

# Are We Protecting Our ARFF Firefighters?

by Jack Kreckie

## ARE WE PROTECTING OUR ARFF FIRE FIGHTERS?



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**FACT:** Firefighting is a dangerous occupation. Those of us in the business are aware of the obvious hazards of firefighting, such as heat, flames, toxic products of combustion and structural collapse. In addition to the risk of injuries, firefighters are at risk for Heart Disease, Cancer, Chronic Respiratory Disease, Hepatitis B and C and stress. When entering an Immediately Dangerous to Life and Health (IDLH) environment, firefighters are much better today than in years past in ensuring that they are protected with full personal protective equipment. The key word here is "better". Images on the news routinely still show firefighters engaged in overhaul or carrying a tool up an aerial to pass off to the roof team without SCBA. These images remind us that there are failures every day that contribute to the increase in firefighter Line of Duty

Deaths (LODD) and job-related injuries. As a fire officer, this is totally unacceptable. How can this still be happening in 2018? Are there really departments that still don't have Personal Protective Equipment (PPE) SOPs, or is it a failure in compliance? In my opinion, if fire departments today are not providing the training, equipment and policies that protect firefighters from these well-known hazards, it is not just an error or omission, but rather a criminal act. Rather, if firefighters are violating procedure by not being fully protected while in an IDLH atmosphere, and the Company Officers and Safety Officers are not enforcing the rules, we have another problem. This most likely can be attributed to old school images and the culture of the fire service. As a young fire fighter in 1976, I wore rubber boots that I pulled up to my thighs or rolled down to just below my knees. Our Self-Contained Breathing Apparatus (SCBA) were demand breathing rather than positive pressure. We all shared the same mask assigned to the SCBA. There was no sizing or fit test conducted, and we used our discretion whether to wear breathing apparatus. We never "masked up" for a car fire, dumpster or outside firefighting position. We were so proud to be standing around at a fire with soot on our face and "black phlegm" running from our nose. We rode in open cabs with no seat belts and stood on the back step holding on as the truck raced to the fire. You cannot make this stuff up. Hopefully this sounds crazy to you! That



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means you have probably been on the job 25 years or less. If you are still seeing this on the fire ground, we are in even more trouble than I thought.



**Riding the back step was a popular riding position**  
**Photo Mike Schlags - "Firefighter Nation" October 7, 2008)**

If firefighters are putting themselves in harm's way by not using PPE appropriately and officers are not enforcing the rules, we need a significant culture change. We also know that these obvious hazards are not the only thing that threatens the health and safety of firefighters. There are new threats emerging every day. We have dirty bombs, Improvised Explosive Devices (IEDs), weaponized chemical microbial and biological agents, attacks on communications infrastructure, epidemics, pandemics and failures in training. Never have we needed to be better prepared to safely fulfill our mission.

### **Current Threats**

We have known for many years that Perfluorooctane Sulfonate (PFOS) is associated with health risks. In 2002, PFOS was classified as persistent, bio-accumulative and toxic (PBT) in the 34th Organization of the Environment, Health and Safety, (OECD) Chemical Committee meeting. In the same year, 3M voluntarily withdrew from the AFFF foam business as PFOS was part of the 3M foam chemistry. Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) are part of a larger group of chemicals called per- and polyfluoroalkyl substances (PFASs). These chemicals have been and, in some cases, are still used as surfactants to improve the effectiveness of Class B foams. These chemicals were found to be contaminants in drinking water supplies in various areas, with a high concentration around U.S. Air Force bases. In 2013, the Air Force reported that perfluorinated compounds (PFCs) were found at every Air Force Base in the U.S. In 2014, the level of PFOS in one of the wells serving Pease AFB was 12 times a provisional safety level set by the EPA, so high, in fact, that the city shut down the well.

The EPA Technical Fact Sheet - Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA), November 2017, states the following.

