

PHASE OUT OF HALONS

**Advice on Alternatives and Guidelines
for Users of Fire Fighting and Explosion
Protection Systems**

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Contents

Aim of this guide	2
Phase out dates.....	3
Phase out legislation: Will you be affected?	3
Evaluation of alternatives to Halon fixed systems.....	6
Traditional alternatives to Halons.....	7
New alternatives to Halons.....	10
Summary of alternatives and their applications	14
Selecting a system	16
Maintenance	17
Evaluation of alternatives to Halon portable fire extinguishers	17
Environmental issues	20
System testing	23
Health and safety issues.....	23
Advice on Halon system management	25
Checking your new system and installer.....	26
Useful information	28

Glossary of terms

CFC	chlorofluorocarbon
CBM	bromochloromethane
HCFC	hydrochlorofluorocarbon
ODS	ozone depleting substances
HFC	hydrofluorocarbon
ODP	ozone depletion potential
PFC	perfluorocarbon
GWP	global warming potential
Competent person, for the purposes of this booklet	someone who has the necessary knowledge, training, experience and abilities to carry out the work.

Aim of this Guide

This Guide provides details of how the new EC Regulation 2037/2000 on ozone depleting substances (ODS) will affect the use of fire fighting systems and explosion protection equipment. The Guide is aimed at all key parties in these markets including users, designers, equipment manufacturers, installation contractors and maintenance contractors.

This Guide has been published as one of a set of four booklets addressing the new EC Ozone Regulation. The other booklets include a general guide on the EC Regulation and two further detailed guides addressing the refrigeration/air-conditioning and solvents markets.

Users of halon fire extinguishing fluids need to be aware of a number of significant changes to the previous halon phase out regulations. The aim of this Guide is to outline these changes and to help users decide on appropriate action plans. Details of how to obtain further help are also given at the end of this booklet.

Halon 1211 is used mainly in hand-held fire extinguishers and halon 1301 in total flooding systems; both forms of hardware are referred to in this document as "equipment".

Phase out dates

Under the Montreal Protocol

Halon 1301, Halon 1211 and Halon 2402

PRODUCTION IN DEVELOPED COUNTRIES CEASED
BY 31st DECEMBER 1993

Under EC Regulation 2037/2000

Halon 1301, Halon 1211 and Halon 2402

USE IN EXISTING FIRE FIGHTING EQUIPMENT IS PROHIBITED
FROM 31st DECEMBER 2002¹

Phase out Legislation: Will you be Affected?

For the time being, you may continue to use and maintain existing halon systems. However, EC Regulation 2037/2000 prohibits the sale and use of halons, including material that has been recovered or recycled, from 31st December 2002. Furthermore, with the exception of equipment deemed critical under the Regulation (see page 2), all fire-fighting equipment in the EU containing halons must be decommissioned before 31st December 2003.

If your building or vehicle is protected by hand-held halon fire extinguishers, or if you have an installed fixed halon system, you will be affected. You may know halons 1211 and 1301 better as bromochlorofluoromethane and bromotrifluoromethane or under trade names such as BCF and BTM. The outside of your extinguisher will indicate whether the contents are halon. However, if you are still unsure, you should contact your supplier or the manufacturer for further detail.

¹ Except for critical uses (see page 2) and existing installations which can remain charged (but cannot be refilled) until 31st December 2003.

The Regulation also prohibits the supply and use of bromochloromethane (halon 1011 or CB) from 1st October 2000. "Use" is defined in the EC Regulation 2037/2000 as "the utilisation of controlled substances in the production or maintenance, in particular refilling, of products or equipment or in other processes except for feedstock and processing agent uses". Running an existing appliance, without maintenance, would NOT qualify as use. An existing system can be kept until it requires refilling or topping up, as the controls requiring decommissioning of equipment containing halons do not apply to CBM.

Portable hand-held extinguishers

The use of such fire fighting equipment must be carried out in accordance with the instructions on the extinguisher and following appropriate training.

Fixed systems

Warnings must be given to occupants working in/entering areas covered by fixed systems that in the event of the alarm sounding or upon a gas discharge, they must evacuate the area immediately. This statement should be part of a total flooding extinguishing system sign that satisfies the Health and Safety (Safety Signs and Signals) Regulations 1996 which should be sited in the close vicinity of the protected area. Note, the sign should be a combination type sign which can be obtained through the Health and Safety Signs Association. Appropriate safeguards must be taken which include personnel training, warning signs, fire alarms, delay devices and provision of respiratory protection.

You should refer to the Home Office guide "Fire Safety An Employers Guide" (web details or The Stationary Office) and the section of "Training Employees" which states that amongst other things 'training should include the location and where appropriate, the use of fire fighting equipment'

Except for the specific list of critical uses shown below, the new EC Regulation 2037/2000 will make it illegal to supply or use halon including recovered and recycled material in the EU after 31st December 2002. "Use" as defined in the Regulation means, "the utilisation of controlled substances in the production or maintenance in particular refilling of products or equipment or in other processes²". Hence, you cannot top up a non-critical halon system after 31st December 2002, regardless of whether you already own any halon material. However, an existing halon system can remain operational until 31st December 2003, providing it requires no halon top-up. All non critical halon systems must be decommissioned by 31st December 2003.

