

MANAGING PFAS RISKS UNDER INCREASINGLY STRINGENT REGULATIONS



Prepared for:

NAEM Community

Prepared by:



EA Engineering,
Science, and
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April 6, 2023

NAEM: Your Professional Community

Get the solutions you need to make an impact!

Benchmark

Benchmark your programs via events, online learning, research and executive networks

Learn

Learn tools & techniques to execute your strategy and be inspired by peers

Build

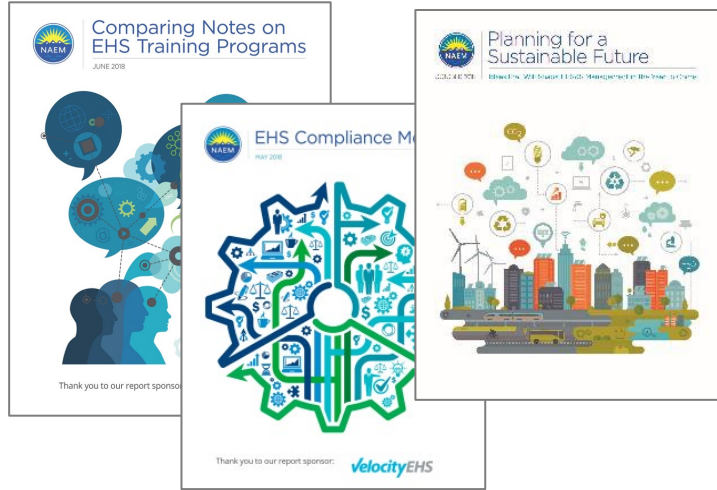
Build a network of peers whose experience can help you solve your challenges

Delivering Knowledge & Professional Wisdom

Peer Forums



Research Insights



Targeted Networking



Actionable strategies to empower EHS&S leaders to make an impact



NAEM Connects EHS & Sustainability Leaders

125

Corporate Members

4,200

Individual Members

60

Affiliate Members

Reaching a
community of Practice

25K+



Learning Objectives

MANAGING PFAS RISKS UNDER INCREASINGLY STRINGENT REGULATIONS

- **How the changing PFAS regulatory landscape will significantly increase regulatory liability and risk for primary and secondary PFAS manufacturers and parties using PFAS or managing environmental media contaminated with PFAS**
- **Why the increasing liability associated with PFAS contamination will necessitate identification and use of safe and secure treatment technologies to manage the risks**
- **How the use of high-temperature incineration of PFAS and PFAS-containing media has been proven effective for destroying these chemicals**

Speakers



**Director of EHS
Software
Implementations**

EA Engineering,
Science, and
Technology, Inc., PBC



**Senior Engineer,
Senior Project
Manager**

EA Engineering,
Science, and
Technology, Inc., PBC



**Vice President -
Environmental
Clean Harbors**

Integration of Engineering, Science, and Technology



- **5** decades in business
- **600+** staff in 27 nationwide offices
- **100%** employee-owned Public Benefit Corporation
- **80%** of business is from repeat clients
- **\$255M** annual revenue
- **~1,700** projects for over 575+ clients executed annually



Engineering



Environmental Health and Safety



Site Characterization and Remediation



Natural Resources Management



Data Management and Technology



Laboratory Studies

EA'S PBC FRAMEWORK AND CSR PROGRAM



PROFESSIONAL DEVELOPMENT



COMMUNITY SUPPORT



CHARITABLE GIVING



EA'S SUSTAINABILITY PROGRAM



Corporate Social Responsibility

EA'S PBC FRAMEWORK & CSR PROGRAM



Providing Solutions to Complex Challenges



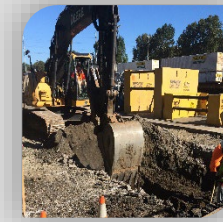
Water & Natural Resources

NEPA & State Equivalent
Contaminated Sediment
Design, Management, &
Remediation
Protected Species and Habitat
Surveys
Terrestrial & Wetland Surveys



Infrastructure & Engineering

Solid Waste Management
Water & Wastewater Treatment
Stormwater Systems
Ecosystem Management
Construction Management



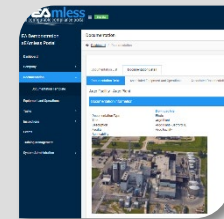
Characterization & Remediation

Site Investigation &
Remediation
Munitions Response
Emerging Contaminants
Risk Assessment
Remediation System Design
and O&M



Environmental Health & Safety

Air Quality Consulting
Integrated Management
Systems
Multi-Media Compliance and
Auditing
Pollution Prevention



Technology Solutions

SaaS Compliance Software
Data Management
Information Management Systems
IT Consulting
System Development, Hosting, and
Maintenance
Asset Management Software
Implementations
GIS Solutions