- Human epidemiological studies found associa-

tions between PFOA exposure and high cholesterol, increased liver enzymes, decreased vaccination response, thyroid disorders, pregnancy induced hypertension and preeclampsia, and cancer (testicular and kidney). (EPA 2016e)

- There is suggestive evidence that PFOS and PFOA may cause cancer. (EPA 2016d)
- The American Conference of Governmental Industrial Hygienists (ACGIH) has classified PFOA as a Group 3 carcinogen – confirmed animal carcinogen with unknown relevance to humans. (Group 2B) (IARC 2016)



**Foam release during training and testing has been routine for decades**

### **Exposure Sources**

PFAS have been used in manufacturing around the world since the 1940s. The chemicals don't break down in the environment or in the human body and they accumulate over time. The Environmental Protection Agency (EPA) uses the term "PBT", persistent – bio-accumulative – toxic.

Look at that title closely:

Persistent = does not break down in the environment.

Bio-accumulative = builds up over time in the body.

This includes other protein-rich compartments in fish, birds and marine mammals. Consider the food chain, contaminated plants or fish eaten by an animal, which is eaten by a person. The accumulation increases with each step in the food chain.

Toxic = As firefighters, we understand toxicity. We strive to avoid any level of toxicity. There are various studies to examine toxicity from ground water contamination, adverse effects in adults (e.g., liver and kidney toxicity). Developing fetus and newborn are particularly sensitive to PFOA-induced toxicity.

Do we need to wait for additional long-term studies on the effects of exposure to products containing these PBT products? I think NOT!

PFAS are present in a number of household and workplace items such as:

- Food grown in contaminated soils, and or watered with contaminated water





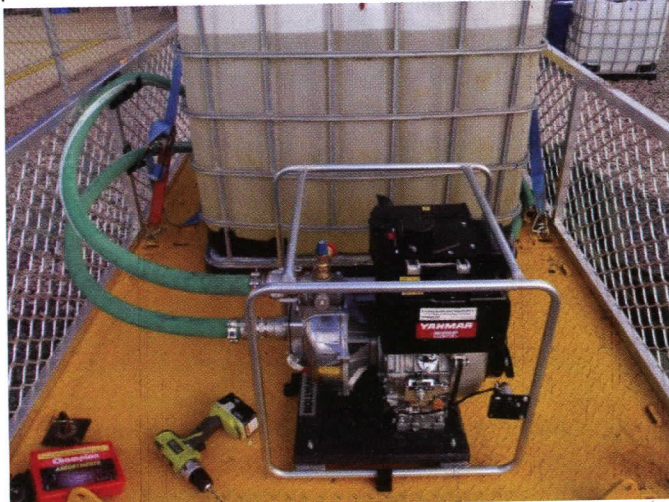


Manufacturer's Designation for the proposed foam concentrate as well as a current MSDS for the same product. The bidder must also include a copy of the current page from the QPL that shows the proposed foam by the same manufacturer's designation and percentage, with a GREEN light in the CAGE Code column.

Another consideration when ordering foam is the container size. How is the foam being put in the truck? The least desirable method is with 5-gallon cans. Each can must be carried to the top of the truck. This might be accomplished by establishing a line of firefighters (bucket brigade) to pass the cans up or hoisting a pallet to the area adjacent to the truck and carrying them to the fill point. Either way, there is a great deal of lifting which puts firefighters at risk for injury. Next it is poured into the foam reservoir or pierced on the foam cutter. There will always be some spilling, which creates a slipping hazard and, as we now know, the product spilled is a chemical with health hazards. The person pouring is also exposed to the foam vapors. Further discussion on this is discussed later in this article. Once complete, we have all these empty foam cans. Can they be thrown in the dumpster? The airport's environmental department should be consulted for the proper disposal method. In the past, those cans were rinsed out. This should obviously not be done anymore, as the rinsate only further adds to contamination if released on the ground.

