EPA/EGLE Fume Suppressant Study

July 9, 2020

EGLE Water Resources Division (WRD), Emerging Pollutants Section

The United States Environmental Protection Agency (EPA) Region V

EPA Office of Research and Development (ORD)

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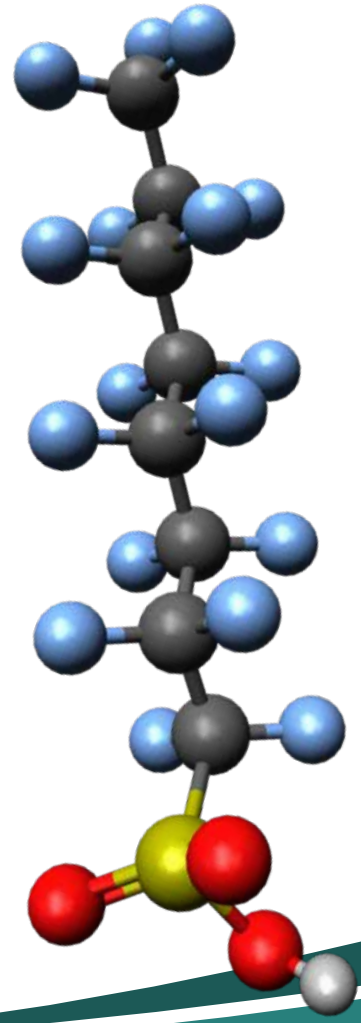
Agenda

- What are PFAS and Why are they Important?
- Chrome Platers & the PFAS Story
- EPA R5 Fume Suppressant/Effluent Study
- The Fume Suppressant & Surface Water Connection
- EPA/EGLE Fume Suppressant Study Design
- Results
- Q & A

PFAS—Class of Manufactured Chemicals

- **PFAS** – Per and Polyfluoroalkyl Substances
- Synthetic, used extensively for 70 years
- Useful properties: oil- and water-resistance
- PFAS of Concern for some Chrome Platers:
  - **PFOS:** Perfluorooctane Sulfonate
  - Used in fume suppressants prior to 2015



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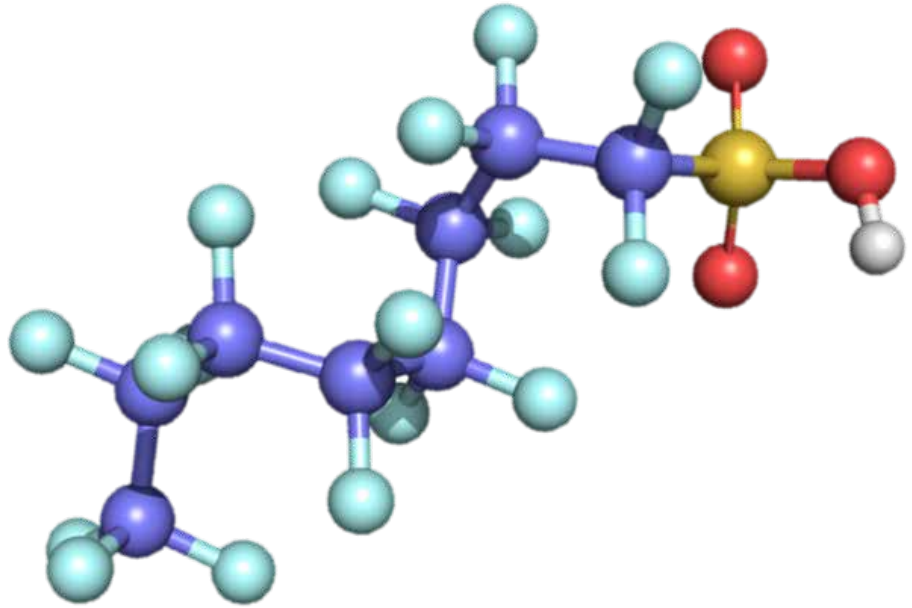
Why the Concern?

- Widespread
- Do not break down easily - hard to get rid of
- Bioaccumulative – build up in our bodies
- Some PFAS may affect health
- Lack of information
- Lack of standards



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Chrome Platers & the PFAS Story

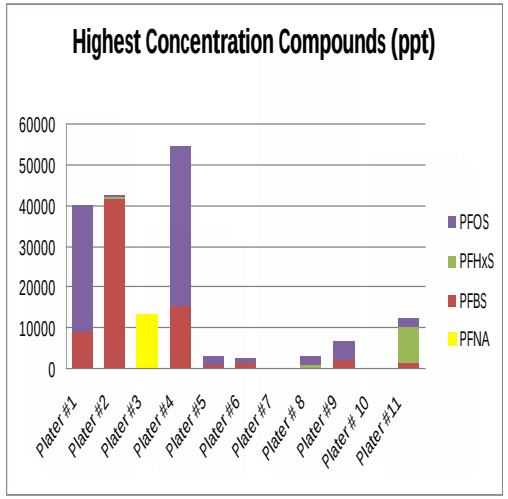
- EPA lists hexavalent chromium as a known human carcinogen (inhalation pathway)
- National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chromium Electroplating
  - **Fume** suppressants are effective at controlling hexavalent chromium emissions
  - Widespread use due to simplicity, cost and effectiveness
- PFAS concerns were raised to EPA subsequent to the NESHAP

Many Current and Past Partners

- State of Minnesota
- Industry Representatives
- The National Association for Surface Finishing
- EPA's Office of Air Quality, Planning and Standards
- EPA's Office of Chemical Safety and Pollution Prevention
- EPA's Office of Water

EPA R5 Fume Suppressant/Effluent Study

- In 2009, EPA conducted a chromium electroplating study to examine PFOS releases from effluent waters
- 11 plating facilities in Chicago and Cleveland were sampled for PFAS compounds
- PFAS was found to be released in the effluent of virtually all of the facilities sampled
- The study supported revision to chromium MACT standard phasing out **PFOS**-containing fume suppressants by 2015



