

# FEPN™

## Fire/EMS Product News

### Chemical Reaction



Firefighters' jobs put them in hazardous environments, but active textiles in turnout may keep them safe from unseen dangers.

By Francois Simard, Stedfast Inc.

If protection against heat, flames, microbiological agents and a variety of industrial chemicals isn't enough for current firefighting turnout gear to defend against, try adding chemical and biological warfare agents to the list. The potential for acts of terrorism on North American soil has become a reality, and the only line of defense that first responders have is their regular protective gear.

NFPA 1971-certified firefighter turnout gear is resistant to many hazards. In addition to heat and flame, these ensembles provide protection against microbiological agents and several industrial chemicals. Despite the extreme protection provided by a composite of a 6- to 8-ounce polyaramid outershell, a 2.7-ounce non-woven polyaramid, an FR moisture vapor-permeable membrane and a 10-ounce polyaramid-blend thermal liner, there's almost no protection against chemical agents used for mass destruction. The bottom line: Even wearing first-class turnout gear, one remains extremely vulnerable to chemical warfare agents.

#### Intelligent design

To illustrate the ease with which a chemical can move through turnout gear materials, consider that the vapor of a 2.5 micro-liter drop of ammonia placed on the top surface of the material composite, in a closed cell, will take just a few seconds to go through the outer shell and the thermal barrier, and barely a minute to penetrate the moisture barrier. Incidentally, this situation is no better for emergency medical services personnel wearing NFPA 1999-compliant garments.

The Chemical Weapon Convention list is composed of

Continued on page 4



The rugged P-100 portable pump is completely marinated and features a one-pull start. *W.S. Darley, Melrose Park, Ill. Page 8*



The Torrentula Lite Valve is a variable dump option for smaller Bambi buckets and retrofitable for standard buckets. *SEI Industries, Delta, B.C. Page 8*



F-Series four-fold door systems are designed in standard sizes but also can be customized for larger openings and specialized applications. *Door Engineering & Mfg., Kasota, Minn. Page 7*

The ICM Tx adds the functionality of a heads-up display transmitter with an integrated PASS device. The unit is fully compliant with NFPA 1982. *MSA, Pittsburgh. Page 5*



The Night Scan Light Duty Vertical Tower extends up to 16 feet with numerous lighting options. *The Will-Burt Co., Orrville, Ohio. Page 6*



The TurboFlare Alert incorporates an electronic motion detector early warning and anti-theft system. Attached pennants are used to deploy and recover flares. *TurboFlare USA, Henderson, Nev. Page 5*

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more than 50 extremely toxic substances that, for the most part, will easily penetrate regular first responder protective gear. Being able to protect from every toxic substance is a very difficult challenge, which NFPA 1994 tries to address by providing a carefully selected list of chemicals for materials and material composites to be tested against.

The first responder community is well aware of this situation and recognizes the need for protective gear designed according to NFPA 1994 specifications. NFPA 1994-compliant garments, however, are currently made from a thermoplastic material in a overall design. Although these garments provide an adequate level of protection, they aren't comfortable to wear. It's well understood that the 1994 coveralls currently on the market are not vapor permeable and thus, do not allow for any heat transfer. As far as the firefighter is concerned, this is a drawback best explained by the simple fact that the wearer, doing moderate activity in 77°F at sunset, will have difficulty wearing the suit more than 10 minutes. This isn't acceptable in their line of work.

An alternative to thermoplastic materials that's very well known in the military world, is based on activated carbon. Carbon protective materials, whether

made with carbon yarns or beads, are extremely efficient at capturing chemical agents in gas or vapor form. When it comes to liquid exposure, typically the liquid repellent treatment on the outer shell delays penetration sufficiently to allow the vaporization of the chemical substance before it comes in contact with the carbon as a liquid. However, when pressure is applied to the liquid on the fabric there is a risk that the liquid agent will saturate the carbon rapidly, which could result in chemical breakthrough. Moreover, once the micro traps are filled by any contaminant from the environment the filtering capacity is significantly reduced.

### Solid barriers

Some manufacturers have attempted to introduce a hybrid material, a carbon fabric laminated onto a chemical-resistant membrane. In addition to the inconvenient saturation of the carbon, this option eliminates the material's permeability, which is the primary benefit of carbon fabrics and a very important component of firefighting turnout gear.

Fortunately, barrier textile manufacturers have identified the deficiencies in the relationship between protection and comfort. There are materials currently available that can be incorporated into flame-

resistant, moisture-vapor permeable and chemical warfare-resistant membranes. Barrier materials use an "intelligent membrane" that provides liquid protection as good as typical NFPA 1994 materials. However, due to their permeability to vapor, an interesting heat load reduction is obtained that compares to conventional moisture barriers. Unlike activated carbon-based substrates, the membrane doesn't become saturated with contaminants and remains efficient for years like any normal laminated fabric. There's no shelf life for these products, as there is for carbon-based protective technologies.

The membrane that can be applied to Stedfast moisture barriers works because of a partnership between two polymers. One polymer acts as a solid barrier to trap the chemical intruder and slow down the transmission of the chemical agent, while the other breaks down the intruder into harmless sub groups. The chemical action is independent of the humidity level and, because of its catalytic nature, can't run out of reactant. This technology which encompasses chemical active textiles using catalytic reactions, is referred to as CAT technology.

The moisture vapor-permeable chemical active textile has the potential to be used in place of regular moisture barriers

in turnout gear with virtually no compromise on other characteristics other than a slight weight increase.

The benefit to the firefighter is to be able to conduct operations wearing turnout gear that provides the same protection from heat and fire and better protection from a wider variety of toxic industrial chemicals/materials and chemical agents such as VX, sarin, mustard and lewisite. This added level of protection does not compromise comfort, providing equivalent thermal heat loss values.

This technology breakthrough has rendered a "no compromise" attitude for performance and has guided the NFPA 1971 committee to include a CBRN option in the 2006 edition. The new NFPA 1971 with CBRN option not only incorporates the chemical challenges from NFPA 1994 Class 2, it adds a series of demanding pre-conditioning procedures to the performance requirements far beyond anything seen so far in the NFPA standard.

We can't stop firefighters from going into hazardous environments to risk their own lives to save another's life. That is the reality of their job. However, the CAT technology could provide firefighters and first responders with added protection that may one day make the difference between life and death.

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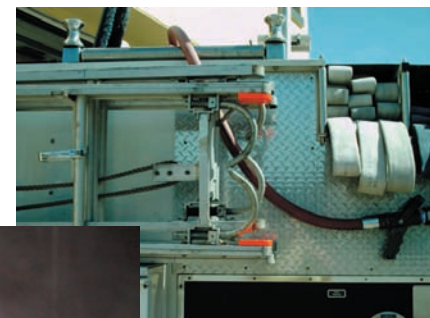
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