

Firefighting Foam Transition Guidance

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Contents

	Page
1 Review Existing Foam Use and Facility Scenarios	1
2 Selection of Replacement Foam	1
3 Review Engineered Foam System Modifications	2
4 Address Potential Worker Safety/Health Concerns Associated with Foam	2
5 Update Existing Emergency Response and Training/Testing Processes	3
6 Update Existing Environmental Practices	3
7 Plan for Transition	3
8 Terms and Definitions	4
Annex A (informative) Review Existing Foam Use and Facility Scenarios	6
Annex B (informative) Select Replacement Foam	9
Annex C (informative) Review Engineered Foam System Modifications	12
Annex D (informative) Health Information Summary for All Firefighting Foams	14
Annex E (informative) Update Existing Emergency Response and Training/Testing Processes	15
Annex F (informative) Update Existing Environmental Process	16
Annex G (informative) Plan for Transition	22
References	24

Introduction

This document is intended to share information on firefighting performance and safety practices to help improve firefighting performance and safety awareness throughout industry. The goal is to share work practices that can be used or considered by companies or sites when developing new process safety practices or improving existing ones. This document has been prepared leveraging input of many industry members, but this does not mean it must be used or that it will produce exemplary results when put into practice. Rather, it is an option to consider when implementing or adjusting programs and practices at a site.

By themselves, guidance documents are not standards or recommended practices. They are not intended to replace sound engineering or management judgment. They do not preclude the use of alternative methods that comply with legal requirements. A subject-matter expert should be consulted prior to determining whether any of these sample practices can be used in any specific situation.

Firefighting Foam Transition Guidance

The following management-of-change (MOC) guidance provides the industry with suggestions and considerations for the transition from C8 legacy fluorinated foams concentrates to another type of foam concentrate [such as C6 or synthetic fluorine-free foam (SFFF)]. For each step of the MOC, a separate document is available that provides considerations and examples on how an entity may choose to execute the transition. While it is ideal to have a drop-in foam concentrate replacement with minimum changes in processes or practices to use during this transition, the MOC process plans for any changes that must be accounted for.

When switching from C8 legacy fluorinated foam concentrate to C6 or SFFF concentrate, a formal MOC should be developed that addresses (at a minimum) the following steps:

1 Review Existing Foam Use and Facility Scenarios

All emergency response fire scenarios should be assessed to establish the foam concentrate that should be used and its compatibility at a given facility. An emergency response assessment is an important component of an MOC to identify fire scenarios and respective foam use requirements (fixed systems and portable application). Foam use assessment (or foam risk assessment) examples are available in Annex A.

For sites where all fire scenarios cannot be addressed with SFFF, a site could consider selective use of foam such as SFFF for one fire scenario and C6 foam for a different scenario ("two-foam solution"). This guidance does not advocate a two-foam solution where there is a potential impact to operational safety, process safety, or firefighting capability.

2 Selection of Replacement Foam

The selection of replacement foam(s) should be based on the foam assessment described in Section 1, the use of a checklist such as the one provided in Annex B, and consideration of the foam's potential impact on human health and the environment. Updated procurement documentation should be developed to ensure that future purchases of foam concentrates are aligned with the foam transition plan. When considering replacement foam, the following areas should be considered:

- a) Check approval listings and usage temperatures for foams.
 - guidance on listing from UL and information in National Fire Protection Association (NFPA) Standard 11 *Standard for Low-, Medium-, and High-Expansion Foam*;
 - foam storage temperature rating due to limited flow at low temperatures.
- b) The compatibility of replacement foam(s) being considered with existing foam equipment should be verified through the suppliers. Foam quality produced from existing hardware may differ, impacting foam application rates and durations.
 - API members with experience changing from fluorinated firefighting foam to SFFF have learned that they must confirm that the proportioning equipment and the foam nozzles are properly designed for the physical properties of the new SFFF.
 - For storage tanks that have sub-surface foam application, C6 foam or SFFF should not be used without confirmation that the foam has been approved for that application method. Testing by the Large

Atmospheric Storage Tanks Project (LASTFIRE) suggests that some SFFF are effective via sub-surface application¹.

- Foam monitors (portable or fixed), when used with SFFF, may require an air aspirated nozzle, which may limit their effective reach. Testing by the Fire Protection Research Foundation (FPRF) suggests that some SFFF need to be air aspirated by a factor of 7–8 times to be as effective as the traditional AFFF². Air aspirated nozzles are available with effective reaches similar to non-air aspirated nozzles.
- c) Verify foam concentrate is compatible with the materials that could be released or be burning.
- d) When considering a two-foam approach, the added complexity in storage, use, and training should be considered.
- Necessary measures required to manage multiple foam types (e.g., training foams and response foams, or SFFF and C6 foam to be used for separate scenarios) and implications to response plans, etc. should be evaluated as part of the MOC. Sites should consider implementing methods to ensure that the correct foam type is used when fighting a fire.
- e) Foam compatibility with dry chemical needs to be evaluated where response plans include use of dry chemical with foam. Check with the foam manufacturer to see if they have this information. Finished foams can be compromised with the application of dry chemicals over the surface of the finished foam. Particulates falling on the finished foam can collapse bubbles. This information should be available from the foam manufacturers.

3 Review Engineered Foam System Modifications

Engineering modifications to existing fixed and portable foam proportioning systems and application devices should be assessed when transitioning the foam concentrate SFFF. Ensuring that all proportioning systems, foam nozzles, and other hardware are compatible with new foam agents is critical. The equipment should be listed or tested with the specific foam and its properties to ensure that it will operate correctly together as outlined in NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*. Ensure that necessary process safety information (PSI) is updated as a result of this MOC for the foam types, procedures, uses, equipment, etc.

