Environmental Assessment Sourcebook
UPDATE

Environment Department
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Elimination of Ozone Depleting Substances

The World Bank has been at the forefront of international efforts to curb the use of ozone depleting substances (ODSs) and has an important role in implementing the Montreal Protocol on Substances that Deplete the Ozone Layer. The Bank has also committed to withholding financing from projects which further the production and use of ODSs. In practical terms, the application of Environmental Assessment (EA) techniques for projects with the potential for release of ODSs should ensure that potential adverse impacts are prevented, minimized or mitigated.

This update provides guidance on the issues associated with the use of ODSs and the application of EA to control ODSs. It also provides a comprehensive introduction to alternative technologies, processes or chemicals which may be employed to control the release of ODSs from existing or proposed developments.

Background

Surrounding the earth at a height of about 25 kilometers is the stratosphere, rich in ozone, which prevents the sun's harmful ultra violet (UV-B) rays from reaching the earth. UV-B rays have an adverse effect on all living organisms, including marine life, crops, animals and birds, and humans. In humans, UV-B is known to affect the immune system; to cause skin cancer, eye damage, and cataracts; and to increase susceptibility to infectious diseases such as malaria.

In 1974, Drs. Rowland and Molina hypothesized that chlorinated compounds were able to persist in the atmosphere long enough to reach the stratosphere where solar radiation would break up the molecules and release chlorine atoms that would destroy the ozone. Mounting evidence and the discovery of the Antarctic ozone hole in 1985 lead to the global programme to control CFCs and other ozone destroying chemicals. In addition to Antarctica, ozone loss is now present over New Zealand, Australia, southern Argentina and Chile, North America, Europe, and Russia.

The ODSs of concern are: chlorofluorocarbons (CFCs), halons, methyl chloroform (1,1,1,-trichloroethane; MCF), carbon tetrachloride (CTC), hydrochlorofluorocarbons (HCFCs), and methyl bromide.

In September 1987, The *Montreal Protocol on Substances that Deplete the Ozone Layer* (the Protocol) was signed by 25 nations and the European Community (see Box 1). The Protocol was the first international environmental agreement and its signing by so many nations represented a major accomplishment, and a major shift, in the approach to handling global environmental problems.

ODSs and the EA Process

Prior to project categorization during project identification, the environmental screening process should identify whether the project would further the production and use of ODSs. The Bank has committed to withholding financing from such projects unless the use of alternatives poses serious technical or economic problems.

For projects which invest in existing industrial or commercial operations, the potential for atmospheric releases (point source or fugitive) of ODSs or disposal of wastes containing ODSs should be identified. Typical applications for ODSs include use as a carrier solvent for inks or adhesives, for cleaning components, as a propellant, and in refrigeration, air conditioning, or fire protection systems.

The terms of reference (TOR) for the EA should explicitly require the analysis of alternatives to ODSs

Box 1: The Montreal Protocol

Parties to the Protocol agreed to cut annual consumption of CFCs by half of the 1986 consumption rates by the year 1999. In addition, they agreed to halt increases in use of halons.

New scientific evidence surfaced after the entry into force of the Protocol indicating that the ozone depletion was more serious than originally thought, and in 1990 (in London), in 1992 (in Copenhagen), and in 1995 (in Vienna) amendments were made to the Protocol regulating additional ODSs. To the end of October 1995, 150 countries had ratified the Montreal Protocol.

Major provisions of the Protocol now call for:

- Consumption of CFCs, halons, methyl chloroform and carbon tetrachloride ceases at the end of 1995 in developed countries, and by 2010 in developing countries. (Developing countries are defined in the Protocol as those that use less than 0.3 kg per capita per year of ODS. They are often called Article 5 countries in reference to the defining "article" within the Montreal Protocol).
- HCFCs, originally developed as a less harmful class of CFC alternatives, will be phased out by 2020 in developed countries (with some provisions for servicing equipment to 2030). Developing countries are to freeze consumption by 2016 (base year 2015) and phase out use by 2040.
- Consumption and production of methyl bromide will end in 2010 in developed countries (there are phase out stages and exemptions) and developed countries will freeze production by 2002 at the average of 1995–98 levels.
- Establishment of a Multilateral Fund consisting of developed countries contributing. These funds pay for incremental costs such as technical expertise and new technologies, processes and equipment associated with the phaseout in developing countries so that industry in these countries do not suffer undue financial hardship as they convert to non-ozone depleting substances.