The best method of transferring foam is by pumping it from the container in which the foam was delivered through the 1.5" bottom fill connection to the foam reservoir on the ARFF vehicle. The larger the vessel containing

the foam, the less of a problem disposal of the vessel will be. Foam totes may vary in size, but 265 gallons is typical. It will cost less per gallon than 5-gallon cans or 55 gallon drums and involves less contact with the foam than smaller containers. Many ARFF vehicles come with a foam transfer pump. They are relatively slow, but they are convenient when topping off the foam tank. Higher capacity pumps can be purchased and positioned on top of, or adjacent to, the tote while pumping into the bottom fill connection. Ensure that someone is posted on top of the truck monitoring the fill so that the tank is not over filled. The person on top of the truck will still be exposed to some degree to fumes as the concentrate tank fills and pushes the air out of the tank. Appropriate PPE should



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be provided to anyone involved in the foam transfer, including respiratory protection, for at least the person positioned near the foam reservoir cover or vent on the top of the truck.

### **Personal Protective Equipment for Handling Foam Concentrate**

Regardless of the method used to transfer foam, there is always a risk of exposure to personnel with foam concentrate. Although the fire service has known for years that AFFF concentrates that contain PFOS / PFOA are a confirmed health hazard, little has been said about protecting firefighters when they handle foam. During fires where foam is being applied, firefighters must be fully protected while in the hot zone. If those firefighters have foam on their PPE, should they be de-contaminated when leaving the hot zone? Perhaps bagging the gear and returning to quarters for proper laundering is a better option. Laundering gear is another practice that needs to be more widely accepted. In the past, having burned or sooty gear was a badge of honor. It was "duty" not dirt on the gear. If it was suggested that the gear should be laundered, it was often rejected because "rookies have clean gear". During station tours, that same gear is used in posing with children for pictures to remember their fire house visit. The IAFF paper: PFOA and Turnout Gear, (November 2017) cites: "A study of 101 California firefighters found similar PFOA levels compared to the US population, however levels were higher in firefighters whose turnout gear had not been professionally cleaned in the prior year". The report concludes that: "This may indicate that PFOA, like many other chemicals in smoke, permeates turnout gear and later off-gases, posing a continued risk of exposure until the gear is cleaned".

Concerns have also been raised about the use of fluoropolymers in the manufacturing process for turnout gear. A number of PPE manufacturers used fluoropolymers to treat the outer shell of the gear as a repellent finish to prevent absorption of water and other fluid contaminants. PFOA's have been largely phased out in the last decade, but may still be present in turnout gear still in use.

Other related important issues for consideration are foam concentrate handling during reservice, testing, training or repairs? An SOP / SOG regarding PPE to be worn while handling foam concentrate should be issued by the department. Certainly, airports should not be waiting for the state or federal government, or the FAA to inform them that firefighters should not be exposing themselves to a chemical that has been associated with multiple medical disorders and may be a carcinogen?

Granted, there is still a great deal to learn about PFOS / PFOA contamination. In my opinion, we know enough to take precautions to protect our firefighters and anyone else that may encounter foam concentrate. A foam leak on the floor, tracked into the living area of the fire station, provides opportunity for transfer to bare feet or other exposed skin. Foam that spills on a uniform may soak through and be absorbed by the skin. Foam on bunker gear may continue to off-gas, providing an exposure every

time the gear is worn.

### **Time for Action**

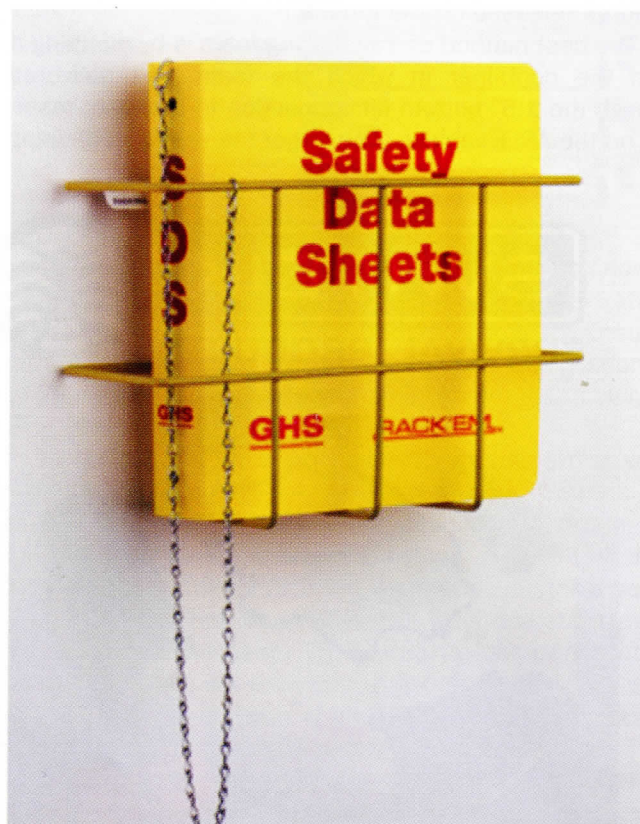
The time is now! There is no benefit to waiting for a higher command to take steps to protect firefighters from exposure to PFOS and PFOA. Every day that exposures continue is a day that the cumulative damage from contamination can continue. The following suggested actions are a good start to reducing or preventing exposure to PFOA and PFOS.