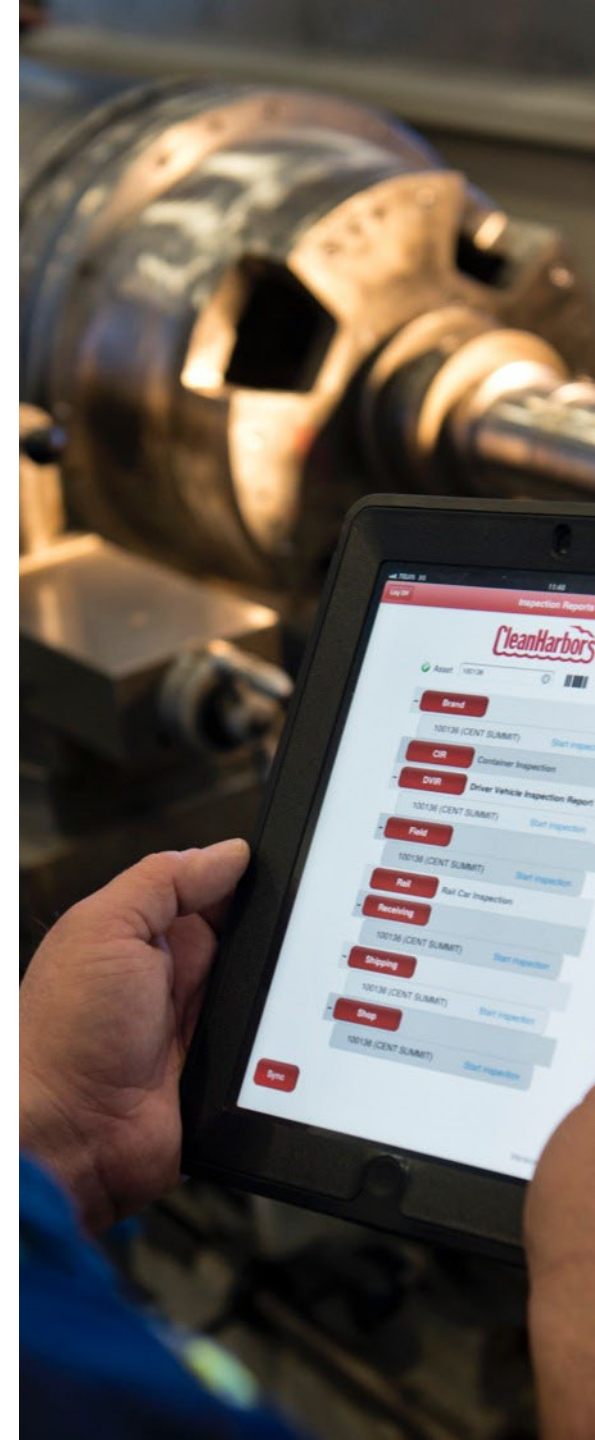


Laboratory Services

Ecotoxicological
Product Testing
Toxicity Testing
Treatability and Design
Waste Treatment Optimization

About Clean Harbors

- Founded in 1980 and based in Massachusetts, Clean Harbors operates throughout the United States, Canada, Mexico and Puerto Rico
- Publicly Traded (NYSE: CLH)
- Approximately \$5 Billion in Revenue
- Broad range of services including end-to-end hazardous waste management, emergency spill response, industrial cleaning and maintenance, recycling, and oil refining and blending services
- Diverse customer base spanning numerous markets including chemical, energy, manufacturing, and automotive, as well as many government agencies



Company Overview

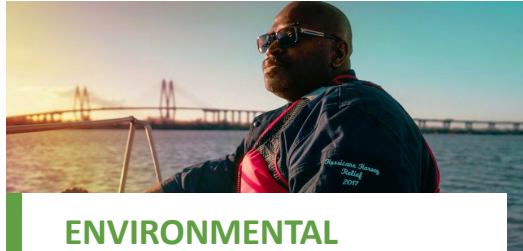
Company Facts

- North America's
 - Largest hazardous waste management company
 - Largest collector, recycler and re-refiner of used oil
 - Leading provider of comprehensive environmental, energy and industrial services
- Top 20 largest private motor carrier
- More than 350,000 customers including a majority of the Fortune 500
- More than 20,000 employees
- More than 650 service locations in the US, Canada, Mexico and Puerto Rico
- More than 100 recycling, treatment and disposal facilities



OVERVIEW

At a Glance, 2021



ENVIRONMENTAL

2X EMISSIONS AVOIDED
Compared to emissions generated as calculated by the Net Climate Benefit Factor

16M GALLONS
Solvent recovered annually

1.6M METRIC TONS
Key materials recycled

226M GALLONS
Used oil collected avoiding over 17 million metric tons of greenhouse gas emissions

196M GALLONS
Used oil re-refined to high-quality recycled oil products avoiding more than 21 million metric tons of greenhouse gas emissions

3.2M POUNDS
Ozone-depleting substances destroyed avoiding 14 million metric tons of greenhouse gas emissions

23% OF U.S. ENERGY
From renewable sources, **2,100 MWh** generated annually from solar arrays on property



