

UNEP/OZL.PRO/WG.1/9/6

# Montreal Protocol

*Executive Summary of*

## **The 1993 Report of the Halons Technical Options Committee**

*July 1993*



EXECUTIVE SUMMARY OF THE 1993 REPORT OF THE  
TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL

ES.1. HALON PRODUCTION/CONSUMPTION EXEMPTION FOR ESSENTIAL USES

The Technology and Economic Assessment Panel thanks the Halon Technical Options Committee for their hard work in the first implementation of the Copenhagen Essential Use Decision.

The Technology and Economic Assessment Panel agrees with and endorses the unanimous recommendation of the Halon Technical Options Committee that it is technically and economically feasible to eliminate the use of halon in some applications for which exemptions were requested and that adequate halon supplies are available from stockpiled and recycled sources for those applications where alternatives and substitutes are not yet developed and/or approved. Thus, no application for halon production in 1994 has met the Essential Use Production/Consumption Exemption Criteria as passed in Copenhagen in 1992.

Halon 1301 is also used in minor amounts particularly for servicing purposes in cold-temperature refrigeration applications. The bank of halon is also sufficient to supply these uses.

While the existing supply of stockpiled and recycled halon is adequate to supply essential applications in 1994 and beyond, work must continue in organizing and managing national and international halon banking transactions. The Halon Technical Options Committee Report on Halon Banking offers valuable advice on how halon banking can be promoted and on how the UNEP IE/PAC office can facilitate international transfers for critical uses.

Although no exemption for halon is required for 1994, the process of application and review has been valuable. Through self-evaluation companies and Parties have learned about the challenges they face in the halon phaseout and are cooperating on solutions; networks of experts have mobilized to more specifically identify alternatives and substitutes for the most critical uses; halon banking has been energized and is a high priority for work for 1994. Some potential applicants notified their countries that they would depend on halon banking in 1994 and as long as possible but that they may apply for essential use in future years if alternatives and substitutes are not forthcoming for their applications and if halon is not available from the banks.

It is encouraging to note that some organizations are conspicuous by the absence of applications for essential use. Military organizations in Russia, Sweden, United Kingdom, and the

United States and the U.S. National Aeronautics and Space Administration will rely on halon banking for critical military and space exploration needs; not one manufacturer of military or civilian aircraft requested an exemption; and many off-shore oil producers including Arctic locations will depend on banking. Support of these organizations that have had critical uses of halon has been valuable in persuading users with other critical applications to also depend on halon banking. The North Atlantic Treaty Organization (NATO) officially supported the acceleration of phaseouts of ozone-depleting substances in 1992 and assisted military organizations in achieving a consensus to depend on banking.

It is also significant that applications are primarily for halon 1301 and not halon 1211. It could be economically and environmentally prudent to accelerate efforts to halt halon 1211 production for developing countries.

## ES.2. PROGRESS IN ELIMINATING CONTROLLED SUBSTANCES

Developed and developing nations Party to the Protocol continue to make progress in reducing and eliminating substances controlled by the Montreal Protocol. Most developed Parties are well below the amounts authorized under the phaseout schedule. As a result of this rapid progress by consuming nations, many CFC production facilities are already closing or switching to HCFC production. Article 5 developing nations continue to phaseout CFC use in aerosol product and other sectors. Developing nations not qualifying under Article 5 have equalled or exceeded the rate of reduction of developed nations.

These national and regional reductions are being accomplished through a variety of sector-specific achievements that can and will be duplicated in other nations. These phaseouts demonstrate the technical and economic feasibility of global elimination in these sectors.

Individual companies have achieved complete phaseouts in their global operations. Chemical producers are rapidly commercializing chemical substitutes in adequate quantities to meet growing market demands. Some of the most significant corporate achievements since the 1991 Assessment are: Audi, BMW, Nissan, Porsche, and Volvo cars have converted from CFC-12 to HFC-134a in 1993 and 12 other companies introduced HFC-134a into some of their vehicle models. By the end of 1993 almost all new car models in the United States will have shifted; most automobile manufacturers will phaseout worldwide by January 1995; over 60 manufacturers from Canada, Germany, Japan, Sweden, and the United States halted by May 1993 the use of CFC-113 in global operations. Most multinational companies are not requesting funding for the portion of joint-venture company owned by residents of the Article 5 nations where it is located. Lockheed

Fort Worth Company manufactured the first sophisticated fighter aircraft (F-16) virtually without CFC and methyl chloroform; Lufthansa eliminated CFC and methyl chloroform solvents from commercial aircraft maintenance; in 1993 Matsushita is the first company to manufacture diversified household consumer appliances without the use of CFC and methyl chloroform; Hoechst opened the first substitutes factory in a developing country (manufacturing HFC-134a in Brazil); DuPont announced that they will close their CFC facilities in developed nations by January 1995 and concentrate on production of substitute chemicals; Japanese chemical producers have achieved efficiencies and economies of scale that have reduced the price of HFC-134a to levels approaching the competitive equilibrium of US \$3.30 to 6.00 per kilogram (3-5 times the 1986 CFC price).

