NC STATE UNIVERSITY STUDY FINDINGS:

How Clean is Your Firefighter PPE?

FIRE GEAR WASHING TECHNIQUE EFFECTIVENESS TAKEAWAYS

The International Agency for Research on Cancer (the cancer agency of the World Health Organization) has classified occupational exposure as a firefighter as carcinogenic to humans (Group 1) on the basis of sufficient evidence for cancer in humans. This raises the cancer risk classification from Group 2B to the highest danger classification of Group 1.

Recently, North Carolina State University made public a study on the efficacy of different washing techniques currently used in the fire service. All of the testing was done in accordance with the **NFPA 1851 Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting**. The test samples were contaminated with known fireground contaminants (phenols, PAHs and phthalates).

> "**For a firefighter,** his/her gear is a very personal thing. It is infused with memories, values and experiences but it is also unwise to not perceive it as a tool and the only protection during the face of adversity. Thus, it is very important to take proper care of the PPE. The NFPA 1851 standard is also revising the guidelines of washing to fill the research gaps, address the efficacy of removing contaminants and make washing and decontamination procedures less cumbersome and more economical."
>
> **~ Girase, Arjunsing, North Carolina State University**

Dirty gear is no longer a badge of honor.

AS THE NUMBER OF FIREFIGHTERS DIAGNOSED WITH CANCER INCREASES, WE ARE SEEING A SLOW SHIFT IN THE ATTITUDE AND PERCEPTION AROUND DIRTY GEAR.

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Carcingens often found in fireground smoke...

PAHS | Incomplete combustion of organic matter produces PAHs in the environment.

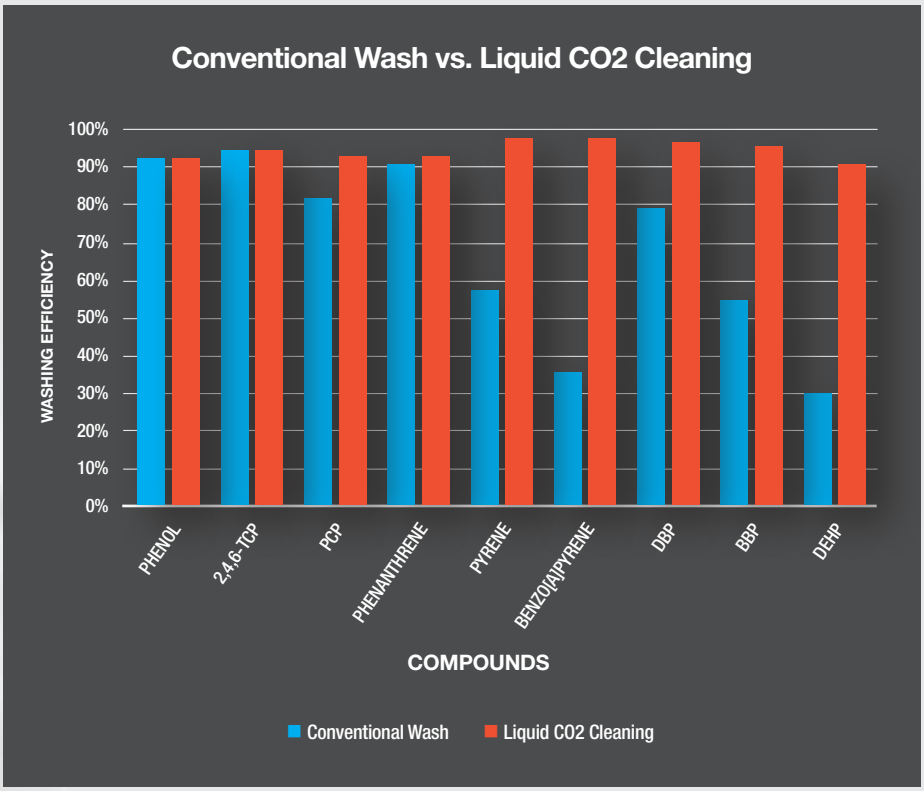
- **Occupational exposures can happen via inhalation, ingestion and dermal**
- **Short term effects include asthmatic and thrombotic effects**
- **Long term effects can result in cancer, liver damage and adverse reproductive effects**

PHTHALATES | The esters of phthalic acids which are widely used as plasticizers that are added to impart flexibility to polymers. They are used in PVC, flooring and roofing.

- **Short term and long term studies indicate adverse effects on the liver, kidneys and thyroid tissue**

PHENOLS | Cyclic compounds containing a hydroxyl group attached to an aromatic ring. Phenols are a pollutant that is found largely in industrial effluents, oil refineries, pulp and paper manufacturing industries, pharmaceutical industries, plastic and varnish industries. These can be used as wood preservatives and/or flame retardants.

- **Phenols have teratogenic, carcinogenic and mutagenic effects**



CO2 CLEANING: TAKING PPE CLEANING TO A HIGHER LEVEL IN THE FIRE SERVICE

The results of the NC State research indicated that the protocols that most departments and ISP's follow are not very effective at removing contaminants.

The study utilized commercial surfactants that are commonly used in the fire service in a UNIMAC® 45-lb washer extractor.

Tersus Solutions in Denver, Colorado conducted the liquid CO2 cleaning of the test samples using protocols that are proprietary to Tersus Solutions and to LION TotalCare®.

KEY HIGHLIGHTS:

- Conventional washing methods are limited in removing phthalates and PAHs
- Liquid CO2 cleaning was superior at removing these compounds
- Liquid CO2 cleaning did not have any adverse effect on the outer shell's physical

SOURCE:

Evaluation and Improvements of Cleaning Methodologies Practiced in the Firefighting Community, 2022 (A dissertation submitted to the Graduate Faculty of North Carolina State University in partial fulfillment of the requirements for the degree of Doctor of Philosophy) by Arjung Girase