SOCIAL

1.12
Total Recordable Incident Rate (TRIR)

6.85 YEARS
Average Employee Tenure

>6,000 EMPLOYEES
Tenure over 10 years

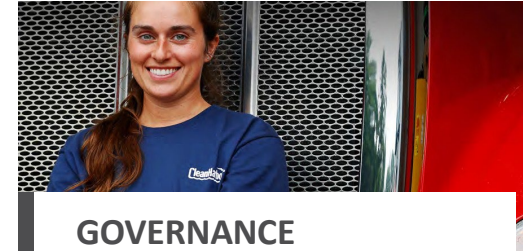
5% US WORKFORCE
Are veterans

38% ETHNIC DIVERSITY
In the US workforce

20% INTERNAL PROMOTIONS
To fill open positions over past 2 years

>540
Service locations

+1,000 EMPLOYEES
Comprise our growing Global Capabilities Center (GCC) in India



GOVERNANCE

30% WOMEN
On our Board of Directors

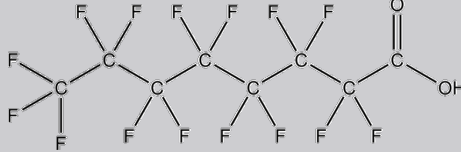
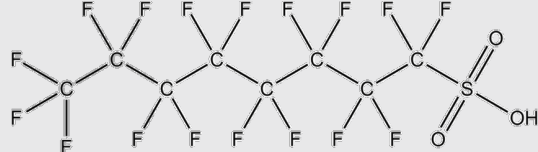
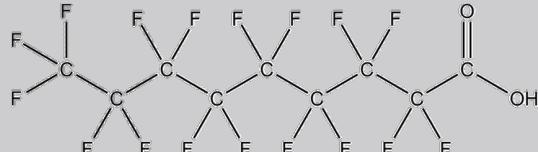
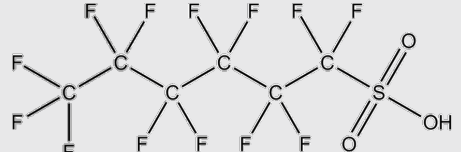
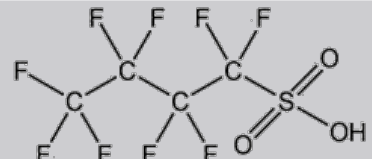
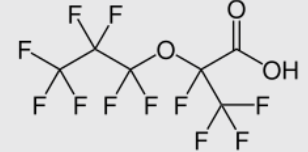
10% ETHNIC DIVERSITY
Representation on our Board of Directors

Alignment with
7 DISTINCT
UN Sustainable Development Goals

>20,000 EMPLOYEES
As of December 31, 2021

NYSE:CLH
Public NYSE Company

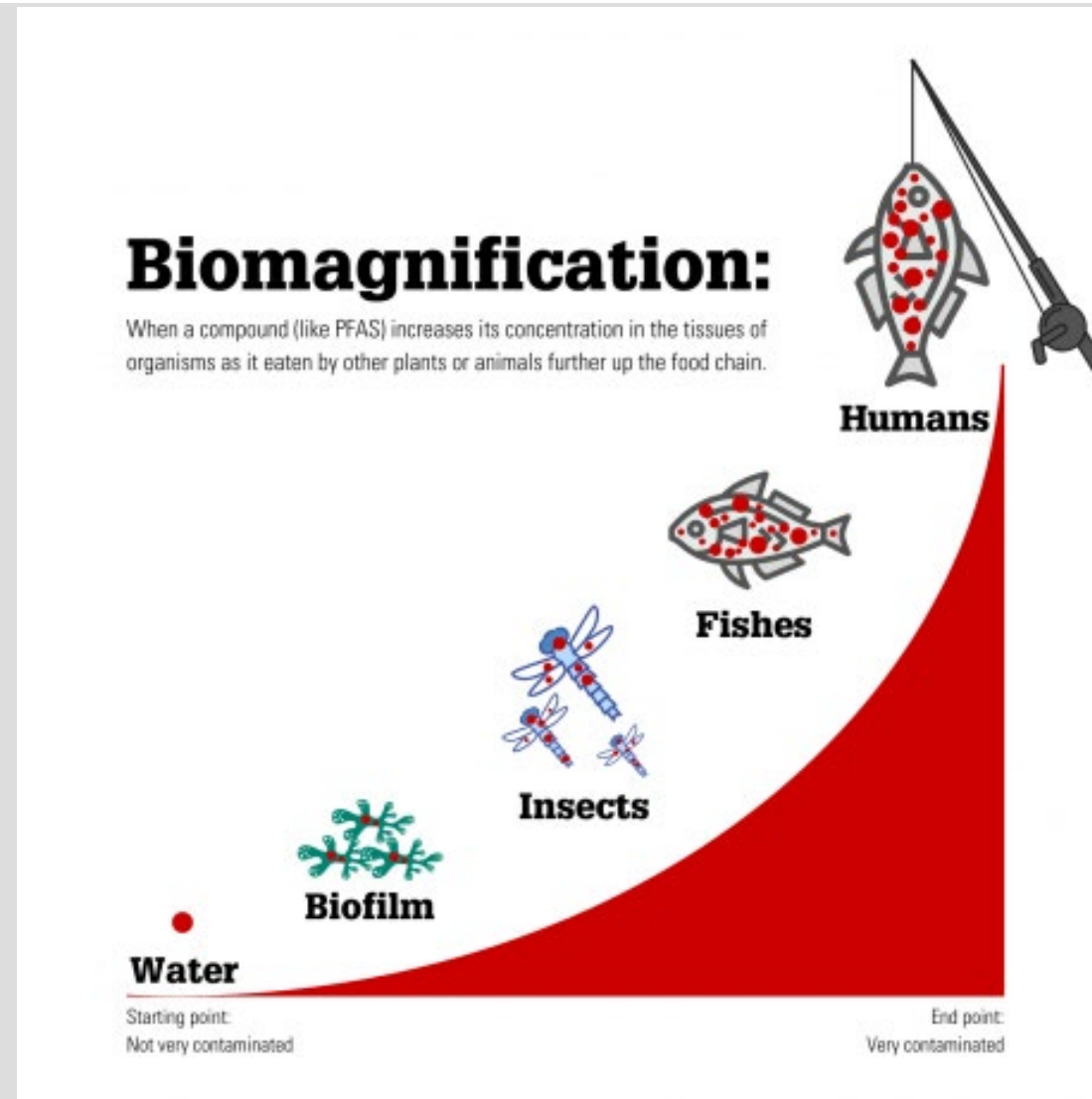
Per-fluoroalkyl substances (PFAS)

CAS No.	Compound Name	Acronym	Molecular Formula	Structure
335-67-1	Perfluorooctanoic acid	PFOA	$C_8HF_{15}O_2$	
1763-23-1	Perfluorooctanesulfonic acid	PFOS	$C_8HF_{17}O_3S^-$	
375-95-1	Perfluorononanoic acid	PFNA	$C_9HF_{17}O_2$	
355-46-4	Perfluorohexanesulfonic acid	PFHxS	$C_6HF_{13}O_3S^-$	
375-73-5	Perfluorobutanesulfonic acid	PFBS	$C_4HF_9O_3S^-$	
13252-13-6	Hexafluoropropylene oxide dimer acid	HFPO-DA	$C_6HF_{11}O_3$	