1) If not already in place, institute mandatory intervals for bunker gear laundering in compliance with the manufacturer's recommendations for laundering. If this policy was not previously in place, all gear should be scheduled for initial cleaning.

2) If not already in place, implement an SOP / SOG for exposures that would require turnout gear to be laundered. This SOP / SOG should include a method of securing the gear at the scene, e.g. bags, drums, etc.

3) If not already in place, implement an SOP / SOG for safe handling of foam concentrates which includes transfer methods that pose the least risk of foam release, PPE required and clean-up methods for inadvertent exposures.

4) If not already in place, implement an SOP / SOG for safe methods of conducting FAA mandated foam testing.



### **What do the Safety Data Sheets (SDS) Tell Us?**

The Occupational Safety and Health Administration (OSHA) "Hazard Communication Standard" (HCS) (29 CFR 1910.1200) states:

*Employers are required to maintain SDSs (or MSDSs) for each hazardous chemical they use. The HCS does not*



specify how the SDS (or MSDS) is to be maintained (e.g., paper, electronic), as long as employees have immediate access to the SDS (or MSDS) in their work area. (Note: Older versions of SDSs (or MSDSs) may still need to be maintained as an employee exposure record under OSHA's Access to employee exposure and medical records standard, 29 CFR 1910.1020).

Is AFFF a "hazardous chemical"? It is not regulated by the Department of Transportation (DOT), requiring placards for transportation. Is it a requirement to maintain an SDS for all the firefighting foams stored at the airport? An argument can be made that OSHA does not have jurisdiction in certain departments, but that does not relieve the authority having jurisdiction from protecting its employees.

### OSHA – Occupational Safety and Health and Health Administration

OSHA provided the following response on October 26, 2018, to a written inquiry asking: if firefighting foams containing PFOS or PFOA's are considered a hazardous chemical under the hazard communications standard.

Information developed by the U. S. Environmental Protection Agency (EPA) and the European Chemicals Agency (ECHA) regarding per- and polyfluoroalkyl substances (PFAS), including perfluorooctanoic acid (PFOA) or perfluorooctanesulfonic acid (PFOS), indicates that long-term exposure to these chemicals are likely to cause adverse health effects. OSHA has not performed a hazard classification for these chemicals, however, EPA and ECHA have determined that these chemicals are bio accumulative and bio persistent.

Studies in humans have indicated that exposure to PFOS and PFOA have been associated with increased cholesterol levels, adverse immune effects, thyroid hormone effects (PFOS) and cancer (PFOA). The EPA determined that high concentrations of PFOA and PFOS can cause reproductive, developmental, liver, and kidney damage, as well as immunological effects and tumors in experimental animals.

ECHA has determined that PFOS and PFOA should have the following hazard classification:

PFOS

Acute toxicity (inhalation, oral), category 4

Carcinogen, category 2

STOT RE category 1

Toxic to reproduction, category 1B

PFOA

Acute toxicity (inhalation, oral), category 4

Eye damage, category 1

Carcinogen, category 2

STOT RE, category 1

Toxic to reproduction, category 1B

Based on the findings from these two authorities, OSHA would expect Safety Data Sheets for materials containing these chemicals to include these hazard classifications.

