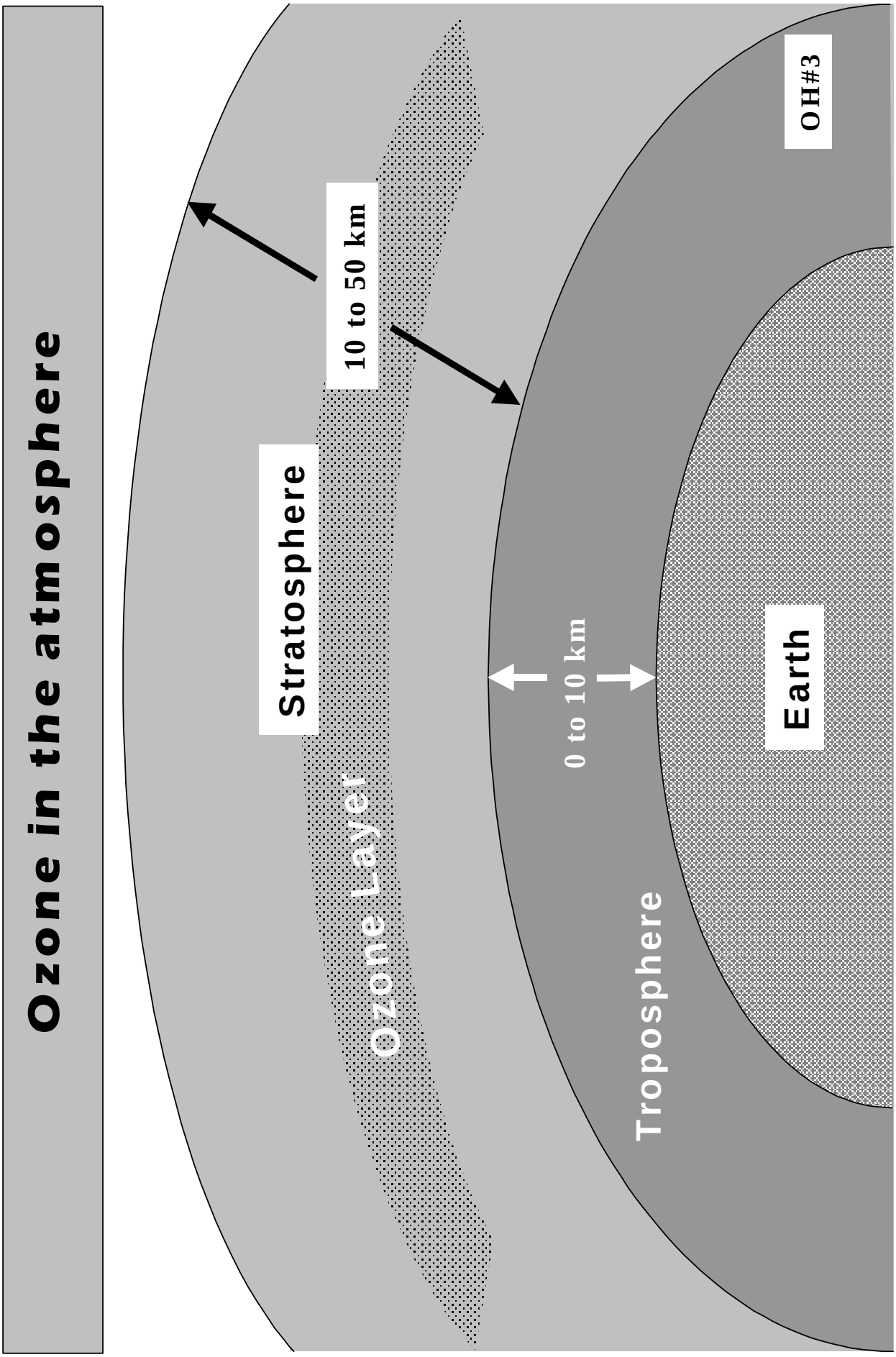
- Increasing awareness of ozone depletion issues.
- Introducing the different types of ODS being used in the sector and for which applications they are used.
- Introducing the provisions and phase-out schedules of the Montreal Protocol and its amendments.
- Providing an understanding of the national RMP.
- Providing an overview on the newly established licensing system for ODS and its implications for customs officers and other stakeholder agencies.
- Presenting the revised customs codes which allow for the identification of ODS and ODS products / equipment containing them.
- Refining and optimizing the establishment of the operational details of the monitoring and control system for ODS.
- Providing an overview of customs regulations and monitoring and control systems for ODS in other countries in the region.
- Training in the use of identification equipment for refrigerants.
- Designing the concept, agenda, strategy and the time schedule for the training of the remaining customs officers in the country.

OH #1

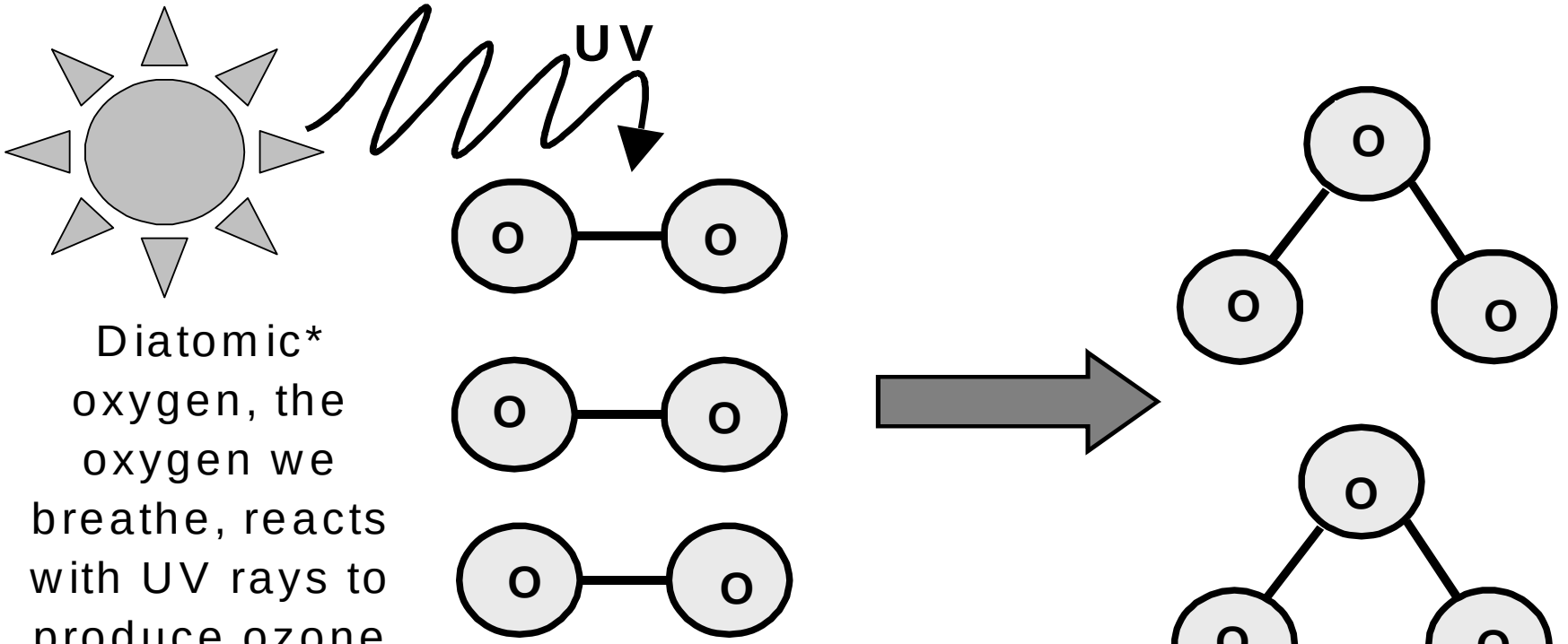
Who should use the manual?

