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Protection of the stratospheric ozone layer—the ultimate objective of the Montreal Protocol on Substances that Deplete the Ozone Layer—allows life on Earth to prosper. However, reaching that target through the implementation measures required by this treaty should not come at the expense of the social and economic development of developing countries. This balancing act of environmental protection and development is the challenge that is set before the countries that have joined this multilateral agreement, and nowhere is this more evident than in the South Asia region.

One way in which the countries of South Asia are successfully meeting this challenge is through their commitment and cooperation to adopt newer, ozone-friendly technologies and policies. Their combined actions are contributing significantly to global implementation of the Montreal Protocol, which is considered one of the most successful multilateral environmental agreements to date.

The reason for its success can be attributed to its exceptional features: a grace period of 10 years for developing countries, the provision of financial and technical assistance for developing countries through the Multilateral Fund, and the periodic scientific and technical assessments for Parties. As a result, the gradual global elimination of all types of ODS is progressing smoothly and it is hoped that there would be substantive recovery of the stratospheric ozone levels by the middle of this century.

Despite this success, the global community—including South Asia—cannot afford to be complacent. Though nearly 159,000 tons of controlled substances have already been phased-out in developing countries, roughly the same amount of ODS is still being used. Refrigeration servicing and agriculture are the sectors where the use of ODS continues to pose significant problems.

The South Asia region represents the largest production and consumption of ozone depleting substances (ODS) today. Unlike most other regions, it faces a unique challenge of balancing the needs and actions of both large and small producers and consumers of ODS within the same region. This poses specific implementation challenges affecting balance of supply and demand and timing of the phase out. Illegal trade in ODS is another important issue for the region.

One way to address these challenges is to create action-oriented public awareness so that key segments of society participate in and support national compliance strategy. The celebration as the International Day for the Preservation of the Ozone Layer is thus an extremely important opportunity to sensitive and motivate the public to become part of the solution. This booklet, which highlights what countries in the South Asia region have achieved under the Protocol, and where they are heading, will be an important awareness-raising tool during and beyond International Ozone Day.

During this Ozone Day, we should all keep in mind that we can no longer address environmental issues in a ‘straitjacket’ manner. Life and the environment are interdependent and so also will be the solutions that we seek for the associated challenges. There are many inter-linkages between environmental issues such as ozone depletion and climate change. There are opportunities for achieving synergies during the implementation of multilateral environmental agreements from which all could benefit. Within the frameworks of the respective agreements, the Montreal Protocol community—including the countries in the South Asia region—should promote integrated and coordinated implementation of environmental treaties (including the Montreal Protocol) so as to achieve multiple environmental benefits wherever possible. This is the sustainable path to the future down which South Asia should tread.

Monique Barbut, Director
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Ozone depletion in the atmosphere has been a worldwide concern for the past two decades. From the Vienna Convention to the Montreal Protocol and likewise the London and Beijing Amendments, today 188 countries are signatories to the Protocol.

The deep concern and commitment of all these member nations will undoubtedly lead to a great reduction of ozone depletion. The big hope is that by the middle of this century the ozone layer will have fully recovered.

Nepal’s consumption of ODS is very low. As a signatory to the Montreal Protocol, Nepal has already started implementing the ODS phaseout programme.

I express my sincere thanks for publication of this booklet by Nepal Bureau of Standards and Metrology in collaboration with UNEP.

I believe this booklet will enlighten us with the information on ozone depletion related issues along with the country profile of South Asian countries and the desired future actions.

Nearly 15 years have passed since the global community, recognising the need to protect the ozone layer, signed the Montreal Protocol to phase out ozone depleting substances. The Montreal Protocol regime itself is a result of decades of studies, meetings and negotiations. The scientific realisation that stratospheric ozone filters ultraviolet radiation from the sun and that a diminished ozone layer can be harmful to living organisms and the environment was realised over decades of research.

Awareness of this scientific fact and its translation into concrete action by the international community has taken also some time. UNEP has fully supported all these studies and researches, and was instrumental in brokering the initial discussions that led to the development and adoption of the Vienna Convention for the Protection of the Ozone Layer in 1985. Two months after the Vienna Convention negotiation ended, the ‘ozone hole’ was discovered over the Antarctic. The heightened concern as a result of this discovery led to the Montreal Protocol on Substances that Deplete the Ozone Layer, which spelled out specific phaseout targets for countries for identified ozone depleting substances.

Significant successes have been achieved since then and it is now expected that all consumption and production of ODS would be phased out by 2040, and that ozone levels should return to normal by 2050, if all phase out targets agreed upon under the Montreal Protocol are met in time. Meeting these targets leaves no room for complacency. While developed countries have now phased out their ODS production and consumption, and developing countries are in their compliance phase, the concerns of small and medium enterprises where alternatives are not readily available should be taken very seriously. In addition, illegal ODS trade, if left unchecked, could also undermine the global effort to phase out these chemicals. The coming years will thus be important as developing countries will increasingly phase-out their consumption of major ODS to achieve compliance with the Montreal Protocol.

The South Asian sub-region is most important as far as phase-out of ODS production and consumption is concerned. The region uses up to 66% of the global ODS consumption and has 90% of the global CFC for developing countries. Countries in the region have put in tremendous efforts to meet their targets under the Montreal Protocol.

This publication is an effort to raise awareness and part of regional events to mark International Ozone Day (16 September, 2004). It highlights the actions taken in the subregion and looks for solutions to constraints by countries in their phase-out efforts. It is hoped it will contribute towards enhancing awareness of this issue and towards promoting the ideals of ozone protection in particular and sustainable development in general in Asia and the Pacific.

Dinesh Chandra Pyakural
Secretary
His Majesty’s Government of Nepal
Ministry of Industry, Commerce and Supplies

Surendra Shrestha,
Regional Director and Representative for Asia and the Pacific
United Nations Environment Programme
The Ozone Shield

High on the upper layers of the Earth’s atmosphere, a rare form of oxygen has been functioning as our ultraviolet filter. For millions of years ozone has protected our planet from harmful ultraviolet rays of the sun, allowing life to flourish. While an oxygen molecule (O₂) has two atoms of oxygen, the ozone molecule (O₃) is a cluster of three atoms.

Ozone is most abundant in the stratosphere, the layer of the upper atmosphere between 15-40 km above the earth’s surface. Ninety percent of all ozone is in the stratosphere and serves the all-important purpose of shielding the Earth from the lethal rays in the ultraviolet region of the spectrum. The remainder exists at ground level, where ozone is a harmful atmospheric pollutant from automobile exhausts and contributes to photochemical smog.

Stratospheric ozone is essential for life, since it screens solar radiation that would injure or kill most living things. The most intense of these rays is called UV-C and has a wavelength between 200-280 nanometers, but is completely absorbed by ozone as well as normal oxygen molecules in the atmosphere. UV-B, between 280-320 nm, also poses serious danger to life, and our helpful ozone layer screens out most of this radiation as well, allowing only 2-3% of it to reach the Earth’s surface. UV-A has a wavelength of 320-400 nm, and passes through the ozone layer, but since it has weak energy it is quite harmless.

The conversion of oxygen, O₂, into ozone, O₃, and vice versa is a dynamic and balanced process that occurs naturally in the atmosphere through the absorption of solar radiation, resulting in a roughly unchanged concentration of ozone. This balance has been disrupted by the release of artificial chemicals, notably CFCs (chlorofluorocarbons, which are made up of combinations of chlorine, fluorine, carbon, and hydrogen), into the atmosphere. CFCs and other ozone-depleting manmade chemicals have reacted with much of the ozone in the stratosphere, turning it into oxygen. It is this chemical destruction of the stratospheric ozone layer, rather than the natural reaction converting ozone into oxygen, that is referred to as ‘ozone depletion’ and has caused such global concern.

Impact of Ozone Depletion
UV-B has its uses: it is essential in the formation of vitamin D by the skin. But in general, increased UV-B radiation on the Earth’s surface is harmful not only for humans but also agriculture, ecosystems, materials, and air quality.

In humans, early exposure to UV significantly increases the risks of skin cancer, the risk being greater for fairer skins, which are likely to develop nonmelanoma skin cancer. It also causes cataracts.

In livestock, prolonged exposure to UV-B rays causes cancers, especially around the mouth, nostrils, and other parts not covered by hair. It slows the growth of certain sensitive plants, affecting yield and quantity...
of exposure in the tropics and subtropics affect the distribution of phytoplankton, which are at the basis of aquatic food webs. It damages early development of fish, shrimp, crab, amphibians and other animals, resulting in decreased reproductive capacity.

UV-B also causes accelerated photodegradation rates resulting in discoloration, loss of mechanical strength, and reduced lifetimes of synthetic polymers and natural material.

Climate Change
Solar UV radiation, through its influence on terrestrial and aquatic bio-geo-chemical cycles, can alter the emission and stability of major greenhouse gases such as carbon dioxide and methane. The CFCs that destroy the ozone layer are greenhouse gases themselves. As much as 17% of the total global warming is due to CFCs. Ozone depletion also leads directly to global warming, reducing the productivity of phytoplanktons, which absorb carbon dioxide.

Some effective replacements for ozone depleting chemicals, such as hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs), are being used only as temporary alternatives because of their global warming potential. HFC-134a, for instance, has zero ozone depleting potential and is a perfect substitute for CFCs in refrigerators and aerosols, but cannot be used as a long-term solution because it is 1,600 times more potent than carbon dioxide as a global warming agent.

Present Status of the Ozone Layer
Scientists have been monitoring the ozone layer since 1957, when the World Meteorological Organisation (WMO) established a worldwide network of ozone observing stations that eventually became the Global Ozone Observing System, which today has approximately 140 monitoring stations all over the world.

The Antarctic ozone hole was first reported by a team of British scientists in May 1985 as a dramatic decline in the thickness of the ozone layer. By the fall of 1987, the hole measured twice the size of continental United States, sending shockwaves throughout the world.

The Antarctic ozone hole of 2003 was the second largest ever observed. The dark blue indicates the region of maximum ozone depletion in this image taken on 29 September, 2003. Earthobservatory.nasa.gov

So why only Antarctica? Limited air exchange with the mid-latitudes in winter because of the circumpolar stratospheric vortex (a belt of westerly winds located over the edge of Antarctica) causes stratospheric temperatures to drop below –80°C, while polar stratospheric clouds contain ice particles, both of which contribute to the accumulation of ozone depleting agents. Throughout the cold winter nights, the ice particles attract and accumulate CFCs released into the atmosphere. The return of sunlight in early spring liberates this high concentration of CFCs in the form of active chlorine and bromine radicals, which proceed to destroy ozone molecules in the region at an astounding rate resulting in the ozone hole over the region between August and November every year. Sufficient heating of the stratosphere in late October dissipates the polar vortex, allowing ozone-rich air from mid-latitudes to flow in and mix with the ‘hole’, and the Antarctic ozone hole thus
Life under the Ozone Hole

In the Chilean town of Punta Arenas, the world’s southernmost city with a population of 120,000, the residents are facing a host of problems—mothers complain that their children turn bright pink when they play outdoors, farmers say their sheep are going blind from cataracts, youngsters have realised that they cannot play soccer without risking at least a sunburn, and people seldom venture outside without donning sombreros, dark glasses, sun-block lotions and extra clothing.