² Except for feedstock and processing agent uses

The list of **Critical Uses of Halon**, taken from *Annex VII* of the new EC Regulation is as follows.

USE OF HALON 1301 WILL BE PERMITTED:

- in aircraft for the protection of crew compartments, engine nacelles, cargo bays and dry bays,
- in 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 existing manned communication and command centres of the armed forces or others, essential for national security
- for the making inert of spaces where there may be a risk of dispersion of radioactive matter,
- in the Channel Tunnel and associated installations and rolling stock.

USE OF HALON 1211 WILL BE PERMITTED:

- 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 fire extinguishers essential to personal safety used for initial extinguishing by fire brigades,
- in military and police fire extinguishers for use on persons.

The list will be reviewed annually, with the intention of removing applications from the list as suitable replacements become available.

Evaluation of Alternatives to Halon Fixed Systems

For the purpose of this leaflet, a “halon alternative” is defined as any permitted form of fire protection that can be used to protect a hazardous area previously protected by halon. Possible alternatives to halons include some long established technologies and new agents that have emerged since the environmental problems associated with halons have been recognised.

Halons have been used to protect a wide range of risks and the choice of alternative has to be based on consideration of the hazard to be protected. The following sections suggest a number of alternative technologies and give an indication of their applicability and limitations. Reference to the publications of the United Nations Environment Programme Halons Technical Options Committee will also provide guidance to the selection of halon alternatives (see Bibliography and References at the end of this leaflet).

Halon Alternatives

The potential alternatives for specific applications are suggested in the table at the end of this section. They include both traditional and new alternatives.

TRADITIONAL ALTERNATIVES TO HALONS

- Detection and manual intervention
- Water Sprinkler Systems, including those with pre-action and/or quick response features
- Carbon Dioxide - local application and total flood
- Foam - low expansion, high expansion and foam spray systems
- Dry Powder

NEW ALTERNATIVES TO HALONS

- Inert Gases
- Halocarbon Gases
- Fine Water Spray/Water Mist
- Inert Gas Generators
- Fine Solid Particulates

Traditional Alternatives to Halons

Detection and Manual Intervention

Especially with the introduction of high sensitivity smoke detection and aspirating systems, it is possible to base a fire protection strategy on suitable detection coupled with arrangements for the fire to be tackled manually with fire extinguishers and hose reels or by the Fire Brigade.

It must be emphasised that detection systems themselves do nothing to suppress the fire (although they may isolate and shut down electrical power sources). Adopting a detection and manual intervention approach represents a major change to your fire protection strategy if you have previously been using a fire suppression system. However, many users have adopted this approach.

Water Sprinkler Systems

Water sprinkler systems are a very common type of fixed fire protection system in the UK and are a long established technology with acknowledged reliability. However, they **should not be used** for certain hazards including live electrical equipment, fires of flammable liquids, areas of hot working such as salt-baths or anything that would react violently with water.

For shielded fires, such as those in computer cabinets or in switchgear housing, water cannot penetrate in the same way as halon gas and sprinklers should not be used as the primary system in such fire risks, unless systems are designed with nozzles inside the cabinets. However, a sprinkler system will provide safe and effective protection to limit structural damage. Although equipment in the room will inevitably suffer some water damage, the fire itself will cause damage whatever suppression system is used.

One of the most important benefits of sprinkler systems is their outstanding reliability. The records of a major US insurer shows that the probability of a sprinkler accidentally discharging due to manufacturing defect is only 1 in 16 million per year in service. Nonetheless, as an even greater assurance against false discharges, sprinkler systems can be designed so that they only activate if the sprinkler head operates **and** a separate system of smoke detection is activated. This is called a 'Pre-Action Sprinkler System'. On receipt of signals from two or more detectors, the main control panel automatically opens the control

valves, allowing water to flow into the sprinkler pipework in readiness for the first sprinkler to operate. If the sprinkler is damaged without a fire being detected, the system will not release any water, so these systems have particular application where it is essential to ensure that there are no unwanted releases of water.

Another type of system is a dry pipe system. These are designed so that exposed pipework and sprinkler heads do not contain water until the sprinkler is activated; this has particular applications in locations where freezing might occur.

Sprinklers can also be used in conjunction with a gas system, with the sprinklers protecting the main room, and the gas system protection the floor void.

Areas where sprinkler systems have provided an alternative to halons include computer rooms, control rooms, record storage and cultural heritage.

Carbon Dioxide (CO₂) Systems

Carbon dioxide flooding systems have been in use for many years. However, carbon dioxide is toxic and an asphyxiant at the concentrations necessary to extinguish fire. Because of this, carbon dioxide total flooding systems should not be on automatic control when the spaces they protect are occupied.