- Implementing and bilateral agencies under the Multilateral Fund for the Implementation of the Montreal Protocol.
- International customs trainers.
- Trained customs trainers should use the manual as resource document to design a country-specific training module for Phase II of the training programme.
- Customs trainers, customs and enforcement officers and other relevant stakeholders involved in the operation and enforcement of the import / export licensing system for ODS.

OH#2


Ozone in the atmosphere
OH#3
10 to 50 km
Stratosphere
Ozone Layer
0 to 10 km
Troposphere
Earth

Formation of Ozone



Diatomic* oxygen, the oxygen we breathe, reacts with UV rays to produce ozone

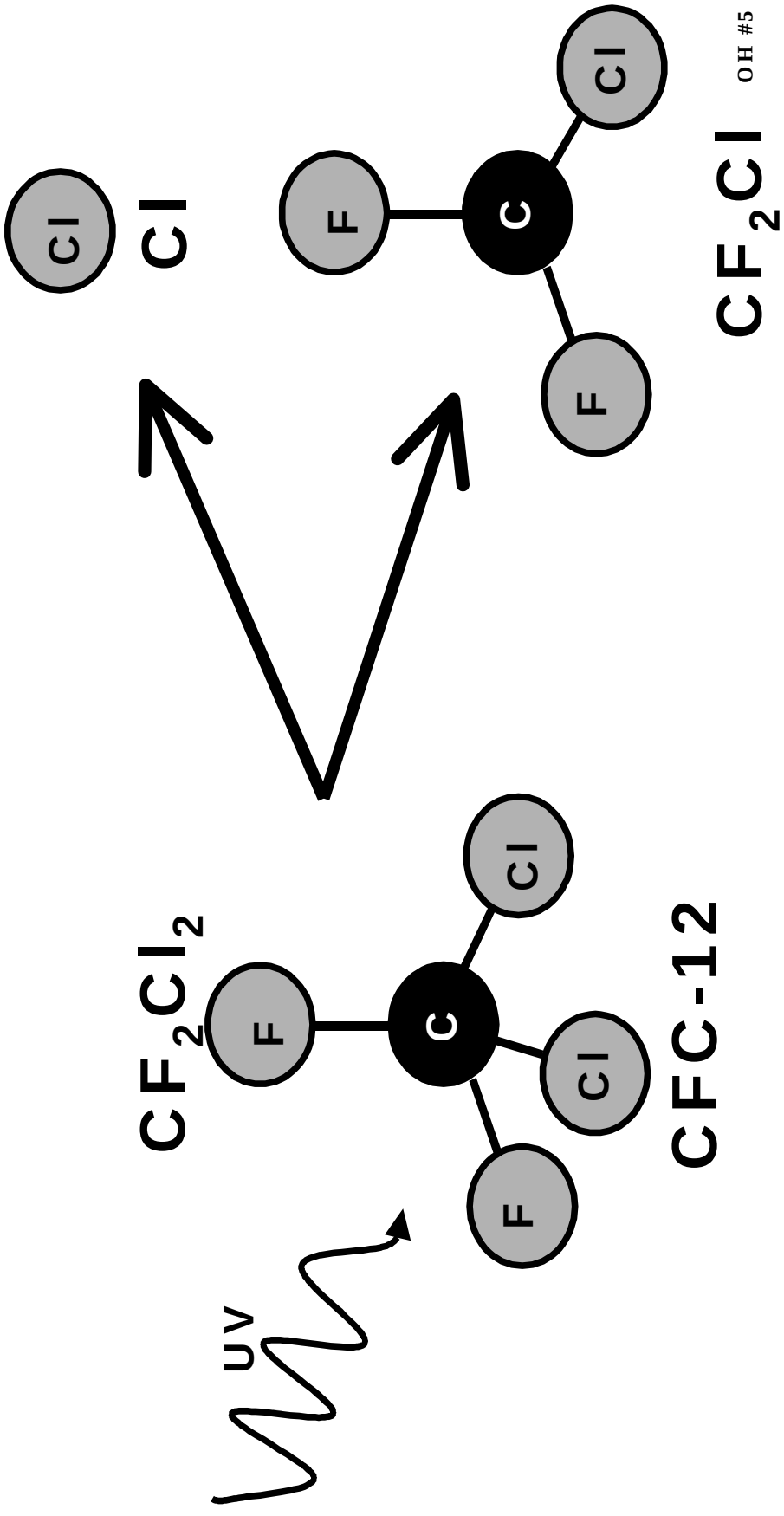
Diatomic* Oxygen (O_2)

Ozone (O_3)

