Spring 2008

3M Horizons NOVEC Newsletter

New ways to balance safety, sustainability and performance, from the makers of 3M™ Novec™ Products

3M™ Novec™ 1230 Fire Protection Fluid

Enhancing fire safety for the oil and gas industry

In the past, halon-based extinguishing systems have been a popular choice to provide fire protection in the offices, equipment rooms and other confined spaces that form part of onshore and offshore oil and gas installations. As an extinguishing agent, halon is efficient, clean and relatively low in toxicity.

It does, however, have two crucial shortcomings – as a brominated fluorocarbon it does significant damage to the Earth's ozone layer. In addition, halon is long lived in the atmosphere and has a high global warming potential. As a result of these shortcomings and the Montreal Protocol, the production of halon was phased out in the 1990s, and most manufacturers ceased to make halon-based fire suppression systems around the same time.

Clearly, an alternative was needed, and the most widely adopted class of compounds were hydrofluorocarbons (HFCs). These agents have the required zero ozone depletion potential, but their global warming potentials are substantial. For this reason, the continued use of HFCs is being questioned.

For the oil and gas industry, this creates two challenges. The first is to achieve effective fire protection for workers and property without increasing their carbon footprint. The second is to minimize facility lifetime costs by avoiding systems that may need extensive modifications or replacement to meet future regulatory requirements.

To solve these problems, an increasing number of oil and gas facilities are turning to 3M™ Novec™ 1230 Fire Protection Fluid. Like HFCs, Novec 1230 fluid has zero ozone depletion potential, but its key differentiating factor is its global warming potential of just one. This is significantly less than the 3,220 (2007 IPCC assessment) for the most common HFCs. In addition, Novec 1230 fluid's atmospheric lifetime is only five days, in contrast to about 30 years for HFCs.

Novec 1230 fluid offers a very wide margin of safety and therefore can be used in occupied areas. "Margin of safety" reflects the difference between the design

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From the Editor

Today, businesses in virtually every industrial sector are faced with challenges that were scarcely dreamed of a few short decades ago.

New competitors are cropping up in every corner of the globe. Managers are under relentless pressure to improve productivity and cut costs. And public demands to reduce environmental impact and ensure worker safety are creating a growing maze of regulatory restrictions.

For users of chemical products, finding balanced solutions to meet these challenges has become a business imperative. This was the impetus behind the development of 3M's Novec family of products.

The Novec brand is the hallmark for a variety of patented 3M chemical compounds – each with its own unique formula and performance properties, and each designed to address the need for safe, effective, sustainable technology in applications ranging from precision cleaning and heat transfer to electronics coatings, surfactants and fire protection.

This newsletter was created as a vehicle to share ideas, successes and best practices of customers who are using Novec products. Our goal is to help you find better, safer and more sustainable ways of doing business – today, and for many years to come.

Sincerely,

Craig Schwartz

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Using 3M™ Novec™ Aerosol Cleaners in Aerospace Applications

3M™ Novec™ Aerosol Cleaners are a family of non-flammable, high-performance cleaners developed to replace ozone-depleting materials.

Novec aerosol cleaners are an excellent choice for many aerospace cleaning applications. Most pure (neat) Novec fluids are exempt from the U.S. EPA's Aerospace NESHAP (National Emissions Standards for Hazardous Air Pollutants). This includes 3M™ Novec™ Contact Cleaner, designed to remove light oils, greases, silicones, dust and particulates from electronic equipment and fiber optic connectors, including energized components.

The Novec aerosol cleaners product line includes several azeotropes with improved cleaning strength. These products provide an excellent balance of safety, performance and environmental properties, and as such are valuable and allowable options for both hand wipe and flush cleaning in aerospace facilities. Two of the Novec aerosol products – Novec Flux Remover and Novec Electronic Degreaser – are classified as "Option 2" solvents under the Aerospace NESHAP because they are formulated with solvents that are VOCs. Option 2 solvents are allowable, but must be used in conformance with specific housekeeping and recordkeeping procedures.

Why use Option 2 solvents?

Many wipe and flush cleaning operations cannot tolerate water-based cleaning systems or are sensitive to residues left by the low volatility of compliant solvents. Often the platforms are handled more effectively with volatile solvents, such as Novec aerosol cleaners. The few additional steps required for Option 2-compliant solvents must be weighed against the added cleaning performance and superior compatibility of the Novec aerosol cleaners.

