Foam Technician Level I

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Fire Foam For Transportation Events

Hazardous Liquid Spill Fires And Vapor Management

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Foam Technician Level I

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Handouts & Video Support

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

https://www.youtube.com/user/arafff136/videos?flow=grid&view=0

VIDEOS

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What We Do

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Foam Field Services

- Foam fitness and system output evaluation (mail in)
- Mobile equipment and special appliance advisory
- Fire testing foam samples (NF's modeling lab.)
- Fire apparatus foam system specs. review
- Appliance overhaul, repair and upgrade

4

Marine Systems

5

Special Ops. Training

Risk Analysis - Special Operations Training

Fuel Terminals - Rail Yards - Hi-Hazard Occupancies

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Foam Technician Level - I
Program Overview

Foam For Transportation Events

I. Gasoline / Ethanol Blends & Crude By Rail
a. liquid fuel (class B) origins / characteristics.
b. liquid fire behaviors (safety / survivability).
c. ethanol / gasoline storage and distribution.
d. light crude transportation spills and fires.

II. Regular & Alcohol Resistant (smart foams)
a. AFFF foam concentrate storage and handling.
b. the future with fluorine free foam overview
c. class A and CAF interactions on B fuels.
d. class B foam (alcohol resistant foams)
e. foam proportioning basics (eductors, self-inducting appliances and simple on-board systems).

III. Foam Application (mechanisms)
a. low and medium expansion foam - application techniques.
b. managing safety and security at un-gnited spills.
c. logistics support for ethanol/gasoline fires and major crude spills.
d. mitigating foam's environmental impact.
e. fluorine free foam application techniques and application rates

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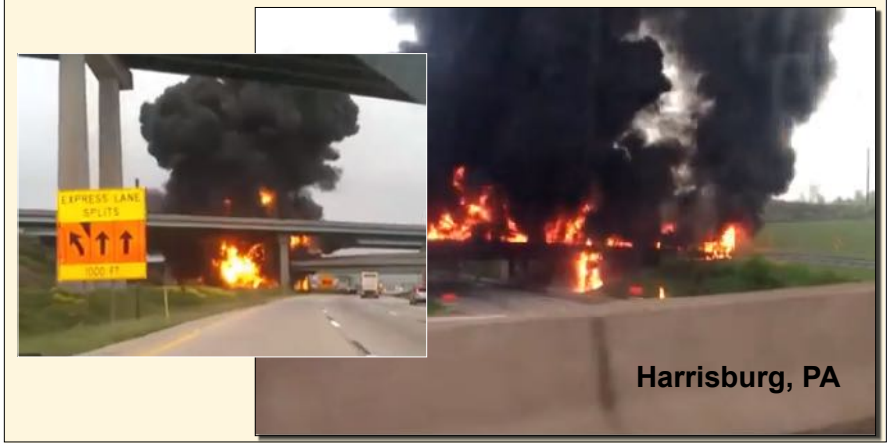
Ignited spills

Ignited spills account for about 50% (+/-) of fire department runs to tanker crashes.



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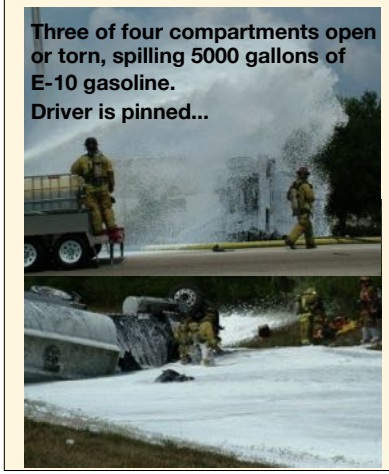
Un-ignited spills

Un-ignited spills account for about 50% (+/-) of fire department runs to tanker crashes.

Spill Security

Foam provides security for the majority of un-ignited jobs where firefighters at work are at maximum risk.



Laboratory Spill Burn Rates

Gasoline - one inch in five-minutes

Diesel - one inch in eight-minutes

Crude - one inch in eight-minutes

Ethanol - one inch in ten minutes

Will be longer when soaked into the earth.

Terrain's affect On Burn Rates

HYPOTHESIS:
Fuel soaked media will burn at different rates depending on the type and density of the media.

QUESTION:
What effect does gasoline soaked into the earth have on its burn rate? ***Baseline test: pooled gasoline burned at +/- 1" (2.5 cm) in about 4 minutes.***

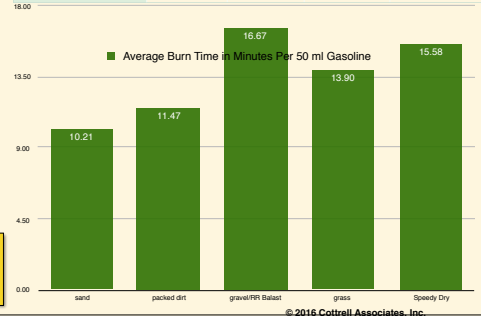
TEST APPARATUS
One-inch (2.5 cm), +/-50 ml of 87 octane gasoline in a four inch (100 mm) stainless steel bowl.

MEDIA:
* Play sand
* Packed dirt (topsoil and clay)
* Gravel / railroad balast
* Grass (turf)
* Speedy-Dry (cat litter)

CONCLUSION:
Given the same amount of fuel. Fuel soaked media will burn at substantially longer rates as opposed to pooled fuel, depending on the coarseness and density of the media;

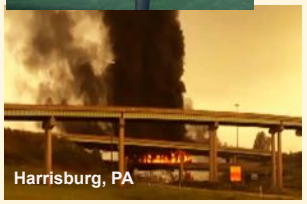
BURN SUMMARY PER ONE INCH (50ML) OF FUEL

MEDIA	TEST 1 MIN	TEST 2 MIN	TEST 3 MIN	AVERAGE MIN
SAND	10.05	10.25	10.34	10.21
DIRT / CLAY	11.40	11.54	11.47	11.47
GRASS TURF	15.03	14.45	12.22	13.90
SPEEDY DRY	15.25	15.45	16.03	15.58
RR BALAST	16.43	17.03	16.54	16.67



Spill Fires Defined

One-inch or less in depth. Otherwise known as a "skin" fire. These fires are typical of transportation accidents and are generally short lived, often less than twenty minutes.



Fule In Depth

These fires are typical of fuel storage tank fires, where long duration, concentrated heat exposes containment structures and their materials of construction.

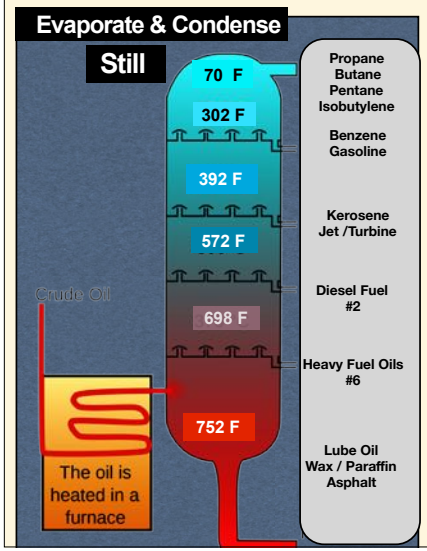
Fighting large tank fires often require artillery which is capable of "over the top" application, known as Type III application. Such fires and can last many hours.

Collins City, MS - Crude batteries extinguished at 500 gpm in five-minutes.

Photo: Chief John Pope

Need To Know About Class B Fuels

Refining Crude



Refining Subtracts Carbon

Liquid Fuels - Significant Terms And Definitions

Flash Point: Temperature needed to release ignitable vapor:

	Flash Point	Ign. Temp
Gasoline	-45 °F	530 °F
Ethanol E-98	20 °F	720 °F
Ethanol E-85	-6 °F	685 °F
Bakken Crude	+50 to -20 °F	482 °F
Kerosene (Jet A)	100 °F	565 °F
Diesel	130 °F	580 °F

Road spills will reach road temperature on contact.

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Flammable Limits

Air to vapor ratio needed for combustion

Ethanol (easy) ..... 3.3 to 19%

Gasoline (fickle) ..... 1.4 to 7.6%

Light Crude (Bakken) ..... 15 to 30%

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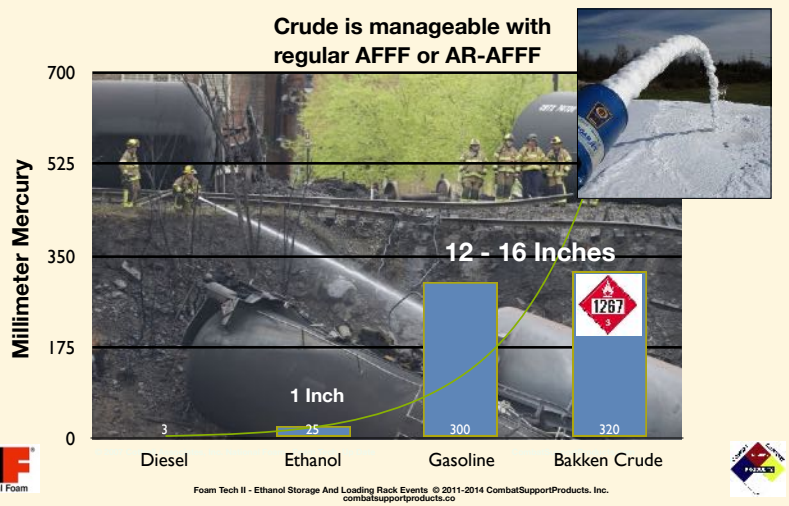
Vapor Pressure Comparisons

(mm/inches of mercury @ 70 F - 22 C)

Vapor pressure is an indication of volatility.



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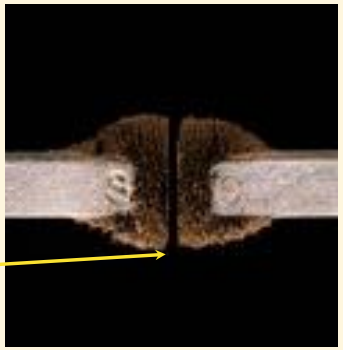
Hydrocarbon Characteristics

Oil and water do not mix, and are known to be insoluble, since their electrical systems tend to be similar.

Here, water and oil are actually pushing apart at their interface.



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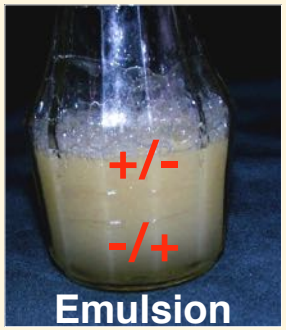
Emulsions From Detergent or Food-Grade Surfactants

Only when shaken in the presence of an emulsifier will oil and water create an emulsion.



Hydrocarbon Fuels Produced From Biomass

In 2007 the US Government announced a goal to expand consumption of biofuels to 35 billion gallons by 2017.

No Special Firefighting Needs

Blends of high flashpoint biodiesel and conventional petrodiesel are beginning to find their way into the mainstream diesel fuel marketplace.

Firefighting is as for diesel or home heating oil.

ETHANOL CHANGED EVERYTHING

The goal of The Federal Energy Policy Act of 2005 was to replace MTBE and TAME with a more environmentally friendly oxygen compound, ethanol.

Gasoline Blends

E-10

10% ethanol

Ethanol Conversion In U.S.A.

Complete

Source: United States Department Of Energy

E-15 Gasoline

15% ethanol

E-15 (15%) Recently Approved By The EPA.

MUST TREAT WITH AERATED AR-AFFF OR AR-F3

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E-85

E-85

MUST TREAT WITH AERATED AR-AFFF OR AR-F3

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Pipe Line Gasoline Distribution

Ethanol is not distributed in the nation's pipe line system

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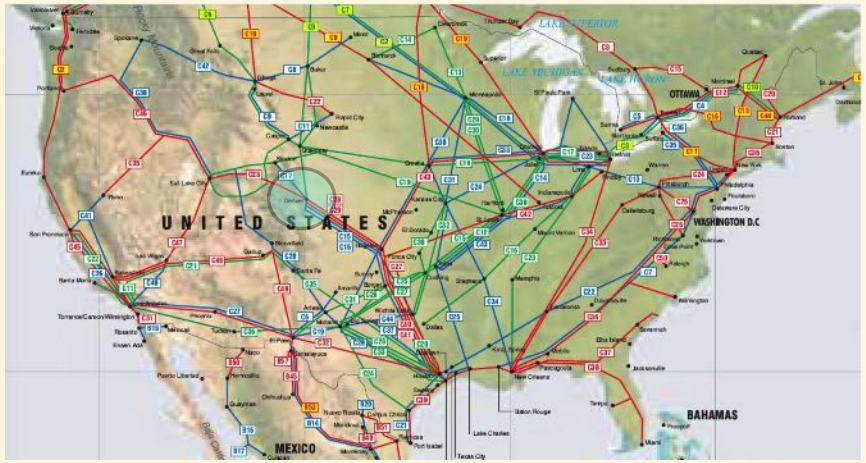
PIPE-LINES

RED = GAS **BLU = Gasoline / Oil** **Green = Crude**



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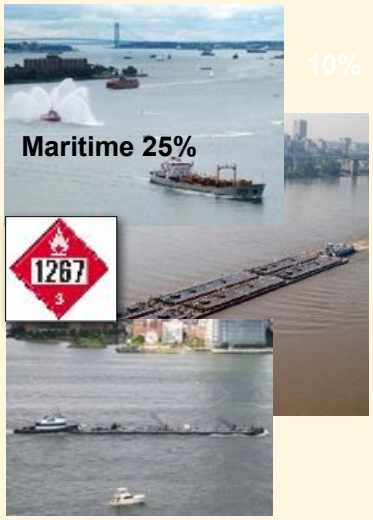
U.S. Ethanol And Crude Movements

RAIL 75% - Unit trains



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Where's It All Going?