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EPA R5 Fume Suppressant/Effluent Study

EPA worked with EGLE to study PFAS releases from chrome platers/chromic acid etchers

- Subset inadvertently releasing PFOS into environment despite ban/phase-out
- PFOS-containing fume suppressants phased out in 2015

§ New fume suppressants generally contain PFAS

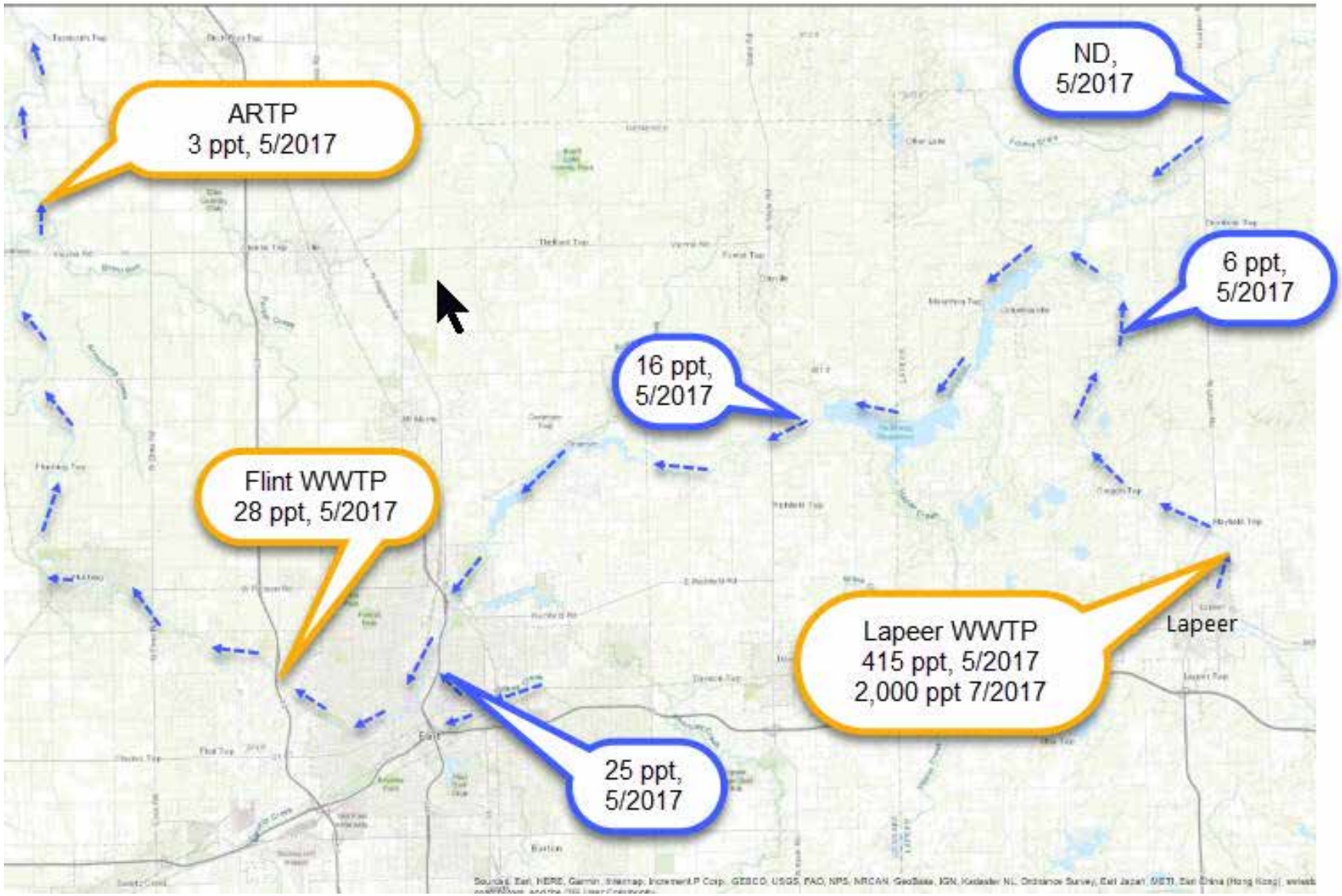
EGLE Water Quality Criteria for PFAS

- Michigan developed Rule 57 Human Noncancer Values (HNV) for PFOA (2011) and PFOS (2014) in surface waters

PFAS	HNV (nondrinking)	HNV (drinking)	FCV, ppt	FAV, ppt	AMV, ppt
PFOS	12	11	140,000	1,600,000	780,000
PFOA	12,000	420	880,000	15,000,000	7,700,000

Human Noncancer Values (HNVs); Aquatic Life Final Chronic Value (FCV), Final Acute Value (FAV), and Aquatic Maximum Value (AMV)

- PFOS builds up in fish tissue to a higher degree than PFOA



Flint River PFOS 2017

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Source Identified

- Chrome plating facility using PFOS-free fume suppressants
- Discontinued use of PFOS-based fume suppressants in 2013

NPDES Requirement: Industrial Pretreatment Program (IPP)

- **For WWTPs w/IPPs**: require **source evaluation** and **follow up**
- To ensure WWTPs are not passing through PFOS or PFOA greater than water quality standards
- To prevent interference with management of biosolids
- Current permit requirement, new pollutants

Sources of PFOS to WWTPs in Michigan

Industry/Category/Type	Total Number Evaluated *	Number (%) Sources of PFOS by Type**	Range Effluent PFOS exceeding screening level of 12 ppt
Solid Waste Landfills* **	57	**49** (86%)	20-5,000
Metal Finishing	320	**47(**15%)	20 to 240,000
· Chrome Plating	50	33 (66%)	24-240,000
· Chromate Conversion Coating	24	12 (50%)	16-9,950
Contaminated sites	40	**20** (50%)	14-34,000
Centralized Waste Treaters (CWTs)	17	**11** (65%)	13-8400
Paper manufacturing, packaging	14	**9** (64%)	16-410
Industrial laundry facilities	7	**5** (71%)	24-69
Chemical manufacturers	17	**4** (24%)	18-4,600,00
AFFF-contaminated sewers	2	**2** (100%)	240-45,000

