CONCURRENT SESSION II—Urban Interface Topics

Use of Class A Foams on Structures and Wildlands[1]

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Abstract: The increase of homes in wildlands indicates a significant change. The build-up of fuels around homes and in wildlands over time also indicates change. Resistance to change, however, remains the norm. Fires get worse, but plain water continues to be used for fire suppression and property protection. With Class A foam, the objectives of protection are to wet the exposure rapidly, creating a heat sink, and then leave or apply elsewhere while the foam remains behind. This foam can be generated in low-, medium-, and high-expansion forms. Class A foam can be applied from pump-and-roll monitors, large water capacity structure protection engines, small home protection units, aircraft and conventional hose lines. Foam has been successfully applied to save structures threatened by wildfire and to contain prescribed fires near valuable resources. As developed at this time, durable foam is capable of remaining in place as a barrier to fire for 24 to 48 hours. Class A foam technology offers an effective tool to improve the use of water for structure and resource protection.

Change is constant. For instance, the landscape has changed, and in rural areas, homes have been built, increasing the fire protection problem for these areas.

In suburban and rural areas, canopy trees grow, the understory and brush grows, limbs and leaves fall, and fuels continue to build up. Residents prefer the ambiance of thick vegetation surrounding their property rather than an occasional blackened slope from a fuels-reducing prescribed fire. Fuel loading and fuel models continue to change.

In forests and rangelands, prescribed fire is increasingly restricted by impacts of smoke emissions and resource protection. Burn opportunities are fewer and, when they occur, sensitive resources, such as snags, often must be saved. The regulations by which we conduct prescribed fire have changed.

Each of these changes has increased the burden on our fire suppression and protection technologies. Our job keeps getting more difficult to perform. The only thing that does not change in the fire service is our resistance to change. For centuries, plain water has been accepted as the primary fire-extinguishing tool for all Class A or natural fuel fires. Perhaps some time ago this practice was sufficient. Given the annual parade of wildland-urban interface examples of how the fire service has not kept up with the fire problem, it is time to re-examine how we do business.

Presuppression measures, such as creating defensible space and fireproofing exposures, are significant steps to protecting structures from wildland fire. But, once a fire is rapidly approaching and embers are flying everywhere, there is only time for protection activities.

The fact is suppression and protection are relied upon for every wildland-urban interface fire. Certainly, not every structure can be safely defended from fire, but we have to do our job better in the face of ever-worsening situations.

Why Foam?

Possibilities for change begin with that old standard—plain water. The idea is not to replace it—for water has great potential for suppression and protection—but rather to improve it. When a surfactant like liquid dish soap is added to water, water loses its surface tension and gains an emulsifier, allowing rapid wetting of Class A fuels. Without the surfactant, water clings to itself and runs off fuels to the ground. Some fuels, like cedar shingles, naturally shed plain water. Wetting fuels with plain water requires time and large quantities of water. A traditional way to counter this dilemma while protecting structures is to maintain a stream of water on the exposure while it is threatened.

The combination of water and a Class A foam surfactant is called “foam solution” and acts like a high-performance wet water. All of the water in the solution is immediately available for wetting. However, most wood fuels are not able to absorb water all at once. The problem with applications of foam solution is that they are short-lived. Wetting occurs at the fuel surface, but no solution is left for further and continued wetting. And the solution that cannot be absorbed immediately runs off.

The rapid run-off of foam solution can be slowed by adding air and creating a foam. Foam can hold the solution in place until it is absorbed by the treated fuel.

Foam also provides a visual reference for an application. A specific depth of foam can be applied. With foam solution, it is difficult to know if any has been applied and if that amount is sufficient. As long as foam is visible, the fuel below the foam is not drying out. Fuels wetted by non-aerated foam solution begin to dry immediately.

Structure Protection

The spread of fire from house to house is primarily because of wind-borne fire brands and radiation. A fire that starts on a roof begins as one or more very small fires. The structural protection objective with Class A foam is to sufficiently wet exposures to withstand these ignition sources.

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A wet house becomes a heat sink, effectively forcing brands and flames to spend their energy on drying rather than igniting the house. An application of foam buys time while the fire front burns around and past the structure. And it does this without the need for continuous application.

Because foam is effective well after application, the fire apparatus and crew can move on and treat other structures or leave the area if necessary. The opportunity for multiple-structure applications has led to the development of apparatus designed for rapid and continuous foam discharge. These wildland/urban interface foam engines carry 1,000 to 3,000 gallons of water and at least 40 gallons of foam concentrate. They are plumbed to deliver compressed air foam through monitors or side ports. During pump-and-roll they can deliver the water flow at which the pump is rated. Using the compressed air foam system this type of engine can discharge at least 100 gallons per minute of water as foam for exposure protection a distance of 200 feet. The large water capacity and the flow-conserving use of compressed air foam means these engines often will be pumping off the same water load long after conventional Type 1 engines have run out of water and hydrants have lost pressure.

