



# INTRODUCTION

## DEFINITIONS OF FOAM TECHNOLOGY

**Absorption:** The act of absorbing or being absorbed. i.e. drawn into.

**Aeration:** The introduction (or entraining) of air into a foam solution to create bubbles that result in finished foam.

**Adhesive Qualities:** The ability to bind together substances of unlike composition. When a foam blanket clings to a vertical surface, it is said to have adhesive qualities. This is required to prevent vapor release at a tank shell fire or to describe Class A foam application to exposures.

**AFFF (Aqueous Film Forming Foam):** A foam concentrate containing fluorochemical surfactants that control the physical properties of water enabling it to float and spread across the surface of the hydrocarbon liquid.

**Airfoam:** Foam produced by the physical agitation of a solution of water and foaming agent and air. Also called mechanical foam.

**Alcohol Resistant (AR):** A foam concentrate for use on polar solvents in addition to hydrocarbons.

**Alcohol Resistant Aqueous Film-Forming Foam (AR- AFFF):** AFFF that is suitable for use on polar solvents in addition to hydrocarbons.

**Alcohol Resistant Film-Forming Fluoroprotein (AR-FFFP):** FFFP that is suitable for use on polar solvents as well as hydrocarbons.

**American Bureau of Shipping (ABS):** U.S. shipping classification society which establishes and administers standards known as 'rules' for the design, construction, and periodic survey of ships and other marine structures. Approves foam concentrates and foam equipment as a system.

**Application Rate:** The rate at which foam solution is applied to a fire. Expressed as either gallons of foam solution per minute per square foot or litres of foam

solution per square meter per minute. Typically between 0.1 gpm/ sq. ft. and 0.16 gpm/sq. ft. (4.0 and 6.5 l/m<sup>2</sup> /min.)

**Application Time:** The duration of time over which foam is applied.

**Approval:** Certificate that ensures a foam concentrate meets the requirements of a foam Standard. i.e. U.L. 162.

**Aquatic Toxicity:** A measure of how foam negatively affects creatures living in the water environment. See LC<sub>50</sub>

**Aqueous Film-Forming Foam (AFFF):** Pronounced A-triple-F. A synthetic foam concentrate containing detergent and fluorocarbon surfactant that forms a foam capable of producing a vapor-suppressing aqueous film on the surface of some hydrocarbon fuels. Provides rapid flame knockdown for aircraft crash fires. Developed in the 1960s, by the Naval Research Laboratory (NRL) in association with the 3M Company.

**AR:** See Alcohol Resistant.

**AR-AFFF:** See Alcohol Resistant Aqueous Film-Forming Foam.

**AFFF -Polar (AR-AFFF):** An AFFF that contains a polysaccharide material that forms a polymeric layer or film only on polar solvents to separate and protect the finished foam.

**ARC -Alcohol Resistant Concentrate:** See AFFF Polar.

**ARFF:** Aircraft Rescue and Fire Fighting.

**AR-FFFP:** See Alcohol Resistant Film-Forming Fluoroprotein.

**Aspirated Foam:** Foam blanket obtained by mixing wa-ter, foam concentrate, and air. Expansion ratio typically 3:1 or more. Also called Finished or Expanded Foam.



**AVGAS:** Aviation gasoline. Similar to gasoline used in cars except that AVGAS has a higher octane rating (130). A complex mixture of relatively volatile hydrocarbons with or without small quantities of additives, blended to form a fuel suitable for use in aviation reciprocating engines. Fuel specifications are provided in ASTM Specification D 910 and Military Specification MIL-G-5572.

**Avtur:** Aviation kerosene. Used for aircraft jet engines. See JP-5 & JP-8.

**Backboard:** Metal sheet attached to back of test fire pan that enables foam to be applied gently on to the fuel surface. Particularly important for Alcohol Resistant foams.

**Back Pressure:** Pressure loss or gain created by changes in elevation between nozzles and pumps.

**Bag Tank:** A steel pressure vessel containing a flexible rubber bladder for storing foam concentrate. This device controls the flow of foam concentrate into a ratio controller at a pressure that is balanced to water line pressure. Also called Diaphragm Tank.

**Balanced Pressure Proportioner (BPP):** A foam concentrate proportioning system (ratio controller) designed to automatically inject the correct quantity of foam concentrate into a water stream over wide flow and pressure ranges by balancing the pressure of a foam concentrate with that of the water supply. Used in combination with a bladder tank or balance valve and foam concentrate pump.

**Balance Valve:** A device that controls the flow of foam concentrate into a ratio controller at a pressure that is balanced to water line pressure.

**Barrier:** Any physical obstruction that impedes the spread of the fire (typically an area or strip devoid of flammable fuels).

**Base Injection:** A technique used for the protection of fixed roof hydrocarbon fuel storage tanks where fuel-resistant aspirated foam is injected into the base of the tank and rises through the fuel to the surface to effect extinguishment. Expansion ratios typically between 2 and 4:1. Also called Sub-Surface Injection.

**Batch Mix:** Manual addition of foam concentrate to a water storage container or to make a foam solution.

**Biochemical Oxygen Demand (BOD):** The amount of oxygen consumed by aquatic micro-organisms in a specified number of days (usually 5 or 21) when metabolizing an organic material such as foam concentrate.

**Biodegradable:** Capable of being broken down into innocuous or harmless products by the action of living creatures such as micro-organisms.