Crude oil and Ethanol (E-98) are the most commonly shipped hazardous materials on U.S. railroads.

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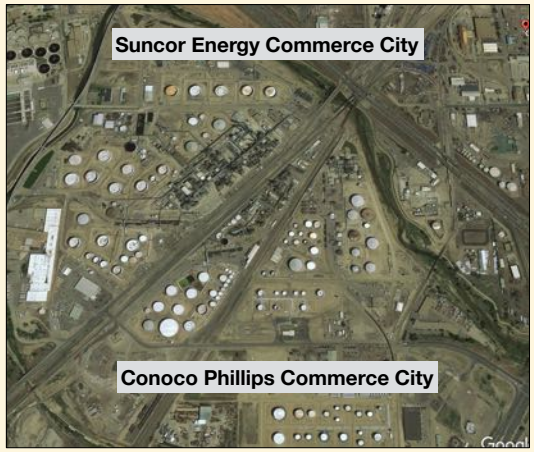
Refining, Storage and Distribution



To Mkt. Terminals

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Colorado Marketing Terminals

Name	Address	City
Magellan Pipeline	15000 E. Smith Rd.	Aurora
NuStar Logistics, L. P.	7810 Drennan	Colorado Springs
Suncor Energy USA	5800 Brighton	Commerce City
Suncor Energy USA -	5575 Brighton	Commerce City
NuStar Logistics	3601 East 56th Street	Commerce City
ConocoPhillips PL -	East 56th	Commerce City
Aircraft Service	1111 sburg St.	Denver
Union Pacific Railroad	1400 West	Denver
Rocky Mountain	8160 Krameria	Pont
Rocky Mountain	1004 S. Sante Fe	in
Colorado Fuel	1493 Hwy 6 & 50	Fruita
Colorado Fuel	1629 21 Road	Fruita
Sinclair Transport.-	8581 East 96th Ave	Henderson
ConocoPhillips PL -	31610 East Hwy 50	LaJunta

+/- 14 Mkt. Terminals In CO

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Ethanol On The Road

Daily ethanol delivery to terminals having no rail or marine access.

Truck To Storage Tank

Sometimes five or more a day

Trans-loading

crude 1267 | acetone 1090 | methanol 1170 | denatured ethanol 1987

Rail To Truck Trans-loading

Sterling CO

US DOT Emergency Response Guidebook

Searchable online

UN 1203 Gasoline up to 10% ethanol.

Name of Material	Guide	ID No.
Gas identification set	123	9035
Gasohol	128	1203
Gas oil	128	1202
Gasoline	128	1203
Gasoline and ethanol mixture, with more than 10% ethanol	127	3475

UN 3475 Gasoline over 10% up to 20% ethanol.

Includes E-15

ID No.	Guide	Name of Material
1987	127	Alcohols, n.o.s.
1987	127	Denatured alcohol
1988	131	Aldehydes, flammable, poisonous, n.o.s.
1988	131	Aldehydes, flammable, toxic, n.o.s.
1988	131	Aldehydes, poisonous, n.o.s.

UN 1987 - Alcohol up to 5% gasoline including E-85

Ends Up At Retailers

Retail Delivery - DOT 406 or MC 306

1203

3475

Missed Deliveries

California found that 60 of 76 rollovers produced spills, with an average size greater than 5,000 gallons. With gasoline cargos, almost 50% of the spills produced fires, some of them disastrous.

Handout

http://www.cottrellassociates.com/combat-support-products/ewExternalFiles/Calculating%20Foam%20Needs%20For%20Tanker%20Crashes.pdf

National Foam

Foam Lines

Cottrell Associates, Inc. March 2012

Calculating Foam Needs

At gasoline tanker fire events By: Jim Cottrell

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

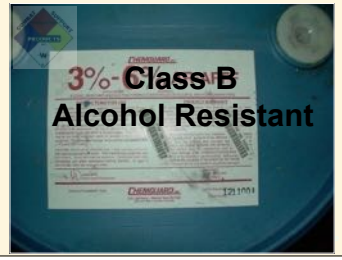
There are no hard resource [illegible] these fire events. [illegible] I'll give [illegible] two [illegible] we a[illegible] about a [illegible] load, at highway speed, you may not have much fire left to fight

Don't waist foam on this stuff. Unignited gasoline s[illegible] the earth can easily use [illegible]0+ gallons of AR fo[illegible] concentr[illegible] maintain scene secu[illegible] while disentangling casualt[illegible], managing body recovery or just holding off ignition while the investigators and wreckers do

Special Note: Airport Crash/ Rescue trucks are no longer candidates for fighting fires involving gasoline/ ethanol blends [illegible] (F-24385) AFFF is no longer

Stop - Read

Foam Concentrates Generally In Service



Class A Foams

Authorities: NFPA 18, 1145, 1150 - UL (wetting agent) - US Forest Service

In the 1980's, water and foaming detergent surfactants were developed for firefighting in wild-land settings. The mechanism of extinguishment was and still is improved hydration.

It soon became popular for everyday structure fire use. Finished foam drains its wetting solution fairly fast, allowing the super-soaking of fuels which would normally resist plain water.

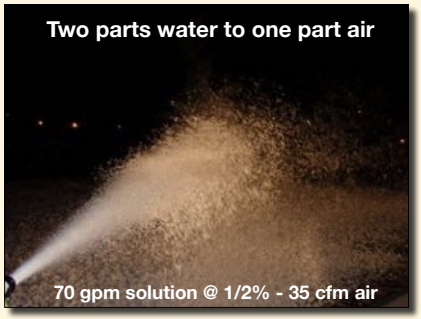
Fires that are knocked-down tend to stay down till fuel again evaporates its water.

Note: Water application rates for structure firefighting still apply.

CAF - Compressed Air Foam

Authorities: NFPA 1145 & 1150 - US Forest Service

Same as class A solution with addition of compressed air. Air enhances stream reach and residence time, making it an ideal exposure protection or wild-land fuel pre-treatment.



Note: Standard water application rates for structure firefighting still apply.

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Class A foams On Liquid Fires

Class A foams will NOT touch alcohol (solvent) fires.

Contaminated Class A Foam Blanket

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Contaminated Class A Foam Blanket

VIDEO

https://www.youtube.com/watch?v=nRrPWQ_4XN4

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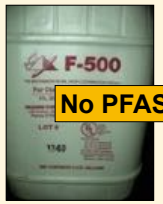
Emulsions From Detergent Surfactants



No PFAS (fluorine)

Federal / State Spill Response Agency, Reg. 6

Gasoline may NOT emulsify

Characteristi	
Gasoline Products (Group I)	**Diesel-like Products and Light Crude Oils (Group II)**
Examples – Gasoline	Examples – No. 2 fuel oil, jet fuels, kerosene, West Texas crude, Alberta crude
• Very volatile and highly flammable (flash point near 100°F/40°C)	• Moderate varies 100-
• High evaporation rates; narrow cut fraction with no residues	• Refined pr evaporate oils do hav evaporatio
• Low viscosity; spread rapidly to a thin sheen	• Low to mo spread rap • Specific gr gravity of 35-45
• High acute toxicity to biota	• Moderate to high acute toxicity to biota; product-specific toxicity related to type and concentration of aromatic compounds
• Does not emulsify	• Can form stable emulsions
• Will penetrate substrate; non-adhesive	• Tend to penetrate substrate; fresh spills are not adhesive • Stranded light crudes tend to smother organisms

Emuls-A-Fire®
Novacool®
F-500®
FireAid 2000®
FuelBuster®
KnockDown®
PyroCool®
WD881®

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SDS For Gasoline

USE NFPA 11 Foam, Not NFPA 18 Wetting Agents

AMERADA HESS CORPORATION

MATERIAL SAFETY DATA SHEET

Gasoline, All Grades MSDS No. 9950

FLAMMABLE PROPERTIES:

FLASH POINT:	-45 °F (-43°C)
AUTOIGNITION TEMPERATURE:	highly variable; > 530 °F (>280 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1A (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.4%
UPPER EXPLOSIVE LIMIT (%):	7.6%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

During certain times of the year and/or in certain geographical locations, gasoline may contain MTBE and/or TAME. Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration - refer to NFPA 11 "Low Expansion Foam - 1994 Edition."

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

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Wetting Agent's Effect On Gasoline

VIDEO

http://www.youtube.com/watch?v=Ml9C0zPfnT0

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Handout

http://www.cottrellassociates.com/combat-support-products/ewExternalFiles/1012%20Wetting%20Agents.pdf

National Foam

Foam Lines

Cottrell Associates, Inc. October 2012 foamguy@me.com

Wetting Agent Facts - Is Your Scene Secure?

Jim Cottrell

Do Not Confuse NFPA 11 With NFPA 18

1. Wetting agents are listed by UL and approved for use in crash vehicles - this should be your first clue
7. There are many UL applications for both wetting agents and they show no evidence that an

Stop - Read

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AFFF Aqueous Film Forming Foam

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AFFF - Aqueous Film Forming Foam

Authorities: NFPA 11 - U.L 162 GFGV, U.S. Navy - USCG - FAA

Developed by the US Navy in the early 60's.

Fluorochemical (PFAS - PFOS/PFOA) and synthetic foaming surfactants improved firefighter safety, particularly for naval and civilian firefighters involved in crash rescue firefighting, allowing use of structural firefighting nozzles.

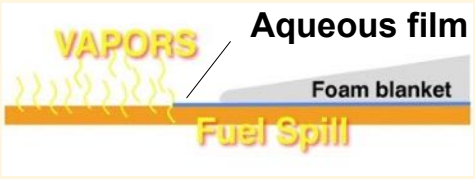
AFFF's are the dominant class B fire fighting agents for municipal firefighter's use on simple hydrocarbon fuels like crude, diesel, jet and home heating fuels.

Not for use on foam destructive alcohol fuels or gasoline / ethanol blends.

Fluorosurfactants

Adding a Scotch-Guard® like chemical (Now C6 PFAS fluorosurfactant) to water changes its surface tension to the point where a microscopic water film floats on oil base fuels (hydrocarbons). Hence the term aqueous film, or "light water®".

Aqueous Film Forming Foam



Adding a foaming hydrocarbon surfactant similar to shampoo's foaming ingredient allows the agent to foam, or froth.

Film Forming

Foam solution drains on contact from the foam blanket spreading a vapor suppressing water film across the fuel surface. The microscopic film is supported by the fuel's surface tension. AFFF's fluorosurfactant (PFAS fluorine) component creates a fuel shedding solution allowing forceful, plunging fire stream application and or sub-surface injection on storage tanks.

Aqueous film forms on contact

What Make AFFF's Work

VIDEO

https://www.youtube.com/watch?v=R-0Nf59_n_c

Go to YouTube postings by: arafff136

U.S. Navy film forming video clip. Film spread rate must be greater than eight feet per minute.

Fuel Temperature Is Critical

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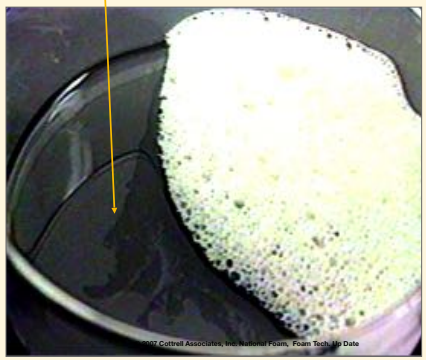
At 140 degrees (60 c) hydrocarbon fuels will not support an aqueous film. Therefore, hot road and flight deck spills require an aerated foam blanket.



Alcohol additive in gasoline has a similar effect on surface tension which will prevent film formation.

CombatSupportProducts.com

Fuel Soaked Into The Earth

Firefighters working in and around soaked gasoline and hot fuel-oil spills should apply aerated foam, as film formation will not occur on soil, sand or gravel.

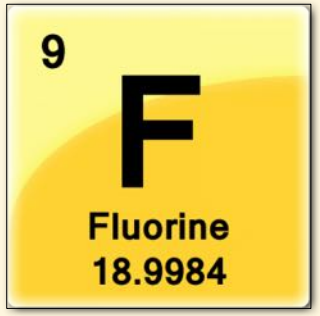
Reapply foam at the foam's quarter life, or when gas meter detects hazardous mixture.

Regular AFFF's quarter life is about five to six minute.

A medium expansion attachment will help with vapor management

Film formation will not happen on fuels soaked into the earth

AFFF Fluorine Debate



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AFFF Fluorine Debate

1970's

NATIONAL FOAM

Environmental folks identified pre 2003, PFAS compounds, PFOS & PFOA fluorosurfactants used for film forming in AFFF and AR-AFFF firefighting foam as bad actors, and in most cases rightly so. These long carbon chain (C8) compounds have been detected in water wells near chemical manufacturing sites and military fire training facilities.

