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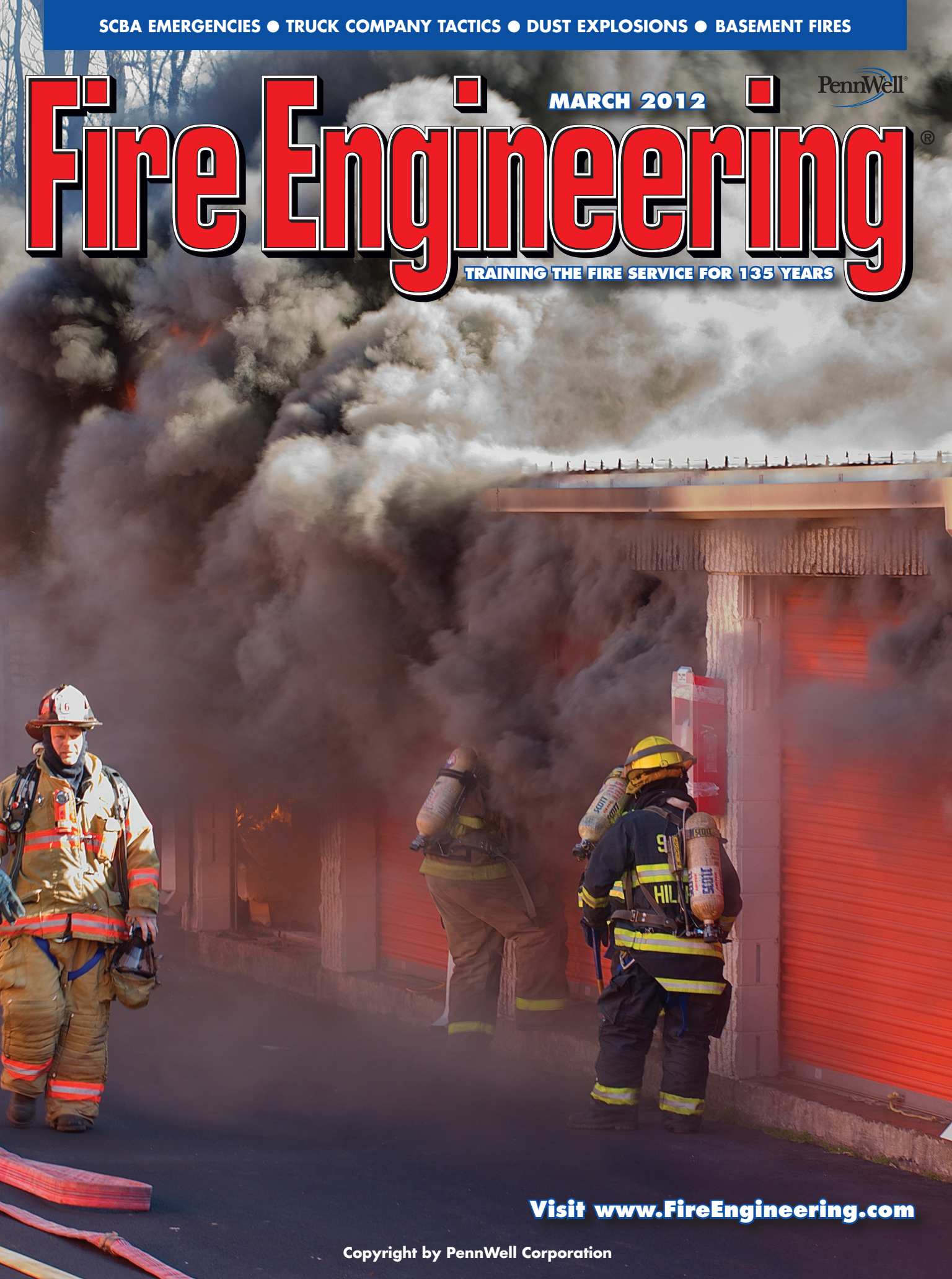

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Testing and New Performance Requirement for Structural PPE

BY WILLIAM J. GORAK

AFTER MANY YEARS OF RESEARCH and discussion, a new minimum performance requirement to help prevent stored energy burns will be added to NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2012 edition. Ensemble manufacturers will be required to perform stored thermal energy (STE) testing to ensure that turnout gear complies with the new performance criteria. What is stored energy, and how does it relate to the thermal protection performance (TPP) requirement already in NFPA 1971?