Some Parties are implementing phase out strategies and regulations more stringent than the Copenhagen Adjustments and Amendments to the Montreal Protocol. The European Community will phaseout production and imports of CFC, methyl chloroform, and carbon tetrachloride by January 1995; Canada will phaseout carbon tetrachloride by 1995; the United States has proposed a complete phaseout of methyl bromide by 2000; Denmark has proposed a methyl bromide phaseout by 1998 with exemptions for essential uses; the EC is proposing a 25 percent reduction in methyl bromide in 1996; Canada, the EC, Netherlands, Sweden, Switzerland, and the United States are proposing product use restrictions, a lower initial cap and/or accelerated phaseout for HCFCs.

There continues to be a lack of understanding in many developed nations of the process of the Montreal Protocol and its impact on the availability of many widely used materials. Those needing to be more aware of its impact include end users, government instrumentalities, and commercial suppliers and distributors. A continuing effort is required to publicise the progress towards phaseout of ODSs.

The phaseout in developed nations is rapidly affecting the developing nations. ODS production facilities are closing, technology dependent on ODS is becoming obsolete, and developed country markets for developing country products are demanding products not containing ODS.

There is some concern that refrigeration, air conditioning, and solvent equipment dependent on CFC will be dumped in developing nations. Such dumping could substantially increase the incremental cost and could delay phaseout in Article 5 nations and could unnecessarily release chlorine to the stratosphere.

Some developed nations are experiencing spot CFC shortages and significant price increases while other nations have experienced price reductions. Some companies, particularly those

that have not selected a substitute, are concerned whether they will be able to contract for adequate supplies of new chemicals. Suppliers of alternative equipment and chemical substitutes are expressing the concern that they may not be able to supply equipment if too many decisions are made at the end of the phaseout. The producers of new chemicals are currently operating their facilities below capacity and are concerned whether they will recover their investment as quickly as planned.

Driven by regulatory initiatives and by Non-Government Organizations (NGOs), the use of hydrocarbons is also being considered for new appliances and marketed in used refrigerators despite flammability, stability and efficiency concerns. Small refrigerators are already being marketed in Germany that use hydrocarbons in the refrigeration circuit. However, the criticism of the global warming potential of HFC-134a--an argument also used by the appliance manufacturers in the promotion of their products--creates uncertainties among the users who are considering conversion to HFC-134a in other sectors. The Panel cautions that used refrigerators with CFC-12 removed and replaced with propane are being exported to developing nations in Africa and the Middle East. Although the risk of fire may be acceptable, it is desirable that customers understand that the product is more hazardous. Furthermore, these refrigerators may be less reliable and may consume more energy.

ES.3. TECHNICAL AND ECONOMIC FEASIBILITY OF IDENTIFYING PRODUCTS MADE WITH BUT NOT CONTAINING CONTROLLED SUBSTANCES

Since, by definition this category of products was manufactured with, but no longer contains Annex A substances, either trace residues must be identifiable or efforts must be undertaken to inspect manufacturing processes. Inspections would only be administratively feasible with the cooperation of exporting companies and their governments.

For those limited products where trace residues would be present, portable gas chromatography (GC) may be suitable for field screening of suspected samples. EC-FID and possibly EC-ECD may be necessary. The EC-ECD detects CFC in parts-per-billion (ppb). Laboratory confirmation could use GC Mass spectrometry.

However, there are no internationally accepted sampling and testing protocols to detect such residues and there is no threshold value of residue that defines "made with". Furthermore, international legal standards of proof may need to be elaborated. In some cases, testing may require destruction of the product.

