Tentative Interim Amendment

NFPA® 1850

Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural and Proximity Firefighting and Open-Circuit Self-Contained Breathing Apparatus (SCBA)

2026 Edition

Reference: 6.1.3.5.2, A.6.1.3.5.2, A.6.1.3.5.2(3), and 6.3.10
TIA 26-1
(SC 25-8-22 / TIA Log #1842)

Note: Text of the TIA was issued and approved for incorporation into the document prior to printing.

1. Revise 6.1.3.5.2 and associated Annexes A.6.1.3.5.2 and A.6.1.3.5.2(3) to read as follows:

6.1.3.5 Lithium-ion Battery (LIB) and Mobile and Stationary Energy Storage System Decontamination Actions.

…

6.1.3.5.2* Following preliminary exposure reduction, a decision shall be made whether ensembles and ensemble elements are subject to advanced cleaning or specialized cleaning including consideration of the following factors:

(1) The total amount and proportion of fire contents attributed to LIBs or related products~~.~~

~~(2) The degree to which firefighters have expected exposure to lithium-ion battery or related product decontamination products from the fire.~~

~~(3)*~~(2) The environmental characteristics of the fire location~~.~~

(3) The degree to which firefighters have expected exposure to LIB or related product decontamination products from the fire

(4) The availability of ~~any~~ measurements from protective elements~~,~~ other surfaces, or air ~~measurements~~ that reveal unusual or high levels of contaminants that are believed to be associated with fires involving the decomposition of lithium-ion battery or related product decontamination products~~.~~

(5) Prior experience within the organization or by others in being able to successfully remove contaminants by current advanced cleaning procedures from protective elements that have been exposed during fire operations involving a significant content attributable to lithium-ion batteries or related products~~.~~

(6) The availability of ~~independent~~ documentation in the form of independent reports or studies on the demonstrated ability of specific cleaning processes or agents to remove contaminants from protective elements that are associated with fires involving the decomposition of ~~lithium-ion battery~~ LIB or related product decontamination products~~.~~

(7) The ability to perform pre- and postfire exposure ~~cleaning~~ testing to examine the effectiveness of the chosen type of cleaning~~.~~

A.6.1.3.5.2 The number and frequency of fire events involving LIBs and related devices or facilities, such as mobile and stationary energy storage systems, are increasing. Prior research ~~is showing~~ has shown that many fires involving this type of content can burn faster and hotter through thermal runaways or other unique conditions associated with these materials. While many of these fires can still be classified as involving products of combustion, the prevalence of possible hazards associated with these fires warrants greater attention by the fire service with respect to how protective ensembles and ensemble elements could be contaminated at the scenes of these fires. This information affects whether advanced cleaning is sufficient or if specialized cleaning should be applied. ~~One of the key decisions with respect to determining if additional attention should be given for the decontamination of protective ensembles and ensemble elements that these fires is~~ This decision can be informed by undertaking a size-up of the situation where exposure has occurred. A recommended approach for conducting the size-up appears in the 2024 Urban Fire Forum (UFF) Position Statement, *Statement in Support of Considering Enhanced Decontamination Methodologies of PPE Following Exposure to Lithium-Ion Battery Fires* (https://www.nfpa.org/membership/member-sections/metropolitan-fire-chiefs-association/urban-fire-forum), where the individual factors indicated in 6.1.3.5.2 are posed as the following questions with the related guidance information:

~~The specific factors identified in determining whether additional decontamination considerations should be applied include the relative content of lithium-ion batteries at the fire location as part of the combustible contents in addition to the length of time and specific activities of firefighters engaged on the fireground.~~

(1) Is the total amount and proportion of fire contents attributed to LIBs or related products considered to be high? In some cases, an understanding of the specific fire contents in combination with any contamination measurements made during or following the fire can help to inform this decision. Many fires can involve lithium-ion batteries or related products, but not all fire events with these products present require specialized cleaning. The greater the content of LIB technology of the fire, particularly if an LIB is the origin of the fire, the more likely significant the contamination from the fire.

