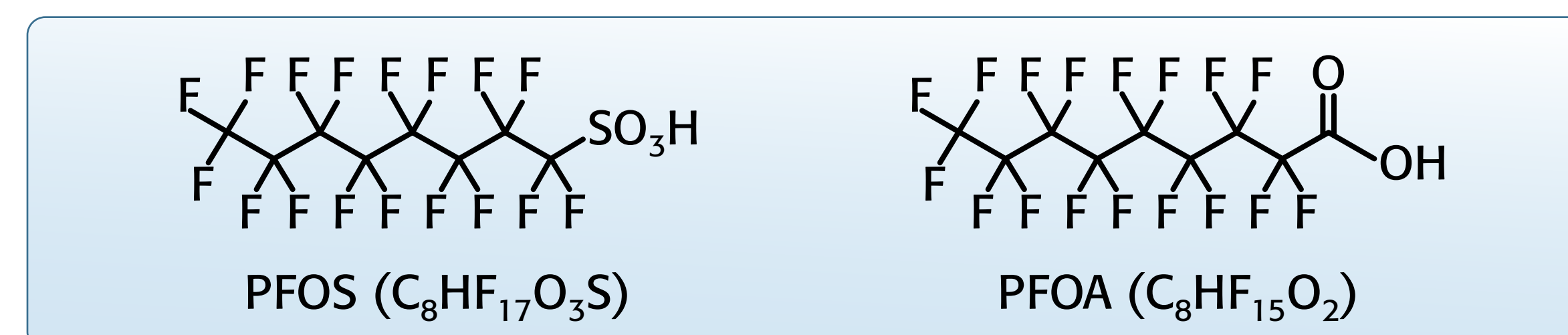


Increasing Regulation of Perfluorinated Compounds and the Potential Impacts at Air Force Installations

Andrew Rak and Catherine M. Vogel, Noblis

Abstract: Perfluorinated compounds (PFCs), such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) have been used in a variety of industrial and military applications, including the manufacturing (through 2001) of fluorochemical surfactants (FCS) used in aqueous film forming foam (AFFF). PFOA and PFOS have attracted increased regulatory scrutiny because of their resistance to degradation, ability to bioaccumulate and growing evidence of toxicity in animal studies. Environmental releases of AFFF on Department of Defense facilities likely occurred from tank and supply line leaks, use of aircraft hanger fire suppression systems, and from fire fighting training activities. Limited available data from historical DoD fire training areas show concentrations of PFOA and PFOS in groundwater samples up to four orders of magnitude greater than risk-based advisory values.

PFOS and PFOA Content in AFFF:



AFFF is used to extinguish flammable liquid (e.g., hydrocarbon) fires. Military Specification MIL-F-24385F mandates the use of FCSs in AFFF to meet performance requirements. Additional ingredients include organic solvents (i.e., glycol ether), foam stabilizers, and corrosion inhibitors.



Figure 1. Firefighters work to put out a fire during an exercise on a mock fuselage at the Charlotte Aircraft Fire Training Center, Charlotte, NC.¹

Since the 1970s, most FCSs used in AFFF were produced by 3M using a PFOS-based electrochemical fluorination process.² These products contained PFOS and a small percentage of perfluorooctanoate (PFO; the dissociated form of PFOA).³ Since 3M's phase-out of PFOS in 2001, the FCSs in AFFF are produced via a telomerization process. Although the process is designed to yield molecules with a chain length <C₆, trace levels of PFOA may be present as an unintended byproduct.⁴

Recent Advisory and Regulatory Actions:

Initially, concern over contamination near PFC manufacturing facilities drove advisory and regulatory actions for PFCs. However, concern is growing to include other site types such as fire training facilities. Table 1 presents regulatory guidelines and action levels in effect for PFOA and PFOS.

Table 1. Regulatory Guidelines and Action Levels for PFOA and PFOS

Regulatory Guideline / Action Level	Media	PFOA	PFOS
USEPA Provisional Health Advisory (PHA) Values ⁵	Drinking Water	0.4 µg/L	0.2 µg/L
Minnesota Health Based Value (HBV) ⁶	Groundwater	0.5 µg/L (proposal to lower to 0.3 µg/L)	0.3 µg/L
New Jersey Preliminary Health Based Guidance ⁷	Drinking Water	0.04 µg/L	NA
North Carolina Interim Maximum Allowable Concentration ⁸	Groundwater	2 µg/L	NA
North Carolina Public Health Goal ⁹	Private Drinking Water Wells	0.63 µg/L for PFOA + PFOS	

NA – Guideline or action level not established

Additionally, a number of activities are underway to improve our understanding of PFCs in the environment and the human health effects of these compounds.

- PFOA is included on the USEPA Draft Contaminant Candidate List (3)¹⁰
- The Agency for Toxic Substances and Disease Registry is developing a Toxicological Profile for perfluoroalkyls.¹¹
- PFOA has been nominated for an International Agency for Research on Cancer monograph.¹²
- The Minnesota Pollution Control Agency is surveying fire training areas with potential for PFC contamination.¹³
- The European Union requires the removal of stockpiled PFOS-based AFFF from service by June 27, 2011.¹⁴
- Environment Canada requires the removal of existing stocks of PFOS-based AFFF by May 29, 2013.¹⁵

Fire / Crash / Training Sites:

Site Investigations under the Defense Environmental Restoration Program (DERP) have not included analysis for PFCs given their emerging status; thus no detections for PFOA in environmental media are included in the Component DERP databases (as of October 2008). The number of sites categorized as Fire/Crash/Training Sites within the DoD Knowledge-Based Corporate Reporting System (KBCRS) can serve as a surrogate for actual site data in estimating the potential scope of the problem from PFC contamination (Table 2). The majority (60%) of these sites are located on Air Force facilities. Additionally, the majority of these sites were estimated to have achieved Remedy in Place (RIP) and/or Response Complete (RC) by the end of fiscal year 2008.

