Standards and Codes of Practice to Eliminate Dependency on Halons

Handbook of Good Practices in the Halon Sector

UNEP Division of Technology, Industry and Economics
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Foreword

The stratospheric ozone layer protects life on Earth. In the 1980s the scientific community reached a consensus that the ozone layer is vulnerable to damage by atmospheric emissions of a specific family of industrial chemicals, the most notable being chlorofluorocarbons (CFCs) and the fire fighting agents halons (brominated fluorocarbons). In September 1987, nations concerned about this crisis signed the Montreal Protocol, a landmark environmental agreement that identified the major ozone-depleting substances (ODS) and established a timetable for their reduction ("phase out"). Today 175 countries -- nearly every Government in the world -- have joined the treaty and committed to the phase out of ODS.

Although they are highly effective fire fighting agents and explosion suppressants, halons are extremely potent ODS as well as significant global warming gases. The production and consumption of halons was successfully phased out in developed countries by the beginning of 1994. Developing countries ("Article 5 countries") have been given a longer phase-out period under the Montreal Protocol, and in January 2002 they will face their first important milestone: the freeze of their halon consumption at 1995-97 average levels. Developing countries currently consume about 35,000 ODP tonnes of halons annually. They will have to phase out all of this consumption plus production by 2010, except for essential uses.

The Parties to the Montreal Protocol have agreed to follow a two-pronged strategy to achieve the halon phase out. First, they will use halons only in "critical" applications where alternative technologies are not available. This requires the efficient management and redeployment of the "banks" of existing halons. Second, they are deploying alternative systems and technologies to replace halons. The first element of the strategy requires the committed application of good practices, codes and standards. This publication assists developing countries to put the first strategic element into place.

Halon consumption continues in many developing countries for newly-installed non-critical fire extinguishers and systems, for reasons including: a lack awareness of halons' impact on the environment; lack of awareness of national commitment to halon phase out; lack of regulatory structure; aggressive marketing of halons; improper servicing and maintenance practices; insufficient water supply; lack of information on available alternatives; and the sometimes prohibitive cost of imported alternatives. All of the above stimulate demand for new ("virgin") halons.

Luckily, appropriate standards and codes of practice can be powerful tools to significantly reduce unnecessary emissions of halon into the atmosphere, promote the use of alternatives to halon, promote halon banking and recycling for essential uses, and promote an orderly phase out of halons - in time to meet the requirements of the Montreal Protocol.

Developing countries as well as industrialized countries have found that there are more opportunities than challenges in the transition away from halons. In particular, the phase out of halons has created many new business opportunities and provided the chance for countries that have successfully managed the halon issue to show private and public sector leadership. The experience of those countries shows that a foundation of standards and codes of good practice are essential to a smooth and effective transition.

Based on the experience of both developed and developing countries, this Handbook is designed to help ozone officers, governments and industry in developing countries recognise the importance of standards and codes of practice in phasing out halons. It explains which types of standards and codes of practice are relevant, and provides step-by-step guidance on how to establish new (or revise existing) standards and codes of practice to promote the halon phase out. The handbook also explains where to get more information and assistance.

The Handbook is the product of collaboration between Paris-based UNEP DTIE OzonAction Programme and the Fire Protection Research Foundation, located in Boston. Additionally, world-renowned experts from developing and developed countries have also contributed to this publication. It is part of the "Eliminating Dependency on Halons" series produced by UNEP to support developing country compliance with the halon provisions of the Montreal Protocol. The Multilateral Fund for the Implementation of the Montreal Protocol has supported the production of this handbook.

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About this Guidebook

This handbook aims to encourage developing countries in the design and establishment of standards and codes of good practice in the halon sector. It seeks to provide a common base for discussion among decision-makers and relevant stakeholders in developing countries, including representatives from:

- *National Ozone Units and other government institutions*
- *Fire protection officials*
- *Industry and trade associations*
- *System owners and operators*
- *Service workshops and technicians*
- *Manufacturers*
- *Insurance companies*

What's the scope of this Handbook?

This handbook addresses issues of fire protection systems and strategies, such as:

- *Available alternatives to halons as extinguishing agents*
- *Essential uses*
- *Emissions reduction in existing installations*
- *Halon recycling and banking*

as they relate to the development of standards and codes of practice.

What's in this Handbook?

*An **introduction** to the issue and background information: The Montreal Protocol; progress and concerns in the halon sector; the role of standards and codes of practice; the opportunity for leadership in developing nations.*

*The **challenge and opportunity** of moving to halon alternatives: essential uses; alternative technologies and approaches; alternative strategies and designs.*

*The **steps** that should be taken in designing and implementing standards and codes of practice to reduce halon use: tasks of the implementation team; tasks of the design team; designing standards and codes of practice.*

*The **elements** of such standards and codes of practice.*

*Where to find **more information** and related documents.*

The annexes contain references to existing regulations, standards, guidance documents, and codes of good practice.

Contents

1. Introducing the Issues

The Montreal Protocol

The fragile ozone layer high in the Earth's stratosphere plays a crucial role in protecting human, animal and plant life from harmful ultraviolet radiation emanating from the sun. In the 1980s it was confirmed that this ozone layer was vulnerable to damage by chlorofluorocarbons (CFCs) and other industrial chemicals. Stable, non-toxic and highly versatile, CFCs have been employed for a wide variety of uses, including refrigerants and air-conditioning fluids, aerosol propellants, solvents and foam-blowing agents.

Other ozone depleting substances (ODS) include halons, carbon tetrachloride, methyl chloroform, methyl bromide and hydrochlorofluorocarbons (HCFCs). HCFCs are much less ozone-depleting than CFCs, and are often used as a transitional substitute.

Halons, the subject of this handbook, have an ozone depleting potential many times higher than CFCs. Halon fire suppression agents have been used throughout the world to protect valuable electronics, oil and gas production facilities, military systems and vehicles, and other critical operations. Halon use during fire suppression, testing of equipment, servicing of equipment, and accidental release during false alarms, can result in the release of halons into the environment.

The United Nations Environment Programme (UNEP) was instrumental in negotiating the 1985 Vienna Convention for the Protection of the Ozone Layer, and the subsequent 1987 Montreal Protocol on Substances that Deplete the Ozone Layer.

The Montreal Protocol's aim is to reduce and eventually eliminate the production and use of man-made ODS by applying quantitative controls to their production and consumption. These controls have been made steadily stricter as the scientific evidence for ozone depletion has strengthened, and as industry has succeeded in developing non-ozone depleting substitutes.

Since 1987, 175 nations have signed the Protocol. By agreeing to its terms, signatory nations are committed to take actions to protect the ozone layer and reverse the damage done by the use of ODS.

In the industrialized world, total phaseout of most categories of ODS, including all CFCs, was achieved in 1996. Developing countries who have signed on to the Monreal Protocol– defined as 'Article 5 parties' – enjoy longer control schedules. The first target they face for halons is a freeze in consumption at their 1995-1997 average levels by 1 January 2002.

Over the life of the Protocol, key decisions applicable to the halon sector have been made at the yearly Meetings of the Parties. In fact, the treaty is an evolving instrument, reflecting the latest findings on the science of ozone layer depletion and the development and implementation of alternative technologies. The major decisions made regarding the halon sector at the Meetings of the Parties are as follows:

At the First Meeting (1989), the ozone depletion potential for Halon 2402 was accepted as 6.0.

The Second Meeting (1990) decided to establish an ad hoc working group of experts to investigate and make recommendations on the availability of substitutes for halons, the need to define essential uses of halons, and if there is such a need, the identification of such uses.

At the Fourth Meeting (1992), it was decided to urge the Parties to take all practicable measures to prevent releases of halons into the atmosphere by recovering halons from fire protection systems for purposes of recyling, reclamation or destruction. Recovery, recycling and reclamation were urged in order to meet the needs of all Parties, particularly those operating under Article 5. Parties were encouraged to submit information relevant to international halon bank management to UNEP. Decisions on essential use criteria were made.

The Fifth Meeting (1993) decided that no level of production or consumption is necessary to satisfy essential uses of halon in non-Article 5 Parties for the year 1994 since there are technically and economically feasible alternatives and substitutes for most applications, and since halon is available in sufficient quantity and quality from existing stocks of banked and recycled halon.

The Seventh Meeting (1995) recommended that all non-Article 5 Parties should endeavor on a voluntary basis to limit the emissions of halon to a minimum by a variety of means, including acceptance as critical those applications meeting the essential use criteria, limiting the use of halons in new installations to critical applications, ensuring that halons are effectively recovered, preventing whenever possible the use of halon in equipment testing and training of personnel, and promoting the environmentally safe destruction of halons when they are not needed in halon banks.

The Tenth Meeting (1998) requested all Parties to develop and submit to the UNEP Ozone Secretariat a national or regional strategy for the management of halons, including emissions reduction and ultimate elimination of their use.

Progress and concerns in the halon sector

The UNEP Technology and Economic Assessment Panel (TEAP) supports the ongoing work of the Montreal Protocol. TEAP and its sector-specific technical committees provide information about alternative technologies that have been investigated and employed to make it possible to virtually eliminate the use of CFCs and halons that harm the ozone layer.

TEAP's Halons Technical Options Committee (HTOC) provides state-of-the-art in halon management, halon banking and halon alternatives. HTOC notes in its 1998 assessment report (see Annex D) that good progress has been made in research and development of a wide range of halon alternative options, resulting in virtually complete cessation of halon use in non-Article 5 countries, and by many Article 5 countries for new installations except essential uses.

But as HTOC notes, concerns remain. Representatives from Article 5 countries have reported that much halon consumption in their countries is not to maintain essential uses, but for newly-installed non-essential extinguishers or systems. This is because it is simpler in the short term to continue with "business as usual", however at the expense of users who will be left with protection systems requiring halon long after all production has ceased. Those users will be required to reinvest in alternative systems, in effect paying twice for protection in a short period.

Securing an inert gas agent supply

PHOTO COURTESY OF FIRE SUPPRESSION SYSTEMS ASSOCIATION (FSSA)

In addition, the necessary national fire protection standards and design codes do not always exist for halon alternatives in these countries, leaving many users vulnerable to unfounded and exaggerated sales claims regarding both the halons and alternatives.

Overcoming these impediments is key to compliance with the January 2002 halon freeze, and with the subsequent control measures for Article 5 countries.

The table below indicates halon-sector targets, reflecting decisions made at meetings of the Parties to the Montreal Protocol through December 2000.

Year beginning 1 January	Control Measures
2002	Freeze of halons at 1995-97 average level
2005	Halons reduced by 50% from 1995-97 level
2010	Halons phased out

The role of standards and codes of good practice

International standards have already evolved in response to the Montreal Protocol, and widely used standards, such as the ones listed in Chapter 5 of this guidebook, now exist. These standards can be used as models in amending national and local pre-Montreal Protocol standards and codes of practice that may still be in force. Developers of national or local standards and codes of good practice may find it more effective to use these models as a starting point, rather than standards that mandate halon use.

The International Organization for Standardization (ISO) defines standards as "documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines, or definitions of characteristics, to ensure that materials, products, processes and services are fit for their purpose." The provisions and requirements found in standards are suitable for reference by other standards or for adoption into law.

Many internationally-recognized standards are developed by independent non-profit membership organizations. Organization members having appropriate expertise serve on technical committees, which are charged with writing and maintaining standards.

There are several processes by which standards are developed. One, for example, is the consensus process, in which the views of all stakeholders are taken into account; i.e. engineers, manufacturers, vendors, users, fire service, insurance, enforcers, and government. Other processes involve development by a government authority, or a single group of industry or technical experts. The processes vary as to the degree of authority and involvement by government and private sectors.

Standards have great influence because they are widely used as a basis of legislation and regulation at all levels of government, from local to international. Standards are often referenced by government agencies and by the fire protection community in designs and specifications. Importantly, in fire protection, the insurance sector relies on international standards, as well as their own.