For several days each year between September and December, the Antarctic ozone hole balloons out and opens up the skies above this quiet port on the southern tip of South America to lethal UV rays from the sun. During these days, people with fair skin are cautioned not to expose themselves to the sun for more than five minutes. Those with darker complexions can afford 20 minutes. Over the past few years, such ‘red alerts’ have become quite frequent in the city. Indeed, television weather forecasters read daily updates on the ozone hole just like daily temperatures. Punta Arenas is an early sign of what ozone depletion can do in the rest of the world.

Ultraviolet rays cause skin cancer, and can also wrinkle your skin to make you look older than you are. They cause cataracts, and can lead to blindness. Children are particularly at risk. Awareness about these risks can be spread with posters like this one from the Maldives.

Although ozone depletion is prominent only in the Antarctic, data collected over the past couple of decades has established beyond doubt that it is taking place throughout the atmosphere at all latitudes. The ozone layer has been steadily but surely weakening all over the world due to increased emission of CFCs. While the present amount of ozone in the Antarctic has dropped 40-55% below the pre-ozone-hole value, leading to as much as a 130% increase in UV-B radiation in early spring in the area, the situation in other parts of the planet is less alarming, but grave nevertheless. Cumulative ozone losses in the Arctic region over the past four years are estimated to be around 25%. While the Antarctic hole looms over a mostly uninhabited region of the planet, an Arctic hole of the same size would affect populated parts of Europe, Asia, and North America.

The amount of ozone-depleting substances in the lower atmosphere was at a peak between 1992 to 1994, but, following the worldwide control of CFC emissions and the adoption of ozone friendly technologies, has been continuously declining since then. If present international agreements regarding the ozone layer are fully observed, the Antarctic ozone hole should disappear entirely by the middle of this century. But for the next few decades, in spite of the improving situation, the ozone layer will continue to remain vulnerable.
Although CFCs started being used in the 1920s, concern over their impact on the environment did not emerge until much later. In 1976 ozone depletion was discussed by the Governing Council of the United Nations Environment Programme (UNEP), leading a year later to a meeting of experts which resulted in the formation of the Coordinating Committee of the Ozone Layer (CCOL) by UNEP and the World Meteorological Organisation. Intergovernmental negotiations in 1981 for an international agreement to phase out ozone-depleting substances (ODS) eventually led to the adoption of the Vienna Convention, the first major landmark in the global attempt to protect the ozone layer, by 41 countries in March 1985. The Vienna Convention committed all parties to take general measures to protect the ozone layer, encouraging intergovernmental cooperation in research, systematic observation of the ozone layer, monitoring of CFC production, and exchange of information, without establishing any legally binding controls or targets.

However, persistent depletion of the ozone layer, especially the discovery of the Antarctic ozone hole in 1985 and the need for more stringent measures to correct this situation eventually paved the way to the Montreal Protocol on Substances Depleting the Ozone Layer which was negotiated in the Second Conference of the Parties to the Vienna Convention on 16 September, 1987 and came into effect in January 1989 following its ratification by 38 countries representing approximately 82 percent of world ODS consumption at that time. It established control measures over eight substances: five CFCs and three halons.

Following periodic scientific and technical assessments, the Protocol was adjusted in London in 1990 through the London Amendment, where 54 parties and 42 non-party countries agreed to phase out the five controlled substances by 2000 and also made provisions to fund developing countries consuming less than 0.3 kg per capita of ODS for this phase-out process. In addition, these developing countries were given a grace period of 10 years to phase out the specified ODS. By the Copenhagen Amendment in 1992, the list of controlled substances to be phased out had been extended to include 15 CFCs, 3 halons, 34 HBFCs, carbon tetrachloride, and methyl chloroform. The seventh meeting of the Parties in Vienna in 1995 then added methyl bromide to the list and decided on a longer-term reduction schedule for the complete phase-out of HCFCs.

Likewise, the Beijing Amendment (1999) brought in new trade rules for HCFCs and decided to monitor the consumption and production of bromochloromethane. In this way, the Montreal Protocol has been further strengthened through five adjustments and four amendments (Vienna, 1995 excluded), each of which is recognised as a separate international agreement.

Today, 188 countries out of 191 member states of the United Nations are signatories of the Protocol. Since more than two-thirds of these countries are developing nations, it was recognised early that these countries would require assistance, especially financial, for the phase-out of ODS within the time specified in the Protocol, in spite of
What if there was no Montreal Protocol?

On the occasion of the 10th anniversary of the Montreal Protocol, Environment Canada conducted a study ‘Global Costs and Benefits of the Montreal Protocol’ in 1997 to try to calculate the total value of the damage avoided through the implementation of the Protocol. The total cost of all activities related to adopting measures to protect the ozone layer was calculated as around US$ 235 billion. The benefits of reduced damage to fisheries, agriculture, and materials came to twice this amount. One only needs to consider the reduced number of eye disorders and skin cancers, which, interestingly enough, were listed only as additional benefits and not expressed in economic terms, to realise what a boon the Protocol has proved to be for humankind.

Without the Montreal Protocol, CFC consumption would have shot up to 3 million tons by 2010 and to an unimaginable 8 million by 2060, causing 50 percent more depletion of the ozone layer by 2035. Thanks to the Protocol, all the countries in the world (even the developing ones) will have got rid of the major CFCs and halons by 2010.

The Protocol has followed the principle of “differentiated but shared responsibilities” under which all signatory countries work actively and efficiently, though with different approaches, towards the common goal of complete phase-out of all categories of ODS.

By 1996, developed countries had already succeeded in putting an end to the production and use of the most damaging CFCs, except for a few with medical uses. They are now working to phase out methyl bromide and HCFCs, which are being used as temporary substitutes for CFCs. In 1999, almost all member developing countries successfully met their first compliance target in the form of a freeze in the consumption and production of CFCs at a baseline level specified for each country. By 2001, production of CFCs had fallen by nearly 95% in industrial countries, and a reduction of 99.8% in halons production had been achieved. Similarly, global consumption of CFCs dropped from 1.1 million tons in 1986 to 156,000 tons in 1998, a remarkable worldwide reduction of 85% in just over a decade. Until the mid-1970s the use of CFCs in aerosols accounted for about 60 percent of their worldwide consumption, now it is down to the last 15,000 tons. Likewise, their use in foams has been reduced by three fourths.

The signatories to the Montreal Protocol allocated US$ 1.7 billion (as of July 2004) to eliminate the annual consumption of 159,000 ODP tons and the production of 52,000 ODP tons of ODS in 135 developing countries. The Multilateral Fund continues to actively support awareness programmes, training workshops, and ODS phase-out and replacement activities in all developing countries.

The results are encouraging. Worldwide concentration of CFCs in the lower atmosphere began to drop after 1994. As CFCs can take a few years to gradually rise into the stratosphere, ozone depletion, which is still occurring at an alarming rate, is expected to peak, and then gradually decline by the end of this decade. If all member countries continue to abide by the Montreal Protocol, the ozone layer should fully recover by the middle of this century.
UNEP, as the Secretariat of the Vienna Convention and Montreal Protocol and as an Implementing Agency of the Multilateral Fund, plays a major role in coordinating the activities of member countries. The UNEP Division of Technology, Industry, and Economics (DTIE) OzonAction Programme has been working since 1991 to strengthen the National Ozone Units (NOUs) and industries in developing countries through information exchange, training, country programmes, institutional strengthening, refrigerant management plans and other activities.

UNEP DTIE OzonAction Programme also introduced regional networking to encourage close partnerships between developed and developing countries to get together and share ideas, problems, experiences, and knowledge: “Collective learning by sharing while doing”. This move links policy-making at the international level with actions taken at the national level. The networks are funded by the Multilateral Fund and coordinated by Regional Network Coordinators (RNCs). UNEP currently operates nine regional networks.

Since the formation of the first network in 1992 Regional Networks have been utilised by officers in NOUs of member countries to exchange experiences and build on existing skills and knowledge. Such networks are especially valued by developing countries as rare opportunities to gain invaluable ideas and advice from their developed counterparts that have already completed most of their phase-out targets. The networks today focus on building the capacity of NOUs and other government officers with a focus on ensuring sustained compliance, as distinct from earlier capacity building efforts, which targeted effective management of projects for phase out.

Of the nine networks, the South Asia Network is probably the most important and consists of 12 member countries: Afghanistan, Bangladesh, China, DPR Korea, India, Iran, Maldives, Mongolia, Nepal, Pakistan, Republic of Korea, Sri Lanka with the Regional Network Coordinator based in Bangkok. Japan participated as a partner of the network. According to Article 5, paragraph 1, these are countries ‘whose annual calculated level of consumption of the controlled substances...is less than 0.3 kg per capita on the date of entry into force of the Protocol for it, or any time thereafter until 1 January 1999’ and are therefore eligible for assistance from the Multilateral Fund. In addition, they have been given a grace period of ten years for full compliance with the phase-out of ODS. Each of these countries has a National Ozone Unit (NOU) which acts as the national focal point responsible for the implementation of the protocol in that country. Detailed profiles of each of the twelve Article 5 countries in the South Asia Network are provided in this brochure.

The South Asian Region is a unique sub-region in itself, especially for the Montreal Protocol. This is where the two countries which are major producers of ODS in developing countries is located, as well as some significant consumers. Recent data shows that the region’s consumption of ODS amounted to 66% of the global consumption–117,000 metric tons out of the total global consumption of 182,727 MT. The share of global production was even higher, with 90% of the global production of CFCs taking place in South Asia, mainly China and India. Reports of rising illegal trade in contraband ODS in the region has further complicated the phase-out process.

The diversity of the different countries of this region necessitates different approaches in planning, focus areas and implementation. Countries like China and India are huge producers as well as consumers of CFCs, but have very small per capita consumptions. Countries like Maldives and Bangladesh consume negligible amounts of CFCs but, due to their low altitudes, will be worst affected by the global warming caused by ODS in the atmosphere. Small and medium scale enterprises are the major consumers of CFCs in all these countries, which limits the effectiveness of investment activities that were so successful in large-scale industries in developed countries.
Every country in the network has its own unique problem, and only specific plans targeted towards specific countries can yield results.

Because of the huge amounts of CFCs currently being produced and consumed in South Asia, the success of the Montreal Protocol in this region might just prove to be the deciding factor in what eventually happens to the ozone layer. While failure by the countries in this region to adhere to the targets of the Protocol can potentially negate everything the developed countries have done so far, successful implementation of the Protocol and phase-out of ODS in the region within the deadlines set by the Protocol will set the ozone layer well on its way towards full recovery.

