



Analysis of Station Wear Selection Worn Underneath a Structural Firefighter Turnout Ensemble

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Structural firefighter turnout gear is essential for the safety of firefighters as they rely on the protective properties against multiple thermal hazards and threats (McQuerry, Den Hartog, Barker, & Ross, 2016). The clothing worn under the firefighter turnout suit, known as station wear, also contributes to the thermal protection of the overall ensemble. Depending on the station wear's fiber content and fabrication, however, it may also contribute to potential burn injury. National Fire Protection Association (NFPA) 1975 is the *Standard on Emergency Services Work Clothing Elements* that defines the performance requirements of both a certified and certified flame resistant (FR) station wear garment to be worn underneath a structural turnout suit (National Fire Protection Association, 2014). NFPA 1971 *Standard on Protective Ensembles for Structural Firefighting* defines the performance requirements of the turnout ensemble (National Fire Protection Association, 2013).

The purpose of this study was to evaluate the impact of materials, design, selection, and use for NFPA 1975 certified and non-certified station wear garments in relation to thermal stability and burn protection while worn under a certified NFPA 1971 turnout suit. To accomplish the purpose of this study, the following research objectives were established:

1. To conduct a comprehensive literature review and identify gaps regarding the impact of station wear on burn injury while worn under a certified NFPA 1971 turnout suit.
2. To design and administer an information gathering questionnaire regarding firefighter station wear selection, use, design, material type, and its perceived protection.

A comprehensive survey of the literature and formal written review was compiled to identify gaps in the current body of knowledge, assess design and material selection, and determine the effects of certified versus non-certified station wear on burn injury potential. The researchers were able to determine that few studies have considered firefighter station wear, especially in conjunction with a NFPA 1971 turnout suit, as the majority of previous research has focused solely on physiological comfort (Smith, Arena, et al., 2013; Smith, Haller, Hultquist, Lefferts, & Fehling, 2013). The impact of wearing synthetic base layer materials that will melt and drip has not been sufficiently studied for burn injury protection.

A nationwide information gathering questionnaire was designed and administered to firefighting personnel. The goal of this questionnaire was to address the personal selection, use, and educational awareness of station wear certification. The questionnaire was divided into subsections that included questions on demographics, fire service experience, selection, use, materials, and design for station wear worn underneath structural firefighter turnout suits.

Over 1,800 completed questionnaire responses were received through the online questionnaire via the survey tool Qualtrics. The demographic and fire service questions gave rise

to data analysis through categorization under criteria such as gender, commitment level, geographic region, and NFPA 1975 certification awareness. The majority of firefighters (70%) indicated that they were familiar with the NFPA 1975 standard (Figure 1). However, in the comments, many elaborated that while they had knowledge of the standard, they did not actually understand its purpose or the differences between a certified, certified flame resistant (FR), or non-certified garment.

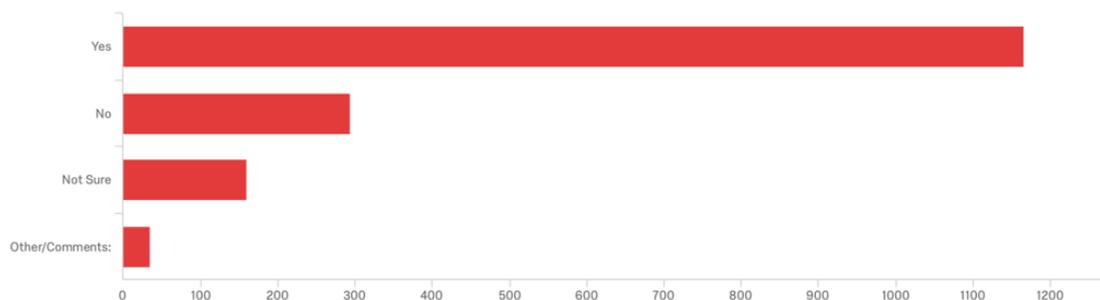


Figure 1. Firefighter Familiarization with NFPA 1975

Within the topic of selection, individual department station wear requirements were analyzed. Over half of the fire departments surveyed indicated that all members did not wear the same base layer underneath their structural turnout suit. The majority of fire departments did, however, provide or require a specific station wear ensemble, and of those, the majority indicated they were not wearing a NFPA-certified garment for thermal protection. Under the topic of station wear use, questions were asked regarding the frequency, configuration, and seasonal usage of each firefighter's station wear. Most firefighters reported wearing shorts at least sometimes, if not more often, and reported wearing a short sleeve shirt most frequently with more than half of firefighters listing it as their preference.

Moving into the station wear design category, firefighters were asked to describe their satisfaction, valued features, and safety concerns with regard to their respective station wear ensembles. When asked what features are most important to them, the top three factors firefighters chose were comfort, mobility, & moisture management. Two overarching factors of importance that participants prioritized when considering selection, use, and design were the cost of certified garments and clothing comfort. The subsection regarding materials collected data on fiber content and fabric construction. At the end of the survey, firefighters were asked to answer open ended questions regarding their thoughts on what changes could be made to their station wear and how those garments impact their firefighting experience.

In conclusion, this study identified gaps in the literature for future research and determined the most common materials and design configurations of station wear currently being worn. This research culminated in a final written report published on the NFPA Fire Protection Research Foundation (FPRF) website, along with a proposed test plan for future laboratory testing on the material and garment levels.

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References:

- McQuerry, M., Den Hartog, E., Barker, R., & Ross, K. (2016). A review of garment ventilation strategies for structural firefighter protective clothing. *Textile Research Journal*, 86(7), 727–742. <https://doi.org/10.1177/0040517515595029>
- National Fire Protection Association. (2014). NFPA 1975 Standard on Emergency Services Work Clothing Elements. Quincy, MA: National Fire Protection Association.
- National Fire Protection Association. (2013). NFPA 1971: Standard on protective ensembles for structural fire fighting and proximity fire fighting. Quincy, MA: National Fire Protection Association.
- Smith, D. L., Arena, L., Deblois, J. P., Haller, J. M., Hultquist, E. M., Lefferts, W. K., ... Fehling, P. C. (2013). Effect of base layer materials on physiological and perceptual responses to exercise in personal protective equipment. *Applied Ergonomics*, 45(3), 428–436. <https://doi.org/10.1016/j.apergo.2013.06.001>
- Smith, D. L., Haller, J. M., Hultquist, E. M., Lefferts, W. K., & Fehling, P. C. (2013, January). The Station Uniform Shirt. *Firehouse*, 74–79.