PFAS in Products in Commerce

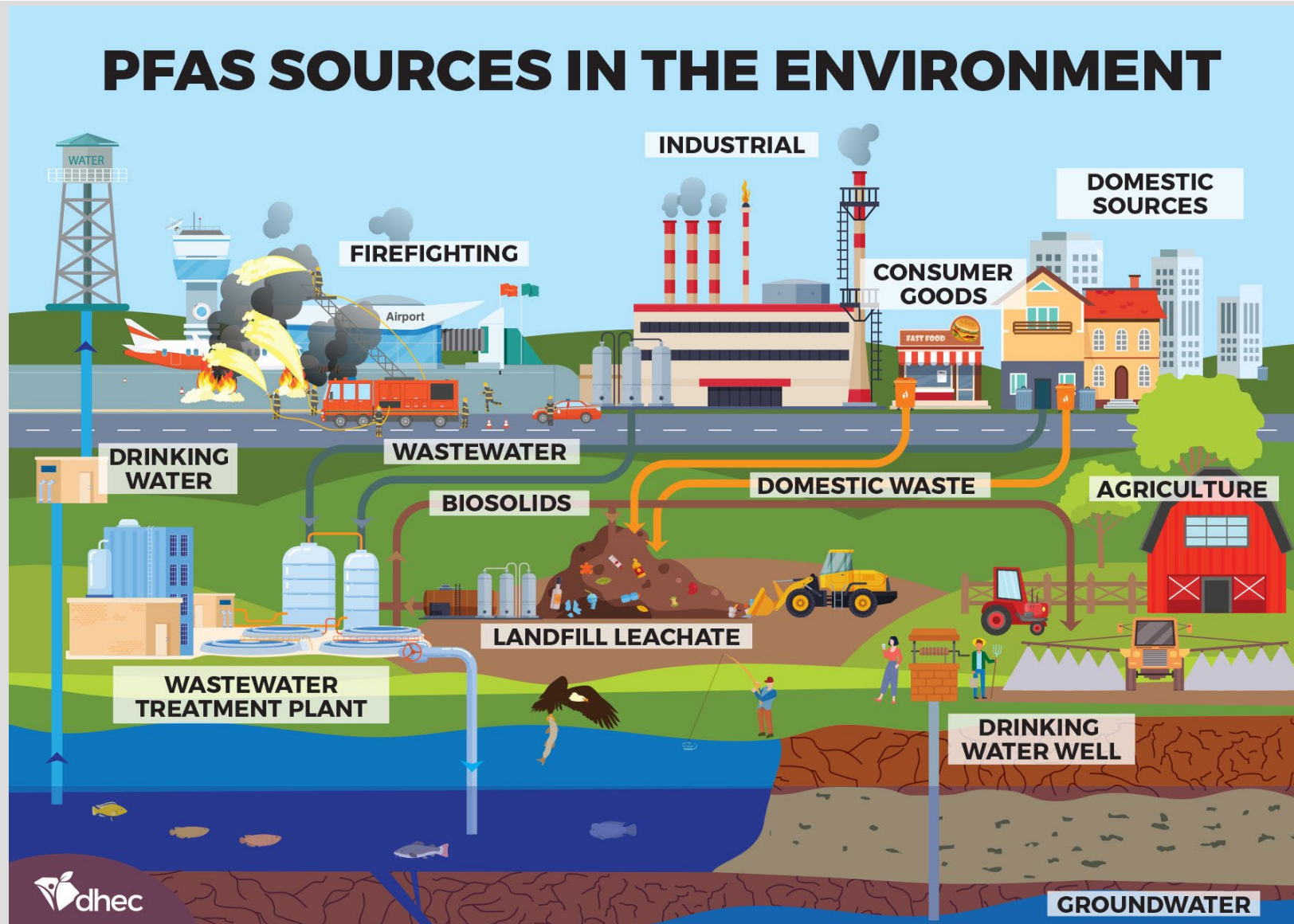


Biomagnification of PFAS in the Food Chain



Source: NC State University

Where PFAS is Found



Poll 1



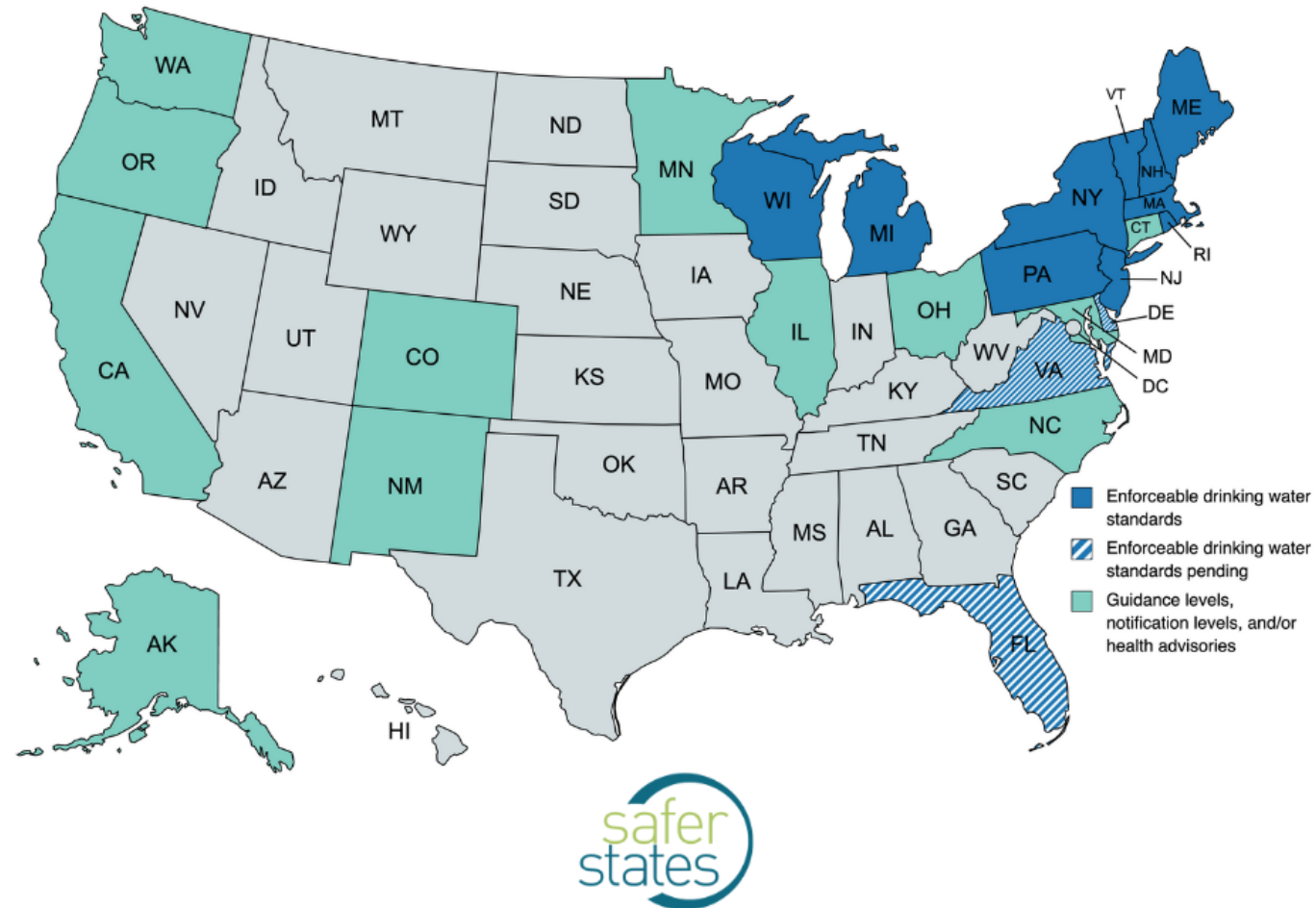
If you currently have PFAS issues at your locations, what media is affected?

Select all that apply.

- ◆ Soil
- ◆ Products
- ◆ Groundwater
- ◆ Industrial/Discharge Water
- ◆ Legacy/Contaminated Sites

State Regulation of PFAS in Drinking Water

<https://www.saferstates.org/toxic-chemicals/pfas/>



State Regulation of PFAS as Air Pollutants

Many states have health risk-based air toxics regulations independent of the federal CAA. Regulated facilities must demonstrate that ambient impacts from their air toxics emissions are below established screening levels to obtain/maintain a permit.

- **Michigan (enforceable):**
 - PFOA/PFOS individual/combined screening levels of $0.07\mu\text{g}/\text{m}^3$ (24-hour average)
- **Minnesota (Air Guidance Values – not yet enforceable):**
 - PFOS: $0.011\mu\text{g}/\text{m}^3$ (24-hour average, > 30-days, > 8-years)
 - PFOA: $0.063\mu\text{g}/\text{m}^3$ (24-hour average, > 30-days, > 8-years)
- **New Hampshire (enforceable):**
 - APFO: $0.05\mu\text{g}/\text{m}^3$ (24-hour average)
 - APFO: $0.024\mu\text{g}/\text{m}^3$ (annual average)
- **New York (Annual Guideline Concentration – enforceable for uncontrolled PFAS ERP > 100 lbs/yr):**
 - PFOA: $0.0053\mu\text{g}/\text{m}^3$ (annual average) [lower than for benzene and formaldehyde]
- **Texas (Effects Screening Levels - enforceable):**
