

Which Foam to Choose for Hydrocarbon Tank Fires



AFFF Weakness - Fire Crew Safety



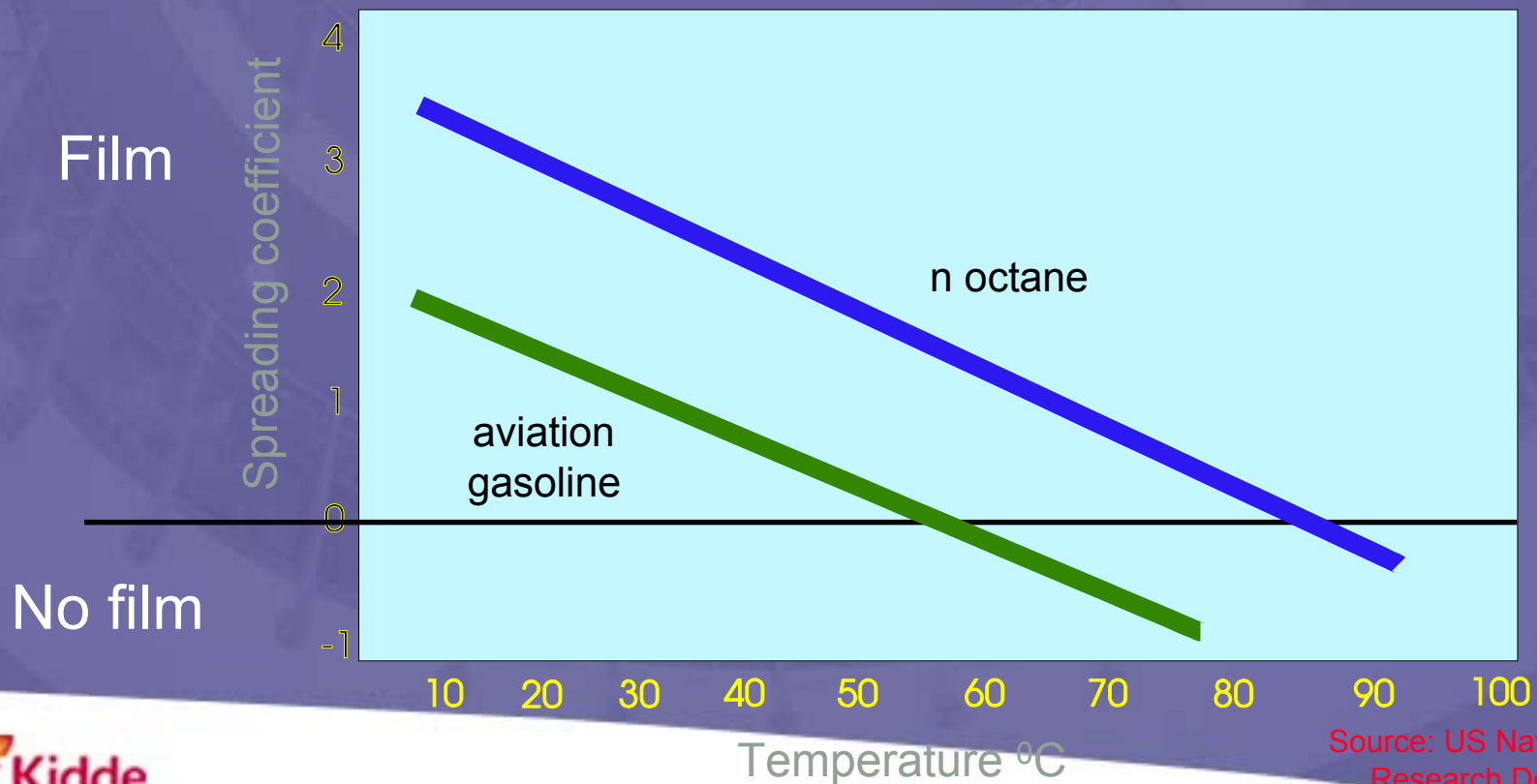
“...foam blanket stability, burnback rate, and wicking action modify the relative degree of efficiency of AFFF on open spill fires...”

“The AFFF blanket should not be relied on to be permanent and should be renewed from time to time as the rescue operation proceeds”

Source: NFPA 403 (1978)

The effect of heat on film formation

- At high temperature film formation will not take place on most hydrocarbons



Source: US Naval Weapons Research Department

Storage Tank Fire Fighting



- No longer shallow spill fire
- Been burning for several hours before foam attack
- Fuel volatile and very hot (~400deg C)
- Needs a foam with
 - Good bubble quality
 - Resistance to flame attack
 - Resistance to radiated heat
 - Good edge sealing against tank shell
 - Good cooling effect
 - Good post fire security - no flashbacks!