Carbon dioxide is a clean agent with good penetration and is most suited to applications where this is a prime requirement. It is safe to use on live electrical equipment. Carbon dioxide can be used on specific items of enclosed equipment as a localised system. It can also be used to protect enclosed sections of a room, such as the floor void.

Carbon dioxide is stored at high pressure and high concentrations are required to effect extinguishment. As a result such systems involve bulky and heavy hardware and are not suitable for applications where space and weight are important considerations.

It should be stressed that if carbon dioxide total flooding systems are used they should be locked off when people are in the protected area. Also, carbon dioxide is odourless and, in addition to locking devices, the use of odourisers on a system may assist in detecting if the system has operated or malfunctioned

Areas where carbon dioxide systems, locked off or in unoccupied areas, could provide a feasible alternative to halons include telecommunications facilities, computer rooms, control rooms, transformer and switchgear rooms, record storage, cultural heritage, flammable liquid hazards and shipboard machinery spaces.

Foam Systems

The use of low and medium expansion foams is most suited to liquid pool fires, where it acts by forming a barrier between the fire and the supply of oxygen and also by cooling. Foams are not generally effective against running or spray fires. Some liquid fuels, such as alcohols, can destroy some foam blankets by chemical reaction and care must be taken to ensure that an appropriate foam compound is chosen. Since foams are aqueous solutions, they should not be used to protect against anything that would react violently with water.

Developments in systems where foam solutions are delivered through traditional water sprinkler hardware have given rise to increased extinguishing efficiency.

High expansion foam systems can be used as flooding agents in enclosed areas where the foam works primarily by smothering the fire and less by cooling. This makes it suitable for warehousing and document stores or libraries. However, care should be taken in occupied spaces where there is a risk of suffocation and very poor visibility.

Areas where foam systems could provide a feasible alternative to halons include flammable liquid hazards, engine compartments, computer floor voids, cable tunnels and shipboard machinery spaces.

Dry Powder Systems

Dry powder systems are effective against fires of flammable liquids, including spray fires. Powders are capable of effecting very rapid extinguishment but provide little cooling effect and are ineffective once the powder has settled, so the specification of any system must address this. Different types of powders are available to address different types of fire and it is essential to ensure that the powder selected is suitable for use on the risk to be protected.

The levels of chemical toxicity of many powders are low but some require special precautions. All types of powder are unpleasant to breathe, obscure visibility, and would not be recommended for use in occupied spaces. Powders settle out after use and present the problem of post-fire clean up. This must be a consideration in their use.

Areas where dry powder systems could provide a feasible alternative to halons include flammable liquid hazards, shipboard machinery spaces and vehicle engine spaces.

New Alternatives to Halons

Note on Alternative Gaseous Agents

There is a strong demand for “clean” agents that are electrically non-conductive, leave no residue, are relatively non-toxic and have good penetration. Of the alternatives listed below, the following can meet some or all of those requirements:

- Inert Gases
- Halocarbon Gases
- Inert Gas Generators

When considering alternative gaseous agents reference may be made to a number of publications listed at the end of this booklet.

Inert Gases

Inert gas agents are electrically non-conductive clean fire suppressants that are used in design concentrations of 35-50% by volume to reduce ambient oxygen concentration to between 14 and 10%. Oxygen concentrations below 14% will not support the combustion of most fuels (and human exposure must be limited).

Several gases and mixtures are available commercially.

Trade Name	Designation	Gas Blend
NN100	IG-100	Nitrogen
Argotec	IG-01	Argon
Argonite	IG-55	Nitrogen/Argon mixture
Inergen	IG-541	Nitrogen/Argon/Carbon dioxide mixture

When choosing an inert gas agent the following should be considered:

- They are not liquefied gases. They are stored at high pressure in gas cylinders which has implications for space and weight.
- Inert gases will require a system that is sufficiently robust to withstand the pressures involved; the hardware required for this will be similar to that for CO₂ systems.
- The component gases of mixtures are blended so as to have a density similar to that of air. This means that they retain their concentration in the risk area better than halon.
- Discharge times are of the order of one or two minutes. This may limit some applications involving very rapidly developing fires.
- Inert gases are not subject to thermal decomposition and hence form no breakdown products.
- Inert gases are asphyxiants and the health and safety aspects must be considered.
- There is no concern regarding ozone depletion or global warming from inert gases.

Areas where inert gas systems could provide a feasible alternative to halons include telecommunications facilities, computer rooms, control rooms, transformer and switchgear rooms, record storage, cultural heritage, flammable liquid hazards and shipboard machinery spaces.

Halocarbon Gas Systems

HALOCARBON GAS SYSTEMS

A number of fire extinguishing halocarbon gases with zero ozone depletion potential (ODP) have been developed. These include both HFCs (hydrofluorocarbons) and PFCs (perfluorocarbons).