Small amounts of PFAS fluorosurfactants added to water decreased its surface tension characteristics such that it allows water to skim across jet fuel, diesel and gasoline, extinguishing fire as it spreads. It was truly a game changer in the liquid fuel firefighting world.

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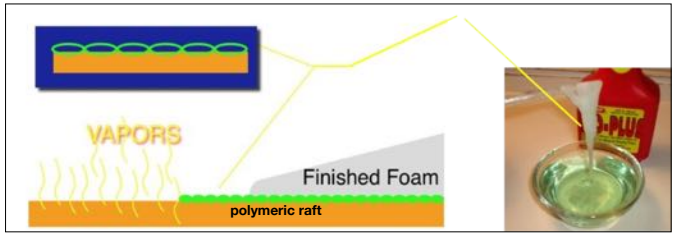
AFFF Fluorine Debate

1970's

NATIONAL FOAM

An alcohol resistant AFFF variant was developed by adding a sugar based ingredient, xanthan. When foam solution drained on a polar solvent (alcohol) it created a polymeric membrane that separated the water in the AFFF foam blanket from the foam destructive solvent beneath. Another game changer in fighting stubborn polar solvent fires.



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AFFF Fluorine Debate

NATIONAL FOAM

C8 Chemistry vs. C6

AFFF - Film Forming Fluorosurfactants PFAS

PFAS is a catch-all acronym that encompass most things relating to fluorosurfactants, which include AFFFs, food contact paper, textile coatings, non-stick cookware, etc. PFOS and PFOA are the known bad actors in the PFAS range of chemicals.

C8 carbon carbon carbon carbon carbon carbon carbon carbon

PFOS and PFOA is said to be persistent, bioaccummulative and toxic (PBT). Some eight carbon chain film forming chemistry that include PFOS and PFOA is said to be cancer linked and long term environmentally persistent. It is no longer manufactured.

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AFFF Fluorine Debate
2019

NATIONAL FOAM

C8 Chemistry vs. C6

AFFF - Film Forming Fluorosurfactants PFAS

2015 **C6** carbon carbon carbon carbon carbon carbon

Six carbon chain chemistry (C6) has replaced eight carbon chemistry (C8) and is considered non-biocumulitave and significantly less environmentally persistent. Is OK for now.

Some science suggests there are trace amounts of bioaccummulative components in C6 chemistry, which is why ALL PFAS compounds regardless of origin are being painted in some circles with a suspect brush, and is why alcohol resistant, fluorine free (F3) replacement foams have been developed.

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AFFF Fluorine Debate
2019

NATIONAL FOAM

Regardless of the outcome of science debates there are those who would prefer to remove all fluorosurfactant, PFAS compounds from firefighting foam. In fact, there are some states in the process of legislating the extinction of PFAS firefighting foams.

Class A Foam And Wetting Agents (emulsifiers)

To be clear, Class A foams are not in the fluorine fight. Their wetting and foaming ability relies hydrocarbon surfactant foamers. Some to include National's Knockdown, Class A foam have UL 162 GOHR Wetting Agent listings which allow limited use on simple hydrocarbon, oil based fuels such as diesel. Wetting agents are not UL listed (tested) on gasoline / alcohol blends and are particularly ineffective where fuel has soaked into the earth. Agent application requires the mixing of detergent solution with fuel using an otherwise unsafe plunging technique where fuel has depth and is not running. Note: Most wetting agents do not foam…

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NATIONAL FOAM

AFFF Fluorine Debate
2019

Q. What are ICAO (International Civil Aviation Organization) Foam Standards. Why Should I Care?

a. European aviation firefighting performance products are guided by International Civil Aviation Organization (ICAO) regs.

In the U.S., NFPA 403 Standard for Aircraft Rescue and Firefighting is the airport firefighting guidance document. NFPA does not approve or test but rather sets performance standards, which are tested under Underwriters Laboratory 162, Standard for Foam Equipment and liquid Concentrates and or as is now, the U.S. Navy MIL-PRF-24385F(SH) AFFF Mil Spec. formulation. At this point in time it is not clear what firefighting performance standard FAA will adopt and or how NFPA 403 will figure in the immediate future in terms of alternate ICAO certifications or F3 (fluorine free) foams.

V030719

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AFFF Fluorine Debate
2019

NATIONAL FOAM

V030719

Q. Will Airport AFFF Foam, MIL-PRF-24385F(SH) Be Affected?

a - No, not at present (February 2019). The Federal Aviation Administration (FAA) still mandates all FAA controlled airports use a C6 Mil Spec AFFF.

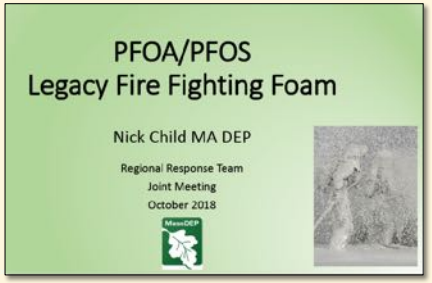
However, FAA reauthorization legislation, HR 302 of Oct. 2018 includes wording that will allow airport fire departments to substitute MIL-PRF-24385F(SH) with an approved foam (U.L / NFPA 403) or perhaps a fluorine free (F3) agent, qualified by ICAO within three years of HR 302 becoming law, which could be 2021-2.

63

Whats Mass. Doing?

Contact Nick Child if your department have pre-2003 AFFF you need to dispose of. Don't Call him if you're not from Massachusetts

Nicholas J. Child
Chief Emergency Planning & Preparedness Officer
MassDept. Of Environmental Protection Commissioner's Office
1 Winter Street, Boston MA
(508) 965-6318 Cell
(617) 574-6847 Desk



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Fluorine Free (F3) Foams

Subtraction of fluorinated surfactants (PFAS compounds) from AFFF foam require firefighters to use aerating nozzles or attachments on all fuels.

Hydrocarbon fuel fires should be treated as polar solvents in terms of appliances and application techniques.

Alcohol resistant formulations, AR-F3s are available using similar non-fluorinated polymers as found in AR-AFFFs.

Foam application rates for spill firefighting can increase by as much as 60% and stay the same for storage tank firefighting.

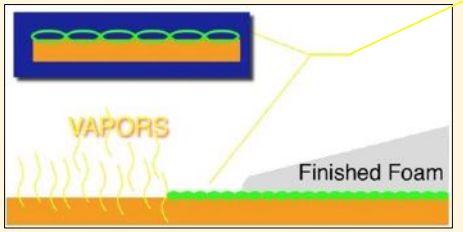
Alcohol Resistant AFFF (AR-AFFF)

Alcohol Resistant - Aqueous Film Forming Foam

Thick, very viscous concentrate

On simple hydrocarbons AR-AFFF's release an aqueous film.

AR-AFFF's and and AR-F3 (fluorine free) foams contain a polymer (sugar) in their bubbles which detect solvents and changes to a liquid Saran Wrap-like film, which blocks water in the foam blanket from being attacked by alcohol from below. AR-AFFF's tend to be longer lasting (slower draining) than regular AFFF's. AR-F3 foams can last on a spill up to two hours or more.



Polymeric Membrane Formation

"Smart Foams"

Alcohol resistant video clip

https://www.youtube.com/watch?v=R-0Nf59_n_c

A thin alcohol resistant foam blanket at room temperature

Xanthan's - sugar membrane is all that's left after five minutes.

Go To YouTube Postings By: arafff136

Foam Application Rates

Foam Application Rates

Liquid fires are fought by the square foot.

Determining finished foam application rates is much like house painting; you need to know how many square feet of wall or floor you need to cover before buying the paint…

How much fire can your eductor handle?

Rule of ten for AFFF - Rule of four for F3

A 60 gpm eductor will cover a 600 sq.ft. hydrocarbon (fuel oil) spill.
F3 - 240 sq. ft.

95 gpm eductor will cover a 950 sq.ft. hydrocarbon (fuel oil) spill.
F3 - 380 sq. ft.

125 gpm eductor will cover a 1250 sq.ft. fuel oil spill. F3 - 500 sq. ft.

250 gpm eductor will cover a 2500 sq.ft. fuel oil spill.
F3 - 1000 sq. ft.

350 gpm eductor will cover a 3500 sq.ft. fuel oil spill.
F3 - 1400 sq. ft.

Small Ignited Spills

Vehicle fuel tank spill fires of up from 300 to 500 square feet are often encountered at highway crashes. Generally a100 (+/-) gpm AFFF or F3 foam hand-line is capable of managing these fires.

Much of the fire violence is over by the time you arrive.

Large Ignited Spills

Not likely to be managed by municipal fire departments without immediate access to big water, large foam concentrate stores and high flow appliances. Once stable, large quantities of concentrate will be needed to maintain scene security.

Light Crude

Hydrocarbon Spills On Water

1-3% AR-AFFF will handle this at 1% using structural nozzles.

Lynchburg, VA

Polar Solvent On Water

Water dilute is about 5:1 to extinguish ethanol.

FOAM CONCENTRATE

Foam liquid in the container, before it's mixed with water.

CONCENTRATE

FOAM CONCENTRATE

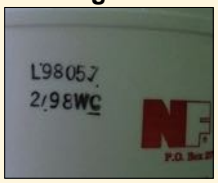
https://www.youtube.com/watch?v=TWwen4ZgdDk

Foam Containers

Foam Containers

UL 162 & US Mil. F24385 containers must be able to withstand a three foot drop on top, side and edges ... contents frozen, with no sign of leakage. Which is why the pail cap is recessed, needing a special wrench.

Date on package is UL birth date
Other marking is UL lot code



Intermediate Bulk Container (IBC) “Totes”

275 gallon (1000 L) 2400 lb. or 330 gallon (1250 L) 2900 lb.

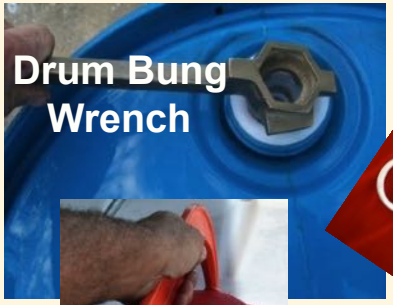
Foam weighs about 8.5 lbs/gal.

Empty tote is about 165 lbs.

IBC totes manifolded - two, three or six on a trailer or flatbed truck.

Transfer with portable 115/230 volt foam concentrate pumps at 23 - 50 or 80 gpm. Two 23’s are pictured.

Tools Of The Trade



Tote Cap
Wrench

Foam Storage

Foam Concentrate Storage

Store foam as if it were latex paint.
Tight, gasket lid keeps it from evaporating.

Foam Concentrate Storage

Foam Concentrate Storage

Store foam as if it were latex paint. As long as packaging remains air tight it will last many years.

Keep foam totes full, as sloshing in a partly full tank will cause AR-AFFF foam concentrate to become air-bound (frothy) making for lean proportioning.

NFPA 11 requires annual foam quality analysis. Send 500 ml samples to our tech. services lab at Combat Support Products, Inc. 3738 Rawls Church Rd. Fuquay-Varina, NC 27526

Foam concentrate should be stored between 35 F (2c) and 120 F (49c).
Freezing and thawing will not affect National Foam AR-AFFF, but may others.
Foam stored in air-tight packaging should last twenty years or more.
Do not mix regular AFFF or class A foam with alcohol resistant foam.

Foam Concentrate Testing

Foam Quality Analysis

Due to PFOS/PFOA issues, AFFF foam mfgd before 2002 is likely to be on do not use status.

NFPA foam quality analysis.

If apparatus foam tank concentrate is more than three years old, or at all questionable, capture two 500 ml (16 fl oz) samples; one from near tank top and one from near bottom. Fifty-five gal. drums and totes treat the same.

Package labeled samples in sturdy, well sealed plastic (no glass) containers tagged with engine, trailer or boat i.d. Include manufacture, product name, proportioning %. If available, record lot or mfg. date. Example: National Foam Universal Gold 1x3% - 6/98 - W/C

A photo of container label showing mfg date would be most helpful.

A sampling kit has containers and a small hand pump for drawing foam samples and is an item we can supply.

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Foam Concentrate Testing

Foam Quality Analysis (FQA)

Foam concentrate stored indoors, in sealed factory packaging, at temperatures between 35F (2c) and 120F (49c) is not likely to have a problem. Shelf life should be 20+ years. At ten years it's a good idea to send a sample for FQA.

If partly full concentrate tanks are exposed to temperature and humidity swings it's quite normal for atmospheric condensate to accumulate inside the tank. Over time, condensate may be sufficient to weaken foam performance. Recommend you send samples for FQA.

If open tank valves are connected to a proportioner's water source, accidental system cycling may have caused water contamination. If you are not sure, send samples for FQA.

NOTE: Due to PFOS/PFOA issues, AFFF foam mfg before 2002 is likely to be on do not use status.