= *Modern FP/AR foams*

AFFF difficulties on tank fires

- AFFFs shown to struggle on many tanks
 - no film formation
 - fast drainage & poor heat resistance
- Detergent base emulsifies with hydrocarbons
 - emulsifies with fuel when applied forcefully
 - causes flashbacks and re-ignition risk
- AR-AFFFs are also used on tanks but:
 - polymer needed for polar solvents only
 - thicker concentrates can give proportioning difficulties
 - expensive option (2-3x cost FP!)

FP is designed for tank fires



- Most SERIOUS fires are large and deep seated (tank fires)
- Good quality FP foam benefits:
 - slow draining foam cools hot fuel
 - seals well against hot metal shell
 - no emulsification with fuel
 - proven performance on tank fires
 - no thick polymers
 - resists severe flame attack (strong protein bubbles)
 - excellent **post-fire security**
 - reliability, no flashbacks
 - cost -effective
- Foam tests help assess suitable products
 - UL 162 (ability & system integrity)
 - Lastfire (representative)



- Detergent-free
- Fuel repellent
- Protein skeletal structure
 - Resistance to heat
 - Edge sealing
 - Cooling effect
- Post-fire security
- Most ***COST-EFFECTIVE*** protection

Major users:

Exxon -Mobil, BP, Shell, Caltex
Formerly marketed as FP70 Plus



- *Applications:*
- Hydrocarbons
- 100% MTBE
- Unleaded Gasolines (20% MTBE)

- Semi-asp & Asp. Monitors
- Top Pourers
- Rimseal Pourers
- Base Injection
- MEX Bund Pourers
- Foam sprinklers



Performance Characteristics

	AFFF	FP	FFFP	AR- AFFF	AR- FFFP
Typical Application	Aviation	Oil Tanks	Aviation	Multi-purpose	Multi-purpose
Knockdown	★★★★★	★★★	★★★★★	★★★	★★★★(*)
Burnback Resistance	★★	★★★★★	★★★	★★★	★★★★★
Fuel Tolerance	★★	★★★★★	★★★	★★★	★★★★★

The more ★ the better!

2 Foam tests help assess products for tank fires



Why is



important?



- totally independent test house
- comprehensive UL 162 standard
- no profit motive
- charge manufacturers for testing
- every product tested by foam specialists
- follow up service monitors quality over time
- ensures consistent product supplied
- all listings shown at www.ul.com
- Poor products FAIL!

Key Global OPC approval!

LASTFIRE Tank Test



= Representative!

- Good Test NEEDS:-
 - Large fire area (~ 5 m²)
 - Long preburn (~ 3 mins)
 - Deep fuel layer (> 6 cm)
 - Large qty (~ 300 litres)
 - Tall wall height (~ 50 cm)
 - With metal obstructions
 - Fixed specification volatile fuel
 - Foam quality matches real equipment (semi-aspirated monitor, aspirated monitor and fixed pourer nozzles)

