National Institute of Standards and Technology

FEMA

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Better fire fighting through research

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Portable Radios in Firefighting Environment Tested

One of the most critical pieces of personal protective equipment that a firefighter carries into a fire is the handheld portable radio. To increase their knowledge of just how durable this piece of radio equipment is, NIST's Building and Fire Research Laboratory recently conducted a series of tests using three portable radio models from three different manufacturers.

The test series was conducted in a wind tunnel at different temperatures of varying intensity: Thermal Class I, a maximum temperature of 100ºC (212ºF) for 25 minutes; Thermal Class II, a maximum temperature of 160ºC (320ºF) for 15 minutes; and Thermal Class III, a maximum temperature of 260ºC (500ºF) for 5 minutes. Each radio tested was listed for maximum operating temperature of 60ºC (140ºF). The frequency stability for the radio signal was guaranteed to 60ºC (140ºF).

The testing of the radios was performed using the Fire Equipment Evaluator (FEE). The FEE is a closed-loop, re-circulating wind tunnel designed to simulate thermal conditions up to Thermal Class III.

Cont. on page 2.

Photograph of the NIST Fire Equipment Evaluator (FEE). The test section (open area bounded by red) has radio protected by a "pocket" in place.

CAF System for Fire Protecting of Power Transformers

Power distribution is critical to every community and protecting power transformers from the occurrence of fire is equally essential. Therefore, having the proper fire protection system in place for power transformers is most important. One fire approach to protecting power transformers from fire is to use sprinklers that require a large quantity of water, which in turn may cause a problem to the electrical function or the transformer and perhaps create water damage, having a negative environmental impact. Clean-up after this type of fire suppression must be performed carefully. Power transformers contain hazardous materials and any runoff water from the fire suppression must be collected.

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Portable Radios in Firefighting Environment Tested, cont.

Radio inside of "pocket" from turnout gear. Radios that were protected inside the turnout gear pocket were able to operate at the Thermal Class III temperature of 260ºC (500ºF).

Radios were tested inside the FEE suspended by the radio belt clip from a 50 mm wide Kevlar strap with the front of the radio (speaker and microphone) facing the airflow. Radios were also placed inside a pocket constructed and used for testing. (It is not uncommon for radios to go into the firefighting environment worn clipped close to the body underneath the turnout gear coat or placed in a pocket.)

Test results indicated that the radios need to be protected when used in a firefighting environment. Radios that were protected inside the turnout gear pocket were able to operate at the Thermal Class III temperature of 260ºC (500ºF). The radios that were directly exposed to the airflow did not survive the Thermal Class II temperature of 160ºC (320ºF).

Work will begin with the National Fire Protection Association (NFPA) to develop a radio standard that would include requirements for thermal testing of handheld radios.

The publication, *Testing of Portable Radios in a Fire Fighting Environment*, by W. D. Davis, M. K. Donnelly, and M. J. Selepak, (NIST Technical Note 1477), August 2006, describes the series of tests with three portable radio models. The report is available online at: http://fire.nist.gov/bfrlpubs/fire06/PDF/f06015.pdf.

For additional information, contact: michelle.donnelly@nist.gov.

Positive Pressure Ventilation (PPV) Tactics

Improving firefighter safety is an ongoing effort for the fire service. A series of fire experiments were conducted by the National Institute of Standards and Technology's (NIST) Building and Fire Research Laboratory to better understand the effectiveness of using fans at different locations to reduce the temperature in stairwells, corridors, room of origin, etc. The tests were not limited to a single-family home, but high-rise buildings of different heights were also investigated. All of the fire tests, videos, and technical reports are compiled on a DVD entitled, *Positive Pressure Ventilation Research: Videos and Reports*, by Stephen Kerber and Daniel Madrzykowski (April 2008).

The DVD contains two discs. Disc one contains six complete reports on Positive Pressure Ventilation (PPV), covering PPV characteristics using Computation Fluid Dynamics (CFD) and in several different fire test configurations: Room fire, firefighter training building, high-rise pressure experiments, and high-rise fire experiments. Another report evaluates the ability of the Fire Dynamics Simulator (FDS) to simulate PPV in the laboratory and in regular environments.