**Biodegradation:** Decomposition by microbial action as with synthetic detergent or protein based agents.

**Bladder Tank:** A steel pressure vessel containing a flexible rubber bladder for storing foam concentrate. This device controls the flow of foam concentrate into a ratio controller at a pressure that is balanced to water line pressure. Also called Diaphragm Tank.

**BLEVE:** Acronym for Boiling Liquid Expanding Vapor Explosion. Explosive fire ball caused by the rapid escape of flammable gas discharging from sealed pressurized containers which have ruptured due to adverse heat exposure.

**Bolover:** Violent ejection of flammable liquid from its container caused by vaporization of a water layer beneath the body of a liquid. This may occur after a lengthy burning period of products such as crude oil when the heat wave has passed down through the liquid and reaches the water bottom in the storage tank. The water bottom turns to steam due to the elevated temperature and expands to a ratio of approximately 1,700:1. Boilovers typically will not occur to any significant degree with water soluble solvents or light products such as gasoline.

**BPP:** See Balanced Pressure Proportioner.

**British Standards Institute (BSI):** An independent national organization that facilitates the production of standards, tests products, and assesses organizations against the national standard for quality management systems. A member of ISO.

**Bund:** An area surrounding a storage tank, which is designed to contain the liquid product in the event of a tank rupture. Also referred to as Dike.

**Bubble:** The building block of foam performance and durability, which is influenced by water content of the bubble.

**Burnback Resistance:** The ability of a foam blanket to resist direct flame and heat impingement such as would be evident in a partially extinguished fire.

**Bag Tank Module:** e.g. Buckeye Fire Bag Tank Module. A device that controls the flow of foam concentrate into a BPP at a pressure that is balanced to water line pressure.



**CAFS:** Compressed Air Foam System.

**Carcinogenic:** Cancer causing.

**CFR:** Crash, Fire and Rescue.

**Chemical Foam:** Foams (now obsolete) produced as a result of a reaction between two chemicals. (Aluminum sulfate and sodium bicarbonate).

**Chemical Oxygen Demand (COD):** The amount of oxygen required for the complete oxidation of a known quantity of an organic material such as a foam concentrate.

**Civil Aviation Authority (CAA):** Organization responsible for civil aviation.

**Class A Fire:** A fire in materials such as wood and paper where the cooling effect of water or Class A foam is of paramount importance in extinguishing the fire. Fires that occur in ordinary combustible materials, i.e. wood, paper, rubber, and certain plastics, etc. (NFPA 10 definition).

**Class A Foam:** Foam specially formulated for use on Class A fires. Essentially wetting agents that reduce the surface tension of water and allow it to soak into combustible materials easier than plain water.

**Class B Fire:** A fire involving a flammable liquid where a blanket or smothering effect is of first importance in extinguishment (CEN definition). Fires which occur in flammable liquids, oils, tars, lacquers, etc. and flammable gases (NFPA 10 definition). Fires in flammable and combustible liquids, gases, and greases (UL 162 definition).

**Class B Foam:** Foam formulated to be used on fires or spills of flammable and combustible liquids.

**Class C Fire - USA:** A fire in "live" electrical equipment where the use of non-conducting fire suppression agents is of prime importance.

**Class C Fire - EUROPE:** Fires involving gases or liquefied gases in the form of in the form of a liquid spillage, or a liquid or gas leak (CEN definition).

**Class D Fire:** A fire involving a metal such as magnesium, sodium, lithium, etc (CEN definition). Fires that occur in metals such as magnesium, zirconium, lithium, etc. (NFPA 10 definition).

**Class E Fire - Europe:** A fire in 'live' electrical equipment where the use of non-conducting fire suppression agents is of prime importance.

**Cloud Point:** The lowest temperature at which foam concentrate remains clear. Applies only to synthetic foams.

**Control:** A reduction in fire intensity of approximately 90 percent.

**CEN:** Comite European de Normalisation (French) or European Committee for Standardization (English). Brussels-based association of national standards bodies from the member countries of the European Union (EU) and the European Free Trade Association (EFTA).

**Cohesive Qualities:** The ability to bind together substances of like composition. A good foam blanket is held together by its cohesive qualities.

**Combustible Liquid:** A liquid having a flash point at or above 37.8°C (100°F).

**Compatibility:** The ability or inability of extinguishing agents to be mixed together or used simultaneously.

**Compressed Air Foam System (CAFS):** A generic term used to describe high energy foam delivery systems consisting of an air compressor (or air source), a water pump (or pressurized water) and foam injection equipment (or foam solution).

**Concentration:** The amount of foam concentrate contained in a given amount of foam solution. The type of foam used determines the foam concentration. (i.e. AFFF 1%, 3% or 6% and Class A foams from 0.1 % up to 1%).

**Corrosion:** Resulting chemical reaction between a metal and its environment, (i.e. air, water and impurities).

**Critical Application Rate (CAR):** The minimum rate at which foam solution needs to be applied to a fire in order to achieve extinguishment.

**Crude Oil:** A dark oil consisting mainly of hydrocarbons found mostly underground. Base product is refined to produce gasoline, diesel and jet-fuel.

**Degradation:** A negative change in the characteristics or qualities of a of a foam.

**Det Norske Veritas (DNV):** The Norwegian Testing House. An independent Foundation with the object of safeguarding life and property at sea and ashore. Approves foam concentrates and foam equipment.



**Density:** The weight of a specific volume of solution, relative to water.

**Dike:** An area defined as a contour of land or a physical barrier that retains a fuel to a depth greater than 1 ". (See Bund).