In fire protection, there are relevant standards covering building construction, fire protection engineering, suppression and detection system use (installation), and suppression and detection system performance.

Once adopted, standards pertaining to halon substitutes, recovery and recycling, and halon banking can provide direct and authoritative support for the phaseout goals of the Montreal Protocol.

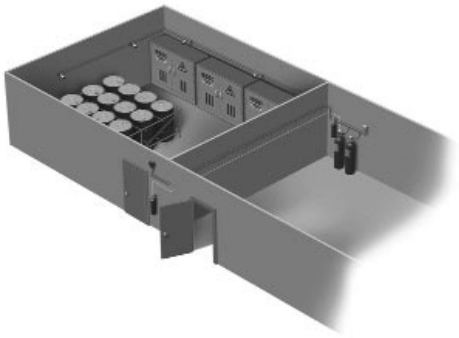
Reasons to Adopt Standards and Codes of Practice for Halon Phaseout

- *Fulfill your country's obligation to protect the ozone layer under the Montreal Protocol.*
- *Promote the use of effective halon alternatives.*
- *Avoid non-essential use of halons.*
- *Promote state-of-of-the-art fire protection technologies and approaches.*
- *Promote re-deployment of halons for essential uses via halon banking.*
- *Prepare and protect businesses for increasing restriction of virgin halon supply.*
- *Eliminate unecessary requirements for halon use in old standards and codes of practice.*

Codes of good practice are designed to complement existing standards and regulations by giving direction and focus as to their requirements. They typically are voluntary in nature, but carry the force and influence of an industry profession or government authority. In the halon sector, codes of practice introduce the key element of responsibility in the halon management strategy. Such voluntary codes of practice are designed to reduce the risk to humans and the environment associated with the use of halons, and to provide a framework for owners, users and service personnel to accomplish the following:

- *Reduce the potential for unwanted emissions into the atmosphere*
- *Promote the use of recycled halons as a means of minimizing unwanted emissions*
- *Promote the use of alternatives to halon fire protection*
- *Encourage an orderly phase out of halons in existing fire protection systems.*

Codes of good practice are designed not to supersede existing regulations and standards, but to be used in conjunction with them.



Paint supply warehouse protected by a halocarbon agent system

GRAPHIC COURTESY OF FSSA

Insurance specifications

Since the halons were introduced in the 1970s, the insurance industry has considered them to be valuable fire protection tools. Due to their extinguishing properties as well as their cleanliness, prior to the Montreal Protocol most insurance companies recommended halon in areas where critical equipment and equipment susceptible to damage from traditional extinguishing agents may be located. These areas include, but are not limited to, the data-processing and telecommunications areas of large institutions, or control rooms of large manufacturing facilities where the loss of critical equipment can result in excessive operational interruption and loss of revenue.

Following the Montreal Protocol and the phaseout of halons, the insurance industry has changed their philosophy on the protection of such occupancies. Insurance companies no longer recommend or require the installation of extinguishing systems utilizing halons as an agent. Although most insurance companies are not requiring the removal of existing halon extinguishing systems, some are recommending the installation of an acceptable alternative extinguishing system in areas protected by halon. This will eliminate the possibility of the area being unprotected if an accidental halon discharge occurs until a new system is installed.

In addition to recommending other accepted halocarbon-extinguishing agents, insurance companies have also been returning to more traditional schemes, such as compartmentation and isolation of critical assets from ignition sources and other combustibles; water sprinklers at the ceiling; and smoke detection and/or CO_2 in concealed areas. Such alternative protection schemes, although effective in extinguishing a fire, may result in a longer loss of use of the affected equipment. This "business interruption" in a financial institution or manufacturing facility can result in a significant loss of revenue, which must be addressed by an alternative protection scheme.

In addition to looking for alternative means of protection, insurance companies have re-emphasized the need for pre-emergency planning at such locations. This plan can include redundancy of assets or protection schemes, regular duplication of all data, and training personnel in loss prevention, as means of mitigating a loss.

Insurance companies traditionally follow existing national fire standards in setting protection criteria for these types of occupancies. Insurance companies also use standards such as NFPA's standards on the installation of carbon dioxide extinguishing systems, on the installation of sprinkler systems, on the installation of water mist fire protection systems, and on clean agent fire extinguishing systems.

International standards have evolved to reflect the need to phase out halons, and these provide a good starting point if the insurance sector desires to develop its own new recommendation.

The opportunity for leadership

Facing the challenge of halon phase out presents administrative as well as technical challenges. But it also provides opportunities for leadership in showing the way to improve fire protection while reducing ozone depletion, two goals which have been shown not to be mutually exclusive in developed as well as developing nations.

In numerous cases throughout the world, business opportunities as well as opportunities for leadership in both public and private sectors have been abundant.

2. Facing the Challenge of Eliminating Dependency on Halons

Essential uses of halon applications in fire protection

Prior to the advent of "clean" fire suppression agents, water was the most effective extinguishing agent available. Unfortunately a fire of any size required a large amount of water and water itself could cause damage, particularly to modern electronic equipment.

With the increase in equipment and processes susceptible to excessive damage from standard extinguishing systems as well as even small amounts of smoke, the search began for an effective, safe and clean suppressants.

Halogenated fire suppression systems have been installed primarily to provide a very high level of property protection with minimal secondary damage to crucial equipment and minimal disruption to resumption of operations. In the past the insurance industry has recommended and relied on halon as the preferred means of protecting critical assets. The ability of Halon 1301 total flooding systems to extinguish fires very quickly with minimal potential disruption to the facility being protected often has effects on safety other than direct fire safety. In a very limited number of installations, halon systems are installed primarily to protect human life from fire. In most cases however, the total flooding halon systems are designed and installed to protect equipment, facilities and their associated missions, not to protect human life. This has been accomplished by the designing the actuation of the system for the very early stages in the fire development and through the application of a clean agent with minimum secondary damage.

The selection of fire suppression systems is driven by the properties they possess as well as the hazards they are designed to protect.

Halogenated agent systems have been selected for use in areas where:

- *A clean agent is required*
- *Live electrical or electronic circuits exist*
- *The area is normally occupied by personnel*
- *The area to be protected contains objects or processes highly susceptible to extensive damage or downtime.*

Halon fire extinguishants are used in fixed automatic total flooding systems, local application systems and manually applied fire equipment. In most areas, Halon 1211 and blends of Halon 1211 and 1301 are used in manually applied equipment and local applications systems. Halon 1301 as well as 1211 is used in total flooding fixed systems.

Total Flooding Systems

This type of system has been designed and used to protect enclosed or at least partially enclosed hazards. A precalculated amount of the extinguishing agent is discharged into the space to provide a uniform fire extinguishing concentration throughout the space in a specified time. The enclosure is designed in such a way as to maintain that concentration for a specific amount of time to permeate all areas and ensure extinguishment of even the most deeply seated fires. This system should be capable of extinguishing a fire within the enclosure regardless of the location of the fire. This is crucial in areas where a deep-seated fire may be allowed to develop if the extinguishing method does not penetrate all areas.

Halogenated total flooding systems are prevalent in data processing centers and associated storage vaults, electronic control rooms and electrical switchgear rooms where a concealed fire in electrical equipment may be allowed to develop. Other locations where total flooding systems are used include valuable paper storage areas, storage areas in large aircraft, shipboard machinery spaces, aircraft cockpits and some military vehicles. Halon is often used in areas where the properties, which make it a desirable extinguishing agent, are not required and more traditional fire protection methods may be employed. These locations can include non-critical data processing areas, electrical vaults and other areas where damage to equipment by an extinguishing agent is not going to have far reaching consequences. Due to its low toxicity, higher volatility and lower molecular weight, Halon 1301 is more commonly used for total flooding systems, however Halon 1211 is sometimes used in this capacity.

Discharge of a halocarbon system in data processing center

PHOTO COURTESY OF FSSA

Local Application Systems

A local application system is a fixed, automatic or manual system which extinguishes a fire by discharging the extinguishing agent in such a manner that the burning object involved is surrounded locally by a high concentration of agent to extinguish a fire. In this type of application, neither the quantity of the agent nor the type or arrangement of the discharge nozzles is sufficient to achieve total flooding of the enclosure containing the object. Types of occupancies which are typically protected by local application Halon 1211 systems include paint spray booths, dip and quench tanks, oil filled transformers, printing operations, wave solder machines etc. Often, halon is mistakenly used as a local application fire extinguishant where other alternative agents such as carbon dioxide are more effective. This can include dip and quench tanks, wave solder machines etc. In addition, traditional protection such as standard spray sprinklers

can be used in areas where the occupancy is not susceptible or reactive to water.

Portable Fire Extinguishers

Portable fire extinguishers are hand-held, manually operated units used to extinguish fires in the earliest stages. Portable fire extinguishers containing halon are normally found in locations containing sensitive equipment that is susceptible to damage from other more traditional extinguishing agents such as water, foam and carbon dioxide. In addition, they are often provided to supplement total flooding as well as local application halon systems.

Essential Applications

*An **essential application** is defined under the Montreal Protocol as one in which:*

- *There is imminent danger to human life where:*
  (a) Human occupancy is essential and evacuation is not possible.
  (b) The continued operation is necessary to protect human life.
- *The installation is essential to a community and to protect critical assets.*
- *A loss of critical equipment and/or its operation may have far reaching consequences.*
- *Where no acceptable alternative means of fire protection exists.*

The European Union has finalized regulations that will ban the sale and use of CFCs, halons, carbon tetrachloride, hydrobromofluorocarbons and 1,1,1-trichloroethane. The new regulations go beyond the requirements of the Montreal Protocol. They include the mandatory decommissioning of non-essential halon extinguishing systems and fire extinguishers before 31 December 2003.

Other countries may use additional terminology in determining the importance of a location and the need to protect it. China, for example, issued a circular on the ban of new deployment of halon extinguishers in unnecessary areas, i.e. areas deemed not to be crucial enough to utilize halon as an extinguishing agent.

The "essential application" concept does not currently apply to developing countries under the Montreal Protocol, however they are encouraged to adopt this concept and establish their own categories of essential and non-essential uses.

Examples of Halon Total Flooding System Essential Applications:

- *Aircraft for the protection of crew compartments, engine nacelles, cargo bays and dry bays*
- *Military land vehicles and naval vessels for the protection of spaces occupied by personnel and engine compartments*
- *For the making inert of occupied spaces where flammable liquid and/or gas release could occur in the military and oil, gas, and petrochemical sector, and in existing cargo ships.*
- *For the making inert of manned communication and command centers of the armed forces or otherwise essential for national security.*
- *For the making inert of spaces where there may be a risk of radioactive dispersment.*

Examples of Halon Portable Fire Extinguisher Essential Applications:

- *In hand held fire extinguishers and fixed extinguisher equipment for engines for use on board aircraft.*
- *In aircraft for the protection of crew compartments, engine nacelles, cargo bays and dry bays.*

In recent years, since halons were identified as ozone depleters, alternate total flooding extinguishing agents have been developed and widely deployed. In some cases these alternates are also ozone depleters because they contain HCFCs, but less so than the halons. For this reason, they are seen as transitional until a non-ozone-depleting solution is identified for the particular application.

Moving away from dependency on halons

The movement away from dependency on halons can be accomplished in several ways. These methods include the use of alternative (non-halon) fire protection strategies and designs and the practice of halon banking to minimize the need for new production of halons. The steps taken by many nations in moving away from dependency on halons are listed in the box on the next page.

Alternative strategies and designs

In many cases, the solution to shifting from halon while maintaining adequate protection may involve a strategic re-evaluation in which the fire protection principles of isolation and compartmentation are employed. The assets to be protected might be isolated from ignition sources and combustibles with fire resistive barriers. This can be a cost effective alternative, particularly where modern electronic components require far less space than their predecessors.

Halon banking

Halon banking exists to promote the use of recycled halons and to minimize the need for new production of halons. Halon banking is primarily a clearinghouse process, in which halons reclaimed from non-essential and closed down systems are made available for essential use applications.