Although this type of apparatus has been in great demand for structure protection over the last few years, such an engine is not necessary for success with foam. Anything that can deliver water can also deliver foam. The common fertilizer canister filled with dish soap and attached to a garden hose can be effective. Several commercial home protection units are designed for foam use. On fire apparatus, foam concentrate can be added from a proportioner plumbed into the water line or dumped into the engine water tank. Aspirating nozzles will make foam at the end of the hose. Compressed air foam systems will pump foam through the hose and increase discharge distance with the energy from the air compressor. Rotor- and fixed-wing aircraft create foam by dropping foam solution through the air.

Extinguishment

For those structures that become involved and for gaining control over the adjacent wildland fire, foam is again an improvement over plain water. Water is primarily effective at suppressing open flame by cooling. Foam solution changes the structure of water so that water is more completely used for heat absorption. The thin films of foam solution, which are the bubbles in foam, expose a greater surface area of water for absorbing heat than solid streams or drops of water. The amount of water in the extinguishing foam can be adjusted to meet the heat output of the fire, also known as the critical application flow rate. Flame knockdown is often immediate. The clinging nature of the foam structure works to suppress vapors and eliminate smoke. Improved penetration of water reduces hold-over fires. More complete utilization of water results in reduced water damage inside structures.

Prescribed Fire

Foam is making water a more effective tool for prescribed fire. Foam is used to create fuel breaks and burn unit boundaries, to protect important resources within the unit, and to reduce secondary smoke emissions. The objective of fuel break and resource protection applications is similar to that of structure protection: to raise fuel moisture and create a heat sink until the ignition threat passes. With smoke reduction, the objective is to turn black to white, to cover the entire burn area as quickly as possible.

In many fuel types, foam is being used as a fuel break, sometimes as a "light hand on the land" approach in place of fire trail cut by machine or hand crew. A single foam trail, made from a hoselay or during pump-and-roll, becomes an anchor or boundary from which to ignite a prescribed fire area. Wide holding lines are created by firing out between two foam trails. High– (over 200:1) and medium– (20:1 to 200:1) expansion foams are being used to create fire trail downhill from ridgetop to draw. No long hoselay plumbing is necessary to create the barrier; a river of foam slides downslope from the nozzle.

Special resources, such as wildlife corridors, are being protected from prescribed fire with appropriate foam applications and ignition techniques. Low-expansion (compressed air or aspirated) foam is applied to tree trunks, canopies, and other long-distance exposures. Medium- and high-expansion foams are applied to the surface and ground fuels around the exposed resource. Ignition is timed to the effective lifetime of the foam.

After ignition, foam is being used to suppress smoke with a tactic called Rapid Mop-up. Rapid Mop-up is the application of a blanket of foam over the entire burn area as soon after ignition as possible. The blanket of foam effectively smothers the residual fire, cutting off secondary smoke production. Solution draining from the foam works to extinguish the fire before the fire becomes deep-seated. Smoke venting through the foam blanket indicates areas of heat that will require more firefighter attention. This technique has been effective at reducing smoke emissions, firefighter smoke exposure, and mop-up costs. The long discharge of compressed air foam and the long downhill flows of medium- and high-expansion aspirated foam have helped make this tactic practical.

Durable Foam

Class A foam products in use today are, in part, synthetic hydrocarbon surfactants. Much like liquid dish soaps, these components produce the rapid drainage and extinguishment properties exhibited by Class A foam. These surfactants are also the reason that Class A foam is short-lived. Relative to other foam, such as protein foam, Class A foam is a poor foaming agent. The longest time one can expect it to be visible in hot, dry conditions is about an hour, and usually much less. The success of Class A foam in structure and resource protection has been largely because of wetting and good timing, not longevity. Sometimes during structure protection, foam must be reapplied because the impending fire has not yet arrived. The limitation for prescribed fire is that the unit may have to be ignited soon after foam is applied. If winds aloft change and the burn must be postponed, the foam applied is wasted.

To address this short-useful-lifetime limitation of Class A foam, products with longevity, generically called Durable Foam, are being developed. These foams will be created with the same equipment currently used to make Class A foam. A durable foam will be able to hold water as a foam for 24 to 48 hours. Prototypes are already capable of these lifetimes.

Durable Foam will enable one application per structure, well in advance of the fire. It will allow for one application as the prescribed fire unit boundary, even if the ignition time is delayed 1 or 2 days.

A Foam Use Strategy

Foam use can be as simple as buying concentrate, pouring it into the watertank, and applying foam solution with conventional water nozzles. This is a good place to start. However, foam may be formed from a variety of methods and each one has a place in a foam use strategy. Low-expansion foam is needed to reach long distances. Compressed air foam offers lighter hose weights, and medium- or high-expansion aspirated foam quickly covers ground fuels. Durable foam holds water in place for a 12-hour shift. The ability to adapt water into the most appropriate form of foam for the situation is important to successful foam use.

A flexible air strategy with foam is also possible, but needs more development.The use of foam from rotor- and fixed-wing aircraft shares the same advantages as ground-applied foam in comparison to plain water for protection and suppression in the wildland-urban interface. Development of tactics to coordinate air and ground foam apparatus/ resources can lead to improved utilization of the technology.

Conclusion

Fire protection responsibilities are growing more difficult. It may be time to change strategies to keep pace with the changing fire scenario. One strategy for structure protection and prescribed fire is the use of Class A foam. In a wide variety of application schemes, Class A foam technology unlocks the full potential of plain water for fire suppression and protection.