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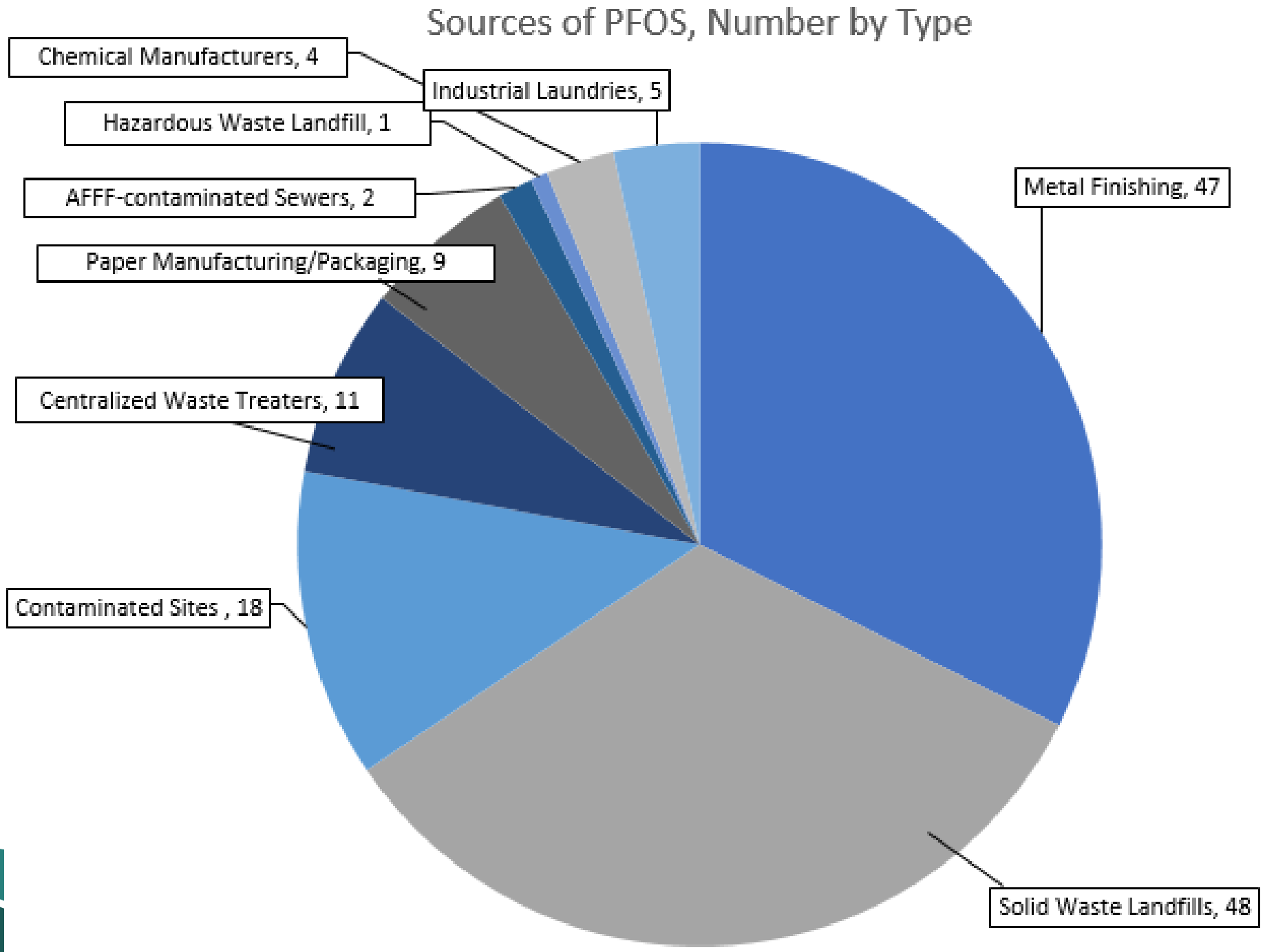
Sources of PFOS, Number by Type
Chemical Manufacturers, 4
Industrial Laundries, 5
Hazardous Waste Landfill, 1
AFFF-contaminated Sewers, 2
Paper Manufacturing/Packaging, 9
Centralized Waste Treaters, 11
Contaminated Sites , 18
Metal Finishing, 47
Solid Waste Landfills, 48

