



PFAS IN BIOLOGICAL SAMPLES AT AFFF SITE, ALASKA

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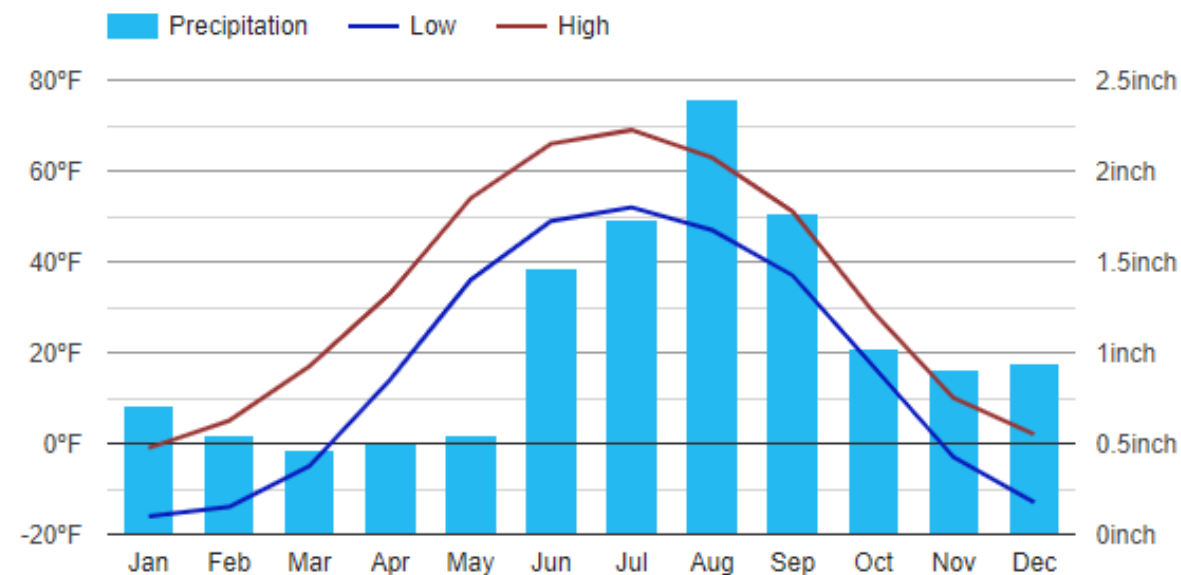
Jennifer Benning, PhD
Edward Heyse, PhD, PE
Bruce Henry, PG
Brian Blicher, PE
Mark Rigby, PhD
Karen Fields, PWS

SITE LOCATION AND CLIMATE



https://www.nationsonline.org/oneworld/map/USA/alaska_map.htm

Galena Climate Graph - Alaska Climate Chart



<https://www.usclimatedata.com/climate/galena/alaska/united-states/usak0092>

SITE AREAS: HISTORY AND AFFF SOURCES

Area 1

- Used 1950s – 1991 for fire protection training

Area 2

- Former fire station – constructed in 1972
- AFFF stored in drums and released in 2013 flood
- Fire engines washed inside (winter) and on asphalt so the south (summer)

Area 3

- Outfall of sanitary sewer system that serves the facility, including 2 former fire stations
- Wastewater potentially contains PFAS from AFFF and non-AFFF sources

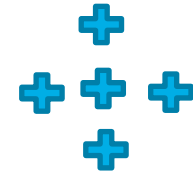


AREA 1: SAMPLING



Soils:

- 3 surface (0 -2 ft bgs) soils closest to nets



Biota:

- 3 locations with lethal pitfall trapping and netting
 - 5 traps in grid at each location
- Invertebrates: grasshoppers (*Melanoplus* spp.), bees (*Apidae*), spiders (*Araneae*), and flies (Diptera)
- Vertebrates: voles



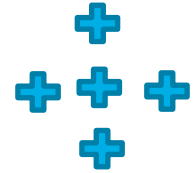
<https://www.newsweek.com/alaskapox-symptoms-origin-virus-1869177>

AREA 2: SAMPLING



Soils:

- 21 surface soil (0 -2 ft bgs)
 - Divided into East and West areas



Biota:

- 3 locations with lethal pitfall trapping and netting
 - 5 traps in grid at each location
- Invertebrates: grasshoppers (*Melanoplus* spp.), bees (*Apidae*), spiders (*Araneae*), and flies (Diptera)
- Vertebrates: voles



<https://www.newsweek.com/alaskapox-symptoms-origin-virus-1869177>

AREA 3: SAMPLING

Surface water : 11 samples

Sediment : 14 samples

Biota:

- 3 locations with 600-micron D frame net
- Aquatic Invertebrates: water beetles (*Dytiscus* spp.)



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METHODS: SAMPLE ANALYSES

- All samples were collected in 2022 field season
- All media analyzed for 25 PFAS compounds following QSM 5.3 Table B-13
- Biota samples:
 - Catches from individual traps in each area were composited
 - Vertebrate samples were whole animal, not organ-specific
 - PFAS compounds represent an average in each area
- Maximum of each PFAS compound in samples in the vicinity of each biota collection area
 - Considered representative of exposures by local biota
 - PFAS concentrations and presence of various compounds were highly variable



