CAFS Attack Lines

Mancahca Fire/Rescue

Travis County Emergency Services District #5

CAFS – It's just foam!

CAFS – Compressed Air Foam System, mixes all of the ingredients needed for finished foam into the fire stream as it enters the hoseline. The stream has additional energy behind it due to the pressurize air that is injected into the line to build the bubble structure.

Terminology Review:

Foam Concentrate: The raw foam liquid as it rests in its storage container prior to the introduction of water and air.

Foam Solution: Mixture of foam concentrate and water after it leaves the proportioner but before air is added to it.

Finished Foam: Extinguishing agent formed by mixing a foam concentrate with water and aerating the solution for expansion

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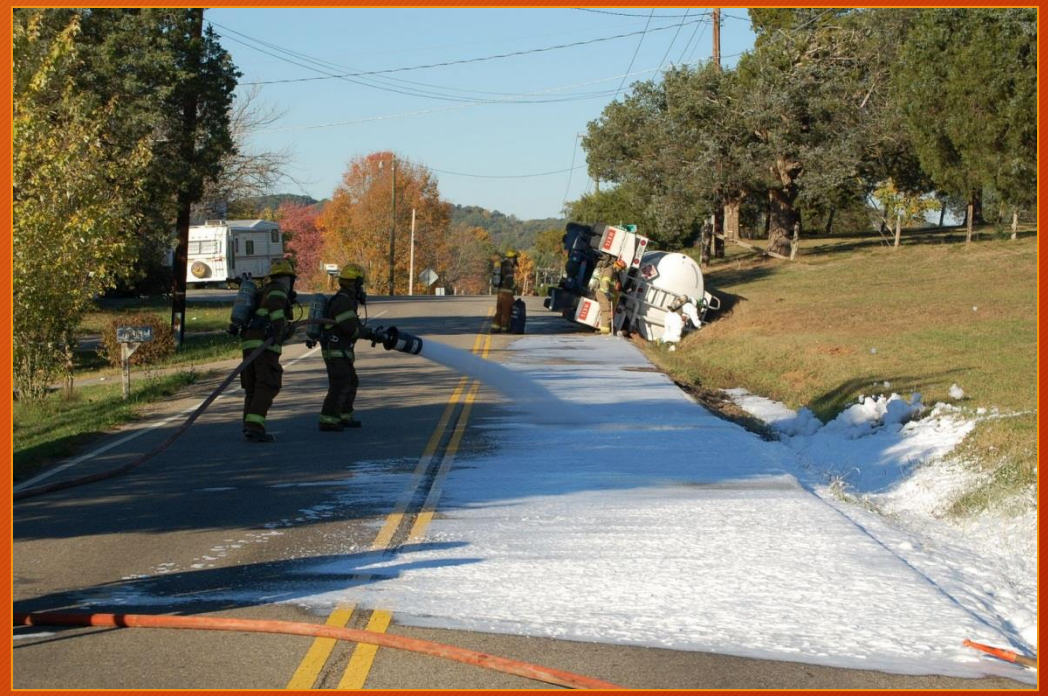
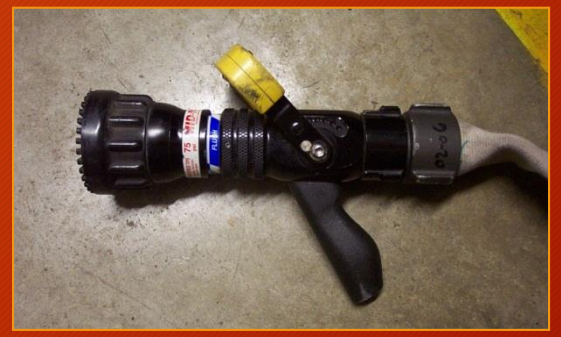
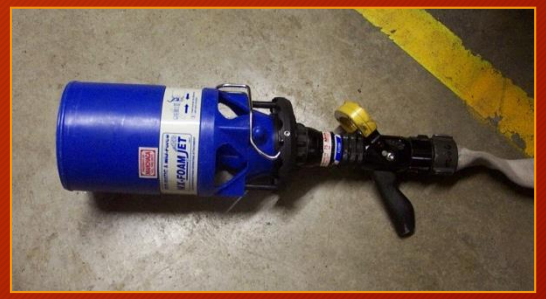
CAFS or NAFS

NAFS = Nozzle Aspirated Foam System

The liquid in the hose is foam solution (concentrate + water) and the air is introduced at the nozzle. Typically a fog nozzle breaks up the stream into droplets and mixes the solution with air