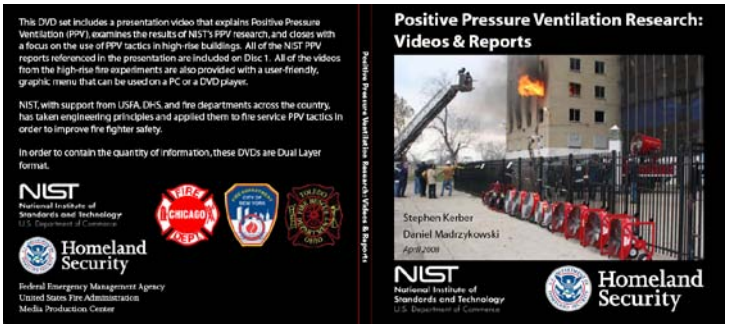
Disc 1 also has a narrated video presentation: *Overview of NIST Positive Pressure Ventilation Research*, experiment videos from the apartments on the 3rd and 10th floors, as well as full versions of all the reports.

Disk 2 has additional experimental videos from the apartments on the10th and 15th floors.

NIST received support for this work from the U. S. Fire Administration/Department of Homeland Security (USFA/DHS), and fire departments across the United States. NIST has taken engineering principles and applied them to fire service PPV tactics so that firefighter safety may be improved.

To obtain a copy of the DVD set, contact Dan Madrzykowski via e-mail (madrzy@nist.gov) providing your name and complete mailing address.

More information on NIST's PPV research is available online at: http://www.fire.gov/PPV/index.htm.



Cover of the two DVD set documenting several studies with reports and video.

CAF System for Fire Protecting of Power Transformers, cont.

Another fire protection approach is to use an air-aspirated foam system. However, current air-aspirated systems must produce a large quantity of foam to provide proper fire protection. Therefore, clean-up afterwards may be a problem, thus delaying the re-start of the power transformers and prolonging the power shutdown to the community.

The National Research Council of Canada (NRC) has developed a means of producing compressed-air foam (CAF) in a fixed pipe system. The advantage is that this system produces superior quality foam with uniform distribution and high momentum, therefore using less foam to suppress a fire. In earlier work, the NRC has performed full-scale fire tests to illustrate that CAF has superior fire suppression performance compared to current foam or sprinkler systems.

NRC developed CAF systems with 3 or 4 TAR (Small Flow Turbine Action Rotary) nozzles and with 2 GDR (Large Flow Gear Driven Rotary) nozzles. Full-scale fire tests were carried out to determine the fire suppression capability of the CAF systems using a power transformer mock-up facility. As a comparison, a full-scale fire test using a water deluge system was also conducted. Test results clearly demonstrated that the CAF system, either with 2 large GDR nozzles or with 3 or 3 small TAR nozzle, performed better than the water deluge system with 21 sprinkler heads.

Details of the tests and instrumentation are discussed in the report, *Compressed-air-Foam (CAF) System for Fire Protection of Power Transformers*, by A. Kim and G. Crampton, (NRCC48320). For additional information, contact the author: andrew.kim@nrc-cnrc-gc.ca. Information on NRC's compressed-air-foam research is available online: http://www.nrc-cnrc.gc.ca/eng/projects/irc/compressed.html.

Simulated transformer fire prior to CAF application.

Simulated transformer fire after CAF application.

Protective Clothing Tools to Evaluate Performance

When is turnout gear no longer as effective as it was when purchased? How does moisture from the fireground or perspiration affect turnout gear performance? These are just some of the questions that are being asked by the University of Saskatchewan's Fire Research Group (USFRG). To address these questions, they are developing several engineering tools to assist the fire department in better understanding the performance and limitations of their protective clothing over its entire useful lifetime. Current standards from the American Society for Testing Materials (ASTM) and the Canadian General Standards Board (CGSB) are used and the USFRG is conducting research to develop and improve protective clothing tests to ensure that they will be realistic and repeatable as possible.