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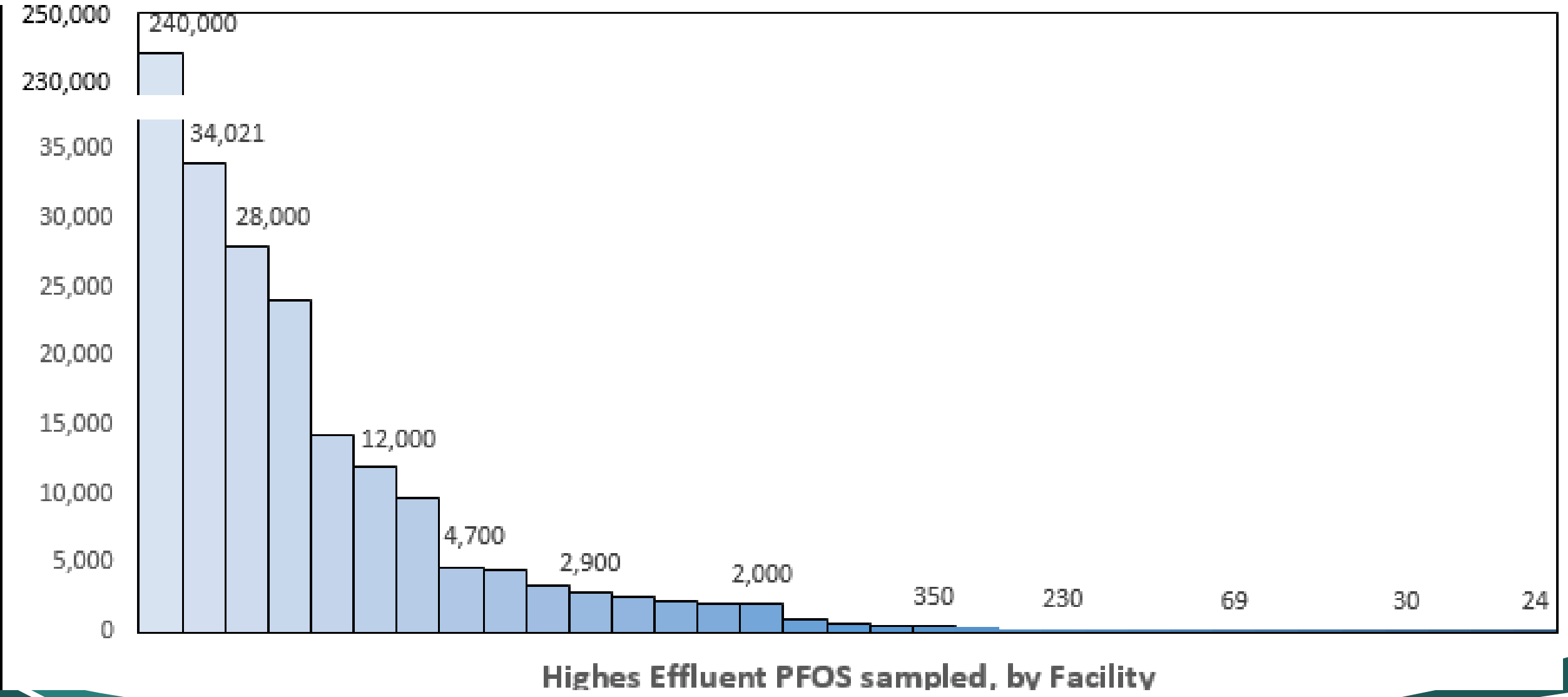
Chrome Plater Sources, Highest Effluent PFOS Sampled, ppt



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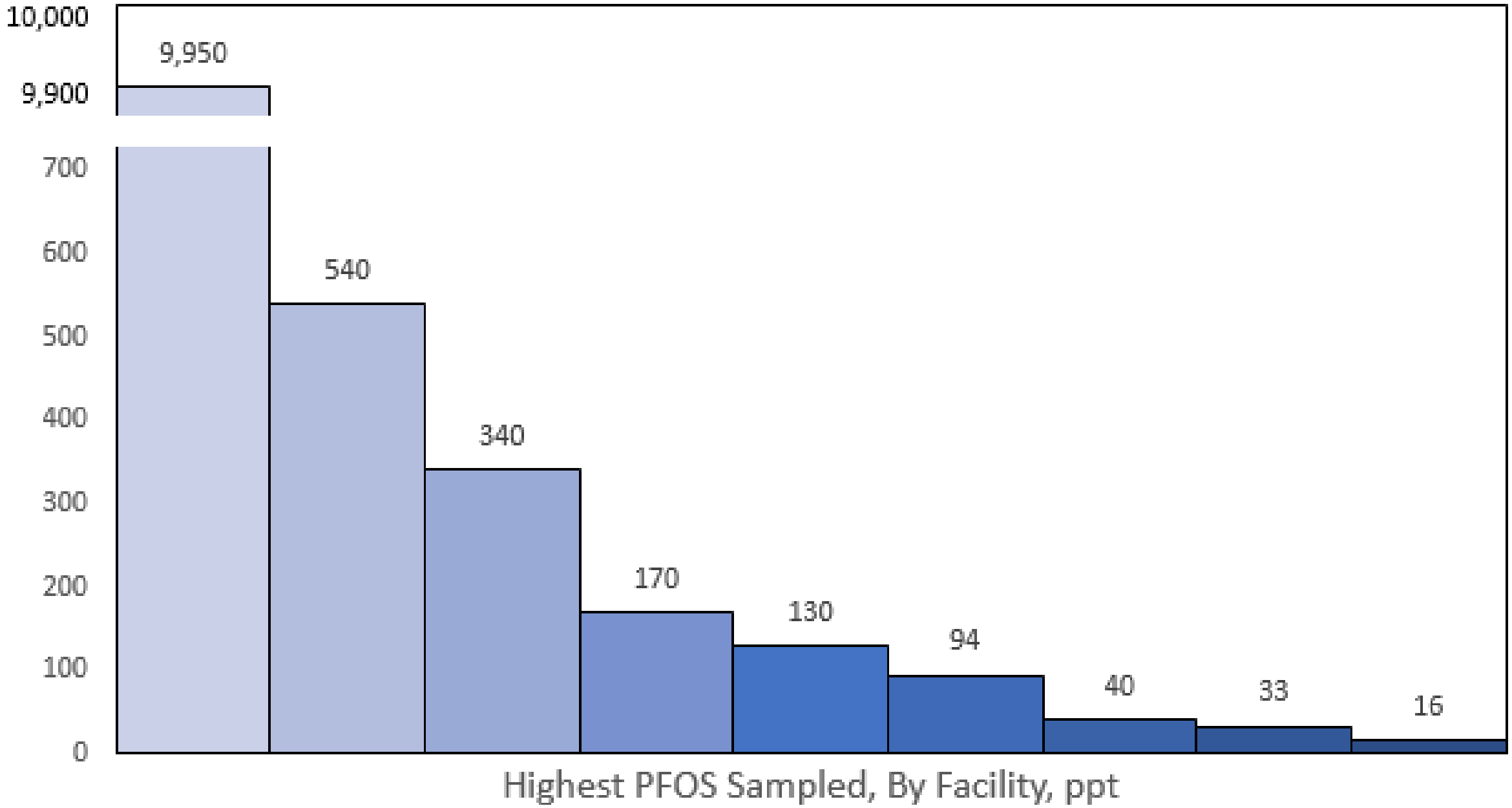
Chromate Conversion Coating Sources, Highest PFOS Effluent Sampled, ppt



Purpose of Study

Is PFOS in chrome plater effluent linked to currently-used products?