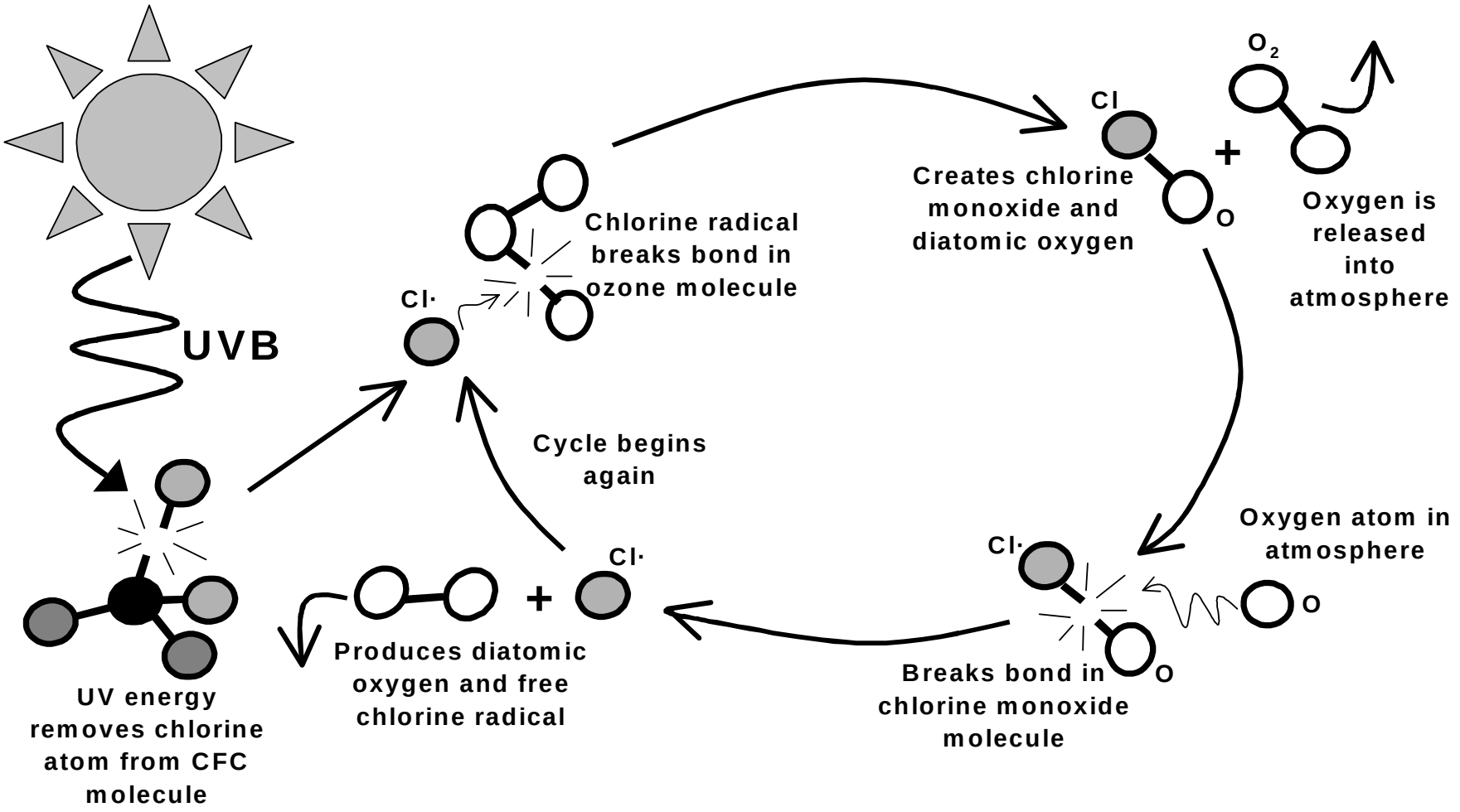
*Diatomic means 2 atoms

OH #4

UV Radiation Releases Chlorine from CFCs



Destruction of Ozone by CFCs



OH # 6

Effects of ozone layer depletion

Human health

- Damages DNA which suppresses immune system resulting in increase in infectious diseases
- Skin cancer
- Eye cataracts

Plants & trees

- Reduces crop production, damage to seeds
- Reduces quality of crops

Aquatic organisms

- Damage to plankton, aquatic plants, fish larvae, shrimp, crabs
- Affects marine food chain, damage to fisheries result

Materials

- Paints, rubber, wood, & plastic are degrades, especially in tropical regions
- Damages could be in billions of US dollars.

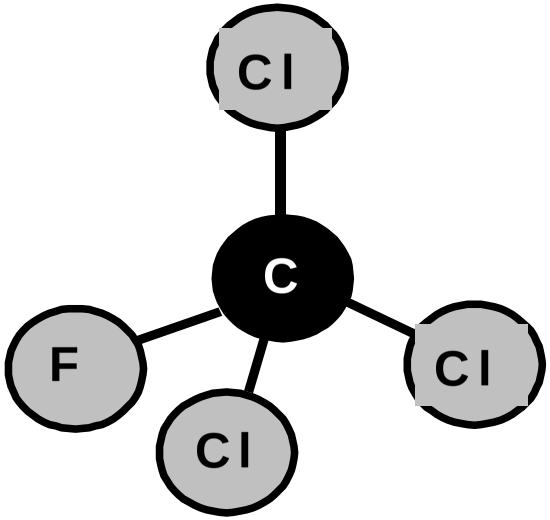
OH #7

List of ozone depleting substances with ODP

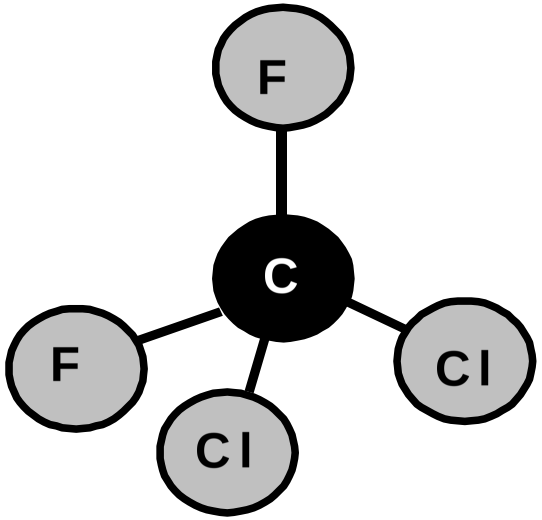
• chlorofluorocarbons (CFCs)	ODP from 0.6-1.0
• halons	ODP from 3.0-10.0
• carbon tetrachloride	ODP of 1.1
• methyl chloroform	ODP of 0.1
• hydrofluorocarbons(HCFCs)	ODP from 0.001-0.11
• hydrobromofluorocarbons (HBFCs)	ODP from 0.02-1.0
• bromochloromethane	ODP of 0.12
• methyl bromide	ODP of 0.6

