Contamination Control in the Fire Service
NIOSH Hierarchy of Controls

1. Elimination
   - Physically remove the hazard

2. Substitution
   - Replace the hazard

3. Engineering Controls
   - Isolate people from the hazard

4. Administrative Controls
   - Change the way people work

5. PPE
   - Protect the worker with Personal Protective Equipment

Source: NIOSH
Effects of firefighting hood design, laundering and doffing on smoke protection, heat stress and wearability

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ABSTRACT
Firefighting hoods must provide protection from elevated temperatures and products of combustion (e.g., particulate) while simultaneously being wearable (comfortable and not interfering with firefighting activities). The purpose of this study was to quantify the impact of (1) hood design (traditional knit hood vs particulate-blocking hood), (2) repeated laundering, and (3) hood removal method (traditional vs overhead doffing) on (a) protection from heat contamination on the neck, (b) heat stress and (c) wearability measures. Using a fireground exposure simulator, 24 firefighters performed firefighting activities in realistic smoke and heat conditions using a new knit hood, new particulate-blocking hood and laundered particulate-blocking hood. Overall, heat contamination levels measured from neck skin were lower when wearing the laundered particulate-blocking hoods compared to new knit hoods, and when using the overhead hood removal process. No significant differences in skin temperature, core temperature, heat rate or wearability measures were found between the hood conditions.

Practitioner Summary: The addition of a particulate-blocking layer to firefighters’ traditional two ply hood was found to reduce the PAH contamination reaching the neck but did not affect heat stress measurements or thermal perceptions. Modifying the process for hood removal resulted in a larger reduction in neck skin contamination than design modification.

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KEYWORDS
Personal protective equipment, firefighting, chemical exposure, heat stress, wearability

Abbreviations: ANOVA, analysis of variance; B: new particulate-blocking hood and PPE (PPI) configuration; FII: firefighting exposure simulator; GC: gas chromatography; K: new knit hood and PPE (PPI) configuration; L: laundered particulate-blocking hood and PPE (PPI) configuration; LOD: limit of detection; MESC: maximum likelihood estimation; NFPA: National Fire Protection Association; PAHs: polycyclic aromatic hydrocarbons; PPE: personal protective equipment; SCBA: self-contained breathing apparatus; TEL: total heat loss; TPI: thermal protective performance

Doffing Method

Traditional
Overhead

![Graph showing Neck Skin Total PAHs (µg/m²) for New Knit, New Blocking, and Laundered Blocking Hoods.]

<LOD

New Knit
New Blocking
Hood Design
Laundered Blocking