

Clean extinguishing agents used in modern fire protection systems are more environmentally responsible than those in use a decade or so ago, but some are still causing concern. Kurt Werner, Environmental Affairs Manager at 3M Company, examines their limitations and introduces a new agent that represents an environmentally sustainable technology.

Protection that Respects the Environment

For many years, halon was the fire extinguishing agent of choice in a wide variety of applications and particularly those where it was important to minimize damage to valuable assets (e.g. electrical and computer equipment, museum artifacts, ships' engines, etc). However, in the 1980s, it started to become clear that halon had enormous potential for harming the Earth's ozone layer. In fact, it not only has one of the highest ozone-depletion potentials of any chemical in use but has a high global warming potential, as well.

As a result, the production of halon was phased out in the early 1990s under the terms of the Montreal Protocol. Also, for the first time, environmental regulators were direct participants as members of committees dealing with fire protection codes and standards development. The initial effect of this move in most countries was that existing halon installations could only be recharged using recycled halon. However, in many parts of the world including for example, the EU, the use of halon-based fire protection systems is now illegal except in very specialized, critical applications.

For the fire protection industry and, indeed, for specifiers and users of fire protection, the phaseout of halon created a problem, as it was a very convenient and effective agent. Clearly, a replacement had to be found, and this led to the development of hydrofluorocarbon agents (HFCs).

There's no doubt that, in environmental terms, HFCs were a step forward. Their ozone depletion potential is zero but, unfortunately, ozone depletion is not the only item on today's environmental agenda – global warming is an equally important issue.

The global warming potential of Halon 1301 is an astonishing 7,140 times that of CO₂, the most common greenhouse gas, while that of the HFC most commonly used in fire protection is 3,220 (2007 IPCC assessment for HFC-227ea). Further, the atmospheric lifetime of Halon 1301 is 65 years, and that of HFCs used in fire protection about 30 years. So, with HFCs, the footprint on the environment is still substantial.

In fact, the high global warming potential and atmospheric persistence of HFCs are already leading to concerns about whether their use will continue to be permitted. It is entirely possible that HFCs may follow halons in being restricted, or even banned, in the not-so-distant future.

The first steps toward this can already be seen in the F-Gas Regulations that have recently been introduced in Europe. While these regulations stop short of

banning the use of HFCs, they do impose requirements specific to HFCs for technician training, inspections, testing, and reporting. These regulations are based on a technical assessment carried out in 2001, which is due to be updated in the near future. It is possible that, based on the availability of new alternatives since 2001, this update will tighten the restrictions on HFCs in fire protection.

Measures addressing the use of HFCs are also being drafted in the USA. An early action identified under the California Global Warming Solutions Act of 2006 includes a consideration that, from 2012, all new fire protection systems in California must use an agent with a GWP below a minimum threshold level. A proposal from the California Air Resources Board (CARB) reflects the regulator's concern that, while emissions from this sector are currently low, they are growing quickly and the emission potential of an ever growing installed base represents a significant future liability. The only means to limit this future liability is to reduce the use of HFCs.

These concerns create two big issues for those who are currently specifying or purchasing fire protection installations.

The first is that most principled organizations have strong environmental policies and are unlikely to specify fire protection agents that have poor environmental credentials. Indeed, in countries where regulatory requirements are currently less stringent, such policies will likely be the biggest driving factor for the adoption of environmentally sustainable fire protection.

The second issue, or risk, is that future bans or restrictions may mean that an HFC system installed today would need to be replaced long before it has reached the normal end of its useful life. The costs of carrying out this replacement work could be substantial. California's proposal also includes a provision to enhance inspections of, or replace total flooding fire suppressant systems that contain an agent with a GWP above a specified threshold.

The shortcomings of HFCs led 3M to search for a fire protection agent with environmental characteristics superior to those of any agent previously available. The result is the introduction of 3M™ Novec™ 1230 Fire Protection Fluid, which has been developed with the clear objective of providing a technology that offers a viable long-term solution for special hazards fire protection.

In order to assess how well this objective has been met, let's start by looking at the environmental properties of Novec 1230 fluid. Like HFCs, Novec 1230 fluid has zero ozone depletion potential, but its key differentiating attribute is its global warming potential of just one, a dramatic reduction from 3220 for the most common HFC. In addition, Novec 1230 fluid's atmospheric lifetime is only five days, in contrast to a period of about 30 years for HFCs.

With environmental characteristics as desirable as this, the prospect of Novec 1230 fluid being restricted in use is negligible. Nevertheless, for specifiers who desire reassurance, 3M backs its technology with its unique Blue Sky™ Warranty. Under the terms of this warranty, if Novec 1230 fluid is banned from or restricted in use as a fire protection agent because of its ozone depletion or global warming potential, 3M will refund the price of the fluid. The warranty is valid for 20 years.

Novec 1230 fluid offers a very wide margin of safety and, therefore, can be used in staffed areas. For most applications, it is typically used at a concentration of between 4% and 6%, but its no observed adverse effects level is 10%. Therefore, its safety margin is between 67% and 150% - the widest margin of safety of any viable chemical replacement for halon.

Unlike most other extinguishing agents, Novec 1230 fluid is not stored as a pressurized gas but as a liquid, which instantly dissipates to form a gas when it is discharged from a properly designed system. Storage in liquid form has many benefits; Novec 1230 fluid can be easily transported in bulk - even by air.

Further, refilling a system after discharge is much simpler than working with bulk pressurized gas supplies and much more convenient than sending the cylinders off site. Finally, cylinders containing Novec 1230 fluid occupy significantly less space than cylinders of CO₂ or inert gas systems. All of these benefits are particularly significant when the product is used in offshore applications.

With less impact on the environment, favorable handling characteristics, and excellent extinguishing properties, Novec 1230 fluid is unmatched. It is suitable for delivery by flooding, and its non-corrosive, non-conductive properties allow it to be used to protect sensitive equipment such as telecommunications and computer installations.

Novec 1230 fluid is a clean extinguishing agent. It evaporates immediately and, unlike foams and powders, it leaves no residues. This means time-consuming clean up operations are eliminated, minimizing the delay before the system can be returned to service.

With concerns over HFCs growing rapidly, specifiers need an environmentally sustainable alternative that will not only help address the risk of an installation's early demise under regulatory pressure, but which will also complement the progressive environmental policies of their businesses. That alternative is Novec 1230 fluid, which has already demonstrated its value around the world in applications as diverse as shipboard installations, data centers and oil rigs. ■

The 3M™ Novec™ Brand Family

The Novec brand is the hallmark for a variety of patented 3M compounds. Although each has its own unique formula and performance properties, all Novec products are designed in common to address the need for safe, effective, sustainable solutions in industry-specific applications. These include precision and electronics cleaning, heat transfer, fire protection, lubricant deposition and several specialty chemical applications.

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