The South Asia region has fully risen to this challenge. At present, most of the member countries of the network, especially the low-volume consuming countries, are well on their way to fully implementing national phase-out strategies with funding from the Multilateral Fund (see country profiles). Production sector phase-out in the larger countries like China and India are also meeting their performance targets fully, thereby reducing supply of CFCs in the region. ODS consumption in these two large countries especially in the servicing sector is slowly but surely declining.

Networking as a concept is working very well in this sub-region, where countries help one another in overcoming obstacles to compliance. One main achievement of the regional network is the promotion of South-South cooperation among the network members. This has resulted in expediting the ratification of the Montreal Protocol of the remaining two countries in the region, Afghanistan and Bhutan (see page 30).

### ODS Phase-out Schedule for Article-5 Countries

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>1 July 1999</td>
<td>Freeze of Annex A CFCs at 1995-97 average levels</td>
</tr>
<tr>
<td>1 January 2002</td>
<td>Freeze of halons at 1995-97 average levels and methyl bromide at 1995-1998 average levels</td>
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<tr>
<td>1 January 2003</td>
<td>Annex B CFCs reduced by 20 percent from 1998-2000 average consumption</td>
</tr>
<tr>
<td>1 January 2005</td>
<td>Freeze in methyl chloroform at 1998-2000 average levels</td>
</tr>
<tr>
<td>1 January 2007</td>
<td>Annex A CFCs reduced by 85 percent from 1995-97 average levels</td>
</tr>
<tr>
<td>1 January 2010</td>
<td>Annex B CFCs reduced by 85 percent from 1998-2000 average levels</td>
</tr>
<tr>
<td>1 January 2015</td>
<td>CFCs, halons, and carbon tetrachloride phased out</td>
</tr>
<tr>
<td>1 January 2016</td>
<td>Methyl chloroform reduced by 70 percent from 1998-2000 average levels</td>
</tr>
<tr>
<td>1 January 2016</td>
<td>Methyl chloroform and methyl bromide phased out</td>
</tr>
<tr>
<td>1 January 2016</td>
<td>Freeze of HCFCs at base line figure of 2015 average levels</td>
</tr>
<tr>
<td>1 January 2040</td>
<td>HCFCs phased out</td>
</tr>
</tbody>
</table>

Annex A: CFCs 11,12,113,114,115
Annex B: CFCs 13,111,112,211-217

The calculated level of production of 0.3 kg/capita for Annex A CFCs and halons, and 0.2 kg/capita for Annex B CFCs can be used as average levels if the actual level for a country is lower.
Illegal Trade

With the approach of the deadlines to phase-out ODS, and because CFC production is also decreasing, legitimate supply of ODS has been going down, pushing market prices up and thus encouraging the smuggling of these substances into many countries. Illegal trade first came into light in the 1990s and has been growing alarmingly all over the world. In 1997, it is said that an estimated 20,000 tons of ODS, over 12% of global ODS production at that time, were being illegally traded worldwide. Some estimates show that around 20% of all trade in ODS in the mid-1990s was illegal. And the situation has grown worse since then.

Profit levels between 75 to 225 percent generated from ODS smuggling, especially smuggling of CFCs for refrigeration and air conditioning, has established it as a lucrative profession for smugglers. These traders illegally sell CFCs in industrialised countries in the guise of recycled CFCs or as exports to developing nations. Misdeclaration and mislabeling have also become common. Detailed investigations by the Environmental Investigation Agency (EIA) showed that smugglers use a number of transit countries, usually three or more, while shipping the ODS from the source to the end market to make it difficult for investigators to track them.

Following the freeze of CFCs consumption levels in Article 5 countries in 1999, illegal trade has been on the rise in these developing countries, especially in the Indian subcontinent, central, southern, and Southeast Asia, the Middle-East, southern Africa, and the Caribbean. Some countries were found to be more recent conduits for illegally re-routing ODS to major consumers. Other countries in the region were also identified as newer and emerging markets for re-routing of CFCs. Illegal trade is especially common in the Indian subcontinent because of the free trade zone and the open borders between some countries.

In the 1990s the United States was a major market for illegally traded ODS, and Europe is continuously being used as a trans-shipment point. However, more stringent procedures for importing ODS, the active multi-agency US Task Force on ODS Smuggling, and its cooperation with Customs, Department of Justice, EPA, and FBI have greatly discouraged illegal trade in the US. Similarly, a ban on the use and sale of CFCs by EU has also helped.

In South Asia, a recent attempt to address illegal trade was the ‘Nepal Dialogue’ among Nepal, China, and India in Kathmandu in September 2003 following the seizure of 74 metric tons of illegal shipment of CFC12. In the dialogue, which was facilitated by UNEP, the three participating countries agreed to share information regarding the importers with licenses in Nepal, the amount of ODS exported to them every year, the agreed upon quotas, the results of any investigations undertaken, and the labels used on traded ODS equipments. They also agreed to hold regular meetings between customs officers working at the borders between Nepal and India and between Nepal and China.

A more recent attempt was the Workshop on Preventing Illegal Trade: Public Private Partnership, organised in Hua Hin, Thailand in February 2004, which brought together industry and government representatives from China, India, the European Union, and Russia, the World Bank, the Environmental Investigation Agency (EIA) and the Stockholm Environmental Institute in a commitment to greater cooperation and transparency in sharing information and intelligence to combat illegal trade in the ODS.
Iran, Pakistan, and Afghanistan agreed to meet and discuss on a joint collaboration regarding controlling and preventing illegal trade of Ozone Depleting Substances. This two-day meeting launched by UNEP and hosted by Iran on 17-18 August 2004 in Tehran, provided the opportunity for exploring cooperation and coordination mechanism / framework to tackle illegal trade of ODSs. The Ministries of Commerce, Departments of Custom, and National Ozone Units of these three countries participated at the meeting to exchange their views, experiences, and expectations to enforce better controls on illegal trade of ODS as part of their efforts to combat environmental crimes.

The second initiative was the Mongolia Dialogue, held in Ulaanbaatar, in August 2003, bringing together ozone and customs officers from China and Mongolia. The outcome of these Dialogues resulted in agreements on information exchange between participating countries on registered importers and exporters, the establishment of the Mongolia-China Task Force, and other cooperation activities.

Illegal trade has proved to be the biggest obstacle to the achievement of the goals of the Montreal Protocol, and it is therefore very important for all countries to take measures to eliminate it. National licensing systems to better track imports and exports of ODS, improved national regulations, sharing of information, international cooperation, training initiatives, distribution of ODS identifiers at focal checkpoints, and network meetings could well be the most potent weapons to overcome this obstacle.

Where to Turn for Help
A National Ozone Unit is present in every country to help individuals with such initiatives to protect the ozone layer. The NOU can provide the latest and the most comprehensive information on matters such as ODS regulations, substitutes and technologies available for the replacement of a particular ODS-containing appliance, and national and regional activities currently under implementation. In addition, consulting with local suppliers or servicing technicians can often bring up very effective techniques for a replacement or retrofit process.

Customs Regulations
Customs and regulations were initially targeted towards gradually decreasing the amount of ODS in use, thus facilitating their phase-out process. Today, these perform an additional, perhaps even more important, job of keeping a check on illegal trade. The Montreal Protocol started things by defining, in Article 4, restrictions in trade of ODS with countries that had not joined the Protocol. Building on this single restriction, member countries have today implemented various legislative measures to keep track of the amount of ODS being traded and consumed.

Most countries started by imposing heavy taxes on ODS and appliances using CFCs and CFC compressors, to discourage their use. Some countries also reduced or entirely eliminated customs duties and excise taxes on ozone-friendly equipment, for the same purpose. These steps were instrumental in closing the price-gap between ODS and their alternatives, thus making ozone friendly technologies competitive in the market.

Smugglers were imprisoned and fined heavily to discourage illegal trade. Today, the trade and use of most ODS in various applications have been banned in most of countries, and national licensing systems have been established to prevent unauthorised use of these substances. Member countries of the South Asia Network have also initiated such action.

In response to Meeting of the Parties Decision XIV/7, UNEP CAP is encouraging parties to exchange information and intensify joint efforts to improve means of identification of ODS and prevention of illegal ODS traffic, and also to make even greater use of the regional networks to increase cooperation on illegal trade issues and enforcement activities. The SIDA funded project on customs ozone coordination is an example of such efforts in the Asia and the Pacific region. UNEP will also continue to work with regional customs institutes like the National Academy of Customs, Excise and Narcotics (NACEN) in India to ensure that training on these subjects is integrated into ongoing curricula.
Anti-ozone Chemicals

ODS are listed by the Montreal Protocol as specific chemicals or ‘controlled substances’ to be phased out within specified deadlines. Chlorofluorocarbons (CFCs), chemicals containing chlorine, bromine, and fluorine, head this list as the substances that need to be controlled most urgently. Currently 15 CFCs, 3 halons, 34 hydrobromofluorocarbons (HBFCs), 40 hydrochlorofluorocarbons (HCFCs), carbon tetrachloride, methyl chloroform, and methyl bromide make up this list of controlled substances. CFCs are stable, non-toxic, and easy to store chemicals that have been extensively used since the 1930s in refrigerators, aerosols, air conditioning, and foam blowing. CFC-11 and CFC-12 are the most widely used chlorofluorocarbons. Halons, chemicals consisting of fluorine, and carbon, are used mainly in fire extinguishers and are ten times stronger ozone destroyers than the most potent CFCs.

HCFCs, which are increasingly being used as short-term substitutes for CFCs, destroy ozone at a much slower rate than CFCs but do have high global warming potential. Carbon tetrachloride is used as a cleaner and in the production of CFCs. Similarly, methyl bromide, which has a significant ODP, is used mainly as an agricultural pesticide and fumigant. Methyl chloroform is popular as a solvent and blowing agent and has an ODP about one-tenth that of CFC-11.

The need to phase out these chemicals is obvious, but since they are so useful to the global economy, only the availability of proper ozone-friendly substitutes will allow countries to realise phase-out targets. Countries had started working towards the phase-out of some of the most damaging ODS even before substitutes became available. Intense research over the past few years has today yielded a large number of substitute chemicals and technologies to effectively replace CFCs, halons, CTC, and methyl chloroform. These substitutes range from natural substances like water and carbon dioxide, and simple chemicals like ammonia and isobutane, to blends of complex chemical compounds like hydrofluorocarbons (HFCs).

There is no one perfect substitute for a certain ODS. The choice of the substitute depends on the purpose behind the use of an ODS. For instance, HFC 134a might be a perfect substitute for CFC-11 in aerosols, but methylene chloride is a much better choice to replace CFC-11 in the foam sector. Similarly, the choice of alternative substances is not without problems. Some very effective substitutes for ODS are not widely used because of problems like high global warming potential, health hazards, high costs of installation, and incompatibility with existing equipment.