Under the Aerospace NESHAP, the use of any Option 2 solvent, including Novec Electronic Degreaser and Novec Flux Remover, will require conformance to the following general requirements:

3M™ Novec™ Aerosol Cleaners vs. Aqueous Cleaners

	3M™ Novec™ Aerosol Cleaners	Aqueous Cleaners
Soils Hydraulic Fluid Flux Silicones Nondestructive Test Indicator Oil-Laden Dust and Debris	• Novec aerosol cleaners leave essentially no residue, are fast drying, compatible with most aerospace substrates and have excellent toxicological and environmental properties. • The three Novec formulations can clean a wide variety of soils from the majority of systems found on aerospace vehicles.	• Variable cleaning strength • Residue likely • Slow drying, with possible corrosion and residual solvent trapped in tight spaces.
Systems Electronics Avionics Airframe Engine Hydraulics	• Novec aerosol cleaners are the same solvents that are used in many vapor degreasers in the aerospace industry for new and MRO cleaning. • The cleaning and flux removal of electronic components and assemblies (prior to their permanent installation in the aerospace vehicle) are exempt from NESHAP compliance.	• Components of aqueous and semi-aqueous cleaners may cause corrosion. • Many hydrocarbon and aqueous solvents have been known to contribute to hydrogen embrittlement.

- Solvents must be stored in closed containers
- Solvent-laden materials must be stored in closed containers
- Standard practices must be instituted to minimize solvent spills

For more details, including a more complete discussion of specific hand-wipe and flush cleaning requirements, please request a copy of our brochure entitled, "Using 3M™ Novec™ Aerosol Cleaners for Hand-Wipe and Flush Cleaining in Compliance with the U.S. EPA's Aerospace NESHAP."

Environment is a priority in rig fleet's fire safety system selection

GlobalSantaFe selects 3M™ Novec™ 1230 Fire Protection Fluid to replace halon system.

Excerpted from *World Oil* December 2007.

In 2004, drilling company GlobalSantaFe (now part of Transocean) decided to address the increasingly tough regulatory, environmental and worker safety issues surrounding fire protection systems on its fleet of 59 mobile offshore rigs leased to oil and gas companies worldwide. An internal task force considered several alternatives, including high-expansion foam, carbon dioxide, water mist, and a number of clean fire-suppression agents.

The clear winner

After considering all available products, the company determined that Novec 1230 fluid was the best replacement product for its halon systems based on its high margin of safety and its low environmental impact. Additionally, Novec 1230 fluid could be more easily refilled onboard than other alternatives, using bulk containers with a low-vapor-pressure liquid, in case the system discharged either accidentally or in a fire.

Ozone depletion potential was not the only issue considered with regard to sustainability. Novec 1230 fluid has an atmospheric life of five days and a Global Warming Potential (GWP) of just 1 – equal to CO_2. Furthermore, the selected fluid complies with all applicable requirements and is certified for use by the vessels' countries of registration, the US Coast Guard, the American Bureau of Shipping and Det Norske Veritas, as well as Underwriters Laboratories and FM Global.

"It has been determined that Novec 1230 fluid is safe for humans at concentrations much higher than what is required for extinguishing fires," says Mark Dreith, manager of project planning and estimating for GlobalSantaFe. "In our opinion, the wide margin of safety and excellent environmental profile give the product a significant edge over the other alternatives we explored."

Other considerations

Novec 1230 fluid has non-conductive properties, which was a big selling point for GlobalSantaFe because the company could install the systems in engine rooms, SCR rooms, emergency generator rooms and control rooms aboard offshore rigs. Another key benefit was the that the fluid leaves no messy residue to clean, so systems can remain operational after discharge.

Finally, because the fluid has low vapor pressure, it can be shipped in bulk. This makes it "easier to handle and convenient to store so we have the ability to retrofit offshore systems upon discharge without the rig having to return to a shipyard for maintenance," Dreith says. "All other systems' bottles physically have to be sent off the rig to be refilled, costing time and money."

GlobalSantaFe has begun a gradual phase-out of its halon systems. Dreith is confident that the transition will provide both immediate and long-term benefits, allowing the company to meet current environmental regulations and those in the foreseeable future.

Fire Safety

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concentrations necessary to put out a fire and the threshold concentration recognized by approval bodies as suitable for use in occupied spaces. Novec 1230 fluid is used at concentrations between 4% and 6% but is acceptable for use up to 10%. Therefore, its margin of safety for typical applications is between 67% and 150% – the largest margin for any halon replacement.

The use of Novec 1230 fluid has additional advantages. For example, 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. Storage in liquid form has many benefits; one being that Novec 1230 fluid can be easily transported in bulk – even by air. Further, refilling a system after discharge is much safer and 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 less space than cylinders of CO_2 or inert gas systems. All of these benefits are particularly significant when the product is used in offshore applications.

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

Taking all of the factors under consideration, specifiers in the oil and gas industries would do well to consider Novec 1230 fluid from 3M – the extinguishing agent that has been specifically developed to combine performance, safety and ease of handling with an excellent environmental profile.