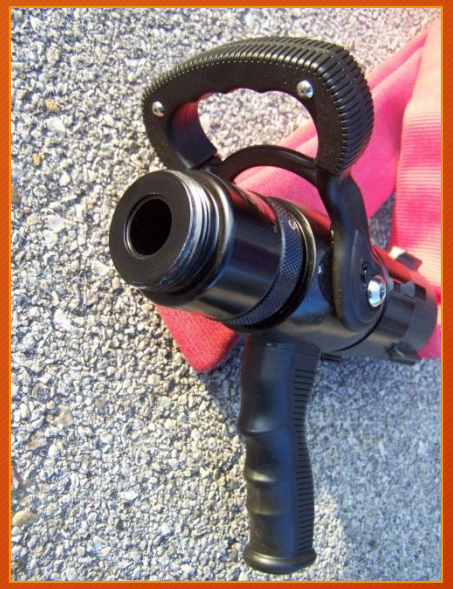


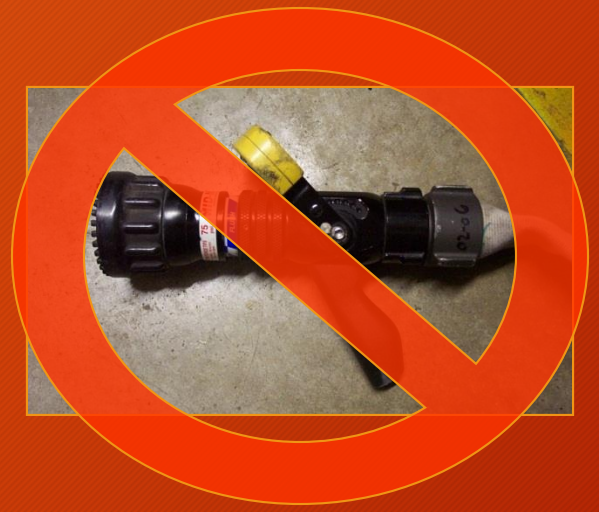


CAFS or NAFS

CAFS = Compressed Air Foam System

Since CAFS is finished foam before it reaches the nozzle a smooth bore tip is used since the fog nozzle is not needed to create finished foam. In fact, moving CAFS through a fog nozzle will degrade the quality of the finished foam.





Why CAFS?

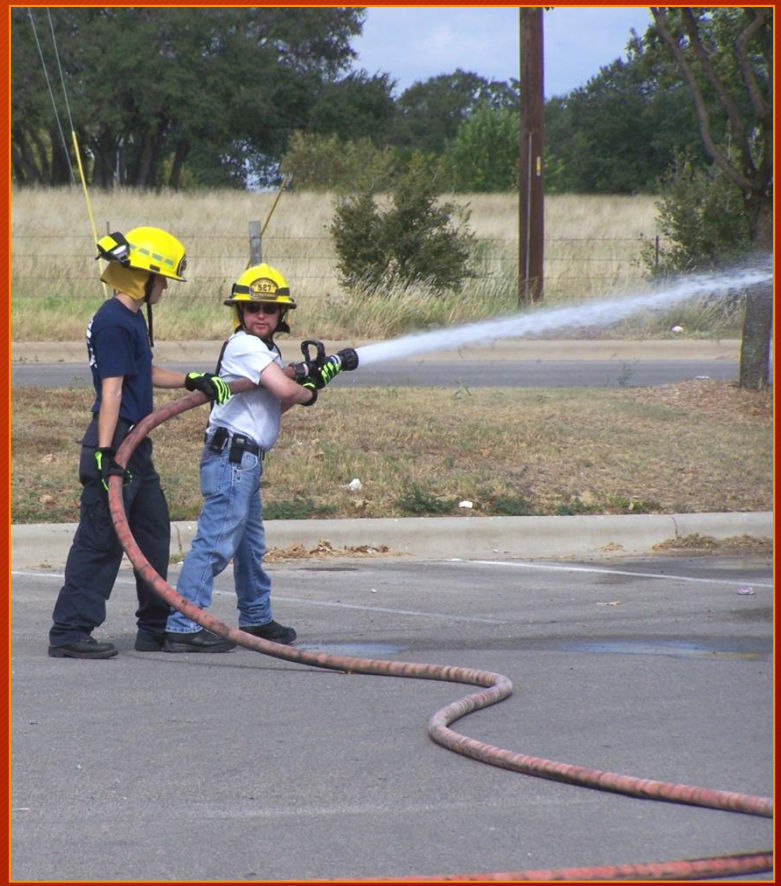
The process of injecting the foam concentrate and air at the apparatus and allowing it to mix as it travels down the hoseline results in a high quality foam with a small, uniform bubble structure. This process of mixing the finished foam in the hoseline is also called “scrubbing”.