Trade Name	Designation	Chemical Formula	Chemical Name
FE-13	HFC 23	CHF_3	Trifluoromethane
FE-125	HFC 125	CF_3CHF_2	Pentafluoroethane
FM-200	HFC 227ea	$\text{CF}_3\text{CHFCF}_3$	Heptafluoropropane
FE-36	HFC 236fa	$\text{CF}_3\text{CH}_2\text{CF}_3$	Hexafluoropropane
CEA-308	PFC-2-1-8	C_3F_8	Perfluoropropane
CEA-410	PFC-3-1-10	C_4F_{10}	Perfluorobutane

The list is not exhaustive and none of the agents can be considered as a drop-in replacement for halon 1301, in the same system. Redesign and modification, if not replacement, will be required. However, the new halocarbon agents share many of the characteristics of halons:

- they are electrically non-conductive;
- they are clean agents in that they vaporise readily and leave no residue;
- they are stored as liquefied compressed gases and use hardware similar to that used for halon 1301;
- they are space and weight efficient.

When choosing a new halocarbon agent the following should be considered:

- Environmental Aspects; while the HFCs and PFCs do not affect the ozone layer, they are greenhouse gases that fall under the Kyoto Protocol and so any release - though probably rare - would count towards the national emissions inventory of global warming gases. Therefore these gases should only be used where other safe, technically feasible cost effective and more environmentally acceptable alternatives do not exist. See the UK Climate Change Programme, details can be found in 'Useful Information' at the back of this booklet.

- FE-13, unlike the others listed, has a high vapour pressure and will require a system that is sufficiently robust to withstand it; the hardware required will be similar to that of CO₂ systems.
- Halon 1301 produces HBr and HF breakdown products in a fire. The new agents produce HF in greater quantities but no HBr. However, an uncontrolled fire can in itself produce large amounts of toxic and corrosive combustion products in addition to smoke and heat.

Areas where halocarbon gaseous agent systems could provide a feasible alternative to halons include telecommunications facilities, computer rooms, control rooms, transformer and switchgear rooms, record storage, cultural heritage, flammable liquid hazards, shipboard machinery spaces and aero engine compartments.

Fine Water Spray/Water Mist

Fine water spray systems fall into two main categories: single fluid systems utilise water stored at 40-200 bar pressure and spray nozzles that deliver droplet sizes in the range of 10 to 100 microns diameter; dual systems use air, nitrogen or another gas to atomise water at the nozzle. In both cases, the resulting heavy mist behaves in some respects like a dense gas but will not diffuse into shielded areas, consequently each water mist system has to be designed individually and a requirement may remain for response team intervention to extinguish small, obstructed fires.

The quantity of water required can be up to 100 times less than that in a sprinkler system. The result of this is that water mists do not conduct electricity in the same way as a solid stream of water, so sprays can be considered for use on live electrical equipment. Fine sprays can also be used on fires of flammable liquids but should not be used on substances that will react violently with water, such as reactive metals.

The major difficulties with water mist systems are those associated with design and engineering. The requirements to generate, distribute and maintain an adequate concentration of correctly sized droplets throughout the space mean that fire protection solutions must be individually tailored. Nevertheless, the technique is gaining approval.

Areas where fine water spray/water mist systems could provide a feasible alternative to halons include transformer and switchgear rooms, record storage, cultural heritage, flammable liquid hazards, shipboard accommodation, storage and machinery spaces and combustion turbine enclosures.

Inert Gas Generators

Inert gas generators utilise a solid material which oxidises rapidly, producing large quantities of CO₂ and/or nitrogen. This technology is a recent and continuing development, and its use has so far been limited to specialised applications such as engine nacelles and dry bays on a few new military aircraft where space and weight are major considerations. Significant work would be required to expand application of this technology to occupied areas but there is no concern regarding ozone depletion or global warming from inert gas generators.

Areas where inert gas generators might provide a feasible alternative to halons include aero engine compartments and aircraft dry bays.

Fine Solid Particulate Technology

This relatively new technology is used in conjunction with inert or halocarbon gases and so is included here. Aerosol and inert gases are formed pyrotechnically and may also require a halocarbon carrier gas; the solid aerosol acts directly on the flame, cooling it, the gases serve as a mechanism for delivering the aerosol to the fire. Solid particulates have very high effectiveness to weight ratios. They also have the advantage of reduced wall and surface losses relative to water mist and the particle size is easier to control. However, they may damage sensitive equipment, are not suitable for explosion suppression due to the high temperature at which they are generated and there are severe physiological problems associated with inhalation of particulate material in the size range required. These problems limit the utility of this technology to unmanned areas.

Areas where fine solid particulate systems could provide a feasible alternative to halons include telecommunications cabinets and automotive, boat and aero engine compartments.

Summary of Alternatives and their Applications

The table summarises the alternatives to halon which might be considered for a range of risks and in a range of applications. It must be emphasised that not all the recommended alternatives will be equally applicable in all such cases. Also, no account has been taken of issues such as the cost of the systems, the cost and complexity of installation, especially in differing circumstances such as new build *versus* retrofit, or of the level of maturity of and experience with the technology. All hazards are different, and it will continue to be important to obtain the advice of appropriate technical experts before selecting an approach.