Many halon banking organizations are not physical banks with warehouses and storage tanks, but are information centers keeping track of halon users who no longer require their halons, and users who still require halon but do not have sufficient stock. These organizations provide the method of matching availability with demand. Such "banks" trade information on the availability of halons and leave the process of sale and purchase to the individuals concerned. There are also halon banking facilities that do manage physical stocks of halons, with the means to recycle halons for approved essential uses.

Halon storage cylinders at the US DOD ODS Reserve, Richmond, VA, United States

PHOTO COURTESY OF MR. PETE MULLENHARD, US NAVY SEIC

Steps to eliminating dependency on halons:

Step 1: Meet with members of the fire protection community and assess the uses on halons in your country

Step 2: Build awareness of the problem of ozone depletion

Step 3: Commit to phase out of halons

Step 4: Reduce unnecessary emissions and uses of halons

Step 5: Switch to alternative fire protection methods

Step 6: Develop halon bank management and recycling to eliminate the need for newly manufactured halons

Step 7: End all imports of newly manufactured halons

From Eliminating Dependency on Halons: Self-Help Guide for Low Consuming Countries, by UNEP DTIE.

Overview of alternative technologies and fire protection approaches

The phaseout of halon has had a dramatic impact on the fire and explosion protection industry. Halon has been used extensively as an extinguishing agent in areas where its properties were advantageous. However, with new understanding and documentation of ozone depletion, the advent of the Montreal Protocol, and the need to phase out halon, selecting a replacement agent presents both significant challenges and opportunities.

Selecting a halon alternative

When selecting a halon alternative, the application to be protected must be evaluated and either an alternate strategy or alternate suppression agent must be chosen.

The Halon Technical Options Committee (HTOC) of the UNEP Technology and Economic Assessment Panel (TEAP) provides information on halon alternatives and substitutes including toxicity and environmental factors on the Internet at www.teap.org

The United States Environmental Protection Agency (EPA) has developed the Significant New Alternatives Policy program (SNAP) which evaluates substitute chemicals and alternative technologies that companies want to use in place of the ozone depleting substances. This is to help ensure that they will not cause greater damage to human health and the environment than the ozone depleters that are being replaced. The EPA maintains a list of acceptable and unacceptable substitutes on the Internet at www.epa.gov/spdpublic/title6/snap/hal.html.

Types of halon alternatives for total flooding and local application systems

Traditional fire protection agents- The use of traditional, non-halon fire protection materials such as dry chemical, CO_2, water sprinklers, and foams to protect special hazards has been promoted as a means of replacing halon use. The effectiveness of these traditional protection alternatives is dependent on the occupancy they are selected and designed to protect. The use of these traditional technologies should be given serious consideration as appropriate halon replacements in occupancies where they are agreeable with the hazard. They also should be properly installed in accordance with applicable standards.

Examples of traditional fire protection agents

- *Dry chemical*
- *CO_2*
- *Water sprinklers*
- *Foams*

Halocarbon agents - These are chemical agents that contain chlorine, fluorine or iodine either individually or in some combination. Classes of agents include hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and fluoroidocarbons (FICs). These agents share several common characteristics with halon including: all are electrically non-conductive, all are clean agents and all are liquefied gases or compressed liquids. These agents do differ widely in ozone depleting potential, toxicity, volume requirements, cost, environmental impact and availability. PFCs for example are only recommended for use in areas where no other agent is technically feasable due to performance or safety requirements. All of these systems need a perfectly designed system to avoid decomposition and to prevent the production of HF. It should be noted that all of these agents can be stored and discharged from systems, which are similar to those used for Halon 1301. There is no system now manufactured that is able to use existing Halon 1301 hardware.

Advantages of halocarbon agents:

- *All are electrically non-conductive*
- *All are clean agents with no residue after operation*
- *Can be stored and discharged from hardware similar to Halon 1301*

Inert gases - Inert gases are designed to reduce the ambient oxygen concentration in a protected space to between 10-14% by utilizing a concentration of 35-40% by volume, a level that is breathable but will not support flaming combustion. These systems use inert gases such as argon, nitrogen, CO_2 or a blend. These are applied in total flooding systems. Inert gases are electrically non-conductive, clean agents however due to excessive discharge times are not recommended for areas where a rapidly developing fire can be expected. Due to the necessary concentrations, inert gases normally require a large tank storage area. It should be noted that fire-extinguishing CO_2, a byproduct of other manufacturing processes, is not seen as adding to the greenhouse phenomenon.

Advantages of inert gases:

- *All inert gases are electrically non-conductive*
- *All are clean agents and leave no residue*
- *Stops combustion at a breathable level*

Water mists - Water mist systems extinguish fires using small amounts of water released as tiny droplets, under low, medium or high pressure. The methods of extinguishment include cooling, oxygen dilution by steam expansion, the wetting of surfaces and turbulence effects. These systems use specially designed nozzles to produce much smaller droplets than are produced by regular standard spray sprinkler systems. The smaller droplets are more effective at extinguishing fires; therefore, less water is needed. There are two types of water mist suppression systems, single and dual fluid systems. Both systems have been shown to be effective. In addition, when properly installed, they can effectively penetrate where deep-seated fires might develop. As a result, damage to water-sensitive equipment is minimized.

Advantages of water mist systems:

- *Smaller droplets are more effective at extinguishing fires*
- *Less water is needed than standard spray systems*
- *Can effectively penetrate to deep-seated fires*
- *Damage to water-sensitive equipment is minimized*

Powdered aerosols - A category of new technology being developed and introduced are those related to fine solid particulate and aerosols. The different types of powdered aerosol systems include pyrotechnically generated aerosols and dry chemical halocarbon mixtures. Another unique category of fine particulate technology is gelled halocarbon/dry chemical suspensions.

The effectiveness and the quality of the different types of powder can differ dramatically and must be closely monitored.

Advantages of powdered aerosols:

- *Very high effectiveness/weight ratio*
- *No environmental concerns beyond those of the carrier gases*

Types of halon alternatives for portable extinguishers

Water extinguishers - Water extinguishers are effective for use on fires involving ordinary combustible material (Class A). They are not all effective for use on fires involving electrical equipment (Class C). Water extinguishers are not to be used on flammable liquid fires (Class B).

Aqueous film forming foam (AFFF) - AFFF as well as other types of foam extinguishing products are acceptable for use on fires involving ordinary combustibles (Class A). This type of extinguisher may not be safe for use on electrical fires (Class C).

Dry Chemical - Ordinary dry chemical extinguishers are acceptable for use on fires involving flammable liquids and gases (Class B). Multipurpose dry chemical extinguishers are acceptable for use on fires involving ordinary combustibles (Class A) as well as fires involving flammable liquids and gases. Both types of dry chemical extinguishers are suitable for fires involving electrical circuits (Class C).

Demonstration of dry chemical fire extinguisher

PHOTO COURTESY OF NFPA

Carbon Dioxide - CO_2 extinguishers are suitable for use on fires involving flammable liquids (Class B) as well as electrical fires (Class C). This type of extinguisher is not effective on fires involving ordinary combustible material (Class A).

- ***Class A fires -*** *Fires in ordinary combustible materials (wood, cloth, paper, rubber and many plastics).*
- ***Class B fires -*** *Fires in flammable or combustible liquids, flammable gases, greases, and similar materials.*
- ***Class C fires -*** *Fires in live electrical equipment. This type of fire can be treated as a class A or B fire if the electrical equipment is de-energized.*

References:

HARC NEWS April 1999

HTOC Technical Note #1, Rev 2 (1999-03-14)

NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems

NFPA 750 - Standard for the Installation of Water Mist Fire Protection Systems

NFPA 13 - Standard for the Installation of Sprinkler Systems

NFPA 12A - Standard on Halon 1301 Fire Extinguishing Systems

NFPA 10 - Standard for Portable Fire Extinguishers

Best and Essential Halon Use: A Methodology (The Fire Protection Research Foundation)

Regulation (EC) No 2037/2000 Of The European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer.

3. Implementing Standards and Codes of Good Practice

*The design and implementation of standards and codes of good practice should form an integrated part of the national halon management strategy, which itself forms part of the wider national phase-out plan for ODS (**Country Programme**).*

*Usually, the **National Ozone Unit** should estimate the necessary resources for such a project, and define scope, time schedule, and target groups.*

*In turn the National Ozone Unit should establish an interdisciplinary **Implementation Team** for the detailed planning and coordination of a project. This team may design the codes of good practice itself or delegate it to an interdisciplinary **Design Team**. The design of standards may be initiated with the appropriate **standards development organization**.*

Members of the Implementation Team should include representatives of fire protection associations, related trade associations, insurance brokers, insurance underwriters and corporate loss control officials.

Responsibility, accountability and regularly scheduled communication are important elements of the operating procedures of both the Implementation and Design team.

The composition of the Design Team may be the same or similar to the Implementation Team, if the team members have sufficient time and technical expertise to prepare standards or codes of practice. It is advisable to have at least one representative from the Implementation Team, to ensure communication between both teams and to monitor the work of the Design Team. The purpose of the Design Team is to acquire information and compile the standards or codes of good practice themselves.

The following describes the steps that need to be taken by both the Implementation and Design Teams in drawing up the standards or codes of good practice. There is also a section on the standards development process. The next chapter contains more detail about the content of the standards and codes of practice.

Inert gas agent supply

PHOTO COURTESY OF FSSA

Tasks for the Implementation Team

The Implementation Team should follow these steps:

Plan and prioritize:
Plan and prioritize activities and necessary resources. The planned actions should take place within the context of the Country Program, to achieve maximum effectiveness and coordination with other activities.

Define time schedule:
Establish a detailed schedule for the implementation process, which should conform to the time schedules of other supporting activities and the implementation of the Country Program. The successful introduction of standards or codes of good practice needs to consider many measures, including awareness raising and training, and the establishment of legal and economic incentives. All stakeholders must be informed about the time schedules, milestones and the steps they need to take.

Identify stakeholders and gain commitment:
Identify the relevant stakeholders, such as service companies, distributors and wholesalers of fire protection equipment, corporate institutions, fire service, insurance underwriters and government officials. Maintain an up-to-date list of contacts.

The early involvement and consultation of these individuals and organizations in the planning, design and implementation process will train and familiarize key decision-makers with ozone issues and develop their commitment and support.

Information and awareness campaigns and the organization of national workshops on good servicing practices help to gain stakeholder commitment.

Identify target groups:
Identify and describe the target groups for the standards or codes of good practice, such as insurance, system manufacturers and distributors, fire protection system operators and service technicians.

Establish the Design Team to develop the standards:
Identify team members with the appropriate technical knowledge and skills and a preliminary time schedule for their work - which should be supervised by the Implementation Team and reported back to the National Ozone Unit. The Design Team may need to be trained and prepared by participating in seminars and field visits. For details on the development process, see pages 29-32.

Enforce the codes and standards:
Established codes of good practice and standards need to be enforced: command and control measures (e.g. regulations), market-based measures (e.g. taxes or permits) or voluntary agreements are all possible incentives. Command and control approaches - the most common approach - do require an effective legal framework and enforcement force.

The Implementation Team should propose the combination of different types of measures, which best suits the country situation. Relevant stakeholders should of course be involved in the discussions, and the existing legislative and administrative framework should be used as far as possible - any proposed changes will have to be submitted to government. If new measures are necessary, industry should be allowed a phase-in schedule to adapt to them in order to avoid necessary disruption.

Since foreign-owned multinational companies usually have ready access to technical expertise, innovative technology, investment capital and the skilled personnel needed to perform the transition, indigenous industries may need protection during the transition phase, while at the same time ensuring that demand for alternative technologies can be met. Any new legislation should be accompanied by appropriate communication monitoring, control and enforcement measures.

Establish voluntary agreements:
Voluntary - but binding - agreements with industry may avoid the need for new regulations if agreements on the content of the standards or codes of good practice can be reached with the relevant stakeholders.

