Tim Olk

What Are You Waiting For?

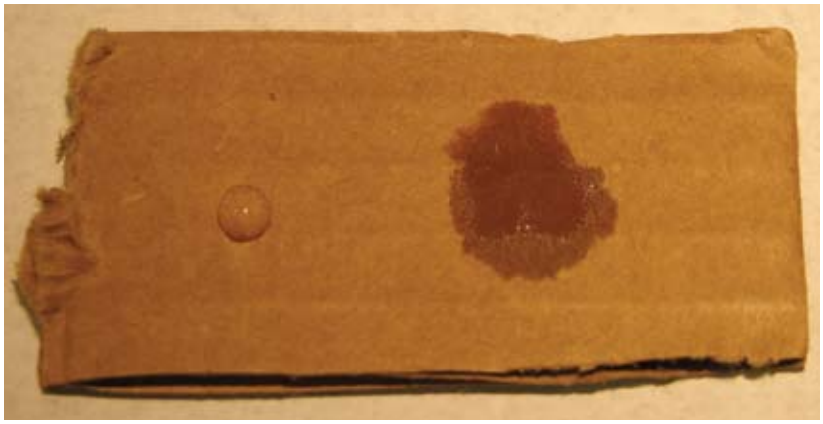
Reasons abound for introducing compressed-air foam into your fire-suppression arsenal. *By Lou DeRosa*

The Madison (N.J.) Fire Department has employed compressed-air foam systems since 1998, and they are used on every fire the department responds to today, replacing the plain water used in prior years. But though CAFS is being used in all aspects of the fireground, it is not a magic potion. Rather, it simply is a powerful, efficient and effective tool that, when used properly, offers tremendous extinguishing advantages and increases the safety of the firefighters who use it.

Why would a fire department choose not to invest in CAFS? Perhaps the additional cost is the discouraging factor. Perhaps it is because CAFS is not fully understood. Or maybe the reason stems from fear of change or the unknown. Based on experience, it seems that the reasons most departments do not invest in CAFS extend beyond just dollars and cents. The most likely cause of such reticence is that many fire departments do not fully comprehend the tremendous advantages and options available to them with such systems. Many fire service personnel simply do not understand the inherent inefficiency of using plain water. Firefighters work so hard to get water onto the fire only to realize that only a very small fraction of what flows is effective in extinguishing the fire.

Let's examine the inefficiency of plain water as an extinguishing agent and compare it to foam solution. Does water work as an extinguishing agent? Yes, eventually it does, provided that the flow is sufficient to meet or exceed the critical application rate and that it flows for an ample amount of time. However, water has a distinct disadvantage — high surface tension. High surface tension signifies that the water does not readily absorb into the surface on which it is applied, i.e., most of the water that is applied beads up and runs off the surface.

In 1997, Robert Taylor wrote a research paper to the National Fire Academy titled, Compressed Air Foam Systems in Limited Staffing Conditions. In it, Taylor documented



Courtesy of the author

A water drop is placed on the left side of the cardboard and the Class A foam solution on the right. The top photo was taken immediately after drops were placed on the cardboard. The bottom photo was taken 20 minutes later.

many facts about CAFS and its capabilities, as well as those concerning the inefficiency of water. "According to IFSTA (1996, p. 122) and U.S. Department of Agriculture (Darley, 1995, p. 17), only 5 to 10 percent of the water used in structural firefighting actually becomes involved in extinguishment," he wrote. This means that 90 to 95 percent of the water that is applied during a fire does not extinguish the fire. As stated above, firefighters work so hard to get water onto the fire — but only a mere 5 to 10 percent of what is applied actually works to extinguish the fire. Have you ever wondered why water cascades down the stairs from upper floors or why the basement fills with water after a structure fire? Simply stated, this occurs due to the inefficiency of plain water.

Taylor also wrote, "Water excels at cooling because it has a high thermal inertia and high latent heat of vaporization, which means it can absorb more heat for its mass than most other substances. It can be transported readily by pumping and is generally available anywhere humans are (W. E. Clark, 1991)." In other words, water does have the ability to absorb more heat in smaller quantities compared to other products, which makes it more effective than most other substances for cooling.

With CAFS, the water is carried by tiny air bubbles that pop upon contact when applied. This allows for quick absorption of the water, which is held in place by the foam.

A simple demonstration can be performed that illustrates plain water's high surface tension and its inefficiency compared with foam solution. Place one drop of plain water onto a piece of cardboard and observe it. The drop of water will remain there for approximately 2-4 hours until it evaporates into the air without ever being absorbed into the cardboard. Next, mix ¼ teaspoon of Class A foam into one cup of plain water, place one drop of the foam solution onto the cardboard, and observe what happens. The droplet of solution spreads out to the approximate size of a nickel and readily absorbs into the cardboard almost instantly upon contact. Further observation reveals how it penetrates deeper into the cardboard until no more solution remains — after 15 to 20 minutes, the reverse side of the cardboard containing the solution will be moist. When fighting those deep-seated fires — e.g., mulch, mattresses, brush and tire-storage facilities — think about the advantages that Class A foam would offer over plain water just in terms of efficiency and effectiveness.