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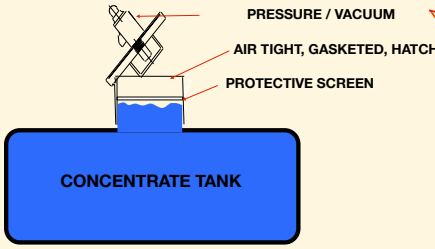
Keep Foam Tank Full



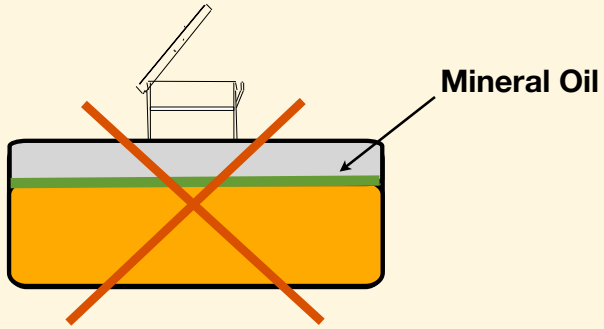
Keep foam tank full

Always flush tanks and system plumbing with warm water before changing foam concentrates.

87

Use No Mineral Oil

No Mineral Oil
Not for mobile apparatus tanks...



 CombatSupportProducts.com

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Outdoor Storage

Sunlight - UV Protection

Not all foams are freeze thaw stable.

Important to keep full tanks

Foam concentrate sloshing around will turn concentrate into a froth. The greater the air space the the worse it gets.

AR-AFFF concentrate may take weeks to calm down, if at all. This condition can cause VERY lean proportioning.

Alcohol Resistant Foam Concentrate Users

Mixing unlike foam can be system fatal...

Half cup alcohol based class A foam or regular AFFF and a shot glass of AR-AFFF can do this in minutes.

The AR-AFFF's polymer is doing what it should… in your tank, rather than on a spill...

Handout

http://www.cottrellassociates.com/combat-support-products/ewExternalFiles/Storing%20A&B%20Foam.pdf

Foam Lines® - November 2014 Update

By: Jim Cottrell

National Foam

Storing Foam A & B Foam Concentrates

Contrary to popular belief, foam concentrate has no shelf life. The date on the foam pail, drum or tote is its birth date. If stored in sealed, original packaging, foam concentrates will easily last thirty years or more. Foam concentrate storage success is more about preventing concentrate evaporation and cross contamination than air contact. Class A and B foam concentrate containers should be kept sealed. In short, store it as if it were latex paint.

Metal container 1976 - Still sealed 9/15/15

Apparatus Foam Tanks

Foam tanks that are not gasket sealed, and fitted with pressure-vacuum vents will eventually be the cause for concentrate evaporation. Two-inches of foam concentrate sealer (mineral oil) floated on class B firefighting foam will prevent evaporation, is usually system fatal. The AR-AFFF will do what its supposed to do in your tank, rather than on the fire, leaving pizza-like dough at the bottom of your foam tank - and system supply lines connected or strainers there to. (see Help! Our Foam Has Gelled in a future piece)

Freeze/Thaw Cycles

Freezing alcohol resistant foam concentrate may cause compound component separation, and will hinder firefighting performance, particularly foamability. Consult your foam manufacturer for advice when using thawed AR-AFFF. Freeze-thaw cycles should not be a problem with regular AFFF or class A concentrates; although Class A concentrates often have foamability and wetting problem when concentrate is < 45F (8C).

Test Freeze Your AR Foam

Freeze a 1/4 cup sample in a clear container. A clean peanut butter jar with an inch or two of head space will do nicely. Normal AR-AFFF

Foam Tank Venting

Hi volume automatic tank vents allow rapid drain-down with no container deformation or flow loss.

In absence of a hi volume vent, be sure to remove cap before draining or pumping down.

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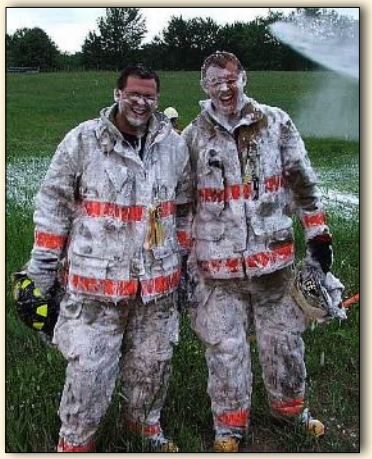
Transfer Tips

From the "experts" with a nose for foam...



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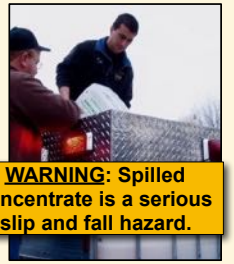
Filling Tanks, Totes & Drums

Filling apparatus foam tanks

Fill to bottom of square or round expansion dome.



WARNING: Spilled concentrate is a serious slip and fall hazard.

Alcohol resistant foams pour quite slowly. Puncture pail with ice-pick or awl opposite the cap.

95

Filling Tanks, Totes & Drums

Pouring five-gallon pails will not keep up with a 95 gpm eductor or system at 6%.

96

Batch Mixing - Dump & Pump

Okay for class A, fluoroprotien and regular AFFF concentrate, as they disperse quite fast in a water tank.

Alcohol resistant (AR-AFFF and AR-F3) foams are not candidates for dump and pump (batch mixing) because AR foam concentrates do not disperse when poured in water. Further, the AR component has a short life (weeks) after mixing with water.

97

Concentrate Transfer

Gasoline / Diesel Powered

Advantage:
* Long distance nursing capability.
* Handles the most viscous foams.
* Larger configurations available.

Disadvantage:
* Recirculates concentrate when discharge is closed; bad for AR foams
* Not portable
* Requires usual gasoline motor and fuel maintenance.

98

Portable, Electric Transfer Pumps

Transfer can be done with portable 110 or 220 volt foam concentrate pumps at 23, 50 or 100 gpm.

Advantage:
* Low cost
* Will not harm AR-AFFF
* Light weight
* No motor maintenance
* All weather enclosures

Disadvantage:
* Low pressure (50 -70 psi)
* Dependent on available electric power source: generator or apparatus power inverter.

99

Concentrate Transfer Tip

Always fill foam tanks from bottom-up. Use stingers (dip tubes) on both tanks if necessary; preventing messy, frothing over-flows. Same for engine tanks.

100

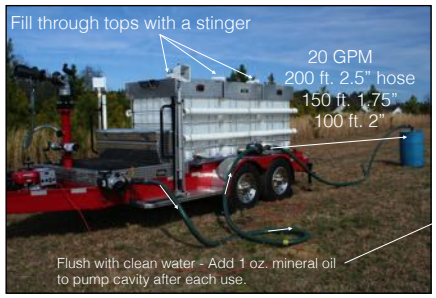
Electric Transfer Kit

Transfer Pump Kit

TPK23

Do Not Pump Flammable Liquids

23 gpm / 26 psi
Dry prime - 20 seconds max.
120 volt, 3/4 Hp TEFC enclosure
Thermal overload
Onboard switch
Remote RF fob switch
5/8" rubber flex base
Pump assy. wt. - 37 lbs.
2 - 2" x 12 ft. hose / cam-lock
2 - Drum / tote stingers



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Materials Of Construction

Foam Concentrate Tanks:

No - aluminum

No - mild steel
Yes - poly & fiberglass

Yes - stainless steel

Flooded Plumbing & Valves:

Yes - stainless steel
Yes - brass & copper
Yes - Threaded PVC, schedule 80
Yes - poly & EPDM flex hose

No - mild steel

No - galvanized pipe

No - PVC, schedule 40

102

Materials Of Construction

Failed fitting caused 200 gallon apparatus room spill.

Avoid air brake hose & component fittings
(some o-rings are incompatible, need buna-n, or Viton)

Use 3/4" (id) or larger plumbing for 95 - 125 gpm class B systems

103

Finished Foam

Solution mixed with air as it leaves the nozzle.

104

Foam Tech Level - I

Aerating Foam

Must do for F3 foams

Firefighters now need to be using aerating foam nozzles or structural nozzles fitted with aerators, as aqueous films may no longer form on ethanol gasoline blends.

Additionally, the use of aerating devices will improve foam's staying power.

105

Expansion Ratio

One gallon of solution aerated ten times is a 10:1 ratio.

Low expansion, 7 to 10:1 is preferred for reach and extinguishment.

Medium expansion (mid-x) class B foam is preferred for spill vapor control. Mid-x is from 15 - 50:1 expansion.

106

Expansion Ratio

A structural nozzle with no aerator will expand foam solution about +/- 4:1.

Disadvantage: Poor vapor suppression. Not an option with F3 (fluorine free) foams.

Advantage: AFFF Reach.

U.L. fire tests are conducted at 7 to 10:1

107

Applying AR foams On Solvent Fuels

https://www.youtube.com/watch?v=0u8_Dirk5J4 **Video**

E-98 (gasoline grade ethanol) will not respond to non-aerated or plunged (forcefully applied) streams.

108

Foam Solution

A mixture (ratio) of concentrate and water.

0.5 ml of green dye added to 99.5 ml water is a 1/2% solution. (Class A)

One ml green dye added to 99 ml water is a 1% solution.

Three ml added to to 97 ml water is a 3% solution.

Six ml. added to to 94 ml. water is a 6% solution.

Proportioning Basics

Ratio: 94:6

A one thousand gallon booster tank needs how much 6% foam concentrate to convert it to 1000 gallons of foam water solution?

6%

Six % of a thousand is 60

Proportioning Basics

Ratio: 97:3

A one thousand gallon booster tank needs how much 3% foam concentrate to convert it to 1000 gallons of foam water solution?

Three % of a thousand is 30

Proportioning Basics

Ratio: 99:1

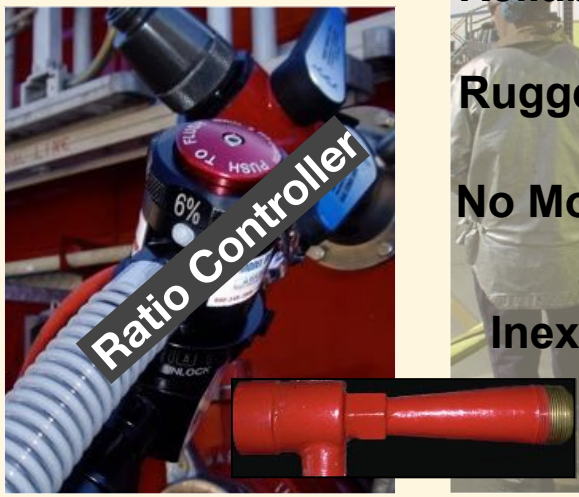
A one thousand gallon booster tank needs how much 1% foam concentrate to convert it to 1000 gallons of foam water solution?

One % of a thousand is 10

Proportioning Basics

Ratio: 99½ : ½

Foam Eductors



Reliable

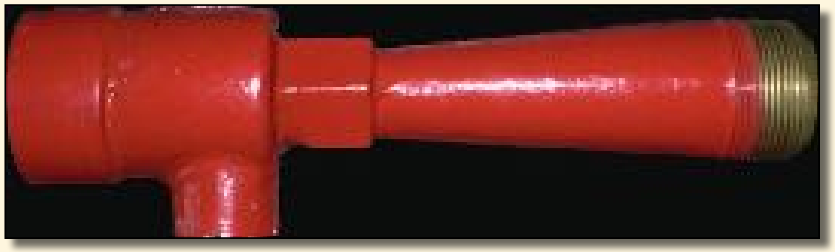
Rugged

No Moving Parts

Inexpensive

Foam Eductor

Also Known As: Inductor - Eductor - Ratio Controller - Line Proportioner - Jet Pump



Simple System Alternative

On board foam tank connection.

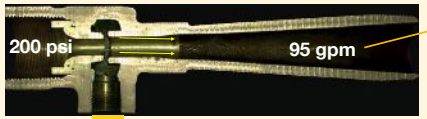
Add a 'T' and connect two eductors.

Big fire, big eductor.

Hydraulic Match For The Nozzle

125 GPM setting and higher is OK…
(less back pressure is good)

60 GPM setting will shut down a 95 gpm eductor - too much back pressure.



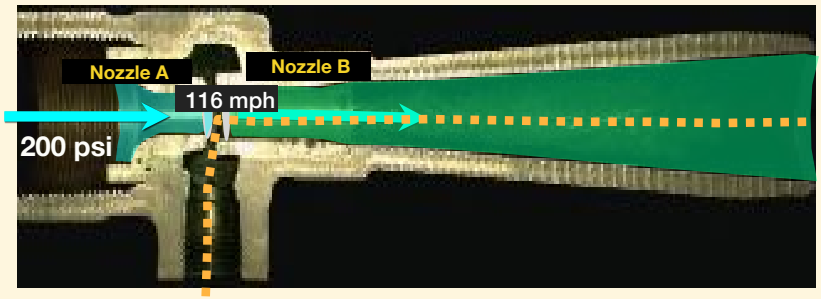
1/2% - 1 -3-6%

Metering / Check valve

Foam concentrate supply

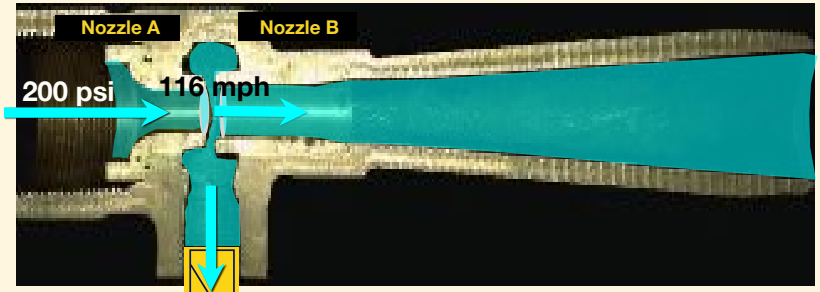
Venturi Effect

Smoothbore nozzle A discharges into nozzle B at 200 psi (116 mph) causing concentrate to be drawn into the low pressure area created by a venturi effect.