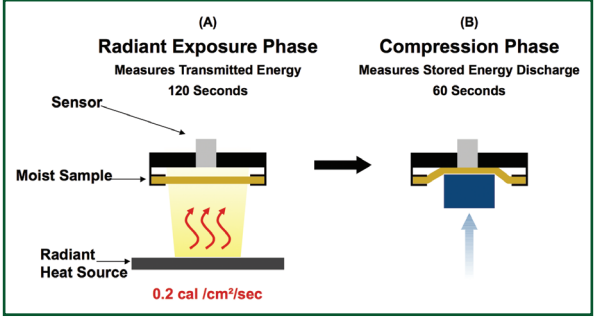
The NFPA 1971 Technical Committee on Structural and Proximity Fire Fighting Protective Clothing and Equipment has focused on firefighter burns caused by heat buildup under outer shell attachments. One study[1] indicated that many reported burns occurred on arms and shoulders, with many of them under nonporous materials attached to the outer shell such as trim, patches, logos, lettering, and so on. The burns typically occurred after minutes of thermal exposure without visible damage to the gear. Therefore, the 2012 edition of the NFPA 1971 standard specifically addresses burns under attachments located only on outer shell sleeves.

TPP TESTING

Many firefighters are familiar with TPP, which measures the heat transfer characteristics of composite materials for a short duration under flashover conditions. In this test, a dry composite (i.e., outer shell, moisture barrier, and thermal liner combination) is exposed to high levels of thermal energy. Based on the amount of energy transmitted through the composite, the time required for second-degree burns to occur is predicted, and the calculated TPP value is reported.

TPP test results can lead you to believe that when dry, composites with nonporous attachments (trim, patches, logos, lettering, and so on) provide more protection than those without. However, the reported burns that the committee addressed (as described above) indicated that the opposite was true: Burns were occurring under the areas with nonporous attachments, implying that less protection was afforded. It was this inconsistency that prompted further studies of subflashover burns and led the committee to add new performance criteria to the 1971 standard.

Figure 1. Preconditioned Samples Test



STE TESTING

With funding by the National Institute for Occupational Safety and Health and work led by North Carolina State University (NCSU), a new test method was developed, and key factors were identified that contribute to stored energy burns. In 2010, American Society for Testing and Materials F2731, *Standard Test Method for Measuring the Transmitted and Stored Energy of Firefighter Protective Clothing Systems* was adopted, including the procedures used in the NCSU study. This new method provides the ability to study personal protective equipment (PPE) composite performance in subflashover exposures under a variety of conditions.

These tests now deliver consistent, repeatable results that measure both transmitted thermal energy and the heat discharged during compression of composite test samples—with or without trim or other attachments. Because data have shown that moisture content can increase the probability of STE burns, the testing begins with a preconditioning protocol that ensures consistent levels of moisture in samples.

The moist test specimen is exposed in the radiant phase (Figure 1), where the transmitted energy is measured. The specimen then moves to the compression phase (Figure 1), where a plunger presses against the specimen, releasing the thermal energy stored in the test composite. The measured energy throughout the test is used to predict onset of a second-degree burn.

As an example, samples of different composites were preconditioned with moisture and tested. Results showed that second-degree burns would occur between approximately 100 and 120 seconds for a composite with trim; the same composite without trim had a predicted time of greater than 140 seconds. In this evaluation, the composites without trim actually provided better protection than the composites with trim—an opposite result of what the TPP test would provide.

W. L. Gore & Associates is investigating alternatives to satisfy both the end-users' concerns for subflashover burns under outer shell attachments and the manufacturers' need to accomplish performance certification according to the standard's new edition when published. Each manufacturer will choose its own solutions, such as relocating patches, using porous trim, or increasing insulation in certain areas under outer shell attachments. When purchasing new gear, talk with your manufacturer about these changes and what can be expected as a result. ●

REFERENCE

1. National Institute for Occupational Safety and Health, The National Personnel Protective Technology Laboratory, National Institute of Standards and Technology, and North Carolina State University, "Thermal Capacity of Fire Fighter Protective Clothing," The Fire Protection Research Foundation, Quincy, Massachusetts, October 2008.

● **WILLIAM J. GORAK** is a product development engineer with W. L. Gore & Associates. For more than 28 years, Gorak has developed new technologies and products for fire and military professionals. He has a BS in chemistry from the University of Delaware and participates in NFPA 1971 technical committees and subcommittees related to stored energy.