**Discharge Device:** A fixed, semi-fixed, mobile, or portable device that directs the flow of foam on to a fire. (Example: Fixed Master Stream Nozzle or an aspirating handline).

**DIN:** Deutsches Institut für Normung. The German national standards body. Coordinates and publishes standards governing foam concentrate performance.

**DNV:** See Det Norske Veritas.

**Downstream:** The direction to which the water is flowing.

**Drainage Time (OT):** The time required in minutes for 25% (usually) or 50% of the total foam solution to drain from aspirated foam. A measure of foam stability. Also referred to as Drainage Rate, quarter life or quarter drain time.

**EC<sub>50</sub>:** The Effective Concentration in water of a material such as foam concentrate that would produce a particular response in 50% of a test batch of animals (e.g. Immobilization of Daphnia) or a 50% reduction in a particular response (e.g. inhibition of the growth of algae).

**Eductor:** A proportioning device which uses the vacuum created by the water moving through a venturi to draw concentrate into the hose line or piping system.

**Eduction Rate:** The percentage of foam concentrate mixed or introduced into the water supply line to produce foam solution. Also called Induction Rate, Proportioning Rate or Pick-Up Rate.

**Environment:** The complex surrounding an area such as water, air and natural resources and their physical conditions (temperature and humidity).

**Expanded Foam:** Foam blanket obtained by mixing water, foam concentrate, and air. Expansion ratio typically 2:1 or more. Also referred to as Aspirated Foam or Finished Foam.

**Expansion Ratio (ER):** The ratio of volume of foam formed to the volume of solution used to generate the foam (example: an 8:1 expansion ratio means 800 gallons of finished foam were created from 100 gallons of foam solution). Expansion ratio is determined by the use of different aspiration devices, low energy and high-energy delivery devices.

**Explosive Limit:** See Flammable Limit.

**Explosive Range:** See Flammable Range.

**Extinction Time (ET):** The time taken by foam (or any other fire extinguishing agent) to extinguish a fire.

**F. M. Global:** The industrial and commercial property insurer specializing in loss prevention engineering and risk management services. Internationally recognized as an approved testing body for loss prevention, equipment, materials, and services. Approves foam concentrates and foam equipment.

**FDA:** See Foam Destroying Action.

**Federal Aviation Administration (FAA):** The US authority responsible for civil aviation.

**FFFP:** See Film-Forming Fluoroprotein.

**Film-Forming:** A foam concentrate containing fluorocarbon surfactants that has a spreading coefficient greater than zero and so forms a foam capable of producing a vapor-suppressing aqueous film on the surface of most hydrocarbon fuels.

**Film-Forming Fluoroprotein (FFFP):** Pronounced Triple-FP. A natural protein-based foam concentrate containing additional fluorocarbon surfactants that forms a foam capable of producing a vapor suppressing aqueous film on the surface of some hydrocarbon fuels.

**Finished Foam:** Foam blanket obtained by mixing water, foam concentrate, and air. Expansion ratio typically 2:1 or more. Also referred to as Aspirated Foam or Expanded Foam.

**Fire Retardant:** Any substance that by its chemical nature or physical action reduces or impedes the flammability of a combustible material.

**Fixed System:** Complete installation that generates aspirated foam and discharges it on to the risk to be protected.



**Flame Transmission:** Faint flames that flicker over the surface of a foam blanket. If the foam blanket does not completely cover the fuel, the flames may ignite exposed fuel. Also referred to as Ghosting Effect.

**Flammable Liquid:** Any liquid at normal temperatures and pressures having a flash point below 37.8 °C (100 °F).

**Flammable Limit:** Percentage of a substance in air that will burn once it is ignited. Most substances have an upper (too rich) and lower (too lean) flammable limit. Also called Explosive limit.

**Flammable Range:** The range between the upper flammable limit and lower flammable limit in which a substance can be ignited. Also called Explosive Range.

**Flashback:** Re-ignition of flammable liquid caused by exposure of its vapors to a source of ignition such as a hot metal surface or a spark.

**Flash Point:** The point at which a flammable liquid gives off enough vapor to ignite.

**Fluorocarbon:** An inert organic compound in which fluorine replaces hydrogen.

**Fluorocarbon Surfactant:** Fluorocarbon surface-active agent component in some foam concentrates to improve fuel tolerance and fluidity. Will reduce the surface tension of a foam solution, enabling the formation of an aqueous film on most hydrocarbon fuels.

**Fluoroprotein (FP):** A natural protein-based foam concentrate containing fluorocarbon surfactants that provide a fuel shedding property to the finished foam. Extensively used in oil and petrochemical industries. (See oleophobic).

**Foam - (Finished):** A homogeneous blanket obtained by mixing water, foam concentrate and the addition of air or an inert gas by the use of energy.

**Foam Chamber:** A permanently installed device that generates foam from foam solution and introduces it into storage tanks through a glass vapor-sealing membrane. Also called Top Pourer.

**Foam Concentrate:** A concentrated liquid foaming agent supplied by a manufacturer for mixing with the appropriate amount of water and air to produce finished mechanical foam. Also called Foam Compound.

**Foam Destroying Action:** The ability of polar solvents to collapse standard foam blankets.

**Foam Generator:** A device designed to introduce air into a pressurized foam solution flow. Typically associated and used to generate high expansion foam.

**Foaming Agent:** A component in foam concentrate responsible for foaming properties. Usually natural protein or synthetic detergent.