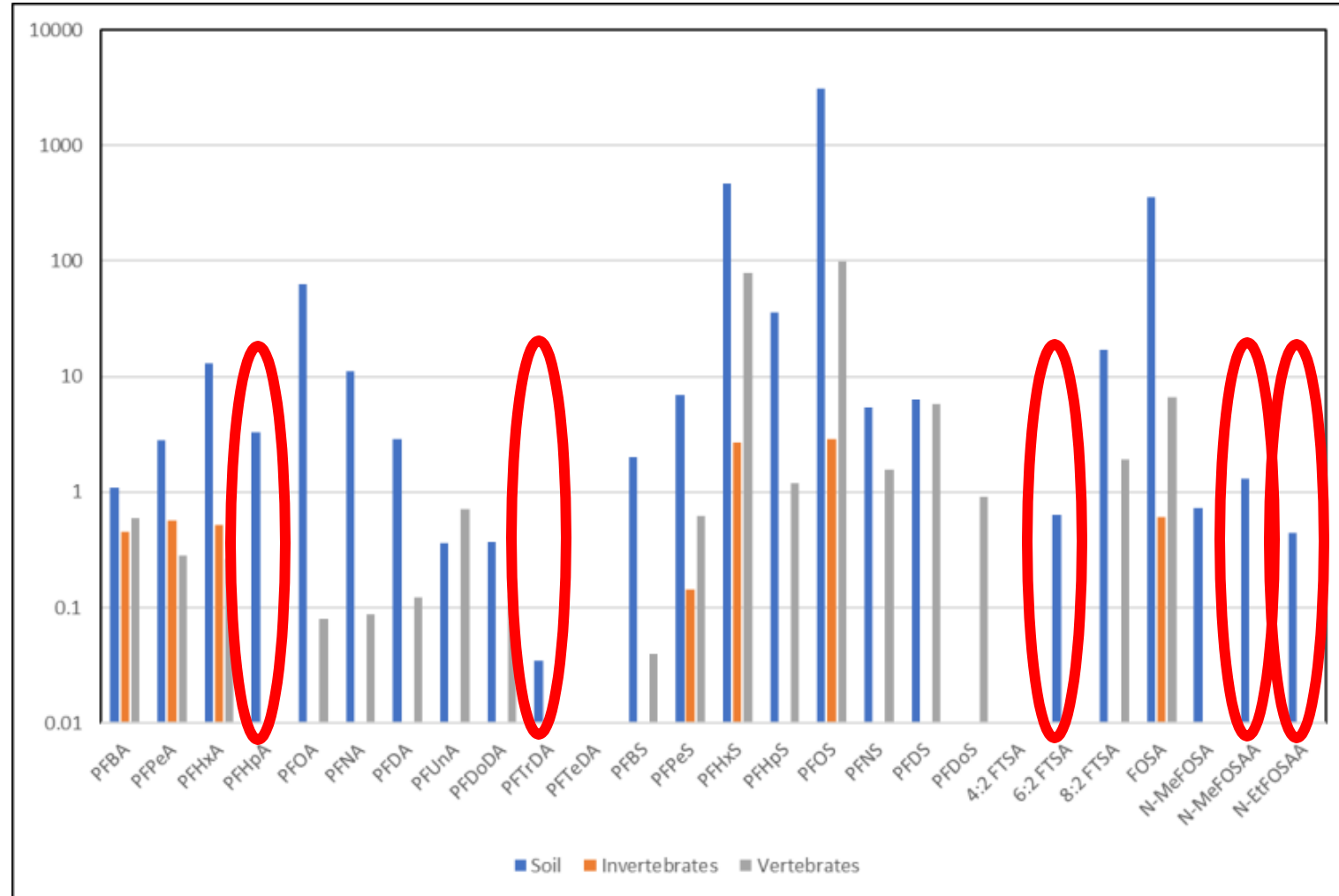
RESULTS AND LESSONS LEARNED

Not all PFAS compounds detected in soil or sediment were detected in biota samples.

Area 1: Fire training area

In soil, but not in biota:

