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## Chapter 12 Suppression Chemicals & Delivery Systems

### Policy for Use of Fire Chemicals

Use only products qualified and approved for intended use. Follow safe handling procedures and use personal protective equipment recommended on the product label and *Material Safety Data Sheet* (MSDS).

A current list of qualified products and approved uses can be found on the Wildland Fire Chemical Systems website:

- <http://www.fs.fed.us/rm/fire/wfcs/index.htm>
- Click on Wildland Fire Chemicals
- Click the appropriate Qualified Products List

Refer to local jurisdictional policy and guidance related to use of wildland fire chemicals for protection of historic structures.

### Retardant Policy

Using approved long-term retardants in wildland fire suppression efforts is standard in fire management and planning. The retardants are most often delivered by fixed or rotor-wing aircraft. Some products are formulated specifically for delivery from ground sources.

### Foam Policy

Standard operating procedures for fire management and suppression activities involving water as the suppression or protection agent delivered by engines and portable pumps, may include the use of Class A fire suppressant to improve the efficiency of water. The exception is near watercourses where accidental spillage or over spray of the chemical could be harmful to the aquatic ecosystem (see Environmental Guidelines page 12-03). Helicopters and Single Engine Airtankers (SEATs) can also deliver foam. Some agencies also allow application of foam from fixed-wing water scoopers.

### Water Enhancer Policy

These products may be used in structure protection within the wildland interface or on wildland fuels. These products are qualified for use in helicopter buckets and ground engines.

### Types of Fire Chemicals

#### Long-Term Retardant

Long-term retardants contain fertilizer salts that change the way fuels burn. They are effective even after the water has evaporated.

Principles of application and coverage levels are outlined in *Recommended Retardant Coverage Levels NFES 2048, PMS 440-2*. Retardant mixing,

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1 blending, testing, and sampling requirements can be found in *Lot Acceptance,*  
2 *Quality Assurance and Field Quality Control for Fire Retardant Chemicals,*  
3 *NFES 1245, PMS 444-1.*

#### 5 **Fire Suppressant Foam**

6 Fire suppressant foams are combinations of wetting and foaming agents added  
7 to water to improve the effectiveness of the water. They are not effective once  
8 the water has evaporated.

9  
10 Technical guidelines for equipment operations and general principles of foam  
11 application are discussed in *Foam vs. Fire, Class A Foam for Wildland Fires,*  
12 *NWCG, PMS 446-1, NFES 2246, 2nd ed., October 1993, and Foam vs. Fire,*  
13 *Aerial Applications, NWCG, PMS 446-3, NFES 1845, October 1995.*

#### 15 **Water Enhancers for Wildland Fire Suppression**

16 Water enhancers, such as fire fighting gels, are products added to water to  
17 improve one or more of the physical properties of water. They are not effective  
18 once the water has evaporated. Water enhancers are typically applied from  
19 ground equipment and are especially suited to exposure protection for vertical  
20 surfaces. They are fully approved for use in helicopter bucket and engine  
21 application. See the Qualified Product List for updated uses.

#### 23 **General Safety Criteria**

24 All wildland fire chemicals must meet minimum requirements with regard to  
25 aquatic and mammalian toxicity, which includes acute oral toxicity, acute  
26 dermal toxicity, primary skin irritation, and primary eye irritation. *Current-*  
27 *Specifications for Wildland Fire Chemicals [Long-Term Retardants, Fire*  
28 *Suppression Foams, and Water Enhancers],* June 2007. See the Wildland Fire  
29 Chemical Systems website: [www.fs.fed.us/rm/fire](http://www.fs.fed.us/rm/fire)

30  
31 Personnel involved in handling, mixing, and applying fire chemicals or solutions  
32 shall be trained in proper procedures to protect their health and safety, as well as  
33 that of the environment.

34  
35 Personnel must follow the manufacturer's recommendations, including use of  
36 PPE (i.e. goggles, gloves, eyewash kits on site) as found on the product label  
37 and product Material Safety Data Sheet (MSDS). Approved fire chemicals can  
38 be irritating to the eyes. Anyone involved with or working in the vicinity of fire  
39 chemical concentrates should use protective splash goggles.

