Tentative Interim Amendment

NFPA® 11

Standard for Low-, Medium-, and High-Expansion Foam
2021 Edition

Reference: Annex E
TIA 21-1
(SC 20-12-5 / TIA Log #1540)

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

1. Delete the entire Annex E and replace with the following:

Annex E Foam Health, Safety, and Environmental Issues

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

E.1 General. There has been a significant shift in the emphasis on environmental and health concerns associated with legacy foam products. The purpose of this annex is to provide the foam user community with high-level information and information on the regulatory authorities that are objectively developing suggested solutions to the questions being asked about firefighting foam health, safety, and environmental issues.

In general, the chemicals contained in legacy fluorinated foams, such as AFFF, AR-AFFF, FFFP, etc. (i.e., fluorinated surfactants that are classified as PFAS), have come under significant health and environmental scrutiny.

The approach of dilution and release into the environment and/or wastewater treatment systems is obsolete and unacceptable going forward for all fluorinated foams. International, federal, state, and local jurisdictions are limiting the use of legacy AFFF as a result of these concerns.

U.S. Department of Defense (DoD) and civil aviation authorities are also researching and implementing new restrictions on the use of these legacy products.

Most NFPA standards that cover foam fire suppression agents and systems are being revised to address these new trends and to allow for flexibility going forward.

Currently the criteria for defining an environmentally/toxicologically acceptable alternative is still changing. Once defined, the industry will also need to define the testing and metrics needed to validate the acceptability of such criteria. With that said, there has been a significant shift to the use of synthetic fluorine-free foam (SFFF).

The following are key issues that should be evaluated when using existing legacy fluorinated foams, switching to AFFF C6 foams, or switching to SFFF foams:

(1) *Firefighter health and safety*. First responder exposure should be minimized using safer work practices and personal protective equipment. In addition, procedures should be developed for rinsing if the foam comes into contact with a person's eyes or skin.

(2) *Collection of firefighting foam after use*. Industry best practice is that all foams and fire water/foam runoff should be contained, collected, and disposed of based on federal, state, and local requirements and the most current technical information as suggested in the references listed. Foam discharge is more easily handled where there is an in-place collection capability, i.e., primary and secondary containment. This situation might be found in warehouses, tank farms, and firefighting training facilities. Where these facilities are not available, temporary diking is an alternative where time and resources permit. The overall environmental impact of foam discharge requires additional evaluation and development of generally recognized guidance. Until recognized guidance is promulgated, users should rely on manufacturers' data and guidance from policy makers such as the Interstate Technology and Regulatory Council (ITRC) and LASTFIRE. In all situations, discussions with environmental regulatory authorities are appropriate. Work is continuing to identify appropriate policy and criteria to protect facilities that have typically been protected by foam suppression systems. These efforts are focusing on identifying applicable codes and standards, analyzing environmental impact, evaluating alternatives, and revisiting containment options.

(3) *Disposal of firefighting foams*. Currently, high-temperature incineration by an accredited environmental firm should be considered the default for disposing of legacy AFFF products (concentrates, solutions, and effluents).

(4) *Procedures for decontaminating legacy equipment and acceptable levels of cleanliness.* Trying to determine how clean is clean continues to be an issue and might need to be determined based on the regulators' direction or manufacturers' information. Unless equipment is properly cleaned, it might allow the new foam to continue to contaminate the environment. Clean levels might be in the parts per billion to trillion range. Testing and metrics will also need to be defined to validate the level of cleanliness.

The environmental/health concerns associated with these chemicals are challenging for both toxicologists and regulators, requiring continued research and updated regulatory requirements that are still changing. Any users of firefighting foam should research the latest procedures and precautions for their use and disposal prior to placing it into service. The following are two organizations that have developed technically up-to-date and accurate information on this subject.

The ITRC is a state-led coalition working to reduce barriers to the use of innovative air, water, waste, and remediation environmental technologies and processes. ITRC produces documents and training that broaden and deepen technical knowledge and expedite quality regulatory decision making while protecting human health and the environment. With public and private sector members from all 50 states and the District of Columbia, ITRC provides a national perspective. The issues associated with AFFF and the changes in the environmental/use landscape are well documented on the ITRC website https://pfas-1.itrcweb.org/

The Office of the Secretary of Defense Strategic Environmental Research and Development Program and Environmental Security Technology Certification Program (SERDP/ESTCP) are funding research for PFAS-free AFFF; detection, fate, and transport of PFAS in the environment; ecotoxicity; and PFAS treatment technologies, including equipment clean out. More information is available at https://www.serdp-estcp.org/Featured-Initiatives/Per-and-Polyfluoroalkyl-Substances-PFASs

The LASTFIRE Project provided an independent and comprehensive assessment of fire-related risk in large, open-top, floating roof storage tanks resulting in a methodology, by which site-specific fire hazard management policies can be developed and implemented. It, therefore, represents a major advancement in the knowledge about this risk.