Demonstration of a CO^2 fire extinguisher

PHOTO COURTESY OF NFPA

Incorporate standards and codes of good practice in regular training:
Ensure that the regular training agenda of technical training institutions is based on the established standards or codes of good practice. National training workshops should teach and explain codes of good practice.

Apply project management techniques:
Apply proper project management techniques, including regular control and monitoring of the implementation process and documentation and reporting of progress to the National Ozone Unit.

Review and update the standards and codes of good practice:
Establish a procedure to survey technology developments internationally, and changing conditions in the country. New technologies will probably require reviews and updates of the established standards and codes of good practice, especially when servicing practices or safety requirements change.

Tasks for the Design Team

The Design Team should follow these steps:

Plan and establish time schedule:
Plan the design process, define the necessary activities, and establish a detained time schedule. This should be coordinated with existing schedules for the implementation of standards and codes of good practice, other supporting activities and the implementation of the wider Country Program.

Collect and analyze data from:

- *The Country Program - including country characteristics, strategies, and the fire protection sector; and*
- *The Implementation Team - on the profile of target groups and the inventory of existing halon-using locations in the country.*
- *Existing codes of good practice, standards and specifications that represent a valuable source of technical information.*

Establish contacts:
Make contact and cooperate with similar bodies in other countries and the relevant stakeholders to exchange information and experiences and to gain expertise on new technical developments. Participation in regional and international conferences and workshops, and direct contact with key professional and industry organizations facilitates innovation and reduces the cost of change. Subscribe to technical journals and related periodicals.

Compile the standards or codes of good practice:
Draw up the standards or codes of good practice and involve stakeholders and expert reviewers for comments and approval.

Report on progress:
Report progress during regularly scheduled meetings to the Implementation Team.

Designing codes of good practice

The Design Team should follow these three steps in drawing up the codes of good practice:

Define their scope:
Codes of good practice should focus on the defined target groups and specify clearly their scope and limit of applicability.

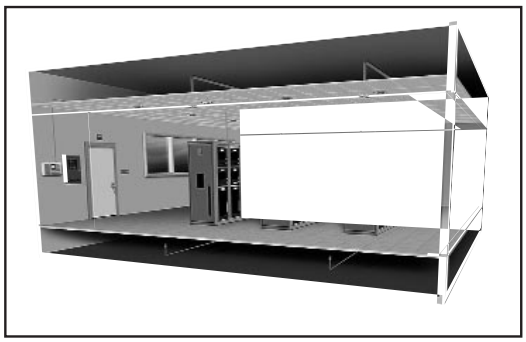
Codes need regular reviewing and updating and should motivate the user to send comments and feedback.

Structure their format:
Codes of good practice should be neither too brief nor too exhaustive. They must be practical and easy to understand and should therefore be well structured and written in the country's language(s).

Checklists or questionnaires may be appropriate for installer and service technicians to become familiar with new practices, and to encourage the learning process. Specifically, checklists for trouble-shooting of halon equipment and halon replacement equipment, and recording forms for proper record keeping and documentation will be a practical help for service technicians.

Decide their contents:

Existing codes of good practice, standards or specifications related to halon replacement and alternatives represent a valuable source of information for developing countries. They vary in scope and purpose and usually originate from international standards organizations like NFPA, ISO and CEN, and from national standards organizations in developed countries such as Australia, Canada, the European Union, Japan and the United States.



"Clean" agent system in telecommunications facility

GRAPHIC COURTESY OF FSSA

It is important to motivate technicians and installers and to explain why proper servicing practices should be adopted, while at the same time giving them the necessary technical information and support. Since service technicians in many developing countries may have poor access to recent information and training, codes of good practice could include also non-technical sections on certification and training, to explain the regulatory and policy framework and to provide useful contact addresses and hints.

Development of standards

As discussed in Chapter 1, there are several processes by which standards are developed and revised. One is the consensus process, which involves invited participation and substantial consent or agreement to the standard by a broad representation of stakeholders. Consensus enhances the technical validity of a standard.

Stakeholders might include:

- *The government officer from the country's National Ozone Unit*
- *Fire protection engineers*
- *Equipment manufacturers and vendors*
- *Equipment users*
- *Equipment installer and maintainers*
- *Fire service personnel*
- *Code enforcing authority*
- *Research and testing laboratories*
- *Insurance representatives*

Recognizing there is more than one consensus process that could be followed, generic elements common to many standards-development processes are offered below, adaptable to the laws or rules that the standards-making authority may deem advisable for the development of a fire protection standard:

Standards-making Authority

The standards-making authority may be a government authority, or it may be a non-government professional or technical standards development organization (SDO). An SDO may be international, regional or national.

Technical Committee

The standards-making authority may assemble technical representatives of major stakeholders into a technical committee with a stated mission and scope of activity, and establishes rules (or utilizes its customary rules) and a schedule of regular meetings.

Steps

Public Notice:
The authority gives public notice of intention to develop or revise a standard.

Draft Standard:
The authority invites and takes into consideration such information as it deems appropriate to the development of the proposed standard, or revision of an existing standard.

The authority develops the first draft of the proposed standard. This activity may be carried out by a technical committee under the auspices of the authority.

Public Comment:
The authority publishes the draft standard, and invites public comment. (This step may be repeated.)

Public comment is considered by the standards-writers, according to the standards-making authority's rules. This may be carried out by a technical committee. Written or oral comment may be accepted. Typically, a time period is specified. There may be public meetings of the authority or technical committee, at which the commenters may be heard. (This step may be repeated.)

The authority publishes a revised draft of the proposed standard. (This step may be repeated.)

Usually, there is opportunity for public comment on at least one revised draft of the proposed standard. This means there are usually at least two opportunities for public comment.

Approval:
There is final approval of the standard by the standards-making authority, according to its rules.

Issuance and Promulgation:
The new or revised standard is issued.

The standards-making authority publicizes the new or revised standard.

Usually, if the standard is developed by a non-governmental SDO, it is copyrighted (rights to publication are owned and protected) and made available for purchase.

In the modern era, standards are usually available in both paper and electronic media.

Cycle:
There may be a specified time period within which the standard must be considered for revision according to the standards-development process. This allows for new knowledge and technologies to be considered for the standard, and can add to its acceptance and use.

The next chapter provides details on the possible contents of standards and codes of good practice.

4. Elements of Standards and Codes of Good Practice

This chapter contains a compilation of some typical elements of standards and codes of good practice, derived from selected technical publications. A listing of exemplary standards and codes of good practice, and how to obtain them, is given in Chapter 5, Annexes C and D.

Elements of standards

Scope and purpose

- *The kinds of halon alternative systems covered in the standard are specified. (E.g. clean agent fire extinguishing systems; CO2 systems; water mist systems)*
- *The purpose of the standard is stated (E.g. as a response to international restrictions on certain halons under the Montreal Protocol.)*

Definitions and units of measure

- *Technical terms use in the standard are defined for clarification.*
- *Units of measurement are specified, which could include the name of the unit, the unit symbol, and conversion factors to other units of measure.*

General information

- *The extinguishing agents addressed in the standard would be listed.*
- *Uses and limitations of the fire extinguishing systems covered in the standard are described.*

Safety and environmental factors

- *Information is given on safe exposure time to the extinguishing agents covered in the standard.*
- *The requirement to provide safeguards such as personnel training, discharge alarms, evacuation plans, and fire drills is stated.*
- *The need to select extinguishing agents with consideration for the potential environmental effect is stated.*

Retrofitability and compatibility with other agents

- *The requirement is stated that retrofitted systems result in an approved system.*
- *Restrictions on systems employing different agents to protect the same enclosed space are stated.*

System components

- *Requirements on extinguishing agent supply, storage containers, and storage container arrangements are given.*
- *Requirements on pipe, pipe joints, fittings, valves and discharge nozzles are given.*
- *Requirements on detection, actuation, alarm, and control systems are given.*

System design

- *Requirements are stated for the supervision and approval of system specifications and plans by the authority having jurisdiction.*
- *Requirements are given for the enclosure being protected.*
- *Requirements are given for flame extinguishing or inerting concentrations.*
- *Total flooding quantity calculation formulas are provided.*

Inspection, Maintenance, Testing, and Training

- *Requirements are given for inspection and testing of all systems.*
- *Requirements for container and hose testing are given.*
- *Requirements for enclosure inspection are given.*
- *Requirements for maintenance are given.*
- *Requirement is given for the training of persons who will inspect, test, maintain and operate the extinguishing systems.*
- *Requirement is given for approval of the installation by the authority having jurisdiction.*

Marine systems

- *Modifications, additions and deletions to the standard are outlined as necessary for marine applications.*

Referenced Publications

- *Documents and publications referenced in the standard are listed.*

Elements of codes of good practice

Regulatory framework

- *Commitment to the Montreal Protocol would be stated here.*
- *Also, existing acts, laws, regulations and standards applicable to the halon sector would be cited. These may be national, territorial, or local. Such acts, laws, regulations and standards may provide the legal framework for compliance with provisions of the Montreal Protocol.*
- *If no such local documents exist, or if they exist but do not reflect the goals of the Montreal Protocol, reference may be made to widely- used international standards that have already evolved in response to the Protocol.*

Alternatives to halons

- *Here, commitment to choosing halon alternatives wherever possible would be stated.*
- *Acceptable halon alternatives and their applications can be listed.*
- *Applications for which alternatives are not available can be specified.*

Note: Alternatives to halons are discussed in Chapter 2 of this handbook.

Recycling of halons

- *Halon recycling would be specified as halons are removed from applications where alternatives provide acceptable fire protection, or where the asset being protected has reached the end of its useful life.*
- *Procedures and guidelines for removal and recycling would be listed, with the aim of minimizing emissions of halon into the atmosphere*
- *A requirement may be made that removal and recycling be done by certified companies.*
- *The disposition of recycled halons can be specified.*

Transferring halon 1211 into a recovery cylinder

PHOTO COURTESY OF MR. PETE MULLENHARD, US NAVY SEIC

Essential uses

- *The practice of the Montreal Protocol's criteria for essential use could be encouraged.*

> *"The use of a controlled substance should qualify as essential only if:*
>
> *1. It is necessary for the health, safety or is critical for the functioning of society (encompassing cultural and intellectual aspects); and*
>
> *2. There are no available technically and economically feasible alternatives or substitutes that are acceptable from the standpoint of environment and health."*
>
> *Fourth Meeting of the Parties to the Montreal Protocol*

- *Essential uses may be specified, based on current economic and technical assessments.*
- *Or, conversely, non-essential uses may be specified, in which halon use would be banned.*
- *Allowable new installations of halon systems may be specified.*
- *Conversely, new installations where halon systems are not allowed may be specified.*

Note: essential use of halons is discussed in Chapter 2 of this handbook.

Halon banking

- *Here a commitment to managed halon banking could be stated, promoting the use of recycled halons in order to prevent new production.*
- *A requirement might be given that the acquisition of needed halon or the disposal of unneeded halon be accomplished through a halon bank.*
- *The procedure for buying or selling halons might be specified.*
- *Halon bank contact information would be listed.*

Note: Information resources on halon banking and where to access an up-to-date contact list of halon banks around the world are given in Chapter 5, Annex D of this handbook.

Emissions reduction in existing installations

The following points might be stressed regarding existing installations to avoid or minimize needless halon discharge.

- ***Establish halon management team***
  Large halon consumers, especially, should establish a halon management team to

ensure compliance with standards and codes of practice.

- ***Compliance with codes and standards***
  Existing systems should comply with relevant standards and codes of practice. If compliance requires upgrading, upgrades should be designed by qualified persons.

System components should be listed by an accredited certification organization.

- ***Record keeping***
  Current literature should be available at the site at all times: description of original installation, specifications, drawings, flow charts, electrical layouts, modifications to original installation, operator's manual.

  Decisions, actions and policies related to the installation should be documented.