In some cases, it might be possible to use a new technology that entirely eliminates the need of an ODS. For instance, the use of fire-resistant materials can greatly reduce the instances of accidental fire and therefore of the use of halons from fire extinguishers. Similarly, the use of mechanical pumps, dual compartments, and roll on/stick systems has removed the need of propellants in aerosols.

In spite of these problems, the process of substituting all ozone depleting substances with ozone friendly chemicals or technology is already in full swing throughout the world, well before the required deadlines. This is mainly because countries will soon enforce regulations to control ODS consumption, and ODS containing equipment and chemicals will not only be costly but also increasingly difficult to find as time passes on. The common strategy among factories has been to continue using existing ODS containing equipment until the end of their service lives before proceeding...
with retrofitting or replacement plans. CFCs from obsolete equipment are then recovered and recycled. This is economically more favourable, but might prove to be harmful in case of significant leakage of CFCs into the atmosphere.

Today, alternative substances are also manufactured in developing countries like India, China, and Brazil, and distributed worldwide. The substitutes have proved to be particularly important in electronics. In the fire fighting sector, halons are now used only in critical areas like control rooms and aircrafts. Hydrocarbons and hydrofluorocarbons (HFCs), which have zero ODP (HFCs, however, do have significant GWP), have proved to be effective long-term substitutes. In many cases, the use of substitute substances has led to greater efficiency. And as more and more such substitutes are discovered, manufactured, and made accessible, instances of cost-effective replacements of ODS in all parts of the world will continue to grow. If the current situation is anything to go by, it would be safe to say that alternative substances and technologies available today should have no problems in replacing existing ODS, without any noticeable effect on the global economy.

### Labelling

Products using substances that have zero or negligible ODP contain various kinds of labels such as ‘CFC-free’ and ‘ozone friendly’ so that consumers can make their choice accordingly. Even when such labels are not used, it is possible to tell most of the time whether a product contains ODS or not. In case of fire extinguishers, for example, the thumb rule that almost always works is that yellow cylinders contain halons, which have very high ODS, whereas red cylinders use ozone friendly chemicals. In addition, such equipment and appliances almost always contain labels listing the chemicals they use, which is the most reliable source of information in determining whether an appliance is really ozone friendly.

These chemicals can be identified in three major ways:

- **Chemical name**, such as 1,1,1-trichlorofluoroethane, which is almost never used on labels
- **Trade name**, such as FREON™
- **Refrigerant code**, such as CFC-113 or R-13, which is the most commonly used form of identification. The American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) established refrigeration nomenclature (codes beginning with R, such as R-500 and R-600a).

Tables in the Annex of this booklet list the refrigerant codes and chemical names of the most common refrigerants and their key substitutes, along with their ozone depleting potential (ODP).

### Many Solutions to the Same Problem

CFC-12 finds its greatest application in the refrigeration and air-conditioning industry. Over the past few years, three substances have emerged as replacements for CFC-12 in domestic refrigerators and small capacity commercial refrigeration appliances. HFC-134a has zero ozone depletion potential but a relatively high global warming potential. Its capacity, similar to CFC-12 at high temperatures, goes lower than CFC-12 at temperatures below –10°C. Although it is nonflammable, nontoxic, and matches the capacities and operating conditions of CFC-12, its use in refrigeration is not without a few problems-it is sensitive to contamination, does not mix with mineral oils used with CFCs, dissolves much more moisture, and is twice as expensive as CFC-12.

Isobutane (R-600a) is a hydrocarbon that is miscible with mineral oils, and the resulting mixture is also compatible with compressor materials. However, its low refrigerating capacity (about 60% of that of CFC-12) means that it requires new models with different displacement/motor combinations and so cannot be used for the conversion of existing CFC-12 or R-134a systems. Another problem with isobutane is that it is flammable.

A blend of propane (R-290) and isobutene (R-600a), mixed in equal proportions by weight, has a refrigeration capacity similar to CFC-12 and operates at similar pressures. This blend of hydrocarbons, too, is fully miscible with mineral oil and compatible with compressor materials. HC blend is the refrigerant mostly used when retrofitting existing CFC-12.

There are more than one substitute available for the same ODS and for the same application, yet none of them is without problems. Which substitute is best for a particular equipment is largely determined by the condition of that equipment, the amount of money available, and whether the user is willing to replace entire components or just the ODS.
inadequate capacity, and excessive energy consumption, the hotel decided to replace all the equipment. The eight cold storage and freezer units were replaced with 11 new units based on R-404A (which is a blend of HFCs with zero ODP). Although the total cost of this replacement was US$ 200,000, the hotel now saves almost US$40,000 every year due to energy efficiency and reduced food spoilage. In this way, the hotel expects to recover the cost of installation in five years. Following the success of this replacement, the hotel has also replaced its CFC-12 mini bars with vapour absorption models, which consume 34% less energy than the CFC system they replaced.

The Iran Meat Organisation’s (IMO) Ziaran Meat Complex, needing a major update of its capacity, decided to shift from the existing chlorofluorocarbons to ammonia, which has zero ODP as well as very low global warming impact. Accordingly, York Refrigeration Global Contracting supplied fully assembled and tested blast-freezing modules, complete with ammonia charge and ready to operate on the day of delivery, causing minimum disruption to production. Since the two units were installed outside the main building, there were no safety concerns regarding the gas being released within buildings. Although the purchase price per kW capacity of ammonia was higher than equivalent HCFC plants, its efficiency made it perfect for a long-term investment business like the Meat Complex. The improved technology has already led to 25-40% energy savings, resulting in significant running cost savings.

Most ozone-friendly appliances are labeled ‘CFC-free’ to enable consumers to tell the difference. Countries of the world have made a legal commitment to phaseout using all main types of ozone-damaging chemicals through the Montreal Protocol. Industrialised countries have already met these targets, and developing countries have time till 2010.

**COMPLIANCE POSITION**

2002 Consumption Data Reported Under Article 7

To attract attention of NOUs, the following table has been prepared by CAP to highlight the compliance status. The colours of traffic signals are used to highlight the status on compliance.

<table>
<thead>
<tr>
<th></th>
<th>AI-CFCs</th>
<th>All-Halons</th>
<th>BII-CTC</th>
<th>BIII-MCF</th>
<th>EI-MB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>581.60</td>
<td>328</td>
<td>0.0</td>
<td>0.0</td>
<td>5.7</td>
</tr>
<tr>
<td>China</td>
<td>57818.70</td>
<td>30621.2</td>
<td>34186.70</td>
<td>6604.2</td>
<td>55903.80</td>
</tr>
<tr>
<td>India</td>
<td>6681</td>
<td>3913.7</td>
<td>1249.4</td>
<td>317.2</td>
<td>11505.4</td>
</tr>
<tr>
<td>I.R.of Iran</td>
<td>4571.70</td>
<td>4437.8</td>
<td>1420</td>
<td>1420</td>
<td>77</td>
</tr>
<tr>
<td>Korea, DPR</td>
<td>441.70</td>
<td>299</td>
<td>0.0</td>
<td>0.0</td>
<td>1285.20</td>
</tr>
<tr>
<td>Korea, R.of</td>
<td>9159.8</td>
<td>6646.6</td>
<td>3678</td>
<td>2287</td>
<td>638</td>
</tr>
<tr>
<td>Maldives</td>
<td>4.60</td>
<td>2.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Mongolia</td>
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<td>6.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Nepal</td>
<td>27</td>
<td>0.0</td>
<td>2.0</td>
<td>0.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Pakistan</td>
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<td>1647</td>
<td>14.20</td>
<td>17.0</td>
<td>412.90</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>445.60</td>
<td>185</td>
<td>0.0</td>
<td>0.0</td>
<td>35.10</td>
</tr>
</tbody>
</table>
Although the Montreal Protocol is working better than anyone could have envisioned, sustaining the fruits of this hard work by countries is a very big challenge. Although the initial success of the Protocol can be attributed initially to what has taken place in large-scale industries in developed countries, developing countries now face the test of having to meet compliance on their own. This focus on developing countries, where factories are small, scattered, poorly managed, and operated informally, and the majority of the people are not only uneducated but live below the poverty line, implementation of the Protocol calls for a lot more effort, coordination, dedication, and perseverance.

Following the agreement of a regional awareness action plan for Asia and the Pacific at the network meeting in Agra in April 2004, the South Asia and SEAP networks have proposed to celebrate Ozone Day through a regional event. This concept is consistent with UNEP CAP’s regional approach, and is seen as an opportunity to highlight achievements not only from a national but also a regional perspective. This new regional celebration plans to demonstrate successes of regional cooperation, especially how networking has contributed to a higher level of compliance in the region.

In the South Asia region, consumption of ODS is increasing in very few countries. Current consumption data from countries in the region show that almost all countries have met the targets for the CFC freeze, and even the methyl bromide freeze. However, as targets get tighter in the next few years, efforts would need to be increased, coupled with positive enforcement of current ODS regulations in order for the phase out to be sustained.

Many countries have, in their phase out plans, opted for schedules much faster than what the Protocol requires. This speaks very highly of the political commitment that has been evident in the region right from the start of Montreal Protocol implementation. Public awareness has been identified as the first step towards this solution. September 16, the day the Montreal Protocol was adopted, is celebrated all over the world as World Ozone Day to publicise the issue of ozone protection. Massive public awareness programmes in the developing countries, consisting of workshops and rallies, banners, publication of brochures, inclusion of environment related materials in school and college textbooks, and media coverage, have helped in the phaseout of ODS. Until individual producers and consumers all over the world are made aware of the impact of their choices on the ozone layer, the planet, and eventually on their own lives, the problem will not be addressed.
How Can You Help?

In spite of everything that has been done by international organisations and governments to eliminate the use of ODS, this target can be successfully achieved only if individuals contribute. The general public can help in this global effort in a number of ways.

As responsible citizens
- Buy only those products (spray cans, refrigerators, fire extinguishers etc.) that are labelled ‘ozone friendly’ or ‘CFC-free’. The seller should be consulted in case of doubt.
- Maintain appliances containing ODS regularly to prevent the release of ODS into the atmosphere, hiring trained personnel for all servicing of existing equipments to ensure efficiency and prevention of leakage.
- Replace ODS in appliances with ozone friendly substances wherever possible. In some cases a retrofit, which involves replacement of some existing equipment, may be required.
- Dispose of old appliances (eg refrigerators) responsibly, making sure the ODS (such as CFCs and HCFCs) are removed carefully by technicians and submitted for recycling or re-use.
- Return unused ODS-containing products such as CFC-containing aerosols or halon-containing fire extinguishers, and use ozone-friendly substitutes instead.
- Inform other people about the importance and ways of protecting the ozone layer.

As farmers
- Eliminate methyl bromide as pesticide and soil fumigant, and switch to safer and more effective alternatives available today (such as integrated pest management).

