



# Foam Lines

Cottrell Associates, Inc. March 2012 - rev. Aug. 2020


## Calculating Foam Needs

*At gasoline tanker fire events* By: Jim Cottrell



I-10 Phoenix AZ - November 2011  
Successfully extinguished with two handlines.

Universal F<sup>3</sup> Green, fluorine free foam developed in 2017-18 will hold scene security for two hours between applications, as its quarter life is 120+ minutes. Although application rate is 60% higher than fluorinated (PFAS) AR-AFFF such as Universal Gold 1-3%. Example: a 1000 sq. ft. E-10 or diesel spill fire requires an aerated 100 gpm foam stream, Universal F<sup>3</sup> Green would need 160 gpm (aerated). Where gasoline grade ethanol is involved E-95 or E-98 (placard 1987) application rate is still 100 gpm.



Special Note: Airport ARFF rigs are not candidates for fighting fires involving gasoline/ethanol blends, E-15, E-85 and or E-95, as their mil. spec (F-24385) AFFF is not indicated for use on such fuels... Okay for E-10 gasoline, diesel and kerosene/jet A.

There are no hard resource calculations for these fire events. So, I'll give you my quick two-minute version:

If we are talking about a tanker event which has lost most of the load at highway speed, you may not have much fire left to fight after ten minutes, as gasoline/ethanol blends go off at about one inch every five minutes. This would be a 50 gallon foam event if all that was left was a few isolated pool fires still burning. Tires and fiber-glass body wreckage usually respond well to water streams.

Don't waist foam on this stuff. Unignited gasoline soaked into the earth can easily use 100+ gallons of AR foam concentrate to maintain scene security while disentangling casualties, managing body recovery or just holding off ignition while the investigators and wreckers do their thing. Post fire security is where 85% of foam us used. The extended quarter life of Universal Gold 1-3% could cut that quantity in half when it comes to scene security.

If the subject tanker was stationary or moving slowly when hit by another vehicle and has lost perhaps one or two compartments, with ignition, a two thousand gallon spill under and around the vehicle would require perhaps 90-100 gallons of AR-AFFF concentrate to extinguish and hold secure for an hour. National's Fluorine free F<sup>3</sup>-



AR foam will need 60% greater flow rate. Figure on 200 gpm for AR-AFFF and 320 gpm for F<sup>3</sup>. When the under vehicle fire is secure you can then go to the remaining topside fire. Gentle medium expansion application for this part of the job is critical if you want the remaining ignited fuel to keep from slopping over, reigniting the under vehicle spill.

## CALCULATING FOAM NEEDS



### Got Ethanol?

Gasoline grade ethanol (E-95 or E-98) is often shipped in standard gasoline delivery tankers (placard 1987).

Recently a retired NY State Haz-Mat Specialist / Instructor and now volunteer fire chief in Barre, NY responded to a fatal, ignited, 10,000 gallon ethanol tanker wreck. His firefighters, with the help of area mutual aid put it out leaving one full ethanol compartment untouched. They did it with a handline and a TFF Blitzfire, using Universal Gold, 1-3% AR-AFFF. They used perhaps 75 gallons for extinguishing and 200 gallons more for hours of scene security.

### CONCENTRATE USE

As I said, there are no hard resource rules in cases of tanker spills with or without fire. In all cases, depending on stream reach requirements, wind issues and or obstructed access, I would insure (at minimum) a fifteen minute supply of water and AR-foam concentrate with longest staying power available.

Keep in mind that there is a fair degree knockdown power in 500 gallons of properly proportioned AR foam solution. A 500 gallon booster tank needs three pails of 3% foam concentrate. A 100 gpm eductor can handle a 20 x 50 ft. (1000 sq.ft.) fire for five minutes, which may be all you need to get under vehicle fires knocked. Using NF Universal F<sup>3</sup> Green, concentrate and water needed increase by 60%.

For a fifteen minute 3% solution flow of 200 gpm have at the ready, 90 gal 3% AR-AFFF or 144 gallons AR-F3. For a 500 gpm stream have 225 gal. 3% AR-AFFF or 360 gal. of 3% AR-F3.

If you have ignited diesel fuel or kerosene, I would go after it at 1% with Universal Gold 1/3% and secure it at 3%. If water is scarce, regardless of fuel, secure the spill at 6%, as foam's drain time doubles at 6%.