- ***Training***
  Provision for training should be provided on an ongoing basis. Training is to include safety procedures for all persons in fire situations, and work procedures for specialized service personnel.

  Training methods not requiring the release of halons should be implemented.

  Safety procedure training for all persons in fire situations should cover emergency procedures, alarms, and voice communications.

  Work procedure training for specialized service personnel should cover operation of the various manual and automatic controls, procedures during an alarm, and environmental awareness.

- ***Testing***
  Testing refers to verification of operational specifications of the system components, requalification of halon cylinders by the hydrostatic pressure test, and testing of halon cylinders to detect leaks.

  Testing methods not requiring the release of halons should be implemented, such as those recommended in NFPA 12A: Standard on Halon 1301 Fire Extinguishing Systems.

- ***Inventory control***
  Good inventory control of halons contained in portable extinguishers and fixed systems allows better management of the resource by the owner, better planning for alternatives to halon, and better enforcement of applicable regulations. For each facility using halon fire protection, the following information might be recorded:

  Protected area:

  ✓ *Physical location*

  ✓ *Details of protected area (asset being protected, size of area, description of area)*

  Installation:

  ✓ *Date of original installation*

✓ *Type of protection (e.g. portable, total-flooding, explosion suppression)*

✓ *System configuration (e.g. local application, all spaces, room only, under floor only, backup system)*

✓ *Names and addresses of suppliers, installers, manufacturers, and servicing companies*

✓ *Alterations or modifications to original installation*

✓ *Maintenance history (e.g. discharges, recharges, tests, inspections, hydrostatic testing,repairs)*

For each halon container:

✓ *Location of the halon containers*

✓ *Type of halon (e.g. Halon 1301 or 1211)*

✓ *Type of container (TC markings stamped on container)*

✓ *Serial number*

✓ *Quantity of agent (in kilograms)*

✓ *Storage pressure*

✓ *Date of last service*

✓ *Initials of person that performed the last service*

✓ *Date of last hydrostatic test*

- ***Maintenance***

Ensure that a comprehensive maintenance program is implemented as recommended in standards such as NFPA 10 (Portable Fire Extinguishers) or NFPA 12A (Halon 1301 Fire Extinguishing Systems).

Maintenance should be conducted by companies qualified to service halon systems, replacement systems, and the associated fire detection alarm and electrical control equipment. A license or certification procedure should be in place for persons servicing fire protection systems and equipment. This ensures fully integrated maintenance of mechanical and electrical equipment, and prevents accidental releases when maintenance is done on any part of the system.

All debris, dirt and dust accumulations should be removed regularly. The cleanliness of the protected space is an essential part of a comprehensive maintenance program. Excessive dust and debris can result in an unintentional actuation of a detector and a possible accidental halon release.

Decommissioning

Plans for the removal of halons and systems from active service might be set forth. (Decommissioning is not currently required for Article 5 countries, however the issue will have to be faced in the future as halon phaseout target dates get closer.)

Steps in decommissioning might involve the following:

- *Removal of stand-by halon cylinders*
  All stand-by or back-up halon cylinders for existing systems should be removed from service by a certified service company for recovery and recycling of the halon. This will help to minimize the supply of halon susceptible to discharge. It will also help to increase the diligence of the systems owners on maintenance and cleanliness issues, as well as providing incentive to select a replacement fire suppression system.

- *Planning the phaseout of halons*
  Identify the person(s) responsible to initiate, develop and implement the phaseout plan. Clearly delineate the mandate, and provide adequate authority, accountability, and financial resources to implement the plan.

Regularly assess the need for halons as fire extinguishing agents, with an eye toward developments in halon alternatives, improvements in detection systems, and changes in regulatory requirements.
Set a date when to replace the halons with alternatives, and include it in the decommissioning plan.

- *Carrying out the actual disposal of halons*

  Possible avenues include:

  - *Storing the halon cylinders in the facility and advising an appropriate halon bank of the availability of the halon.*

  - *Contracting out the disposal to a certified service company which will recover and recycle the halons.*

  A good resource is the Safety Guide for Decommissioning Halon Systems (see Chapter 5 of this handbook).

References

Here, references could be listed for:

- *relevant local, national and international standards and other guidance documents*

- *contact information of key institutions and persons*

- *contact information for service and inspection services*

5. Further information

Organizations with resources and information

Center for Global Environmental Technologies (CGET)

New Mexico Engineering Research Institute (NMERI)
The University of New Mexico
901 University Blvd. SE
Albuquerque, NM 87106-4339 USA
Tel: +1.505.272.7259
Fax: +1.505.222.8228
Email: mather@nmeri.unm.edu
WWW: http://nmeri.unm.edu/cget/cget.htm

Founded in 1990 as an interdisciplinary institute within University of New Mexico, the Center carries out research, development and informational services on technologies to solve environmental problems that cross national boundaries.

One of the areas of emphasis is stratospheric ozone depletion, with emphasis on technical options. CGET is heavily involved in halon options and non-halon fire protection technologies.

Environment Canada

Headquarters
351 St.Joseph Blvd.
Hull, Quebec K1A 0H3 CANADA
Tel: +1.819.953.6072
Fax: +1.819.994.0007
Email: greg.carreau@ec.gc.ca
WWW: http://www.ec.gc.ca/ozone

Environment Canada's Stratospheric Ozone web site contains information and publications on the health and environmental impacts of ozone depletion, Canadian ozone layer protection programs, halon and other sector-specific ODS information, regulatory information, and an ODS management plan.

Environmental Protection Agency (U.S.)

Halon Program Manager
Stratospheric Protection Division
U.S. EPA 6205J
Washington, DC 20460 USA
Tel: +1.202.564.9193

Fax: +1.202.565.2095
WWW: http://www.epa.gov/ozone/title6/snap/hal.html

The halon-specific portion of EPA's Ozone Depletion web site is indicated above. In question and answer format, it provides information on the phaseout of halons, halon banking and recycling, halon disposal, and the Significant New Alternatives Policy (SNAP) program.

Halon Alternatives Research Corporation (HARC)

2111 Wilson Boulevard, Suite 850
Arlington, VA 22201 USA
Tel: +1.703.524.6636
Fax: +1.703.243.2874
Email: harc@harc.org
WWW: http://www.harc.org

HARC is an international non-profit trade association formed in 1989 to promote the development and approval of environmentally acceptable halon alternatives. HARC serves as an international facilitating organization and information clearinghouse on issues related to halon replacement, halon recycling, and halon regulation.

Technology and Economic Assessment Panel (TEAP) of the Montreal Protocol

WWW: http://www.teap.org

The TEAP provides technical information related to the alternative technologies that have been investigated and employed to make it possible to virtually eliminate use of the chlorofluorocarbons and halons that harm the ozone layer.

The halon sector portion of the TEAP's web site contains state-of-the-art assessment reports and technical notes by the Halons Technical Options Committee (HTOC), and a list of committee members with contact information.

Standards organizations

American Society for Testing and Materials (ASTM)

100 Barr Harbor Drive
West Conshohocken, PA 19428-2959 USA
Tel: +1.610.832.9585
Fax: +1.610.832.9555
WWW: http://www.astm.org

ASTM is a not-for-profit organization that provides a forum for the development and publication of voluntary consensus standards for materials, products, systems and services. Its members—representing producers, users, consumers, government and academia from over 100 countries—develop documents that serve as a basis for manufacturing, procurement, and regulatory activities. ASTM's standards include those on Halon 1301 as a fire fighting medium, and the transportation and storage of Halon 1301.

European Committee for Standardization (CEN)

CEN Management Center
36, rue de Stassart
B-1050 Brussels, BELGIUM
Tel: +32 2 550 08 11
Fax: +32 2 550 08 19
Email: infodesk@cenorm.be
WWW: http://www.cenorm.be

CEN is an international non-profit organization whose mission is to promote voluntary technical harmonization in Europe. CEN works in conjunction with other private or public organizations representing European and worldwide interests. In particular, it has an agreement for technical cooperation with the International Organization for Standardization (ISO). Among CEN's more than-6000 standards are those on fixed and portable fire extinguishing systems.

FM Global

Tel: +1.781.255.6681
Fax: +1.781.255.0181
WWW: http://www.fmglobal.com

FM Global is the world's largest commercial and industrial property insurance and risk management organization specializing in property protection. FM global publishes an approval guide which contains chapters on portable and fixed extinguishing systems. It also publishes data sheets on extinguishing agents.

International Organization for Standardization (ISO)

ISO Central Secretariat
1, rue de VarembÈ, Case postale 56
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ISO is a non-governmental worldwide federation of national standards bodies from 130 countries, one representative from each country. The mission of ISO is to promote the development of standardization and related activities with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity. ISO's work results in international agreements, which are published as international standards. ISO standards include those on fire extinguishing systems, portable and wheeled extinguishers, and fire extinguishing media.

NFPA

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NFPA is an international non-profit membership organization founded in 1896. Its mission is to reduce the worldwide burden of fire and other hazards on the quality of life by developing and advocating scientifically-based consensus codes and standards, research, training, and education. It publishes codes and standards relating to fire, electricity, and the built environment. NFPA standards include those on carbon dioxide fire extinguishing systems and clean agent fire extinguishing systems.

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Underwriters Laboratories Inc. (UL) is an independent, not-for-profit product safety testing and certification organization. UL has tested products for public safety since its founding in 1894. UL's conformity assessment services extend to electrical devices, programmable systems, and quality processes. UL develops standards on physical halon systems and halon replacement systems.

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Underwriters' Laboratories of Canada (ULC) is a safety, certification, testing, quality registration, and standards development organization dedicated to the protection of life and property. It exists for the purpose of investigating devices and materials as to their relation to life, fire or accident hazards, or their value in crime prevention, and providing authoritative information to inspection authorities.

List of regulations and standards

Ideally, government regulations are rendered from a legal Act covering all ODS-related issues, such as the US Clean Air Act. Provisions of such an Act can be amended to produce specific ODS-related legislation and regulations, without creating a whole new law.

In the absence of such a legal Act, governments must introduce regulations step by step, covering particular areas of ODS issues necessary to implement provisions of the Montreal Protocol. Such regulations may be adoptions of standards developed by organizations such as International Organization for Standardization (ISO) or NFPA International.

Following is a sampling of existing regulations and standards related to the halon sector, with brief descriptions. All currently valid national and international standards are subject to revision. Any reference to a standard is deemed to be a reference to the latest edition of that standard.

Such regulations and standards, as they were developed and reviewed by government and industry stakeholders, may be seen as models for officials in developing their own standards.

Most of the documents are accessible on the internet, in which case the world wide web address is indicated. Standards usually involve a purchase fee, and permission may be required for re-printing.

The addresses and phone numbers of the issuing organizations are listed in Annex B.

Regulations

Environmental Protection Agency (U.S.) Regulation 63 FR 11084 - concerning handling and disposal of halon and halon-containing equipment

The regulation, published in 1998, bans the manufacture of blends and halons, establishes provisions for training of technicians who handle halons and halon-containing equipment, releases of halons from halon-containing equipment during testing, maintenance, and disposal of halons and halon-containing equipment.

A fact sheet explaining the regulation, and the regulation itself are available on the internet at www.epa.gov/ozone/title6/608/halsumm.html.

Ozone Depleting Substances and Other Halocarbons Regulation (British Columbia)

Part 4 of this regulation, published in 1999 covers fire extinguishing equipment. Available on the internet at www.qp.gov.bc.ca/stat_reg/regs/elp/r387_99.html.

Ozone Depleting Substances (Regulation and Control) Rules, 2000 (India)

India's new regulations on the production, consumption, export, import, purchase, sale, reclamation, destruction, monitoring, and record-keeping requuirements of ozone-depleting sub-

stances including halons.

For availability, contact The Fire Protection Research Foundation, 1 Batterymarch Park, Quincy, MA 02269 USA.

