

# PFAS Introduction and Due Diligence for Clean Fill

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# AGENDA

- **PFAS Introduction**
  - What is it?
  - Uses
  - History
  - Impacts
- **PA DEP Management of Fill Policy “Clean Fill”**
- **Due Diligence**
- **Specialized Sampling Requirements**





# PFAS - What is it?

## Examples of Complex PFAS Names

Name	Abbreviation	Structural formula	Molecular weight (g/mol)	CAS No.
Perfluorobutane sulfonamide	H-FBSA	$C_4F_9SO_2NH_2$	299.12	30334-69-1
Perfluoropentanesulfonamide	PFPSA	$C_5F_{11}SO_2NH_2$	349.12	82765-76-2
Perfluorohexanesulfonamide	PFHxSA	$C_6F_{13}SO_2NH_2$	399.13	41997-13-1
Perfluoroheptanesulfonamide	PFHpSA	$C_7F_{15}SO_2NH_2$	449.14	82765-77-3
Perfluorooctanesulfonamide	PFOSA	$C_8F_{17}SO_2NH_2$	499.14	754-91-6
Perfluorobutanesulfonyl fluoride	PFBSF	$C_4F_9SO_2F$	302.09	375-72-4
Perfluorooctanesulfonyl fluoride	PFOSF	$C_8F_{17}SO_2F$	502.12	307-35-7



# PFAS - What is it?

## Examples of Complex PFAS Names

Contaminant	CASRN <sup>1</sup>	MRL <sup>2</sup> (µg/L)	Additional Information
<b>25 PFAS: EPA Method 533</b>			
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	763051-92-9	0.005	PFAS are a group of synthetic chemicals used in a wide range of consumer products and industrial applications including: non-stick cookware, water-repellent clothing, stain-resistant fabrics and carpets, cosmetics, firefighting foams, electroplating, and products that resist grease, water, and oil. PFAS are found in the blood of people and animals and in water, air, fish, and soil at locations across the United States and the world.
1H,1H, 2H, 2H-perfluorodecane sulfonic acid (8:2FTS)	39108-34-4	0.005	
1H,1H, 2H, 2H-perfluorohexane sulfonic acid (4:2FTS)	757124-72-4	0.003	
1H,1H, 2H, 2H-perfluorooctane sulfonic acid (6:2FTS)	27619-97-2	0.005	
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	0.003	
9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)	756426-58-1	0.002	
hexafluoropropylene oxide dimer acid (HFPO-DA)(GenX)	13252-13-6	0.005	
nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	151772-58-6	0.02	
perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	113507-82-7	0.003	
perfluoro-3-methoxypropanoic acid (PFMPA)	377-73-1	0.004	
perfluoro-4-methoxybutanoic acid (PFMBA)	863090-89-5	0.003	
perfluorobutanesulfonic acid (PFBS)	375-73-5	0.003	
perfluorobutanoic acid (PFBA)	375-22-4	0.005	
perfluorodecanoic acid (PFDA)	335-76-2	0.003	
perfluorododecanoic acid (PFDoA)	307-55-1	0.003	
perfluoroheptanesulfonic acid (PFHpS)	375-92-8	0.003	
perfluoroheptanoic acid (PFHpA)	375-85-9	0.003	
perfluorohexanesulfonic acid (PFHxS)	355-46-4	0.003	
perfluorohexanoic acid (PFHxA)	307-24-4	0.003	
perfluorononanoic acid (PFNA)	375-95-1	0.004	
perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.004	
perfluorooctanoic acid (PFOA)	335-67-1	0.004	
perfluoropentanesulfonic acid (PFPeS)	2706-91-4	0.004	
perfluoropentanoic acid (PFPeA)	2706-90-3	0.003	
perfluoroundecanoic acid (PFUnA)	2058-94-8	0.002	
<b>4 PFAS: EPA Method 537.1</b>			
N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	0.005	See above for PFAS information.
N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	0.006	
perfluorotetradecanoic acid (PFTA)	376-06-7	0.008	
perfluorotridecanoic acid (PFTrDA)	72629-94-8	0.007	



# PFAS - What is it?

- PFAS are widely used, long lasting chemicals, components of which break down very slowly over time.
- Because of their widespread use and their persistence in the environment, many PFAS are found in the blood of people and animals all over the world and are present at low levels in a variety of food products and in the environment.
- PFAS are found in water, air, fish, and soil at locations across the nation and the globe.
- Scientific studies have shown that exposure to some PFAS in the environment may be linked to harmful health effects in humans and animals.
- There are thousands of PFAS chemicals, and they are found in many different consumer, commercial, and industrial products. This makes it challenging to study and assess the potential human health and environmental risks.