Testing of protective clothing to determine its replacement life cannot be destructive. Keeping this in mind, the USFRG is developing a non-destructive test for assessing turnout gear by using digital image analysis. This type of analysis can estimate the deterioration in tensile strength of fabrics after high heat flux exposure. A comparison can be made between the color changes in the image and tensile strength of outer shell fabrics after high heat flux exposures.

Details of these tests can be found in the paper, *Development of Engineering Tools for Evaluating the Performance of Firefighters' Protective Clothing*, by David Torvi, presented at the Society of Fire Protection Engineers Symposia: Partners for Protection: Fire Protection Engineers and the Fire Service, Ellicott City, MD, October 17-18, 2006. For additional information, contact David Torvi at: david.torvi@usask.ca.

Tensile strength testing of PPE fabric.

New Deputy Assistant Administrator for the U.S. Fire Administration

Chief Glenn Gaines has been named as the new Deputy Assistant Administrator for the United States Fire Administration (USFA). He is also currently serving as the Federal Emergency Management Agency's (FEMA) Acting Assistant Administrator. As a well respected member of the International Association of Fire Chiefs and its Metropolitan Fire Chiefs Section as well as, Chief Gaines has spent the past eight years as a principal architect and manager of both the Assistance to Firefighters and SAFER grant programs. In this new role, Chief Gaines brings to the position of Deputy United States Fire Administrator a keen understanding of the needs of career, combination, and volunteer fire departments and the issues affecting them during these unique times in our Nation's history. Chief Gaines began his career as a volunteer firefighter and fire officer and rose through the various ranks until finally serving as Fire Chief of the Fairfax County (VA) Fire Department. Throughout his career, Gaines has served in key roles in the areas of training, prevention, and operations, as well as overseeing a nationally recognized Urban Search and Rescue (USAR) team which has been deployed to disasters many times, both within the U.S. and internationally. Chief Gaines holds a degree in fire administration and has served as an instructor at USFA's National Fire Academy since 1991.

Chief Glenn Gaines

USFA Introduces *Tech Talk*

Self-Illuminating Tritium Sign

Tech Talk, an online newsletter, provides information on topics of interest to the fire protection community. The inaugural issue (July 2009) looks at self-illuminated or self-powered lighting, to which are used to mark exits.

http://www.usfa.dhs.gov/fireservice/research/techtalk/index.shtm

Tech Talk provides accurate and timely information on topics of interest to the fire protection community. Topics are selected based on inquiries and suggestions that USFA receives from readers.The currect issue talks about the up and coming presence of self-illumintaing exit signs.To suggest a topic for a future edition of Tech Talk, contact USFA at https://www.usfa.dhs.gov/applications/feedback

Fire.Gov Has a New Editor

Dan Madrzykowski

Dan Madrzykowski, of the National Institute of Standards and Technology's (NIST) Building and Fire Research Laboratory (BFRL) has recently been named the new Editor of ***FIRE.GOV***. Dan is a Engineer in BFRL's Fire Fighting Technology Group, and is currently leading research projects related to fire fighter safety and fire investigation.

Dan was recognized at the 2009 meeting of the Fire Department Instructor Conference (FDIC) in Indianapolis, Indiana for his long fire research career that involves conducting large-scale fire tests of importance to the fire service.

Dan was awarded the International Society of Fire Service Instructors (ISFSI) / Fire Engineering George D. Post Instructor of the Year Award. A video briefly summarizing Dan's research activities is available online at: http://www.isfsi.org/fullstory.php?84775.

We would like to take a moment to wish the previous Editor of ***FIRE.GOV***, Nelson Bryner, success in his new career as Deputy Division Chief of the Fire Research Division, BFRL/NIST. His dedication to directing and performing fire research for the fire service is well recognized and his contributions to ***FIRE.GOV*** are greatly appreciated.

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