



Fire Service Gear Cleaning Validation

Validation of Cleaning Procedures for Fire Fighter Personal Protective Equipment (PPE) & Equipment
(For more information see www.nfpa.org/PPECleaning)

PROJECT SUMMARY

Last updated: 15 October 2018

Background: This AFG funded Fire Grant project establishes a validated and scientifically-based cleaning methodology for the primary spectrum of potentially contaminated fire service personal protective equipment (PPE) and equipment, including PPE not addressed by previous work such as helmets, gloves, and footwear, and other key components subjected to contamination such as hand tools, fire hose, and apparatus seat covers. This study is important because it provides a critical contribution to effective contamination control, which is believed to be a significant contributor to fire fighter long term health concerns (e.g., cancer). Project partners include NIOSH (National Institute for Occupational Safety and Health) and IPP (International Personnel Protection).



This effort is a logical extension of an earlier research project that established validated cleaning procedures focused on PPE textile garments that are traditionally cleaned in commercial laundering extractors. The focus of the earlier baseline work optimized turnout clothing cleaning procedures and provided solutions relative to minimizing contaminant exposures that result in long term adverse health conditions. This earlier study established a methodology that can evaluate the effectiveness of cleaning and decontamination processes for removing both chemical and biological contaminants from garment outer shell materials. The cleaning process for other gear is significantly different, and this project will adapt the validated cleaning procedures to the primary spectrum of potentially contaminated fire service gear.

Purpose and Objectives: The overall goal of this project is to improve fire fighter health and safety by reducing repeated exposure to harmful contaminants in unclean or inadequately cleaned PPE and related equipment. Specifically, this effort will answer new questions about turnout clothing contamination removal to further refine recommended fire service advanced cleaning and sanitization procedures to levels of greater efficiency with conventional laundering/treatment approaches. Equally important, this project will adapt the established evaluation methods for the consistent measurement of cleaning effectiveness (demonstrated in a DHS AFG project currently being completed) beyond their originally-designed use with fire service washer/extractors (used for garment outer shells) to address other critical contamination concerns involving other garment layers and components, helmets, boots, gloves, SCBA, and related response equipment that could include hand tools, fire hose, and fire apparatus. The direct benefit to the fire service of the research is the broader validation of PPE/equipment cleaning that increases the assurance that fire fighters are not unnecessarily exposed to persistent harmful contaminants through their PPE or tools.

Study Design and Methods: This project is composed of six phases and multiple tasks as follows:

- I. **Phase I – Initiate Project:** Establish and initially convene panel; Engage contractors.
- II. **Phase II – Investigate Cleaning Parameters:** Prepare test plan to evaluate cleaning changes; Adapt kit-based procedures for other materials; Carry out kit-based testing and experiments; Specify updated cleaning procedures.

- III. Phase III – Characterize Other PPE Contaminants: Characterize PPE/equipment contamination; Devise methods to assess contamination; Establish overall evaluation approach; Establish overall evaluation approach; Hold panel meeting to set overall approach.
- IV. Phase IV – Evaluate Cleaning for Other PPE: Confirm target contaminants; Determine appropriate metrics; Assess other PPE cleaning methods; Evaluate cleaning procedures at field test sites.
- V. Phase V – Refine Test Procedures and Utility: Carry out further validation efforts; Finalize test procedures for PPE assessment; Identify mitigation strategies.
- VI. Phase VI – Document Project Output and Outreach: Prepare project final report; Recommend standards public inputs/comments; Provide industry guidance document/outreach

Results (Projected): The following are the project results from this project:

- Determine principal areas of contamination retention for other types of PPE (beyond coat/pant outer shells) and fire service equipment and characterize the mechanisms by which exposure to contamination occurs.
- Characterize current cleaning processes applied to various forms of PPE and equipment.
- Identify and investigate specific adjustments to conventional laundering and presoaking techniques using the established kit procedures.
- Adapt current contamination, extraction, and analysis techniques for evaluating cleaning, disinfection, or sanitization effectiveness on other types of PPE and equipment against both chemical and biological contaminants.
- Demonstrate the reliability and appropriateness of proposed evaluation approaches through correlation using an extensive field validation process involving fire departments, independent service providers, and verified organizations for turnout clothing cleaning and care.
- Evaluate the effectiveness of selected processes now used for cleaning other fire service PPE and equipment using refined project procedures for verifying removal of contaminants and determine those process parameters that provide the greatest efficiencies.
- Prepare industry guidance for cleaning, decontamination, and disinfection or sanitization procedures of fire service PPE and equipment.
- Facilitate proposed specific test methods for evaluating decontamination effectiveness for potential adoption as part of the next edition of the NFPA 1851, Standard on the Selection, Care, and Maintenance of Structural and Proximity Firefighting Protective Ensembles.
- Facilitate proposed design, construction, and textile considerations for improved contamination resistance and reduction pertinent to PPE for the next edition of NFPA 1971.

Conclusions (Projected): This project seeks the following conclusions:

- 1) Improve Baseline Garment Advanced Cleaning and Sanitization Procedures: Determine those process steps and parameters (e.g., use/type of pretreatments, detergent type and number of rinses) that provide the greatest efficiencies in contaminant removal in turnout clothing, which further consider all principal material components, permitting changes to the current default advanced cleaning and sanitization procedures recommended in NFPA 1851.
- 2) Characterize Contamination Processes for Other PPE and Equipment: Identify and quantify contamination mechanisms involving helmets, hoods, boots, gloves, SCBA, hand tools, fire hose, and apparatus to prioritize target PPE/equipment for evaluating cleaning and sanitization effectiveness;
- 3) Successfully Adapt Chemical and Biological Decontamination Verification Procedures to Other PPE and Equipment: Develop and validate specific approaches for demonstrating cleaning effectiveness for each of the selected PPE-related equipment items by modifying previously-established evaluation techniques for the consistent measurement of cleaning effectiveness;
- 4) Extend Overall Fire Service Guidance and Proposed Standards: Define and promote implementable cleaning, decontamination, and disinfection strategies to establish best practices that effectively reduce fire fighter exposures to persistent contaminants through PPE and related equipment in addition to promoting cleaning verification procedures that can be standardized to validate different approaches.