Table 2: DoD Fire/Crash/Training Sites in the KBCRS Database

Service	Total Sites	Remedy in Place (RIP)		Response Complete (RC)	
		RIP ≤ 2008	RIP > 2009	RC < 2008	RC > 2009
Air Force	353	296	47	249	104
Army	94	7	6	79	15
Navy	132	115	17	51	56
DLA	3	1		3	
FUDS	12		1	7	5
Total	594	419	71	389	180

Data current as of October 2008. Note that not all sites included a date for RIP or RC in the KBCRS database.

Limited data on the concentration of PFCs in groundwater samples from historical fire training areas at Wurtsmith Air Force Base (AFB) MI, Tyndall AFB, FL and Naval Air Station (NAS) Fallon, NV are available.¹⁶ These data indicate maximum concentrations of PFOA and PFOS in groundwater up to four orders of magnitude greater than the USEPA's PHA values (see Figure 2 for PFOA data).

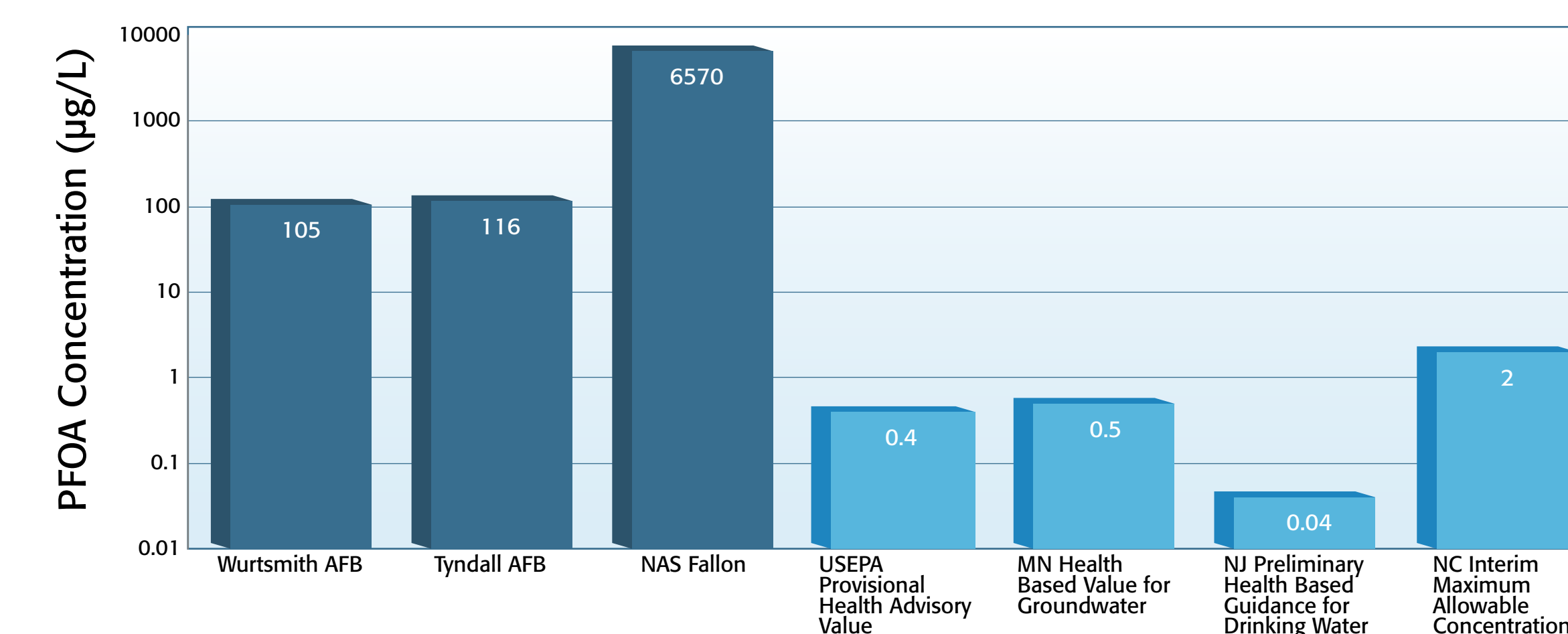


Figure 2. Maximum PFOA concentration observed in the groundwater at three DoD fire training areas and Federal and State guidelines for PFOA (µg/L)

Summary: The increasing regulatory scrutiny focused on PFCs is likely to adversely impact the DoD Cleanup Program. The historical use of AFFF for fire fighting and training activities released PFCs into the environment. Limited data indicate levels of PFOA and PFOS in the groundwater at fire training sites that exceed current USEPA Provisional Health Advisory values by up to four orders of magnitude. Given the limited nature of available site data, additional investigation of PFC contamination at these sites is advised to better define the scope and level of PFC contamination associated with the historical use of AFFF.

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