# PFAS

## Industrial/Commercial Uses

### Industrial Use

- Surfactants
- Raw material for surface protection products
- Intermediate for transformation of other products
- Polymer production

### Commercial Use

- Stain and water-resistant products (furniture, boots, etc.)
- Aqueous Fire Fighting Foam (“**A-TRIPLE-F**”, “**AFFF**”)
- Non-Stick Cookware (Teflon)



# PFAS

## Industrial/Commercial Uses



### Drinking Water

An important potential source of PFAS exposure.



### Waste Sites

Soil and water at or near landfills, disposal sites, and hazardous waste sites.



### Fire Extinguishing Foam

Used in training and emergency response events at airports and firefighting training facilities.



### Facilities

Chrome plating, electronics, and certain textile and paper manufacturers that produce or use PFAS.



### Consumer Products

Stain- or water-repellent, or non-stick products, paints, sealants, and some personal care products.



### Food Packaging

Grease-resistant paper, microwave popcorn bags, pizza boxes, and candy wrappers.



### Biosolids

Fertilizer from wastewater treatment plants used on agricultural lands can affect ground and surface water.



### Food

Fish caught from water contaminated by PFAS and dairy products from livestock exposed to PFAS.





# PFAS Industrial Commercial Uses

Sector	Example Uses
Textiles & Leather	Factory- or consumer-applied coating to repel water, oil, and stains. Applications include protective clothing and outerwear, umbrellas, tents, sails, architectural materials, carpets, and upholstery.
Paper Products	Surface coatings to repel grease and moisture. Uses include non-food paper packaging (for example, cardboard, carbonless forms, masking papers) and food-contact materials (for example, pizza boxes, fast food wrappers, microwave popcorn bags, baking papers, pet food bags).
Metal Plating & Etching	Corrosion prevention, mechanical wear reduction, aesthetic enhancement, surfactant, wetting agent/fume suppressant for chrome, copper, nickel and tin electroplating, and post-plating cleaner.
Wire Manufacturing	Coating and insulation.
Industrial Surfactants, Resins, Molds, Plastics	Manufacture of plastics and fluoropolymers, rubber, and compression mold release coatings; plumbing fluxing agents; fluoroplastic coatings, composite resins, and flame retardant for polycarbonate.
Photolithography, Semiconductor Industry	Photoresists, top anti-reflective coatings, bottom anti-reflective coatings, and etchants, with other uses including surfactants, wetting agents, and photo-acid generation.