As servicing technicians
- Regularly check and fix leaks, and ensure that refrigerants recovered from air conditioners, refrigerators, or freezers are not accidentally released into the atmosphere.
- Inform consumers about alternative environment-friendly technologies available today, and encourage their use.
- Start a refrigerant recovery and recycling programme in the community.

As company or office workers
- Identify existing equipment that use ODS and develop plans to replace them with cost-effective substitutes—suppliers should be consulted to make this process more effective. Companies might be eligible for financial and technical assistance from the Multilateral Fund.
- Inform other staff members and stakeholders about the harmful effects of using ODS, alternative technologies available, what your office is currently doing to help protect the ozone layer, and how they can get involved in such replacement or retrofit programmes.
- Take steps to start an overall environmental programme in the office.

The benefits of the Montreal Protocol, including avoided cancers, cataracts and crop damage, exceed the cost of the investments in this issue by the international community. This poster won the first prize in a UNEP-sponsored contest in 2002.
ACI Limited, a Bangladeshi insecticide company, was found to be the only unit in the country using a mixture of CFC-11 and CFC-12 as propellant gas for its products, accounting for more than 60 percent of the total ODS consumption in Bangladesh in 1999 (refrigeration and air conditioning service being the second largest ODS user after ACI Limited). Recognising the enormity of the problem, the government in collaboration with UNDP implemented a project called ‘Conversion of CFC-free technology in Manufacture of Aerosol products at ACI’ at a total cost of US$ 562,258. The Multilateral Fund contributed US$ 322,920 to this project. Through the completion of the project in March 2002, Bangladesh succeeded in reducing its 2002 ODS consumption to half the 2001 value.

Bangladesh imports its quota of 580.4 metric tons of CFCs (permissible up to December 2004) mostly from India, China, and the UK. It is impressive to note that per capita consumption of ODS in the country dropped from 7.15 grams in 2001 to 3.63 grams in 2002.

The National Ozone Unit (Ozone Cell) within the Department of Environment coordinates all activities related to ODS phase-out in the country. Following the ratification of the Montreal Protocol, the Government of Bangladesh undertook a detailed survey in early 1993 on the use of ODS in the country. This was followed by a detailed country programme in 1994, which consisted of four proposals:

- Institutional Strengthening
- Conversion Project for Aerosol Sector
- Phase-out in Large Refrigeration Units
- Training project for Technicians

These proposals were submitted to the Multilateral Fund for financial assistance. The first two were approved by the MLF at its 14th Executive Committee Meeting in September 1994. The first and second phases of Institutional Strengthening were carried out during March 1996-February 1999 and March 1999-March 2002 respectively, whereas the third phase was initiated in April 2003.

The government has also formulated a Refrigerant Management Plan (RMP) in association with UNDP and UNEP to control ODS consumption. Bangladesh’s National CFC Phase-out plan has been approved as well. Its baseline for Annex A, Group I substances is 580 ODP-tonnes. It reported consumption of 805 ODP-tonnes of Annex A, Group I substances in 2000, and consumption of 740 ODP-tonnes of Annex A, Group I substances for the consumption freeze control period of 1 July 2000 to 30 June 2001. As a consequence, for the July 2000 to June 2001 control period, Bangladesh was in non-compliance with its obligations under Article 2A of the Montreal Protocol. However, with proactive steps taken by Bangladesh in consultation with UNDP, CFC consumption was phased out from one big aerosol company and Bangladesh returned to compliance.
Since 1992, 410 projects from China have been approved by the Multilateral Fund, which are expected to phase-out 58,000 ODP tons of production and 92,000 ODP tons of consumption of ozone-depleting substances. By the end of 2004, the Multilateral Fund had approved a cumulative total of US$512 million as grant for these projects. The implemented projects have already taken China halfway to the target by successfully phasing out 46,000 ODP tons of production and 67,000 ODP tons of consumption.

China’s Halon Sectoral Plan, approved in 1997, was the first to be ever approved by the Executive Committee. Production of Halon 1211 has dropped from 9,950 tons to 1,990 tons in 2003. China has also started working towards the phase-out of carbon tetrachloride. The Executive Committee of the MLF has already approved sector-based phaseout plans for CFC production (except for the sectoral plans for refrigeration servicing and MDI) and 6 other ODS consuming sectors.

Since 1996, several special working groups have been formed to implement the sectoral phaseout plans. The National Office for Management of ODS Import and Export, set up jointly by SEPA, Ministry of Foreign Trade and Economic Cooperation (now merged with other ministries into the Ministry of Commerce), and General Administration of Customs in 2001 now carries out comprehensive management of ODS import and export in China.

From 2002, China adopted in-factory supervision and inspection systems for CFC producing factories, under which data related to raw material consumption, CFC production, and sales are regularly monitored to ensure that production does not go beyond the allocated quota.

To build the local authorities’ capacity of enforcing ozone related regulations in China, SEPA, with the assistance of UNEP, is developing an on-line training system through the latest IT technology in a constant way to all levels of local authorities. This system is expected to be operational by the middle of 2005.

**Big Challenge**

The foam sector in China contains a large number of factories, most of which are small in size and not properly maintained. In addition, they are scattered all over the country and do not observe adequate safety measures for workers. These factors have severely affected sectoral phase-out programmes in the Chinese foam industry. In response, the government has implemented umbrella projects all over the nation, which involve merging small factories into large ones and closing down the few in the worst conditions. This approach has not only assisted the ODS phase-out program, which was the intended target of the project, but also aided industrial restructuring and raised the efficiency as well as safety standards in these larger factories.

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11 September 1989
Acceded to Vienna Convention

14 June 1991
Acceded to Montreal Protocol

14 June 1991
Acceded to London Amendment

22 April 2003
Acceded to Copenhagen Amendment
DPR Korea dismantled all production facilities of methyl bromide in 1996 and phased out CFC-113 and methyl chloroform in 2001. Consumption of CFCs 11 and 12, which amounted to 299 tons in 2002, is expected to be reduced by half by 2005 following a ban on the import of CFC-11, CFC-12, Halon-1211, and Halon-1301 from 1992 (excluding medical use). RMP projects, implemented in association with UNIDO and UNEP, which include technicians training, monitoring, customs and licensing training, and a project on Domestic Refrigeration and Domestic Refrigeration Compressors, are expected to further facilitate this 50% reduction in CFC consumption.

The ODS most consumed in the country is carbon tetrachloride–CTC consumption in 2002 amounted to 1,843 tons, just below the 1998-2000 average base level of 1,867 tons. Five MLF approved projects currently under implementation are expected to phase-out 565.8 metric tons of CTC through the conversion of CTC cleaning processes to non-ODS processes at various factories. The MLF has already approved a project for the closure of CTC production facilities, which will dismantle a facility with a total capacity of 2,300 tons per year by 2005. UNIDO also submitted a Process Agent Sector Plan covering seven projects for the phase-out of 704 tons of CTC by 2005, a Fumigation Sector Plan covering two projects for the phase-out of 306 tons of CTC in agricultural activities, a Solvent Sector Plan, and a Fumigation Sector Plan to MLF for approval. In the 41st ExCom Meeting in December 2003, UNIDO received approval for the terminal phase-out of CTC in DPR Korea at a total cost of US$5,684,840.

The government established an ODS quota licensing system and prohibited import and export from/to non-party of the Montreal Protocol from the beginning of 1990s. Producers, importers and exporters of ODS need to obtain licenses from the State Planning Commission and the National Coordinating Committee for Environment and must report to the agencies on their import and sales data (including export data) each quarter.

The NOU in Korea has reached a consensus on ODS regulation within the RMP. This involves, among other things, a ban on the installation of CFC-based air-conditioners in all newly manufactured vehicles. The NOU in DPR Korea has also taken steps to inform the public about ozone protection activities through the publication of booklets and articles in newspapers and magazines, production of a scientific and educational film on the protection of the ozone layer, a lecture meeting, workshops, and painting competitions. Phase I workshops for refrigeration technicians on good practices and for customs officers has been organised by the CAP team in the first half of 2004.
Unlike most other countries in the South Asian region, India is a producer and consumer of nine ODSs. India produces CFCs and carbon tetrachloride and consumes CFCs, halons and carbon tetrachloride and also exports CFCs, HCFCs and carbon tetrachloride to meet the needs of other Article 5 countries. India also uses methyl bromide for quarantine and preshipment applications. All the ODSs are being controlled as per the phaseout schedules defined under the Montreal Protocol. India’s present per capita consumption of ODS is less than 3 grams, and was under 20 grams at all times between 1995 to 1997, well short of the 300 grams permitted by the Montreal Protocol.

The Executive Committee of the Multilateral Fund to the Montreal Protocol has approved more than 350 projects with a grant of about US $233 million to phase out production and consumption of about 34,000 ODP tons and 20,000 ODP tons respectively.

With financial assistance from Germany and Switzerland, India has implemented the ECOFRIG project, which involved transfer and adoption of ecofriendly technologies to the refrigeration equipment manufacturers all over the country. The Project Management Unit, established under the technical assistance component implemented by UNEP for CFC production phase-out has conducted workshops in over 30 States and Union Territories in the country to raise awareness of ozone related issues during May 2001-July 2003. The National Academy of Customs, Excise and Narcotics of India has been identified as a Regional Centre of Excellence to train customs officers of the region. Training programmes have been undertaken to sensitize customs and enforcement authorities in the borders on monitoring ODS trade and this has also resulted in confiscation of illegal movement of ODSs.

The Government of India has also taken many fiscal and regulatory measures to encourage the adoption of non-ODS technologies, including full exemption from payment of Customs and Excise duties on capital goods necessary for ODS phase-out projects (this benefit was later extended to new establishments with non-ODS technologies), licencing for all import and export of ODS, and a ban on ODSs and ODS based equipment export to non-Article 5 countries.

With comprehensive nationwide public awareness campaigns, strong monitoring systems, and all halon producing plants already dismantled beyond use, India looks to be well on its way towards achieving the targets of the Montreal Protocol.

18 March 1991
Acceded to Vienna Convention

19 June 1992
Acceded to Montreal Protocol and London Amendment

3 March 2003
Acceded to Copenhagen, Montreal, and Beijing Amendments
n 2001, Iran’s ODS consumption was 6,179 tons, which consisted mostly of CFC-11 and CFC-12 used by refrigeration and foam industries. Between 1993 and 2002, 87 projects were implemented in the refrigeration sector, which accounts for about 37% of overall CFCs consumption, to phase-out an intended 2,720.9 ODP tons of ODS. 32 of these have already been completed, achieving the phase-out of 1,940 tons of CFCs. These included the conversion of one of two local hermetic refrigeration compressor manufacturers, three car factories, and a wagon manufacturing company to non CFC-technology. In the foam sector, 21 MLF funded projects were implemented to phase-out 2,513.4 ODP tons of CFC by 2005. More than 1,500 ODP tons of CFC have been phased out (62% of the target). The consumption of halons has dropped from 3,170 ODP tons in 1998 to 1420 ODP tons in 2001. A Halon Advisory Group (HAG) has been set up, with a Physical Halon Bank and a Halon-Clearing House expected to follow.