- Analyze Fume Suppressants for PFAS
  - Ø Is PFOS present?
  - Ø Are precursors to PFOS present?
- Analyze Chrome Plater Effluent for PFAS (prior to any pretreatment for PFAS)
  - Ø Compare to Currently-Used Products

Fume Suppressant Study Design

- Sample 11 chrome platers (some with chrome etching):
  - 11 effluent samples
  - 12 fume suppressant samples (9 different products, 3 replicates)
  - Includes a sister plant (newer) that never used PFOS-containing fume suppressant (but does use PFAS-containing product)
- Analyze with Targeted and Non-Targeted Analysis

EPA/EGLE Fume Suppressant Study Team

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Types of Analysis

- **Targeted Analysis:** Reports exact quantities of specific "targeted" chemicals (24 MPART Minimum Analytes + GenX)

- **Non-Targeted Analysis:** more qualitative but can detect unanticipated chemicals and show relative abundance of various compounds

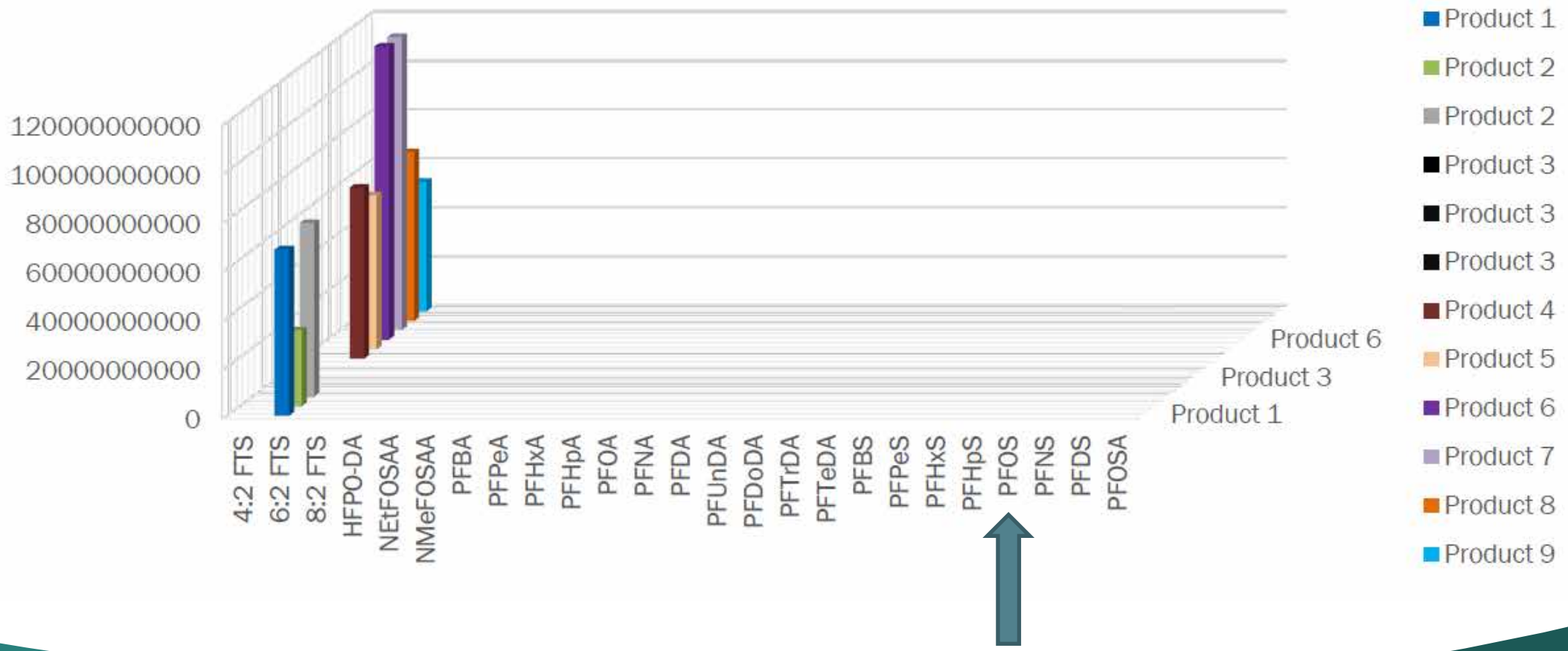
Approaches to Chemical Measurements

	Targeted	Screening	Discovery
Chemical Targets	Few, selected chemicals	100s – 100,000s per library	Any chemical
Method of Analysis	Focused method	Non-Targeted Method	Non-Targeted Method
Chemical Structure	Known	Known in library	Unknown
Reference Data	Available	Some, maybe simulated	Some, maybe simulated
Standards	Available	For common compounds	Unlikely