# PFAS - History

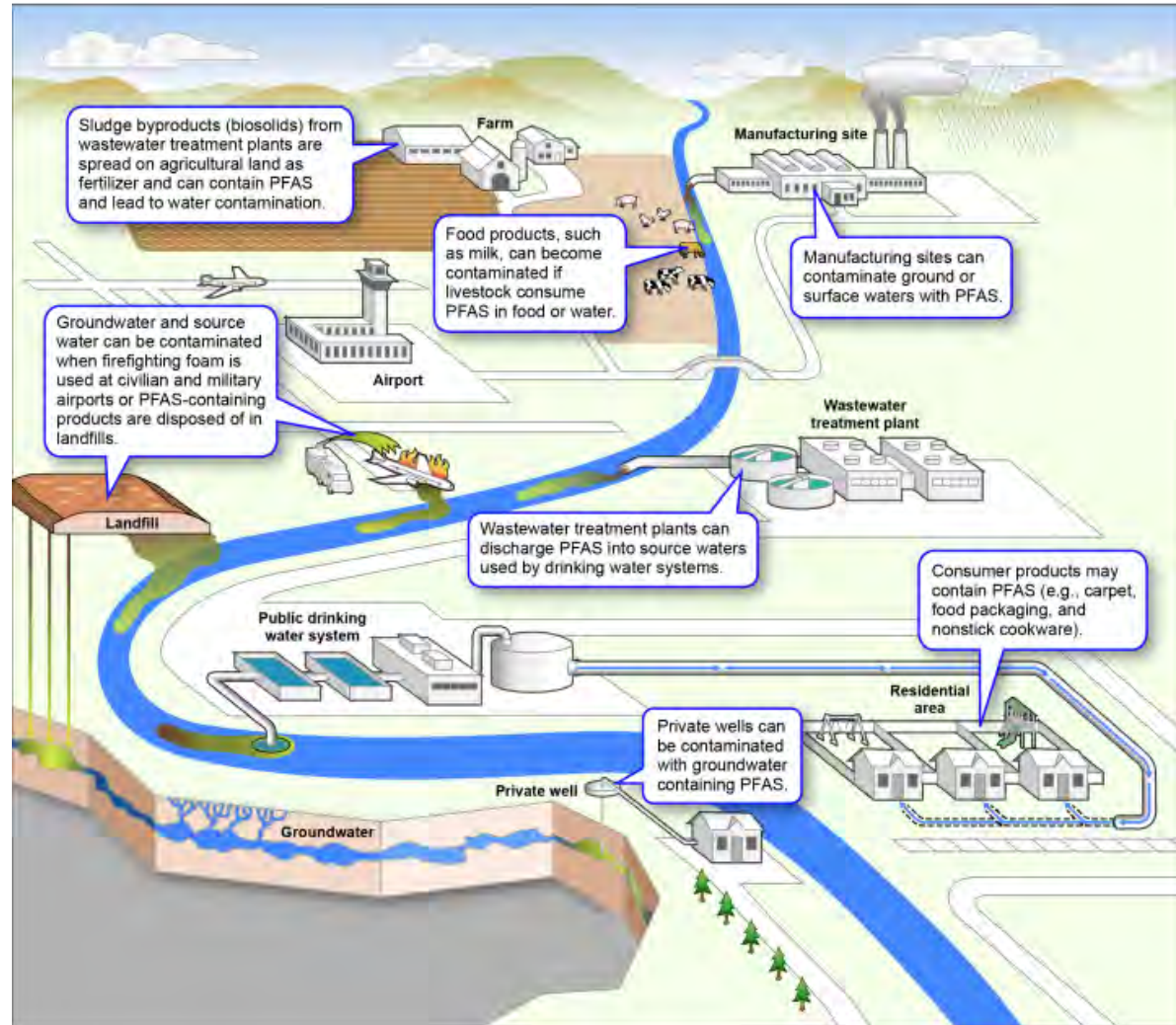
Table 2-1. Discovery and manufacturing history of select PFAS

PFAS <sup>1</sup>	Development Time Period							
	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s
PTFE	Invented	Non-Stick Coatings			Waterproof Fabrics			
PFOS		Initial Production	Stain & Water Resistant Products	Firefighting foam				U.S. Reduction of PFOS, PFOA, PFNA (and other select PFAS <sup>2</sup> )
PFOA		Initial Production	Protective Coatings					
PFNA					Initial Production	Architectural Resins		
Fluoro-telomers					Initial Production	Firefighting Foams		Predominant form of firefighting foam
Dominant Process <sup>3</sup>		Electrochemical Fluorination (ECF)						Fluoro-telomerization (shorter chain ECF)
Pre-Invention of Chemistry /			Initial Chemical Synthesis / Production			Commercial Products Introduced and Used		
<b>Notes:</b>								
1. This table includes fluoropolymers, PFAAs, and fluorotelomers. PTFE (polytetrafluoroethylene) is a fluoropolymer. PFOS, PFOA, and PFNA (perfluorononanoic acid) are PFAAs.								
2. Refer to Section 3.4.								
3. The dominant manufacturing process is shown in the table; note, however, that ECF and fluorotelomerization have both been, and continue to be, used for the production of select PFAS.								
<b>Sources:</b> Prevedouros et al. 2006; Concauwe 2016; Chemours 2017; Gore-Tex 2017; US Naval Research Academy 2017								



# PFAS Exposure Pathways

- Soil
- Surface Water
- Groundwater
- Air
- Research shows rainwater can be impacted by PFAS



# Potential PFAS Health Impacts

- Understand the Measurement of PFAS to nanogram levels.