OH #8

Some CFCs



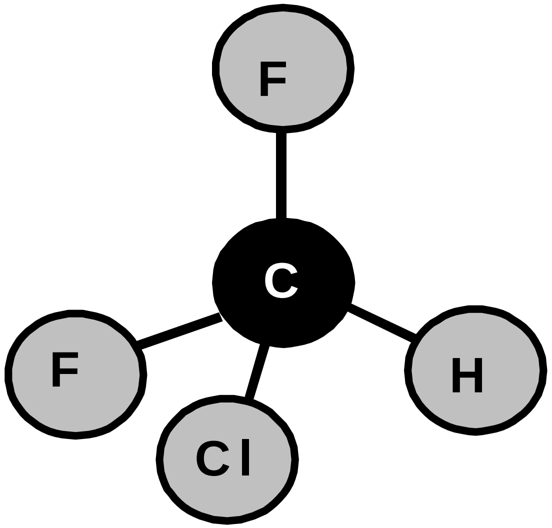
CFC-11



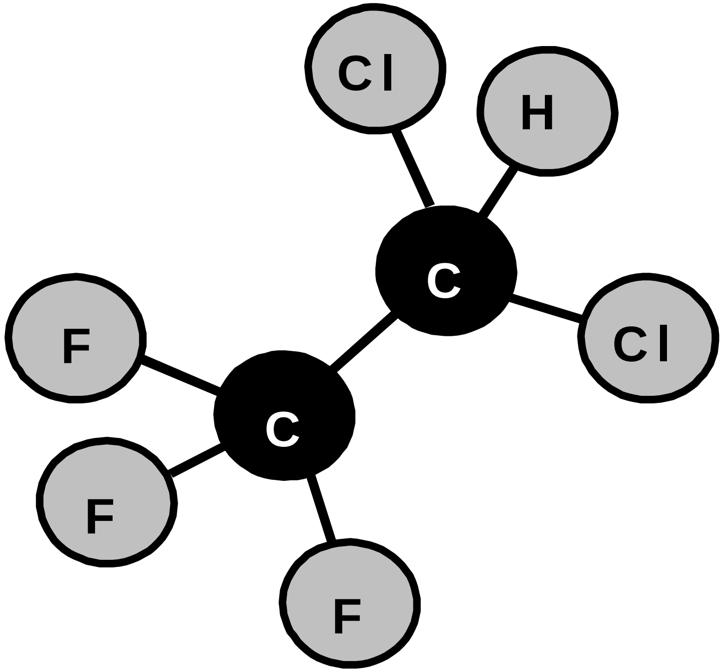
CFC-12

OH #9

Some HCFCs



HCFC-22



HCFC-123

OH #10

Uses of ODS

- **Refrigerants**: Domestic, commercial, and transport refrigerators; air-conditioning & heat pump systems; motor vehicle air-conditioners.
- **Blowing agents**: CFC-11 foam blowing agent for the manufacture of polyurethane, phenolic, polystyrene and polyolefin foam plastics.
- **Cleaning solvents**: CFC-113, methyl chloroform, carbon tetrachloride for electronic assembly production processes, precision cleaning & general metal degreasing. Also for dry cleaning & spot cleaning in textile industry.
- **Propellants**: CFC-11, -12, -113, -114 for aerosols like deodorants, shaving foam, perfume, window cleaners, lubricants, & oils
- **Sterilants**: Mixtures of CFC-12 & ethylene oxide used for medical sterilisation.
- **Fire extinguishers**: Halons & HBFCs.
- **Fumigants**: Methyl bromide, pesticide for soil fumigation & pre-shipment & quarantine apps.
- **Feedstock**: HCFC & carbon tetrachloride are used as feedstock for chemical synthesis.

OH#11

Amendments & adjustments to the Montreal Protocol

Adjustments

- May modify the phase-out schedules of already controlled substances as well as ODP values of controlled substances based on new research results.
- Automatically binding for all countries that have ratified the Protocol, or the relevant amendment, which introduced the controlled substance.

Amendments

- May introduce control measures or new ODS.
- Countries, which have not ratified a certain amendment, are considered as a **non-Party** e.g. with regard to a new ODS introduced by that amendment.

OH #12

Phase-out schedule for ODS

Annex	ODS	First control measure for Article 5 countries	Final phase-out for Article 5 countries (production & consumption)
Annex A-I	CFCs	1999 freeze	2010 phase-out
Annex A-II	Halons	2002 freeze	2010 phase-out
Annex B-I	CFCs	2003 reduction 20%	2010 phase-out
Annex B-II	Carbon tetrachloride	2005 reduction 85%	2010 phase-out
Annex B-III	Methyl chloroform	2003 freeze	2015 phase-out
Annex C-I	HCFCs	2016 freeze	2040 phase-out consumption only
Annex C-II	HBFCs	1996 phase-out	1996 phase-out
Annex C-III	Bromochloromethane	2002 phase-out	2002 phase-out
Annex E	Methyl bromide	2002 freeze	2015 phase-out

OH# 13

Exemptions for use & production of ODS

- **Essential use:** An exemption from the total phase out of controlled substances can be granted for certain essential uses upon application, if approved by the Meetings of the Parties on a case-by-case basis (exempted category).

- **Feedstock:** Controlled substances that are used in the manufacture of other chemicals and that are completely transformed in the process.

- **Process agents:** Some ODS are used in the production of other chemicals e.g. as a catalyst or an inhibitor of a chemical reaction without being consumed. Only those uses of controlled substances approved by the Montreal Protocol are allowed.

- **Production to satisfy basic domestic needs:** Article 5 countries are allowed a grace period compared with non-Article 5 countries to phase-out the use and production of controlled substances in order to meet their domestic needs.

OH# 14

Trade with Parties

- ***Each Party to regulate (including labelling) export and import*** of products, equipment, components and technology whose functioning relies on ODS or contains ODS as described in Annexes A and B of the Protocol;

- ***Non-Article 5 Parties control the export of used (second hand) products and equipment*** whose functioning relies on ODS as described in Annexes A and B of the Protocol;

- ***After the phase-out date*** for a controlled substance, if a Party is unable to stop production of that substance for domestic consumption, other than uses agreed by the Parties to be essential, it shall ***ban the export of used, recycled and reclaimed quantities*** of that substance, other than for the purposes of destruction; and

- ***Countries which do not want to receive products and equipment*** containing controlled substances from Annex A and B of the Montreal Protocol may request to be included on a list of countries maintained by the Ozone Secretariat. Customs officers should be aware whether their country is listed or not.

OH# 15

Ban on trade with non-Parties

- **Non-Party**: Any country whose government has not ratified, accepted, approved, or accessed the Montreal Protocol or one or more of its specific amendments.

- **1990** - Ban on all **imports** of Annex A substances from any non-Party states.

- **1993** - Ban on **exports** of Annex A controlled substances to non-Party states from party states.

Countries that have not yet ratified any ozone treaties (as of July 2000):

- African States: Cape Verde, Eritrea, Guinea-Bissau, Rwanda, Sao Tome and Principe, Sierra Leon, Somalia.

- Asian States: Afghanistan, Bhutan, Cambodia, Cook Islands, Iraq, Nauru, Niue, Palau.

- Other States: Andorra, Holy See, San Marino.

OH# 16

Crosscutting issues

- **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)** regulates international trade in certain protected species. It is an international agreement that monitors global trade in many species of wildlife and plants. Developing customs training.

- **Basel Convention on Control of Trans-boundary Movements of Hazardous Wastes and their Disposal** strictly regulates the trans-boundary movements of hazardous wastes and provides obligations to its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner. Developing customs training.

- **Rotterdam Convention on Prior Informed Consent** controls the trade in hazardous chemicals. The new Convention promises to create a first line of defence against chemical risks by empowering governments with the information and procedures they need to monitor and control cross-border trade. Developing customs training.

- **Kyoto Protocol** set binding limits on greenhouse gas emissions for developed countries, those most responsible for past and current levels of greenhouse gas emissions. Some replacements for ODS (HFCs) and some ODS (CFCs & HCFCs) are greenhouse gases.