Complex, More Time-Consuming Analysis

Is **PFOS** in Currently-Used Fume Suppressants? No

Figure 1. PFAS in Fume Suppressants, ng/L or ppt



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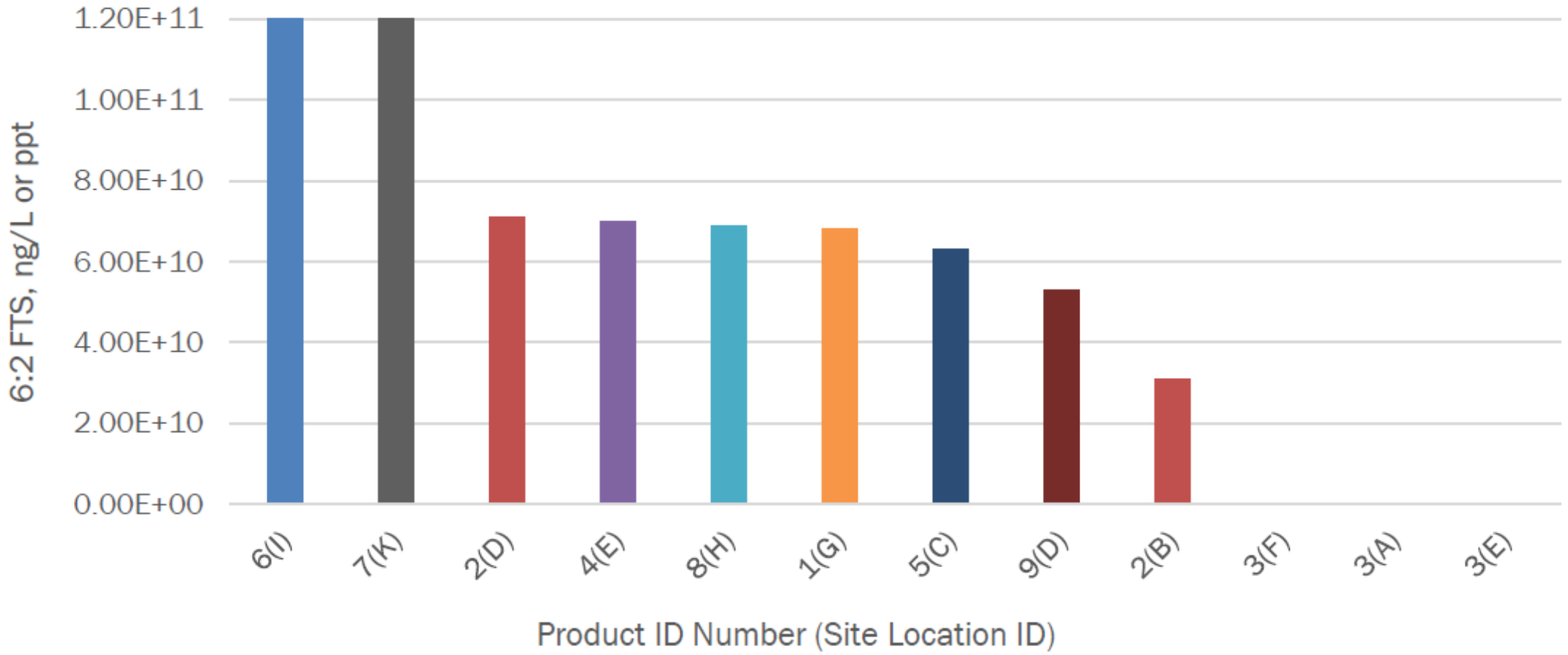
What PFAS are in Fume Suppressants? 6:2 FTS

Figure 2: 6:2 FTS Concentration in Fume Suppressants



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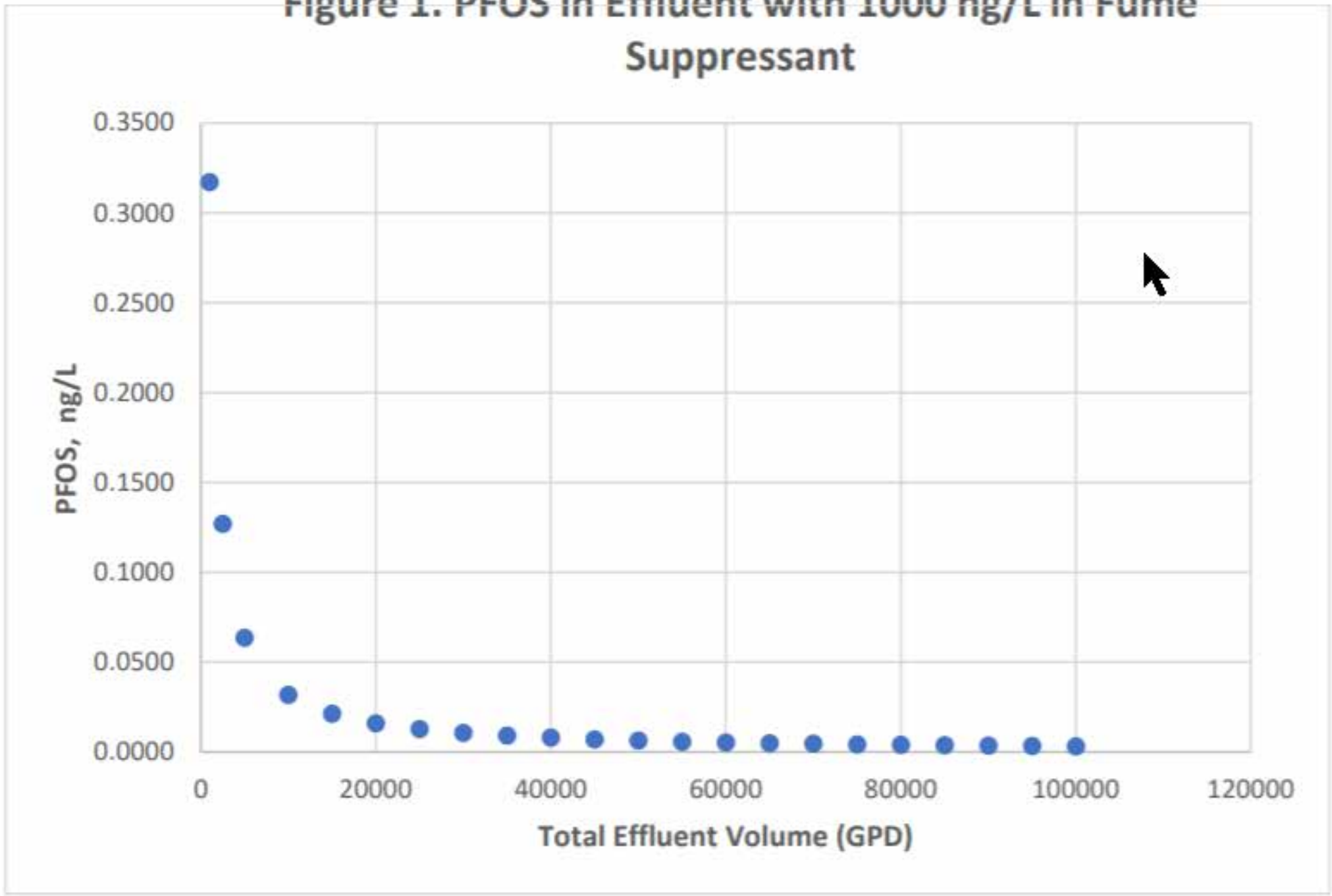
Product Analysis Reporting Limits