ALTERNATIVE	TYPICAL HAZARDS						
	Telecom/ Computer/ Control Rooms	Record Storage	Cultural Heritage	Flammable Liquids	Shipboard Machinery Spaces	Transformer switchgear room	Aeroengine compartment
Automatic sprinklers	√	√	√	√ (only with foam)	√ (only with foam)	X	X
Detection and pre-action sprinkler	√	√	√	X	X	X	X
Detection and water sprays (mist)	X	√ (in rack)	√ (local)	√	√	√	X
Detection and total flood CO ₂	√	√	√	√	√	√	X
Foam	√ (under floor)	√	X	√	√	√	X
High sensitivity smoke detection aspirating systems	√	√	√	X	X	X	X
Detection and dry powder	X	X	X	√	√	X	X
Detection and manual intervention	√	√	√	X	X	X	X
Detection and inert gas	√	√	√	√	√	√	X
Detection and fine particulate aerosol	X	X	X	√	√	X	√
Detection and halocarbon gas	√	√	√	√	√	√	√

Key: √ means the alternative can be considered for the hazard
X means the alternative is not suitable for the hazard

Selecting a System

Once you have established which systems are technically capable of protecting against the hazard, the individual requirements for a specific project then need to be evaluated.

You may find the following checklist useful when selecting an alternative:

FIRE FIGHTING EFFECTIVENESS

- Speed of fire suppression
- Suitability for the fire hazard
- Post-fire hold time
- Ability to permeate
- Risk of re-ignition

DISCHARGE DAMAGE/EFFECT ON EQUIPMENT (COLLATERAL DAMAGE)

- Clean up
- Water damage
- Decomposition products and corrosion
- Condensation
- Thermal shock

INSTALLATION ISSUES

- Floor space/weight
- Pipework
- Ease of maintenance
- Time to re-instate system
- Installed cost
- Refill cost
- Availability of extinguishant

SUITABILITY OF ROOM FOR GASEOUS SYSTEM

- Capability of room to hold gas
- Desirability of room integrity test
- Need to seal leak paths

HAZARDS FOR OCCUPANTS

- Toxicity
- Noise levels
- Pressurisation
- Visibility
- Inhalation
- Safety with live electrical equipment
- Thermal decomposition products

ENVIRONMENTAL ACCEPTABILITY

- Ozone depletion
- Global warming
- Atmospheric lifetime

Maintenance

There is a statutory requirement for the regular maintenance, inspection and testing of fixed fire protection systems. This should be carried out by a competent person in accordance with the relevant British Standard or the manufacturer's/installer's specifications. Systems should also be serviced annually by a competent person.

Evaluation of Alternatives to Halon Portable Fire Extinguishers

In this section possible alternatives to halon 1211 (BCF) in portable extinguishers are evaluated. Halon 1211 was a universal extinguishant that could be used on a wide range of flammable materials. The alternatives may not be suitable for all hazards in a particular location and it may be necessary to select more than one type. It is, therefore, essential that staff are trained properly to identify different types of extinguisher and to use them.

Professional advice should be sought where metal fires or fires involving gases may be a hazard.

Streaming Water

Straight stream water is suitable for uses on fires of potentially smouldering materials such as wood, paper and fabrics which may leave glowing embers. Water is very efficient at cooling and so re-ignition is unlikely. The extinguishers have a long water jet that can be used to penetrate deep-seated fires.

This type of extinguisher is unsuitable for use on fires involving liquids or gases and in fact could spread a flammable liquid fuel. They should not be used on powered electrical equipment.

Water Fog (spray) (BS 5306 PART 2 1990)

Water spray extinguishers are most suitable for use on fires of potentially smouldering materials such as wood, paper and fabrics. They are particularly effective on burning embers but are less effective than streaming water on deep-seated fires.

Some water spray extinguishers can be used on electrical equipment but users should ensure that the extinguisher has been tested and certified appropriately.

Water spray extinguishers may offer a very limited capability on fires involving combustible liquids, again appropriate testing and certification, coupled with adequate training of the operator, are essential.

Foam Spray (BS 5306 PART 6)

Aqueous Film Forming Foam (AFFF) spray is a general purpose extinguishant which may be used, with appropriate training, on a wide range of flammable liquids and materials.

Foam spray extinguishers are relatively light and can be considered as a replacement for halon 1211 extinguishers in vehicles. They are also suitable, with the correct fire rating, for public service vehicles. Depending on the stream pattern, this type of extinguisher may not be safe for use on electrical equipment.

Carbon Dioxide

Carbon dioxide (CO₂) may be used safely on a wide range of flammable liquids and materials including live electrical equipment. Care must be taken, however, to avoid contact with any solid CO₂ which may form on any cold parts of the discharge tube and horn so as to avoid frostbite.

CO₂ is inexpensive but the containers are relatively heavy and the noise of the discharging gas can be alarming to the untrained user. Once the gas has dispersed re-ignition is a possibility.