**Foam Maker:** A device designed to introduce air into a pressurized foam solution flow to form a low expansion finished foam. Typically associated with a dike foam maker or rim seal foam maker.

**Foam Pourer:** A device designed to deliver aspirated foam gently on to a burning liquid surface.

**Foam Quality:** A measure of a foam's physical characteristics expressed in terms of its 25% drainage time and expansion ratio.

**Foam Solution:** A homogeneous mixture of water and foam concentrate in the correct proportions. Called Premix Solution when in storage.

**Foam Spray:** Discharge outlet, which delivers aerated foam of typical expansion ratio 6-10:1 in a spray pattern.

**Foam Stability:** The relative ability of a finished foam to withstand spontaneous collapse or breakdown from external influences such as heat, chemical reaction or ambient conditions.

**Forestry Foam:** Buckeye Class A foam Concentrate. Foam concentrate for use on Class A fuels in vegetation and structural fires.

**Freezing Point:** The temperature at which foam concentrate solidifies. Of no particular value, since once frozen, the foam concentrate is unusable. Of more importance is the "minimum use temperature".

**Freeze/Thaw Cycle:** The process of freezing and thawing out a foam concentrate to assess its storage stability.

**Friction Loss:** The loss of pressure in a flowing stream resulting from resistance to flow imposed by the inside of the pipe or hose and by changes in flow direction such as elbows, tees and elevation change.

**Fuel Tolerance:** The ability of aspirated foam to withstand contamination by hydrocarbon fuels.

**Foam-Water Sprinkler System (FWSS):** A system that is designed to discharge either finished foam through aspirating open sprinkler heads, or non-aspirated foam solution through closed sprinkler heads.





**Gasohol:** A blend of finished motor gasoline containing alcohol (generally ethanol but sometimes methanol) in the range of 10 percent by volume.

**Gelling:** AR-AFFF foams that contain polymer can "set" or turn into a gel particularly when stored at low temperatures or when exposed to metal ions.

**Ghosting:** Faint flames that flicker over the surface of a foam blanket caused by vapor trapped in the bubble structure. The flames wilt typically self-extinguish and the bubbles burst and replenish the aqueous film.

**Glycol Ether:** Ingredient commonly found in some AFFF and AR-AFFF concentrates.

**Ground Monitor:** A monitor designed to be operated at ground level. Possibly positioned and anchored in place for cooling purposes.

**GPM:** Gallons per minute.

**Gum:** Water-soluble ingredient in alcohol resistant (AR)-AFFF that comes out of solution when brought into contact with polar solvent flammable liquids to form a physical barrier or "raft" that separates the foam blanket from the polar solvent. Also called Polymer.

**Hand Monitor:** A monitor designed to be operated by hand.

**Hazmat:** Abbreviation for Hazardous Material. Hazmat spills are best dealt with by blanketing with Buckeye 3% AR-A.F.F.F.

**Heat Resistance:** The ability of a foam blanket to withstand the effects of exposure to heat. (Radiant, Conductive or Convective).

**High Back Pressure Generator (HBPG):** A device that introduces air into foam solution to produce expanded foam in a base injection or sub-surface foam system.

**High Energy System:** A foam generating system that adds the energy of the air source to the energy of the water pump, CAFS (Compressed Air Foam System) is a high-energy foam delivery system.

**High Expansion Foam:** Special foam as defined in NFPA 11 and NFPA 11 A as having an expansion ratio in the range 200:1 to 1000:1.

**Hydrocarbon:** Fuel based exclusively on chains or rings of linked hydrogen and carbon atoms. Hydrocarbon fuels are not miscible in water.

**Hydrocarbon Pickup:** The characteristic of a fuel that is suspended or absorbed by expanded foam.

**Hydrocarbon Surfactant:** Alternative term for synthetic detergent.

**Hydrophilic:** Water-liking (having the property of mixing with water readily).

**Hydrophobic:** Water-hating (having the property of not mixing with water).

**IBC:** See Intermediate Bulk Container.

**ICAO:** See International Civil Aviation Organization.

**IMO:** See International Maritime Organization.

**Induction Rate:** The percentage of foam concentrate mixed or introduced into the water supply line to produce foam solution. Also referred to as Proportioning Rate or Eduction Rate or Pick-Up Rate.

**Inductor:** A device (portable or fixed) that introduces foam concentrate into the water stream. Also called Eductor or Proportioner.

**Ingestion:** To take things into the body as by swallowing, breathing or absorbing.

**Interfacial Tension:** The tension in the interface between foam solution and fuel.

**Intermediate Bulk Container (IBC):** 1,000-litre capacity container used to supply foam concentrates.

**International Civil Aviation Organization (ICAO):** A United Nations (UN) agency, which is charged with matters dealing with the development, coordination, and preservation of international civil aviation. Publishes "Annex 14 to the Convention on International Civil Aviation, International Standards and Recommended Practices, Aero-dromes, Paragraph 9.2.8" which concludes with a "Note" directing the reader to a test procedure in the



ICAO "Air-port Service's Manual, Part 1, Chapter 8 (3rd edition, 1990)". This test procedure assesses the suitability of foam concentrates for use at modern civilian airports.

**International Maritime Organization (IMO):** A United Nations (UN) agency, which formulates and publishes conventions concerned with maritime safety. Publishes International Convention for Safety of Life at Sea (SOLAS). Publishes standards for foam systems.