40  
41 Human health risk from accidental drench with retardant can be mitigated by  
42 removing any residue from exposed skin by washing with water.

43  
44 Containers of any fire chemical, including backpack pumps and engine tanks,  
45 should be labeled to alert personnel that they do not contain plain water, and that  
46 the contents must not be used for drinking purposes. Sickness is a hazard at

1 storage areas and unloading and mixing sites. Because all fire chemical  
2 concentrates and solutions contribute to slippery conditions, all spills must be  
3 cleaned up immediately, preferably with a dry absorbent pad or granules.

4  
5 Personnel applying foam should stand in untreated areas. A foam blanket can be  
6 dangerous to walk through because it conceals ground hazards. Foam readily  
7 penetrates and deteriorates leather boots, resulting in wet feet and potentially  
8 ruined leather.

9  
10 All safety precautions associated with ground crews near retardant drops also  
11 apply to aerial foam drops.

### 12 **Aerial Application Safety**

13 Persons downrange, but in the flight path of intended retardant drops, should  
14 move to a location that will decrease the possibility of being hit with a drop.

15  
16  
17 Persons near retardant drops should be alert for objects (tree limbs, rocks, etc.)  
18 that the drop could dislodge.

19  
20 During training or briefings, inform field personnel of environmental guidelines  
21 and requirements for fire chemicals application and to avoid contact with natural  
22 bodies of water.

23  
24 Notify incident or host authorities promptly of any fire chemicals applied within  
25 300 feet of, or spilled into, a body of water. The incident or host authorities  
26 must immediately contact appropriate regulatory agencies and specialists within  
27 the local jurisdiction. Spills must immediately be reported to Wildland Fire  
28 Chemicals Systems in Missoula, Montana at phone 406-329-3900 or to  
29 individuals listed in the website: [www.fs.fed.us/rm/fire](http://www.fs.fed.us/rm/fire)

30  
31 Avoid dipping from rivers or lakes with a helicopter bucket containing residual  
32 fire chemicals. Set up an adjacent reload site and manage the fire chemicals in  
33 portable tanks, or terminate the use of chemicals for that application.

34  
35 Quality control maintenance and safety requirements dictate that mixing or  
36 blending of retardants be accomplished by standard approved methods.  
37 Powdered or liquid retardants must be blended or mixed at the proper ratio prior  
38 to being loaded into the aircraft.

### 39 **Environmental Guidelines for Delivery of Fire Chemicals near Waterways**

#### 40 **Definition**

41  
42 *Waterway* - Any body of water including lakes, rivers, seeps, intermittent  
43 streams and ponds whether or not they contain aquatic life.

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46

1 **Aerial Application Guidelines**

2 Avoid aerial or ground application of fire chemicals within 300 feet of  
3 waterways.

4  
5 These guidelines do not require the pilot-in-command to fly in such a way as to  
6 endanger his or her aircraft, other aircraft, structures, or compromise ground  
7 personnel safety.

8  
9 **Exceptions**

10 When alternative line construction tactics are not available due to terrain  
11 constraints, congested area, life and property concerns, or lack of ground  
12 personnel, it is acceptable to anchor the fire chemical application to the  
13 waterway. When anchoring a fire chemical line to a waterway, use the most  
14 accurate method of delivery in order to minimize placement of retardant or foam  
15 in the waterway.

16  
17 Deviations from these guidelines are acceptable when life or property is  
18 threatened, and the use of fire chemicals can be reasonably expected to alleviate  
19 the threat. When potential damage to natural resources outweighs possible loss  
20 of aquatic life, the agency administrator may approve a deviation from these  
21 guidelines.

22  
23 **Environmental Procedures for Application of Fire Chemicals**

24  
25 **Threatened and Endangered (T&E) Species**

26 The following provisions are guidance for complying with the emergency  
27 Section 7 consultation procedures of the Endangered Species Act (ESA) with  
28 respect to aquatic species. These provisions do not alter or diminish an agency's  
29 responsibilities under (ESA).