It is not technically or economically feasible to determine whether controlled substances were used: as solvents in the

manufacture of electronic, metal or other parts or products; as mould release agents in the manufacture of plastic products, drugs or as unintentional ingredients in products manufactured with CFC as a feedstock. Little, if any, residue of controlled substances would be present or detectable. It is theoretically possible to employ forensic chemical strategies to surmise where CFC was used as a cleaning solvent by examining the soil residues for a "fingerprint." The Technology and Economic Assessment Panel is not aware of any studies that have investigated whether it is technically feasible to identify such products in this way.

It will be very difficult to select which products to subject to laboratory testing or to factory inspection since virtually every product in trade might have a component that was manufactured with a controlled substance. There is no possibility of using a product code or other simplifying practice for customs agents.

If the Parties decide at their 5th meeting to elaborate products in an Annex, the earliest possible date for adopting the Annex is at the 6th meeting of the Parties in 1994. A new Annex from the 6th meeting might enter into force late in 1995 to be implemented under Article 4(4) one year after entry into force. This process would therefore take almost three years after the halon phaseout and months after the CFC phaseout. Further, virtually all nations with major manufacturing of these products have already ratified the Protocol and the number of non-Parties with such manufacturing is insignificant.

In light of these technical and economic difficulties of detection and inspection, and the comprehensive global membership in the Protocol, the Parties may want to consider whether additional import restrictions will significantly increase the incentive for countries not Party to the Protocol to join. These nations are already influenced by prohibitions on sale of controlled substances from countries Party to the Protocol and from restrictions on import by Parties of products containing CFCs and halon.



## 1.1 Introduction

The adjustments adopted at Copenhagen by the Fourth Meeting of the Parties to the Montreal Protocol mandated a phase out of production and consumption of halons by January 1, 1994, save to the extent that the Parties decide to permit the level of production or consumption that is necessary to satisfy uses agreed by them to be essential. Decision IV/25 of the Fourth Meeting set the criteria and the procedure for assessing an essential use and requested each Party to nominate uses it considers essential to the Secretariat, at least six months before the Fifth Meeting of the Parties to the Protocol. This decision also requested the Halons Technical Options Committee to consider and recommend on the nominations.

May 15, 1993 was fixed as the last date for nominations. The Halons Technical Options Committee and the Technology and Economic Assessment Panel drafted detailed guidelines for nominations. These were communicated to the Parties on March 29, 1993.

The following Parties responded, as indicated:

Country	Status	Production/consumption
Australia	Party	Not required
Austria	Party	
Belgium	Party	
Canada	Party	Not required
Czech Republic	Not a Party	
Denmark	Party	Not required
Egypt	Article 5	
El Salvador	Article 5	
Finland	Party	
France	Party	
Germany	Party	
Iceland	Party	Not required
Ireland	Party	
Israel	Party	
Italy	Party	
Jamaica	Article 5	
Japan	Party	
Jordan	Article 5	
Malaysia	Article 5	
Malta	Party	
Morocco	Article 5	
Norway	Party	Not required
Pakistan	Article 5	
Peoples Republic of China	Article 5	
Poland	Party	
Seychelles	Article 5	
Singapore	Party	
Slovak Republic	Party	
Spain	Party	
Sweden	Party	Not required
Thailand	Article 5	
Tunisia	Article 5	
United Kingdom	Party	
United States of America	Party	Not required

The nominations from Article 5 Parties are not required since paragraph 7 of Decision IV/25 clarified that essential use controls will not be applicable to such Parties until the phase out dates applicable to them. Therefore, these were not considered.

The criteria for "essential" use set by Decision IV/25 has two important elements. Each Party should demonstrate that:

*It is necessary for the health, safety or is critical for the functioning of society (encompassing cultural and intellectual aspects); and*

*There are no available technically and economically feasible alternatives or substitutes that are acceptable from the standpoint of environment and health; and*

Production and consumption, if any, of a controlled substance should be permitted only if:

*All economically feasible steps have been taken to minimise the essential use and any associated emission of the controlled substance; and*

*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".*

The Halons Technical Options Committee reviewed all of the submitted nominations for consumption/production exemption. In general it appears that for almost all of the nominations, alternative technologies now exist, particularly for new installations. As well there were no nominations that could satisfy the requirement that halons are not available in sufficient quantity and quality from existing stocks of banked or recycled halons.

## 1.2 Availability of halons

In its 1991 report the Halons Technical Options Committee found that if production ceases in 1995 "the bank of Halon 1301 would be adequate to supply maintenance quantities for equipment for at least 40 years after production ceases." The Committee finds that the calculations for the 1995 phase-out apply equally for the 1994 phase-out. According to the Committee's conservative estimates the world available stock of halon 1301 will be about 66,000 tonnes by the end of 1993. Of this about 5,400 tonnes will be retired from service and available for recycle world-wide in the year 1994. The total request for production and consumption exemptions for 1994 was less than 200 tonnes which represents 3.7 % of the total available.