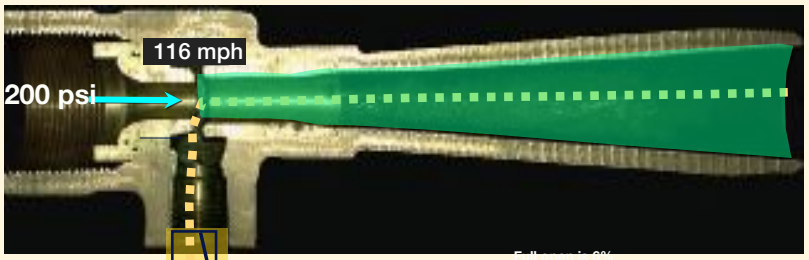
CHECK VALVE

If discharge nozzle shuts, water backup will be stopped by a check valve



Check Valve Close

Metering valve



Needle & Seat

Concentrate Flow

Meter & Check valve

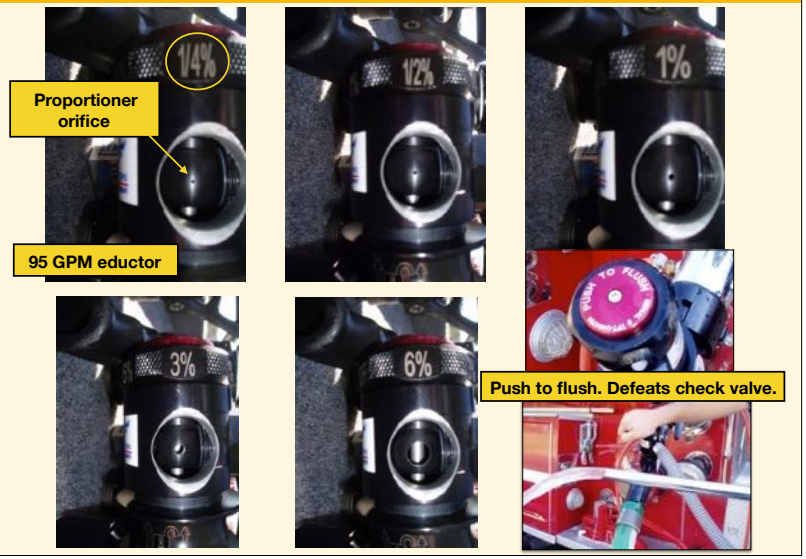
Full open is 6%

Half open is 3%

Third open is 1%

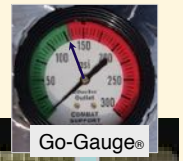
1/4%
1/2%
1%,
3%,
6%

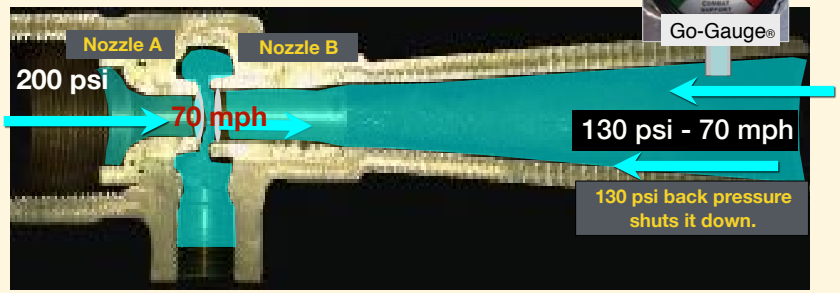
Adjustable Metering



Back Pressure

Eductors fail when they see back-pressure caused by a onboard plumbing restrictions, partly closed nozzle, too low a nozzle's flow setting, discharge hose too long, too small or excessive nozzle elevation when supplying elevated streams.



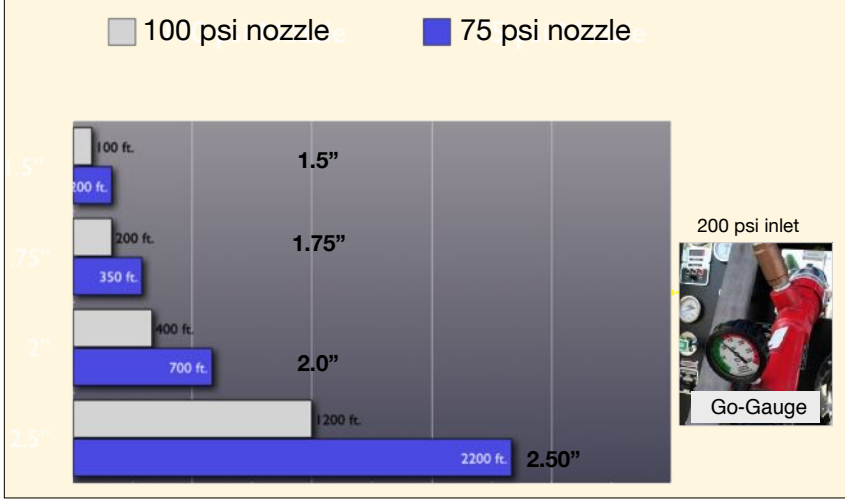


As long as water speed does not slow below 65% of the water's inlet speed, it will continue to draft foam concentrate into the stream.

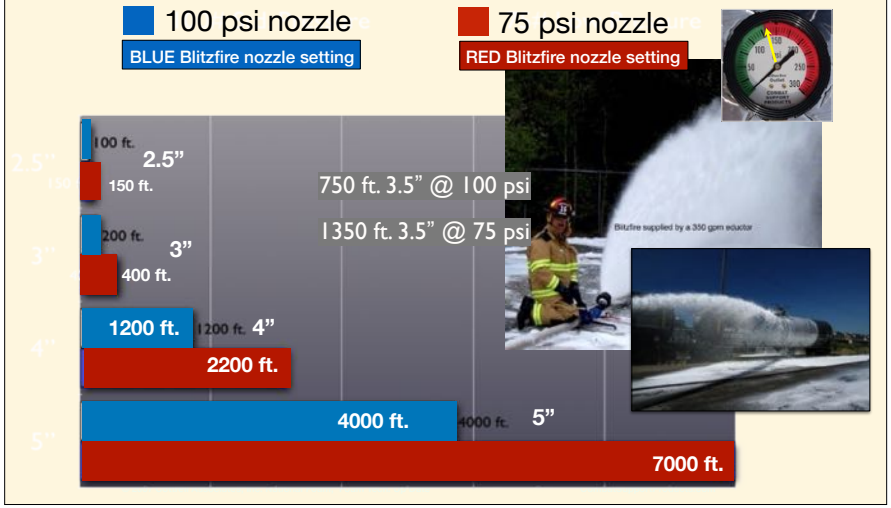
If a downstream hose is kinked, or a nozzle partially closed, the back pressure slows the water across the crack. If outlet back pressure goes to >130 psi (65% of inlet pressure) it will shut it down, which was inspiration for the Go-Gauge®

Go-Gauge ®

How far can a 95 gpm eductor be from your nozzle?



How far can a 350 GPM eductor be from a Blitzfire?



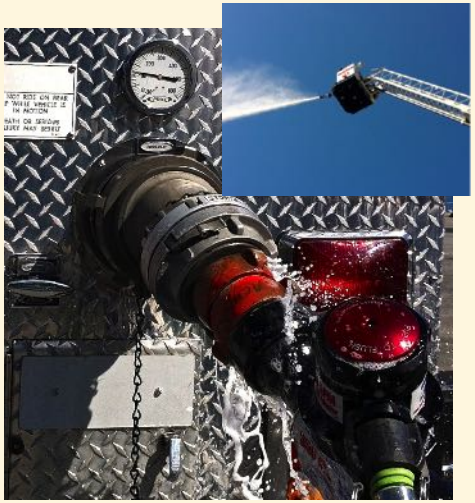
Eductor Performance And Distance Chart

Foam Eductor Distance

Foam Eductor GPM @ 200 PSI 60 gpm	Fire Control size AFFF & AR-AFFF	Concentrate flow GPM	Nozzle or Hose outlet psi	Distance Hose I.D. 1.5" LEVEL GROUND	Distance Hose I.D. 1.75 LEVEL GROUND	Distance Hose I.D. 2 LEVEL GROUND	Distance Hose I.D. 2.5 LEVEL GROUND	Distance Hose I.D. 3 LEVEL GROUND	Distance Hose I.D. 4	Distance Hose I.D. 5
	Hydrocarbon 600 sq ft	1%= 0.6	100	300 ft	700 ft	850 ft	3300			
	AFFF & AR-AFFF	3%= 1.8	75	600 ft	1250 ft	1550 ft	6100			
	Polar Solvent 300 sq ft	6%= 3.6	50	850 ft	1850 ft	2200 ft	8800			
			10	1300 ft	2800 ft	3400 ft	13300			
95 gpm	Hydrocarbon 950 sq ft	1%= 1.0	100	100 ft	200 ft	350 ft	1200 ft	3300 ft		
	AFFF & AR-AFFF	3%= 3.0	75	250 ft	350 ft	650 ft	2200 ft	6100 ft		
	Polar Solvent 425 sq ft	6%= 6.0	50	350 ft	500 ft	1000 ft	3200 ft	8850 ft		
			10	550 ft	800 ft	1500 ft	4800 ft	13300 ft		
125 gpm	Hydrocarbon 1250 sq ft	1%= 1.25	100	50	100	250	750	1900		
	AFFF & AR-AFFF	3%= 3.75	75	175	200	450	1400	3500		
	Polar Solvent 625 sq ft	6%= 7.2	50	250	300	650	2200	5100		
			10	400	500	1000	3000	8000		
250 gpm	Hydrocarbon 2500 sq ft	1%= 2.5	100				200 ft	480 ft	3000 ft	
	AFFF & AR-AFFF	3%= 7.5	75				350 ft	880 ft	5500 ft	
	Polar Solvent 1250 sq ft	6%= 15	50				500 ft	1280 ft	8000 ft	
			10				800 ft	1920 ft	12000 ft	
350 gpm	Hydrocarbon 3500 sq ft	1%= 3.5	100				150 ft	250 ft	1250 ft	4800
	AFFF & AR-AFFF	3%= 10.5	75				250 ft	450 ft	2300 ft	8800
	Polar Solvent 1750 sq ft	6%= 21	50				400 ft	650 ft	3300 ft	12800
			10				600 ft	1000 ft	5000 ft	20800
500 gpm	Hydrocarbon 5000 sq ft	1%= 5	100				50 ft	100 ft	600 ft	2000 ft
	AFFF & AR-AFFF	3%= 15	75				100 ft	200 ft	1100 ft	3600 ft
	Polar Solvent 2500 sq ft	6%= 30	50				100 ft	300 ft	1600 ft	5300 ft
			10				200 ft	450 ft	2400 ft	8000 ft

NFPA 11 requires a 15 minute foam concentrate supply for spill fires (one-inch or less)
NFPA 11 requires a 65 minute foam concentrate supply for fires in depth (tank type fires)
Eductor back pressure cannot exceed 65% of inlet pressure. BP is sum of hose friction loss, elevation and nozzle pressure.
Put a pressure gauge on eductor inlet and outlet. At 200 psi nilet pressure, do not exceed 130 psi on the outlet gauge (65% of inlet psi).
Distance to hose outlet is based on NFPA friction loss tables and or actual field experience. BE SURE TO ADD OR SUBTRACT ELEVATION HEAD.