OH#17

Key players in enforcing ODS licensing system

- **Customs officers**
- **National Ozone Unit**
- **Licensing agencies**
- **Ministry of Trade, Industry or Commerce**
- **Food & Drug Administration**
- **Pesticides Board**
- **Attorney General's Department**
- **Police and Coast Guard**
- **Bureau of Standards**
- **Industry & trade representatives & associations**
- **General public**
- **Government laboratories**
- **National ozone & climate committees**
- **Other law enforcement agencies**
- **Ministry of Justice**

OH# 18

Role of customs officers in enforcing ODS regulations

- **Enforcement of ODS licensing system**
- **Training of customs officer in identification of ODS and ODS-based products**
- **Awareness raising on ODS regulations among importers and exporters**
- **Checking and inspecting shipments, trucks and vessels**
- **Detecting illegal trade with ODS and ODS-based products**
- **Using refrigerant identifiers and analysers**
- **Cooperation with other stakeholders involved in monitoring of ODS trade**
- **Reporting legal and illegal trade as well as seizures to the NOU**
- **Seizing illegal imports including storage and disposal**
- **Supporting other enforcement agencies e.g. in providing evidence for court cases**
- **Refer to customs checklist for identification of ODS and ODS-based products**

OH# 19

Customs checklist

The initial examination of documents should be the first instance where discrepancies might be found.

✓	**Compare the packing list, bill of entry, and the country of origin to make sure they match.**
✓	**Ensure the customs code on the entry matches the description on the invoice.**
✓	**Compare the invoice and the bill of lading to the outward bound ships manifest.**
✓	**Verify the country of origin. Is the country a party to the Montreal Protocol and its amendments?**
✓	**Verify that the importer and place of business actually exist.**
✓	**Contact the licensing agency to verify with that importer is licensed to import that specific material.**
✓	**Note the quantity, source, and destination of ODS. These will serve as important clues that may provide indicators to prohibit illegal importations.**
✓	**Verify that the container number actually exists. Discovery of fictitious container numbers have led to the disclosure of illegal trade.**
✓	**Review all the necessary documents, if there is something that doesn't match, it may be an illegal shipment.**
✓	**Inspect the merchandise.**
✓	**Check packaging, size and shape, and label on container.**
✓	**Identify the name and description of the chemical, which should match ALL paperwork.**
✓	**Seize the material if the importer does not have the import/ export license.**
✓	**Coordinate this seizure with the customs officer, environment agency, and the prosecution agency. Anyone involved with the seizure may be called to testify in court, so take good notes.**

OH#20

HS tariff classification

- Structure of the HS codes (based on chemical contents or application)
- HS codes for ODS
- HS codes for ODS products
- WCO and UNEP Ozone Secretariat developing recommendations for HS codes for ODS-containing mixtures
- International HS codes (See Annex B in UNEP's customs training manual)
- National HS codes (See National Handbook on ODS Regulations and Import / Export Licensing System)

OH# 21

Trade & chemical names

Trade names

- The names companies give to their products, e.g. Freon-12
- See Annex B of UNEP's customs training manual

Chemical names

- Different names and formulas can be used
- Chemical names, e.g. methyl chloroform or 1,1,1-trichloroethane
- See Annex B of UNEP's customs training manual

OH# 22

ASHRAE & UN numbers

ASHRAE number

- American Society of Heating, Refrigerating, and Air-conditioning Engineers
- Number designation for refrigerants based on their chemical structure, e.g. R-12

UN number

- United Nations Substance Identification Number (UN SIN or UN number)
- A four-digit international standard number which identifies a particular chemical or group of chemicals; e.g. CFC-12's UN number is 1028

OH# 23

CAS numbers

CAS number

- Chemical Abstract Service number to identify a chemical. The CAS number contains from 5 to 9 digits separated into three groups by hyphens.
- The first group, starting from the left, has up to 6 digits;
- The second group always has 2 digits; the third group always has 1 digit.
- The CAS number is specific for single chemicals and for some mixtures, e.g. CFC-12 is 75-71-8

ASHRAE designations for single components

R-134a

- One less than the number of carbon atoms (i.e., there are 1+1 = 2 carbon atoms)
- One more than the number of hydrogen atoms (i.e., there are 3-1 = 2 hydrogen atoms)
- Number of fluorine atoms (i.e., there are 4 fluorine atoms)
- The "a" indicates an isomer (i.e., a different arrangement of the same atoms) of R-134

OH # 25

Portable refrigerant identifiers/ analysers

Some identifiers may:

- detect R-11, R-12, R-22, R-134a, R-500, R-502, hydrocarbons and air;
- detect composition of mixtures;
- detect purity and water content;
- be connected to a computer or printer;
- saves several test results;
- uses infrared optical technology to identify refrigerant type; and
- costs USD$ 900-3,000.

OH#26

Temperature/pressure method

- Be careful when testing, frostbite & other injury could occur. Safety gloves & mask should be worn.
- Place thermometer with cylinder and wait until the cylinder contents have reached the approximate temperature of the warehouse. For cylinders which are in direct sunlight, allow to cool in shaded area for 1-2 hours.
- Take temperature reading.
- Attach hose to container & open valve to get true reading (PSI)* on gauge.
- After obtaining reading, close valve and remove hose.
- Compare temperature and PSI readings to PSI chart. Refer to temperature/pressure chart in Annex B.8 e.g. for a temperature of 21 degrees celcius, the PSI should be 70.2 for CFC-12.
- Smugglers can change the pressure of the container by adding other gases, like nitrogen.
- If you suspect something, send the cylinder for laboratory analysis.

* PSI= pounds per square inch

OH# 27

Laboratory analysis

- Laboratories use more extensive techniques for testing than field equipment.
- Laboratory testing can identify specific compounds.
- What size containers can be sent directly to the laboratory?
- Check with lab to see who can take samples.
- Should be conducted by a professional.

OH# 28

Safety checklist for customs officers

Handling, transport, storage and identification of ODS refrigerants

DOs

- Do observe local regulations and industry-recommended procedures for the handling, transport and storage of virgin, recovered, recycled or contaminated refrigerants.
- Do use protective clothing, including safety goggles and cold-insulating gloves when handling refrigerants. Refrigerants can cause frostbite and other damaging effects to the skin and eyes.
- Do equip storage areas with appropriate fire extinguishing systems to reduce the risk of fire. CFC refrigerants are not combustible but produce irritating or toxic fumes in a fire.
- Do use electronic leak detectors to inspect storage areas and access valves for leakage.
- Do check the contents of refrigerant cylinders using the temperature / pressure method or electronic refrigerant identifiers - but only if you are trained and authorised to do so under local regulations.
- Do inspect access valves for leaking glands and effective gaskets. Protective caps should prevent valve damage.Do secure storage areas for ODS and ensure that they are only accessible by authorised personnel & that they are protected against theft.
- Do properly label ODS and storage areas and show appropriate warnings if necessary.
- Do store seized ODS until further legal action determines what will be done with the substances. They should be clearly labelled and safely stored. The Country Handbook on ODS Regulations should detail storage requirements for seized ODS.
- Do disconnect the power supply when inspecting or testing equipment, e.g. refrigerators should be unplugged and vehicle motors turned off.
- Do respect local requirements and standards for pressure vessels with low- and high-pressure refrigerants. In many countries safety inspections are mandatory.
- Do store and transport ODS cylinders carefully in an upright position (this does not apply to ISO containers) and prevent dropping them.

