Researchers at the National Institute of Standards and Technology (NIST) have conducted an in-depth examination of a range of textiles used in turnout gear coats and pants, which are constructed in three layers.

The results showed that the amount of PFAS present varies widely between manufacturers and layers, with the highest PFAS concentrations observed in the outermost two. The results of the study suggest that selecting optimal combinations of fabrics for each layer could significantly reduce the amount of PFAS present in turnout gear.

Researchers have shown that firefighters are burdened by comparatively high levels of at least one type of PFAS.

The first step to better-protecting firefighters from this potential health hazard is to learn about the sources of PFAS exposure, which may include their protective gear.

The research team collected 20 brand-new textile samples, each used for one of the three layers of turnout gear — the outer shell, the moisture barrier and the thermal liner. All meet a standard published by the National Fire Protection Association (NFPA), which specifies requirements for resisting heat, water and other hazards.

The researchers targeted 53 PFAS within 20 textiles used to fabricate the different layers of turnout gear. They identified and quantified the concentrations of 26 different PFAS, uncovering some important differences among the samples.

The team found the least amount of PFAS in the layer closest to firefighters’ skin, the thermal lining, which may correspond to water repellency being a lower priority for this layer than the other two.

At the other end of the spectrum, the moisture barrier and the outer shell contained PFAS concentrations up to 400 times higher, though those numbers varied widely from fabric to fabric.

Two of the outer shell textiles they tested had not been treated with a water-repellent coating. Those samples contained far less PFAS than other outer shell layers, while the treated outer shell fabric consistently contained the greatest amounts of PFAS.

Ongoing work at NIST is aiming to unveil the effects that wear and tear — UV exposure, heat, laundering, etc. — have on measurable PFAS in turnout gear. The researchers suspect that regular use may lead more PFAS to escape from the gear.

The results of that research should further cement our understanding of what is inside the gear. NIST is also completing a similar study of PFAS in new and stressed hoods, gloves, and wildland gear.

Further research by federal partners will focus on what kinds and levels of PFAS are dangerous and how the chemicals find their way into firefighters’ bodies.