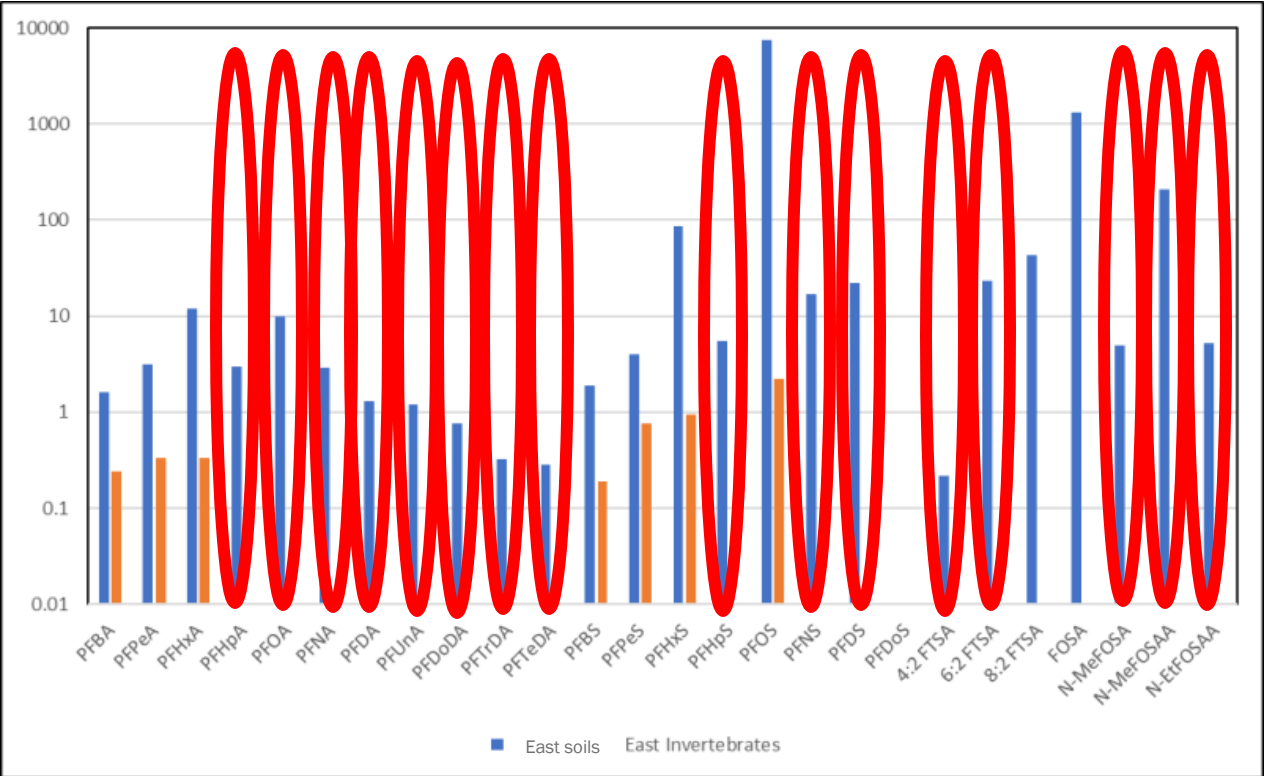
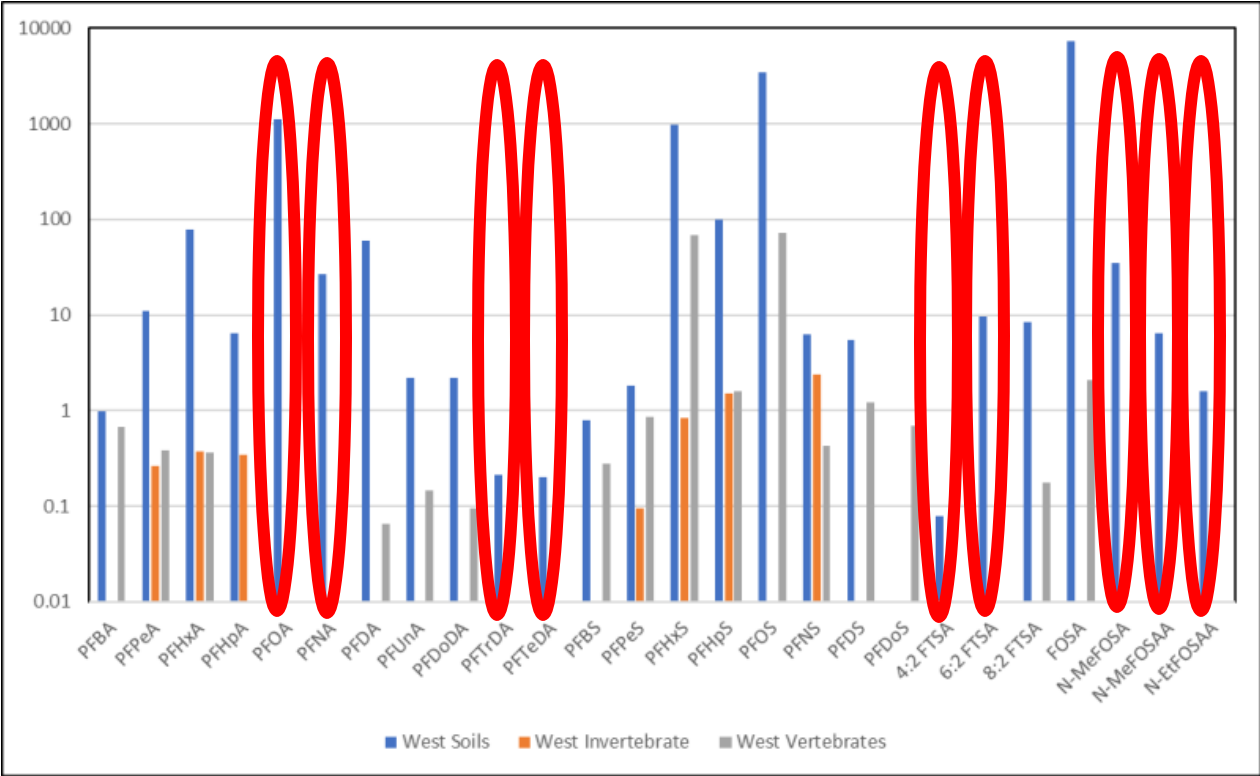
- PFHpA, PFTrDA
- 6:2 FTSA
- N-MeFOSAA, N-EtFOSAA



PFAS measured in µg/kg in soils, biota, sediment; in ng/L in surface waters

Not all PFAS compounds detected in soil or sediment were detected in biota samples.

Area 2: Former Fire Station



PFAS measured in µg/kg in soils, biota, sediment; in ng/L in surface waters

Not all PFAS compounds detected in sediment or surface water were detected in biota samples.



Area 3: Wastewater outfall

In surface water/sediment,
but not in aquatic
invertebrates:

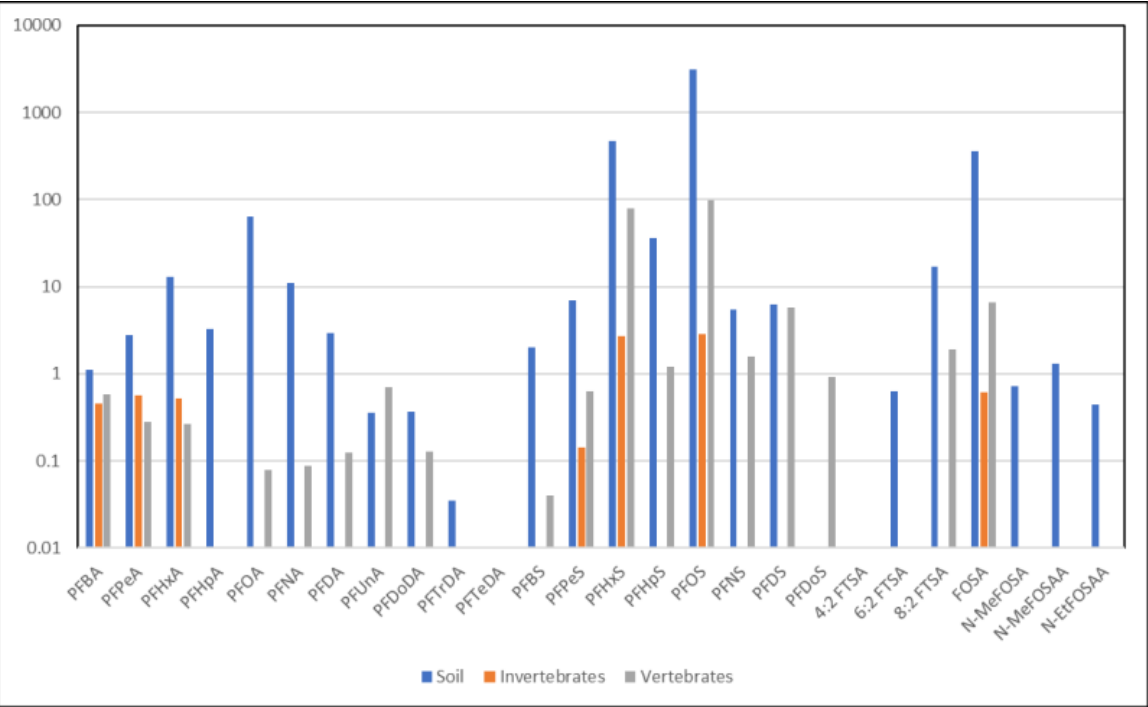
- PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnA, PFDoDA, PFTeA
- PFBS, PFPeS, PFNS, PFDS
- 6:2 FTSA, 8:2 FTSA
- N-MeFOSA



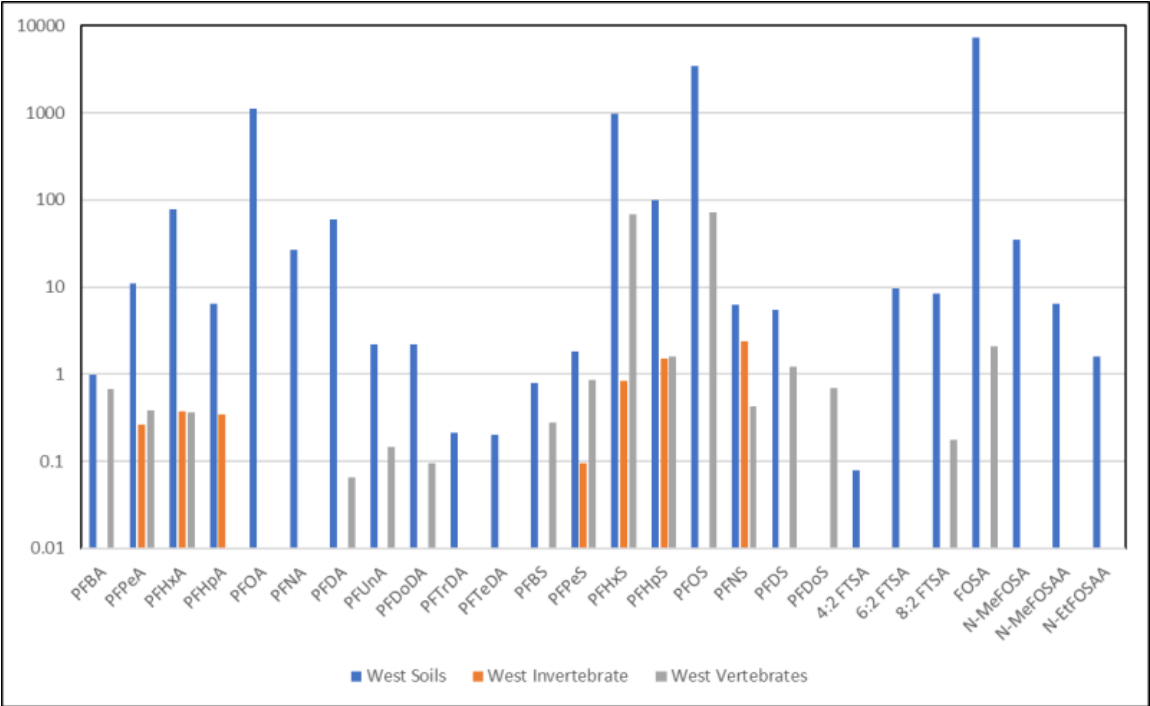
PFAS measured in µg/kg in soils, biota, sediment; in ng/L in surface waters



PFAS compounds detected in terrestrial invertebrates and vertebrates vary in type and magnitude.