OH# 29

DON'Ts

- Do not eat, drink or smoke in storage areas or near ODS or ODS products/ equipment.
- Do not vent ODS into the atmosphere knowingly. Do not dispose of any ODS by using methods other than R&R, reclaim, reuse, adequate storage or approved destruction methods.
- Do not handle or store ODS in confined spaces which lack ventilation since some ODS can accumulate in confined spaces. This increases the risk of inhalation and may cause unconsciousness or suffocation resulting in death. Use breathing protection if appropriate.
- Do not store ODS cylinders in direct sun light or near hot surfaces. A rise in temperature will cause an increased pressure with the risk of bursting.
- Do not take samples of ODS – this should be done by trained and authorised technicians or personnel of accredited Government laboratories.
- Do not use open flames in storage areas or near any refrigeration & air-conditioning system to reduce the risk of fire. Do not use the "halide torch method" (flame test) for leak testing.
- Do not handle chemicals or ODS if you are not trained and familiar with the necessary safety precautions.

OH# 30

Smuggling schemes

- Scheme I: Mislabelling as non-ODS
- Scheme II: Mislabelling as recovered ODS
- Scheme III: Concealment and double layering of ODS
- Scheme IV: Diverting ODS from transhipment harbours or ODS produced for export

OH# 31

Screening methods

- ☑ **Screening for importers which are not licensed to import ODS refrigerants**
- ☑ **Screening documentation for consistency of codes & names**
- ☑ **Screening by quantity of import**
- ☑ **Screening by country of origin**
- ☑ **Screening by transhipment harbour**
- ☑ **Screening by recovered or recycled ODS shipments**
- ☑ **Screening by countries with recycling capacity**
- ☑ **Physical examination of containers & packaging**
- ☑ **Screening containers & packaging for consistency of codes & names**
- ☑ **Check consistency of ISO container labelling**
- ☑ **Consistency check of container type and labelling**
- ☑ **Consistency check on flammability of refrigerants**
- ☑ **Check cylinder valves**
- ☑ **Direct identification & analysis**

OH# 32

Main ODS producing countries

Annex	ODS	Main producing countries
Annex A-I	CFCs	China[2], India[2], Russian Federation[1,2], Netherlands, Brazil, Republic of Korea, Italy, Spain, Mexico, Venezuela, United Kingdom
Annex A-II	Halons	China, Republic of Korea, Russian Federation
Annex B-I	CFCs	Russian Federation, China
Annex B-II	Carbon tetrachloride	India, Brazil, Ukraine, Romania
Annex B-III	Methyl chloroform	Japan, United States, France, China
Annex C-I	HCFCs	United States, France, Japan, China, United Kingdom, Netherlands, Spain, India
Annex C-II	HBFCs	Currently there are no producers.
Annex C-III	Bromochloromethane	No data available at publication time.
Annex E	Methyl bromide	United States, Israel, Japan, France, China, Romania, India

[1] The Russian Federation was supposed to stop CFC production from 1 July 2000 but could not comply with its obligation because of its economic difficulties.

[2] China, India and Russia as the main CFC producing countries agreed to close down their manufacturing plants following a pre -defined time schedule.

OH# 33

List of ODS products

- Automobile and truck air-conditioning units (whether incorporated in vehicles or not)
- Domestic and commercial refrigeration and air-conditioning / heat pump equipment, e.g. :
    - Refrigerators,
    - Freezers,
    - Dehumidifiers,
    - Water coolers,
    - Ice machines, and
    - Air-conditioning and heat pump units.
- Aerosol products, except medical aerosols
- Portable fire extinguisher
- Insulation boards, panels and pipe covers
- Pre-polymers

OH# 34

Training tools

- **Country handbook**
- **UNEP customs training manual**
- **Videos**
  - *Video 1: "Saving the Ozone Layer: Every Action Counts"*
  - *Video 2: "Protecting the Ozone Layer and the Illegal Importation of CFCs"*
  - *Video 3: "Contraband Cool"*
- **Case studies**
- **Overheads**
- **Examples of ODS, ODS-containing products and ODS-based equipment**
- **Customs poster**
- **Evaluation questionnaire**
- **Diskettes**
- **Deskbook for customs officers**
- **WWW**

OH# 35

Knowledge check

Chapter 1

1. What is the ozone layer?
2. Why is the ozone layer important?
3. What are the effects of ozone layer depletion?
4. What is the ozone hole?
5. What are ozone depleting substances?
6. What are the common uses for ODS?

Chapter 2

1. What is the Montreal Protocol?
2. What is the ODS phase-out schedule for Article 5 countries?
3. What is the difference between ODS and ODS products ?
4. What are the exemptions for use and production of ODS?
5. What are the limits for ODS trade with Parties?
6. What are the provisions for trade with non-Parties?
7. Who are the different international stakeholders in the Montreal Protocol?
8. What are the other crosscutting international environmental agreements?

Chapter 3

1. What is a RMP?
2. What is an import/export licensing system designed to do?
3. What is the difference between a quota and an allowance ?

OH# 36

4. What is the role of customs officers in the import/export licensing system?
5. Who are the stakeholders in an import/export licensing system?

Chapter 4

1. Why should customs officers take safety precautions when handling ODS?
2. Why shouldn't customs officers handle ODS in confined spaces?
3. How should sampling be conducted ?

Chapter 5

1. What are the basic smuggling schemes for ODS?
2. What is the first thing a customs officer should verify for a shipment of ODS?
3. What are the screening methods for paperwork relating to an ODS shipment ?
4. What are the screening methods for physical inspection of ODS?
5. Why should customs officers educate their stakeholders?
6. Why should customs officers establish an ODS information exchange?

OH# 37

Chapter 6

1. What HS codes are being developed to better monitor ODS trade?
2. Describe the various ODS names.
3. Describe the different containers and packaging for ODS.
4. Describe the location of labelling for refrigerators and vehicle air conditioners.

Chapter 7

1. Where can ODS be found?
2. Describe the temperature/ pressure test.
3. What are the prescribed methods for sampling?

Chapter 8

1. Describe the various tools needed for training during Phase II.
2. Why is monitoring and evaluation of the training program important?
3. What are the different interactive training techniques?