1 Part Per Million Parts (PPM)                      1/1,000,000

- Typical soil measurement of contaminants

1 Part Per Billion (PPB)                                1/1,000,000,000

- Typical water measurement of contaminants

1 Part Per Trillion (PPT)                              1/1,000,000,000,000

- Nanograms – typical measurement of PFAS



# Potential PFAS Health Impacts

- Studies ongoing to determine effects
- Some studies suggest increases in blood cholesterol
- High blood pressure
- Pregnancy-induced hypertension, decreased infant and fetal growth
- Liver diseases
- Decreased antibody response to vaccines in children
- Possible **Carcinogenic to Humans**





# So Why Do We Need to Know about PFAS in the Asphalt Industry?

- SOIL Management



“**CLEAN FILL** or **NOT**”



# So Why Do We Need to Know about PFAS in the Asphalt Industry?

- ASPHALT Management



Airport Projects, Industrial Sites  
Utilities Projects



# So Why Do We Need to Know about PFAS in the Asphalt Industry?

- RAP Storage Piles
  - NAPA Presentation from October 2023 (**Recommend Reviewing**)
- Old Projects (PFAS the Forever Chemicals)
  - How Long Has RAP Been Stored At Your Facility?
  - What is the Likelihood of RAP At Your Facility Being from a Site Where PFAS May have been Released?
- New Projects At Sites Where PFAS May Have Been Released
  - Do you Segregate Potentially PFAS Impacted RAP?
  - Do you Take It At All?





# PA DEP MANAGEMENT OF FILL POLICY “CLEAN FILL”

- In 2021, PA DEP published the most recent version of the Policy.
- Since then (**and even before**), our industry has taken extensive steps to assure that Soils moved from project sites can be done so in accordance with the Policy.

SO, WHAT ARE THE POTENTIAL  
IMPACTS TO CLEAN FILL RELATED TO  
PFAS?



# Management of Fill Due Diligence

- Environmental Due diligence

*Environmental due diligence* – Investigative techniques used to determine whether fill from a donor site has been affected by a release of a regulated substance. Examples of investigative techniques included in this term are visual property inspections, electronic data base searches, review of ownership and historical use of a property, Sanborn maps, environmental questionnaires, transaction screens, analytical testing, environmental assessments, audits, or procedures outlined in ASTM standard E1527-13. A single investigative technique may not be used as the basis for environmental due diligence. Environmental due diligence includes visual property inspection and a review of ownership and historical property use, at a minimum, unless analytical sampling is performed in lieu of a review of ownership and historical property use.

- Used to determine if sampling is needed and what you should test for...





# Management of Fill Due Diligence

- Environmental Due Diligence
  - Except for historic fill, analytical testing of the fill is not necessary unless environmental due diligence indicates that the **fill may have been affected by a release of a regulated substance**. However, a person performing a fill determination may choose to perform analytical testing in lieu of conducting a review of ownership and historic property use to satisfy the minimum condition for performing environmental due diligence.



# Management of Fill Determinations


- Due Diligence Shows NO potential releases to material
- Analytical Testing and Comparison to Statewide Health Standards.
  - Remember
    - Statewide Health Standards are Risk-based Standards, routinely updated based on most recent Scientific Data. Minimum every 3 years.
    - Standards Change
    - Parameters Can Be Added
    - Lower of Direct Contact or Soil to Groundwater



# Management of Fill Determinations

- January 2023 – PA DEP has Statewide Health Standards for **THREE of the THOUSANDS** of PFAS Compounds

	Groundwater	Direct Contact	Soil to Groundwater
• PFBS	10 ug/L (ppb)	66 mg/kg (ppm)	<b>1 mg/kg (ppm)</b>
• PFOS	0.07 ug/L (ppb)	4.4 mg/kg (ppm)	<b>0.007 mg/kg (ppm)</b>
• PFOA	0.07 ug/L (ppb)	4.4 mg/kg (ppm)	<b>0.007 mg/kg (ppm)</b>

