The Health Problem

Firefighter exposure to dirty and contaminated personal protective equipment (PPE) is an increasing concern for long-term health. Firefighters are exposed to highly toxic substances (a variety of carcinogens) on the fireground, and more insidiously to an increasing range of infectious pathogens while caring for patients and operating at emergency incidents. Motivating the need for this study, was the lack of procedures or requirements demonstrating whether current PPE cleaning practices, including those specified in NFPA 1851 standard, will remove contaminants from firefighter PPE. This project established clear and definitive guidance to the fire service for applying cleaning and decontamination procedures that effectively remove both chemical and biological contaminants. As a majority of fire departments in the US make use of NFPA standards, providing the results of this research to support changes to the NFPA 1851 standard is a viable way to both inform firefighters and improve cleaning of firefighter PPE.

Impact on Standards

The project team provided extensive input and comments based on the research to the committee responsible for NFPA 1851. The committee significantly revised the standard for its 2020 edition. Consequently, cleaning verification is now a mandatory requirement applied to PPE manufacturers and independent service providers (ISPs) that routinely clean firefighter clothing. It is expected that manufacturers and ISPs will transfer knowledge of effective procedures directly to the fire service. The incorporation of project findings in fire service standards has proven to be a powerful way of transitioning research into practice.

Promoting Better Cleaning

Casey Grant, Executive Director of the Fire Protection Research Foundation, served as the principal Investigator for the 3-year study conducted in conjunction with the National Institute for Occupational Safety and Health (NIOSH) and International Personnel Protection, Inc. The project team undertook detailed investigations of firefighter garment contamination levels and created standardized test procedures to determine the effectiveness of cleaning. This effort entailed developing procedures that could be portably applied at different cleaning facilities for determining removal rates of both chemical and biological contaminants. Through a comprehensive set of experiments, including multiple validation steps, the project team utilized a kit-like approach where clothing swatches could be treated with standardized contaminants and inserted into gear for cleaning, and then removed after the cleaning process for analysis of remaining contaminants. The amount of and type of contaminants removed from the swatch is a measure of both cleaning and sanitization effectiveness. The developed procedures took into account practical factors such as cost and ease of implementation.

Steps in Cleaning Verification Kit Process

A. Representative material sample swatches prepared
B. Swatches treated with standardized chemical or biological contaminates in a laboratory process
C. Swatches packaged in kit and sent to organization seeking verification
D. Swatches placed inside surrogate turnout clothing
E. Clothing with swatch washed according to organization’s existing process
F. Swatches re-packaged in kit and sent to qualified lab
G. Swatches analyzed for contamination levels
H. Results provided for showing cleaning effectiveness by contaminant

Link: www.NFPA.org/PPEcleaning