References:

US EPA [www.epa.gov/PFAS](http://www.epa.gov/PFAS)

ECHA C&L inventory <http://echa.europa.eu/information-on-chemicals/cl-inventorydatabase>

### NFPA Rating - Health

Although each foam concentrate that meets the Mil

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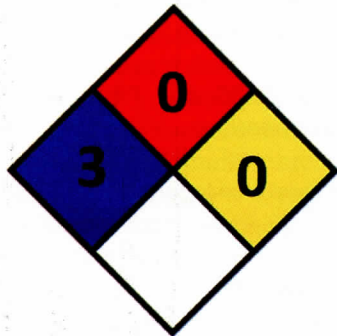
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Spec requirements, will equally suppress a Class B fire and meet expansion and drain down performance requirements, they are each of a different formula. Each proprietary formula uses different ingredients and quantities of ingredients. It is interesting to note that of the foams listed



on the Qualified Product Database (QPD), one of the manufacturers did not include an NFPA Health Hazard rating. The Health rating provided in the SDS for the other concentrates included two with Health ratings of 1, one with a Health rating of 2 and one with a Health rating of 3.

### Warnings

Each SDS includes warnings as related to the product. Not all these warnings are described the same way on each SDS, as illustrated below. In some cases, the warning may refer to a specific ingredient in the foam concentrate, while others refer to the foam concentrate itself. These examples are taken from different SDSs, but all were selected for review, because they appear on the QPD.

- Disposal: Liquid wastes not permitted in landfill
- California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). WARNING, this product contains a chemical known to the State of California to cause cancer and/or reproductive / developmental effects: Ethyl alcohol, Ethylene Glycol
- Respiratory: Avoid breathing vapors or mist
- Causes serious eye irritation
- Principal Routes of Exposure: Eye Contact, Skin Contact, Inhalation, Ingestion
- OSHA Regulatory Status: This chemical is considered hazardous by the 2012 OSHA Hazard Communications Standard (29CFR 1910.1200)
- Wear protective gloves/protective clothing/eye protection/face protection
- SARA 311/312 Hazard Categories  
Acute Health Hazard Yes Chronic health hazard No  
Fire Hazard No Sudden Release of Pressure Hazard No  
Reactive Hazard No
- Respiratory Protection will be necessary if a mist forms or if professional exposure levels are exceeded.
- If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
- Do not eat, drink or smoke when using this product. Handle in accordance with good industrial hygiene and safety practice

Browse through the SDS for the foam that is in your truck. I don't need a placard or a letter from OSHA to tell me that this is a hazardous chemical. In nearly three

decades in ARFF, I never considered it hazardous. As a rookie ARFF firefighter, my airport used fluoro-protein foam. Nobody had to tell me to avoid getting it on me or wash thoroughly after getting exposed. The odor told me, and I complied quickly. AFFF was different, i.e., it was clean looking and didn't smell bad. I conducted foam testing on all the apparatus for years. I handled the foam, got it all over me and didn't give it a second thought. It seemed harmless, but I was diagnosed with prostate cancer at age 50.

### What Now?

Handling hazardous chemicals is not new to the fire service. We simply recognize the threat of that chemical and protect ourselves accordingly. We would like to think we get smarter as we go. Years ago, it was common for fire departments to wash fuel spills down the storm drains. Apparently, it seemed like a good idea at the time. We carry dry chemical fire extinguishers on our trucks. We are not afraid of dry chemical powder, but if you have ever walked into a cloud of dry chemical without SCBA, you will develop a whole new appreciation for taking your next breath.

Anyone handling foam or foam concentrates needs to treat the foam for what it is - a hazardous chemical. Use common sense, consult available resources, such as your hazmat team and environmental departments, to help you draft procedures. The following are some common-sense considerations that may help in the development of these procedures.