Using Universal F<sup>3</sup> Green at 6%, quarter life goes to four hours compared to two hours at 3%. A massive water savings where water is scarce on interstates or four lanes state roads,



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<http://www.cottrellassociates.com/combat-support-products/training-library.html>

### Long Term Scene Security



When it comes to tanker incidents, the events that use the most foam are usually the unignited ones, which is about 50% of the time. Holding scene security until the event is cleared is the bang for the buck issue, and these days may be a bigger environmental issue. Foam choice and how long it holds its water becomes an environmental consequence of using AFFF, since it's the water weight in the foam blanket that holds vapors down. When the blanket gives up 25% of its water weight its time to give it another aerated coat. Using 1-3% Universal Gold, reapply aerated foam every 20 minutes @ 3% and every 40-45 minutes at 6%, or when instruments detect ignitable vapor. If using Universal F<sup>3</sup> Green, that times increases to two hours or more. How to test your foam's 1/4 drain time is on page 3.

*Note: pulling the PFAS (film forming chemical) from AFFF's reduces its effectiveness to the point that it is virtually useless. It is why National Foam formulated and patented Universal F<sup>3</sup> Green 3% AR-F3 for fire department use.*

## Cottrell Bottle Shake Test - Not very scientific, but close enough for comparison purposes.

Using water and a lab. graduate, mark a 1000 ml. water bottle at 25, 100, 500 and 750 ml. Using a medication syringe or eyedropper, add 3 ml. of foam concentrate, then add water to the 100 ml. line. You have now made a 3% solution. AFFF will disperse instantly. AR-AFFF will not, due to its sirup or gel-like alcohol resistant polymer. It will need to be swirled till 3 ml. of concentrate in the bottom has dissolved.

Note: If the eyedropper lifts AR-AFFF foam, so will a foam eductor. All National Foam products are UL listed for use with foam eductors.

Once dissolved, shake the bottle vigorously for at least twenty seconds; turn the bottle on its cap and start the clock. Lightly tap the capped end on the table or desk and record the expansion ratio. If the foam sample has filled the bottle, you have achieved a 10:1 expansion ratio. Just about what a low expansion foam nozzle, or nozzle attachment will achieve. If it goes to 750, you are at 7.5:1 expansion and so on. Record the expansion ratio, water source and its temperature, as water temperature and its clarity may have an effect on the test result. Salt water may cut drain time by 40 - 50%.

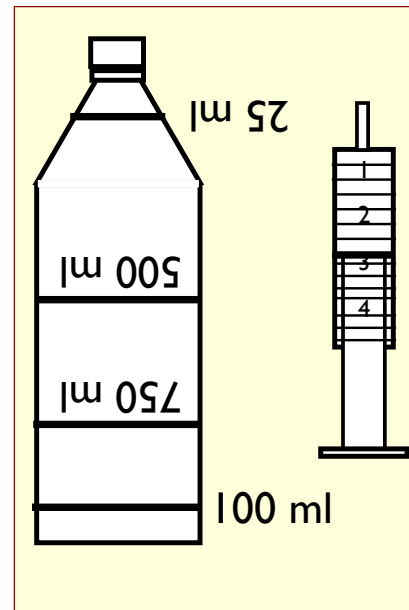
When 25 ml. of liquid has accumulated at the capped end, stop the clock; the foam has reached its quarter life. At this point the foam has lost 25% of its vapor suppression ability, which means it's about time for reapplication. Airport foam (regular AFFF) will go in less than five minutes. Universal Gold should go 19-25 minutes @ 3% depending the water source and how accurately you measured the foam concentrate sample. At 6% it will go 45 to 50 minutes. The longer the better, as this quarter life business is what that determines foam replacement cost and how much waste needs to be cleaned up. **Universal F<sup>3</sup> Green goes 120 min.**

Let the sample continue to drain. When it's all drained you will still have foam in the bottle, which was almost useless minutes after you reach quarter life.

Re-shake the bottle for twenty seconds and put a dollop of finished foam on some acetone or denatured alcohol. If it disappears as fast as you apply it, it's not alcohol resistant.



More at [combatsupportproducts.com](http://combatsupportproducts.com)



Test your foam and system: Take concentrate sample from your engine's foam tank and the water from its booster tank. Do the 3% bottle shake and record the time.

Run your foam system for twenty seconds, capture a solution sample from a hose coupling and put 100 ml. into another bottle, shake it and compare the two times. If the system sample is faster, it's lean. If it's slower, it's rich. You can be 1% rich, no lean.