(2) Is the environment involving the LIB fire open (such as an electric vehicle on a highway) or closed (such as the same electric vehicle in a garage)? In many cases, closed environments would be more likely to cause greater exposure of firefighters to LIB fire decomposition products.

(3) Were the assigned firefighters likely exposed to LIB fire decomposition products based on their specific fire scene roles and length of time on scene? Firefighters who remain proximate to the fire and are actively engaged in mitigating the fire for longer period of time will be more contaminated.

(4) Were any measurements taken during or after the fire suggestive of contaminants associated with LIB fire? In sizing up a fire, the department can use a hazmat team or other capability to assess exposures or to be able to sample gear and structure surfaces after overhaul to determine if certain types of chemicals are present that could be associated with LIB fires. Any air sampling conducted during the fire can also be helpful. Depending on the types of ~~lithium-ion battery~~ LIB technologies involved, a variety of different decomposition products can be present that involve lithium compounds, hydrogen fluoride, hydrogen cyanide, hydrogen chloride, and various phosphorus and fluorinated compounds that can react with other combustible materials that are present. Known metals, including lithium, cobalt, nickel, and manganese have been characterized at the sites of fires involving ~~lithium-ion battery~~ LIB technology. Therefore, the measurement of these substances at relatively higher levels than normally expected could be an indication that specialized cleaning or an enhanced version of advanced cleaning should be applied.

(5) Does the department have prior experience or knowledge of other department incidents similar to the fire event that showed that some form of enhanced process or specialized cleaning has been required? Networking within the fire service is helpful in establishing lessons learned that can be shared to provide broadly applied best practices. Many fire departments have posted information for how they have had to handle specific LIB fire challenges, including approaches for addressing contaminated gear. Some departments have specifically found that apparent persistent contamination remains despite multiple regular washings of gear. Organizations can further learn from the experience gained from other departments that have either successfully or not successfully applied various types of advanced cleaning, depending on the specific circumstances faced during the specific referenced fires. In addition, some cleaning technologies could present advantages in their overall effectiveness for removing both semivolatile and metal materials that can inform cleaning decisions.

(6) Is independent documentation available that demonstrates the ability of specific cleaning or decontamination processes as being successful in effectively removing LIB fire contaminants from firefighter PPE? Some limited research has been performed by different organizations and suppliers of cleaning equipment and services to show how specific decontamination approaches can be used to remove LIB contamination. One study conducted in late 2024 by the Texas A&M Engineering Extension Service (https://teex.org/ev-ess-current-practices/) indicated measured concentration of 75 different semivolatile organic compounds (SVOCs) and 24 different metals on protective clothing exposed to different lithium-ion battery fires in a thermal runaway condition. Testing of uncleaned sample gear and sample gear subject to one of two different cleaning processes showed relatively high effective removal rates for the principal metals of concern (lithium, nickel, manganese, and cobalt) at over 99 percent for both a standard washer/extractor-based cleaning and an enhanced liquid carbon dioxide drycleaning process, but significantly different results for the SVOCs with over 90 percent for the liquid carbon dioxide drycleaning and just over 50 percent for the washer/extractor-based cleaning. Equally important was the finding that penetration of particles containing the bulk of metallic contamination through the outer shell was relatively low, whereas high deposition rates of SVOC occurred in the moisture barrier. The use of studies like this can inform the likelihood of specific cleaning processes as providing satisfactory rates of contaminant removal.

~~Lastly, those organizations that have access to resources for testing contaminated protective ensemble and ensemble elements both before and after cleaning may obtain information that is also able to allow them to distinguish as to whether the intended advanced cleaning procedures will be effective.~~

(7) Does the department have resources available to conduct outside testing of PPE before and after cleaning to examine the effectiveness of the chosen type of cleaning? The ability to properly evaluate exposed gear before and after

cleaning takes the guesswork out of determining whether cleaning is successful or not in significantly reducing LIB fire contamination. Generally, this capability can be costly as it can require sacrificing some gear to attain the needed accuracy for quantifying contaminants present in gear. The testing also must be conducted correctly to avoid results that under-report contamination levels and lead to wrong conclusions.