 - AFPO: $0.1\mu\text{g}/\text{m}^3$ (1-hour average) $0.01\mu\text{g}/\text{m}^3$ (annual average)
 - PFOS: $0.1\mu\text{g}/\text{m}^3$ (1-hour average) $0.01\mu\text{g}/\text{m}^3$ (annual average)
 - PFOA: $0.05\mu\text{g}/\text{m}^3$ (1-hour average) $0.005\mu\text{g}/\text{m}^3$ (annual average)
- **North Carolina is currently developing ambient air PFAS guidelines**

Pending Federal Regulation of PFAS in Drinking Water

Compound	Proposed MCL (enforceable levels)	Proposed MCLG
PFOA	4.0 parts per trillion (also expressed as ng/L)	Zero
PFOS	4.0 ppt	Zero
PFNA	1.0 (unitless) Hazard Index	1.0 (unitless) Hazard Index
PFHxS		
PFBS		
HFPO-DA (commonly referred to as GenX Chemicals)		

Source: US EPA

- [Public Hearing – May 4, 2023](#)
- [Public Comment Period – May 4 – 30, 2023](#)

PFAS Regulation Status Summary

- Enforceable drinking water standards in 10 US states
- Enforceable drinking water standards pending in 3 US states
- Drinking water guidance levels, notification levels and/or health advisories in 12 US states
- Enforceable ambient air concentrations in 4 states and concentrations in development in 2 US states
- Federal designation of 6 PFAS as *hazardous* substances under CERCLA proposed by US EPA
- Federal drinking water Maximum Contaminant Levels (MCLs) for 6 PFAS proposed by US EPA
- PFOA, perfluorinated carboxylic acids (C9-14 PFCAs), PFHxS, HFPO-DA, PFBS, PFHpA on EU *REACH* Substances of Very High Concern list
- EU Drinking Water Directive: combined limit of 0.5 µg/l for all PFAS

Poll 2



How concerned are you about the potential effect of evolving PFAS regulations on your operations?