In order for the CAFS foam to discharge in a properly mixed state, there are minimum hose lengths for lines so proper scrubbing can occur.

1 ¾” hose = 100 feet

2 ½” hose = 150 feet

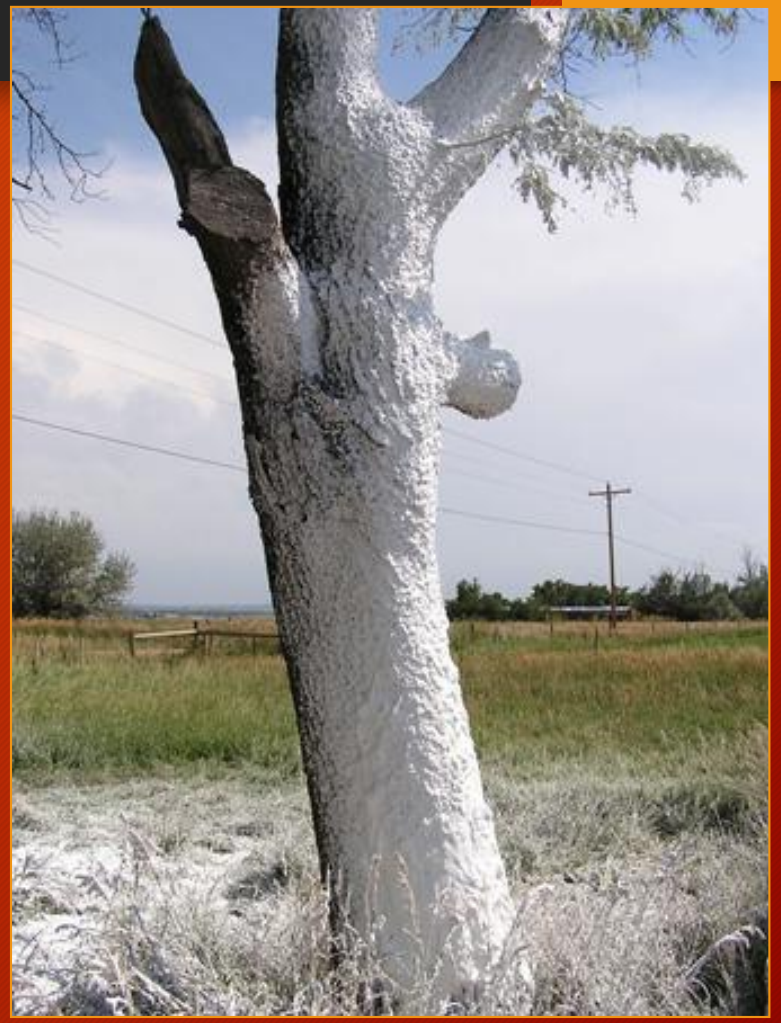
3 “ hose = 200 feet



Why CAFS?

The foam resulting form CAFS gives water a vastly increased surface area, allowing it to more efficiently absorb heat over the same quantity of straight water.

The foam will also adhere to vertical and overhead surfaces and remain in place longer, absorbing more heat in the higher portions of the room. The majority of straight water applications will run off and fall from these surfaces, exposing little of the water to the superheated areas of the fire.



Why CAFS?

The energy of the compressed air in the hoseline provides extra propulsion to the stream. This gives a CAFS stream excellent reach and reduced friction loss characteristics.