**BP, Shell, Exxon-Mobil,
MOL, Total-Fina-Elf,
Chevron - Texaco, Repsol,
Saudi Aramco etc.**

LASTFIRE test



0 3 10 12 23 25 30 mins

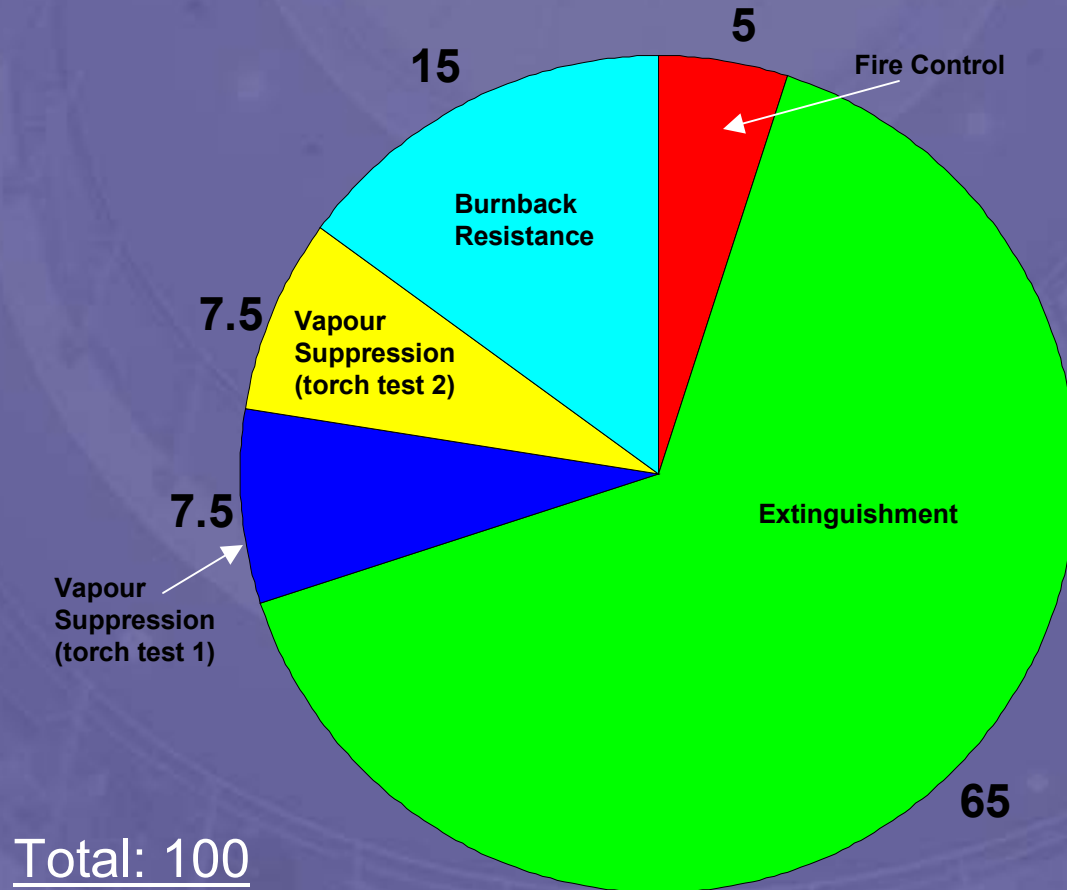


Preburn Foam Torch Burnback

LASTFIRE test results



Maximum 300 points,
100 available for
each 3 stages of
LASTFIRE TEST



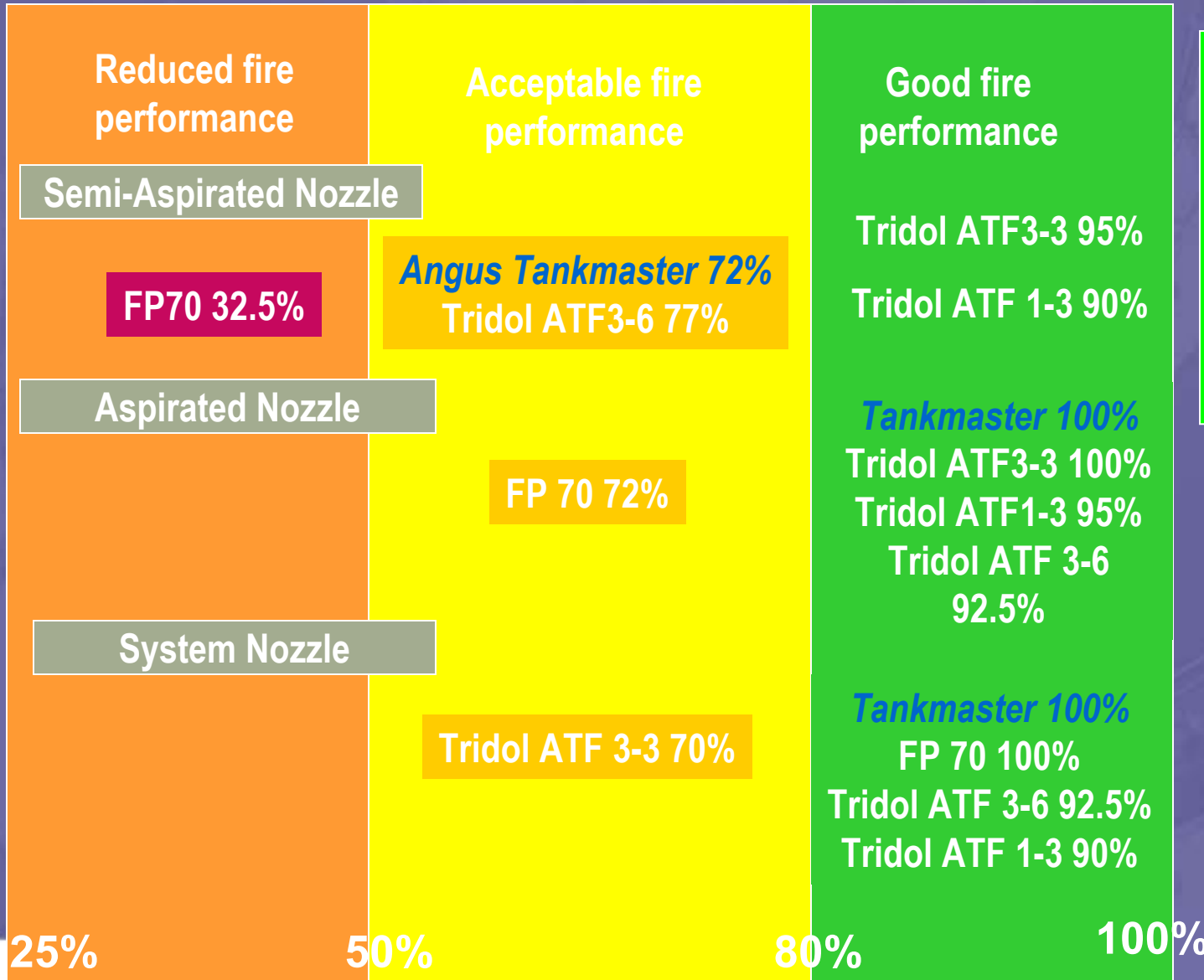
End users relative importance of LASTFIRE Test fire performance criteria
(Developed from poll of end users)