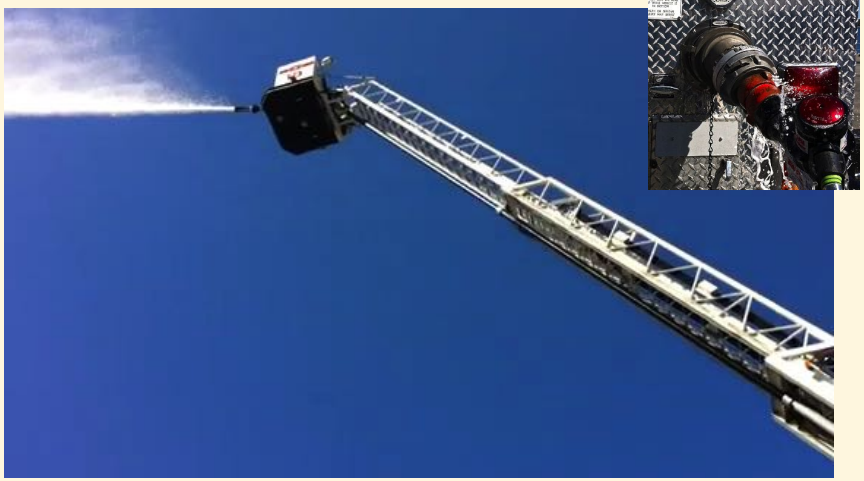
Managing Back Pressure



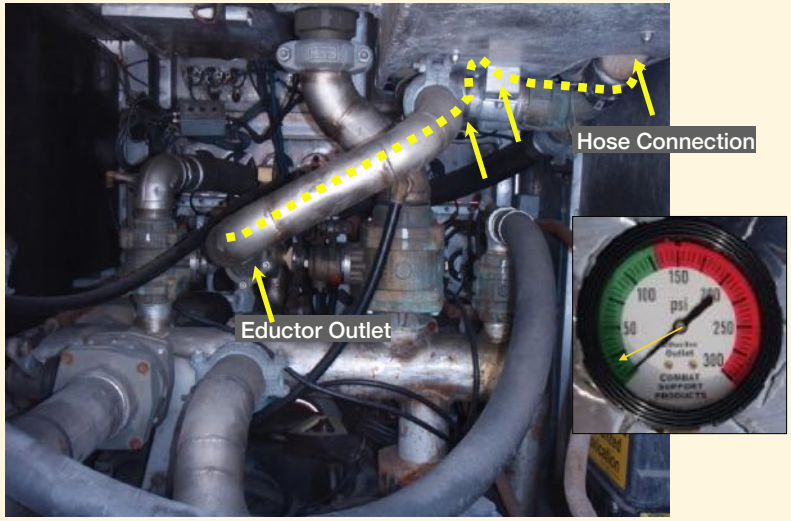
NP	75 psi
Elevation	37 psi
Plumbing	3 psi
Total BP	114 psi

Managing Back Pressure Video

https://www.youtube.com/watch?v=2s6N8MM_wJQ



Elbows create back pressure. problems for on board eductors…



May contribute 15-20 psi back-pressure before solution goes int discharge hose.

129

Transit Time

Time it takes solution to get to application device

1.75” hose flowing 95 gpm 9 sec. / 100 ft.

Self Inducting - Instant

130

Step 3 last

Step 2

Step 1 first

Open water LAST.
Fill dry hose with solution at 50 psi then throttle to 200 psi. If water is first, it has to be discharged before solution arrives. Could be near 20 second lag.

Reordered Operation Steps Akron & Elkhart

131

Send 95 GPM Solution. No Nozzle

Fill a drop tank with solution at 10 psi outlet pressure

1.75” hose - 95 gpm solution, 500 ft.

2.5” hose - 95 gpm solution, 3000 ft.

132

Self Inducting Master Stream

Poor Man's Crash Truck

Poor man's crash truck.

Attach a self inducting nozzle.

Drop pickup hose in foam tank and make 100 psi…

On Board System Covered In Tech II

- Electric, on board systems
- ATP (around the pump) systems
- Balanced pressure systems
- Demand balance pressure systems
- Jet pump (JRC) operations.

Foam Quarter Life

Water weight in the blanket is what holds vapor in check.

As the foam drains solution, the blanket gets lighter, eventually allowing ignitable vapor to escape.

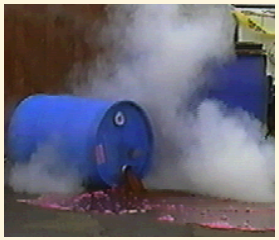
When the blanket drains 25% of its water weight or instruments indicate it's time to reapply, At least a fresh four inch cover.

Quarter Life Importance

UL fire test listings are the most important specs when it comes to ignited events in terms of what your foam is designed to accomplish.

At crash scenes, finished foam must have the ability to hold for long periods of time under high vapor pressure conditions (hot road spills or post fire overhaul)

How long you can hold scene security with the least amount of agent and water is the bang for the buck issue.



Read ¼ Life Handout

http://www.cottrellassociates.com/combat-support-products/ewExternalFiles/Quarter%20Life%20Important.pdf

Foam Lines

National Foam

Cottrell Associates, Inc. September 2012

What's Quarter Life Got To Do With It?

By: Jim Cottrell

Like beer, the light ones loose their head fast. The stouter brews tend to stay around a while.

Water weight in a foam blanket is what holds flammable vapors down, not the bubbles in the foam. Some foams release water fairly fast. Class A foam, for instance, proportion 3% foam at 6%, you have doubled the foaming compound. If you want 3% AFFF foam to last twice as long, proportion it at 6% - 94 parts water fires which have pooled or soaked into the earth.

When it comes to long term vapor suppression at gasoline or ethanol spills, quarter life is a most

Vapor Suppression

Vapor suppression may be short or long lived depending on the rate at which finished foam releases water. On un-ignited events, three percent foam used at six percent will last two times longer and is more effective at long term vapor suppression.

In a pinch, proportion 3% foam at 6%, doubling up on the foaming chemical. This will make six minute AFFF last for twelve. A good 1x3% AR-AFFF @ 6% will go almost an hour with medium expansion appliances. National Foam's Universal Green at 3% will go two + hours in fresh water.

Test Your Foam's Quarter Life

See ¼ Life Handout

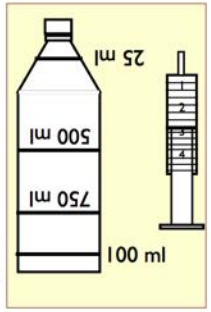
http://www.cottrellassociates.com/combat-support-products/ewExternalFiles/Quarter%20Life%20Important.pdf

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



Maximize Scene Security

Replacement Cost

500 GPM @ 3% - Reapplied at quarter life - One minute to cover spill

List $	Two Hour Event	1/4 life	Concentrate Used
$45/gal	–	25 min	72 gal = $3,240
$52/gal	Competitor 1x3	16 min	112.5 = $5,850
$27/gal	AFFF / Wetter	5 min	360 = $9,720
$45/gal	Universal Green	120 min	15 = $675

Environmental Cost

100% Biodegradable - No hazardous ingredients

Two Hour Event	1/4 life	Remediate
–	25 min.	2,400 gal.
Competitor 1x3	16 min.	3,750 gal
AFFF / Wetter	5 min.	12,000 gal
Universal Green	120 min.	500 gal.

Training Foam - AFFF Surrogates

Add five gallons Knockdown Class A foam to 100 gallons water. Proportion at 3%.

No Fluorine!

Training - Proportion Water!

Use colored water for foam eductor drills. If pump operators can suck water from a bucket they can proportion foam concentrate.

Use Go-Gauge® to sort out downstream back pressure issues. It works on any 200 psi foam eductor.

When you're satisfied, go ahead and add a quart of Knockdown to 5 gallons water and practice application techniques.

Quiz - p1

Foam Tech - Level 1 QUIZ

CombatSupportProducts.com

1. Liquid hydrocarbon fuels include ethanol and methanol T___ F___
2. Combustible liquids have flash point above 100 F (38 C) T___ F___
3. Gasoline blended with more than 10% oxygen additive should be treated with alcohol resistant (AR) foam T___ F___
4. Oil and water do not mix because water is heavier then oil T___ F___
5. Alcohols aggressively mix with water and are therefore foam destructive T___ F___
6. Film formation of AFFF is of little help when fuel is soaked into the earth T___ F___
7. Reapply AFFF every half hour T___ F___
8. Foam concentrate is a mixture of water and foam solution T___ F___
9. Quarter life is a measurement of how long it takes to drain 50% solution from finished foam T___ F___
10. A 95 gpm eductor will handle a 950 sq. ft. ethanol spill fire T___ F___
11. Foam eductors usually require 225 psi inlet pressure T___ F___
12. Transit time in 1.75" hose, at 100 gpm is eleven seconds per 100 ft. T___ F___
13. An eductor with 200 psi inlet pressure can stand ___ psi back pressure
14. Two-inch hose will triple the distance of 1.75" from eductor to nozzle T___ F___
15. Diesel fuel is a hydrocarbon T___ F___

Quiz - p2

16. Blended gasoline has higher vapor pressure than diesel T___ F___
17. Regular AFFF contains no dispersing solvent T___ F___
18. Sugar in AR foams is what makes it so viscous and alcohol resistant T___ F___
19. Shelf life is not an issue if concentrate is sealed in a proper container T___ F___
20. It's OK to store foam concentrate in aluminum tanks T___ F___
21. Keeping an apparatus foam tank full prevents concentrate frothing T___ F___
22. Type III foam discharge devices are FD type nozzles T___ F___
23. Long quarter life is less desirable than short T___ F___
24. Ethanol is most often shipped via rail T___ F___
25. Ethanol is added to gasoline at the loading rack T___ F___
26. Fuel temperature dose not affect film formation T___ F___
27. Jet fuel (kerosene) at 140 F will not affect film formation T___ F___
28. Elmulsifiers (wetting agents) are FAA approved for CFR vehicles T___ F___
29. NFPA 11 is the airfoam standard T___ F___
30. Emulsifiers can require considerable more water and agent to extinguish a U.L. test fire than AFFF, AR-AFFF or F3-AR T___ F___
31. The mechanism of extinguishment using an emulsifeir is smothering T___ F___
32. Class A foam allows users to reduce fire flow by 500% T___ F___
33. CAF is OK for use on class B fuel spills T___ F___
34. Hess MSDS says it's OK to use emulsifiers on ignited gasoline T___ F___

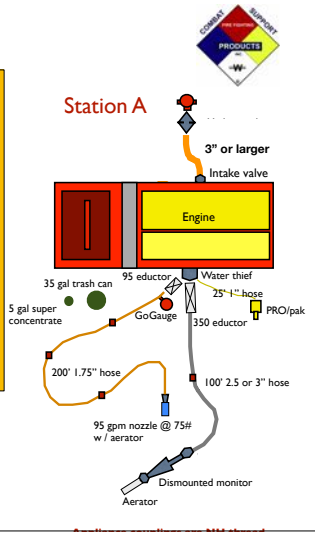
Quiz - p3

35. DOT Guide says it's OK to use emulsifiers on ethanol and gasoline T___ F___
36. AR foams should be aerated to gain maximum effectiveness T___ F___
37. Mixing A foam concentrate with B foam can be system fatal T___ F___
38. Foam eductors will work with all foams T___ F___
39. NFPA 1901 says onboard foam systems should be tested for accuracy during annual pump test T___ F___
40. Application rate is the quantity of concentrate used for spill fires T___ F___
41. A 1000 sq. ft. jet fuel (kerosene) spill fire requires a 3% AFFF application rate of:
    a. 750 gpm b. 100 gpm c. 25 gpm
42. A 500 sq. ethanol spill fire requires an AR application rate of:
    a. 750 gpm b. 50 gpm c. 100 gpm
43. In question 41, how much foam concentrate should be on hand for this fire:
    a. 50 gal. b. 75 gal. c. 45 gal.
44. Fuel storage tank fires require a 60% higher application rate than a spill fires T___ F___
45. It is difficult, if not impossible to emulsify fuel which has soaked into the earth T___ F___
46. AR-F3 foams must be aerated on all fuels T___ F___

Field Layouts For Tech I

Field Exercises:

1. Proportioning basics PRO/pak, U-Green (pan fire)
2. Making training foam. (empty trash can)
3. Foam solution transit time. (200 ft, 1.75")
4. Managing back pressure. (Go-Gauge)
5. Handline application techniques areated and no.
6. Dismounted monitor ops. (350 foam eductor), 100 ft. 3"



Foam Technician Level I

Jim Cottrell - Cottrell Associates, Inc.
foamguy@me.com

Fire Foam For Transportation Events

Hazardous Liquid Spill Fire And Vapor Management

NATIONAL FOAM **Factory agents since 1988**

National Foam®

Foam Lines

Cottrell Associates, Inc. March 2012

Calculating Foam Needs

At gasoline tanker fire events *By: Jim Cottrell*

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

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. The extended quarter life of Universal Gold 1-3% could cut that quantity in half when it comes to scene security and is well worth the price bump over straight 3% AR-AFFFs.

Special Note: Airport Crash/Rescue trucks are no longer candidates for fighting fires involving gasoline/ethanol blends, especially E-15, E-85 and or E-95, as their mil. spec. (F-24385) AFFF is no longer appropriate for use on such fuels... Okay for diesel and kerosene/jet A.

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. Figure on (minimum) 200 gpm foam solution for about 15 minutes. 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.

Foam Lines

Cottrell Associates, Inc. December 2012

Reply To The Commissioner On Training Foams

by: Jim Cottrell

For starters, Mr. Commissioner, I will not comment on the MSDS analysis of the class A training agent you identified in your note, but I can say that National Foam's Class A agents contain no alcohol, fluoro-surfactants or chemistry compounds identified as hazardous substances by the U.S. EPA or PA DEP (see attached MSD document).

National Foam manufacture (in PA) two clean AFFF simulator foam compounds, which are basically less expensive versions of our premium, Knockdown, Class A foam product, which is USDA (U.S. Forest Service) approved for use as a firefighting agent on federal lands or in National Parks. Generally, generic training foams such as ours are not so approved, which is why I prefer Knockdown.

The reason I'm more comfortable with using a U.S. Forest Service approved Class A foam is they are likely to exhibit low biological oxygen demands (BOD) when diluted with water at less than 1/2%. Moreover, USDA (U.S. Forest Service) approved agents go through quite a rigorous environmental evaluation.