Iran had already eliminated the use of CFCs in aerosol propellants and in non-medical products in 1989, long before signing the Montreal Protocol. In the solvent sector, which in 2001 used 111 ODP tons of ODS mostly in electronics and precision industries, a project in 1999 successfully phased out 11 ODP tons of CTC. An investment project also approved in 1999 is expected to phase-out 12.4 ODP tons of methyl bromide in post-harvest applications.

The 41st meeting of the Excom in November 2003 approved the National Phase out Plan for CFCs with Germany as the lead agency and UNIDO, UNDP and UNEP as cooperating agencies. UNEP is assisting the country to set up an enforcement unit and develop a database for monitoring the implementation of the licensing system for ODS. UNEP through a bilateral project with Japan assisted the country in stakeholder consultations, which also culminated in the formulation of the Country Programme Update.

The Government of Iran has also greatly assisted in the phase-out of ODS by organising various seminars, establishing quotas for the import of Annex A and B CFCs (2003); reducing commercial benefit tax and excise tax on non-ODS compressors (2002). The import of CFC based compressors, establishment of new enterprises using ODS, expansion of existing ODS using enterprises, and conversion to ODS technology have all been banned. The Deputy Head of DOE is also the Director of NOU.

However, the NOU manager, who oversees the MP operation with the support of few technical and administrative staff handles day-to-day activities of the Unit. The manager maintains liaison with the MLF Secretariat, coordinates the activities of the United Nations implementing agencies, and bilaterals.
The then Ministry of Planning and Environment prepared the Country Programme for the Maldives in April 1993, with technical assistance from the Industry and Environment Program Activity Centre (IEPAC) of UNEP. An Ozone Committee, a technical committee to implement the MP and Vienna Convention, was formed on June 3, 2001 to control the use of ODS, especially CFC-11, in cleaning, refrigeration, and air-conditioning systems and establish import/export licensing and quota systems. This was followed by the “Institutional Strengthening for the Implementation of the Montreal Protocol in the Maldives” (ISP) project in January 1995, under which a National Ozone Cell was set up at the non-governmental Environmental Research Centre (ERC) in the country.

The Maldives banned the use of halons and 1,1,1 trichloroethane in 2003. The import of methyl bromide, bromochloromethane, carbon tetrachloride, and all ODS based equipments have also been banned. A licensing system to control the amount of imported ODS came into effect from April 1, 2002. The country’s total ODS consumption in 2002 was 2.95 ODP tons, a significant reduction from 14.09 tons in 2001. This is below the 1995-97 base line of 4.6 tons that the Maldives is obliged to limit its consumption to.

The Refrigerant Management Plan (RMP) for the Maldives was formulated in 2002 with four projects to train trainers on servicing of refrigeration and air-conditioning equipment, training customs officials, supervising ODS phase-out, awareness and incentive programme targeting ODS equipment. Maldives’ state of non-compliance resulted from a large volume of imports in one year, resulting from the fact that the supplier was not willing to sell less than one container load of substances. Maldives adopted and submitted a comprehensive plan of action including a licensing system implemented in March 2002, ODS import quotas to be implemented from 1 January 2003, government control of CFC stockpiles, proposals to ban the import of ODS-using equipment by January-February 2003, the conversion of ODS-using mobile air-conditioning systems, and a temporary ban on imports of CFC-12 from 1 January 2003 to 2005.

School Children Study Ozone

The most notable among the Maldivian government’s public awareness programmes has been the launching of various ozone related activities at different schools. The Environmental Research Centre (ERC) has held regular presentations at numerous primary and secondary schools in the capital city Male and organised poster competitions for students as well as the public. On the occasion of World Ozone Day, the ERC organised an ozone banner drawing programme in association with the Environment Clubs of 16 schools in the capital in 2001. The banner, measuring 190 feet by 7 feet and prepared in a total of 150 hours, was the largest environmental banner ever unfurled in the country. (See p 6)
Training Trainers

Recognising the importance of controlling ozone depleting substances, various training workshops were organised for customs officers in Mongolia. The most regular and notable of these include Customs Officers Training on Monitoring control of ODS and ODS containing imports and exports, organized in Ulaanbaatar in 2000-2003. The ‘Train the Customs Officers Workshop on Monitoring and Control of ODS Imports and Exports’, which is phase II of the National Train-the-Trainers Workshop for customs officers, was organized at important locations such as Selegne at the Russian Border (in September 2001) and Zamiin-Uud at the Chinese border (in December 2001). A manual for customs officers on ODS legislation and import/export licensing system was published and distributed to participants of the Train-the-Trainers Workshop for Custom Officers in September 2001.

Mongolia has already put an end to the import of CFC-13. The seven major companies that import ODS and ODS contained equipment have also made a pledge agreement with NOU to cut use. The NOU also distributed 22 ODS identifiers as well as three CFC refrigerant cylinders and other equipment for refrigeration service to all customs borders in 2002.

In addition, several seminars and workshops have been organised in Mongolia over the past few years, such as a seminar on ODS containing refrigeration system and implementation of the MP in Mongolia in 1999 for national ODS users, one on Control and Monitoring of ODS in Mongolia and Future Challenges in 2000, Recovery and Recycling of CFC-12 Refrigerant Workshop, and Workshop on Good Practices in Refrigeration. Several technical manuals and guides have also been translated into Mongolian. The NOU has taken numerous measures to promote public awareness through schools and media.

The Mongolia Dialogue on illegal trade was held in Ulaanbaatar, with participants from China to discuss border control of ODS and ODS-equipment trade, resulting in the establishment of the Mongolia Task Force. The Mongolia Dialogue Task Force had its first meeting in October 2003, where it was decided to invite the Russian Federation to become a member. The NOU/Customs network funded through a SIDA bilateral assistance was held back-to-back with the network meeting in October. This was the first formal meeting with the participation of the South Asian Customs Officers after the project extension was approved in 2002.

Since the approval of the Country Programme of Mongolia and the ‘Institutional Strengthening Project to implement the MP’ under the Ministry of Nature and Environment by the Multilateral Fund at its 28th meeting in, the National Ozone Unit established under this Institutional Strengthening Project in December 1999 has been working to effectively fulfill Mongolia’s obligations as a party to the Vienna Convention and Montreal Protocol. The ‘National Programme of Protection of Ozone Layer’ was approved by the government on 25 August, 1999.

7 March 1996 Acceded to Vienna Convention, Montreal Protocol, and London and Copenhagen Amendments

28 March 2002 Ratified Montreal Amendment
To implement the Montreal Protocol, Nepal set up a National Ozone Committee within the Nepal Bureau of Standards and Metrology on 6 July 1998. The country program, along with the Institutional Strengthening program, was approved in 1998. The Gazette Notification, issued on September 25, 2000, determines the annual consumption quotas and established annual phase-out schedules of CFCs, HCFCs, halons, and other ODS. Similarly, the ODS Consumption (Control) Rules, 2001, requires all ODS importers to obtain a license and doesn’t allow re-export to any other country of imported substances. Since Nepal does not produce any ODS, this is expected to keep track of the amount of ODS being consumed. The joint phaseout rate of CFC 11/12 will be 10 percent a year to be zero by 2010. Without such measures, ODS consumption in the country would have grown threefold in that period.

Consumption of ODS in Nepal is very small, even when compared to the other developing countries of the network—only 30 tons of CFCs and 23 tons of HCFCs in 1999. CFC-11 and CFC-12 are the most used ODS in the country, refrigeration and air conditioning services accounting for the greatest consumption of these substances. The rapid growth of agriculture (5% per annum) and tourism (8-11%) means that the use of ODS is growing, especially in commercial and domestic refrigeration, air conditioning, and fumigation.

Nepal customs in 2001-2 seized 74 tonnes of CFCs and HCFCs being imported without a license. While taking this credible step, it put the country in non-compliance as this seizure got counted as consumption. Nepal submitted a plan of action to ensure that the illegal CFCs were released on to the domestic market in annual quantities that would not exceed the amounts permitted under the relevant control measures. Nepal also committed to release annually specific quantities of CFCs from its seized quantities and to monitor its existing system for licensing imports and exports of ODS, including quotas, introduced in 2001, which includes a commitment not to issue import licenses for CFCs, in order to remain in compliance with its plan of action.

Follow Thy Neighbour

ODS phase-out activities in Nepal are deeply related to those in its southern neighbour, India, and for obvious reasons. The existence of a long, open border between these two countries means that Nepal imports almost all of its ODS and other appliances from India, so the availability of these substances and alternative technologies in India decisively affect the choices made by consumers in Nepal. Incidentally, the open border also means that it becomes difficult for customs officials to keep track of ODS and ODS-using appliances entering Nepal, and that ODS can be illegally traded. Nepal finalised and adopted its Ozone regulations only in 2002. During this year, although CFC imports were reported at 94 ODP tonnes, 74 ODP tonnes of these were seized as illegal and are currently not being used but stored in Customs. Nepal has committed to not allow further CFC imports, and release only enough CFCs from this stock per year for its domestic use, not exceeding quantities that will put the country in non-compliance with the Montreal Protocol.
Pakistan

One Step at a Time

In order to minimise the impact of the sudden reduction of Annex A CFCs as outlined in the phase-out schedule of the Montreal Protocol, the Ministry of Commerce has issued instructions to progressively reduce the quota over the next few years, as follows:

<table>
<thead>
<tr>
<th>MP Phase-out Schedule</th>
<th>Pakistan’s breakdown of phase-out targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% reduction in Annex A CFCs from 1995-97 average levels by 1 January 2005</td>
<td>10% reduction by July 2002</td>
</tr>
<tr>
<td>85% reduction in Annex A CFCs from 1995-97 average levels by 1 January 2007</td>
<td>15% reduction by July 2005</td>
</tr>
<tr>
<td>Annex A CFCs phased out between 2007-09, adding up to a total of 100% reduction</td>
<td>5% reductions by every July</td>
</tr>
</tbody>
</table>

The Multilateral Fund has sanctioned 33 investment projects in Pakistan and they are being implemented by UNIDO and the World Bank. Ten of these have already been completed successfully achieving a phase out of 430 metric tons of ODS.

Pakistan’s consumption of CFCs has remained below its freeze level of 1679.40 ODP tons, with one exception. In 2002, Pakistan’s import of halons amounted to 5.6 metric tons, higher than the 4.6 metric tons set as its freeze level. Pakistan has sought to get over this problem by introducing a ban on the import of virgin halons, allowing only recycled halons to be used in the country. Since there is no limit to the amount of recycled halons a country can use, this puts Pakistan in compliance with the Montreal Protocol. Methyl chloroform imports have already been reduced to zero, and substitutes for immediate conversion are being made available to facilitate a reduction in the import of carbon tetrachloride.

