OzonAction

OzonAction Kigali Fact Sheet 18

Use of HFCs in Fire Protection Systems

UN environment

NEW

Background:

A variety of different fire protection systems (FPS) are available to address the wide range of fire protection requirements. The most widely used FPS involve water based systems such as automatic sprinklers. An important category of FPS are chemical agents that can quickly extinguish a fire without creating some of the consequential damage that is created by water-based FPS.

Historically, the most important chemical agents were halons. These are compounds containing bromine that were extremely effective at extinguishing certain categories of fire. Halons are extremely powerful ozone depleting substances (ODS) also with very high global warming potentials (GWPs) and have now been completely phased out on a global basis (except for a few essential uses where reclaimed halons are still allowed to be used).

For the last 20 years certain HFCs, such as HFC-227ea (GWP 3220) have been used in place of halons for chemical FPS. As they have a very high GWP, end users are now seeking lower GWP alternatives to these HFCs. This Fact Sheet examines trends towards alternatives in the FPS market.

Types of fire protection system (fixed systems):

The main types of FPS used for protecting installations such as buildings, industrial installations and certain vehicles include:

1) Water sprinklers
2) Water mist systems (very small water droplets sprayed at high pressure)
3) Foam systems (foam water mixtures)
4) Inert gases (e.g. CO_2, and mixtures of nitrogen, argon and CO_2)
5) Dry powder chemical agents
6) Gaseous chemical agents (including halons and certain HFCs).

The choice of system depends on the type of fire that may be encountered and the type of installation being protected. Gaseous chemical agents are often used in specialised installations where highly effective fire suppression needs to be combined with limited property damage and limited risk to building occupants. Example applications include: computer rooms, data centres, telecommunication sites, control rooms, vaults, museums, art galleries, archives, uninterruptible power supply switchgear, process equipment and other industrial risks. Gaseous chemicals are also used in certain fixed installations for transport applications including aircraft cargo bays, aircraft engine nacelles (housings) and various military vehicles such as tanks and armoured cars.

Types of fire protection system (portable extinguishers):

Portable fire extinguishers are also available in a range of types including:

1) Water
2) Foam
3) CO_2
4) Dry powder
5) Gaseous chemical agents.

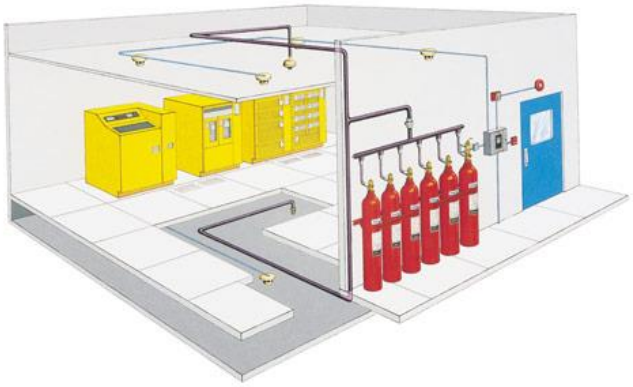
Gaseous agents, especially halons, are widely used for portable extinguishers on civil aircraft.

HFCs in current use for fire protection systems:

The table below illustrates the halons and HFCs used in gaseous chemical fire protection systems.

	Halon previously used	**HFCs in current use** (GWP)
Fixed	Halon 1301	HFC-227ea (3220); HFC-125 (3500); HFC-23 (14800)
Portable	Halon 1211; Halon 2402	HFC-236fa (9810); HFC-227ea (3220)

In fixed systems, HFC-227ea is the most widely used HFC agent. All the HFC agents have very high GWPs and specialist FPS companies are trying to provide lower GWP alternatives. In the EU, where HFC phase-down regulations are creating a much faster phase-down than under the Kigali Amendment, the use of HFCs in new FPS has already been eliminated, except in very specialised applications where the alternatives are considered inferior in performance.



Alternative chemical agents:

The most important low GWP chemical alternative is a fluoro-ketone molecule, FK-5-1-12. This has good fire suppression performance and is now being used in many new building applications in place of HFCs. It has a zero ozone depleting potential and a GWP of 1. A potential drawback of this fluid is that it has a relatively low vapour pressure. Systems using this chemical may need to be pressurised with alternatives substances such as nitrogen.

Another agent that is used in some applications is FIC-1311. This is a fluorocarbon containing iodine (CF_3I). It has a reasonable vapour pressure and good fire suppression performance. A potential drawback of this fluid is that it has a low human exposure limit, which makes it inappropriate for use in occupied spaces.

Inert gases: In many applications inert gases can provide similar advantages to gaseous chemicals – in particular, they can limit consequential damage. Mixtures with nitrogen, argon and CO_2 can be used in both occupied and unoccupied spaces. Pure CO_2 is an equally effective fire suppression agent, but it cannot be used in occupied spaces. Exposure to CO_2 at concentrations greater than 10 vol. % poses severe health risks, including risk of death. In some applications inert gases are considered less effective than gaseous chemical agents, especially if very rapid fire suppression is required.

Water mist: Water mist systems can be used in place of gaseous chemical systems in some applications. Through the use of a high pressure spray of very small droplets of water, the volumes of water used are low compared to more conventional sprinkler systems. Water mist can be an effective fire suppression agent and is much less likely to create consequential damage than sprinklers.

Fire avoidance: For new facilities, some companies are adopting an inherently safe design approach to the protection of their facilities. This means preventing the release of hydrocarbons and eliminating the availability of flammable or explosive materials. Only when all such measures have been considered, and a residual risk of the hazard still remains, are other risk reducing measures considered. In most cases, new technology detection systems are employed to shut-down and blow-down processes, and turn on high rate ventilation systems rather than closing up the space and trying to make it inert it with an extinguishing agent.

Continuing use of halons via reclaimed product: For some applications, especially in the civil and military aircraft sectors, halons are still considered the most effective fire protection agents. Banks of halon 1301 and halon 1211 have been created, using halons available in old FPS reaching end-of-life. These banks allow continuing halon use in these limited specialised applications.