BOD statistics are indicators of the foam solution's competition for available oxygen in a column of water over time.

When training or demonstrating foam firefighting appliances we use Knockdown at proportioning ratios of 1/4 to 3/10 % (99.75 to 99.7 parts water) In this dilute form, the foaming elements are still present in enough strength to give a foamy froth, but not enough to give the solution long lived expansion characteristics. When finished we NEVER rinse residual foam from the site with hose streams, as wash-down water used to clear the site often finds its way into storm drains, run-off ditches, retention ponds or rivers, where it will re-foam as it tumbles or agitates on its journey to where ever it ends up.

Using class A foam for class B (AFFF) training simulations at high water dilution rates insures that BOD of discharge solution is at its lowest - and more importantly, fluorinated surfactants are not un-unnecessarily discharged. In the case of Knockdown, BOD ranges from 1,070 mg/kg (1/4%) to 1,267 mg/kg (3/10%).

To put it in perspective, the BOD of raw concentrate (Knockdown) with no water dilution as would be right out of the shipping container is 389,000 mg/kg.

When training, or in use at fires without regard for concentrate consumption and proportioning rates, run-off solution can have a significant impact on aquatic life in small, still bodies of water.

Seeing training foam in a river is why we prefer training sites having open fields, where solution can drain into the earth. Solution draining into turf, sand and gravel is generally best with respect to preventing run-off from entering waterways. In the more than 20 years I've been training and demonstrating, I have never once been called for harming lawns and gardens. Generally I can get several small devices and quite a few 500 gpm deck gun applications done with 150 gallons of water mixed with five-gallons of Knockdown, with appliance metering valves set at 3%. If you are doing the math, that 30:1 ratio comes to 3/10 %. The 150 gallons is half a 330 gallon tote on one of our foam training trailers.

Another after training or firefighting issue can be where clouds of expanded foam starts drifting through the air, often into vehicle traffic lanes. This is usually caused by foam loosing its water to the extent that the foam's skeleton is set adrift on air currents. This should be anticipated and controlled by misting water over the drained foam blanket... Don't confuse misting with washing down.

Another way of eliminating piled-up foam is to use a de-foaming agent. Foam disappears on contact. When demonstrating, training or when we need to manage tons of foam at our U.L. fire test field, we apply it directly on the finished foam as a mist from a garden-type pump sprayer. Cottrell Associates, Inc. / Combat Support Products division keeps de-foamer it in stock. I'll have a sample with me when I visit the Academy on Monday.

Finally, training pump operators how to make foam is the single biggest waste of foam concentrate I know of. If engine drivers can suck water out of a pail, they can suck foam out of a pail. Substituting colored water for foam concentrate will eliminate the associated environmental impact completely.

How to:
Use a five to eight gallon, translucent, graduated training pail. You can get-em at a good agricultural supply store. Alternatively use an empty (square) Knockdown pail, it's translucent and graduated.

If using a 95 gpm eductor at 200 psi you will drink a little more than 3 gallons of water in a minute with meter set at 3%. At 6%, you will drink +6 gpm. A 125 eductor will use +3.6 gpm at 3%, and +7.2 gpm training water at 6%. Most eductors and onboard systems will drink 15% more water than the thickest alcohol resistant foam.

In the end, foam run-off into streams, ponds or rivers can and will catch the attention of the public and can be cause for concern to anyone, myself included. These sights often cause the alert of environmental enforcement authorities - and rightfully so.

When training or at the real thing keep a few copies of Material Data Safety with you. We all have the right to know, keeping MSDS documents at hand is a common sense thing for all, including the curious public.

Remember, when training - less is best.

The author
Jim Cottrell has been a National Foam and TFT factory rep. / product development consultant since 1988.
For more, visit
www.cottrellassociates.com/Training.html

National Foam

Foam Lines

COMBAT SUPPORT FIRE FIGHTING PRODUCTS

CombatSupportProducts.com

Portable Foam Eductors - The inexpensive, bullet-proof alternative.

A simple, inexpensive foam eductor or self inducting master stream nozzle is an accurate, bullet-proof alternative to complex and often maintenance intensive multi-discharge foam firefighting systems. Eductors have no moving parts, no flow meter interfaces, pumps, motors or electrical requirements. Foam eductors can work within UL accuracy with all known fire fighting foams, wetting agents and specialty chemicals - as long as the first commandment of foam eductor operations is not broken.

"Thou shalt not have too much back pressure, lest ye don't make foam"

Basically, a foam eductor is a jet pump which relies on a high-speed water jet to provide suction energy

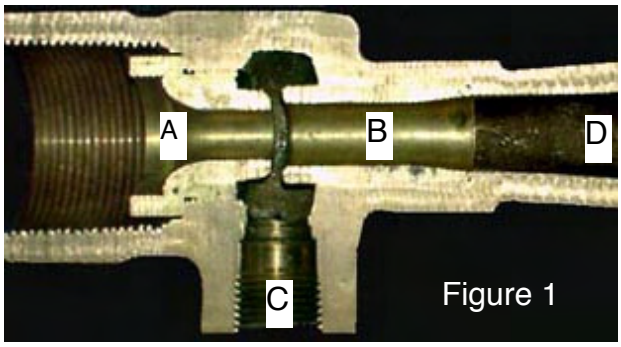


Figure 1

This foam eductor cross section shows two nozzles aligned front to back in a common space. As water passes from nozzle A to nozzle B it jumps across a narrow gap causing a strong suction effect. The gap is vented by way of casting or machined space to the pick-up tube inlet, C. As long as water speed across the inner nozzle gap does not slow below 65% of inlet pressure it will continue to draft foam concentrate into the stream, creating a foam/water solution.

Self-Flushing eductor designed for very viscous alcohol type foams.

If discharge is interrupted at the outlet of the eductor (D), a check valve will prevent water back-flow through the gap, into the pickup hose and on to the foam concentrate supply.

At the pickup tube connection (C) there is often an adjustable choke (meter) and check valve. When the choke is wide open, proportioning rate is 6%, which is 94 parts water and 6 parts foam concentrate, a 94:6 ratio. When half open it proportions 3%, a 97:3 ratio. Modern fire service eductors have metering capability from 1/4% through 6%, accommodating both class A and B foams.

65% Velocity Rule

When operating a fire service foam eductor at 200 psi, water velocity at the inlet smoothbore (A) is 116 mph. If eductor discharge (D) is slowed by a partly closed nozzle, too long or a kinked hose can causes water flow across the gap to slow. Too slow is 130 psi (70 mph) - the eductor begins to stops drafting.

Foam Eductor Operation Pointers

Solution Transit Time

Transit time is the time it takes foam solution to get from eductor outlet to nozzle inlet. With 200 ft of 1.75" hose, at 95 gpm, it will take about 18 seconds. A 60-gpm eductor can take as much as thirty seconds for the solution to get to a nozzle. The larger the hose, the longer it will take. This is true for on-board foam system too. So, whatever setting changes you make, it will take half a minute or more before you notice change at the nozzle. Never charge the hose with water before putting tube in the pail.

Eductor Start-Up Steps.

1. Connect eductor to a convenient discharge.There is no technical reason to have eductor in a hose-line other than extending distance when long stretches are needed. Never throttle eductor supply discharge, use pump speed throttle.
2. Put pick-up hose in foam pail or connect it to an onboard foam tank eductor connection.
3. At idle, fully open discharge and fill hose with solution. It works at idle pressure because the eductor feels no back pressure associated with discharging into an empty hose.
4. Once hose-line is full, throttle to 200 psi.

No transit time issues if done in this order, and nozzle will have solution ready to go when operator opens the nozzle bale.

Proportioning Accuracy - A Major Safety Issue At Crash Scenes

Just because you're making bubbles does not mean they will have enough body to hold down gasoline vapors on a hot road spill. Industry standards allow proportioning as much as one full percent rich, no lean. Lean proportioning means fires may not go out as fast as you want, if at all. Lean means finished foam disappears (drains) way too fast while trying to maintain vapor security at crash scenes. **Caution: Never use class A foam for this task.**

During the summer, unignited road spills can get very hot, resulting in dangerously high vapor pressure. **Here's where I proportion 3% foam at 6%.** Doubling up on concentrate should double your foam staying power (quarter life).

Since foam concentrate viscosities vary from type to type it would be wise to test all your eductors for accuracy. AR-AFFF's (ATC's) are the most viscous. My experience with older foam eductors and AR-AFFF has not been good, they tend too be lean. Proportioning accuracy can be tested using water. **Remove pick-up tube strainers before testing.** Equivalency numbers for Universal Gold is 15%. Your eductor will drink +/- 15% less foam concentrate than water. How to test is at www.CombatSupportProducts.com.

Flushing

After making foam, put the pick-up tube in fresh and flush for a minute. If using a TFT push-button flush foam eductor - shut the nozzle, or cap the eductor; set pump pressure less than < 50 psi; press the red button for a few seconds. If necessary, throttle the discharge gate to get pressure low enough to press the button.

Eductor on pump discharge, not 50' down the street... Try it!

Long term vapor suppression require properly proportioned solution.

Eductor Firefighting Capability - The Rule of Ten

Liquid firefighting is done by the square foot. A 100 gpm foam eductor will handle a 1000 sq. ft. oil spill fire when using AFFF, and 60% less when using protein base foams. Multiply your eductor flow rate by 10 and you have the size fire you can manage. If up against alcohol multiply by 5 when using alcohol resistant foam (AR-AFFF). You should have a 15 minute supply of foam and water on hand for each device you bring to the party. The table below will come in handy for calculating distance and how much fire you can handle and how much foam it will drink..

Foam Eductor Distance & Fire Fighting Table

Foam Eductor GPM @ 200 PSI	Fire Control size AFFF & AR-AFFF	Concentrate flow GPM	Nozzle or Hose outlet psi	Distance Hose I.D. 1.5"	Distance Hose I.D. 1.75	Distance Hose I.D. 2	Distance Hose I.D. 2.5	Distance Hose I.D. 3	Distance Hose I.D. 4	Distance Hose I.D. 5
				LEVEL GROUND		LEVEL GROUND		LEVEL GROUND		
60 gpm	Hydrocarbon 600 sq ft	1%= 0.6	100	300 ft	700 ft	850 ft	3300			
	AFFF & AR-AFFF	3%= 1.8	75	600 ft	1250 ft	1550 ft	6100			
	Polar Solvent 300 sq ft	6%= 3.6	50	850 ft	1850 ft	2200 ft	8800			
			10	1300 ft	2800 ft	3400 ft	13300			
95 gpm	Hydrocarbon 950 sq ft	1%= 1.0	100	100 ft	200 ft	350 ft	1200 ft	3300 ft		
	AFFF & AR-AFFF	3%= 3.0	75	250 ft	350 ft	650 ft	2200 ft	6100 ft		
	Polar Solvent 425 sq ft	6%= 6.0	50	350 ft	500 ft	1000 ft	3200 ft	8850 ft		
			10	550 ft	800 ft	1500 ft	4800 ft	13300 ft		
125 gpm	Hydrocarbon 1250 sq ft	1%= 1.25	100	50	100	250	750	1900		
	AFFF & AR-AFFF	3%= 3.75	75	175	200	450	1400	3500		
	Polar Solvent 625 sq ft	6%= 7.2	50	250	300	650	2200	5100		
			10	400	500	1000	3000	8000		
250 gpm	Hydrocarbon 2500 sq ft	1%= 2.5	100				200 ft	480 ft	3000 ft	
	AFFF & AR-AFFF	3%= 7.5	75				350 ft	880 ft	5500 ft	
	Polar Solvent 1250 sq ft	6%= 15	50				500 ft	1280 ft	8000 ft	
			10				800 ft	1920 ft	12000 ft	
350 gpm	Hydrocarbon 3500 sq ft	1%= 3.5	100				150 ft	250 ft	1250 ft	4800
	AFFF & AR-AFFF	3%= 10.5	75				250 ft	450 ft	2300 ft	8800
	Polar Solvent 1750 sq ft	6%= 21	50				400 ft	650 ft	3300 ft	12800
			10				600 ft	1000 ft	5000 ft	20800
500 gpm	Hydrocarbon 5000 sq ft	1%= 5	100				50 ft	100 ft	600 ft	2000 ft
	AFFF & AR-AFFF	3%= 15	75				100 ft	200 ft	1100 ft	3600 ft
	Polar Solvent 2500 sq ft	6%= 30	50				100 ft	300 ft	1600 ft	5300 ft
			10				200 ft	450 ft	2400 ft	8000 ft

NFPA 11 requires a 15 minute foam concentrate supply for spill fires (one-inch or less)
NFPA 11 requires a 65 minute foam concentrate supply for fires in depth (tank type fires)
Eductor back pressure cannot exceed 65% of inlet pressure. BP is sum of hose friction loss, elevation and nozzle pressure.
Put a pressure gauge on eductor inlet and outlet. At 200 psi nilet pressure, do not exceed 130 psi on the outlet gauge (65% of inlet psi).
Distance to hose outlet is based on NFPA friction loss tables and or actual field experience. BE SURE TO ADD OR SUBTRACT ELEVATION HEAD.