Pakistan has faced a few problems in the implementation of the Protocol because of slow implementation of investment projects, delays in the country programme update, and procedural problems related to policy formulation and notification and institutional strengthening. But effective solutions are also being sought.

The Ozone Cell updated the Country Programme in 2003 with the assistance of the World Bank. Various seminars, workshops and other public awareness campaigns such as publication of brochures and placing banners in large cities have played a crucial role in involving the entire nation.

Ministry of Commerce had issued a Public Notice in July 1999 introducing quota/licensing system for the import of CFCs through 29 registered importers. In June 2004, the Ministry has issued a Public Notice covering other ODSs such as Halons, CTC, Methyl Chloroform, Methyl Bromide and HCFCs. By setting such intermediate targets, Pakistan hopes to emphasize on the implementation of the Protocol from the very beginning and avoid last minute rush reductions that might negatively affect its economy. The above information also indicates that Pakistan will be able to complete these parts of the phase-out schedule a full six months ahead of the respective deadlines set by the Montreal Protocol.

18 December 1992
Acceded to Vienna Convention, Montreal Protocol, and London Amendment

17 February 1995
Ratified Copenhagen Amendment
Ratification process of the Montreal & Beijing Amendments is in progress.
The Republic of Korea is classified as an Article 5 country under the Montreal Protocol and has legislated laws to comply with the Montreal Protocol by phasing out ozone depleting substances (ODSs).

It established and implemented an ODS quota licensing system for production, import and export from 1992. Producers, importers and exporters of ODS need to get license issued by the Ministry of Commerce, Industry and Energy (MOCIE). The import of CFC-11, CFC-12 and Halon-1211, Halon-1301 were banned from 1992 except for medical use. To encourage cooperation between the licensing agency, Korea Specialty Chemical Industry Association (KSCIA), and the customs they were linked by an on-line system.

A special committee within the Ministry of Commerce, Industry and Energy carried out a ODS phase-out plan and now determines the limits of overall production and consumption of the regulated substances. The basic plan calls for a 50% reduction of the annex A substances by the end of 2005 from the baseline data, which are the average values of production and consumption from 1995 to 1997. To accomplish this goal, 9.8% reduction is made annually for 7 years from 1998 for a smooth transition.

A compulsory tax of 1.5-30 cents per kg of the annex A and B substances produced and imported is put in a revolving fund which finances research and development of new ozone friendly technologies and alternatives of CFCs and Halons.

Loans for research and development and building new facilities are being provided from the fund to companies using ODS in order to help them develop new ozone friendly technologies and alternatives of CFCs and halons for the earlier reduction and phase-out of the hazardous materials.

Regulations related to the protection of ozone layer are publicised and updated. Brochures, newsletters and posters have been published. Workshops have been held with domestic and international experts on trends in alternative chemicals.

Ozone-friendly Legislation

By the end of 2000, a revolving fund created by imposing a compulsory tax of 1.5-30 cents per kg of annex A and B substances produced and imported had amassed US$ 30 million. The fund now provides loans to companies producing and/or using ODSs for research and development and building new facilities. This is expected to facilitate the earlier reduction and phase-out of CFCs and halons by developing new ozone friendly technologies and alternatives. The fund had already provided US$ 30 million for various projects by the end of 2000.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 February 1992</td>
<td>Ratified Vienna Convention and Montreal Protocol</td>
</tr>
<tr>
<td>10 December 1992</td>
<td>London Amendment</td>
</tr>
<tr>
<td>2 December 1994</td>
<td>Copenhagen Amendment</td>
</tr>
<tr>
<td>19 August 1998</td>
<td>Montreal Amendment</td>
</tr>
<tr>
<td>9 January 2004</td>
<td>Ratified Beijing Amendment</td>
</tr>
</tbody>
</table>
The NOU in Sri Lanka was established under the Ministry of Environment in July 1994. Sri Lanka also organised the 13th meeting of the Parties to the Montreal Protocol in October 2001 in Colombo. In addition to these, Sri Lanka was selected by Japan for a UNEP/Japanese bi-lateral pilot project ‘National Compliance Action Plan to phase out ODS before due dates’.

Japan and UNEP assisted Sri Lanka through the first ever country stakeholder consultations initiated as an innovative approach by Japan. This initiative culminated in the preparation of the National Phase out plan, which has been approved by the Excom. in its 43rd meeting in July 2004. Sri Lanka is well on its target of an early phase out.

In 1996, Sri Lanka introduced regulations to control the imports of CFCs and halons. The 1980 National Environment Act prohibits all use and trade of Annex A and B substances (specified in the MP) from 1 January 2000, except for servicing equipments or industrial plants already using them, for which these substances can be used until 1 January 2005. Import of Annex A and B substances have been brought under the Import Control License (ICL), carbon tetrachloride, methyl chloroform, and methyl bromide.

Sri Lanka had already reduced its CFC imports by nearly 60% by 2001. It reduced its consumption of CFC-11 and CFC-12 by nearly 25 tons through the conversion of the International Cosmetics Limited, the only aerosol manufacturing factory in the country, and three refrigerator manufacturing factories into ozone friendly technologies. The NOU also established eight recycling centers and distributed 100 recovery units to servicing workshops.

Under the RMP for Sri Lanka, approved by the ExCom in December 2000, the NOU has been organizing various training programmes throughout the country. These include the National Train-the Trainers Workshop for Customs Officers, the Training of Customs Officers, and Train the Trainers of Refrigerant Service technicians.

In 1999, the NOU in Sri Lanka prepared a project proposal to eliminate the use of methyl bromide as a fumigant in tea nursery soils with the assistance of Tea Research Institute (TRI) of Sri Lanka. The project, which was approved the same year and has already been completed, reduced methyl bromide imports by 6.5 tons, equivalent to 3.9 ODP tons, annually. Following the success of this project, the government plans to eliminate and prohibit the use of methyl bromide in the entire tea industry in the near future. In fact, methyl bromide, which poses hazards to human health in addition to the ozone layer, is expected to be phased out from all sectors except pre-shipment areas and quarantine purposes.

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The South Asian sub-region is heading for 100 percent ratification. The Compliance Assistance Team in Bangkok is assisting Afghanistan to meet its Montreal Protocol commitments. Afghanistan is the latest Party to the Montreal Protocol when it ratified the Protocol on 17 June 2004. The 43rd Executive Committee meeting of the MLF has approved US$ 40,000 for setting up the ozone office and US$60,000 for preparing the Country Programme/RMP for the country. Preparations are on for initiating the work on CP/RMP formulation. The capacity building of the new ozone office has been initiated and two officers from Afghanistan attended a three day capacity building initiative organised by CAP in Islamabad where the NOU of Sri Lanka trained them on ozone issues and reporting requirements. Afghanistan Customs and Director Environment attended the tripartite consultations on ODS trade control in Teheran on 17-18 August 2004. The team is working with GTZ on the Afghanistan projects. The future activities are preparing the country programme and RMP for the country and organising a stakeholder workshop in Kabul on ozone and chemical issues. UNEP is also managing the Institutional Strengthening Project of the country and will be assisting the ozone office in its activities relating to the Montreal Protocol. UNEP is preparing an approach paper to outline actions needed to assist the country to meet with their 2005 control measures soon after the ratification.

Bhutan has sent the draft of its ratification to the Ozone Secretariat which has with UNEP’s OzoneAction programme been guiding and advising to it to take informed decisions.

The network of ODS Officers for the South Asia sub-region are supporting the two countries. At a meeting in Agra in April 2004, representatives of both countries participated for the first time in a network meeting to share experiences and learn about the technical and political implications of signing. Representatives of the two countries interacted with two top stakeholders of the Montreal Protocol, the Ozone Secretariat and the Multilateral Fund Secretariat.

To further support the initiatives of these two countries, the Executive Committee of the Multilateral Fund of the Montreal Protocol has approved funds for institutional strengthening of the national offices in each country to help meet Protocol targets. Similar funds have also been approved for the preparation of a country strategy and plan to reduce CFC use on the refrigeration-servicing sector.

Afghanistan and Bhutan have started building capacity to address ozone issues. Two officers from Afghanistan underwent a three-day training in Islamabad 1-3 August 2004. A tripartite consultation was organised in Teheran in 17-18 August where Iranian and Pakistani ozone officers along with UNEP, Economic Cooperation Organisation Secretariat, Regional Intelligence Liaison Office and GTZ drew up an action plan to assist Afghanistan to meet its 2005 commitments.

The South Asian region has also benefited from a series of South-South and North-South cooperation activities. For instance, Bangladeshi customs officials have received training from Indian, Malaysian and Sri Lankan experts on customs procedures, refrigeration, etc. Bangladeshi legal experts, for their part, have reviewed Cambodia’s draft ODS legislation. Indian and Japanese experts have taken part in technical assistance on the servicing sector while Chinese ozone officers have visited the DPR Korea.

Indian legal experts have helped Iran build its licensing system, worked with neighbours Nepal and Bangladesh and helped DPR Korea build capacity of the NOU. Thailand has been helping its own northern neighbour Laos and even technicians from Jordan on ozone issues. Mongolia has got help from Japan, Russia and China, while Sri Lankan experts have helped capacity building of Pakistan, Afghanistan and Mongolia.

Nepal has got help from its giant northern and southern neighbours, China and India, in tackling illegal trade. Sri Lanka has worked with Pakistan and Afghanistan in NOU training.

The Montreal Protocol is an example of an international environmental treaty that works. It has many lessons that could be shared with other environmental issue areas. Posters, like this one help in raising awareness.
In 2002, UNEP as an Implementing Agency of the Multilateral Fund of the Montreal Protocol made a conscious departure from the past in assisting developing countries to enable them to implement the Montreal Protocol. The new context of the compliance regime of the Protocol requires countries to: achieve and sustain compliance, promote a greater sense of country ‘ownership’ and implement the agreed Executive Committee framework for strategic planning.

In line with this re-orientation, UNEP proposed through the Compliance Assistance Programme (CAP) to begin moving from a project management approach to a direct implementation approach through specialised staff. Active partnership with implementing agencies and bilateral agencies is the key element of such approach, which is expected to yield consistent and quality advice and support for countries. The Regional Office for Asia and Pacific (ROAP) CAP team is the centre for policy advice and compliance guidance and conduct training to refrigeration technicians, customs officers and other relevant stakeholders on compliance issues, promote bilateral and multilateral cooperation and promote high-level awareness by utilising UNEP staff. The regional vision of CAP is to draw from typical regional characteristics to forge priorities and a work plan. The region consists of 12 parties from the South Asia Network, 11 Parties from the South East Asia Network and 14 from Pacific countries, and it accounts for more than 80% of the global production and consumption of ODS. The region has the largest as well as the smallest consumers in the world, it is the region of swing plants (can produce both CFCs and HCFCs) which no other region has, and the Asia Pacific has taken the lead in designing national phase-out strategies and adopting innovative financing approaches.