Area 1



Area 2

	PFBA, PFPeA, PFHxA	PFHpA	PFOA, PFNA, PFDA, PFUnA, PFDoDA	PFTTrDA, PFTeDA	PFBS	PFPeS, PFHxS, PFHpS, PFOS, PFNS	PFDS	4:2FTSA	6:2 FTSA	8:2 FTSA	FOSA	N-MeFOSA, N-MeFOSAA, N-EtFOSAA
Soils	X	X	X	X	X	X	X	X	X	X	X	X
Terrestrial Invertebrates	X	X				X		X	X		X	
Terrestrial Vertebrates	X		X		X	X	X			X	X	

Perfluorocarboxylic acids (PFCAs)

- All detected in soil samples
- Most in sediments and surface water

Terrestrial invertebrates

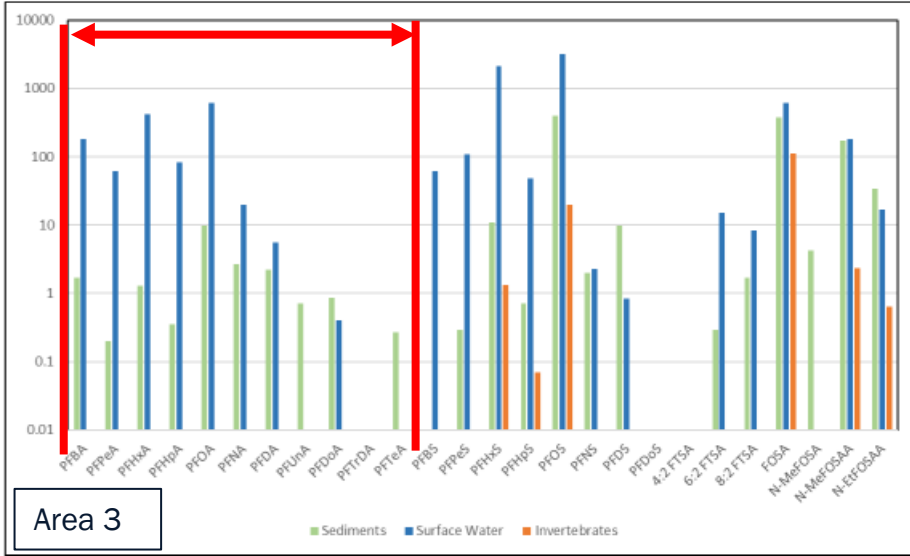
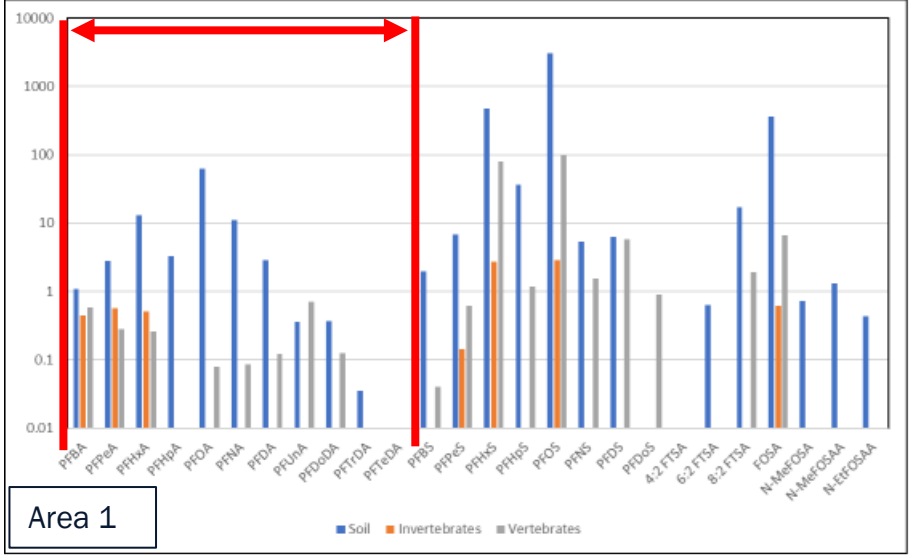
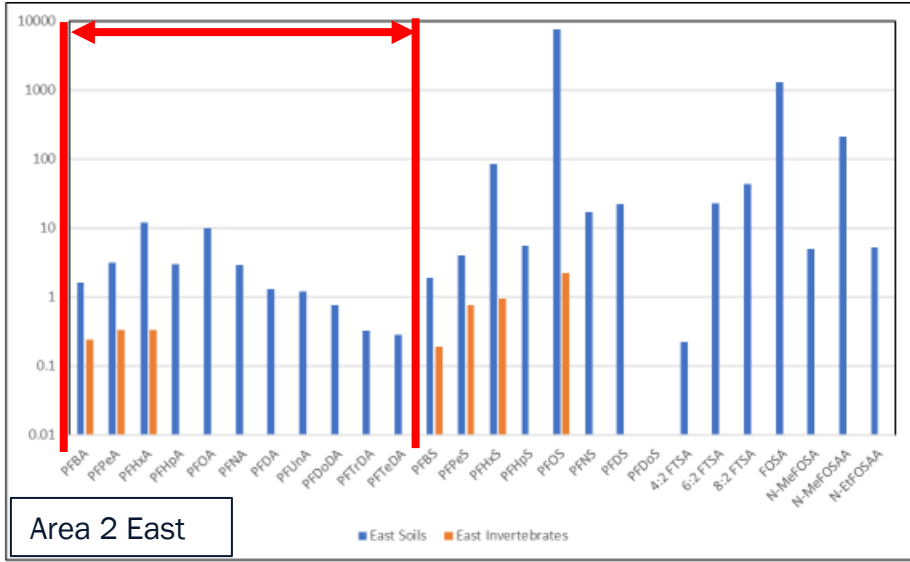
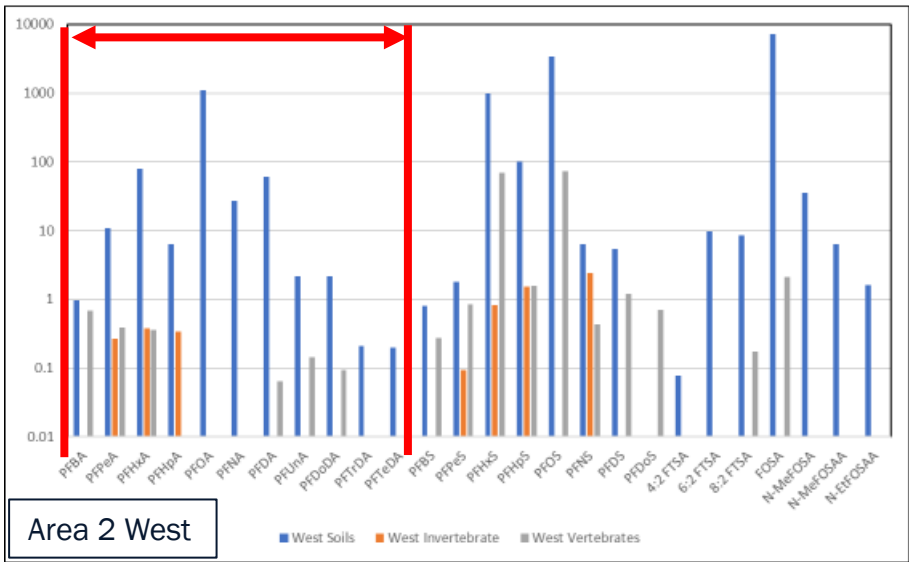
- Up to PFHpA (C7) detected