At the time this standard was prepared, there was no agreed-upon battery of chemicals or analytical procedures that were established for the standardized assessment of verifying cleaning for protective garment materials subject to LIBs or related content fires. For this reason, a placeholder exists for Section 13.10 for the establishment of a future decomposition products efficacy test.

Typically, if applied to events involving contaminated clothing, some testing would be relegated to large events involving multiple companies where firefighters were significantly exposed to LIB fire contaminants. For any testing to be meaningful, the testing should take on the following characteristics:

(1) Selected gear must be tested before and after washing. Removal effectiveness generally requires both, though only testing already washed gear can provide some insight into gear cleanliness if contamination levels are very low.

(2) Except on hard surfaces like helmet shells on certain SCBA parts, wipe sampling should not be used. It is not effective in showing the state of gear contamination as it only shows exterior surface concentration. Many contaminants penetrate materials and interior layers that can come out later and expose firefighters.

(3) Clothing that is believed to be the most contaminated (based on time on scene and wearer activities) should be destructively sampled. This means sacrificing one or more sets of gear to physically take samples from the areas with the greatest soiling.

(4) The same gear should become its baseline. Cutting the gear in half and testing one-half uncleaned and the other half after cleaning is likely to provide the best comparison for judging contamination removal. This is because contamination levels can be highly varied across the clothing item.

(5) Testing should target relevant contaminants. All fires involve a unique mixture of contaminants. Testing of firefighter PPE following LIB fires should include metals, including lithium, cobalt, nickel, and manganese, as well as a battery of semivolatile organic compounds that include PAHs, phthalates, and phenols. Separate analysis could also be needed for fluorine-based chemicals that require different analytical equipment.

(6) Outside expertise should be sought to judge the results of testing and the effectiveness of the cleaning process. The absence of standardized limits of acceptable levels for most contaminants makes it difficult to determine if appropriate removal has been achieved.

Information from this testing, when performed, is most often used to determine if gear can be safely returned to service. Regardless of what laboratories report and outside experts opine, the ultimate authority for the decision to continue using gear that has been exposed and cleaned rests with the department.

~~**A.6.1.3.5.2(3)**~~
~~Fire and exposure characteristics can be different for closed environments (e.g., an electric vehicle inside a garage) and open environments (e.g., an electric vehicle on a highway).~~

…

2. Revise section 6.3.10 and associated Annexes to read as follows:

6.3.10* Handling of Wastewater

6.3.10.1* Facilities using washers/extractors or other machines that generate ~~waste-water~~ wastewater or other effluent shall comply with all applicable local, state, and federal regulations for discharge of wastewater or other effluent relative to specific contaminants.

6.3.10.1.1* Facilities shall ensure that wastewater or effluent discharge does not exceed maximum contaminant levels (MCLs) established under local, state, and federal regulations.

6.3.10.1.2* Where onsite treatment or filtering equipment is used to achieve this requirement, evidence for verifying effectiveness of the process or equipment shall be provided for its ability to meet local, state, and federal requirements for removing contaminants to below stated MCLs.

6.3.10.1.3 Wastewater discharge or other effluent shall be periodically evaluated and documented at least quarterly for specific contaminants that are the subject of local, state, and federal requirements related to wastewater discharge or effluent.

6.3.10.2 Facilities that store or treat wastewater or other effluent shall document the specific techniques used for ~~storing, treating, and disposed or wastewater and other effluent~~ its collection, treatment, and disposal, ensuring compliance with all applicable environmental regulations.

6.3.10.3 Facilities shall have a period of 2 years from the effective date of this standard to comply with these requirements.

A.6.3.10 Firefighter protective ensembles and ensemble elements are exposed to various hazardous contaminants in structural fires and other emergencies, including per- and polyfluoroalkyl substances (PFAS), heavy metals, surfactants, and combustion byproducts. The laundering of these protective ensembles and elements generates wastewater that contains these contaminants, posing risks to the environment, human health, and municipal wastewater treatment systems.