For halon 1211 the stock at the end of 1993 will be about 69,000 tons and about 1,200 tonnes will be available for recycling in 1994. The total request for production and consumption exemptions for 1994 was about 85 tonnes which represents 7.0 % of the total available.

For halon 1211 and halon 1301, details on the calculated bank sizes will be found in Appendix Three.

The request for exemption for halon 2402 was for only 2 tonnes for 1994. It would appear that this could reasonably be provided from existing stocks.

The nominations indicate a need to improve the availability of information on managing the supply of halons where banks presently do not exist. Appendix Two (of the full report) on bank management provides guidance to help establish the necessary banking procedures in the nominating countries. UNEP IE/PAC will support transfer of information on how to access existing banks. This will assist countries with small halon banks to access halons through the free market process of other countries banking schemes.

Involvement by national governments is crucial to the effort to encourage investment in recycling facilities and the formation of national halon banks. Further, co-operation at the international level must be established to ensure that one nation does not destroy halon while another continues to produce it to meet the needs of essential uses. National regulations should facilitate imports and exports of recycled halons wherever possible.

All producers in the developed countries have either closed their manufacturing plants or have indicated their intention to do so by the end of 1993. The probable method for any halon production in 1994 and beyond, were it allowed, is likely to be by small scale production at a cost expected to be much in excess of the current price. This significantly improves the economic feasibility of alternative fire protection means and replacement chemicals. It is not known whether nominees attempted to meet their 1994 needs through the purchase of readily available, newly produced halon before the phase out date in 1993.

The Committee is very concerned that exempting those users that clearly have important halon fire protection needs will diminish efforts to establish and develop halon bank management procedures. It might also encourage continued reliance on the use of halons and impede the further development of replacement agents and the implementation of alternative fire protection strategies.

### **1.3 Alternative fire protection technologies**

In general, the information provided with the nominations was insufficient for a detailed analysis of the fire protection options available for specific cases. It is recommended that those with the responsibility of making final fire protection determinations consult with experienced and competent fire protection engineers to achieve an acceptable degree of fire risk reduction for the specific cases nominated. This review by the Halons Technical Options Committee should not be construed as a definitive fire protection recommendation for specific fire risks.

A brief discussion of each of the nominations and the possible alternative protection technologies follows. Further information regarding alternatives to halon fire suppression systems and portable fire extinguishers is provided in Appendix One (of the full report). In many cases the need for an alternative suppression system may be eliminated by thorough application of improved facility design. Such measures include compartmentation, control of material flammability, control of ignition sources, advanced detection technologies, smoke control, emergency ventilation (for flammable vapours), etc. However the following discussion assumes that where appropriate, secure, early

warning fire detection and alarm systems are provided. The potential application of these features was in general not described in the essential use nominations. Any hazard for which the use of halon is proposed should be subjected to a complete hazard assessment and design review including a complete evaluation of alternative fire hazard mitigation strategies and techniques.

It should be noted that, while the Halons Technical Options Committee believes that replacement chemicals are now commercially available for most new applications, the systems engineering necessary for new and for retrofit applications is not yet complete in all cases, and retrofit may not be feasible. In applications for which zero ODP gaseous chemical agents are available (versus non-zero ODP agents) the zero ODP agents were specified.

## 1.4 Conclusions

In conclusion, the Committee believes that there is no justification for granting halon production/consumption exemptions for 1994.

As there was no need to recommend production/consumption exemptions the Halons Technical Options Committee makes no specific recommendation as to the essentiality of any nominated use. The Halons Technical Options Committee further recommends that creating a list of 'essential applications' is neither appropriate nor necessary. In fact the creation of a list may be detrimental to the rapid elimination of dependency on the halons.

## 2 Alternatives for nominated uses

### 2.1 Telecommunications Facilities, Computer Rooms, and Control Rooms

A large fraction of the proposed essential uses involve facilities requiring protection of electronics equipment. For all of these applications, alternative technologies now exist for use in new facilities. Retrofit of existing halon installations with these new technologies appears feasible in many applications.