Advantages of solvent vs. aqueous cleaning

In the early 1990s, the Montreal Protocol forced many users of conventional vapor degreasers to switch to aqueous cleaning systems, due to the phaseout of ozone-depleting solvents (ODS) such as CFC-113, HCFC-141b, and 1,1,1-trichloroethane that were commonly in use at the time. Because they are non-emissive and use relatively low-cost detergents as cleaning agents, aqueous systems offered an immediate solution to the problem posed by the elimination of ozone-depleting solvents. However, aqueous systems are by necessity larger, more complex and more labor-intensive than solvent-based systems. They also use copious amounts of water, which can be a hidden cost. Water must typically be processed with deionization or reverse osmosis equipment prior to use. Water consumption may also be limited by local municipalities or other government agencies. Fortunately, recent technical advances may make solvent cleaning a more cost-effective solution than aqueous cleaning in certain critical applications.

Advances spur return to the proven performance of vapor degreasing

In recent years, improved equipment designs, combined with the advent of advanced, non ozone-depleting solvents, have spurred a resurgence in the use of vapor degreasing cleaning systems. In addition, the rise of cell manufacturing, in which workers are arranged in semi-autonomous teams rather than long production lines, has made the use of low-volume/small-footprint vapor degreasers a more attractive option than large centrally-located aqueous cleaning systems.

Among the most successful of the new generation of precision cleaning solvents for vapor degreasing are 3M™ Novec™ Engineered Fluids – a complete line of nonflammable, non-ODS solvents that exhibit a unique balance of environmental, safety and performance properties.

Advantages of solvent cleaning with Novec Fluids vs. aqueous systems

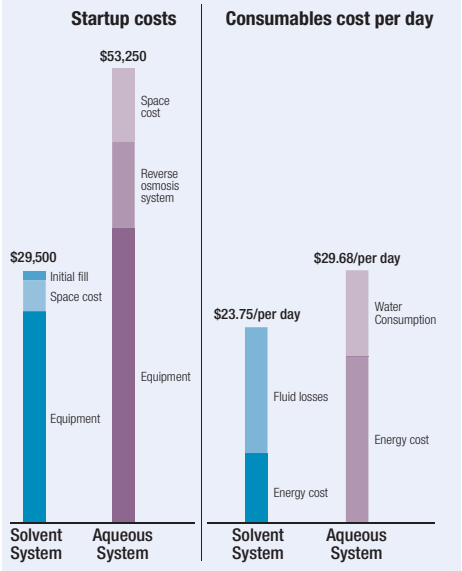
- Easier to use with cellular manufacturing
- Can be used for silicone deposition
- Better solvency for organic soils
- No need for waste water treatment
- Reduced power consumption
- No anti-corrosion additives required
- Does not promote growth of bioburden
- Smaller equipment "footprint"
- No water spotting
- No drying equipment needed

Novec fluids are ideal for many cleaning applications where high purity and low contamination levels on finished parts are critical. Novec fluids can clean a wide range of soils, demonstrate excellent materials compatibility and have proven successful in vapor degreasing, spray cleaning and hand wipe operations.

The extremely low surface tension of Novec fluids makes them excellent for the removal of particulate contamination and also aids cleaning by allowing better penetration of tight clearances in complex parts. The low heat of vaporization of Novec fluids ensures faster drying. The combination of a high molecular weight fluid and a low heat of vaporization has been shown to be beneficial in controlling fluid losses, making Novec fluids economical to use in vapor degreasing operations. Unlike most aqueous cleaning processes, Novec fluids offer faster cleaning, and quick drying with lower energy consumption. Unlike most chlorinated solvents and many hydrocarbon solvents, Novec fluids are not hazardous air pollutants (HAPs).

Novec fluids offer users a high margin of safety in their intended application. They are low in acute and chronic toxicity, which is reflected in high exposure guidelines. In addition, Novec fluids are non-flammable for easier storage and handling. (see Material Safety Data Sheets for precautions and handling recommendations).

Compare the Total Cost of Ownership of Solvent and Aqueous Cleaning



In summary, Novec fluids can save time and money over aqueous cleaning for a number of reasons. They require less floor space and consume less energy; waste disposal costs are eliminated;* the process allows for quick drying; and parts with complex geometries can be cleaned more easily.

* 3M offers a Used Fluid Return Program free of charge for returns of 30 gallons or more.

Working with 3M gives you access to world class technical service and sales specialists to help make sure you get the performance you need from 3M Novec products. Our experts can help you with equipment conversion; process development/optimization; environmental, health and safety support; and much, much more. In North America, our team of technical service and sales specialists can be reached at **3M.com/novec or at the following numbers**.

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