# A matter of time

## Reducing thermal decomposition risks through faster detection and extinguishment

Advanced fire suppression systems, such as those using 3M™ Novec™ 1230 Fire Protection Fluid, have evolved to minimize the risk of thermal decomposition products.

The longer a fire burns, the greater the risk for the generation of potentially harmful thermal decomposition products (TDPs). It's partly for this reason that third party approvals such as Underwriters Laboratories require a suppression system to quickly extinguish large fires under difficult circumstances.

The good news is that advanced fire suppression systems, such as those that use 3M™ Novec™ 1230 Fire Protection Fluid, are designed to detect and extinguish a fire even before it reaches the "flame" stage – minimizing meaningful TDP generation. This is an important consideration in assessing the impact of TDPs on the people and valuable assets being protected by your system.

### Fire suppression technology and standards have evolved to minimize TDP risk

TDPs can result from both the fuel consumed by a fire and the agent used to extinguish it. The extent of their production depends on many variables, including the energy of the fire and the speed of extinguishment. To address this issue, fire protection standards have been adapted to minimize the risk of thermal decomposition from both fuels and the agents themselves.

In 1972, Ford showed that, by reducing system discharge time from 15 seconds to 5 seconds, TDPs can be reduced by as much as two-thirds.[1] This relationship between discharge times and TDPs was thoroughly investigated over the next 25 years and ultimately led the NFPA committee on clean agents (NFPA 2001) to settle on a maximum 10 second discharge time as reflecting "a reasonable value based on experience with Halon 1301 systems"[2] as well as testing with other halocarbon clean agents. Adhering to the standard addresses concerns related to TDPs resulting from either the fuel or the agent.

While fast discharge times are important, they are only part of the solution. Many advanced detection systems are designed to continuously sample air in the protected space for the presence of products of combustion. The combination of early detection and fast system discharge precludes the production of TDPs at levels that would be harmful to human health or the assets being protected.

Longer discharge times may lead to longer extinguishment times and more products of combustion than one would expect from a rapidly operating system using 3M™ Novec™ 1230 Fire Protection Fluid.

## Low levels of TDPs determined to be acceptable for valuable works of art and artifacts

3M, in collaboration with leading museums, has generated data to demonstrate that the very low levels of TDPs that would be generated from a fire suppressed with a system using 3M™ Novec™ 1230 Fire Protection Fluid are not anticipated to harm valuable pieces of art in some of the world's most treasured museums.

Advanced detection technologies can detect a fire while it is small enough to be easily controlled, thus limiting resultant TDPs below a threshold level. Research conducted by 3M scientists and experts at the Hermitage Museum and the Russian National Library has resulted in experimentally quantifying a TDP threshold level for the valuable assets typically found in museums and archives. The work demonstrated that TDP levels of less than 200 ppm are not anticipated to adversely impact valuable museum or archival contents[3]. Furthermore, suppression systems utilizing Novec 1230 fluid are designed to detect and extinguish fires in a manner that maintains TDPs well below the 200 ppm threshold.

Although the longer discharge times of inert gas systems may help to mitigate the over-pressurization challenges, the longer discharge times may also lead to longer extinguishment times and more products of combustion than one would expect from a rapidly operating system using Novec 1230 fluid.

## Summary

Assessing risk in emergencies such as a fire event is not as straightforward as assessing the kinds of risks we may face in our everyday lives. Risks in a fire situation include the fire itself, the decomposition products resulting from the fire, and exposure to occupants and emergency responders – in addition to the potential damage to the assets being protected. Rapid system detection and suppression using Novec 1230 fluid can help assure the safety of your people and your valuable assets.

1. Ford, C. L., "An Overview of Halon 1301 Systems," in *Halogenated Fire Suppressants*, ACS Symposium, Series No. 16 (1975), pp. 1-63.
2. 1994, 1st Edition, 3.8.1.2, A-3.8.1.2, and 2015, 7th Edition, 5.7.1.1, A.5.7.1.1 of NFPA 2001 Standard on Clean Agent Fire Extinguishing Systems
3. Bulanov K, Kossolapov A, Rivers P, "Report on recent research: quantifying safe HF exposure limits for sensitive materials in museums and archives", SUPDET Conference, Orlando FL, USA, 6 March, 2015.

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3M™ Novec™ 1230 Fire Protection Fluid is an advanced clean agent fire suppression material, based on a proprietary chemistry from 3M. It was designed to address industry needs for clean agent fire protection that is safe and effective, while offering a sustainable environmental profile that no other halocarbon agent can match. This includes: Zero ozone depletion potential; a 5-day atmospheric lifetime, and; a Global Warming Potential of 1. Because of these properties, Novec 1230 fluid is not targeted for phase-down or regulatory restrictions anywhere in the world. It is approved for use in total flooding fire suppression systems by the U.S. EPA and most major regulatory bodies. All of this makes Novec 1230 fluid today's sustainable choice for clean agent fire protection.

### The 3M™ Novec™ Brand Family

The Novec brand is the hallmark for a variety of proprietary 3M products. 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, protective coatings, immersion cooling, advanced insulation media replacement solutions and several specialty chemical applications.

3M™ Novec™ Engineered Fluids • 3M™ Novec™ Aerosol Cleaners • 3M™ Novec™ 1230 Fire Protection Fluid • 3M™ Novec™ Electronic Grade Coatings • 3M™ Novec™ Electronic Surfactants • 3M™ Novec™ Dielectric Fluids


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