The Multilateral Fund of the Montreal Protocol (the MFMP) is managed by an Executive Committee (ExCom) which consists of delegates from seven developing countries and seven developed countries. The following international organizations have been made Implementing Agencies of the Multilateral Fund for the purpose of helping governments and industry in developing countries with their programmes to eliminate ODSs (the roles outlined are not intended to be exhaustive):

- the United Nations Environment Programme (UNEP)—performs a clearing house function including information exchange, country programmes, training and workshops;
- the World Bank—assists developing countries with investment projects, country programmes, workshops, training, and institutional strengthening;
- the United Nations Development Programme (UNDP)—responsible for feasibility and pre-investment studies, training and workshops, demonstration projects, investment project design, country programmes; and
- the United Nations Industrial Development Organization (UNIDO)—implements small and medium scale projects, feasibility studies at plant level, technical assistance and training, country programmes.

and identification of measures to avoid or mitigate their usage.

At the review stage, Bank staff should ensure that ODS issues have been adequately addressed in the EA, and that alternatives have been selected on a sound basis. In all other instances, the technical and economic justification for continued use of ODSs should be evaluated. The measures to eliminate or control ODSs should be reflected in the project legal documentation. During project implementation, monitoring and supervision efforts should confirm compliance with agreed measures.

Uses of ODSs

In general, ODSs are most often used in the following applications:

- as propellants in aerosols (CFCs and HCFCs);
- in refrigeration, air conditioning, chillers and other cooling equipment (CFCs and HCFCs);
- to prevent and extinguish fires (halons);
- in the manufacture of foams (CFCs and HCFCs);
- as solvents to clean printed circuit boards and precision parts, and to degrease metal parts (CFCs, HCFCs, methyl chloroform, and carbon tetrachloride);
- in dry cleaning (CFCs)
- in a variety of other areas, such as inks and coatings, and medical applications (CFCs, HCFCs, methyl chloroform and carbon tetrachloride); and
- as a fumigant (methyl bromide).

Alternative Technologies, Processes and Chemicals

Introduction

The following provides a brief overview of the alternatives to ODSs that have been developed in the various sectors. It is not intended to be an exhaustive listing of all alternatives but it does summarize the more proven alternatives and gives an indication of future development trends. The selection of any alternative should be

Box 2: ODP of Principal ODSs

ODS	ODP
CFC-11	1.0
CFC-12	1.0
CFC-113	0.8
CFC-114	1.0
CFC-115	0.6
CFCs-111, -112, -13, -211, -212, -213, -214, -215, -216, -217	1.0
Halon 1211	3.0
Halon 1301	10.0
Halon 2402	6.0
Carbon tetrachloride (CTC)	1.1
Methyl chloroform (MCF; 1,1,1-trichloroethane)	0.1
HCFC-22	0.05
HCFC-123	0.02
HCFC-124	0.02
HCFC-141b	0.15
HCFC-142b	0.06
HCFC-225ca	0.01
HCFC-225cb	0.04
Methyl bromide	0.7

made with due consideration of other issues that could impact the final choice.

For any alternative, consideration needs to be given, for example, to: its compatibility with existing equipment; its health and safety aspects; its direct global warming potential; whether it increases or decreases energy consumption; and the costs that may be incurred with eventual conversion to a non-ODS technology if an interim HCFC alternative is chosen.