By: Jim Cottrell

Storing Foam A & B Foam Concentrates

Contrary to popular belief, foam concentrate has no shelf life. The date on the foam pail, drum or tote is its birth date. If stored in sealed, original packaging, foam concentrates will easily last thirty years or more. Foam concentrate storage success is more about preventing concentrate evaporation and cross contamination than air contact. Class A and B foam concentrate containers should be kept sealed. In short, store it as if it were latex paint.

Metal container 1976 - Still sealed 9/15/15

Apparatus Foam Tanks

Foam tanks that are not gasket sealed, and fitted with pressure-vacuum vents will eventually be the cause for concentrate evaporation. Two-inches of foam concentrate sealer (mineral oil) floated on class B firefighting foam will prevent evaporation, and is often recommended for level, stationary (class B) tanks fitted with regular atmospheric vents. Not a good idea for mobil or marine tanks because its a combustible liquid. And do not put mineral oil on Class A foam concentrate or wetting agents - they may will with (hydrocarbon) detergent base chemistry.

Fire apparatus, marine units and foam trailer tanks are subject to sloshing when the tank is not full. Alcohol resistant foam concentrates (AR-), which is gel-like to start with, regardless of brand will not like sloshing. An open air space in a foam tankcan cause a whipped cream- like concentrate/air froth in the free space, which can stay this way for quite some time and be the cause for lean proportioning. This is the main reason for keeping mobile AR-AFFF tanks topped off. Not much of a problem with Class A, AFFF or protein based concentrates.

Keep Class A foam concentrate away from AR-AFFF concentrate. Class A concentrate has a lot of alcohol in it; commingling the two is usually system fatal. The AR-AFFF will do what its supposed to do in your tank, rather than on the fire, leaving pizza-like dough at the bottom of your foam tank - and system supply lines connected or strainers there to. (see Help! Our Foam Has Gelled in a future piece)

Freeze/Thaw Cycles

Freezing alcohol resistant foam concentrate may cause compound component separation, and will hinder firefighting performance, particularly foamability. Consult your foam manufacturer for advice when using thawed AR-AFFF. Freeze-thaw cycles should not be a problem with regular AFFF or class A concentrates; although Class A concentrates often have foamability and wetting problem when concentrate is < 45F (8C).

Test Freeze Your AR Foam

Freeze a 1/4 cup sample in a clear container. A clean peanut butter jar with an inch or two of head space will do nicely. Normal AR-AFFF foam concentrate will present as a gel. As a rule, the more AR chemical (polymer) it contains the more gelatinous it will be. If it lifts with a turkey baster or eye-dropper it's good to go. Compound separation looks like thin liquid under the thick stuff. If it separates, you may need to reconstitute it by shaking or stirring. Shaking a foam tank or drum may not be an option, especially if you don't know if it's been frozen.

Cold Class A Foam Concentrate

Class A foam concentrates are formulated using various wetting and foaming components. Most alcohol based Class A foams are sensitive to low temperature storage. Once concentrate gets in the 40 degree range (4 to 5c), it's a good bet that foamability and wetting will suffer. Moreover, viscosity becomes quite variable when class A foam concentrate approaches 40 degrees (5 c). Normal free-flowing class A foam may thicken and

National Foam®

Foam Lines

Cottrell Associates, Inc. September 2012

What's Quarter Life Got To Do With It?

By: Jim Cottrell

Like beer, the light ones loose their head fast. The stouter brews tend to stay around a while.

Water weight in a foam blanket is what holds flammable vapors down, not the bubbles in the foam. Some foams release water fairly fast. Class A foam, for instance, begins loosing its water pretty much as soon as it leaves the nozzle, since its mission is to wet, or soak any dry fuel it lands on.

In the case of AFFF such as found in an airport crash truck, it too looses its water fairly fast, because it's formulated to allow an aqueous film to continue spreading on a jet fuel spill from three to five minutes after initial foam application. The reservoir for the draining aqueous film is the foam blanket and needs to drain fairly fast.

The mechanism that controls drain time is largely a function of how much foam chemical (surfactant) is present in the finished foam and how well it is aerated. If you proportion 3% foam at 6%, you have doubled the foaming compound. If you want 3% AFFF foam to last twice as long, proportion it at 6% - 94 parts water and 6 parts foam concentrate. Same for class A foams. If you want long lasting exposure insulation, proportion Knockdown at 1% rather than 1/2%.

The term used to define firefighting foam drainage is *quarter life*. Firefighting foam's quarter life is the time it takes 25% of the foam's water weight to drain; much as beer or cola does after it's poured into a glass. The time it takes to drain 25% of foam's original liquid weight is the time at which the industry recommends you refresh your foam blanket. This is particularly critical when dealing with highly volatile, un-ignited spills, or recently extinguished gasoline fires which have pooled or soaked into the earth.

When it comes to long term vapor suppression at gasoline or ethanol spills, quarter life is a most important metric, for several reasons:

- The longer the quarter life, the less frequently you have to reapply.
- The longer the quarter life, the less water you need on scene.
- The longer the quarter life the less needs to be cleaned up after you're finished.

Use the following real-life jet fuel situation for quarter life examples:

Let's say you have regular 3% AFFF and its quarter life is four minutes, which is average for 3% airport AFFF. This means you apply foam every four minutes after the fire is out.

Say you have a 100 gpm eductor and it takes a minute to re-coat the spill. You will use three gallons of foam and 97 gallons of water, every four minutes. If you need to keep the spill secure for an hour, you will use about 45 gallons of 3% AFFF concentrate and 1445 gallons of water. If you're on a highway, with no hydrants, you'll

need three, 500 gallon rigs or a tanker on scene to make it happen; double the numbers for a more likely two hour event.

Let's say you have an E-15 gasoline spill and are using the same rig with the same eductor, but are using 3-6% AR-AFFF, which is indicated for gasoline/ethanol fuel fires or spills. You will need to proportion it at 6% if you want optimum performance.

Note: the sugar-like compound in alcohol resistant (AR-AFFF) slows down drain time. The more sugar, the longer the quarter life and the thicker the foam concentrate.

Average quarter life of 3/6 AR foam, proportioned at 6% is six minutes. The on-scene math for a two hour event reveals the following:

Twenty applications uses 120 gallons of 6% foam concentrate and 1880 gallons of water.

The numbers for a two hour event using a straight 3% AR-AFFF with six minute quarter life are:

Twenty applications, use 60 gallons of 3% AR foam concentrate and 1940 gallons of water. If you double the proportioning ratio to 6% you will still use 60 gallons of foam concentrate, but the amount of water needed is halved, because doubling the concentrate doubles quarter life and reduces applications to ten.This water saving tactic is only for use on un-ignited events, as the finished foam will be too rigid to flow freely on ignited fuel surfaces.

Using very thick, Universal Gold 1-3% AR-AFFF, quarter life at 3%, using fresh water is 25 minutes, and at 6% it's 50 minutes.

Using Universal Gold reduces applications from twenty - to five. Five applications uses 15 gallons of 3% Universal Gold, and 500 gallons of water. If proportioned at 6%, the same quantity of foam concentrate will be used, but only 250 gallons of water is needed.

Using Gold at 6% makes a lot of sense when it comes to remediation (clean up) expense and runoff impact, which is why our marketing literature recommends 1% for use on jet fuel spill fires, 3% on ethanol fires and 6% for long term, post fire or spill protection.

Do the replacement cost analysis. You will find using Universal Gold costs much less to replace, because you use two to three times less concentrate to do the same as a the best competitor's AR-AFFF.

Once the fire is extinguished, bump up your proportioning ratio to save water, and the environment.

Post fire and spill security is where it's happening for the highway firefighter. The longer the foam holds its water the easier it is on everyone, to include the budget officer.

Page three shows the how-to's of testing foam quarter life and how alcohol resistant it is - or isn't.

Jim

The author

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For more, visit
www.cottrellassociates.com/Training.html

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.

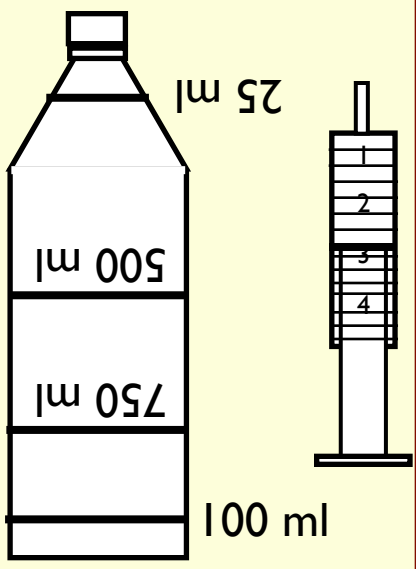
Once dissolved, shake the bottle vigorously for at least twenty seconds; turn the bottle on its cap and start the clock. Lightly tap the capped end on the table or desk and record the expansion ratio. If the foam sample has filled the bottle, you have achieved a 10:1 expansion ratio. Just about what 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.

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.

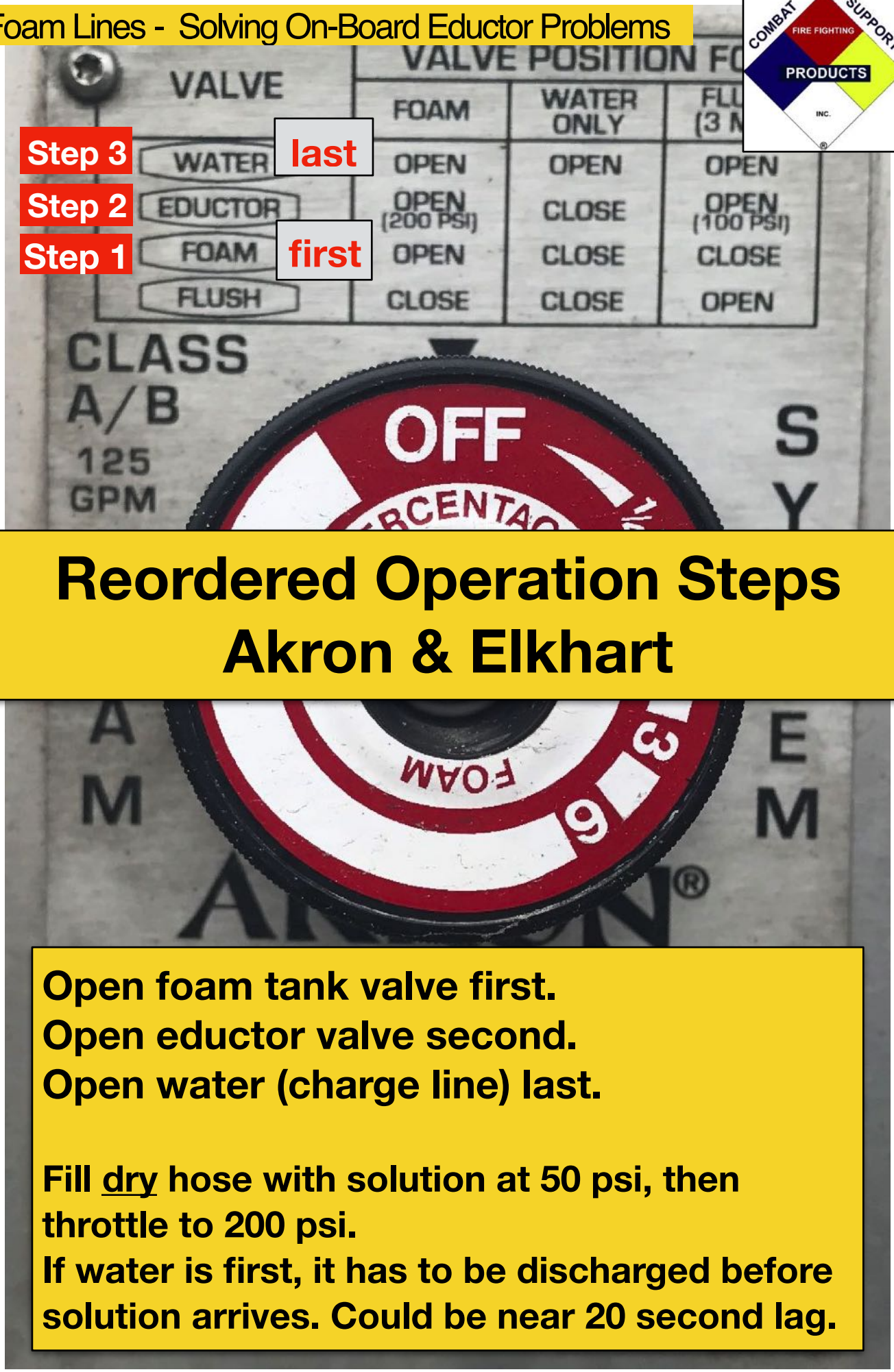
Re-shake the bottle for twenty seconds and put a dollop of finished foam on some acetone or denatured alcohol. If it disappears as fast as you apply it, it's not alcohol resistant.

More at combatsupportproducts.com



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.



Reordered Operation Steps
Akron & Elkhart

Open foam tank valve first.
Open eductor valve second.
Open water (charge line) last.

Fill <u>dry</u> hose with solution at 50 psi, then throttle to 200 psi.
If water is first, it has to be discharged before solution arrives. Could be near 20 second lag.