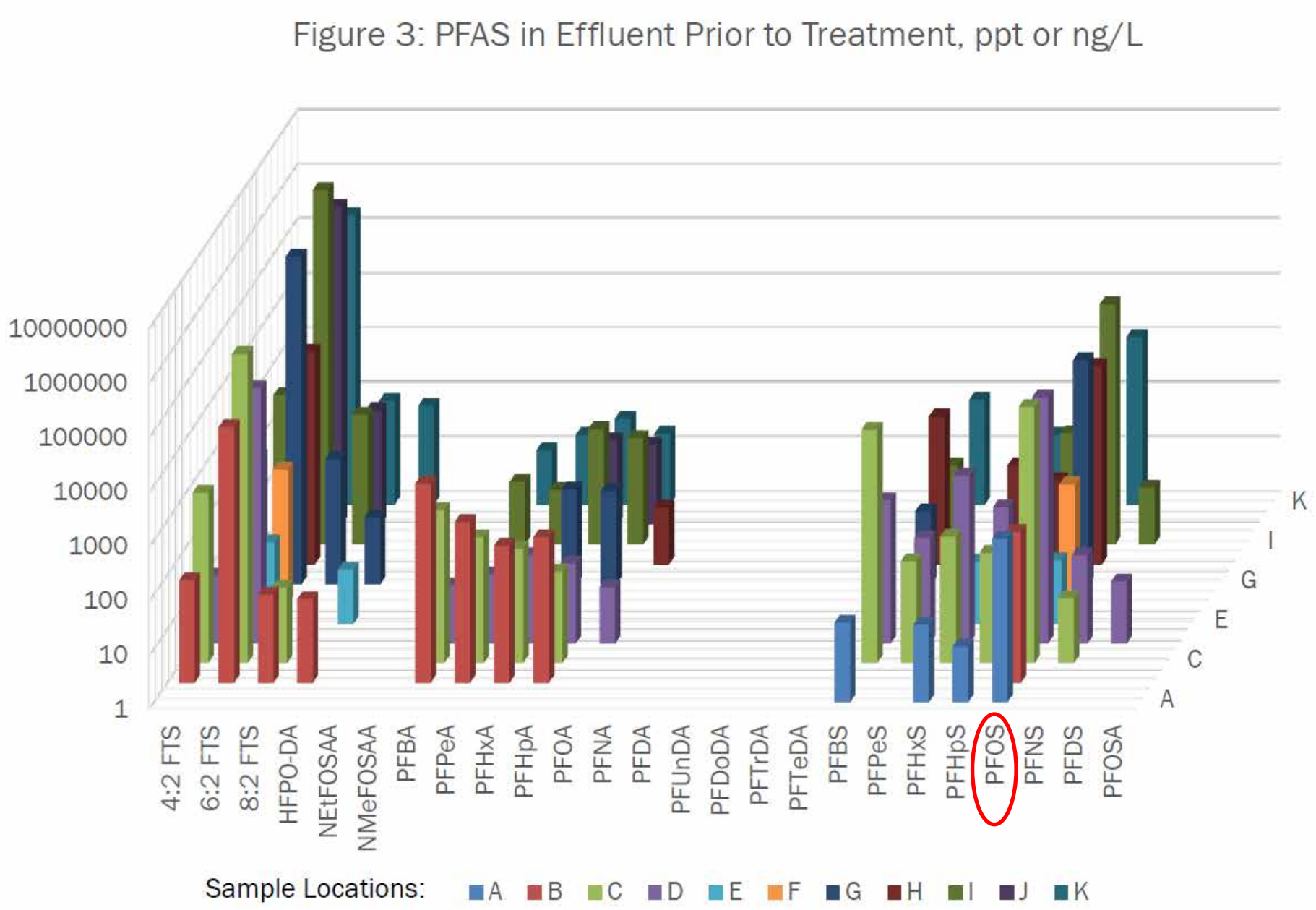


Is 6:2 FTS (or 6:4 FTS) a PFOS precursor?

- Neither 6:2 FTS (or 6:4 FTS) are precursors to PFOS.

- Both are shorter-chain PFAS that cannot break down to the longer-chain PFOS.

Which PFAS are in Chrome Plater Effluent?



