



**Jeffrey O. and Grace G. Stull**

PPE Update

## How firefighter hoods will fight cancer

**While no silver bullet for cancer prevention, barrier hoods are a great step in that direction**

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In **February 2014 we wrote** that protective hoods are the most vulnerable area of the firefighter's ensemble. That's because hoods lack any type of barrier characteristics to keep out the superfine particles that absorb a variety of hazardous chemicals including carcinogens.

This shortcoming was coupled with NIOSH studies and other research showing carcinogen buildup on firefighters' skin, particularly on the neck and face areas unprotected by the SCBA face piece. Further, that skin absorbs chemicals easily around a person's jaw line led to the obvious conclusion that current-day hoods have little effectiveness in keeping out soot.

Then in January 2015, **we assisted the IAFF** with a study to show how much particle penetration takes place throughout the entire structural firefighting ensemble. After that, there could be no doubt that the hood is one of the serious gaps in firefighter protection that needs to be solved.

An overwhelming number of firefighter hoods consist of two layers of knit material fashioned into a sock-like hood that stretches over the firefighter's head with an opening for the SCBA face piece and bib that is supposed to stay tucked inside under the top of the coat.

The current requirements in **NFPA 1971** considers hoods an interface devices for providing thermal protection in areas where other ensemble elements do not always provide complete coverage, such as the SCBA face piece, helmet ear covers and coat collar.

Yet as the firefighter moves, the hood shifts and leaves the interface areas exposed to the hostile environment.

## **Revising NFPA 1971**

When the revision process for the NFPA 1971 standard began, a specific task group was charged to come up with possible ways for minimizing firefighter exposure to the carcinogens and other harmful substances contained in soot.

Through NFPA 1971 public input process, we proposed that a new optional category of protective clothing be added to the standard covering a particle barrier layer added to the hood. We further recommended that the effectiveness of this barrier layer be demonstrated through a standardized particle-filtration efficiency test.

This test was selected to show how the combination of hood materials, including a new barrier layer, would greatly diminish how many particles could pass through the hood to the firefighter's neck and head. An initial target of 90 percent effectiveness percent was suggested.

One way to achieve complete particle blockage could be to install a moisture barrier as part of the hood composite, similar to the way garments use the same barrier materials.

In this instance, there would be no need to test the moisture barrier since, as a continuous solid layer, it already is fully effective particle-blocking material. Thus, the particle-filtration efficiency test would be applied to those materials that had some level of air permeability.

The increased layering of the hood and the further encapsulation of the firefighter's head pose additional stress to an already physiologically challenged first responder. We therefore suggested that a total heat-loss test be applied to these newly reinforced portions of the hood at levels far above those required for garment composites.

In this way, the maximum amount of heat stress relief could be provided without compromising the particle holdout capabilities of the new hoods.

## **Research and development**

These proposed requirements will not be adopted in one form or another until mid-2017. Meanwhile, several manufacturers and fabric suppliers have been working on prospective hood products to reduce firefighter exposure to soot and the adsorbed chemicals contained in smoke particles.

These products encompass a variety of new hood designs and combinations of different barrier materials, including both new particle filter layers as well as conventional moisture barriers.

Hood manufacturers have had to develop creative designs to still allow the "one size fits all" without the benefit of the same level of elasticity. In most cases, there is more to a particle-barrier hood than simply inserting a barrier layer between the two knit fabric layers. Each manufacturer has responded with new product designs that transformed their traditional hoods in some fashion.

Those hood suppliers not using established moisture barriers are using different ways to evaluate their barrier layer particulate filtration efficiency. For overall product efficacy, one manufacturer has undertaken the same testing that was performed by the IAFF showing the difference between a non-barrier hood in their barrier-based product in full ensemble testing.

Another company conducted similar testing, but put the hoods on a head form in the same particle laden chamber used for the IAFF test with photographs showing the differences between new and existing products. Each manufacturer has tried a variety of field evaluations, some involving live-fire conditions and others simply determining the relative comfort and ease of use.

All of the new products, many unveiled this past spring, are certified to current requirements in NFPA 1971 as regular hoods. The new particle barrier hood criteria are not finished.

### **More work to do**

It would be nice if we could acknowledge "a job well done" and move on to the next issue. Yet, this avenue of protection is not completely solved.

As would be expected, the new hood products are more complex, use new materials and are consequently more expensive. The fact that these hoods are more costly means that fire departments will expect the hoods to stay in service longer.

This brings into question the hoods' durability over an extended period with multiple cleanings and how well the particle-blocking capability and relative fit will be maintained. In short, we don't know how the new products may hold up or how well they can be cleaned and reused.

And since the new hoods incorporate an additional layer, they are also somewhat heavier and will have higher thermal insulation than conventional hoods. The greater levels of heat protection means firefighters will perceive heat to a lesser degree than they already do, which can be good or bad depending on how firefighters are trained to react to heat.

Some new hoods may reduce a firefighter's ability to hear. Further, not all products have been validated on the full scale dynamic human subject-based particulate environment testing.

The industry still has to work out these issues, particularly as the new version of NFPA 1971 comes to fruition. The fact that there is industry movement in this area should be cause for optimism. Nevertheless, as with all new technologies there are still a lot of details to be worked out.

Remembered, in minimizing exposure to carcinogens, PPE use is only one of several approaches needed to solve this problem. Thus, barrier hoods are an important first step, but not the silver bullet for cancer prevention.

## **About the author**

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Jeffrey and Grace Stull are president and vice president, respectively, of International Personnel Protection, Inc. They are members of several NFPA committees on PPE as well as the ASTM International committee on protective clothing. Mr. Stull was formerly the convener for international work groups on heat/thermal protection and hazardous materials PPE as well as the lead U.S. delegate for International Standards Organization Technical Committee 94/Subcommittees on Protective Clothing and Firefighter PPE. They participate in the Interagency Board for Equipment Standardization and Interoperability and have authored the book, "[PPE Made Easy](#)." Send questions or feedback to the Stulls via [email](#).

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