Rate your level of concern 1-5 with 1 being least concerned and 5 being most concerned.

State Regulation of PFAS as Air Pollutants

Arising from concerns over airborne PFAS deposition impacting ground and surface water quality, NC DEQ and NH DES ARD have required stack and other environmental testing, permits, and emission controls on a primary PFAS manufacturer in NC and a secondary manufacturer of PFAS containing products in NH.



Chemours – Fayetteville, NC
Air emission controls include carbon absorbers, waste gas scrubbers and a thermal oxidizer

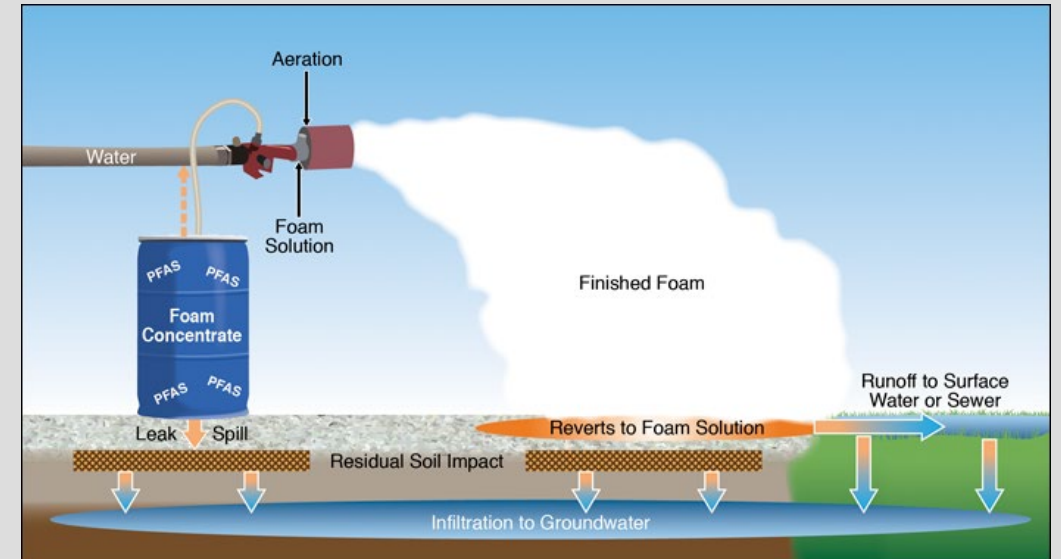


Saint-Gobain Performance Plastics Corporation – Merrimac, NH
Currently installing a thermal oxidizer to treat exhaust

PFAS in Aqueous Film Forming Foam (AFFF)