**ISO:** International Organization for Standardization. Geneva-based worldwide federation of national standards bodies from about 100 countries.

**JCDD:** Joint Committee on Design and Development. Former UK Fire Brigade committee that published specifications for fire appliance equipment, including the JCDD 28 (1972) specification for high expansion foam concentrate. Today replaced by Joint Committee on Appliances, Equipment, and Uniform (JCAEU).

**Jet-A:** Kerosene-grade jet fuel. Also called JP-5.

**Jet-B:** Jet fuel that is a blend of gasoline and kerosene. Also called JP-4.

**Jet Ratio Controller (JRC):** In-line venturi proportioner that proportions foam concentrate as a rich solution (over 60%) to a self-inducting large capacity monitor. Allows foam concentrate stocks and operating personnel to be a safe distance from the fire.

**JP-4:** A fuel in the heavy naphtha boiling range having an average gravity of 52.8 degrees API, 20 to 90 percent distillation temperatures of 290 to 470 degrees F, meeting Military Specification MIL-T-5624L. It is used primarily for military turbojet and turbo-prop aircraft engines because it has a lower freeze point than other aviation fuels and meets engine requirements at high altitudes and speeds.

**JP-5:** A kerosene-based product having a maximum distillation temperature of 400 degrees Fahrenheit at the 10-percent recovery point and a final maximum boiling point of 572 degrees Fahrenheit and meeting ASTM Specification D 1655 and Military Specifications MIL-T-5624P and MIL-T-83133D (Grades JP-5 and JP-8). It is used for commercial and military turbojet and turboprop aircraft engines.

**JP-8:** See JP-5.

**JRC:** See Jet Ratio Controller.

**K-Factor:** The flow rate through a piece of equipment divided by the square root of the pressure (or in other words the volume of water that passes through a piece of equipment in one minute at 1 bar pressure). Also called Discharge Coefficient.

**LC<sub>50</sub>:** The "lethal concentration" in water of a material such as foam concentrate that would kill 50% of a test batch of animals (e.g. fish) within a given period of time.

**LEX:** See Low Expansion.

**Line Proportioner:** A device that siphons foam from a container to make a foam solution (i.e. an eductor).

**Liquefied Natural Gas (LNG):** Cryogenic flammable liquid consisting mostly of methane. The recommended fire protection comprises a special high expansion foam system using foam generators & high expansion foam concentrate.

**Lloyd's Register (LR):** World's leading ship classification society. Approves foam concentrates and foam equipment for marine and offshore applications. Also undertakes independent witness testing.

**Low Energy System: A** foam generation system that uses the velocity energy of the water stream delivered from the water pump to mix air at the nozzle tip with the solution to deliver a finished foam. An aspirating foam tube is a low energy delivery system.

**Low-Expansion (LEX):** Foam with expansion ratio in the range 2:1 to 20:1.

**Lowest Use Temperature (LUT):** The lowest temperature at which foam concentrate can be used through conventional equipment such as venturi proportioning devices.

**LPM:** Liters per minute.

**LUT:** See Lowest Use Temperature.



**Material Safety Data Sheet (MSDS):** Document that communicates hazards associated with a product to the user. Now commonly referred to as Safety Data Sheets (SDS). It is required that the supplier of potentially hazardous products send a SDS to the customer. What is more, this SDS must contain certain information presented in a standard format with multiple headings.

**Marine Safety Agency (MSA):** UK agency that publishes regulations concerning safety on ships and the prevention of marine pollution. Approves foam concentrates and foam equipment.

**Mechanical Foam: Foam** produced by a physical agitation of a mixture of water, foam concentrate, and air. Also called Airfoam.

**Medium-Expansion (MEX):** Foam with expansion ratio in the range 21 :1 to 200:1.

**Methyl Tertiary Butyl Ether (MTBE):** Mildly polar flammable liquid used as a component in reformulated gasoline.

**MEX:** See Medium Expansion.

**MIL-F:** US military specification MIL-F-24385F(SH) or current edition, used for testing high performance A.F.F.F. concentrate for all branches of the Armed Forces. Recognizes only the standard 3% & 6% A.F.F.F. concentrates.

**Minimum Use Temperature:** The lowest temperature a foam concentrate will proportion with venturi devices in accordance with UL and USDA/USFS requirements.

**Ministry of Defence (MOD):** UK Ministry of Defence publishes Defence Standard 42-40 for Fire Extinguishing Foam Liquids.

**Monitor:** A portable, fixed or truck mounted device to which a large throughput foam nozzle or cannon is attached to allow the operator to direct the water or foam as required.

**MSDS:** See Material Safety Data Sheet.

**MTBE:** See Methyl Tertiary Butyl Ether.

**National Fire Protection Association (NFPA):** Organization that is committed to protecting people, property, and the environment from the effects of fire. It has a membership of over 60,000 from over 85 countries. It develops, publishes, and disseminates many standards relating to foam (e.g. NFPA 11 Standard for Low-Expansion Foam).

**NATO:** See North Atlantic Treaty Organization.

**Newtonian:** Foam concentrate that displays constant viscosity at various shear rates.

**NFPA:** See National Fire Protection Association.

**Non-Aspirated:** Foam with expansion ratio in the range 1-2: 1. The only aeration is the result of air entrainment and impact. Only film-forming foam concentrates are suitable for non-aspirating applications. Also referred to as Unaspirated.