#### Fixed Fire Suppression Systems:

There are a wide range of potential alternatives to halons in electronics facilities. These include both traditional and new technologies. The optimum protection scheme for a particular facility will be driven by the details of a specific installation. The Halons Technical Options Committee believes that feasible alternatives exist for all of these applications.

The potential alternatives include:

- Automatic sprinkler systems, including the use of pre-action features, and quick response sprinkler heads.
- Zero ozone depletion, clean agent total flooding gas systems.

- Inert gas total flooding systems.
- Partial flooding gas systems including CO<sub>2</sub> for subfloor and cabinet protection.
- The use of water mist systems for in-cabinet protection.
- The use of very high sensitivity detection systems.
- Consideration of alternative design strategies to eliminate the need for active fire suppression systems particularly in facilities manned at all times.

#### Portable Fire Extinguishers:

Feasible alternatives exist for halon 1211 portable extinguishers in these applications. CO<sub>2</sub> or new clean agent portable extinguishers are available.

## 2.2 Records Storage

Several essential use nominations were received involving protection of records storage areas including medical or other vital records.

#### Fixed Fire Suppression Systems:

There appear to be a wide range of feasible alternatives to halons for protecting vital record storage. These include:

- Automatic sprinkler systems including the use of pre-action and/or quick response features.
- Zero ozone depletion clean agent total flooding systems.
- Inert gas total flooding systems.
- Partial flooding of modular record retrieval systems using gases including CO<sub>2</sub>.
- Water mist systems.

#### Portable Fire Extinguishers:

The use of water-based portables, CO<sub>2</sub> portables, and extinguishers using new clean agents are considered feasible alternatives to the use of halon-based extinguishers for record storage applications.

## 2.3 Cultural Heritage

### Fixed Fire Suppression Systems:

The protection of objects of cultural heritage can be feasibly accomplished using technologies similar to those proposed for vital records storage. The optimum protection scheme is a function of the objects or facility being protected. The Halons Technical Options Committee believes that feasible alternatives to the use of halons exist for this application. The range of alternatives includes:

- Automatic sprinkler systems including the use of pre-action and/or quick response features.
- Zero ODP clean agent total flooding systems.
- Inert gas total flooding systems.
- Partial flooding of enclosures with gases including CO<sub>2</sub>.
- Water mist systems.
- Very high sensitivity detection systems.

### Portable Fire Extinguishers:

The use of water-based, CO<sub>2</sub>, or clean agent portable extinguishers as alternatives to halon-based extinguishers is considered feasible.

## 2.4 Flammable Liquid Hazards

### Fixed Fire Suppression Systems:

Facilities involving the storage, handling, or processing of flammable liquids potentially involve the use of fire suppression, explosion inerting and/or explosion suppression systems. Explosion suppression systems protecting unoccupied spaces are currently being provided with dry powder, water and zero ODP gas systems. No effective alternatives have been demonstrated for explosion suppression in occupied areas. Explosion inerting alternatives involving the use of zero ODP clean gaseous agents look promising and are currently under development. However there is concern that the only feasible gaseous inerting agents from a human health standpoint may have global warming properties. Hence, it is not clear that these agents will become commercially available. This would effectively eliminate the only currently possible halon alternatives for inerting use.

There appears to be a range of feasible alternatives for fire suppression systems in these application.

These alternatives include:

- Total flooding zero ODP gases.
- Inert gas total flooding systems (assuming discharge time and evaluation of potential human health effects is acceptable).
- CO<sub>2</sub> total flooding systems (assuming personnel hazards can be managed and discharge time is acceptable).
- Low expansion foam sprinkler and spray systems.
- Water mist systems.
- Total flooding dry chemical systems (potentially limited to small enclosures).

#### Portable Fire Extinguishers:

Portable extinguisher alternatives for these facilities include CO<sub>2</sub>, clean agent gases, dry chemical, and low expansion foam-based portables.

## **2.5 Shipboard Machinery Spaces**

Shipboard machinery spaces are similar to flammable liquid hazard areas that are more sensitive to fire protection system space and weight requirements.

#### Fixed Fire Suppression Systems:

Feasible alternatives exist for new ship design and for current construction where space and weight allowances can be made.

These alternatives include:

- Total flooding zero ODP gases.
- Inert gas total flooding systems (assuming discharge time and evaluation of potential human health effects is acceptable).
- CO<sub>2</sub> total flooding systems (assuming personnel hazards can be managed and discharge time limits are acceptable).
- Low expansion foam spray or sprinkler systems.
- Water mist systems.
- Total flooding dry chemical systems (potentially limited to small enclosures).