Source: American Chemical Society

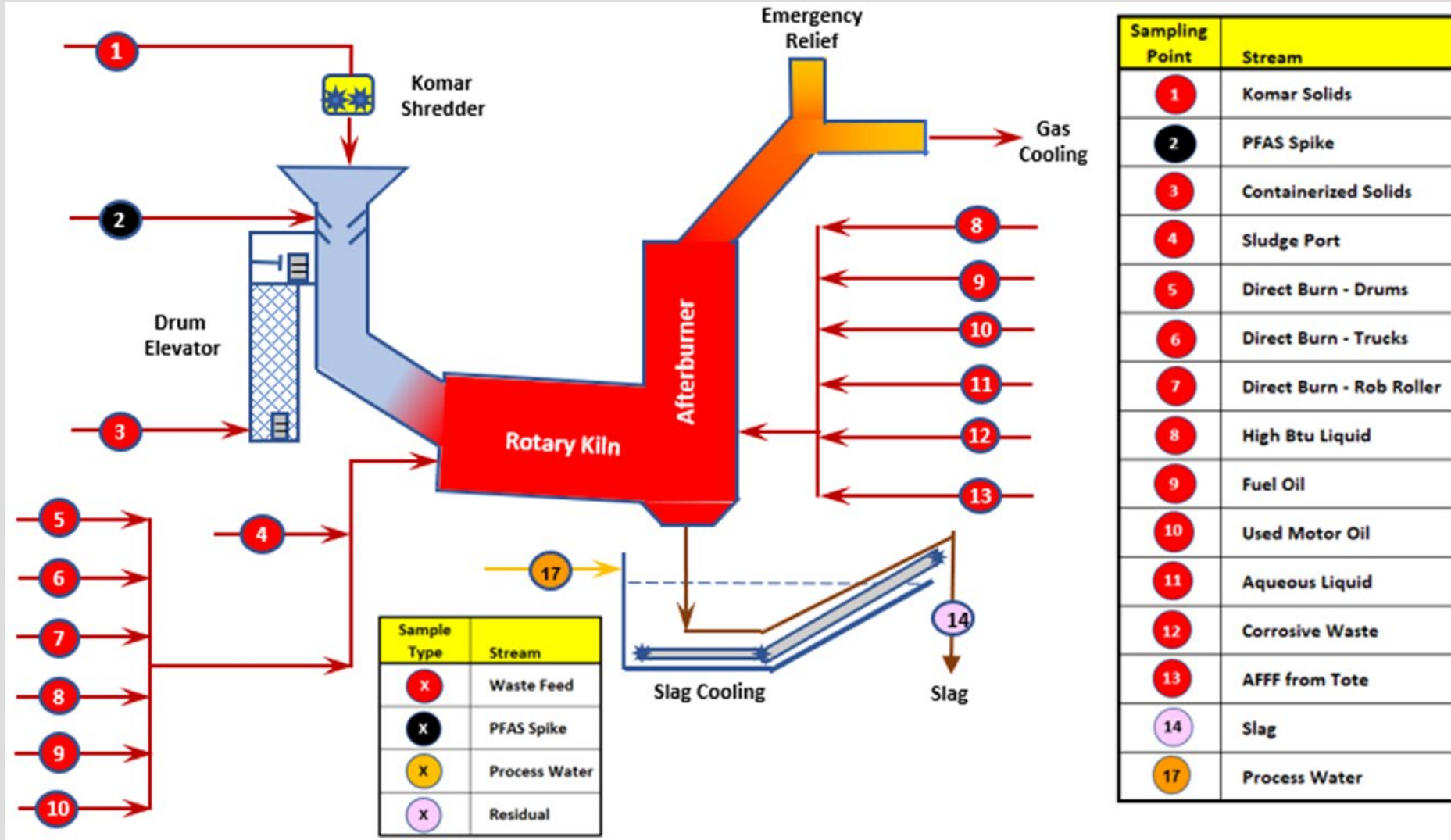


Source: ITRC

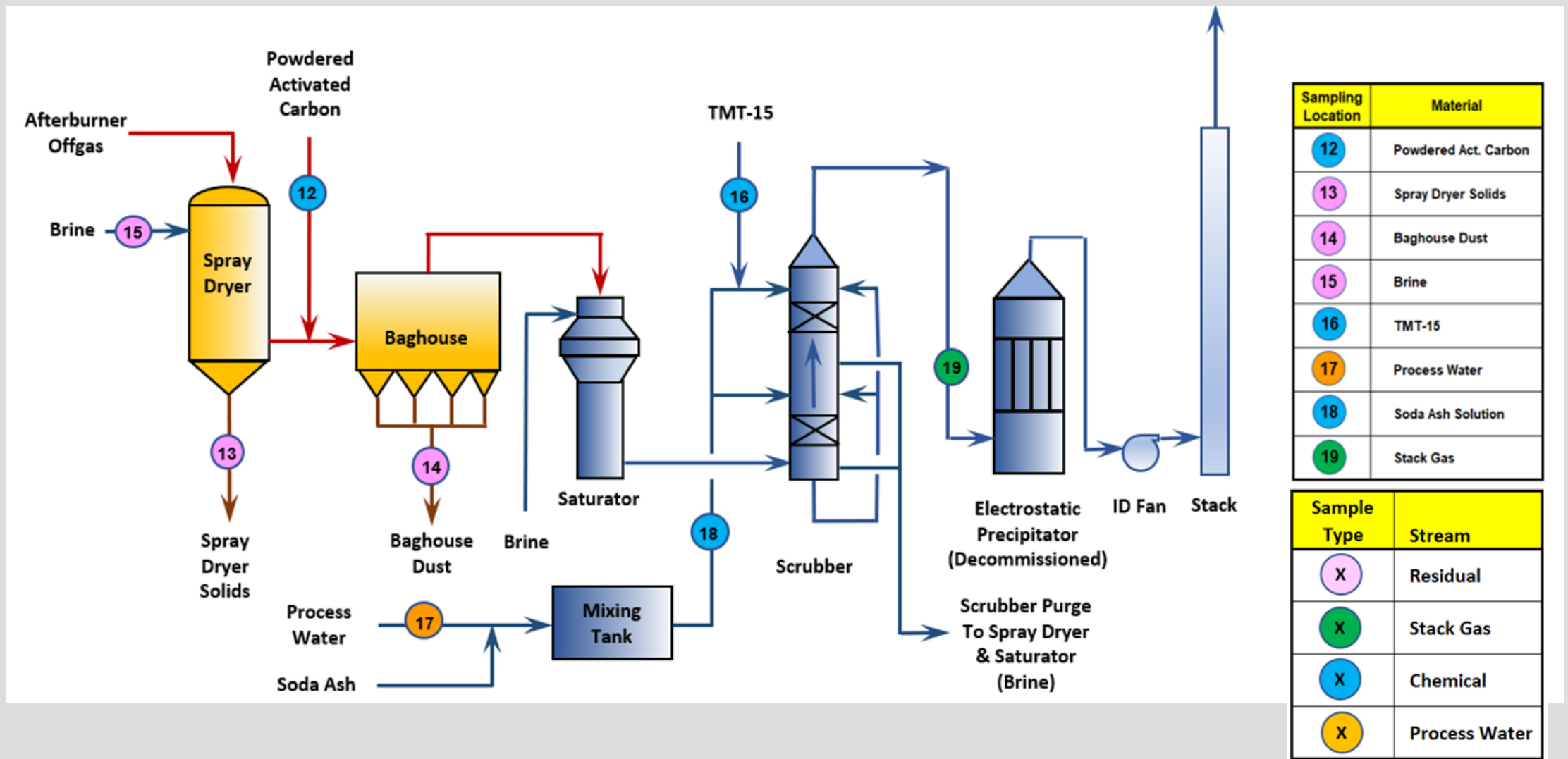
Clean Harbors PFAS Incineration Project



Combustion System Sampling Points

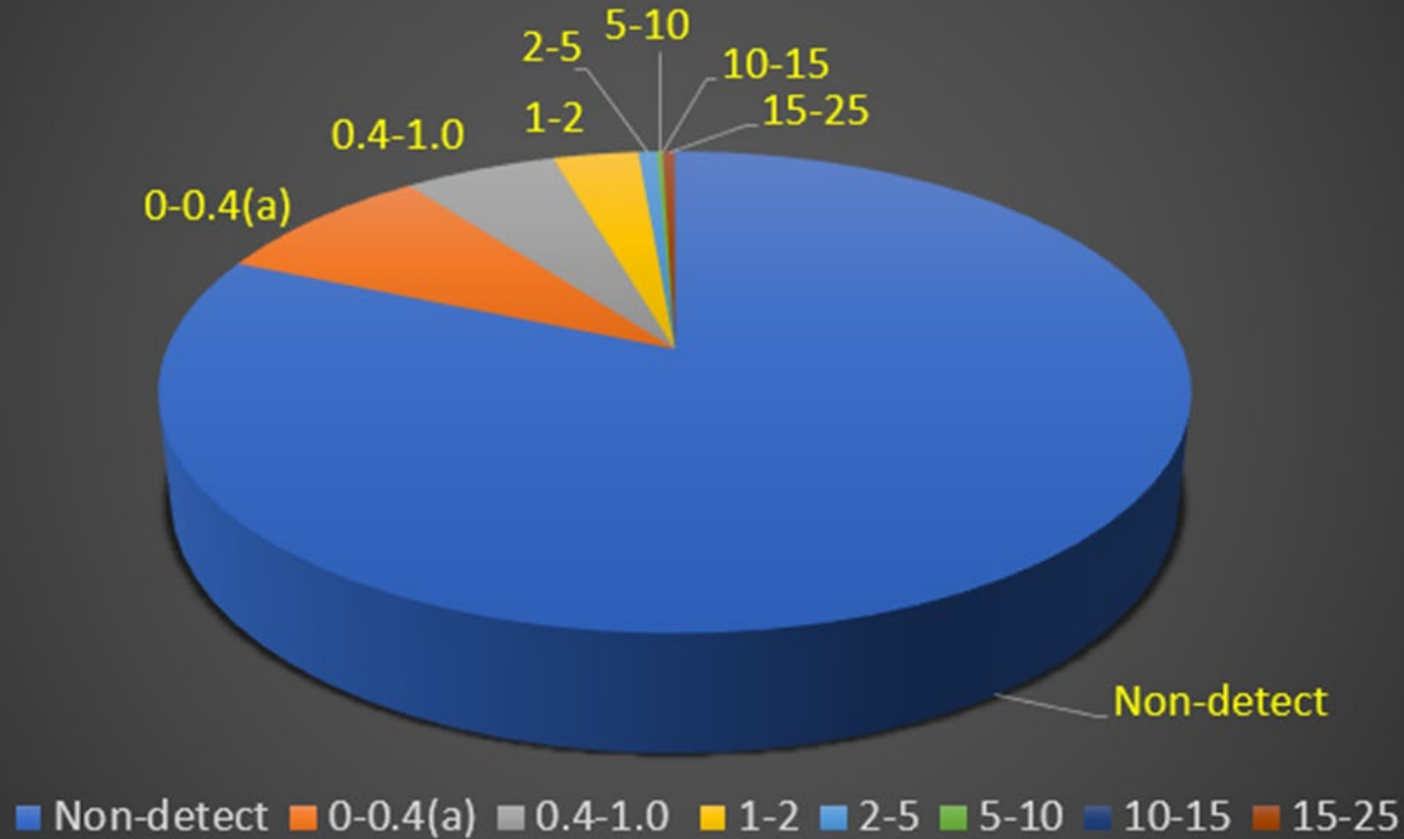


Emission Control System Sampling Points



Stack Gas PFAS Compound Concentrations

Stack Gas PFAS Concentration Distribution
(ng/dscm @7% O₂)



(a) Note: for comparison, Dioxin/Furan TEQ Emission Standard is 0.4 ng/dscm @7% O₂

PFAS Test Program Summary of DRE and Emission Results

- **DRE**
 - >99.9999% DRE for all spiked PFAS compounds during spiking runs
 - 99.99-99.999% DRE for FTS compounds, all runs
- **PFAS Emissions**
 - 90% of stack gas PFAS analyte concentrations <0.4 ng/dscm @7%O₂ (dioxin/furan TEQ emission standard)
- **PFAS Ambient Concentrations**
 - 2-8 orders of magnitude below state and EPA air limits/guidelines

Q&A

Thank you for your time!

John Kumm – jkumm@eaest.com

Mike Crisenbery - crisenberym@cleanharbors.com

2023 Conferences



IMPACT23 | Sustainability Impact Series

April 19, July 12, Dec. 7

Virtual



OPEX23 | EHS Operational Excellence

May 17 - 18

Virtual



FORUM23 | EHS & Sustainability Management Forum

October 24 - 27

Cleveland, Ohio



Upcoming Webinars on EHS&S Management



**Developing an Environmental Justice
Policy and Community Engagement
Strategy**

June 8



**ESG Data Management: Challenges and
Solutions**

July 6



**Using ISO Management Systems to
Reach ESG Goals**

September 7





Member Drop-Ins

The 3rd Thursday of the Month
Just-in-Time Knowledge Sharing

Thursday, April 20th

Thursday, June 15th

Connect with NAEM!

- Online: www.naem.org
- Via email: programs@naem.org
- Social media:
 - Twitter: [@NAEMorg](https://twitter.com/NAEMorg)
 - Facebook: www.facebook.com/NAEM.org
 - LinkedIn: <https://www.linkedin.com/company/naem>



**Thank you for
Attending!**

**A recording will be
available in 3-4 days.**

**You will receive an
email once it's
posted to our site.**

**Have a safe,
healthy and
environmentally
friendly day!**