Post-fire security crucial!

- Aspirated applications = best results
- Foam needs to control/prevent edge flickers and resist re-ignition
- Post-fire security is very important
- Foams that suddenly flashback can be dangerous to firefighters!
- More common with AFFFs/ AR-AFFFs
- More common during semi-aspirated applications



ANGUS FIRE FOAMS: LASTFIRE TESTED



Total Scores:

ATF1-3	275
FP70 Plus	272
ATF3-3	265
ATF3-6	264.5
FP70	202



25%

50%

80%

100%



Environmental Issues



- Comprehensive Data - mild effect only on fish & aquatic organisms
- Rainbow trout LC50 (48 hrs) for TANKMASTER >10,000ppm
- 10,000 ppm = 1% foam solution
- Protein base = Lowest Environmental Impact
- UK Environment Agency Advice - Avoid Detergents
- ***NB - the higher the ppm number the more you can use before bad effects!***

Environment: Improved WWTP



“AFFF fire fighting foam significantly disrupted a refinery’s wastewater treatment plant (WWTP)”.

Source: Industrial Fire Safety, Nov/Dec 92

FP foams like  are far less disruptive

Also readily biodegradable

Natural protein base (FP) more easily digested by bacteria

Can use more before any problem

AFFF Toxicity - Detergent



“Detergent is the most acutely toxic of the main foam constituents”

Source: UK Environment Agency

24 Hour $LC_{50} < 20 \text{ mg l}^{-1}$

Oil / Water Separators

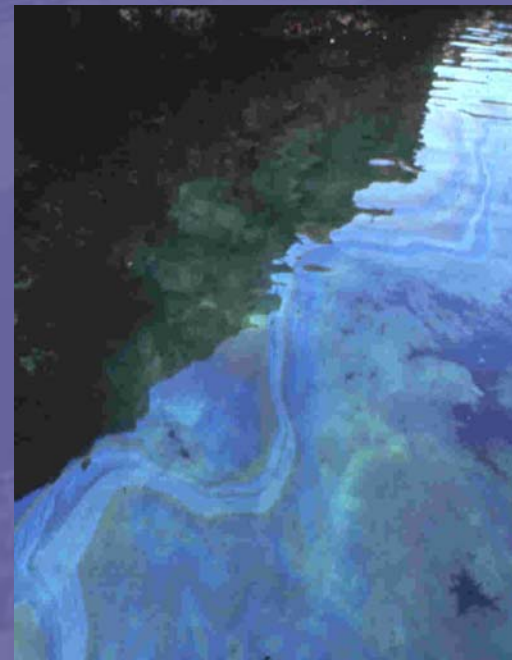


“Foams that contain detergent can mix with the fuel itself and carry it into the water environment, giving rise to much higher oxygen demands in the water”

Source: UK Institution of Water & Environmental Management

“The only solution for fire fighters is to avoid the use of foams that contain detergent”.

Source: UK National Environmental Technology Centre



Proven Emergency Response



- Repsol S. Spain - Aug. 03
- Antonov - 100kL
- Trucks - non-stop 2 drivers ea.
- Wide range products incl. Alcoseal, Niagara & Tridol ATF
- Idemitsu, Japan- Sept. 03
- Boeing 747 - 60kL
- Alcoseal & ATF3-6
- Atas Refinery, Turkey- Mar 04
- A 300 Airbus - 42kL FP70
- 100kL  replenishment

Comprehensive Foam Service



- 24hr/365 days Emergency Service
- Bulk emergency stocks
- Technical support - Foam/Equipment
- Full range Portable & Fixed Eqpt.
- Full Foam Testing Service
- Your Partners in Protection!



ALL OPTIONS COVERED



WHEN YOU NEED IT MOST!

Atas Refinery Tank Fire,
Turkey - July 2004