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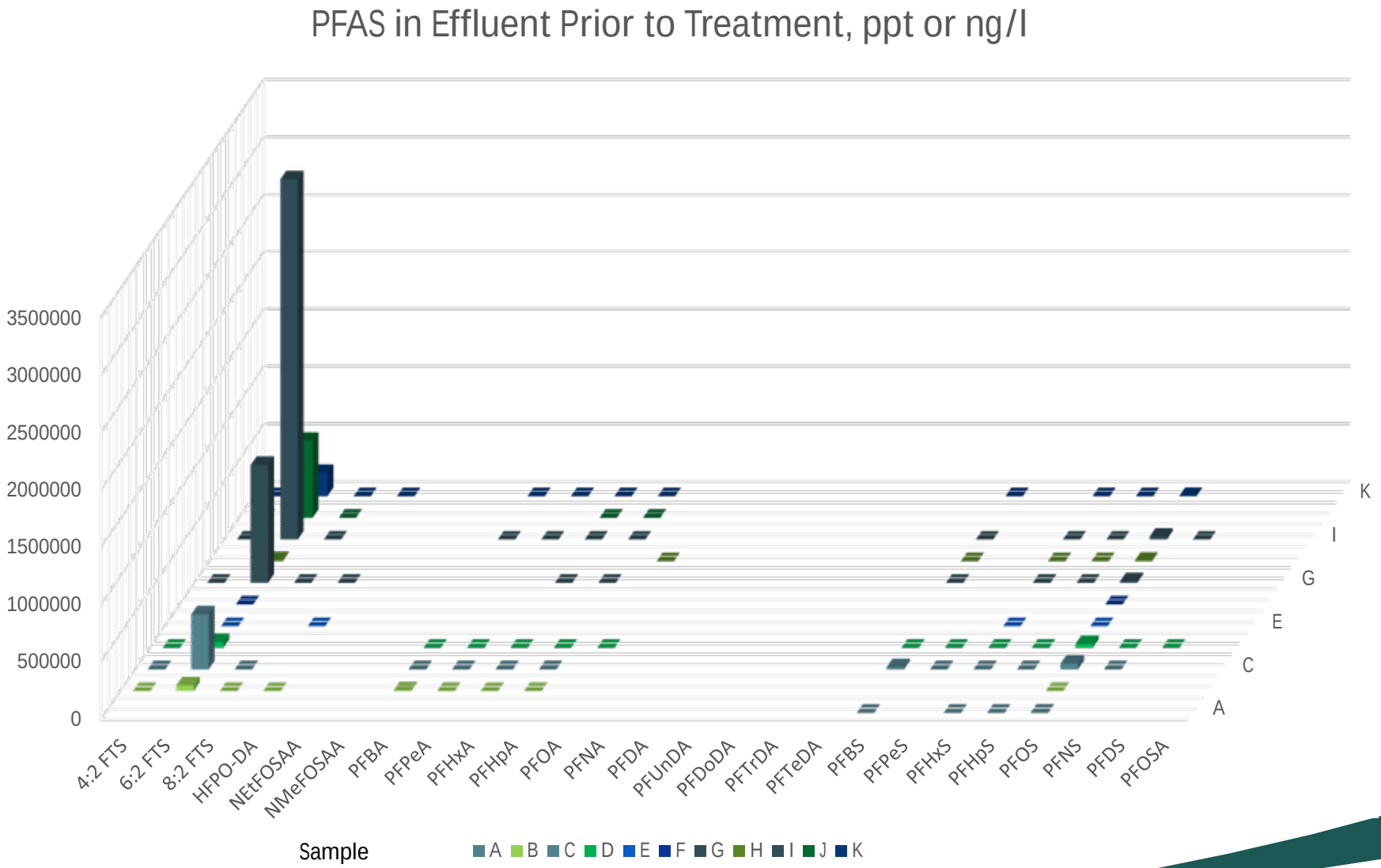

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PFAS in Effluent

- Most PFAS is 6:2 FTS, likely from current products (except at platers using Product 3)
- Are other PFAS in effluent breakdown products from **6:2 FTS**?
  - Beyond scope of this study
  - Terminal breakdown products are PFPeA, PFHxA, and 5:3 FTCA
  - Intermediates? Unclear

Location Sample ID	Total (ppt)	6:2 FTS (ppt)	PFOS (ppt)	23 Other PFAS Analytes (ppt)
I	3,166,509	3,140,000	25,300	1,209
G	1,043,339	1,030,000	12,700	639
J	672,399	672,000	**ND**	399
C	556,393	482,000	51,700	22,693
K	204,615	203,000	1,200	415
D	85,455	49,500	33,700	2,255
B	58,239	51,000	610	6,629
H	12,837	7,880	4,330	627
A	1,130	**ND**	1,060	70
F	452	294	158	**ND**
E	71	32	15	24

Simplified Effluent Data

(prior to any PFAS pretreatment)

Substantial Reductions in PFOS Concentrations at WWTPs

Municipal WWTP	PFOS, Effluent (ppt, most recent**)	PFOS Reduction in Effluent (highest to most recent)	Actions Taken to Reduce PFOS
Lapeer	8.4	99%	Treatment (GAC) at source (1)
Wixom	18*	99%	Treatment (GAC) at source (1)
Ionia	<7.5	99%	Treatment (GAC) at source (1)
Port Huron	13*	99%	Source control/reduction at source
Howell	4.3	97%	Treatment (GAC/resin) at source (1)
Bronson	6.9	95%	Treatment (GAC) at source (1)
Kalamazoo	3.1	92%	Treatment (GAC) at sources (2), change water supply
K I Sawyer	13*	95%	Eliminate leak AFFF, some cleaning
GLWA (Detroit)	30*	23%	Treatment (GAC) at sources (9)
Belding	7.2	49%	Restricted landfill leachate quantity accepted

*Greater than Water Quality Standards

**Data received/processed as of April 30, 2020

Summary

- No currently-used fume suppressants contained PFOS or PFOS precursors
- PFOS found in untreated effluent is likely due to historical use and the nature of “forever chemicals”
- Currently-used fume suppressants may contain other PFAS compounds, primarily 6:2 FTS

PFAS Reports & Information

- EPA/EGLE Fume Suppressant Study Report
- Summary Report, Municipal Wastewater and Biosolids/Sludge & PFAS
- MPART Wastewater Treatment Plants/Industrial Pretreatment
- Industrial Pretreatment Program PFAS Initiative

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