



THE FIRE PROTECTION RESEARCH FOUNDATION

Improved Liquid Integrity Evaluation Techniques for First Responder Ensembles

PROJECT SUMMARY

1 March 2013

Background: Presently, many different types of protective clothing are required to prevent the penetration of various types of liquids that can include hot water, fire ground chemicals, industrial chemicals, blood/body fluids, and even chemical or biological warfare agents. While requirements exist for characterizing how materials keep these substances from contacting the responder, the industry generally relies on full-scale product testing to assess full garments or ensembles.

Liquid integrity testing is now performed on clothing placed on a manikin that is subjected to surfactant treated water spray from several nozzles over a specified period. The “shower” test as it has commonly been called has focused attention on garment design, particularly for closures and interfaces with other clothing items, but has also been criticized for being overly rigorous, lacking consistency, and making it difficult to identify failure modes.

This research project has the principal effort to develop sensors to replace the subjective determinations of liquid penetration made as part of the test. Research will also be conducted in the project to investigate different parameters related to how the test is conducted and correlate these observations made in simulated field exposures. In addition, test method changes and sensor technology will be validated through an interlaboratory test program. The project will recommend the new test procedures for incorporation into various standards such as NFPA 1971 on turnout clothing and NFPA 1994 for chemical/biological terrorism protective ensembles.

Research Goal: The goal of this project is to develop new procedures to improve how barrier protective clothing for first responders is evaluated when limiting exposure to hazardous liquids.

Affected NFPA Documents: This project is related to the family of NFPA personal protective equipment (PPE) related standards such as NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, and NFPA 1994, *Standard on Protective Ensembles for First Responders to CBRN Terrorism Incidents*.

Project Tasks: This 20 month project is led by International Personal Protection Inc (IPP) and involves a collaborative effort with the Fire Protection Research Foundation (FPRF) in coordination with emergency response partners. Intertek Testing Services (ITS) will be providing technical support for the development and evaluation of the sensor systems as well as conducting tests to demonstrate changes to the test method. The project involves the following general tasks:

- a) Simulate potential liquid exposures under field conditions and measure/document failure modes;
- b) Investigate conductivity-based sensors to improve test precision;
- c) Prepare initial test protocols and laboratory test plans;
- d) Conduct experiments with candidate sensors and modified test procedures to correlate test results with field observations;
- e) Undertake interlaboratory test program to document ease of implementation, consistency of new test procedures and ability to identify failure modes; and
- f) Finalize proposed test methods to standards developing organizations.

Implementation: The research program will be conducted under the auspices of IPP and will receive guidance throughout the project by a Project Technical Panel. Funding for this project is provided through the Technical Support Working Group (TSWG) of the Department of the Defense's Combating Terrorism Technical Support Office (CTTSO). The final report is scheduled to be issued by October 2014.