New ways of doing business may also develop in the review and selection of alternatives. For example, in the electronics industry many companies have now converted their manufacturing plants to “no clean” technology. The benefits: elimination of circuit board cleaning after soldering, savings in chemical costs and waste disposal costs, savings in maintenance and energy consumption, improved product quality, and advancements towards new technologies such as fluxless soldering. The selection of any alternative should not be done in isolation of these factors.

Flexible and rigid foams

Zero-ozone depleting potential (ODP) alternatives are the substitutes of choice in many foam manufacturing applications (see Box 2 for ODPs of the principal ODSs). However, in order to meet some product specifications the use of HCFCs is sometimes necessary. The viability of liquid HFC isomers in this industry remains to be proven. Hydrocarbon alternatives need to be better qualified as well.

The issues in these evaluations are safety (toxicity, flammability), environmental impact (volatile organic compounds, global warming), product performance (insulating properties, fire codes), cost and availability, and regulatory requirements.

The following sections summarise the alternatives for specific products of the foam manufacturing sector. Because of the complexity of the industry and the variety of products, the alternatives have been listed briefly as short- and long-term without an elaboration of the merits of each. (Readers are referred to the 1995 UNEP Technical Options Report for this sector for additional information).

Rigid polyurethane foams used in refrigerators and freezers: Current alternatives include hydrocarbons (pentane) and HCFC-141b; longer term alternatives include HFCs (-134a, -245, -356, -365). Vacuum panels may also be used in the future.

Rigid polyurethane for other appliances: Current alternatives include HCFC-141b, HCFC-22, blends of HCFC-22 and HCFC-142b, pentane, and blowing with carbon dioxide / water. In the longer term the alternatives include HFCs.

Rigid polyurethane used for boardstock/flexible faced laminations: Current alternatives for this application include HCFC-141b and pentane while in the longer term there should be a development in the use of HFCs.

Sandwich panels of rigid polyurethane: HCFC-141b, HCFC-22, blends of -22 and -141b, pentane, and HFC-134a are now used as alternatives to CFCs in this application. In the longer term, HFCs and carbon dioxide / water will be the replacement technologies.

Spray applications of rigid polyurethane: The alternatives that are currently in use for spray applications include carbon dioxide / water and HCFC-141b. Longer term alternatives will be HFCs.

Slabstock of rigid polyurethane: Current alternatives include HCFC-141b; longer term alternatives include HFCs and carbon dioxide with water and / or injected. Pentane may also be used.

Rigid polyurethane pipe construction: At present, CFCs in this application are being replaced by carbon dioxide / water, HCFC-22, blends of -22 and -142b, HCFC-141b, and pentanes. Longer term alternatives will include HFCs and carbon dioxide / water. For district central heating pipes pentane and carbon dioxide / water are the preferred technologies.

Polyurethane flexible slab: Many alternatives now exist for flexible slab construction. They include: extended range polyols, carbon dioxide / water, softening agents, methylene chloride, acetone, increased density, HCFC-141b, pentane and other alternative technologies such as accelerated cooling, and variable pressure. The longer term will likely see the use of injected carbon dioxide and alternative technologies.

Moulded flexible polyurethane: The standard now is carbon dioxide / water blowing.

Integral skin polyurethane products: The current alternatives for these products include HCFC-22, hydrocarbons, carbon dioxide / water, HFC-134a, pentanes and HCFC-141b. The long term alternate is expected to be carbon dioxide / water.

Phenolic foams: Phenolic foams can now be made using HCFC-141b, hydrocarbons, injected carbon dioxide or HFC-152a instead of CFCs. In the longer term, HFCs may be the predominant alternative.

Extruded polystyrene sheet: The alternatives for extruded polystyrene sheet currently include HCFC-22, hydrocarbons, injected carbon dioxide, and HFC-152a. In the longer term, these same alternatives will be used (except HCFC-22), along with possible use of atmospheric gases.