Use of CO₂ is particularly recommended in computer and telecommunication rooms and similar applications on board ships.

Dry Powder

General-purpose (ABC) dry powder is an extremely effective extinguishant giving rapid knockdown on flammable liquids. It may also be used on potentially smouldering materials. The amount of clean up necessary after use is insignificant when compared to the loss and damage due to the fire.

HCFC (hydrochlorofluorocarbon) Agents

HCFC agents may not be used in the UK in portable extinguishers. It is not the policy of the fire industry to select halocarbons for use in this sector except in special circumstances and none are generally available on the market at present.

Training

Staff must be provided with such training in the use of fire fighting equipment as appears necessary according to the role they may be expected to play in a fire emergency situation. Training should be provided by a competent person.

Maintenance

Portable fire extinguishers should be maintained at regular intervals and in accordance with the requirements of BS5306 Part 3.

Environmental Issues

When considering an alternative to halon, you should look at its possible environmental impact.

HCFCs

Hydrochlorofluorocarbons (HCFCs) have ozone depletion potentials, and although they are less than those of halons, HCFCs remain controlled substances under the Montreal Protocol. EC Regulation 3093/94 (the previous Regulation on the use of ozone depleting substances in the EU) has already prohibited their use in fire fighting.

Global Warming and the Kyoto Protocol

Hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs) are important alternatives and replacements for some uses of ozone depleting substances. They are not ozone depleting gases and therefore are not covered by the Montreal Protocol but they are greenhouse gases (along with carbon dioxide, methane, nitrous oxide and sulphur hexafluoride). The UK's legally binding target under the Kyoto Protocol is to reduce emissions of all these greenhouse gases, together, by 12.5% based on 1990 or 1995 levels in the years 2008-2012.

UK Voluntary Agreement

UK Government and the UK Fire industry are reviewing the Voluntary Agreement on further reducing emissions of HFCs and PFCs in fire fighting applications in line with the UK Climate Change Programme.

Global Warming Potentials and Atmospheric Lifetimes

Trade Name	Designation	Chemical Formula	Global Warming Potential @ 100 yr. time horizon, relative to CO ₂ = 1	Atmospheric lifetime (years)
FE-13	HFC 23	CHF ₃	11,700	264
FE-125	HFC 125	CF ₃ CHF ₂	2800	33
FM-200	HFC 227ea	CF ₃ CHFCF ₃	2900	37
FE-36	HFC 236fa	CF ₃ CH ₂ CF ₃	6300	209
CEA-308	FC-2-1-8	C ₃ F ₈	7000	2600
CEA-410	FC-3-1-10	C ₄ F ₁₀	7000	2600
perfluorohexane	FC-5-1-14	C ₆ F ₁₄	7400	3200
NN100	IG-100	N ₂	0	permanent gas
Argotec	IG-01	Ar	0	permanent gas
Argonite	IG-55	N ₂ /Ar mixture	0	permanent gas
Inergen	IG-541	N ₂ /Ar/CO ₂ mix	0.08	permanent gas
Water mist			0	
Fine particulate aerosol			0	

Recovery

The new EC Regulation requires that halons and other ozone depleting substances shall be recovered if practicable when equipment is serviced or maintained as well as prior to when it is dismantled or sent for disposal. Currently the recovered halons may be recycled, reclaimed or destroyed; after 31st December 2002, they may be recycled or reclaimed only for critical uses. Recovered halons might have value to those companies with critical uses. From 31st December 2001 personnel involved in recovery and recycling will have to meet minimum qualifications.

Leakages

The new EC Regulation requires that all precautionary measures practicable shall be taken to prevent and minimise leakages of halons and other ozone depleting substances from fire protection systems during their manufacture, installation, operation and servicing.

You should take similar steps for systems containing HFCs, PFCs and other greenhouse gases. Clearly, this is desirable anyway: a leak in any fire protection system will affect the extinguishing performance and may even result in failure of the system.

Waste Regulations

Waste halons are already controlled by the waste management controls in the Waste Management Licensing Regulations 1994 and the Environmental Protection Act 1990. The relevant provisions are sections 33(1)(c) and 34 of the 1990 Act, which are designed to ensure that waste travels only along legitimate routes towards proper disposal or recycling without harm to the environment or health.

Section 33 prohibits the disposal and recovery of waste in a manner likely to cause pollution of the environment or human health. The duty of care imposed under section 34 requires all producers and holders of waste (except householders) to take all reasonable steps to keep the waste safe and ensure it is treated lawfully. Anyone concerned with controlled waste must ensure it is managed properly, recovered or disposed of safely; and must only transfer it, with a description of the waste, to someone who is authorised to receive it. Those authorised to receive controlled waste are registered waste carriers or brokers, local authority waste collectors and waste operations with a waste management licence or registered exemption from licensing.

Taken together, these provisions oblige the producer and holders of waste ODS to prevent, as far as reasonable in the circumstances, their release to the atmosphere through their own actions or those of others. You should therefore take great care to avoid any discharge of such controlled wastes and to ensure that all who handle them are authorised for the purposes of the duty of care.