Another advantage of Class A foam is its affection for carbon. Class A foam is designed to be carbon-loving, and as such is attracted to carbon like metal shavings to a magnet. Foam's affinity for carbon allows the water to penetrate deeper into the charred surface.

As mentioned above, water beads up and runs off the surface to which it is applied. With CAFS, the water is carried by tiny air bubbles that pop upon contact when applied. This allows for quick absorption of the water, which is held in place by the foam. Have you ever noticed the "tropical rain storm effect" that occurs during a water-only attack after the line is shut down? Drops of water run off all surfaces, creating the illusion of such a storm. In a CAFS attack, the majority of the water does not run off; it remains where applied, cools the area and extinguishes the fire.

Let's now examine the use of foam in extinguishing a real-life fire. In this example, the crew encountered a fully involved, detached residential garage fire, with the exposure B side beginning to burn upon

Courtesy of the author

A fully involved detached residential garage fire in Madison, N.J., with the exposure on the B side beginning to burn upon arrival.

The same garage after the CAFS attack. Fire knockdown took approximately 20 to 30 seconds.

arrival. The firefighters used a 2.5-inch attack line with a 1⅜-inch tip, flowing approximately 170 gpm of CAF, and about 1,000 gallons total of water to extinguish the fire. Knock down of the fire happened in less than 30 seconds. (See photos.) Look closely at the lack of runoff on the driveway. The water was absorbed where it was applied. Also note the color of the smoke — it is not steam, but simply smoke minus carbon.

The types of materials used in manufacturing today have a great impact upon present-day fires, compared with the fires of yesteryear. Today's fires burn hotter and faster, and result in gas emissions that are far more toxic and dangerous. Also, lightweight construction dramatically increases the potential for structural collapses to occur under a fire condition. Yet, while major improvements have been made to turnout gear, SCBA, and the technology utilized to locate a fire, the fire service seems reluctant to invest in and utilize Class A foam and CAFS as a means of increasing firefighter safety.

How can CAFS increase firefighter safety? The CAFS hand line is about one-third lighter compared to a water line, which results in less physical strain on firefighters who are maneuvering the line. Also, CAFS cools the fire area and knocks down the fire much faster than plain water. This decreases the amount of firefighter exposure to intense heat and hazardous conditions, as well as on-scene time, further reducing the potential for injuries.

There are several other tactical reasons for investing in CAFS, as follows:

- There is virtually no friction loss in a compressed-air foam attack line. This makes the pump operator's job easier because there is not much to calculate; it also allows the foam to be pumped farther and higher. I personally have used 1,800 feet of a 1 ¾-inch line, with a main pump discharge pressure of 110 psi, at a brush fire deep in the woods. The engine was positioned at the hydrant on the road and the handline was carried into the woods. I also have pumped into a 4-story, dry standpipe system with a main pump discharge pressure of 100 psi. We were flowing through 100 feet of 1¾-inch hoseline off the 4th-story standpipe at a rate of 100 gpm.
- CAFS allows the user to create a "shaving cream" consistency of finished foam, which is used primarily for exposure protection and smothering operations due to its ability to adhere to vertical surfaces.
- CAFS also allows for switching to aspirating types of nozzles. In certain situations, a Mid-X nozzle works better than a CAF line because it creates bigger bubbles and fills the area faster. (Remember, a CAF bubble is very small and uniform with an approximate 10:1 expansion ratio.) In Madison, we use a Mid-X nozzle for dumpster and car fires. A 500-gallon booster tank can fill up a 30-yard Dumpster using the Mid-X nozzle.
- Most of the larger CAFS come with a 200-cfm air compressor with the pressure regulator conveniently built into the truck in the form of a pressure governor. This proves to be a useful and powerful tool in a rescue operation. It can be used with an Air Knife or Air Shovel for trench operations, a jack hammer for urban-search-and-rescue operations, and almost any type of air or pneumatic tools.
- CAFS may help increase the Insurance Service Organization ratings for the town/municipality. Last year, while ISO was reevaluating our department, the representative stated that they currently are considering giving additional points to fire departments that utilize CAFS; however no time for this change was indicated. A higher ISO rating will benefit the community in the form of decreased fire insurance premiums.

I want the safest and best for my firefighters. CAFS helps me to achieve this goal, and I never would want to revert to using solely plain water. As retired Chief Alan Brunacini once said, "If you buy a pumping engine without CAFS, it's obsolete." However, it is vital to note that training with and understanding CAFS is paramount. Indeed, intimate knowledge of nozzles, interior attack techniques, applications, as well as an understanding of the technology's limitations, is the key to its successful use.

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