

The January 1, 1994 phaseout of halon production has had an ongoing and dramatic impact on the protection of special hazards against fire and explosion. Halons are clean, non-conductive, safe for people and highly effective. Replacing them in their many applications continues to present challenges for fire protection professionals.

Introduction

Alternatives are now available for the majority of halon uses. The purpose of this paper is to provide a brief review of the issues concerning halon systems, the types of alternatives that are available and manufacturer/vendor information on specific alternatives. This a developing area and new options are now becoming available as exemplified by the recent Dupont product, ECARO.

Under the Clean Air Act (CAA), the US banned the production and import of virgin halons 1211, 1301 and 2402 beginning January 1, 1994 in compliance with the Montreal Protocol on Substances that Deplete the Ozone Layer. Recycled halon and inventories produced before January 1, 1994 are now the only sources of supply.

The EPA's final rule, published March 5, 1998 (63 FR 11084), prohibits the intentional release of halon and improper disposal of halon and halon-containing equipment. The rule became effective April 6, 1998. Laws vary by region.

- In the US, it is legal to continue to use an existing halon system. It is even legal to purchase recycled halon and halon produced before the phaseout to recharge your system. An alternative system would need to be provided if a halon system were removed or modified. The US EPA also

reviews and has guidelines for halon alternatives. Current information can be found on a trade industry web site, www.harc.org, which includes a document called "AcceptableHalon Alternatives under EPA's Significant New Alternatives Policy (SNAP) Program." (See Total Flooding Agents – Table 1.)

- In European Union (EU) territories, Halon 1301 gas protection systems were prohibited and needed to be removed as of December 2003. Some "critical" applications such as approved military systems may be exempt.
- In Canada, a phaseout approach is being tried. The filling of extinguishing systems would be limited to one refill between now and 2010 if the system is replaced with an alternative within one year of the refill.
- In other parts of the world, similar requirements have been enacted. These vary by country. For more specific information, contact your local Willis office.

Some "green" or environmentally conscious companies have decided to voluntarily replace their halon systems for environmental reasons.



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Halon Alternatives

The alternatives to Halon 1301 include traditional fire protection systems, gas protection systems such as inert natural gas systems (e.g., Inergen, CO₂), halocarbon systems (e.g., FM-200, FE-25), vaporizing pressurized fluid (Novec 1230) or other options such as water mist protection.

Traditional Fire Protection Agents. The use of traditional, non-halon fire protection materials such as dry chemical, CO₂, water sprinklers and foams to protect special hazards has been promoted as a means of replacing halon use and should be used in specified applications as directed by manufacturers and NFPA standards. These systems can provide adequate fire control but some can also result in damage due to contamination or the effects of the agent itself. (i.e., water, powder or foams). The new agent (i.e., CO₂) may also create additional life-safety concerns in occupied areas.

Halocarbon Agents. These are chemical agents that contain chlorine, fluorine or iodine either individually or in some combination. Classes of agents include hydrochloro-fluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and fluoroiodocarbons (FICs). These agents share several common characteristics. Trade names include FM-200 and FE-25 (liquefied gases) and Novec 1230 (compressible liquid).

Inert Gases. Inert gas systems are designed to reduce the ambient oxygen concentration in a protected space to between 10 and 14 percent, a level that is breathable, but will not support flaming combustion. These systems use inert gases such as argon and nitrogen, either in mixtures or alone. Inert gases are electrically non-conductive, clean agents. (Example of trade name: Inergen.)

Water Mist. Water mist systems extinguish fires using small amounts of water released as tiny droplets under low, medium or high pressure. These systems use specially designed nozzles to produce much smaller droplets than those produced by traditional water-spray systems or conventional sprinklers. The smaller droplets are more effective at extinguishing fires and, therefore, less water is needed.

Vaporized Fire Protection Fluids. These are fluoroketone-type materials with a very low vaporization point. They are stored as a liquid and pressurized in fire system storage tanks. They vaporize upon discharge to develop proper extinguishment concentration in a protected space.

Powdered Aerosols. A new category of product making its

way to market is fine solid particulate aerosols. Types of powdered aerosol systems include pyrotechnically generated aerosols and dry chemical/halocarbon agent mixtures. Another category of fine particulate technology is gelled halocarbon/dry chemical suspensions.

Note: Information on applicable replacements can be obtained by contacting Willis Property Risk consultants. A special risk assessment and recommendations can be provided.

Glossary of Industry Terms and Products for Life Safety and the Environment

The fire extinguishing systems industry has developed a number of standard terms to categorize and describe the environmental impact and life safety properties of fire extinguishing agents. Information on the following properties of each extinguishing agent can be obtained from the manufacturer or supplier.