Update of Regulations to Control Ozone Depleting Substances

Based on a worldwide survey of National Ozone Units, this document summarizes national regulations and policies to control ozone depleting substances, including halons. The document is being developed for UNEP by the Stockholm Environment Institute.

Standards

ASTM D5632-95 Standard Specification for Halon 1301, Bromotrifluoromethane (CF3Br)

This specification covers requirements for Halon 1301 as a fire-fighting medium. It does not address the fire-fighting equipment of hardware that employs Halon 1301 or the conditions of employing such equipment. It does not address the storage or transportation of Halon 1301.

This and the following ASTM standard may be ordered at www.astm.org.

ASTM D5631-00 Standard Practice for Handling Transportation and Storage of Halon 1301 Bromotrifluoromethane (CF3Br)

This standard covers guidance and direction to suppliers, recyclers, reclaimers, purchasers and users in the handling, transportation and storage of Halon 1301.

Factory Mutual Data Sheet 4 - Extinguishing agents

The Data Sheet addresses industries' current protection requirements to help reduce the chance of property loss. This is achieved by evaluating loss experience, research results, and input from consensus standards committees and equipment manufacturers as well as others with a concern or interest.

Available for puchase at www.fmglobal.com

Factory Mutual Research Approval Guide

Contains over 45,000 listings of equipment, materials and services Approved by Factory Mutual, all related to property loss prevention. Chapters include Portable Extinguishers and Fixed Extinguishing Systems.

Available for purchase at www.fmglobal.com

ISO 6183:1990 Carbon Dioxide Extinguishing Systems for Use on Premises - Design and Installation

This and the following ISO standards may be ordered at www.iso.ch.

ISO 7165:1999 Portable Fire Extinguishers - Performance and Construction

ISO 7201-1:1989 Fire protection — Fire extinguishing media — Halogenated hydrocarbons — Part 1: Specifications for Halon 1211 and Halon 1301

ISO 7201-2:1991 Fire extinguishing media — Halogenated hydrocarbons — Part 2: Code of practice for safe handling and transfer procedures of Halon 1211 and Halon 1301

ISO 7202:1987 Fire Extinguishing Media - Powder

ISO 11602-1:2000 Portable and Wheeled Fire Extinguishers - Part 1: Selection and Installation

ISO 11602-2:2000 Portable and Wheeled Fire Extinguishers - Part 2: Inspection and Maintenance

ISO 14520 (Parts 1-15):2000: Gaseous Fire-extinguishing systems - Physical properties and design

Part 1 covers general requirements. Each succeeding part covers a specific gaseous extinguishing agent.

List of Approved Fire and Security Products and Services (The LPCB Red Book)

The essential reference for everyone having a responsibility for the design, specification and purchase of fire and security protection products and services. This is the authoritative guide to those companies whose operations, products and services achieve compliance with the quality assurance, product approval and certification schemes administered by the Loss Prevention Certification Board. Contains full details of names/products/services of companies manufactur-

ing/installing various building products, fire detection and alarm systems, fire break doors and shutters, portable fire extinguishers, sprinklers and water spray systems. Also includes a section on security products and systems.

Available on the internet at www.brecertification.co.uk/lpcb/redbook.html.

LPS 1230: Requirements for Fire Testing of Fixed Gaseous Fire Extinguishing Systems

This Loss Prevention Standard , which is in draft as of December 1999, stipulates the test requirements for fire testing of fixed gaseous fire extinguishing systems. LPS 1230 is appropriate for the evaluation of extinguishing system performance of halon alternative fixed systems, of the non-liquefied inert and halocarbon gas types.

Available upon request by e-mail: enquiries@brecertification.co.uk

NFPA 10: Standard for Portable Fire Extinguishers

This technical standard covers criteria for every aspect of portable fire extinguisher use, including suggested distribution and placement, required maintenance, proper operation, timely inspection and testing, safe recharging, and new requirements for halon alternative chemicals.

This and the following NFPA standards may be ordered www.nfpa.org.

NFPA 12: Standard on Carbon Dioxide Extinguishing Systems

This technical standard covers designing, installing, testing, inspecting, approving, listing, operating, and maintaining of carbon dioxide fire extinguishing systems.

NFPA 12A: Standard on Halon 1301 Fire Extinguishing Systems

NFPA 12A covers designing, installing, testing, inspecting, approving, listing, operating, maintaining, decommissioning, and removing halogenated agent extinguishing systems.

NFPA 13: Installation of Sprinkler Systems

This technical standard addresses proper design and installation of sprinkler systems for all types of fire hazards. Includes extracts or references to NFPA 231: General Storage; NFPA 231C: Rack Storage of Materials; NFPA 99: Health Care Facilities; and NFPA 101(: Life Safety Code(.

NFPA 750: Standard on Water Mist Fire Protection Systems

This standard includes information on the installation of water mist fire suppression systems. System components and hardware and system requirements are covered. Additional chapters

detail installation requirements, design objectives, hazard classifications, calculations, water supplies, atomizing media, plans, documentation, acceptance tests, maintenance, and marine systems.

NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems

This technical standard addresses the design, installation, testing, inspection, operation, and maintenance of the new gaseous agent fire suppression systems now available. It also specifies components for clean agent systems, including agent supply, distribution and, actuation and control systems. Information and minimum requirements are included for 11 clean agents.

UL 2006: Standard For Safety for Halon 1211 Recovery/Recharge Equipment

UL 2006 covers Halon 1211 recovery/recharge equipment rated 600 volts or less, and intended to be used in ordinary locations in accordance with the National Electrical Code, NFPA 70.

This document may be ordered at www.ulstandardsinfonet.ul.com.

List of codes of good practice and guidance documents

1998 Assessment Report of the Halons Technical Options Committee (HTOC)

The state-of-the-art in halon management, halon banking and halon alternatives. Particularly useful for halon banking are sections 2.5 "Halon inventory management and recycling programmes", 2.6 "Case studies", and Chapter 4 "Responsible management of remaining halons".

Available at www.teap.org.

Best and Essential Halon Use - A Methodology

This report outlines a method to evaluate alternative fire protection measures for hazards where fixed halon fire protection systems and manually applied fire equipment employing halons have typically been the agents of choice. The report recognizes the environmental concerns associated with use of Halons 1211, 1301 and 2402 and offers a mechanism to evaluate applications on the basis of societal need and exposure risk to occupants of hazards to be protected.

Available from The Fire Protection Research Foundation, 1 Batterymarch Park, Quincy, MA 02269 USA.

Carbon Dioxide as a Fire Suppressant: Examining the Risks

This report, produced jointly by the US EPA and industry, was written to provide users of total flooding halon systems with information regarding the potential dangers associated with carbon dioxide(CO2) systems. With this report EPA attempts to raise awareness and promote the responsible use of carbon dioxide fire suppression systems.

The report is available on the internet at www.epa.gov/ozone/title6/snap/co2report.html.

Circular on Ban of New Deployment of Halon Extinguishers In Unnecessary Areas

This circular was jointly issued to Chinese provincial fire-fighting bureaus in 1994 by China's Ministry of Public Security and State Environmental Protection Administration. The circular lists 51 unnecessary areas for new deployment of halon fire extinguishers.

Available from Mr. Yi Liu, Deputy Director, Foreig Economic Co-operation office, State Environmental Protection Administration, No. 115 Nanxiaojie Xizhimennei, Beijing 100035, People's Republic of China, Tel: (86-10) 6615 1775, Fax: (86-10) 6615 1776
Email: nepafeco@public.bta.net.cn

Code of Practice for Halon Reclaiming Companies

This industry code of practice was developed by Halon Recycling Corporation (HRC) to provide an assurance to the public that HRC Enrolled Sellers engaged in the business of halon recycling and recovery operate in a manner that promotes safe and environmentally responsible halon reclamation.

Available from HRC, 2111 Wilson Blvd, Ste. 850, Arlington, VA 22201 USA

Eliminating Dependency on Halons: Self-Help Guide for Low-Volume Consuming Countries

A guidebook to assist countries that consume small volumes of halons with the phaseout of unnecessary halon uses, and the management of existing halon stocks to meet critical uses. The guidebook follows a seven step process that includes raising awareness, setting policies, ending unnecessary halon uses, managing a halon bank, and ending halon imports. Annexes include key technical guidance from the UNEP Technical Options Committee, sample brochures that can be adapted to a local situation, and overhead presentations for workshops.

Available on the internet at www.uneptie.org/ozonaction.html ("Sector-specific information").

Environmental Code of Practice on Halons

This code of practice is intended for halon owners and users. It is designed to give direction on how to manage halon stocks in a manner that takes into consideration the environmental concerns regarding the depletion of the ozone layer. Compiled by Jean M. Carbonneau, Environment Canada, Ozone protection Programs Section, Commercial Chemicals Evaluation Branch.

Available on the internet at www.ec.gc.ca/ozone/firecode.htm.

Gaseous Fire Protection Systems

A Loss Prevention Council (U.K.) guidance document to assist specifiers and potential users of halon alternative gaseous systems. This guide gives risk advice for the specification and management of halon alternative fire protection systems.

Available on the internet at projects.bre.co.uk/frsdiv/halonalternatives/

Halon Management: Banking for the Future

An information brochure by UNEP DTIE OzonAction Programme that provides an introduction to the halon banking concept, describes how to obtain recycled halon through halon banks, describes the "essential use" concept, and provides contacts for national halon banks.

Available on the internet at www.uneptie.org/ozonaction.html ("Sector-specific information").

Halon & Fire Protection Codes of Practice - Fire Protection Industry Association of Australia

This code of practice was drawn up in response to a recommendation formulated by the Australian and New Zealand Environment Council in 1989. It is the result of extensive consultation between government and industry, and is intended to provide a guide for service personnel to minimize the loss of halons from fire protection systems. It contains sections on design and installation, essential use criteria, inspection and testing, and halon recovery and recycling.

Available from the Fire Protection Industry Association of Australia, P.O. Box 18, Burwood, VIC 3125 AUSTRALIA

Indian Halon Phaseout Strategy

Prepared by the Defence Institute of Fire Research, this volume contains India's halon phaseout strategy and progress as of 1999. It includes chapters on selection and adoption of halon alternative technologies; halon management and banking; and an action plan for halon phaseout.

For availability, contact The Fire Protection Research Foundation, 1 Batterymarch Park, Quincy, MA 02269 USA.

List of National Halon Banks

Descriptions and contact information for public, private sector and military halon banks around the world. These focal points are available to help you obtain or trade recovered and recycled halons. For individuals wishing to learn about the different approaches to establishing and operating halon banks, these are the people whom you should contact.

Available at www.uneptie.org/ozonaction.html ("Sector-specific information").

List of Halon Recycling, Recovery and Reclaim Equipment Manufacturers

A worldwide list of the manufacturers of halon recovery and recycling equipment, which is an essential component of a halon bank.

Available at www.uneptie.org/ozonaction.html ("Sector-specific information").

OzoneAction Newsletter

Each issue of this quarterly newsletter includes articles about the halon sector, such as technology updates, halon banking and halon management, halon sector projects approved by the Multilateral Fund, national policies and legislation related to halons.

Available at www.uneptie.org/ozonaction.html ("Sector-specific information").

Safety Guide for Decommissioning Halon Systems

This is Volume 2 of the U.S. Environmental Protection Agency Outreach Report "Moving Towards a World Without Halon." The guide was produced jointly by the US EPA, Department of Defense, and industry. It contains generic instructions for safe decommissioning of Halon 1301 total flooding systems and manufacturer's specifications and instructions for handling specific equipment. It provides information to protect personnel from the risks of handling halon equipment and to reduce unnecessary halon emissions.

Available on the internet at www.denix.osd.mil/denix/Public/News/DLA/Halon/hal1.html.

The Halon Sector in Poland - a CEIT Success Story

An account of the efforts of a "Country with Economy in Transition" (CEIT) to implement the provisions of the Montreal Protocol. This account describes how Poland, a Party to the Protocol since 1990, has fully complied with the provisions of the treaty, with limited costs. Describes the use of regulations and voluntary programs, and the process of building awareness among policy makers and technical experts.