Vertebrates

- Heavier molecular weight, up to PFDoDA (C12) detected

Aquatic Invertebrates

- None detected



PFAS measured in µg/kg in soils, biota, sediment; in ng/L in surface waters

Perfluorosulfonic acids (PFSA)

- All detected in soil, surface water, and sediment samples

Terrestrial invertebrates

- Only up to PFNS (C9) detected

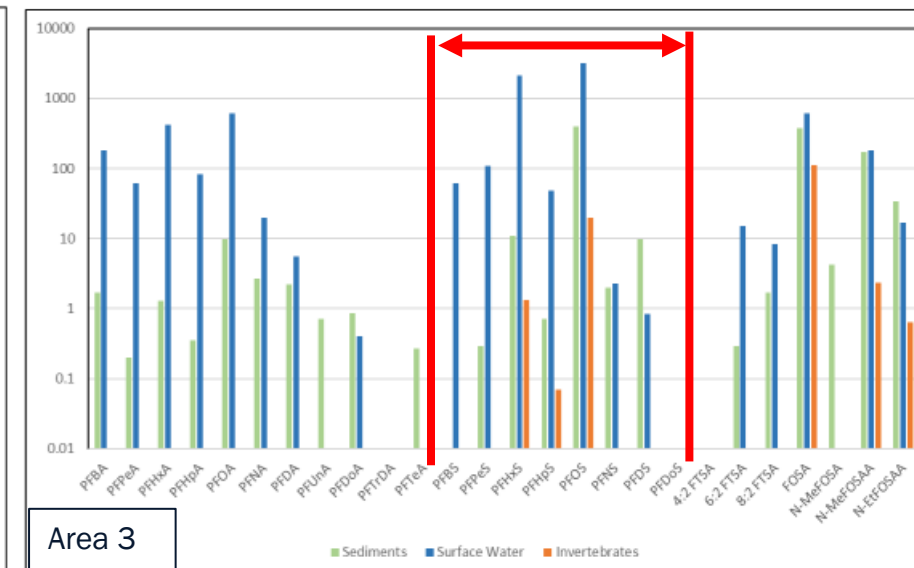
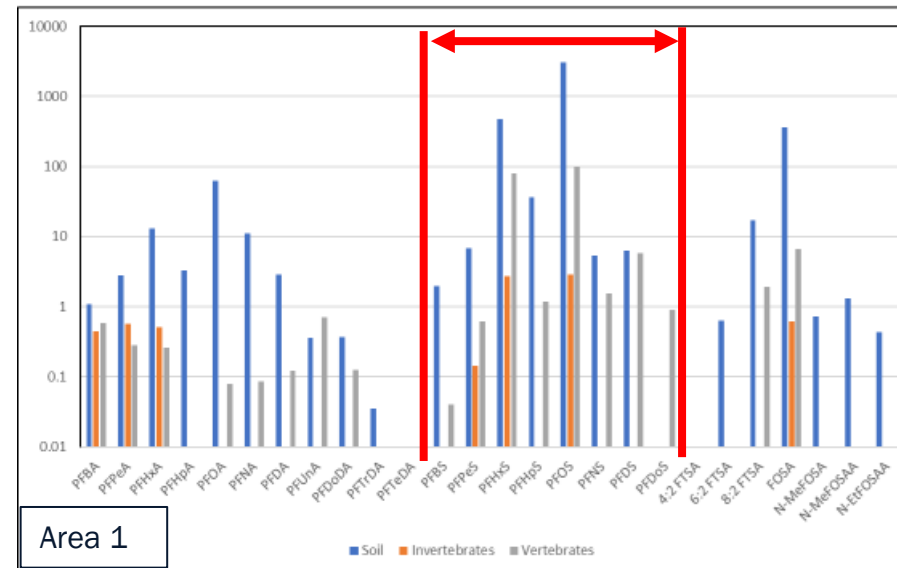
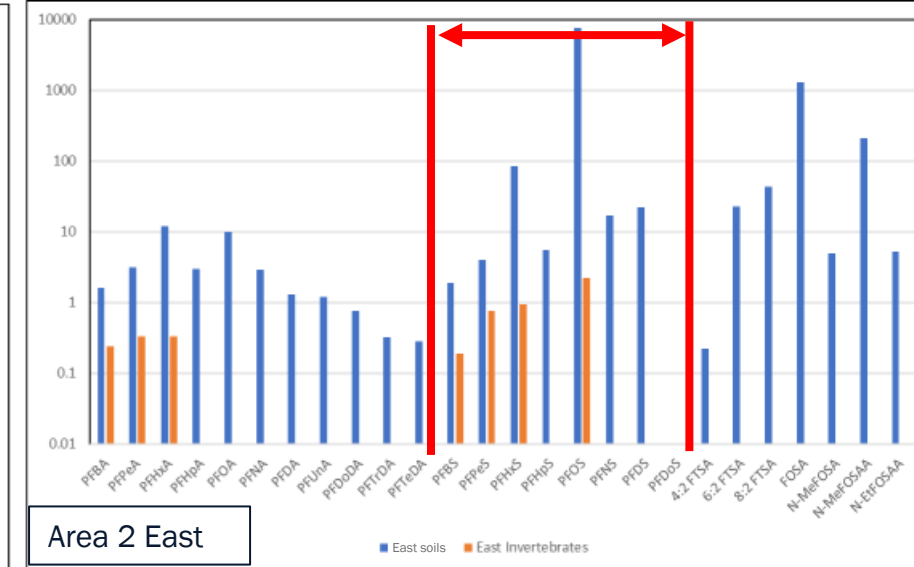
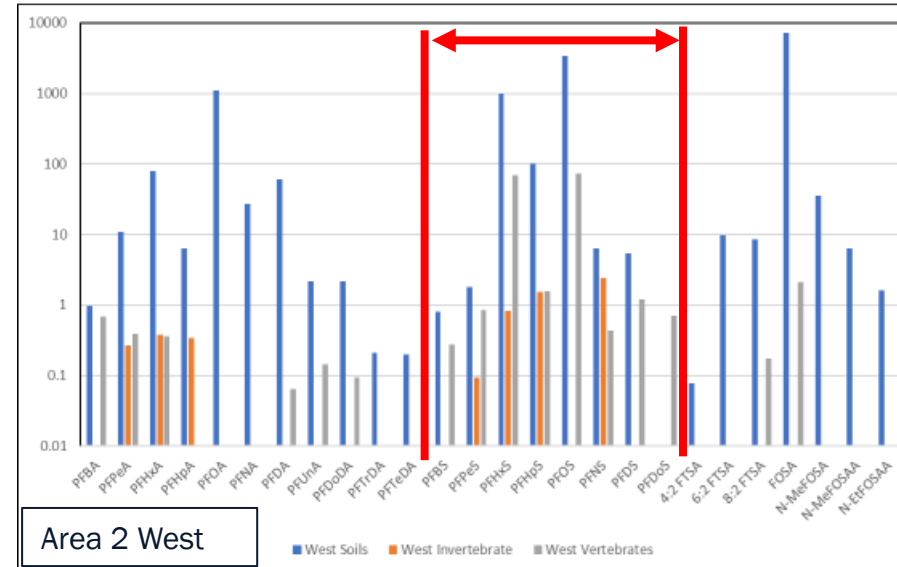
Vertebrates