  
**CLEAN FILL LIMITS**



# Management of Fill Determinations

- Due Diligence Suggests Testing Needed **OR** Receiving Facility Requirement
- Select Analytical Based on Due Diligence **AND** Receiving Facility Requirements



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# Management of Fill Determinations

- Does Due Diligence Suggest Potential PFAS Concerns?
  - Airport Facility (AFFF)
  - Fire Station and Fire Training Facilities (AFFF)
  - Industrial Site Manufacturing PFAS
  - Commercial Site Disposing of PFAS
  - Stormwater Discharges from Facilities
  - Utilities (Sanitary Leakage)
  - Groundwater Management Facilities (De-watering Activities)
- If “YES”, then testing for THREE PFAS Compounds May Be Needed
  - PFBS
  - PFOS
  - PFOA





# PFAS SAMPLING

- NOT YOUR STANDARD SAMPLE COLLECTION
- Types of Collection Bottles Matter
  - Can Transfer PFAS from Bottle to Soil being Sampled
- Types of Sampling Equipment Matter
  - Can Transfer PFAS from the Sampling Equipment to the Soil being Sampled
- Low Standards Means Low Detections Can Show Material Impacted by a Release **(CAN CHANGE HOW THE MATERIAL IS MANAGED)**



# PFAS SAMPLING

## PFC Sampling – Prohibited and Acceptable Items

Prohibited	Acceptable
<b>Field Equipment</b>	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE) materials	Acetate Liners
	Silicon Tubing
Waterproof field books	Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
	Sharpies®, pens
Post-It Notes®	
Chemical (blue) ice packs	Regular ice



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## PFC Sampling – Prohibited and Acceptable Items

Prohibited	Acceptable
<b>Field Clothing and PPE</b>	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and PVC
Tyvek®	Cotton clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	<p><b>Sunscreens</b> - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are “free” or “natural”</p> <p><b>Insect Repellents</b> - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellent, Herbal Armor, California Baby Natural Bug Spray, BabyGanics</p> <p><b>Sunscreen and insect repellent</b> - Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion</p>





## PFC Sampling – Prohibited and Acceptable Items

Prohibited	Acceptable
<b>Sample Containers</b>	
LDPE or glass containers	HDPE or polypropylene
Teflon-lined caps	Unlined polypropylene caps
<b>Rain Events</b>	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
<b>Equipment Decontamination</b>	
Decon 90®	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply
<b>Food Considerations</b>	
All food and drink, with exceptions noted on right	Bottled water and hydration fluids (i.e, Gatorade® and Powerade®) to be brought and consumed only in the staging areas



## **PFCs Sampling Checklist**

Date: \_\_\_\_\_

Weather (*temp./precipitation*): \_\_\_\_\_ Site Name: \_\_\_\_\_

### ***Field Clothing and PPE:***

- No clothing or boots containing Gore-Tex™
- All safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Field crew has not used fabric softener on clothing
- Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
- Field crew has not applied unauthorized sunscreen or insect repellent

### ***Field Equipment:***

- No Teflon® or LDPE containing materials on-site
- All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books on-site
- No plastic clipboards, binders, or spiral hard cover notebooks on-site
- No adhesives (Post-It Notes) on-site

- Coolers filled with regular ice only. No chemical (blue) ice packs in possession

### ***Sample Containers:***

- All sample containers made of HDPE or polypropylene
- Caps are unlined and made of HDPE or polypropylene

### ***Wet Weather (as applicable):***

- Wet weather gear made of polyurethane and PVC only

### ***Equipment Decontamination:***

- "PFC-free" water on-site for decontamination of sample equipment. No other water sources to be used.
- Alconox and Liquinox to be used as decontamination materials

### ***Food Considerations:***

- No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Lead shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the site or removal of worker offsite until in compliance.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

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Field Lead Name: \_\_\_\_\_

Field Lead Signature: \_\_\_\_\_ Time: \_\_\_\_\_



# Questions?



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