Available from UNEP DTIE.

Annex A: UN Implementing Agencies, Multilateral Fund Secretariat and UNEP Ozone Secretariat

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Annex C: Glossary of Terms and Acronyms

Article 5 countries

Developing countries that are Party to the Montreal Protocol whose annual calculated level of consumption is less than 0.3 kg per capita of the controlled substances in Annex A, and less than 0.2 kg per capita of the controlled substances in Annex B, on the date of the entry into force of the Montreal Protocol, or any time thereafter. These countries are permitted a ten year "grace period" compared to the phase out schedule in the Montreal Protocol for developed countries. The Parties in this category known as "countries operating under Article 5(1) of the Protocol." They are sometimes referred to simply as "developing countries".

Chlorofluorocarbons (CFCs)

A family of chemicals consisting of carbon, hydrogen, chlorine and fluorine, once used as aerosol propellants and refrigerants.

Controlled substance

Any ozone depleting substance that is subject to control measures under the Montreal Protocol, such as a phase-out requirement. Specifically, it refers to a substance listed in Annexes A, B, C or E of the Protocol, whether alone or in a mixture. It includes the isomers of any such substance, except as specified in the relevant Annex, but excludes any controlled substance or mixture which is in a manufactured product other than a container used for the transportation or storage of that substance.

Countries with Economies in Transition (CEITs)

States of the former Soviet Union, and Central and Eastern Europe that have been undergoing a process of major structural, economic and social change, which has resulted in severe financial and administrative difficulties for both government and industry. These changes have affected most areas of community life, as well as implementation of international agreements such as the phase out of ODS in accordance with the Montreal Protocol. CEITs include both Article 5 and non-Article 5 countries.

Country Programme (CP)

A national strategy prepared by an Article 5 country to implement the Montreal Protocol and phase out ODS. The Country Programme establishes a baseline survey on the use of the controlled substances in the country and draws up policy, strategies and a phase out plan for their replacement and control. It also identifies investment and non-investment projects for funding under the Multilateral Fund

Critical halon applications

In their Decision VII/12, the Parties to the Montreal Protocol recommended that all non-Article 5 Parties "should endeavour, on a voluntary basis, to limit the emissions of halon to a minimum by: (a) Accepting as critical those applications meeting the essential-use criteria as defined in decision IV/25Ö (b) Limiting the use of halons in new installations to critical applications (c) Accepting that existing installations for critical applications may continue to use halon in the future (d) Considering the decommissioning of halon systems in existing installations, which are

not critical applications, as quickly as technically and economically feasible (e) Ensuring that halons are effectively recovered (f) Preventing, whenever feasible, the use of halon in equipment testing and for training of personnel (g) Evaluating and taking into account only those substitutes and replacements of halon, for which no other more environmentally suitable ones are available (h) Promoting the environmentally safe destruction of halons, when they are not needed in halon banks (existing or to be created). (See also Essential use).

Decommissioning

Decommissioning is the physical process of removing a halon system from service. This must be done to recover the halon so that it can be made available for other essential uses. Effective decommissioning requires knowledge of good practices related to technical procedures and safety measures.

Essential use

In their Decision IV/25, the Parties to the Montreal Protocol define an ODS use as "essential" only if: "(i) It is necessary for the health, safety or is critical for the functioning of society (encompassing cultural and intellectual aspects) and (ii) There are no available technically and economically feasible alternatives or substitutes that are acceptable from the standpoint of environment and health." Production and consumption of an ODS for essential uses is permitted only if: "(i) All economically feasible steps have been taken to minimize the essential use and any associated emission of the controlled substance; and (ii) The controlled substance is not available in sufficient quantity and quality from existing stocks of banked or recycled controlled substances, also bearing in mind the developing countries' need for controlled substances." (see also Critical halon application).

Fluoroiodocarbons (FICs)

A molecule that contains fluorine, iodine, and carbon atoms (in some cases FICs also contain hydrogen). FICs are highly-effective fire extinguishing agents and are alternatives to halons in some applications.

Halocarbons

Halocarbons are compounds derived from methane (CH4) and ethane (C2H6), where one or several of the hydrogen atoms are substituted with chlorine (Cl), fluorine (F), and/or bromine (Br). These compounds are so called "partly halogenated halocarbons". When all the hydrogen atoms are substituted the compound is said to be fully halogenated. The ability of halocarbons depleting ozone in the stratosphere is due to their content of chlorine and/or bromine and their chemical stability. Fully halogenated halocarbons have much higher chemical stability (atmospheric lifetime typically 100500 years) than partly halogenated halocarbons (atmospheric lifetime typically 120 years). CFCs, HCFCs and HFCs are examples of halocarbons.

Halocarbon fire extinguishing agents

Halocarbon chemicals used as alternatives to halons for fire fighting applications. These agents include HCFCs, HFCs, PFCs, and FICs. They share several common characteristics, including: all are electrically non-conductive, all are clean agents (vaporise readily and leave no residue), and all are liquefied gases or compressible liquids.

Halogenated fire extinguishing agents

Halogenated extinguishing agents are hydrocarbons in which one or more hydrogen atoms have been replaced by atoms from the halogen series, fluorine, chlorine, bromine or iodine. This substitution confers not only nonflammability, but also flame extinguishment properties to many of the resulting compounds. Halogenated agents are used both in portable fire extinguishers and in extinguishing systems.

Halon

A halon is a bromochlorofluorocarbon (BCFC), a chemical consisting of one or more carbon atoms surrounded by fluorine, chlorine and bromine. Halons are fully halogenated hydrocarbons that exhibit exceptional fire fighting effectiveness. They are used as fire extinguishing agents and as explosion suppressants. Because halons are ozone depleting substances with high ODPs, they are controlled substances under Annex A of the Montreal Protocol. Their consumption and production is restricted and they will eventually be phased out worldwide.

Halon-1211

An halongenated hydrocarbon, bromochlorodifluoromethane (CF2BrCl). It is also known as "BCF". Halon-1211 is a fire extinguishing agent that can be discharged in a liquid stream. It is primarily used in portable fire extinguishers. Halon-1211 is an ozone depleting substance with an ODP of 3.0 (see also Halon).

Halon-1301

An halongenated hydrocarbon, bromotrifluoromethane (CF3Br). It is also known as "BTM". Halon-1301 is a fire extinguishing agent that can be discharged rapidly, mixing with air to create an extinguishing application. It is primarily used in total flooding fire protection systems. Halon-1301 is an ozone depleting substance with an ODP of 10. (see also Halon).

Halon-2402

An halongenated hydrocarbon, dibromotetrafluoroethane (C2F4Br2). Halon-2402 is a fire extinguishing agent that can be discharged in a liquid stream. It is primarily used in portable fire extinguishers or hand hose line equipment, and fire protection for specialized applications. Halon-2402 is an ozone depleting substance with an ODP of 6.0 (see also Halon).

Halon bank

The total quantity of halon existing at a given moment in a facility, organization, country, or region. The halon bank includes the halon in fire protection systems, in portable fire extinguishers, in mobile fire extinguishers and the halon in storage (containers).

Halon bank management

A method of managing a supply of banked halon. Bank management consists of keeping track of halon quantities at each stage: initial filling, installation, "recycling", and storage. A major goal of a halon bank is to avoid demand for new (virgin) halons by re-deploying halons from decommissioned systems or non-essential applications to essential uses. Halon banks are usually managed by a clearinghouse, i.e. an office that facilitates contact between halon owners and halon buyers.

Halon management strategy

The Parties to the Montreal Protocol through Decision X/7 (November 1998) reinforced the need for a comprehensive strategy to manage halon stocks. They requested all Parties to "develop and submit to the Ozone Secretariat a national or regional strategy for the management of halons, including emissions reduction and ultimate elimination of their use". The strategies should address issues such as: "(a) Discouraging the use of halons in new installations and equipment (b) Encouraging the use of halon substitutes and replacements acceptable from the standpoint of environment and health, taking into account their impact on the ozone layer, on climate change and any other global environmental issues (c) Considering a target date for the complete decommissioning of non-critical halon installations and equipment, taking into account an assessment of the availability of halons for critical uses (d) Promoting appropriate measures to ensure the environmentally safe and effective recovery, storage, management and destruction of halons."

Halons Technical Options Committee (HTOC)

An international group of experts organized by UNEP as per Article 6 of the Montreal Protocol to regularly assess the technical .

Hydrochlorofluorocarbons (HCFCs)

A family of chemicals related to CFCs that contains hydrogen, chlorine, fluorine, and carbon atoms. HCFCs are partly halogenated and have much lower ODP than the CFCs.

Hydrofluorocarbons (HFCs)

A family of chemicals related to CFCs that contains one or more carbon atoms surrounded by fluorine and hydrogen atoms. Since no chlorine or bromine is present, HFCs do not deplete the ozone layer.

Implementing Agency

Under the Montreal Protocol, four international organizations designated to implement the Multilateral Fund. They are UNDP, UNEP, UNIDO and the World Bank.

Inert gases

Fire extinguishing agents containing one or more of the following gases: argon, carbon dioxide, and nitrogen. Inert gases are zero-ODP halon alternatives that extinguish fires by reducing oxygen concentrations in the confined space thereby "starving" the fire.

Local Application System

A fixed, automatic or manual system which extinguishes a fire by discharging the extinguishing agent in such a manner that the burning object involved is surrounded locally by a high concentration of agent to extinguish a fire. In this type of application, neither the quantity of the agent nor the type or arrangement of the discharge nozzles is sufficient to achieve total flooding of the enclosure containing the object.

Montreal Protocol

An international agreement limiting the production and consumption of chemicals that deplete the stratospheric ozone layer, including CFCs, Halons, HCFCs, HBFCs, methyl bromide and others. Signed in 1987, the Protocol commits Parties to take measures to protect the ozone layer by freezing, reducing or ending production and consumption of controlled substances. This agreement is the protocol to the Vienna convention.

Multilateral Fund

Part of the financial mechanism under the Montreal Protocol. The Multilateral Fund for Implementation of the Montreal Protocol has been established by the Parties to provide financial and technical assistance to Article 5 countries.

National ozone unit (NOU)

The government unit in an Article 5 country that is responsible for managing the national ODS phase-out strategy as specified in the Country Programme. NOUs are responsible for, inter alia, fulfilling data reporting obligations under the Montreal Protocol.

Non-Article 5 countries

Developed countries that are Party to the Montreal Protocol. The Parties in this category are also sometimes unofficially known as "countries operating under Article 2 of the Protocol" or simply "developed countries".

Ozone

A reactive gas consisting of three oxygen atoms formed naturally in the atmosphere by the association of molecular oxygen (O2) and atomic oxygen (O). It has the property of blocking the passage of dangerous wavelengths of ultraviolet radiation in the upper atmosphere. Whereas it is a desirable gas in the stratosphere, it is toxic to living organisms in the troposphere.

OzonAction programme

UNEP DTIE's OzonAction programme provides assistance to developing country parties under the Montreal Protocol through information exchange, training, networking, country programmes and institutional strengthening projects.

Ozone depleting substance (ODS)

Any substance with an ODP greater than 0 that can deplete the stratospheric ozone layer. Most of ODS are controlled under the Montreal Protocol and its amendments, and they include CFCs, HCFCs, halons and methyl bromide.

Ozone depletion

Accelerated chemical destruction of the stratospheric ozone layer by the presence of substances produced, for the most part, by human activities. The most depleting species for the ozone layer are the chlorine and bromine free radicals generated from relatively stable chlorinated, fluorinated, and brominated products by ultraviolet radiation.