Extruded polystyrene boardstock: HCFCs -22 and -142b, and injected carbon dioxide are the current alternatives for polystyrene boardstock. Longer term alternatives will be HFCs and injected carbon dioxide.

Polyolefins: Polyolefins are now manufactured using alternatives such as hydrocarbons, HCFCs -22 and 142b, injected carbon dioxide, and HFC-152a. Hydrocarbons and injected carbon dioxide will be longer term alternatives.

Refrigeration, Air Conditioning and Heat Pumps

Refrigeration technology has also been rapidly evolving and immediate replacements for many applications include: hydrocarbons, HFCs and HCFCs,. Some of these will also be candidates for long term replacements of the currently used CFCs. The following sections briefly describe the alternatives that are available for specific refrigeration, air conditioning and heat pump applications.

Domestic refrigeration: Two refrigerant alternatives are predominant for the manufacture of new domestic refrigerators. These are: HFC-134a, which has no ozone depletion potential and which is non-flammable but has a high GWP, and HC-600a, which is flammable, which has zero ODP, and which has a greenhouse warming potential (GWP) approaching zero. Other alternatives for some applications include: HFC-152a, and binary and ternary blends of HCFCs and HFCs.

Retrofitting alternatives may include HCFC / HFC blends after CFCs are no longer available. However, results obtained so far are still not satisfactory. Neither HC-600a nor HFC-134a is considered an alternative for retrofitting domestic refrigeration appliances. Preliminary data indicate that a combination of the latter two may be a retrofit, or “servicing” candidate.

Commercial refrigeration: Alternatives to CFCs for new commercial refrigeration equipment include HCFCs (including HCFC mixtures), and HFCs and HFC mixtures. Retrofit of existing equipment is possible by using both HCFCs and HFCs, along with reduced charges and the opportunity to introduce more efficient compressors. Hydrocarbons are, to a small extent, applied in hermetically sealed systems.

Cold storage and food processing: While there has been a return to the use of ammonia for some cold storage facilities, safety issues are of concern and some regulatory jurisdictions restrict its use. Other alternatives to CFCs in cold storage and large commercial food preservation facilities include HCFC-22 and HFC blends. Hydrocarbons and HCFC-22 will continue to be the favoured alternative until equipment sing other alternatives is developed; ammonia will be used in selected applications.

Industrial refrigeration: New industrial refrigeration systems that are used by the chemical, petrochemical, pharmaceutical, oil and gas, and metallurgical industries, as well for industrial ice making and for sports and leisure facilities can use ammonia and hydrocarbons as the refrigerant. Although it would concern a small product base, existing CFC equipment can be retrofitted to use HCFC-22, or HFCs and HFC blends, and hydrocarbons.

Air conditioning and heat pumps (air cooled systems): Equipment manufactured in this category generally uses HCFC-22 as the refrigerant. Alternatives are under investigation. They include HFCs and HCs (propane). The most promising of these are the non-flammable and non-toxic HFC compounds. Although there is a difference in the interest in propane in various regions. While they have been criticised for their global warming potential, the Total Equivalent Warming Impact (TEWI) which combines GWP and energy efficiency is equal to or lower for HFCs than for the other alternatives.

Air conditioning (water chillers): HCFC-22 has been used in small chillers while CFC-11 and -12 have been used in large chillers where centrifugal compressors have been used. HFC blends are now beginning to be introduced to replace HCFC-22 in the small chillers; HCFC-123 and HFC-134a are the preferred replacements for the large units. Chillers that have used CFC-114 can be converted to use HCFC-124, or replaced by HFC-134a units.