4 Address Potential Worker Safety/Health Concerns Associated with Foam

A review of safety data sheets (SDS) for various SFFF foams and reviews by health professionals suggests that additional health and safety precautions should be taken until more information is learned about the potential health effects of these firefighting agents. These precautions are outlined in Annex D.

- a) Generally, handle all foam concentrates, solutions, and finished foams in accordance with good industrial hygiene and safety practices for a hazardous substance.
- b) Review the manufacturer's SDS hazard information for additional precautions.
- Foam manufacturers may be contacted for additional information.
- c) Determine personnel protective equipment requirements for each foam to be used.

¹ LASTFIRE Foam Position Paper, <http://lastfire.org.uk/uploads/Foam%20Position%20Paper%20Issue%202%20Oct%202016%20s.pdf>

² Back, G., and Farley, J. "Evaluation of the Fire Protection Effectiveness of Fluorine Free Firefighting Foams." Fire Protection Research Foundation.

5 Update Existing Emergency Response and Training/Testing Processes

Once a new foam is selected, evaluate emergency response processes and incorporate updates into existing procedures, training, and assurance processes.

- a) Any new environmental handling impact, such as containment or disposal of wastewater after an emergency.
- b) Any changes in fixed application equipment and their operation.
- c) Any changes in portable application equipment and its operation.
- d) Changes in firefighting tactics (air aspiration of foam, use of foam with polar solvents, etc.) and implications to or from mutual aid agreements/arrangements should be considered.
- e) Foams that will be used for firefighting training and engineering testing.
 - It is recommended that SFFF be used for firefighting training.
- f) Foam storage and handling at the facility.

6 Update Existing Environmental Practices

Sites should have documented environmental guidance for managing foam concentrates, solutions, and finished foams based on environmental regulatory requirements and/or the company or site's assessment of environmental risk. While sites with environmental processes for handling firefighting foam concentrates, solutions, finished foams, and firewater/foam runoff will likely largely remain unchanged in a transition between two different PFAS-containing foams, the aspects of these processes should still be included in environmental procedures and training MOC review.

Consider updating environmental practices to include the following:

- a) system decontamination logistics/procedures and waste management;
- b) how to manage firewater/foam concentrate, runoff, and rinse water;
 - Foam risk assessments should include containment capabilities, including considerations for secondary containment in fixed storage systems;
- c) disposal of foam concentrate, foam solution, rinse water, or fire water;
- d) disposal/destruction of C8 legacy fluorinated firefighting foam;
 - Sale or donation of C8 legacy fluorinated firefighting foams generally is not an appropriate form of disposal;
 - Some foam manufacturers and state governments may develop programs that would allow users to turn in foam concentrate for disposal, which may warrant consideration if the programs include appropriate safeguards;
 - Disposal or cleaning of C8 legacy fluorinated firefighting foam storage containers and firefighting systems prior to refilling with replacement foam.

7 Plan for Transition

Plans should address maintaining firefighting capabilities during transition using a staged approach. This can be done using several risk-reduction approaches:

- reduction or elimination of inventories of hazardous chemicals;
- staging a standby fire crew on-site;
- close coordination with the outside fire department and/or mutual aid partners;
- shutting down or reducing high-hazard operations;
- staging the change out to minimize the impact on operations in any one area, etc.

8 Terms and Definitions

8.1.1

fire water

Water delivered through automatic and manual firefighting means, including that precipitated or leaked from non-firefighting sources, and otherwise commingled into the automatic and manual firefighting water. Includes foam solution, incident contaminants, and waterborne sediment.

8.1.2

fluorinated firefighting foams

Aqueous film forming foam (AFFF), film forming fluoroprotein (FFFP), alcohol-resistant aqueous film-forming foam (AR-AFFF), alcohol-resistant film-forming fluoroprotein (AR-FFFP), and fluoroprotein (FP) foam.

8.1.3

foam concentrate

A concentrated liquid foaming agent as received from the manufacturer [see NFPA 11 (2016), Section 3.3.12].

- alcohol-resistant foam concentrate: a concentrate used for fighting fires on water-soluble materials and other fuels destructive to regular, AFFF, or FFFP foams, as well as for fires involving hydrocarbons;
- aqueous film-forming foam concentrate (AFFF): a concentrate based on fluorinated surfactants plus foam stabilizers to produce a fluid aqueous film for suppressing hydrocarbon fuel vapors; usually diluted with water to a 1 percent, 3 percent, or 6 percent solution;
- film-forming fluoroprotein foam concentrate (FFFP): a protein-foam concentrate that uses fluorinated surfactants to produce a fluid aqueous film for suppressing hydrocarbon fuel vapors;
- film-forming foam: a concentrate that, when mixed at its nominal use concentration, will form an aqueous film on hydrocarbon fuels;
- fluoroprotein foam concentrate: a concentrate very similar to protein-foam concentrate, but with a synthetic fluorinated surfactant additive;
- medium- and high-expansion foam concentrate: a concentrate, usually derived from hydrocarbon surfactants, used in specially designed equipment to produce foams having foam-to-solution volume ratios of 20:1 to approximately 1000:1;
- protein foam concentrate: concentrate consisting primarily of products from a protein hydrolysate, plus stabilizing additives and inhibitors to protect against freezing, to prevent corrosion of equipment and containers, to resist bacterial decomposition, to control viscosity, and to otherwise ensure readiness for use under emergency conditions;
- synthetic fluorine-free foam (SFFF): foam concentrate that is based on a mixture of hydrocarbon surface active agents that do not contain intentionally added fluorine compounds;
- synthetic foam concentrate: concentrate based on foaming agents other than hydrolyzed proteins and including aqueous film-forming foam (AFFF) concentrates, medium- and high-expansion foam concentrates, and other synthetic foam concentrates.