30  
31 Where aquatic T&E species or their habitats are potentially affected by aerial  
32 application of retardant or foam, the following additional procedures apply:

- 33 • As soon as practical after the aerial application of fire chemicals near  
34 waterways, determine whether the aerial application has caused any  
35 adverse effect on T&E species or their habitat using the following criteria:  
36 ➤ Aerial application of fire chemicals outside 300 feet of a waterway is  
37 presumed to avoid adverse effects to aquatic species and no further  
38 consultation for aquatic species is necessary.  
39 ➤ Aerial application of fire chemicals within 300 feet of a waterway  
40 requires that the unit administrator determine whether there have been  
41 any adverse effects to T&E species within the waterway.  
42 ➤ If the action agency determines that there were adverse effects on  
43 T&E species or their habitats, then the agency must consult with Fish  
44 and Wildlife Service (FWS) or National Marine Fisheries Service  
45 (NMFS) as required by 50 CFR 402.05 (Emergencies). Procedures  
46 for emergency consultation are described in the *Interagency*

- 1            *Consultation Handbook*, Chapter 8 (March 1998). In the case of a  
2            long duration incident, emergency consultation should be initiated as  
3            soon as practical during the event. Otherwise, post-event consultation  
4            is appropriate. The initiation of the consultation is the responsibility  
5            of the unit administrator. These procedures shall be documented in a  
6            Biological Assessment (BA). All occurrences of adverse effects will  
7            be immediately reported to Wildland Fire Chemicals Systems in  
8            Missoula, Montana at phone 406-329-3900 or to individuals listed in  
9            website referenced below: [www.fs.fed.us/rm/fire](http://www.fs.fed.us/rm/fire)  
10          ➤ Each agency is responsible for ensuring that their appropriate agency  
11          specific guides and training manuals reflect these standards.

## 13 **Ground Application of Fire Suppressant Foams**

### 15 **Proportioners**

16 Proportioners are designed to provide an appropriate mix of foam concentrate  
17 and water during pumping operations, rather than relying on batch mixing to  
18 prepare foam solutions. Both manual and automatic proportioner systems are  
19 available. Specific agency standards may require the use of a specific type of  
20 system. Proportioners should be flushed after every operational period of use.

21  
22 Agency standards for foam proportioners on engines are an automatically  
23 regulated proportioners, such as Robwen Flowmix 500, or FoamPro 1600.  
24 These devices are available as a foam kit for use with portable pumps.  
25 Automatic proportioners are required for compressed air foam systems to  
26 prevent slug flow.

- 27 • *FS - Manually regulated proportioners, such as around-the-pump*  
28 *proportioners, in-line and by-pass eductors, and suction-side regulators,*  
29 *are acceptable for remote portable pump use when the operator*  
30 *understands the device limitations.*

### 32 **Wet Water**

33 Using foam concentrates at a mix ratio of 0.1 percent will produce a wet water  
34 solution.

### 36 **Conventional Nozzles and Backpack Pumps**

37 Mix ratio is 0.1 - 0.3%. Hydraulic considerations are the same as water.

### 39 **Aspirating Nozzles**

40 Mix ratio is 0.2 - 1.0%. But generally 0.5%, depending on nozzle, “foaminess”  
41 of concentrate used, and type of application. Adjust the ratio to best meet needs  
42 and objectives. Foam production and delivery should occur as readily as water  
43 delivery.

### 44 **Compressed Air Foam Systems (CAFS) Operating Standards**

- 45 • Keep static air and water pressures equal.
- 46 • Start with a 0.3% mix ratio; adjust if necessary.

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**12-5**

- 1 • Typical operation with 1 cfm of air for every gpm of water; adjust if  
2 necessary.
- 3 • Employ a motionless mixer or 100 feet of hose to develop foam in the  
4 hose.
- 5 • Foam production and delivery should occur as readily as water delivery.
- 6 • Recommended minimum hose diameter is 1.5 inches when using foam on  
7 wildland/urban interface and vehicle fires.
- 8 • CAFS Safety - Mandatory training for personnel operating a CAFS  
9 includes: operating the nozzle, working around charged hoselays, and how  
10 to prevent slug flow.