- If your bunker gear gets contaminated with foam at a fire, bag it, bring it and clean it in accordance with the bunker gear manufacturer's cleaning recommendations.
- Consult your environmental department for any policy relative to reporting foam releases.
- Use all the foam you need to control and extinguish a fire. Beyond that, minimize the amount of foam discharged, as it is contaminating the environment.
- Consult your environmental department to identify an approved method of discharging foam during foam testing. If the airport has a deicing pad with a recovery system for deicing fluid, that may be an option. Another possibility is a designated pad that can be cleaned by a hazardous material cleanup company (vacuum truck).
- Consult your environmental department for an approved method of disposal of empty foam cans or drums.
- Develop a procedure for wearing PPE when handling foam concentrate for testing, training or maintenance. Also, consider the following:
  - Limit all unnecessary exposure
  - Wash with soap and water after handling
  - Wear Tyvek Suit with booties
  - Wear rubber, latex or nitrile gloves
  - Wear Goggles
  - Wear respiratory protection, SCBA or approved respirator. One HazMat team I consulted suggested a P100 or R100 mask at a minimum



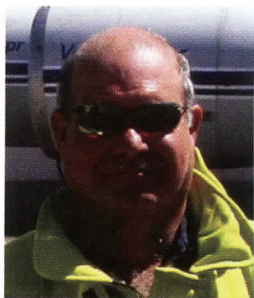
## The Future

FAA Reauthorization Act of 2018 was signed into law on September 24, 2018. There is specific language in Section 22 that directs the FAA to approve a fluorine free foam that meets the requirements of AC 150-5210-6D, "Aircraft Fire Extinguishing Agents" and 14 CFR Part 139.319 in no more than 3 years.

### SEC. 332. Airport Rescue and Firefighting.

(a) *Firefighting Foam.* – Not later than 3 years after the date of enactment of this Act, the Administrator, using the latest version of National Fire Protection Association 403, "Standard for Aircraft Rescue and Fire Fighting Services at Airports", and in conjunction with the Administrator of the Environmental Protection Agency, aircraft manufacturers and airports shall not require the use of fluorinated chemicals to meet the performance standards referenced in Chapter 6 of AC No: 150/5210-6D and acceptable under 139.319(l) of Title 14, Code of Federal Regulations

Based on the directive issued by Congress, there will be a new foam approved to replace the current AFFF. It will be fluorine free and hopefully will have a lower health hazard rating. At that time, a decision will be made relative as to how to phase out the AFFF or how to dispose of it. The new product will undoubtedly be safer for users and the environment based on current findings of scientists and environmentalists. At one time cigarettes were presumed to be safe, lead based paints were amazing, and DDT killed every insect in your vegetable garden. The bottom line is that firefighters should be protected from every possible hazard, regardless of how "green" the product is described to be.



**About the Author:** Jack Kreckie has dedicated over 40 years to emergency services. He is a retired Deputy Fire Chief from Massport Fire Rescue and a past Fire Chief of Komo

Airfield in Papua New Guinea. He is a past Chairman of the ARFF Working Group and holds the distinction of ARFF Legend. Jack is the Chief of Operations for ARFF Professional Services, LLC and founding partner of FleetChek, LLC. He

currently serves as ARFF Subject Matter Expert (SME) for General Dynamics Informational Technologies, supporting the ARFF Research Team at the FAA William J. Hughes Technical Center in Atlantic City, New Jersey. Jack can be reached at Jack.Kreckie@comcast.net.



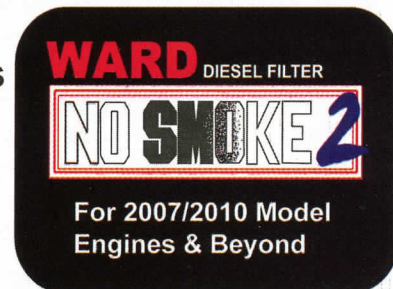
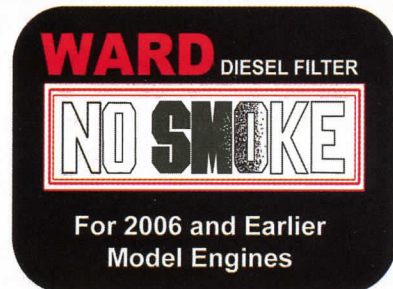
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