Transboundary shipments of waste halons to other EU Countries are only permitted for recovery. Each movement is subject to the prior informed consent regime set out in the EC Waste Shipments Regulation EC 259/93.

System Testing

Pressure testing techniques are available which enable the gas tightness of a room to be accurately evaluated and for leak paths to be identified and sealed, thus increasing the time that the gas will be retained in the room and satisfying the requirements of the BFPSA Code of Practice for Gaseous Fire Fighting Systems. These techniques do not involve the discharge of any gas. Your supplier will be able to give you further information on how to test and maintain systems properly and safely.

Health and Safety Issues

Fire precautions systems are covered both by fire precautions legislation and by health and safety at work legislation:

- in some, albeit few, cases there are specific regulations relating to the selection and use of fire extinguishing systems. For example, the Fire Precautions (Sub-surface Railways) Regulations 1987 contain specific requirements for sprinkler systems. In addition, where a fire certificate is required under the Fire Precautions Act 1971, the fire authority may stipulate the type of system to be used;
- the risks from using the fire extinguishing system, and from the fire itself, need to be assessed under:
 - the Fire Precautions (Workplace) Regulations 1997 (as amended);
 - the Management of Health and Safety at Work Regulations 1999 (MHSWR); and - if the system contains carbon dioxide;
 - the Control of Substances Hazardous to Health Regulations 1999 (COSHH).

BOTH MHSWR AND COSHH:

- require risks to be assessed and prevented or, where this is not reasonably practicable, adequately controlled;
- are supported by Approved Codes of Practice that give additional information on the regulations and guidance and how to comply.

WHAT YOU SHOULD CONSIDER:

- Can the risk of fire be prevented eliminated or reduced? If this is possible, it may be acceptable to adopt an alternative fire protection strategy such as sprinklers or detection and manual intervention.
- If a fire protection system is necessary, can a system be used that does not contain a hazardous substance, such as a water sprinkler system?
- If you decide that you require a system containing a hazardous substance or a system that creates a hazardous atmosphere in use, it may be possible to install the system in such a way that exposure of people to the agent is either prevented or minimised. Such controls would include switching the operation of the system to manual control whilst the protected area is occupied or installing a localised system such as an in-cabinet system.

In some situations, such as those where there is a potentially rapid spread of the fire, an automatic system will be needed to protect an occupied space. In these situations, the system should be specified and designed in such a way that the atmosphere generated on discharge would not cause significant adverse effects on a normal healthy member of the population. The quantity of material used should be at the lowest level consistent with the efficient extinguishment of the envisaged fire.

For these limited situations the potential risk from the extinguishing agent will need to be critically evaluated. A group of experts working under the guidance of the Halon Alternative Group (HAG) have evaluated the toxic hazard for many new generation fire extinguishing agents and produced a review of the toxic and asphyxiating hazards of clean agent replacements for Halon 1301. This publication contains information on the concentrations of these agents that can be used in systems protecting occupied areas. It is available from the Loss Prevention Council or Halon Users National Council (HUNC) (see Bibliography and References at the end of this leaflet).

Advice on Halon System Management

Unless you operate systems that fall within the definitions of critical uses you may only refill your systems up to 31st December 2002 and may operate them only until 31st December 2003 at the latest. By that date the halon in the equipment should have been removed and either destroyed or held for recycling into critical uses.

You should carry out an audit of all your equipment to find out what relies on halon and what, if any, falls into the critical use category. You then need prioritised plans to deal with the equipment that cannot be operated using halon beyond 2003. This will involve alternative agents or replacement fire protection measures and will have to be tailored individually to your systems. The halon recovered in the process of implementing these plans may be recycled into critical uses.

Halon from surplus systems may need to be re-certificated to original "as new" specification. A number of companies in the UK have the ability to reclaim halon to ISO/BS/MIL standards. These same companies will advise you on managing your fire protection requirements through the halon phase out period.

The Halon Users National Consortium (HUNC) was formed by a number of halon users and the fire industry with the support of Government. Its long-term aim is to ensure that existing stocks of halon in the UK can be managed down to zero in a responsible manner.

HUNC will be able to help you to manage your company's response to the changes. It can advise on disposal of your halons or, should you require supplies for critical uses, help you to find halons to keep these systems running.

HUNC:

- Acts as a clearinghouse for sales of recovered halons.
- Can provide a list of companies who will reclaim recovered halons to a recognised specification.
- Advises on the safe handling and disposal of halons.
- Acts as link between UK users and halon clearing houses and stockpiles in other countries.

Checking your new System and Installer

The need to comply with the regulations related to the Montreal Protocol restricting the use of ozone depleting substances should not be allowed to jeopardise the safety of people and property that is provided by good fire protection practice.

Where standards for new systems are in the course of preparation, you are advised to use companies approved to ISO 9001 or EN29001 (BS5750 Part 1) for Design/Development of Fire Protection Equipment and System Approval, or are able to show an equivalent level of competence.

