

# Wildland Fire Chemicals

## Tactics and Product Characteristics

### Ground Application

#### Why are wildland fire chemicals used?

- They chemically treat fuels to make them less combustible (long-term retardant)
- They maximize available water supply (foam and water enhancer/gel)
- They improve efficiency of water (foam and water enhancer/gel)
- They reduce fire intensities (retardant, foam and water enhancer)
- They reduce mop-up time and labor (foam)

#### What kinds of chemicals can be used?

- Only chemicals that are on the Qualified Products List (QPL) shall be used and only for the delivery method approved: See website for details: <http://www.fs.fed.us/rm/fire/wfcs/index.htm>

#### What kinds of products are available?

- **Foam fire suppressants** enhance water in three ways: First, they lower the surface tension of water, which reduces runoff and helps it absorb into fuels faster. Second, they form bubbles, which hold water above the fuels (keeping fuels cooler) and also block combustible gases that fuels release when heated. Third, a thick lather coating of foam can provide a reflective surface which keeps the fuel underneath cooler and protects from ignition. Once the water in the foam has evaporated, it is no longer effective.
- **Water enhancers (gels)** improve the ability of water to cling to vertical and smooth surfaces by making water thick and sticky. The thick, sticky layer of water insulates fuels and delays ignition. The consistency of these products can change drastically depending on the quality of mix water. As with foams, these products also rely on the water they contain to suppress the fire. Once the water has evaporated, they are no longer effective, but generally last longer than foams.
- **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 in the mix has evaporated. None of the fertilizer salts used in retardants has explosive characteristics.

## Personal and Environmental

#### Health/Environmental:

- Approved fire chemical products have been tested and meet specific minimum requirements with regard to mammalian and aquatic toxicity.
- The field is required to report known accidents, and spills, in and near waterways (any body of water including lakes, rivers, streams and ponds whether or not they contain aquatic life) and other avoidance areas and follow the Interagency Policy for Aerial and Ground Delivery of Wildland Fire Chemical Near Waterways and Other Avoidance Areas. ([http://www.fs.fed.us/fire/retardant/interagency\\_policy\\_aerial\\_delivery.pdf](http://www.fs.fed.us/fire/retardant/interagency_policy_aerial_delivery.pdf))
- Develop a local plan for dealing with a spill and report any spill to the Resource Advisor
- Non-municipal water sources may contain aquatic invasive species. Consult with Incident Resource Advisor on areas of exceptional concern, and always avoid transferring water or dirty, muddy equipment to new locations. Use portable wash stations before leaving incident.

#### Do's:

- Follow manufacturer's recommendations as found on product label and MSDS
- Mix in well-ventilated areas
- **PPE:** Wear eye protection and waterproof gloves when mixing
- Have eye wash capability and first aid kit available at mixing sites
- Rinse exposed skin, clothing and equipment thoroughly with water as soon after direct contact as possible (extended exposure to wildland fire chemicals can cause skin irritation)
- Be cautious of slippery conditions in work area
- Follow ICS and/or Agency Chain of Command process for reporting of spills and/or applications in mapped avoidance areas for threatened, endangered, proposed, candidate or sensitive species (TEPCS) or near waterways
  - Reporting form and more information is available at: <http://www.fs.fed.us/fire/retardant/index.html>.

- Always clear personnel and equipment from an aerial drop zone! The impact force of chemicals dropped from a aircraft can severely damage vehicles and injure or kill people.

#### **Don'ts:**

- Don't inhale vapors, dust or powder when mixing (wear dust mask around dry chemicals)
- Don't eat or drink when working with chemicals
- Don't mix, stage or apply chemicals in a waterway Additional avoidance areas may exist outside of a waterway, contact the Resource Advisor for locally mapped areas.
- Don't dispose of unused chemicals without Incident Resource Advisor approval

## **Ground Equipment Basics**

Thoroughly rinse tanks, hoses and attachments after every use or at the end of each day, to minimize corrosion and other damage. Lubricate equipment often. Foam concentrate in a sealed system (not exposed to air) can generally be left alone during use season, but flush before storage. **Note: All rinse water should be handled like it is contaminated. Contain and dispose of properly!**

- Conventional nozzles - more efficient use of common equipment, create only froth (wet foam)
  - o Gels may plug conventional nozzles and valves; test before using and flush thoroughly immediately after using.
- Aspirating nozzles (Nozzle Aspirated Foam Systems or NAFS)- most economical generating device, limited foam variability (do not use for gels)
- Proportioners - control and maintain consistent percentage injection, produce all foam types; gels should have their proportioning system defined by the gel vendor for each application. A report on the tested performance of proportioners in firefighting conditions is forthcoming; preliminary evidence indicates that some proportioners are not always accurate under field conditions
- Compressed Air Foam Systems, or CAFS units - most stable foam, longer stream throw, produces all foam types – consult gel manufacturer for guidance on using CAFS

**Note: most products have specific uses and may not be approved for all application methods. See QPL and website noted above.**

## **Using Chemicals Effectively**

### **Mixing Considerations:**

- Percent Concentration:
  - o Foams: 0.1% to 1%. Most applications use 0.1% for wetting, 0.3% (CAFS) to 0.5% (NAFS) for general use, and up to 1% for exposure protection.
  - o Gels: Maximum 3%. See QPL for approved concentration for each product.
  - o Retardants: Currently approved long-term retardants are generally mixed with specialized equipment and trained personnel (often vendors). Consult with contracting officer for QA/QC responsibilities.
- Mix Water Quality:
  - o Salt in mix water, even in small amounts, will inhibit foams from foaming and gels from gelling. Hard water has a similar, less severe, effect.
- Product Qualities:
  - o Foams: Each product has a different foaming and wetting profile. Varying the percent injected, the type of nozzle used, and the amount of air injected (for CAFS) will vary the foam characteristics within this profile. Crews should become familiar with this profile for the foam they most commonly use.
  - o Gels: Thickness and stickiness can be adjusted, to a limited extent, by varying the percent concentration to adjust for water quality. Increase mix ratios gradually and never exceed the maximum percent approved, as the gel may clog equipment.

### **How long can I expect products to remain effective after application?**

- Long-Term Retardants – Days/Weeks (or until removed by rain or wind)
- Foams - Minutes (direct) to minutes/hours (mop-up)
- Water Enhancers/Gels – Minutes/Hours (direct sunlight breaks down gels faster)

### **Are there issues with mixing different products?**

- **Do not mix:** Each product has specific characteristics; combining different products may give the worst characteristics of each.