These specific characteristics are built into CAP’s regional vision in consultation with the countries for 2003-2005 which has evolved multi-pronged strategies: to analyse the demand-supply scenario and facilitate appropriate policy intervention by dialogue at high political levels, develop ways to deal with LVCs and non-LVCs, assist countries to promote leap-frogging of the transitional technologies away from HCFCs and HFCs and whenever applicable to focus efforts on on-line training and dissemination.

The programme implementation and delivery is organised through the Regional CAP Team.

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### Common Refrigerants

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Symbol</th>
<th>Name/composition</th>
<th>ODP</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-11</td>
<td>CFC-11</td>
<td>Trichlorofluoromethane</td>
<td>1.0</td>
</tr>
<tr>
<td>R-12</td>
<td>CFC-12</td>
<td>Dichlorofluoromethane</td>
<td>1.0</td>
</tr>
<tr>
<td>R-114</td>
<td>CFC-114</td>
<td>1,2-dichlorotetrafluoroethane</td>
<td>1.0</td>
</tr>
<tr>
<td>R-500</td>
<td>Blend of CFC-12 and HFC-152a</td>
<td>0.74</td>
<td></td>
</tr>
<tr>
<td>R-502</td>
<td>Blend of HCFC-22 and CFC-115</td>
<td>0.34</td>
<td></td>
</tr>
</tbody>
</table>

### Key substitutes for the above mentioned refrigerants

<table>
<thead>
<tr>
<th>Refrigerant</th>
<th>Symbol</th>
<th>Name/composition</th>
<th>ODP</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-22</td>
<td>HCFC-22</td>
<td>Chlorofluoromethane</td>
<td>0.05</td>
</tr>
<tr>
<td>R-123</td>
<td>HCFC-123</td>
<td>2,2-dichloro-1,1,1-trifluoroethane</td>
<td>0.020</td>
</tr>
<tr>
<td>R-134a</td>
<td>HFC-134a</td>
<td>1,1,1,2 tetrafluoroethane</td>
<td>0</td>
</tr>
<tr>
<td>R-401A</td>
<td>Blend of HCFCs 22/124 and HCF-152a</td>
<td>0.036</td>
<td></td>
</tr>
<tr>
<td>R-401B</td>
<td>Blend of HCFCs 22/124 and HCF-152a</td>
<td>0.040</td>
<td></td>
</tr>
<tr>
<td>R-402A</td>
<td>Blend of HCFC 22, HFC 123 and propane</td>
<td>0.021</td>
<td></td>
</tr>
<tr>
<td>R-402B</td>
<td>Blend of HCFC 22, HFC 123 and propane</td>
<td>0.033</td>
<td></td>
</tr>
<tr>
<td>R-404A</td>
<td>Blend of HFCs 125/134a/143a</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>R-406A</td>
<td>Blend of HCFCs 22/142b and isobutene</td>
<td>0.057</td>
<td></td>
</tr>
<tr>
<td>R-407A</td>
<td>Blend of HFCs 32/125/134a</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>R-407C</td>
<td>Blend of HFCs 32/125/134a</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>R-408A</td>
<td>Blend of HCFC-22 and HFCs 125/143a</td>
<td>0.026</td>
<td></td>
</tr>
<tr>
<td>R-409A</td>
<td>Blend of HCFCs 22/124/142b</td>
<td>0.048</td>
<td></td>
</tr>
<tr>
<td>R-507</td>
<td>Blend of HCFC-125 and HFC-143a</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>R-717</td>
<td>Ammonia</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>R-600a</td>
<td>Isobutene</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>R-290</td>
<td>Propane</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
The following is a comprehensive, but not exhaustive, list of alternative substances currently being used to replace ODS in various applications:

<table>
<thead>
<tr>
<th>Sub-sector</th>
<th>ODS currently used</th>
<th>Preferred alternative(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Refrigeration and Air Conditioning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic refrigerators</td>
<td>Refrigerant: CFC-12</td>
<td>HFC-134a</td>
</tr>
<tr>
<td></td>
<td>Foamblowing: CFC-11</td>
<td>Isobutene, Cyclopetan</td>
</tr>
<tr>
<td>Refrigerated cabinets</td>
<td>Refrigerant: CFC-12</td>
<td>HFC-134a, Blends of</td>
</tr>
<tr>
<td>(deep freezer, ice-cream cabinets,</td>
<td>Foam blowing: CFC-11</td>
<td>HF-290 and HC-600a</td>
</tr>
<tr>
<td>bottle coolers, visi coolers)</td>
<td>CFC-12</td>
<td>HCFC-141b, cyclopetan</td>
</tr>
<tr>
<td>Water coolers</td>
<td></td>
<td>HFC-134a, blends of HC-290 and HC-600a</td>
</tr>
<tr>
<td>Mobile (car, bus, van, refrigerated</td>
<td>CFC-12</td>
<td>HFC-134a</td>
</tr>
<tr>
<td>trucks, train)</td>
<td>CFC-11, CFC-12</td>
<td>HFC-134a</td>
</tr>
<tr>
<td>Central A/C plants</td>
<td></td>
<td>HCFC-123, ammonia</td>
</tr>
<tr>
<td>Process chillers</td>
<td>CFC-12</td>
<td>HCFC-22, ammonia</td>
</tr>
<tr>
<td>Ice candy machine</td>
<td>CFC-12</td>
<td>HCFC-22, HFC-134a</td>
</tr>
<tr>
<td>Walk-in coolers</td>
<td>[HFCF-22], CFC-12</td>
<td>HCFC-22, HFC-134a</td>
</tr>
<tr>
<td>Room A/C</td>
<td>HFCF-22</td>
<td>HFCF-22, HFC-134a</td>
</tr>
<tr>
<td>Shipping</td>
<td>CFC-12</td>
<td>HFCF-22, HFC-134a</td>
</tr>
<tr>
<td><strong>Foams</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexible PUF [slabstock]</td>
<td>CFC-11</td>
<td>Methylene chloride</td>
</tr>
<tr>
<td>Flexible PUF</td>
<td>CFC-11</td>
<td>CFC-free systems (water-blown), methylene chloride moulded</td>
</tr>
<tr>
<td>Rigid PUF general insulation</td>
<td>CFC-11</td>
<td>HCFC-141b</td>
</tr>
<tr>
<td>(other than refrigeration)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermoware systems</td>
<td>CFC-11, CO₂</td>
<td>Current: HCFC-141b, long term: CFC-free (water blown)</td>
</tr>
<tr>
<td>Integral skin PUF</td>
<td>CFC-11</td>
<td>HCFC-141b, methylene chloride</td>
</tr>
<tr>
<td>Thermoplastic foams:</td>
<td>CFC-11</td>
<td>Hydrocarbons</td>
</tr>
<tr>
<td>-EPPE/EPNN foams</td>
<td>CFC-12</td>
<td>Hydrocarbons</td>
</tr>
<tr>
<td>-EPS foams</td>
<td>CFC-11</td>
<td>Pentane, butane</td>
</tr>
<tr>
<td>Phenolic foams</td>
<td>CFC-11</td>
<td></td>
</tr>
<tr>
<td><strong>Aerosol</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perfumes, shaving foams, insecticides, pharmaceuticals, paints, glues etc.</td>
<td>CFC-11, CFC-12</td>
<td>-Hydrocarbon aerosol propellant or HAP (most preferred for its ease of use and cost; however, highly inflammable)</td>
</tr>
<tr>
<td>Metered dose inhalers</td>
<td>CFC-11</td>
<td>HFC-134a</td>
</tr>
<tr>
<td><strong>Solvent Industry</strong></td>
<td></td>
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<tr>
<td>Electronic and precision cleaning</td>
<td>CFC-113</td>
<td>No clean technologies available</td>
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<tr>
<td>-halogenated solvents, halogenated</td>
<td>Methyl chloroform</td>
<td>Aqueous cleaning processes</td>
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<tr>
<td>solvents, perfluorocarbons, and</td>
<td></td>
<td>Semi-aqueous cleaning process, organic non-volatile</td>
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<tr>
<td>combinations of these Coatings</td>
<td>CFC-113, methyl chloroform</td>
<td>compounds</td>
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<td>-perfluorocarbons, controlled</td>
<td></td>
<td>Aqueous solvents, chlorinated solvents,</td>
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<td>mechanical applications</td>
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<td>Process modification, chlorinated solvents,</td>
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<tr>
<td>Pesticides and pharmaceutical</td>
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<td>Chlorinated solvents, HCFCs, aqueous systems,</td>
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<td>(process solvents)</td>
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<td>Textile cleaning hydrocarbons</td>
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<tr>
<td><strong>Fire Extinguishing</strong></td>
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</tr>
<tr>
<td>Fire extinguishers</td>
<td>Halon-1211, halon-1301</td>
<td>Portable types: [ABC] powder, CO₂</td>
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<td></td>
<td>Fixed types: [FM200], HCFC blend, HFC 23, inert</td>
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<tr>
<td></td>
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<td>gases, water mist system, CO₂ system</td>
</tr>
</tbody>
</table>
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**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>CFC</td>
<td>Chlorofluorocarbon</td>
</tr>
<tr>
<td>CTC</td>
<td>Carbon Tetrachloride</td>
</tr>
<tr>
<td>DTIE</td>
<td>Division of Technology, Industry, and Economics</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Investigation Agency</td>
</tr>
<tr>
<td>Excom</td>
<td>Executive Committee</td>
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<td>GWP</td>
<td>Global Warming Potential</td>
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<td>HBFC</td>
<td>Hydrobromofluorocarbon</td>
</tr>
<tr>
<td>HC</td>
<td>Hydrocarbon</td>
</tr>
<tr>
<td>HCFC</td>
<td>Hydrochlorofluorocarbon</td>
</tr>
<tr>
<td>HFC</td>
<td>Hydrofluorocarbon</td>
</tr>
<tr>
<td>MLF</td>
<td>Multilateral Fund</td>
</tr>
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<td>NOU</td>
<td>National Ozone Unit</td>
</tr>
<tr>
<td>ODP</td>
<td>Ozone Depleting Potential</td>
</tr>
<tr>
<td>ODS</td>
<td>Ozone Depleting Substances</td>
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<tr>
<td>OS</td>
<td>Ozone Secretariat</td>
</tr>
<tr>
<td>RMP</td>
<td>Refrigerant Management Plan</td>
</tr>
<tr>
<td>RNC</td>
<td>Regional Network Coordinator</td>
</tr>
<tr>
<td>UV</td>
<td>Ultraviolet</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development programme</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>UNIDO</td>
<td>United Nations Industrial Development Organisation</td>
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<td>WB</td>
<td>World Bank</td>
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Acknowledgements

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