The Flow Question

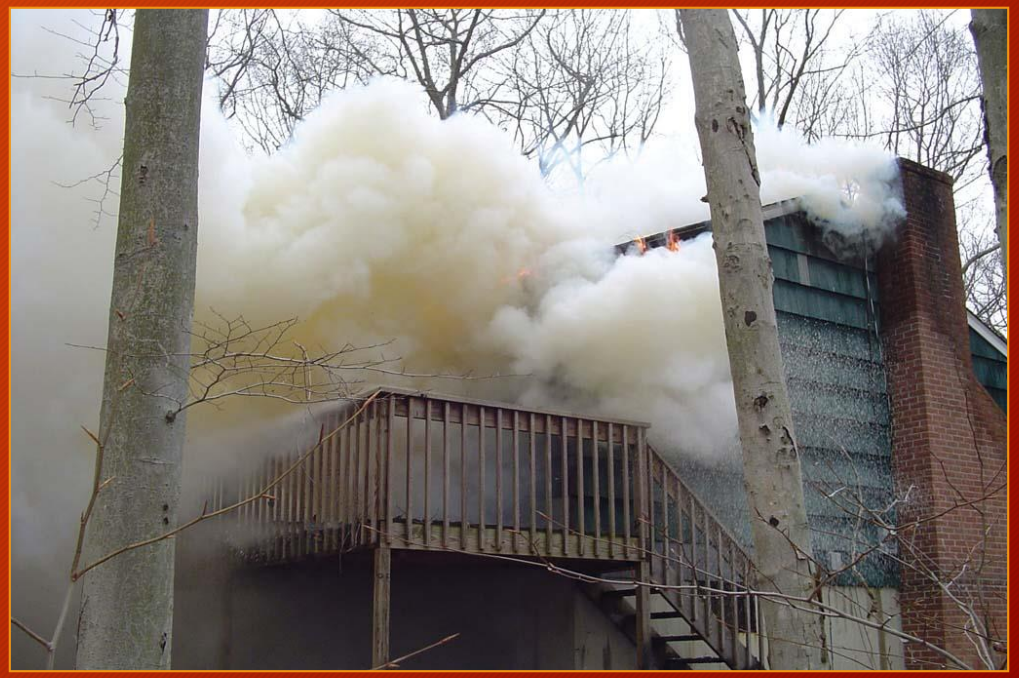
With the increased efficiency provided by CAFS foam, it would logically follow that fires can be extinguished with decreased flow (gpm) compared to a straight water fire stream.

It is IMPORTANT to remember that air bubbles do not extinguish fire – WATER EXTINGUISHES FIRE. There is still a critical application rate that must be applied in order for enough water to be present in the CAFS stream. This application rate insures that the fire is extinguished and firefighters are protected by the stream.

The Flow Question

While it is not our goal to use less water with CAFS (with respect to the rate of application). We do have the potential to put the fire out faster due to the heat absorbing efficiency of the CAFS application (thus using less water due to less application time).

The flow of a CAFS stream is a product of the gpm pumped into the line plus the cfm of air injected into the line. The quality of the foam will depend on the water-air ratio plus the percentage of foam concentrate injected into the stream.



CAFS Application

Class A Foam: Range: .1% to 1%

.3% for interior fire attack

.5% for overhaul and protective streams

Interior Attack:

Flow: .3% @ 100 psi (water) and ~35 cfm air (15/16” tip)

(equals approx. 90-100 gpm)

Class B Foam: 3% or 6%

3% for Hydrocarbon Fuels

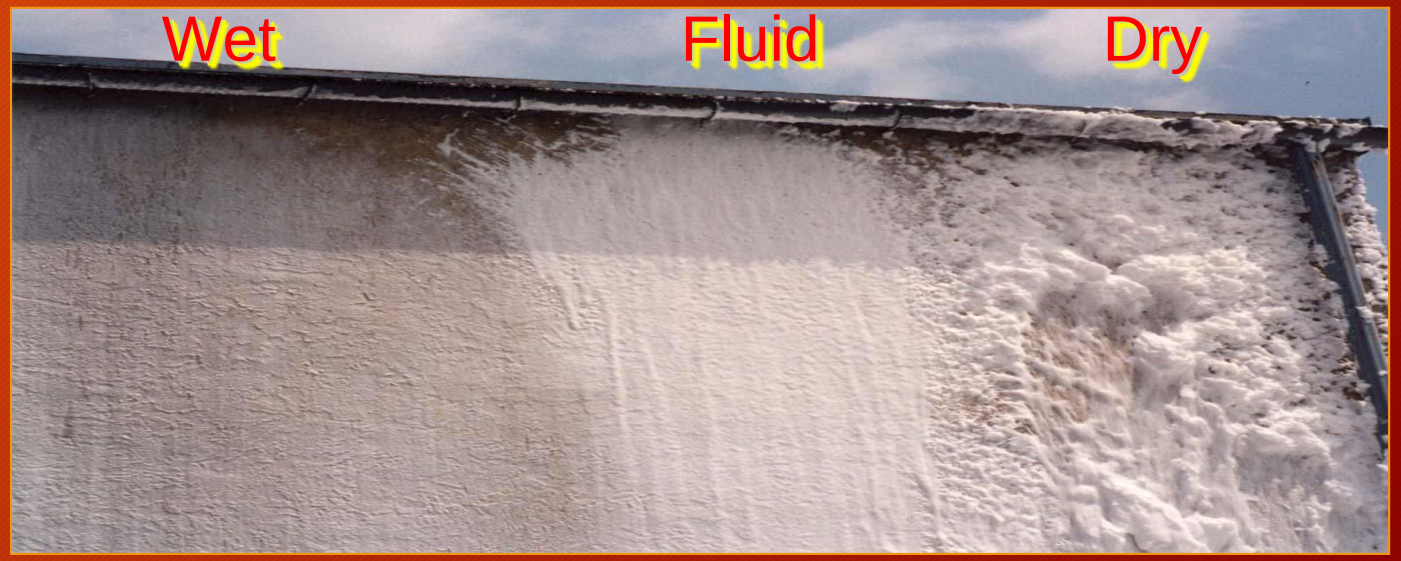
6% for Polar Fuels and Ethanol Fuels

CAFS Application

Water-to-Air Ratio	Application
Wet: 3:1	Interior Fire Attack
Fluid: 2:1	Overhaul Operations
Dry: 1:1	Blanketing and Structural Protection