**Non-Newtonian:** Foam concentrate that displays different viscosity at different shear rates.

**North Atlantic Treaty Organization (NATO):** Paris-based alliance of over 15 countries near or on the North Atlantic Ocean and the Mediterranean Sea. Provides joint action in time of war, and joint military and economic cooperation in time of peace. Issues stock numbers for foam concentrates and foam equipment.

**Octane Rating:** A number used to indicate gasoline's antiknock performance in motor vehicle engines. The two recognized laboratory engine test methods for determining the antiknock rating, i.e., octane rating of gasolines are the Research method and the Motor method. To provide a single number as guidance to the consumer, the antiknock index  $(A + M)/2$ , which is the average of the Research and Motor octane numbers, was developed.

**OECD:** See Organization of Economic Cooperation and Development.

**Oleophobic:** Oil hating, having the ability of shedding gasoline, oil and similar products.

**On-Demand Proportioning:** A foam concentrate induction system designed to inject automatically the correct quantity of foam concentrate into a water stream over a wide range of variable flows and pressures in closed-head foam/water sprinkler systems.

**Organization of Economic Cooperation and Development (OECD):** Paris based economic think-tank for the world's richest nations. Publishes guidelines for the environmental testing of chemicals such as foam concentrates.

**Oscillating Monitor:** e.g. Buckeye Water Powered Oscillating Monitor. Monitor designed to automatically sweep from side to side and typically powered by water pressure. Commonly used for aircraft hangar and offshore heli-deck protection.





**OTFR:** Open-Top Floating Roof tank.

**Oxygenated Gasoline:** Finished motor gasoline, other than reformulated gasoline, having an oxygen content of 2.7 percent or higher by weight and required by the U.S. Environmental Protection Agency (EPA) to be sold in areas designated by EPA as carbon monoxide (CO) non-attainment areas. *Note:* Oxygenated gasoline excludes oxygenated fuels program reformulated gasoline (OPAG) and reformulated gasoline blendstock for oxygenate blending (RBOB). Data on gasohol that has at least 2.7 percent oxygen, by weight, and is intended for sale inside CO non-attainment areas are included in data on oxygenated gasoline.

**Oxygenates:** Substances which, when added to gasoline, increase the amount of oxygen in that gasoline blend. Ethanol, Methyl Tertiary Butyl Ether (MTBE), Ethyl Tertiary Butyl Ether (ETBE), and methanol are common oxygenates.

**P:** See Protein.

**pH:** Measurement of acidity to alkalinity on a scale of 1 to 14. Neutral is 7. Acidic is less than 7. Alkaline is greater than 7.

**Phase Separation:** What happens when AR-AFFF separates into two phases - a thin phase (water and solvent) and a thick phase (hydrated polymer).

**Pick-Up Rate:** The percentage of foam concentrate mixed or introduced into the water supply line to produce foam solution. Also referred to as Induction Rate or Eduction Rate or Proportioning Rate.

**Polar Solvent:** A liquid whose molecules possess a permanent electric moment (e.g. alcohols, amines, ethers, esters, aldehydes, ketones). In fire fighting any flammable liquid that destroys standard foam is generally referred to as a polar solvent. Polar solvents are generally miscible with water.

**Polymer:** Water-soluble ingredient in AR-AFFF that comes out of solution when brought into contact with polar solvent flammable liquids to form a physical barrier or "raft" that separates the foam blanket from the polar solvent. Also called Gum.

**Polymeric Membrane:** A thin, durable, plastic layer formed on a polar solvent fuel surface protecting the foam bubbles from destruction by the fuel.

**Polysaccharide:** A group of carbohydrates composed of long chains of simple sugars; e.g., starch, cellulose, insulin, or glycogen. Xanthans are polysaccharide gums are typically used in foam concentrates. Material that is soluble in water, but insoluble in alcohol.

**Portable Foam Equipment:** Foam production equipment that is easily transportable by hand.

**Portable Foam Inductor:** Inductor that is easily transported by hand.

**Post-Fire Security:** Ability of foam to prevent heat sources from re-igniting fuel after extinguishment.

**Pour Point:** The lowest temperature at which foam concentrate is fluid enough to pour. Generally a few degrees above its freezing point.

**Preburn Time:** The time between ignition of a fire and the commencement of foam application.

**Premix:** A mixture of foam concentrate and water in the correct proportions, which can be stored for a specified time.

**Pressure Drop:** The net loss in flowing water pressure between any two points in a hydraulic system. Pressure is determined by friction loss, head loss or other losses due to the insertion of an orifice plate, venturi or other restriction into a section of pipe or hose.

**Product:** Name that may be applied to flammable liquids.

**Proportioner:** The device where foam concentrate and water are proportionately mixed to form a foam solution. Also a unit that pumps foam concentrate into the attack hose line. Also referred to as Inductor or Eductor.

**Proportioning Rate:** The percentage of foam concentrate mixed or introduced into the water supply line to produce foam solution. Also referred to as Induction Rate or Eduction Rate or Pick-Up Rate. UL 162 and NFPA 11 both state that foam proportioning must be not less than the recommended concentration, and no more than 30% above the recommended concentration, or 1% above the recommended concentration, whichever is less. What this means is that 1% concentrates must be proportioned in the range 1.0 - 1.3%; 3% concentrates must be proportioned in the range 3.0 - 3.9%; and 6% concentrates must be proportioned in the range 6.0 - 7.0%.



**Protein:** Complex nitrogen compound derived from natural vegetative and animal sources. The hydrolysis products of protein provide exceptionally stable, cohesive, adhesive and heat resistant properties to foam.