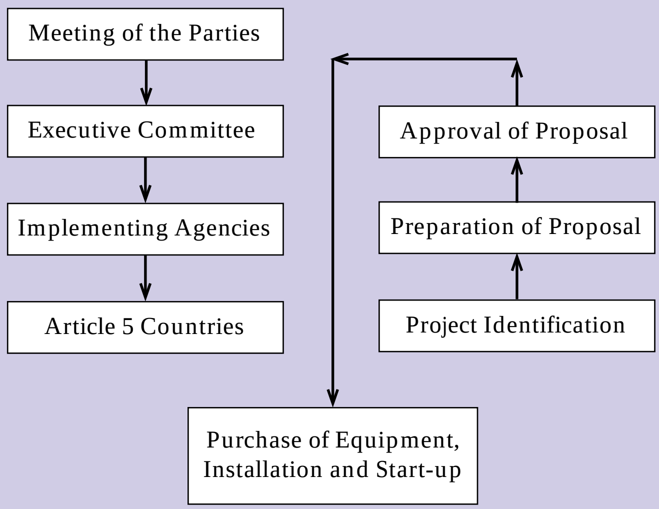
Transport refrigeration: HCFC-22 and CFC-502 have been the refrigerants of choice for transport refrigeration units. However, some applications are using ammonia as the refrigerant. Alternatives include various HFC blends.

Box 3: The Development, Approval and Implementation of Projects Funded by the MFMP

Enterprises in Article 5 countries that qualify for assistance under the Multilateral Fund of the Montreal Protocol are required to follow specified procedures in order to attain this assistance:

- the project for conversion to alternative technologies and processes is developed by the enterprise, with the assistance of experts, and a proposal is prepared;
- the proposal is reviewed by the Implementing Agency and / or its consultants. Any required amendments are incorporated by the project proponent, and the proposal is returned to the IA;
- the Proposal is submitted to the Executive Committee of the MFMP;
- if the project is not approved the ExCom identifies outstanding issues and, in some cases, there may be further opportunity to submit a revised proposal addressing these issues;
- if the project is approved, funds are disbursed and the conversion project can proceed, once conditions of grant are met.

The following figure portrays the project development and approval process.



Automotive air conditioning: The manufacturers of new automobiles have chosen HFC-134a as the fluid for air conditioning and retrofit kits are now available to allow older automobiles to convert to this alternative.

Heat pumps (heating-only and heat recovery): New heating-only heat pumps use HCFC-22 and this is expected to continue. HFC-134a is an alternative for retrofitting existing heat pumps while investigation into the use of ammonia proceeds for large capacity heat pumps. Other being investigated include propane, other hydrocarbons, and hydro-carbon blends.

Solvents, coatings, inks and adhesives

There now exist alternatives and / or quantities of controlled substances in sufficient quantity for almost all applications of ozone depleting solvents. Exceptions have been noted for certain laboratory and analytical uses and for space shuttle rocket motor manufacturing. HCFCs have not been adopted in large scale as alternatives for CFC solvents. However, in the near term they may be necessary as transitional substances in some limited and unique applications. The UNEP Solvents Technical Options Committee does not recommend HCFC-141b as an alternative to replace methyl chloroform (1,1,1-trichloroethane) as it has a three times higher ODP. Alternatives for specific uses of ozone depleting solvents are described in the following sections.

Electronics cleaning: Experience has confirmed that most uses of ozone depleting solvents in the electronics industry can be replaced easily and, often, economically. A wide choice of alternatives exist. If technical specifications do not require post-solder cleaning, then “no-clean” is the preferred technology. If cleaning is required, then the use of water soluble chemistry has generally proven to be reliable. Water soluble chemistry is not, however, suitable for all applications.

Precision cleaning: Precision cleaning applications are defined as requiring a high level of cleanliness in order to maintain low-clearance or high-reliability components in working order. To meet exacting specifications the alternatives that have developed include solvent and non-solvent applications. Solvent options include alcohols, aliphatic hydrocarbons, HCFCs and their blends, and aqueous and semi-aqueous cleaners. Non-solvent options include supercritical fluid cleaning (SCF), ultra violet (UV) / ozone cleaning, pressurised gases, and plasma cleaning.