Some substances, particularly PFAS used in some ensemble element materials, can be removed by laundering and similarly discharged as wastewater or other effluent.

The requirements outlined in 6.3.10 ensure that facilities using washers/extractors or similar cleaning equipment for protective ensemble and ensemble element laundering mitigate these risks by doing the following:

(1) Ensuring compliance with enforceable local, state, and federal regulations governing PFAS, suspended solids, and hazardous waste effluent
(2) Specifying that processes or systems used for complying with regulatory requirements are effective based on evidence verifying the removal of contaminants
(3) Mandating the use of periodic monitoring to demonstrate compliance with regulatory requirements
(4) Requiring the documentation of practices used for the separate collection and subsequent treatment of wastewater or other effluent

A.6.3.10.1 Examples of specific contaminants include PFAS, heavy metals, surfactants, and total suspended solids (TSS).

A.6.3.10.1.1 Wastewater contamination regulations are primarily governed by the Clean Water Act (CWA) and its National Pollutant Discharge Elimination System (NPDES) program established by the US Environmental Protection Agency (EPA). The EPA regulates the discharge and treatment of wastewater, setting limits on pollutants discharged into waterways. These regulations also include effluent limitations guidelines (ELGs) that establish technology-based discharge limits for specific industrial categories. One area of recent emphasis for industrial wastewater contamination is PFAS due to their persistence in the environment and potential health risks.

In April 2024, the EPA established enforceable MCLs for the following six PFAS in drinking water:

(1) Perfluorooctanoic acid (PFOA)
(2) Perfluorooctanesulfonic acid (PFOS)
(3) Perfluorononanoic acid (PFNA)
(4) Perfluorhexanesulfonic acid (PFHx)
(5) Hexafluoropropylene oxide dimer acid (HFPO-DA), also known as GenX
(6) Perfluorobutanesulfonic acid (PFBS)

As of April 2025, the EPA has not established enforceable or recommended limits for the six regulated PFAS compounds in wastewater effluent. These compounds are currently regulated only in drinking water under the National Primary Drinking Water Regulation, with MCLs set at 4 parts per trillion (ppt) for PFOA and PFOS and 10 ppt for the others.

As of May 2025, the EPA has reaffirmed the existing MCLs for PFOA and PFOS in drinking water, extended the compliance deadline to 2031, and initiated a review of MCLs for additional PFAS substances to align with the Safe Drinking Water Act.

Many states have established their own MCLs for PFAS in drinking water, which can differ from the federal standards set by the EPA. For instance, Michigan set MCLs for PFNA at 6 ppt, PFOS at 16 ppt, and PFOA at 8 ppt in 2020. Also, in 2020, New Jersey established MCLs for PFNA, PFOS, and PFOA at 13 ppt each.

Both state and federal regulations are subject to periodic updates and should be consulted to determine applicable MCLs. It is also expected that certain local areas can separately set MCLs.

A.6.3.10.1.2 Any equipment or processes used for reducing specific contaminants in wastewater should have information to support its use in the form of verification testing or similar documentation to support claims of effectiveness. As indicated in A.6.3.10.1.1, an emphasis is place on the reduction of PFAS contamination in wastewater given its ultralow levels of maximum concentration limits that are specified by certain jurisdictions.

Where a wastewater filtration system is used, it should have the following characteristics:

(1) Be capable of capturing both long-chain and short-chain PFAS, including GenX (HFPO-DA) and fluoropolymer degradation byproducts
2) Have selective molecular binding sites or equivalent technology to ensure efficient PFAS capture at trace levels
3) Provide a low-energy, high-throughput operation to maintain facility efficiency
(4) Use regenerable or replaceable filtration media, allowing for sustainable long-term use without introducing secondary contaminants
(5) Be compatible with municipal wastewater treatment standards and integrated pretreatment processes

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