The LASTFIRE Foam Position Paper is available at http://lastfire.org.uk

E.2 Discharge Scenarios. The following are examples of scenarios that might include the use of foam, which are presented here to provide the user with ideas on how to handle these types of situations. The examples are not intended to be complete, as the science on how to handle these scenarios is changing very rapidly. Look at the information provided by ITRC, DoD, and LASTFIRE and sources of current discharge handling approaches. The discharge of a foam-water solution is most likely to be the result of one of the four following scenarios:

(1) Manual firefighting or fuel-blanketing operations
(2) Training
(3) Foam equipment system and foam fire apparatus tests
(4) Fixed system releases

These four scenarios include events at such places as aircraft facilities, firefighter training facilities, and special hazards facilities (such as flammable/hazardous warehouses, bulk flammable liquid storage facilities, and hazardous waste storage facilities). Each scenario is considered separately in E.2.1 through E.2.4.

E.2.1 Firefighting Operations. Fires occur in many locations and under many different circumstances. In some cases, it is possible to collect the foam solution used to douse a fire after it has been put out; and in others, such as in marine firefighting, it is not. These incidents include aircraft rescue and firefighting operations, vehicular fires (i.e., cars, boats, train cars), structural fires involving hazardous materials, and flammable liquid fires. A foam-water solution that has been used in firefighting operations will probably be heavily contaminated with the fuel or fuels involved in the fire. It is also likely to have been diluted with water discharged for cooling purposes.

In some cases, the foam solution used during fire department operations can be collected. However, it is not always possible to control or contain the foam; therefore, a non-persistent foam, such as SFFF, should be considered. This could be a result of the location of the incident, size of the incident, or the circumstances surrounding the incident.

Event-initiated manual containment measures are usually executed by the responding fire department to contain the flow of a foam-water solution when conditions and manpower permit. Those operations include the following measures:

(1) *Blocking sewer drains.* This is a common practice used to prevent contaminated foam-water solution from entering the sewer system unchecked. It is then diverted to an area suitable for containment.
(2) *Portable dikes.* These are generally used for land-based operations. They can be set up by fire department personnel during or after extinguishment to collect runoff.

(3) *Portable booms.* These are used for marine-based operations in the absence of better techniques and are set up to contain foam in a defined area. These operations generally involve the use of floating booms within a natural body of water. The boom contains the foam bubbles, but as the bubbles drain, the foam solution might not be contained and could spread into the rest of the body of water.

E.2.2 Training. There are specially designed training foams available from most foam manufacturers that simulate firefighting foam during live training but do not contain fluorosurfactants. These foams are biodegradable, have minimal environmental impact, and can be safely treated at a local wastewater treatment plant. Because they do not contain fluorosurfactants, training foams also have reduced burnback resistance that allows for more repeat fire training sessions. Firefighters and other foam users should work with the authority having jurisdiction (AHJ) to ensure that the use of training foams meets all the local and application-specific live training requirements. In some cases, training foams can also be used as substitutes for legacy fluorinated foams in vehicle and equipment testing.

Training should be conducted under circumstances conducive to the collection of spent foam. Some fire training facilities have elaborate systems designed and constructed to collect foam solution, separate it from the fuel, treat it, and, in some cases, reuse the treated water. At a minimum, most fire training facilities collect the foam solution for discharge to a wastewater treatment facility. Training can include the use of special training foams or actual firefighting foams. Training facility designs should include containment systems.

Note: The use of fluorinated foams for training is banned in a number of nations and states in the United States.

E.2.3 System Tests. Testing primarily involves engineered, fixed foam fire-extinguishing systems. Two types of tests are generally conducted on foam systems: acceptance tests, which are conducted pursuant to installation of the system, and maintenance tests, which are usually conducted annually to ensure the operability of the system.

In the execution of both acceptance and maintenance tests, only a small amount of foam concentrate should be discharged to ensure the correct concentration of foam in the foam-water solution. Designated foam-water test ports can be included in the piping system so that the discharge of foam-water solution could be directed to a controlled location. The controlled location can consist of a portable tank that would be transported to an approved disposal site by a licensed contractor. The remainder of the acceptance test and maintenance test should be conducted using only water.