- Heavier molecular weight, up to PFDoS (C12) detected

Aquatic Invertebrates

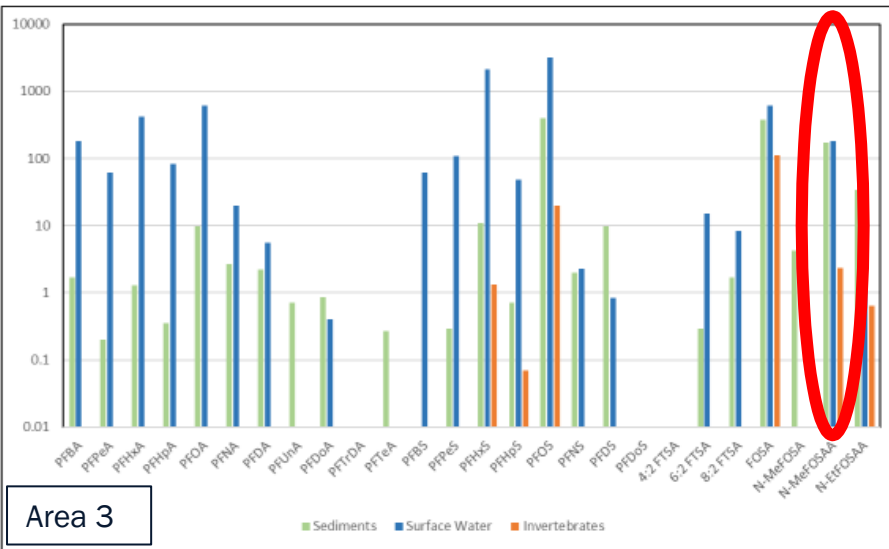
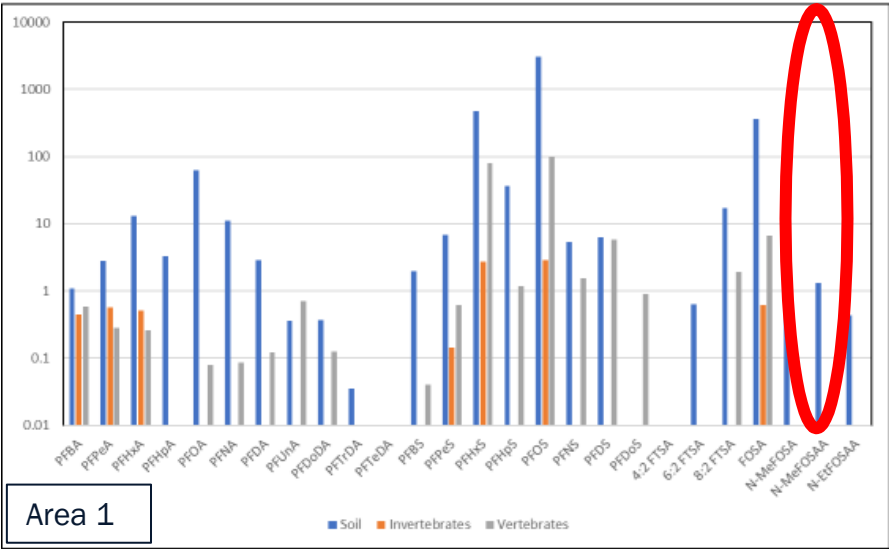
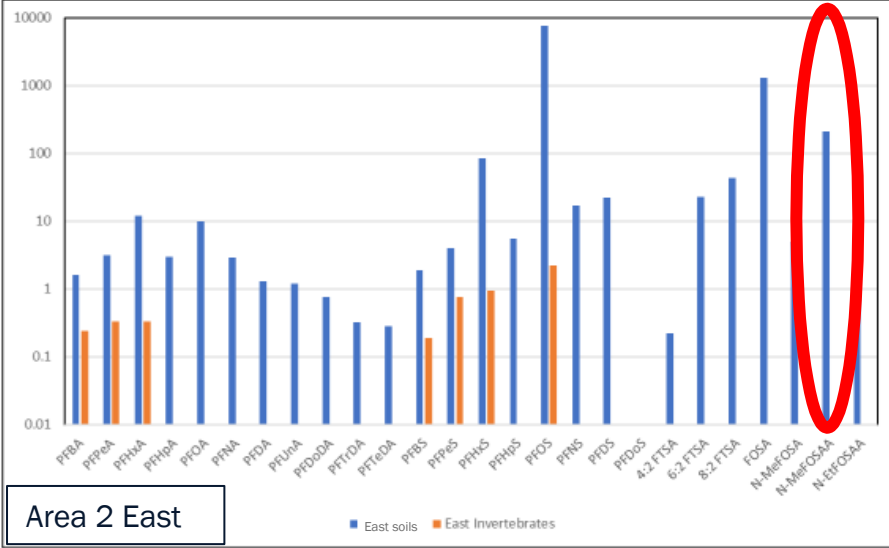
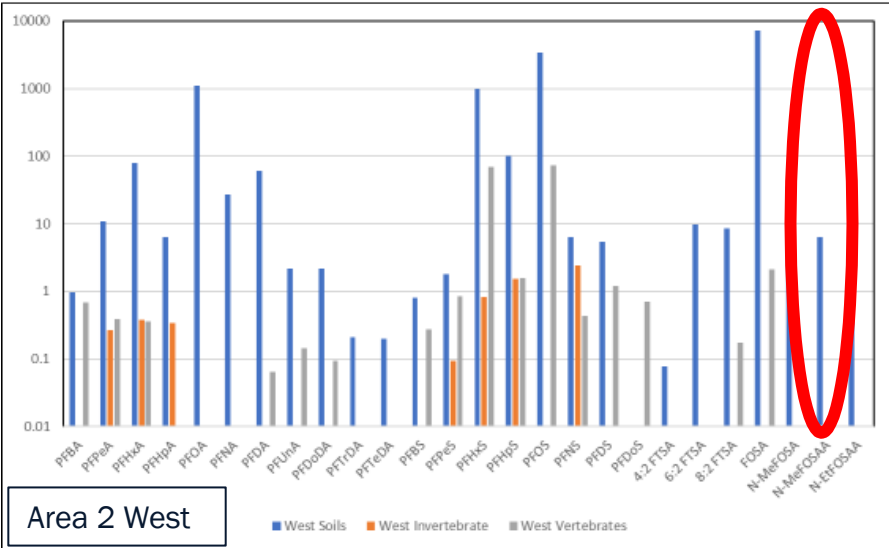
- Only up to PFOS (C8) detected

*PFDoS was not measured in soils, sediments, or surface water



PFAS measured in $\mu\text{g/kg}$ in soils, biota, sediment; in ng/L in surface waters

NMeFOSAA was detected at higher concentrations in sediment and surface water, and NMeFOSAA was detected in aquatic invertebrates but not in terrestrial biota.



PFAS compounds (excepting PFNA) that exceeded Argonne National Laboratory ecological screening values were detected in biota samples.



	Ecological Screening Level		Area 1			Area 2			Area 3		