Metal cleaning: Oils and greases, particulate matter, and inorganic particles are removed from metal parts prior to subsequent processing steps such as further machining, electroplating, painting, etc. Alternatives to ozone depleting solvents that have been developed include: solvent blends, aqueous cleaners, emulsion cleaners, mechanical cleaning, thermal vacuum de-oiling, and no-clean alternatives.

Dry cleaning: Several solvents exist to replace the ozone depleting solvents that have traditionally been used by the dry cleaning industry. Perchloroethylene has been used for over 30 years. Petroleum solvents, while flammable, can be safely used when appropriate safety precautions are taken. They include white spirit, Stoddard solvent, hydrocarbon solvents, iso-paraffins, and n-paraffin. A number of HCFCs can also be used but should only be considered as transitional alternatives.

Adhesives: Methyl chloroform has been used extensively by the adhesives manufacturing industry because of its characteristics—non-flammable, quick drying, does not contribute to local air pollution, and performance. One alternative is water-based adhesives for some applications. Other alternatives include: hot melt adhesives; radiation cured adhesives; high solids adhesives; one part epoxies, urethanes, and natural resins in powder form; moisture cured adhesives and reactive liquids.

Coatings and inks: Improvements have been made to water-based coatings and these can be a substitute for ODS-based applications. Water-based coatings have been used by the following industries and manufacturing sectors: furniture, electronics in automobiles, aluminium sid-ing, hardboard, metal containers, appliances, structured steel, and heavy equipment. Water-based inks are used successfully for flexographic and rotogravure laminates.

High solids coatings are now used for appliances, metal furniture and a variety of construction equipment.

Powder coatings are now used for underground pipes, appliances and automobiles.

Ultraviolet light / electron beam (UV / EB) cured coatings and inks have been in limited use over the past 20 years but their use is now increasing. They are now used in flexographic inks and coatings, wood furniture and cabinets, and automotive applications.

Aerosol solvent products: Methyl chloroform is most often the solvent in aerosol applications, but some CFC-113 has also been used. Most of these applications can now be reformulated to avoid the use of ozone depleting chemicals. With the exception of water, methylene chloride, and some HCFCs and non-ozone depleting chlorinated solvents such as trichloroethylene and perchloroethylene, all of the alternatives to aerosol applied solvents are more flammable than the solvents they replace. Alternative means of delivering the solvent can be considered.

Other solvent uses of CFC-113, methyl chloroform, and carbon tetrachloride: Specialised applications of ozone depleting solvents include drying of components, film cleaning, fabric protection, manufacture of solid rockets, laboratory testing and analyses, process solvents and semi-conductor manufacture. Some of these applications have been granted an exemption under the Montreal Protocol but it is the consensus of the experts that comprised the UNEP Solvents Technical Options Committee that alternatives will be developed for all of these specialised use areas.

Halons

Halon hand-held extinguishers (containing halon 1211) can be replaced, in most applications, by multipurpose dry chemical extinguishers.

New and existing alternatives exist for most halon 1301 total flood systems. These alternatives include zero-ODP halocarbons, inert gas mixtures, and new technologies that are water based (e.g. water mist). The use of HCFCs are not encouraged as alternatives and PFCs (perfluorocarbons) should not be used indiscriminately.

Aerosols; Sterilants; Carbon Tetrachloride (except as a solvent)

Non-medical aerosol products: There are a variety of alternatives to CFCs used in non-medical aerosol applications. Alternatives include: hydrocarbons (HCs); dimethyl ether (DME); compressed gases such as carbon dioxide, nitrogen, and air; HCFCs -142b and -22; HFCs -152a, -134a, and -227ea (hydrofluorocar-bons); and non-aerosol delivery means such as pump sprays, solid sticks, roll-ons, brushes, etc. Hydrocarbons, DME, and HFC-152a are flammable and as such there may be products in which they cannot be used. In a manufacturing plant where they are used for aerosol products appropriate safety precautions will be required.