NFPA 11 explicitly recognizes proportioning test methods that limit or eliminate the need to discharge foam concentrate. These methods are permitted in 12.6.4.

Note the use of fluorinated foams for system testing is banned in a number of nations and states in the United States.

E.2.4 Fixed System Releases. This type of release is generally uncontrolled, whether it is the result of a fire incident or a malfunction in the system. The foam solution discharge in this type of scenario can be dealt with via event-initiated operations or engineered containment systems. Event-initiated operations encompass the same temporary measures that would be taken during fire department operations: portable dikes, floating booms, and so forth. Engineered containment is based mainly on the location and type of facility and would consist of holding tanks or areas where the contaminated foam-water solution would be collected, treated, and disposed of properly.

E.3 Fixed Systems. Facilities can be divided into those without an engineered containment system and those with an engineered containment system.

E.3.1 Facilities Without Engineered Containment. Given the absence of any past requirements for containment, many existing facilities have allowed foam-water solution to flow out of the facility and evaporate into the atmosphere or percolate into the ground. Steps should be taken to avoid this as part of future foam management planning. The choices for containment of foam-water solution at such facilities fall into two categories: event-initiated manual containment measures and installation of engineered containment systems. Selecting the appropriate option depends on the location of the facility, the risk to the environment, the risk of an automatic system discharge, the frequency of automatic system discharges, and any applicable rules or regulations.

Event-initiated manual containment measures are the most likely option for existing facilities without engineered containment systems. This can fall under the responsibility of the responding fire department and include such measures as blocking storm sewers, constructing temporary dikes, and deploying temporary floating booms. The degree of such measures should be dictated by the facility's location, as well as the available resources and manpower.

The installation of engineered containment systems is an option for existing facilities. There are cases, however, that might warrant the design and installation of such systems.

E.3.2 Facilities with Engineered Containment. Any engineered containment system usually includes an oil/water separator. During normal drainage conditions (i.e., no foam solution runoff), the separator functions to remove any fuel particles from drainage water. However, when foam-water solution is flowing, the oil/water separator should be bypassed so that the solution is diverted directly to storage tanks.

The size of the containment system should be dependent on the duration of the foam-water flow, the flow rate, and the maximum anticipated rainfall. Most new containment systems only accommodate individual facilities. However, some containment systems can accommodate multiple facilities depending on the topography of the land and early identification during the overall site planning process.

The specific type of containment system selected should also depend on the location, desired capacity, and function of the facilities in question. The available systems include earthen retention systems, belowground tanks, open-top inground tanks, and sump and pump designs (i.e., lift stations) piped to aboveground or in-ground tanks. Storing spent foam below ground is not advisable due to the potential for leaks. Regular checks can reduce the risk of leaks, but even a small leak over time could result in contaminated soil.

The earthen retention designs consist of open-top earthen berms, which usually rely on gravity-fed drainage piping from a protected facility. They allow the foam-water solution to be collected in an impermeable liner. Legacy foams should not be contained using earthen retention, as the soil can become contaminated.

Closed-top, belowground storage tanks usually consist of a gravity-fed piping arrangement and can be suction pumped out.

Open-top, belowground storage tanks are usually lined concrete tanks that can rely on gravity-fed drainage piping or a sump and pump arrangement. These can accommodate individual or multiple facilities. They must also accommodate the maximum anticipated rainfall.

Aboveground tanks incorporate a sump and pump arrangement to closed, aboveground tanks. Such designs usually incorporate the use of one or more submersible or vertical shaft large-capacity pumps. These can accommodate individual or multiple facilities.

E.3.3 New Facilities. The decision to design and install a fixed foam-water solution containment system is dependent on the location of the facility, the risk to the environment, the possible impairment of facility operations, the design of the fixed foam system (i.e., automatically or manually activated), the ability of the responding fire department to execute event-initiated containment measures, and any pertinent regulations.

Where conditions warrant the installation of engineered containment systems, there are a number of considerations. They include the size of the containment system, the design and type of containment system, and the capability of the containment system to handle individual or multiple facilities. Engineered containment systems can be used where foam extinguishing systems are installed in facilities that are immediately adjacent to a natural body of water. These systems might also be prudent at new facilities, where site conditions permit, to avoid impairment of facility operations.

2. Add a new entry to J.1.2.13 to read as follows:

LASTFIRE Foam Position Paper, LASTFIRE, Issue 2, October 2016.

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