



## Wildland Fire Chemical Products Toxicity and Environmental Concerns General Information



Questions are frequently raised about the safety and environmental impacts of actions taken during fire suppression. Several interagency studies on the impacts of wildland fire suppression products on firefighters, the general public, and the environment have recently been completed. The Forest Service contracted to have a risk assessment conducted to incorporate all of this new information. This article summarizes the general findings of this work.

### Composition

Long-term retardants, mixed for delivery to the fire, contain about 85 percent water, 10 percent fertilizer, and 5 percent minor ingredients: colorant (iron oxide - rust, or fugitive color that fades with exposure to sunlight), thickener (natural gum and clay), corrosion inhibitors, stabilizers, and bactericides.

Fire suppressant foams, diluted for use in fire fighting, are more than 99 percent water. The remaining 1 percent contains surfactants (wetting agents), foaming agents, corrosion inhibitors, and dispersants.

Water enhancers are 95 to 98 percent water. The remaining 2 to 5 percent contains thickeners, stabilizers, and other minor ingredients.

### Mammalian Toxicity

Qualified and approved wildland fire chemicals have all been tested and meet specific requirements with regard to mammalian toxicity as determined by acute oral and dermal toxicity testing as well as skin and eye irritation tests.

As with any chemical substance, 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.

### Environmental Impacts

**Long-Term Retardants** – Fertilizer is a major component of retardants. Therefore caution and good judgement must be exercised when a drop is made onto commercially or aesthetically valuable vegetation. Excessive fertilizer may cause a temporary “burn” on exposed vegetation and in some cases even kill the plants.

The fertilizer contained in the retardant may, under very specific conditions, may cause nitrate poisoning in animals that have consumed hay or other forage crops contaminated by the retardant during firefighting operations.

The fertilizer contained in long-term retardants consists of ammonia and phosphate or sulfate ions. Studies show that a single retardant drop directly into a stream may cause a sufficient ammonia concentration in the water to be lethal to fish and other aquatic organisms. The severity of the effects will be different depending on the volume of the retardant that actually enters the water, the size of the body of water, and the volume of flow in the stream or river. For example, if an 800-gallon drop is made into a fast flowing river, it is likely that the lethal effects will be short-lived as dilution below the toxic level is quickly achieved. In contrast, if a 3,000-gallon drop is made into a stagnant pond, toxic levels will be likely to persist for some time.

**Foam Fire Suppressants** – Foam concentrates are strong detergents. They can be extremely drying and exposure to the skin may cause mild to severe chapping that can be alleviated with the application of a topical cream or lotion to the exposed areas.

All of the currently approved foam concentrates are mildly to severely irritating to eyes. Everyone involved with or working in the vicinity of opened containers of foam concentrates should use protective goggles. Rubbing the eyes or face may result in injury to the eyes if hands have become contaminated with the concentrate during handling.

The primary toxic effect to fish occurs as a result of the surfactant action of foam. The surfactant in the water interferes with the ability of the gills to absorb oxygen from the water causing the fish to suffocate.

Because a very small amount of foam concentrate retains very good wetting capabilities, extra precautions should be taken to avoid getting any concentrate into the water.

**Water Enhancers** – There are several different types of products in this category but most are super-absorbent polymers that can hold many times their own weight of water.

These products are fairly innocuous to people, although goggles and gloves should be used when working with any concentrate. They have a fairly low toxicity to fish. Most are not biodegradable; however, they may break down when exposed to sunlight.

These products create very slippery conditions where they are applied and it can be difficult to remove them once the fire has passed. Because they function by absorbing and holding water, applications to aged wood may hasten deterioration of structures, especially historical resources.

### **Environmental Guidelines**

The following guidelines should be followed to minimize the likelihood of retardant chemicals entering a stream or other body of water.

- During training or briefings, inform field personnel of the potential danger of fire chemicals, especially foam concentrates, in streams or lakes.
- Locate mixing and loading points where contamination of natural water, especially with the foam concentrate, is minimal.
- Maintain all equipment and use check valves where appropriate to prevent release of foam concentrate into any body of water.
- Exercise particular caution when using any fire chemical in watersheds where fish hatcheries are located.
- Locate dip operations to avoid run-off of contaminated water back into the stream.
- Dip from a tank rather than directly from a body of water, to avoid releasing any foam into these especially sensitive areas.
- Use a pump system equipped with check valves to prevent flow of any contaminated water back into the main body of water.
- Avoid direct drops of retardant or foam into rivers, streams, lakes, or along shores. Use alternative methods of fire line building in sensitive areas.
- Notify proper authorities promptly if any fire chemical is used in an area where there is likelihood of negative impacts.

While it is preferable that drops into or along any body of water not occur, it is possible that circumstances such as the fire location and surrounding terrain make it probable that some retardant may enter the water. The person requesting the retardant (such as the incident commander) must balance the possible impacts on the environment, i.e., potential fish kill, with the resources and values to be protected from the fire.