OH# 38

Annex F:Further references & websites

[1] Allied Signal, Quimobasicos and the Frio Banditos: A Case Study of the Black Market in CFCs, Ozone Action, Inc., 1996
[2] ARI Guideline N
[3] ARI Guideline K
[4] ASHRAE Standard 34-1997 on "Number Designation and Safety Classification of Refrigerants"
[5] Contraband Cool (news video), Canadian Broadcast Corporation, 19/9/97
[6] Customs Guide: Controls concerning ozone depleting substance/illegal trade in ozone depleting substance (draft), European Union
[7] Deadly Complacency: US CFC Production, the Black Market, and Ozone Depletion, Ozone Action, Inc., 1995
[8] Elements for Establishing Policies, Strategies and Institutional Framework for Ozone Layer Protection, UNEP, 1995
[9] Guidebook for Implementation of Codes of Good Practices – Refrigeration Sector, UNEP, 1998
[10] Guidelines for Recovery & Recycling Systems – Refrigeration Sector, UNEP, 1999
[11] Handbook for the International Treaties for the Protection of the Ozone Layer, UNEP Ozone Secretariat, 2000
[12] Handbook on Data Reporting under the Montreal Protocol, UNEP, 1999
[13] Information Paper on Montreal Protocol Control Schedule and its Evolution, UNEP, 2000
[14] Information Paper on Separate Identification of Montreal Protocol Pure Ozone-Depleting Substances under the Harmonised System, UNEP, 2000
[15] Information Paper on Trade Names for Refrigerants, UNEP, 2000
[16] Inventory of Approved Projects, Access Database, Multilateral Fund Secretariat, 2000
[17] Monitoring Imports of Ozone-Depleting Substances: A Guidebook, UNEP/SEI/ SIDA, 1996
[18] Operation Frio Tejas: Ozone –Depleting Substances Information and Identification Reference Guide, US Customs Service
[19] Ozone Depleting Substances Regulations: A Refresher Course for Canada Customs Inspectors, Environment Canada
[20] Policies, Procedures, Guidelines and Criteria, UNEP Ozone Secretariat, 2000
[21] Protecting the Ozone Layer and the Illegal Importation of Chlorofluorocarbons (CFCs) (video), US Environmental Protection Agency, 1997
[22] Refrigerant Reference Guide, National Refrigerants, Inc. (USA), 2000
[23] Regulations to Control Ozone-Depleting Substances - A Guidebook, UNEP, 1996
[24] Report of the Refrigeration, Air Conditioning and Heat Pumps Technical Options Committee, UNEP 1998
[25] Resource Module on ODS Import/Export Licensing Systems – Policy Design and Setting Up of Legislation, UNEP/SEI, 1998
[26] Saving the Ozone Layer: Every Action Counts (video & booklet), UNEP 1996
[27] Arctic Ozone Hole – Millions at Risk, Solcomhouse article
[28] Training Manual on Good Practices in Refrigeration, UNEP, 1994
[29] Training Manual on Chillers and Refrigerant Management, UNEP, 1994

Websites

[30] ARI —Air-conditioning & Refrigeration Institute
http://www.ari.org/

[31] ASHRAE — American Society of Heating Refrigerating & Air-conditioning Engineers, Inc.
http://www.ashrae.org/

[32] CAS— Chemical Abstracts Service
http://info.cas.org/

[33] EIA — Environmental Investigation Agency
http://www.eia-international.org/

[34] Environment Canada's Stratospheric Ozone Web Site
http://www.ec.gc.ca/ozone/indexe.htm

[35] Greenpeace Ozone Campaign
http://www.greenpeace.org/~ozone/index.html

[36] International Chemical Safety Cards
http://www.cdc.gov/niosh/ipcs/icstart.html#language

[37] ODS Customs Codes Discussion Group website
http://www.unep.ch/ozone/ods-customs-codes/

[38] Ozone Secretariat
http://www.unep.org/ozone/

[39] Total Ozone Mapping Spectrometer (TOMS) Images of the Ozone Hole
http://toms.gsfc.nasa.gov/

[40] UNEP DTIE OzonAction Programme
http://www.uneptie.org/ozonaction.html

[41] United States Environmental Protection Agency's Ozone Depletion Home Page
http://www.epa.gov/ozone/index.html

[42] World Bank Montreal Protocol Home Page
http://www-esd.worldbank.org/mp/home.cfm

[43] World Customs Organisation
http://www.wcoomd.org/

[44] World Trade Organisation
http://www.wto.org/

Annex G: UNEP DTIE & its OzonAction Programme

About the OzonAction Programme

Nations around the world are taking concrete actions to reduce and eliminate emissions of CFCs, halons, carbon tetrachloride, methyl chloroform, methyl bromide and HCFCs. When released into the atmosphere these substances damage the stratospheric ozone layer — a shield that protects life on Earth from the dangerous effects of solar ultraviolet radiation. Nearly every country in the world — currently 170 countries – has committed itself under the Montreal Protocol to phase out the use and production of ODS. Recognising that developing countries require special technical and financial assistance in order to meet their commitments under the Montreal Protocol, the Parties established the Multilateral Fund and requested UNEP, along with UNDP, UNIDO and the World Bank, to provide the necessary support. In addition, UNEP supports ozone protection activities in Countries with Economies in Transition (CEITs) as an implementing agency of the Global Environment Facility (GEF).

Since 1991, the UNEP DTIE OzonAction Programme has strengthened the capacity of governments (particularly National Ozone Units or "NOUs") and industry in developing countries to make informed decisions about technology choices and to develop the policies required to implement the Montreal Protocol. By delivering the following services to developing countries tailored to their individual needs, the Programme has helped promote cost-effective ODS phase-out activities at the national and regional levels:

Information Exchange provides information tools and services to encourage and enable decision makers to make informed decisions on policies and investments required to phase out ODS. Since the 1991, the Programme has developed and disseminated to NOUs over 100 individual publications, videos, and databases that include public awareness materials, a quarterly newsletter, a web site, sector-specific technical publications for identifying and selecting alternative technologies and guidelines to help governments establish policies and regulations.

Training builds the capacity of policy makers, customs officials and local industry to implement national ODS phase-out activities. The Programme promotes the involvement of local experts from industry and academia in training workshops and brings together local stakeholders with experts from the global ozone protection community. UNEP conducts training at the regional level and also supports national training activities (including providing training manuals and other materials).

Networking provides a regular forum for officers in NOUs to meet to exchange experiences, develop skills, and share knowledge and ideas with counterparts from both developing and developed countries. Networking helps ensure that NOUs have the information, skills and contacts required for managing national ODS phase-out activities successfully. UNEP currently operates 4 regional and 3 sub-regional Networks involving more than 109 developing and 8 developed countries, which have resulted in member countries taking early steps to implement the Montreal Protocol.

Refrigerant Management Plans (RMPs) provide countries with an integrated, cost-effective strategy for ODS phase-out in the refrigeration and air conditioning sectors. RMPs have evolved to meet the specific need to assist developing countries (especially those that consume low volumes of ODS) to overcome the numerous obstacles to phase out ODS in the critical refrigeration sector. UNEP DTIE is currently providing specific expertise, information and guidance to support the development of RMPs in 40 countries.

Country Programmes and Institutional Strengthening support the development and implementation of national ODS phase-out strategies especially for low-volume ODS-consuming countries. The Programme is currently assisting more than 90 countries to develop their Country Programmes and more than 75 countries to implement their Institutional Strengthening projects.