Portable Fire Extinguishers:

Portable extinguisher alternatives for these applications include CO<sub>2</sub>, clean agent chemicals, dry powder, and low expansion foam.

## 2.6 Military Ground Combat Vehicles

Fire Protection Systems:

Feasible alternatives exist for unmanned compartments including engine compartments.

Potential alternatives include:

- Zero ODP gases
- Total Flooding CO<sub>2</sub>
- Total flooding dry powder

There are no demonstrated alternatives to crew compartment explosion suppression applications. Research and development efforts are being actively pursued.

Portable Fire Extinguishers:

Feasible alternatives such as dry chemical, zero ODP gases, and CO<sub>2</sub> exist for portable extinguishers in this application.

## 2.7 Aviation Applications

Fixed Fire Suppression Systems:

No alternative technologies have been demonstrated for protection of aircraft engine nacelles. Research and development is being actively pursued.

For the design of new aircraft, potential feasible alternatives for cargo, baggage and avionics compartments exist and should be used. These include zero ODP gases, water mist, and dry chemical systems.

Portable Fire Extinguishers:

Feasible alternatives exist for portable extinguisher applications on aircraft. Zero ODP gases and dry powder are the most promising.

## 2.8 Locomotive and Railroad Applications

### Fixed Fire Suppression Systems:

In general, it appears that feasible alternatives exist for future systems. For both locomotive and vehicle/passenger carriages the use of zero ODP gases appear to be feasible alternatives. For locomotive applications alternatives also include dry chemical and CO<sub>2</sub> based systems.

### Portable Fire Extinguishers:

Feasible alternatives exist for portable extinguishers in rail applications. Zero ODP gaseous agents, dry chemical, and CO<sub>2</sub> portables are acceptable alternatives to halon-based portables.

## 2.9 Other nominations

Insufficient information was provided with the nominations for any technical evaluation to be undertaken. However, adequate banked halons would be adequate to satisfy the needs of these applications.

## 3 Decision IV/26

### 3.1 Introduction

Decision IV/26 also requested a response from the Halons Technical Options Committee on various technical issues. The response to these queries is as follows:

In Copenhagen the Parties to the Montreal Protocol asked UNEP IE/PAC to act as a clearing house for information relevant to international recycled halon bank management. In looking at what more could be done to facilitate international bank management, the Halon Technical Options Committee concluded that UNEP IE/PAC should hold details of all known halon banking schemes and a list of those 'banks' with halon for sale. Such information will be regularly updated and provided upon request to those requiring halons.

UNEP IE/PAC should also provide on request information on how the halon 'banks', either proposed or in existence, function. Parties are encouraged to submit to UNEP IE/PAC such information which should include a contact address, telephone and fax numbers for the organisation concerned.

### 3.2 Standards

The Committee concludes that at this stage there are no methods to distinguish between newly manufactured and recycled material. It further considers that ISO 7201 and ASTM

ES24-93 are appropriate technical standards for recycled halon. Nitrogen is usually added in order to reuse the material and therefore it is suggested that a higher level of nitrogen could often be tolerated in the recycled product. It should be noted that efforts are presently under way to develop other suitable standards for recycled material.

The Committee also noted that if detailed and reliable records of the servicing history of the material are available, these might obviate the need for quality and certification, providing the potential user had confidence in those records.

### 3.3 Trade

Although the Committee had commenced its investigation into legal and institutional barriers to trade in recovered and recycled material, it was not able to finish its work in time for the publication of this report. The Committee will continue to investigate this issue.

The Committee noted that in most cases Governments do not import or export halons for recycling; this trade occurs between individual companies. The Committee therefore recommends that the principle of buyer beware should apply. Purchasers of recycled halon might consider asking for a certificate of quality or an analysis from the vendor as part of the contract of sale.

The Committee had been asked to look at means to avoid the export of halons in quantities that would encourage excessive dependence by the recipient countries. This work is not yet complete but the Committee will be considering a number of possibilities including

- the application of the essential use criteria by the recipient country
- export permits
- export only to countries which have agreed not to consume newly produced material
- Prior Informed Consent (PIC)

The Committee also recognised that undue restrictions might lead to venting in one country or dependence on newly produced halon in another.

### 3.4 Contaminated halons

Most recycling machines can remove moisture, oil and particulate contaminants through drying and filtration. The more serious common contaminants, such as CFC 12 and mixtures of 1211 and 1301, can only be dealt with through use of a distillation tower.