**Protein Foam Concentrate (P):** Concentrated solution of hydrolyzed protein with select chemicals added to obtain fire resistance and other desirable characteristics.

**Pseudoplastic:** A non-Newtonian foam concentrate that displays a decreasing viscosity with an increasing shear rate. Also called Shear-Thinning.

**Pump:** Foam concentrate pumps are usually either positive displacement pumps (recommended by NFPA for foam concentrates) or centrifugal foam pumps for higher flow rates.

**QPL:** See Qualified Products List.

**Qualified Products List:** AFFF products that have been qualified under US military specification MIL-PRF-24385F(SH) with latest amendment.

**Quarter-Life (Drain Time):** The time required in minutes for one-fourth of the total liquid solution to drain from the finished foam. Also referred to as 25% drainage time.

**RIV:** Rapid Intervention Vehicle.

**RCM:** See Remote Control Monitor.

**Reformulated Gasoline:** Finished motor gasoline formulated for use in motor vehicles, the composition and properties of which meet the requirements of the reformulated gasoline regulations promulgated by the U.S. Environmental Protection Agency under Section 211 (k) of the Clean Air Act. This product typically contains MTBE. *Note:* This category includes oxygenated fuels program reformulated gasoline (OPRG) but excludes reformulated gasoline blendstock for oxygenate blending (RBOB).

**Refractometer:** A device used to measure the amount of foam concentrate in solution. This device operates on the principle of measuring the velocity of light that travels through the foam solution.

**Remote Control Monitor:** A large discharge device commonly used to protect jetties, offshore platforms, oil tankers, chemical carriers, and on fire fighting tugs.

**Residual Pressure:** The pressure existing in a line at a specific flow. (As opposed to static pressure).

**RFG:** See Reformulated Gasoline.

**RFP:** See Aim Seal Foam Pourer.

**RI:** Refractive Index. See Refractometer.

**Rim Seal Foam Generator (RFG):** Device permanently installed on floating roof storage tank that is designed to produce aspirated foam from foam solution.

**Rim Seal Foam Pourer (RFP):** Device permanently installed on floating roof storage tank that is designed to discharge aspirated foam gently on to the rim seal area.

**RIV:** See Rapid Intervention Vehicle.

**S:** See Syndet.

**S.C.B.A.:** Self-Contained Breathing Apparatus.

**Seaweed:** Biopolymer derived from seaweed is key ingredient in alcohol resistant A.F.F.F. concentrates.

**SHE:** Safety, Health and Environment.

**Sediment:** The proportion in percentage by volume of solid matter, which can be centrifuged out of a foam concentrate. Also called Sludge or Un-dissolved Solids.

**Semi-Fixed:** Foam discharge device or equipment that is fixed in place to the risk and supported by mobile proportioning equipment. For example, foam chambers with piping to the dike wall and supported by fire apparatus that includes a proportioning system and foam concentrate. The water is supplied by a hydrant system.

**Semi-Subsurface Injection:** A system used for the protection of fixed roof hydrocarbon and water soluble fuel storage tanks where foam is directed to the fuel surface from the bottom of the tank through a flexible hose normally contained in a seated container.

**SG:** See Specific Gravity.

**Shear-Thinning:** A non-Newtonian foam concentrate that displays a decreasing viscosity with an increasing shear rate. Also called Pseudoplastic.

**Shear Rate:** The rate at which foam is subjected to shearing.

**Short Term Retardant:** A viscous water based substance wherein water is the suppressing agent.



**Skin Fire:** A flammable liquid fire such as a spill on a solid surface where the liquid is not present in a depth exceeding one inch (25 mm).

**Sludge:** See Sediment.

**Slug Flow:** CAFS only -when the foam solution is not rich enough or unevenly mixes with air, inadequate mixing occurs sending pockets or slugs of water and air to the nozzle.

**SOLAS:** (Safety of Life at Sea). See International Maritime Organization.

**Soluble:** The ability to become readily dissolved or mixed.

**Specific Gravity (SG):** Density of foam concentrate divided by density of water. Liquids with an SG less than one are lighter than water and will therefore float on water. Those with an SG greater than one are heavier than water and will sink to the bottom.

**Spray:** See Foam Spray.

**Spray Pattern:** The pattern produced by a divergent flow of fully formed subdivided foam - the pattern varying with the nozzle pressure and the adjustment of the spray-creating device.

**Spreading Coefficient (SC):** A foam solution that has a spreading coefficient greater than zero is film forming. Defined as the surface tension of cyclohexane minus the surface tension of foam solution minus the interfacial tension of cyclohexane and foam solution.

**Sprinkler, Foam-Water Type:** An air aspirating open type sprinkler constructed to discharge water or foam-water solutions.

**Sprinkler, Standard:** A non-air aspirating type sprinkler that discharges water or film-forming foam solutions.

**Stability:** A term used with foam concentrates to determine the performance and security of a foam blanket.

**Static Pressure:** The pressure existing in a line during a no flow situation. This can be considerably higher than residual pressure.

**Storage Stability:** The ability of foam concentrate to withstand long-term storage under varying environmental conditions.

**Stovepipe:** A device intended to provide an open area of free burn during a burnback test.

**Submergence:** Plunging of foam beneath the surface of burning liquid resulting in a partial breakdown of the foam structure and coating of the foam with the burning liquid.

