

Thermal Characteristics of Fire Fighter Training Simulators and Effects on Respiratory Protection Ensembles

Amy Quiring, Judge Morgan, Michael Parham and Yuqing Ding

Scott Health and Safety, Research and Development

The National Fire Protection Association defines the upper limit of human temperature tenability at approximately 212°F, well below temperatures in fires that are beyond the incipient stage¹. Temperatures exceeding 500°F are common with materials of construction used in today's home construction, contributing to rapid fire growth. Flashover typically occurs due to ignition of fire gases and temperatures up to 1500°F can develop in well under five minutes.

Field tests were conducted to characterize the thermal environment inside firefighting training facilities to assess the vulnerability of PPE systems to thermal radiation exposure.

Thermistors were placed near the fuel load in each live fire exercise to record thermal layers inside the training environment. Certified NFPA 1403 subjects were utilized and equipped with NFPA 1981 2007 edition SCBA, protective clothing, helmets, gloves, and boots. Thermistors recorded interior and exterior SCBA facepiece temperature, temperature inside the PPE ensemble and on the mask-mounted regulator. Subjects were instructed to remain in a low position and breathe at a normal rate. Subjects experiencing any discomfort or excessive heat loading were instructed to leave the exercise immediately.

The temperature in thermal layers was recorded over the duration of excursions as was the temperature of the subjects, PPE and respiratory protection ensemble. Observations regarding comfort and conditions of the equipment were also recorded. This study seeks to identify opportunities for continuous improvement to overall thermal resistance characteristics of fire fighter PPE ensembles.

¹) Instructor's Guide, National Fire Protection Association, 1986