



## Wildland Fire Fighting Chemical Products



For additional information: [www.fs.fed.us/rm/fire](http://www.fs.fed.us/rm/fire)

The Forest Service and cooperating wildland fire management agencies use several types of wildland fire fighting chemicals. The specific requirements, uses, and tactics for each type depend on the characteristics of the type of product. The following definitions may help to clarify the different types of products.

- **Long-term retardants** contain retardant salts (typically fertilizers) that alter the way the fire burns, decreasing the fire intensity and slowing the advance of the fire, even after the water they originally contained has evaporated.

Because long-term retardants continue to work after the water they contain has evaporated and continue to work for days or weeks until they are removed by rain or erosion, they are well suited for indirect and line building.

The water they contain when applied serves primarily to aid in uniform dispersal of the chemical over the target area. These products can be used for direct attack but they are only marginally more effective than water for this use.

Retardants can be supplied as wet or dry concentrates. They have been developed to provide mixed product within a specific viscosity level. These concentrates are mixed with water at a mix ratio determined during the evaluation process. Mixing can occur at tanker bases and portable mixing sites to produce mixed retardant.

Application is usually from fixed-wing airtankers and helicopters, but they may also be applied from ground equipment.

- **Foam fire suppressants** contain foaming and wetting agents like those found in dishwashing detergents and other cleaners. The foaming agents affect the accuracy of an aerial drop, how fast the water drains from the foam and how well the product clings to the fuel surfaces. The wetting agents increase the ability of the drained water to penetrate fuels.

Foams depend on the water that they contain to suppress the fire. Once the water has evaporated there is no effectiveness. This property makes them most effective for direct attack and mop up.

Appropriate selection of concentrate dilution and application equipment will yield suppressants having a range of characteristics desirable for specific conditions:

1. Fast draining foam for penetration and wetting to attack deep seated fires and mop-up,
2. Fluid foam with moderate drain times for wet line, to
3. Dry, sticky foam with slow drain times for exposure protection.

Foam fire suppressants are supplied as wet concentrates. These concentrates can be batch mixed, blended with a proportioner, or prepared with a compressed air foam system (CAFS). Mix ratios from 0.1 percent to 1.0 percent provide a range of characteristics.

Foams are typically applied from helicopters and ground equipment, although they may also be applied from single engine airtankers (SEATs). Some agencies may also apply foams from water-scooping aircraft.

- **Water enhancers** contain ingredients designed to alter the physical characteristics of water to increase effectiveness, accuracy of the drop, or adhesion to fuels. They also improve the ability of water to cling to vertical and smooth surfaces.

They depend on the water that they contain to suppress the fire. Once the water has evaporated they are no longer effective. This makes them well suited for direct attack or short-duration indirect attack.

They are also well suited to protection of structures and other vertical surfaces as the viscosity and stickiness of the products reduces runoff and retains more of the product on the fuels. This thicker layer of water may slow evaporation and absorb heat to a greater extent than a thin layer of plain water. The duration of effectiveness will depend on temperature, humidity, and exposure to UV/sunlight.

They are supplied as wet or dry concentrates. They can be batch mixed or blended through proportioning equipment. Because some of these products are sensitive to the amount of shear that they are exposed to during mixing, manufacturers recommendations should be followed. Water enhancers are sensitive to water quality and hard water will require a greater mix ratio than softer water to achieve the same consistency. Most are approved for use over a range of mix ratios to allow the user to obtain the consistency needed for the task.

The water enhancers are typically applied from helicopters, Single Engine Airtankers (SEATs) and ground equipment. Some agencies may apply water enhancers from larger fixed-wing airtankers.

- **Personal Safety.** All products that have been evaluated and listed on the Qualified Products List (QPL) have been tested to assess mammalian toxicity as determined by acute oral and dermal toxicity testing as well as skin and eye irritation tests.

As is true with all substances, a small percentage of the population may have an allergy or unusual sensitivity (to a specific chemical) that will not be detected during the evaluation process.

The material safety data sheet (MSDS) for each product must be available in the workplace for you to read. By following the recommendations for personal protective gear and safe handling procedures you will minimize your exposure to these products and any irritation they may cause.

Safety goggles are commonly recommended when dealing with concentrated liquid products such as foam concentrates and dust masks should be used when mixing dry concentrate retardants.

Chapping and dry or cracked skin may occur with frequent or prolonged exposure to the drying effects of any of the fire chemicals. Washing any of these products off your skin as soon as possible and using a hand cream or protective lotion to minimize chapping is a good idea regardless of the products you are using.

- **Environmental Concerns.** Most of the products on the QPL have been evaluated for toxicity to fish. Some products have not been tested, because they are similar to other products on the QPL and they will be phased out in the near future.

Because all of the products are toxic to fish to some extent, care should be taken to minimize the possibility of accidental contamination of all waterways.

Chapter 12 of the Interagency Standards for Fire and Fire Aviation Operations contains specific guidelines and exceptions to these guidelines. All firefighters should become familiar with these guidelines and the actions to be taken if fire chemicals are introduced into the waterway. For most firefighters, their responsibility is to tell their supervisor if they see fire chemicals in a waterway, application of fire chemicals that impacts a waterway, or something that suggests that fire chemicals were introduced to a waterway.