**Sub-Surface Injection:** A technique used for the protection of fixed roof hydrocarbon fuel storage tanks where fuel-resistant aspirated foam is injected into the base of the tank and rises through the fuel to the surface to effect extinguishment. Also called Base Injection.

**Superstable:** Foam blanket produced by Buckeye AR-A.F.F.F. that suppresses hazardous vapors from spills of hazardous liquids for much longer than conventional foam. Buys valuable extra time for emergency crews.

**Suppressant:** An agent used to extinguish flaming or glowing phases of combustion by direct application to the burning fuel.

**Surface Tension:** The tension in the interface between foam solution and air. Unit is dyne/cm which is equivalent to mN/m. Typical values are water 72 dyne/cm, Protein 40 dyne/cm, Fluoroprotein 20-30 dyne/cm, AFFF <20 dyne/cm.

**Surfactant:** Abbreviation for Surface Active Agent. Chemical that reduces the surface tension of water. Examples used in foam concentrates include Hydrocarbon Surfactants and Fluorocarbon Surfactants.

**Synthetic:** Foam whose main ingredient is synthetic chemical. e.g. High expansion Foam Concentrate, AFFF and AR-AFFF.

**Syndet (S):** A detergent-based foam concentrate that can be used for high expansion foam but offers limited burnback and heat resistance. Synthetic detergent or cleaning agent.

**Thixotropic:** A non-Newtonian foam concentrate that displays a decrease in viscosity with time while it is subjected to constant shearing.

**Top Pouter Set:** See Foam Chamber.

**Training Foam:** Foam concentrate that is formulated especially for training exercises. Has limited burn-back capability to allow the fire to be easily re-lit.

**Transit Time:** The time taken for foam solution to pass from the point where foam concentrate is induced into the water supply to where aeration takes place.



**Type I Discharge Outlet:** Discharge devices that conduct and deliver foam gently on to the liquid surface without submergence of the foam or agitation of the surface. Examples include porous Moeller tubes and foam troughs along the inside of a tank wall. Generally considered obsolete because nearly all currently manufactured foams are suitable for use with Type II discharge outlets.

**Type II Discharge Outlet:** Discharge devices that do not deliver foam gently on to the liquid surface but are designed to minimize submergence of the foam or agitation of the surface. Examples include top pourer sets, rim seal foam pourers, base injection equipment, or applying the foam off a backboard or the wall of a tank.

**Type III Discharge Outlet:** Discharge devices that deliver foam directly on to the surface of the burning liquid in a manner that causes general agitation. Examples include hand-held branch pipes, monitors, and foam-water sprinklers.

**UL:** See Underwriters Laboratories.

**ULG:** See Unleaded Gasoline.

**Ullage:** A space that should be allowed above a foam concentrate in a bulk storage tank to accommodate the differences in thermal expansion coefficient between the tank construction material and the foam concentrate. Generally a measure of 5 to 10% of the tank volume is more than adequate.

**Un-aspirated:** Foam with expansion ratio in the range 2: 1 to 4:1. Only film-forming foam concentrates such as Buckeye A.F.F.F.'s are suitable for non-aspirating applications. Also called Non-aspirated.

**Underwriters Laboratories (UL):** Organization with a high reputation for independent assurance of foam concentrates and foam equipment product quality. The names of companies that have demonstrated an ability to manufacture products that meet UL requirements are published annually in the UL Fire Protection Equipment Directory. The standard used to evaluate products is UL 162 Standard for Foam Equipment and Liquid Concentrates (7th edition).

**Un--dissolved Solids:** See Sludge.

**United States Coast Guard (USCG):** US Government Department of Transportation organization that supervises waterways in and around the U.S. who approve foam concentrates and foam equipment as a system.

**Unleaded Gasoline (ULG):** Gasoline in which lead has been replaced with, for example, an oxygenate such as MTBE.

**Upstream:** The direction from which the water is flowing.

**USG:** United States Gallons. Approximately 83% of a U.K. gallon.

**USGPM:** United States Gallons Per Minute.

**USCG:** See United States Coast Guard.

**Variable Inductor:** A portable foam inductor capable of inducing foam at various percentages, usually in the range 1% to 6%.

**Vapor Suppression:** The use of foam to suppress hazardous vapors or prevent ignition in the event of an accidental spillage of a hazardous liquid.

**Venturi:** A constricted portion of a pipe or tube, which will increase water velocity, thus momentarily reducing its pressure, and simultaneously creating a vacuum. In this reduced pressure area, foam concentrates are introduced into the water stream of many types of proportioning equipment.

**Viscosity:** The thickness of a liquid or its ability to flow. Normally measured in Ostwald U-tube viscometers giving kinematic viscosities in Centistokes (cs), which are equivalent to mm<sup>2</sup>/sec (SI units). Viscosities can also be quoted in a wide range of other units, most commonly as dynamic viscosity in Centipoise or Poise.

**VS:** Vapor Suppression.

**VSA:** Vapor Suppression Additive. Additive used in combination with conventional foam concentrate to produce super-stable suppressing-suppressing foam blanket.

**WEP System:** Water Expansion Pumping Systems. Today largely superseded by CAFS.

**Wetting Agent:** A chemical that, when added to water, reduces the surface tension of the solution and causes it to spread and penetrate exposed objects more effectively. A wetting agent may, or may not be a foam concentrate.

**Wicking Effect:** Occurs when non-aspirated AFFF applied to un-ignited spillage of low volatility/high flash point fuels (e.g. aviation kerosene) causes fuel to ignite more readily.