- Ozone Depletion Potential (ODP)
- Global Warming Potential (GWP)
- Atmospheric Lifetime (ALT)
- No Observable Adverse Effect Level (NOAEL)
- Physiologically-Based Pharmacokinetic – assessment of chemical exposure time (PBPK)

Extinguishing Agent Alternatives

Carbon Dioxide. This is an established fire extinguishing agent that can provide fire control similar to that provided by halon. It creates additional life safety concerns if used in an occupied area. CO₂ is sometimes used in unoccupied areas or unoccupied sections of a protected space in conjunction with another extinguishing system such as sprinklers. A typical unoccupied area is the space below a raised floor in a computer room.

FE-25. Dupont now produces a halon-like extinguishing agent (pentafluoroethane, trade name FE-25) which mirrors the fire extinguishing effects of earlier halon materials. This product does not contain some of the more environmentally harmful components of earlier halons such as bromine. FE-25 demonstrates the closest match to halon, making it a possible replacement with a minimum of system changes and retrofit work. ECARO-25 is a drop-in replacement system developed for halon extinguishing systems using FE-25. ECARO stands for Extinguishing Clean Agent Retrofit Option. (See www.dupont.com/fire/products/fe25_home.html.)

HFC-227ea. This is also a halon replacement (trade name FM-200). Made by Great Lake Fluorine Chemicals (a division of Great Lakes Chemical Corp.), this is a well established alternative in common use in the US and other countries. HFC-227ea was

the first environmentally acceptable replacement for Halon 1301. It has acceptable toxicity for use in occupied spaces at design concentration. (See www.Fm-200.com.)

Novec 1230. A relatively new product produced by 3M Company, this is a fluid fire extinguishing agent that vaporizes when applied. Novec 1230 fire protection fluid is clear and colorless and is designed to replace halon agents. The agent is a fluoroketone compound, which extinguishes fire by heat absorption. One suppression system currently developed to use Novec 1230 fire protection fluid is the SAPPHIRE suppression system (SAPPHIRE is an Ansul Co. trade name). (See www.3M.com/Novec1230fluid.)

Inert Gas Total Flooding Systems

Inert Gas Total Flooding systems are another replacement for Halon 1301. These employ naturally occurring gases that have no environmental impact and provide fire extinguishment at certain concentrations. There are three main gases which are being used:

| Name | Designation | Gas Composition (approximate) |
|----------|-------------|--|
| Argonite | IG-55 | 50% argon, 50% nitrogen |
| Argotec | IG-01 | 99% argon |
| Inergen | IG-541 | 40% argon, 52% nitrogen, 8% carbon dioxide |

Inert gas systems require greater concentrations to achieve extinguishment, normally in the range of 40 to 50 percent.

Summary Comparison of Specific Products

| Agent | Use Conc. | NOAEL | Safety Margin | ODP | GWP | ALT |
|-------------------------|------------------|------------------|-----------------|-----|------------------------------------|------------------------------------|
| Novec 1230 (Fluid) | 4-6% | 10% | 67-150% | 0 | 1 | 5 days |
| HFC-227ea (FM-200) | 4.5-8.7% | 9% | 3-20% | 0 | 3500 | 33 years |
| HFC-125 (FE-25 / ECARO) | 8%-11.5% | 7.5% | 0% | 0 | 3400 | 32.6 years |
| Inergen (IG-541) | 38-43% (approx.) | 43% (approx.) | 7-13% (approx.) | 0 | Not rated, naturally occurring gas | Not rated, naturally occurring gas |
| Argotec (IG-01) | 38-43% (approx.) | 43% (approx.) | 7-13% (approx.) | 0 | Not rated, naturally occurring gas | Not rated, naturally occurring gas |
| Argonite (IG-55) | 38-43% (approx.) | 38-43% (approx.) | 7-13% (approx.) | 0 | Not rated, naturally occurring gas | Not rated, naturally occurring gas |

Table Acronyms

- NOAEL – No Observable Adverse Effect Level for cardiac sensitization (halocarbons), oxygen depletion (inert gases)
- ODP – Ozone Depletion Potential
- GWP – Global Warming Potential
- ALT – Atmospheric Lifetime



Applicable Standards and Publications

The design, equipment, installation, testing and maintenance of the Clean Agent Suppression System should be in accordance with the applicable local code requirements and/or as set forth in the latest edition of the following codes and standards:

- NFPA 2001 – Clean Agent Fire Extinguishing Systems
- NFPA 70 – National Electrical Code
- NFPA 72 – National Fire Alarm Code
- NFPA 12A – Halon 1301 Extinguishing Systems

For more information on this topic or specific guidance on these types of gaseous extinguishing agents or systems contact: Joe Stavish, PE, NA Property Risk Control Practice Leader, Tel: 800 662 1441 or email: stavish_jc@willis.com, or your local Willis Property Risk Control representative.

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