Ozone depletion potential (ODP)

A relative index indicating the extent to which a chemical product may cause ozone depletion. The reference level of 1 is the potential of CFC11 and CFC12 to cause ozone depletion. If a product has an ozone depletion potential of 0.5, a given weight of the product in the atmosphere would, in time, deplete half the ozone that the same weight of CFC11 would deplete. The ozone depletion potentials are calculated from mathematical models, which take into account factors such as the stability of the product, the rate of diffusion, the quantity of depleting atoms per molecule, and the effect of ultraviolet light and other radiation on the molecules. The substances implicated generally contain chlorine or bromine.

Ozone layer

An area of the stratosphere, approximately 15 to 60 kilometres (9 to 38 miles) above the earth, where ozone is found as a trace gas (at higher concentrations than other parts of the atmosphere). This relatively high concentration of ozone filters most ultraviolet radiation, preventing it from reaching the earth.

Ozone Secretariat

The secretariat to the Montreal Protocol and Vienna Convention, provided by UNEP and based in Nairobi, Kenya.

Party

A country that signs and/or ratifies an international legal instrument (e.g. a protocol or an amendment to a protocol), indicating that it agrees to be bound by the rules set out therein. Parties to the Montreal Protocol are countries that have signed and ratified the Protocol.

Perfluorocarbons (PFCs)

A group of synthetically produced compounds in which the hydrogen atoms of a hydrocarbon are replaced with fluorine atoms. The compounds are characterized by extreme stability, non-flammability, low toxicity, zero ozone depleting potential, and high global warming potential.

Phase out

The ending of all production and consumption of a chemical controlled under the Montreal Protocol.

Reclamation of halons

As defined by the Parties to the Montreal Protocol in their Decision IV/24, "the re-processing and upgrading of a recovered controlled substance through such mechanisms as filtering, drying, distillation and chemical treatment in order to restore the substance to a specified standard of performance. It often involves processing "off-site" at a central facility."

Recovery of halons

As defined by the Parties to the Montreal Protocol in their Decision IV/24, "the collection and storage of controlled substances from machinery, equipment, containment vessels, etc., during servicing or prior to disposal."

Recycling of halons

As defined by the Parties to the Montreal Protocol in their Decision IV/24, "the re-use of a recovered controlled substance following a basic cleaning process such as filtering and drying. For refrigerants, recycling normally involves recharge back into equipment it often occurs 'on-site'".

Total Flooding System

A fire extinguishing system that protects a space by developing a critical concentration of extinguishing agent.

Transitional substances

Under the Montreal Protocol, a chemical (e.g. HCFC) whose use is permitted as a replacement for ozone-depleting substances, but only temporarily due to the substance's ODP or toxicity.

Water mist

A halon alternative that uses relatively small droplet sprays under low, medium, or high pressure. to extinguish fires. These systems use specially designed nozzles to produce much smaller droplets than are produced by traditional water-spray systems or conventional sprinklers. Water mist systems are being actively developed due to their low environmental impact, ability to suppress three-dimensional flammable liquid fires, and reduced water application rates relative to automatic sprinklers. Applications to date include shipboard accommodation, storage and machinery spaces, combustion turbine enclosures, flammable and combustible liquid machinery areas, as well as light and ordinary hazard sprinkler applications.

Annex D: UNEP DTIE OzonAction Programme

Nations around the world are taking concrete actions to reduce and eliminate production and consumption of CFCs, halons, carbon tetrachloride, methyl chloroform, methyl bromide and HCFCs. When released into the atmosphere these substances damage the stratospheric ozone layer - a shield that protects life on Earth from the dangerous effects of solar ultraviolet radiation. Nearly every country in the world - currently 172 countries — has committed itself under the Montreal Protocol to phase out the use and production of ODS. Recognizing that developing countries require special technical and financial assistance in order to meet their commitments under the Montreal Protocol, the Parties established the Multilateral Fund and requested UNEP, along with UNDP, UNIDO and the World Bank, to provide the necessary support. In addition, UNEP supports ozone protection activities in Countries with Economies in Transition (CEITs) as an implementing agency of the Global Environment Facility (GEF).

Since 1991, the UNEP DTIE OzonAction Programme has strengthened the capacity of governments (particularly National Ozone Units or "NOUs") and industry in developing countries to make informed decisions about technology choices and to develop the policies required to implement the Montreal Protocol. By delivering the following services to developing countries, tailored to their individual needs, the OzonAction Programme has helped promote cost-effective phase-out activities at the national and regional levels:

Information Exchange

Provides information tools and services to encourage and enable decision makers to make informed decisions on policies and investments required to phase out ODS. Since 1991, the Programme has developed and disseminated to NOUs over 100 individual publications, videos, and databases that include public awareness materials, a quarterly newsletter, a web site, sector-specific technical publications for identifying and selecting alternative technologies and guidelines to help governments establish policies and regulations.

Training

Builds the capacity of policy makers, customs officials and local industry to implement national ODS phaseout activities. The Programme promotes the involvement of local experts from industry and academia in training workshops and brings together local stakeholders with experts from the global ozone protection community. UNEP conducts training at the regional level and also supports national training activities (including providing training manuals and other materials).

Networking

Provides a regular forum for officers in NOUs to meet to exchange experiences, develop skills, and share knowledge and ideas with counterparts from both developing and developed countries. Networking helps ensure that NOUs have the information, skills and contacts required for managing national ODS phaseout activities successfully. UNEP currently operates 8 regional/sub-regional Networks involving 109 developing and 8 developed countries, which have resulted in member countries taking early steps to implement the Montreal Protocol.

Refrigerant Management Plans (RMPs)

Provide countries with an integrated, costeffective strategy for ODS phaseout in the refrigeration and air conditioning sectors. RMPs have to assist developing countries (especially those that consume low volumes of ODS) to overcome the numerous obstacles to phase out ODS in the critical refrigeration sector. UNEP DTIE is currently providing specific expertise, information and guidance to support the development of RMPs in 60 countries.

Country Programmes and Institutional Strengthening

Support the development and implementation of national ODS phase-out strategies especially for low-volume ODS-consuming countries. The Programme is currently assisting 90 countries to develop their Country Programmes and 76 countries to implement their Institutional-Strengthening projects.

For more information about these services please contact:
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About the UNEP Division of Technology, Industry and Economics

The mission of the UNEP Division of Technology, Industry and Economics is to help decision-makers in government, local authorities, and industry develop and adopt policies and practices that: are cleaner and safer; make efficient use of natural resources; ensure adequate management of chemicals; incorporate environmental costs; reduce pollution and risks for humans and the environment.

The UNEP Division of Technology, Industry and Economics (UNEP DTIE), with its head office in Paris, is composed of one centre and four units:

The International Environmental Technology Centre (Osaka), which promotes the adoption and use of environmentally sound technologies with a focus on the environmental management of cities and freshwater basins, in developing countries and countries in transition.

Production and Consumption (Paris), which fosters the development of cleaner and safer production and consumption patterns that lead to increased efficiency in the use of natural resources and reductions in pollution.

Chemicals (Geneva), which promotes sustainable development by catalysing global actions and building national capacities for the sound management of chemicals and the improvement of chemical safety world-wide, with a priority on Persistent Organic Pollutants (POPs) and Prior Informed Consent (PIC, jointly with FAO).

Energy and OzonAction (Paris), which supports the phase-out of ozone depleting substances in developing countries and countries with economies in transition, and promotes good management practices and use of energy, with a focus on atmospheric impacts. The UNEP/RISÿ Collaborating Centre on Energy and Environment supports the work of the Unit.

Economics and Trade (Geneva), which promotes the use and application of assessment and incentive tools for environmental policy and helps improve the understanding of linkages between trade and environment and the role of financial institutions in promoting sustainable development.

UNEP DTIE activities focus on raising awareness, improving the transfer of information, building capacity, fostering technology cooperation, partnerships and transfer, improving understanding of environmental impacts of trade issues, promoting integration of environmental considerations into economic policies, and catalysing global chemical safety.

Annex E: The Fire Protection Research Foundation

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The Fire Protection Research Foundation is an independent international nonprofit whose mission is to provide practical, usable data on the dangers of fire, and on state-of-the-art fire safety measures. Since 1982, the Foundation has served code writers, fire safety professionals, corporate and public agency top management, and the international regulatory community with consensus-based documentation on fire behavior and cost-effective intervention measures.

The Foundation pursues its mission through research in two primary program areas:

New Technologies and Strategies

What is the "state of the art" in fire and building safety? The Foundation continues to probe the frontiers of technology and human behavior. Alternatives to halon fire protection, three-dimensional field modeling, flammable liquid fire suppression, quick response sprinklers, fire detection, Class A fire fighting foam, and safe wire & cable, have been extensively documented.

Fire Risk Assessment

What is the quantitative risk associated with various materials, products, processes, procedures, codes, standards and strategies? The Foundation has helped develop new safety approvals test protocols for a variety of products. Major initiatives have documented furniture, building and electrical risk assessment methodologies; evaluated lightweight roofs vs. fire; and validated screening test protocols for firefighter protective equipment.

Since 1982, The Foundation has conducted consortium projects for code writers, fire safety professionals, corporate and public managers, and the international regulatory community.

Since 1996, the Foundation has hosted "Bridging the Gap" symposia on Fire Suppression & Detection, as well as Fire Risk & Hazard Assessment.

Since 1997, the Foundation has convened Research Advisory Councils on Fire Toxicity, Fire Suppression Futures, Fire Alarm Futures, Post-fire Analysis, Performance-based Design, Transportation, and the NFPA 262 Fire Test.

A Word from the Chief of UNEP DTIE's Energy and OzonAction Unit

Much of the Montreal Protocol's success can be attributed to its ability to evolve over time to reflect the latest environmental information and technological and scientific developments. Through this dynamic process, significant progress has been achieved globally in protecting the ozone layer.

As a key agency involved in the implementation of the Montreal Protocol, UNEP DTIE's OzonAction Programme promotes knowledge management in ozone layer protection through collective learning. There is much that we can learn from one another in adopting effective alternatives to ozone depleting substances.

I encourage you to share your experiences with the OzonAction Programme so that we can inform others involved in ozone protection in the halon sector about the lessons you learned. Send us an e-mail, fax or letter about your experiences and successes. We consider your contribution to be an important part of our collective learning.

UNEP may use the feedback and information received for future updates or supplements to this publication. We will also disseminate your experiences and stories through a variety of channels, including the OzonAction Newsletter and the OzonAction Programme's web site (www.uneptie.org/ozonaction.html).

If we use the information you provide, we will send you a free copy of one of our videos, publications, posters or CD-ROMs as thanks for your cooperation.

So take a pen and write to us. Let us learn collectively to protect the ozone layer.

Rajendra M. Shende, Chief
UNEP DTIE Energy and OzonAction Unit

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Standards and Codes of Practice to Eliminate Dependency on Halons

Handbook of Good Practices in the Halon Sector

Developing countries face the challenge of ensuring effective fire protection while at the same time eliminating their reliance on halons to comply with the Montreal Protocol. In January 2002, they will face their first important milestone: the freeze of their halon consumption at 1995-97 average levels. They will have to phase out all halon consumption and production by 2010, except for essential uses. The Handbook of Good Practices in the Halon Sector is designed to help developing countries make a smooth transition away from halons.

Standards and codes of good practice are key to simultaneously achieving effective -- even enhanced -- fire safety, and the elimination of halons. This handbook cites exemplary regulations, standards, codes of practice and guidance documents. It describes steps authorities in developing countries can take to develop their own effective standards and codes of good practice. The Handbook also points to organizations that have compiled extensive information and resources, and to documents describing halon phase-out success stories in developing countries.

This handbook has been written for National Ozone Units (NOUs) and other members of the fire protection community in developing countries, including public fire services, fire equipment vendors, halon users, insurance companies, and NGOs.

The Handbook has been jointly developed by the UNEP DTIE OzonAction Programme and The Fire Protection Research Foundation. It is part of UNEP's "Eliminating Dependency on Halons" series that support developing country compliance with the halon provisions of the Montreal Protocol.

The Multilateral Fund for the Implementation of the Montreal Protocol has supported the production of this handbook.

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