Inhalant drug products: Some medical aerosol products such as nasal preparations, local anaesthetics, and antibiotics can be reformulated through the use of alternative propellants, mechanical pumps, etc. However, finding suitable alternatives to the CFCs used in metered dose inhalers (MDIs) used by asthma sufferers has been a challenge. Alternatives that have been developed and proven to date include dry powder inhalers and the HFCs -134a and -227.

Important Note

Identification, development and commercialization of alternatives to ODSs is taking place constantly. For this reason it is important to seek information on the latest alternatives from the Bank's Global Environment Co-ordination Division. Technological updates are provided by the Bank's Ozone Operations Resource Group (OORG), which is comprised of experts in halons, solvents, aerosols, refrigerants, mobile air conditioning, foam blowing, and chemical production.

Sterilants: A gas mixture of 88% CFC-12 and 12% ethylene oxide (EO) has been used by the medical community to sterilise equipment and parts. Replacement alternatives include: steam sterilisation; 100% EO; blends of carbon dioxide (10%) and EO (90%); formaldehyde; HCFC-124 (91.4%) and EO (8.6%); and other means such as gas plasma, chlorine dioxide, ozone, and radiation. Ethylene oxide is toxic, mutagenic, flammable, and explosive and is a suspected carcinogen and its use therefore must be carefully controlled.

Carbon tetrachloride (except as a solvent): Carbon tetrachloride has been used as a feedstock for the production of CFCs -11 and -12 and this application will cease with the closing of CFC production operations. CTC is also used as a feedstock and process agent for some pharmaceuticals and agricultural chemicals, and in the production of chlorinated rubber. The establishment of an alternative for each application will only be found through product specific research.

Methyl Bromide

Methyl bromide is used primarily as a fumigant. Only 3.2% of the global sale of more than 75,000 tons in 1992 were for non-fumigant purposes and this was as a feedstock for chemical synthesis. The remainder is used to treat soil, to fumigate durables and perishables, and to fumigate structures and transport equipment.

From a conservation perspective, technology exists to control the release of methyl bromide when treating soil and crops. Molecular sieves are shown to capture the methyl bromide that otherwise would have been lost to the atmosphere after batch fumigation and to regenerate the methyl bromide for use in subsequent batches.

Alternatives to methyl bromide in each application area are described as follows:

Soil: Chemical alternatives include 1,3-dichloropro-pene, dazomet, chloropicrin, metam sodium, and selective contact insecticides and herbicides. Non-chemical alternatives include crop rotation, organic amendments, steam, solar heating, biological control agents, cultural practices, and plant breeding.

Commodity: Chemical alternatives for crop fumigation include phosphine and carbonyl sulphide, as well as insecticides and rodenticides. Non-chemical alternatives include irradiation, controlled atmospheres utilising nitrogen and carbon dioxide, and heat and cold.

Structural: Chemical alternatives include sulfuryl fluoride and phosphine, and contact insecticides and rodenticides. Non-chemical alternatives are the same as for commodity fumigation.

Progress in Eliminating Ozone Depleting Substances

Significant progress has been made in eliminating ozone depleting substances since the entry into force of the Montreal Protocol in late 1987.

For example, in the aerosol industry the use of ODSs has been reduced from 300,000 tonnes globally in 1986 to 180,000 tonnes in 1989 to an estimated level of less than 80,000 tonnes in 1992.

In the refrigeration sector, use of CFC refrigerants in developed countries dropped from 862,000 tonnes in 1986 to 302,000 tonnes in 1993. Globally, CFC refrigerant use decreased from 1,133,000 tonnes in 1986 to 643,000 tonnes in 1992. To help in managing the phase-out of ODS refrigerants a service industry has been established in most countries which captures and purifies ODSs during the servicing of equipment. The removed ODSs are then used to service the ongoing needs of ODS containing refrigeration and cooling equipment until it has reached the end of its useful life.

In the fire protection sector, the focus has been on establishing halon banks to recondition and store halon that has been removed from service and to make this available for maintaining other installations that require continued use of halon until suitable replacements are developed.