For more information about these services please contact:

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UNEP Division of Technology, Industry and Economics
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Email: ozonaction@unep.fr
Web: http://www.uneptie.org/ozonaction.html

About the UNEP Division of Technology, Industry & Economics

The mission of UNEP DTIE is to help decision-makers in government, local authorities, and industry develop and adopt policies and practices that:

- are cleaner and safer;
- make efficient use of natural resources;
- ensure adequate management of chemicals;
- incorporate environmental costs; and
- reduce pollution and risks for humans and the environment.

UNEP DTIE is located in Paris and composed of one centre and four units:

The International Environmental Technology Centre (Osaka) promotes the adoption and use of environmentally sound technologies with a focus on the environmental management of cities and freshwater basins, in developing countries and countries in transition.

The Production and Consumption Unit (Paris) fosters the development of cleaner and safer production and consumption patterns that lead to increased efficiency in the use of natural resources and reductions in pollution.

The Chemicals Unit (Geneva) promotes sustainable development by catalysing global actions and building national capacities for the sound management of chemicals and the improvement of chemical safety world-wide, with a priority on Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC, jointly with FAO).

Energy & OzonAction Unit (Paris) supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition, and promotes good management practices and use of energy, with a focus on atmospheric impacts. The UNEP/ RISØ Collaborating Centre on Energy and Environment supports the work of the Unit.

Economics & Trade Unit (Geneva) promotes the use and application of assessment and incentive tools for environmental policy and helps improve the understanding of linkages between trade and environment and the role of financial institutions in promoting sustainable development.

UNEP DTIE activities focus on:

- raising awareness,
- improving the transfer of information,
- building capacity,
- fostering technology co-operation,
- partnerships and transfer,
- improving understanding of environmental impacts of trade issues,
- promoting integration of environmental considerations into economic policies, and
- and catalysing global chemical safety.

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Annex H: Useful contact addresses

Implementing Agencies

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Keep in mind ...

Much of the Montreal Protocol's success can be attributed to its ability to evolve over time to reflect the latest environmental information and technological and scientific developments. Through this dynamic process, significant progress has been achieved globally in protecting the ozone layer.

As a key agency involved in the implementation of the Montreal Protocol, UNEP DTIE's OzonAction Programme promotes knowledge management in ozone layer depletion through collective learning. There is much that we can learn from one another in enforcing import & export controls of ozone depleting substances.

This customs training manual reflects the latest developments of the Montreal Protocol and its Amendments and the latest information available concerning the Harmonised Customs Codes for pure substances and mixtures. It is however based on the limited experience from Montreal Protocol related Customs operations and training in developed and developing countries. As more experience is gained by the world community, the training manual will become more exhaustive and effective.

We encourage you to share your experiences on customs training, illegal trade with ODS and the enforcement of the licensing system to control trade with ODS in your country with the OzoneAction Programme so that we can inform others involved in these issues about the lessons learned. The more we share such information, the better are the chances to prevent illegal trade.

Send us an email, fax or letter about your experiences and successes in combating illegal trade with ODS. We will consider it as an important part of collective learning.

Based on the feedback and information received, UNEP will update this training manual on a periodic basis to reflect the latest developments.

So take a pen and write to us. Let us learn collectively to protect the ozone layer.

Mr. Rajendra Shende, Chief
UNEP DTIE Energy & OzonAction Unit, France

READER FEEDBACK

TRAINING MANUAL FOR CUSTOMS OFFICERS

All of the information services offered by UNEP DTIE's OzonAction Programme under the Multilateral Fund are designed to meet the specific needs of target readers such as yourself. In order for us to determine if this publication adequately meet your needs, as well as to help us to develop new publications in the future, we request your feedback about its utility, content and format. **Please take a few minutes to express your opinion about this publication, so that we may serve you better in the future.**

1. **Quality** - please rate the following quality aspects:

	Very Good	Good	Adequate	Poor
Objectivity	O	O	O	O
Subject coverage	O	O	O	O
Up-to-date	O	O	O	O
Readability	O	O	O	O
Organization	O	O	O	O
Presentation	O	O	O	O

2. **Usefulness** - how much of this document is useful for you:

	Most	About Half	Less than half	Little
Of substantive value to you?	O	O	O	O
Relevant to you?	O	O	O	O
New to you?	O	O	O	O
Will be used by you?	O	O	O	O

3. **Effectiveness** - this document is designed to assist ozone and customs officers in developing countries in monitoring and controlling trade with ODS and ODS products / equipment. The manual focuses on the detection of smuggling schemes through the use of appropriate screening methods and thus the prevention of illegal trade in ODS. The manual intends to be a useful tool for other agencies conducting customs training as well for local customs trainers during the implementation of Phase II of the training programme. Has this document been effective in meeting these objectives?

Please tick one box: O Fully O Adequately O Inadequately

Please explain the reason for your rating:

_____

_____

_____

4. **Uses** - please indicate in general how you have used the document (tick all that apply):

O Guidance on how to conduct Phase I and II of the customs training programme
O Toolbox for customs trainers
O Resource document for monitoring and control of trade in ODS
O Resource document on ODS identifiers
O Resource document on Montreal Protocol related issues

Please explain in more specifics how the document will/has assisted your ODS phaseout programme and the implementation of refrigerant recovery and recycling systems in your country:

_____

_____

5. **Distribution** - will others read your copy?

O Yes (If 'yes', who? _____) O No O Unknown

Will you reproduce sections of the document and distribute them to others?

O Yes (If yes, to whom? _____) O No

Did you receive the document directly from UNEP?

O Yes O No (If no, who forwarded it to you?_____)

6. **General observations** - please indicate any changes that would make the document more useful to you in the future, or any additional comments you have on the utility or shortcomings:

_____

_____

7. **The following data would be useful for statistical analysis** - please indicate the category which best describes you:

O Customs department or other enforcement bodies
O Training institutes / customs trainers
O Other Government departments or national ozone unit
O Industry and trade associations
O Other (please specify) _____

Your name (optional): _____ Country: _____

Organization/government agency/institution: _____ Date: _____

8. **UNEP would like to thank you for completing this questionnaire** - please airmail or fax to:

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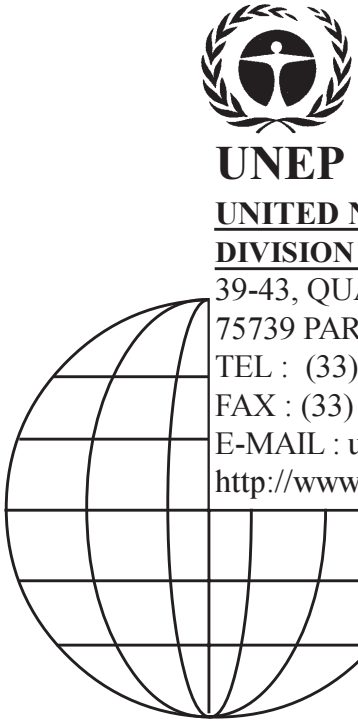
Tour Mirabeau, 39-43 quai André Citroën, 75739 Paris Cedex 15, France
Tel: (33 1) 44 37 14 50, Fax: (33 1) 44 37 14 74



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