To assist you in selecting alternative systems you should ensure that your suppliers, advisers and installers:

- Can provide evidence of compliance with BSI/LPCB/NFPA standards or specifications, where these exist, relevant to the chosen system.
- Are using BS/LPCB/UL/FM/VdS listed or approved equipment wherever possible.
- Are accredited and listed to BSEN ISO 9000 QA system for manufacture.
- Are full members of a relevant Trade Association, (examples from the UK are BFPSA, FETA or BASA. Similar organisations operate in other EU Member States).
- Comply with the UK Fire Industry Code of Practice (or equivalent).

Independent Approvals

One of the best ways to assess the fire fighting capability of an alternative system is to check what independent approvals it has obtained.

The following are generally considered to be among the leading independent approvals authorities:

Loss Prevention Certification Board (LPCB)	UK
U.K. Department of the Environment, Transport and the Regions, Marine Safety Agency	UK
Lloyds Register of Shipping	UK
Verband der Sachversicherer (VdS)	Germany
Underwriters Laboratories (UL)	USA
Factory Mutual (FM)	USA
U.S Coastguard	USA
Assemblée Pleniére de Societes Assurances Domages (APSAD)	France
Det Norske Veritas (DNV)	Norway
Scientific Services Laboratory (SSL)	Australia

Useful information

Contacts

DTI ENVIRONMENT DIRECTORATE
151 Buckingham Palace Road
London SW1W 9SS
Tel: 020 7215 1018
Fax: 020 7215 1691
Website: www.dti.gov.uk

DETR GLOBAL ATMOSPHERE DIVISION
Floor 3/A3 Ashdown House
123 Victoria Street
London SW1E 6DE
Tel: 020 7944 5233
Fax: 020 7944 5219
Website: www.detr.gov.uk

HALON USERS NATIONAL
CONSORTIUM (HUNC)
Global House, College Street
Petersfield, Hampshire GU13 4AD
Tel: 01730 264 040
Fax: 01730 269 042
Website: www.hunc.org

ENVIRONMENT AGENCY
Head Office - public enquiries
Rio House, Waterside Drive
Aztec West, Almonsbury
Bristol BS32 4UD
Tel: 01454 624411
Fax: 01454 624409
Website:
www.environment-agency.gov.uk

To be put through to your local
Environment Agency office, telephone
0845 9333111

THE LOSS PREVENTION COUNCIL,
Melrose Avenue, Borehamwood,
Herts, WD6 2BJ,
Tel: 020 8236 9600
Fax: 020 8207 6305

FIRE INDUSTRIES CONFEDERATION
55 Eden Street
Kingston Upon Thames
Surrey KT1 1BW
Tel: 020 8549 8839
Fax: 020 8547 1564

BRITISH STANDARDS INSTITUTE (BSI)
Customer Services
389 Chiswick High Road
London W4 4AL
Tel: 020 8996 9001
Fax: 020 8996 7001
Email: info@bsi-global.com

Literature

Environmental Protection Act 1990
HMSO Publications Centre
ISBN 0-10-544390-5

Environment Act 1995
HMSO Publications Centre
ISBN 0-10-542595-8

Management of Health & Safety
at Work Regulations Approved Code
of Practice (1999)
ISBN 071 762 4889

Control of Substances Hazardous
to Health Approved Code of Practice
(1999)
ISBN 0 717616703

Climate Change -
The UK Programme, DETR
ISBN 0101491328 available from HMSO
publications or DETR on www.detr.gov.uk

"A review of the toxic and asphyxiating
hazards of clean agent replacements for
Halon 1301" from the Halons Alternative
Group. (1995) updated Feb 2000
Contact Halon Users National Council
(HUNC) for further information.

Halon Technical Options Committee
(HTOC) Report - UNEP, 1998
Available from
http://www.teap.org/html/halons_reports.html

HTOC Technical Note No. 1: Fire
Protection: New Technology Halon
Alternatives
http://www.teap.org/html/halons_reports.html

HTOC Technical Note No 2: Halon
Emissions Reduction Strategy
http://www.teap.org/html/halons_reports.html

HTOC Technical Note No. 3: Explosion
Protection - Halon use and Alternatives
http://www.teap.org/html/halons_reports.html

Fire Industry Code of Practice. Contact
British Standards Institute for details.

Code of Practice for Gaseous Fire
Extinguishing Systems, Physical
Properties and System Design
(BSISO14520). Parts 1-15
Contact British Standards Institute
for details.

Other New DTI/DETR Publications

Guides to the Impact of New
EC Ozone Regulations:

Overview of the New Regulation
URN 00/1153

Solvent Applications including
dry cleaning
URN 00/1155

Refrigeration & Air-conditioning
Applications
URN00/1156

The above booklets can be ordered
from EC Logistics by
Fax: 0870 150 2333,
Tel: 0870 150 2500 or email your
requests to: dtipubs@eclogistics.co.uk