	Soil (µg/kg)	Surface Water (ng/L)	Maximum Soil Concentration (µg/kg)	Maximum Invertebrate Concentration (µg/kg)	Maximum Vertebrate Concentration (µg/kg)	Maximum Soil Concentration (µg/kg)	Maximum Invertebrate Concentration (µg/kg)	Maximum Vertebrate Concentration (µg/kg)	Maximum Sediment Concentration (µg/kg)	Maximum Surface Water Concentration (ng/L)	Maximum Invertebrate Concentration (µg/kg)
PFBA	2,980	64,600	1.1	0.45	0.59	1.60	0.27	0.68	1.7	180	0
PFHxA	6,200	28,800	13	0.52	0.26	79.00	0.35	0.36	1.3	420	0
PFOA	3,840	307,000	63	0	0.08	1,100	0	0	9.9	610	0
PFNA	24.2	2,080	11	0	0.09	27	0	0	2.7	20	0
PFDA	67.7	660	2.9	0	0.12	60	0	0.07	2.2	5.5	0
PFBS	817	400,000	2.0	0	0.04	1.9	0.19	0.28	0	62	0
PFHxS	2.8	5,500	470	2.7	78.9	980	1.52	69	11	2,100	1.34
PFOS	8.7	117	3,100	2.87	98	7,500	2.4	72.5	400	3,200	20



**QUESTIONS,
COMMENTS,
DISCUSSION?**

THANK YOU!

Visit www.parsons.com or stop by our booth,
#135, to learn more.