The foam plastics industry has progressed from a global CFC use of 267,000 tonnes in 1986 to 133,000 tonnes in 1993—a reduction of 50%, in spite of a 45% increase in the size of the industry during the same period.

The phase out of ozone depleting solvents is well advanced in the developed countries and users are draw-

Box 4: Sources of Information and Assistance

Additional information on the Montreal Protocol, the Multilateral Fund, and on alternative technologies can be obtained by contacting offices of the implementing agencies:

The World Bank,
Global Environment Co-ordination Division,
Environment Department
1818 H Street, NW.,
Washington, DC, USA
Tel: 202-473-7289
Fax: 202-522-3258

United Nations Environment Programme,
Industry and Environment Office,
Tour Mirabeau,
Quai André Citroën,
Paris Cedex 15, France
Tel: 33-1-40588858
Fax: 33-1-40588874

United Nations Environment Programme,
Ozone Secretariat,
P.O. Box 47074,
Nairobi, Kenya
Tel: 254-2-623851
Fax: 254-2-521930

Multilateral Fund for the Implementation of the Montreal Protocol,
27th. Floor,
Montreal Trust Building,
1800 McGill College Avenue,
Montreal, Quebec, Canada H3A 3J6
Tel: 514-282-1122
Fax: 514-282-0068

United Nations Development Programme,
One United Nations Plaza,
Room DCI-2152,
New York, NY., USA
Tel: 212-906-5042
Fax: 212-906-6947

United Nations Industrial Development Organization,
Vienna International Centre,
Box 300,
Vienna, Austria
Tel: 43-1-211313782
Fax: 43-1-2309766

ing on stockpiled solvents. In the developing countries, CFC-113 use has been largely halted and production facilities are shutting down. The use of methyl chloroform is no longer increasing in these countries. Dramatic reductions of solvent use have been made in Thailand, Malaysia, and Turkey.

It is important to note that the commercial supply chain has had a role to play in the speed of phase-out of ODSs. In many instances customers have asked their suppliers to implement a phase-out programme. These requests may originate because of labeling and tax legislation such as that implemented by the United States or because the customer has environmental policy in place that commits it to encouraging its suppliers to improve their environmental performance. Manufacturers also understand that the dwindling supply of ODSs cause price increases that eventually make products more expensive and less competitive.

Box 5: Glossary of Acronyms

CFC	Chlorofluorocarbon
CTC	Carbon tetrachloride
DME	Dimethyl ether
EA	Environmental Assessment
EO	Ethylene oxide
ExCom	Executive Committee of the Multilateral Fund
GWP	Global warming potential
HBFC	Hydrobromofluorocarbon
HC	Hydrocarbon
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
IA	Implementing Agency of the Multilateral Fund
MCF	Methyl chloroform; 1,1,1-trichloroethane
MDI	Metered dose inhaler
MFMP	Multilateral Fund of the Montreal Protocol
ODP	Ozone depleting potential
ODS	Ozone depleting substance
PFC	Perfluorocarbon
SCF	Supercritical fluid cleaning
TEWI	Total Equivalent Warming Impact
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UV-B	"B" type ultra violet rays
UV/EB	Ultraviolet light/electron beam
WB	World Bank

This *Update* was prepared by Arthur Fitzgerald with input by Sergio Oxman. Based on Bank policy an procedures on Environmental Assessment (EA) (Operational Directive 4.01), the *EA SOURCEBOOK UPDATE* provides up-to-date guidance for conducting EAs of proposed projects. This publication should be used as a supplement to the *Environmental Assessment Sourcebook.* Please address comments and inquiries to Olav Kjørven and Aidan Davy, Managing Editors, EA Sourcebook Update, ENVLW, The World Bank, 1818 H St. NW, Washington, D.C., 20433, Room No. S-5139, (202) 473- 1297. The Bank is thankful for the Government of Norway for financing the production of the *EA Sourcebook Update.*