CAFS foam quality can be made to be "wet", "fluid"(aka "medium"), or "dry"

This is determined by the ratio of water to air in the stream



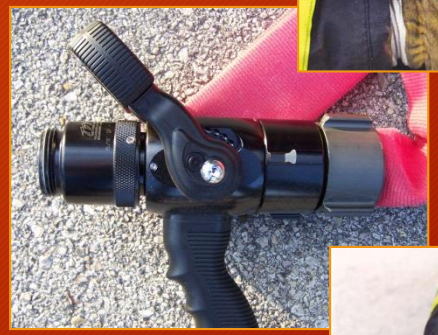
CAFS Application

Foam quality can be controlled at the pump by the adjustments of the DO or at the nozzle by changes made by the nozzle operator.

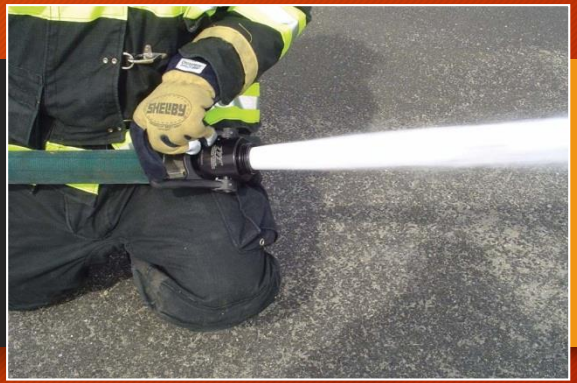
The DO controls the proportioner percentage, the gpm and the cfm.

The nozzle operator controls the orifice size and gating of the nozzle shut off.

- The smaller the nozzle orifice, the more the nozzle compresses the bubbles, making the foam wetter. Larger openings will “dry out” the foam.
- With CAFS, the smooth bore tip can be removed and the waterway of the nozzle shut-off used as a nozzle.



CAFS Application



Controlling CAFS quality via pump & nozzle

1 ¾” Hoseline	
.3% with 15/16” tip	“wet” foam
.3% ~ .5% with 1 3/8” waterway	“fluid” or “medium” foam
.5% with 1 3/8” waterway	“dry” foam with a 1:1 ratio from the pump
2 ½” Hoseline	
.3% with 1” tip	“wet” foam
.3% ~ .5% with 2” waterway	“fluid” or “medium” foam
.5% with 2” waterway	“dry” foam with a 1:1 ratio from the pump

Hose Handling

Nozzle Reaction

- When operating with CAFS, air pressure will build in the hoseline when the line is shut down. This will cause a short surge and sharp nozzle reaction when the line is opened.

Water Hammer

- While not eliminated, water hammer is less of a concern due to the compressible nature of the air mixed into the stream.

Hose Handling

Application in interior fire attack:

- In a pre-flashover state, apply CAFS to upper portions of walls and ceiling in addition to directly attacking the seat of the fire for maximum heat absorption. Foam will stick to the surfaces in the superheated atmosphere and continue to absorb heat.
- In a post flashover state, “paint” the room in a box pattern (walls, ceiling, lower areas – seat of the fire
- Foam is applied by “painting the surfaces” with foam

SLUG FLOW

- Water and Air will not mix without foam concentrate in the mix.
- If air is injected into the hoseline with no foam in the system, slug flow is the result.
- The nozzle operator will experience alternating pulses of water and air
  - This will produce an ineffective stream and is a hazard to interior fire crews.
- If you run out of foam or the foam is shut down AIR MUST BE TURNED OFF TO THE AFFCTED DISCHARGE LINE

Minimum Flows

These minimum flows allow for appropriate application rate (flow) for firefighting operations AND it provides enough flow in the line to minimize effects of hoseline kinking.

1 ¾” Line	90-100 gpm (minimum 100 psi)
2” Line	110-120 gpm (minimum 100 psi)
2 ½” Line	130+ gpm (minimum 100 psi)
Master Streams	Minimum 140 psi