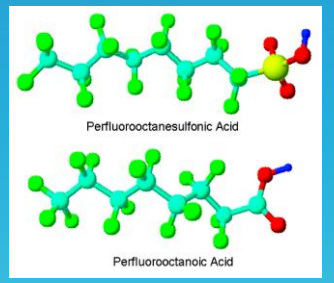
The Changing Landscape of PFAS Due Diligence



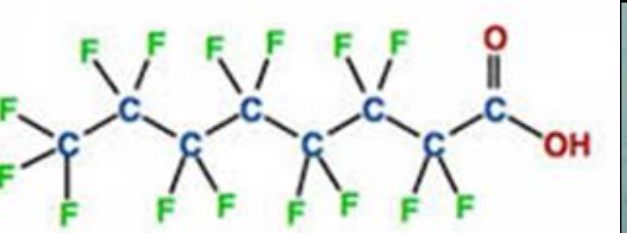
Kyle Foote, Partner – Stinson
Dana Wagner, CHMM, National Director – Terracon Consultants, Inc.

STINSON

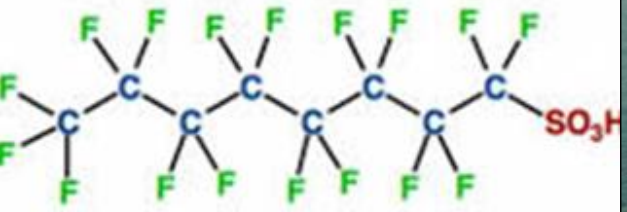
Terracon
Explore with us

Outline of the Presentation

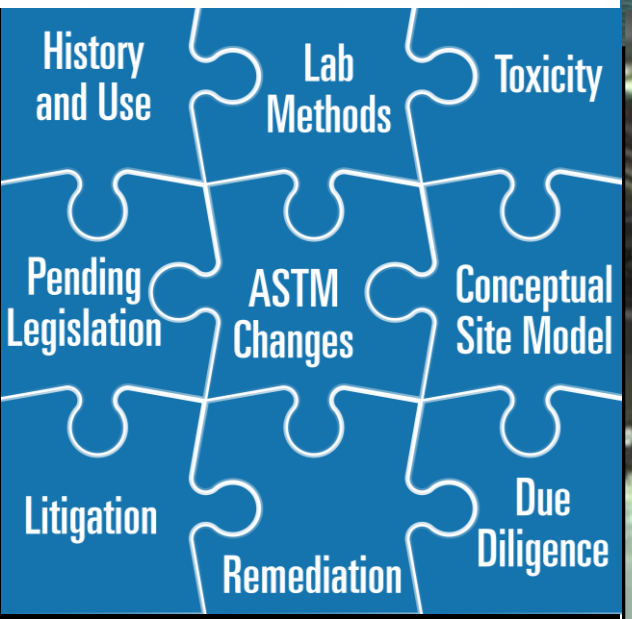
- History and Use
- Toxicity and Health Risk
- Sources of PFAS
- Current State of the Science
- Everchanging Regulatory Framework
- ASTM E1527-21 PFAS Discussion
- PFAS Due Diligence Approach
- Due Diligence Case Studies

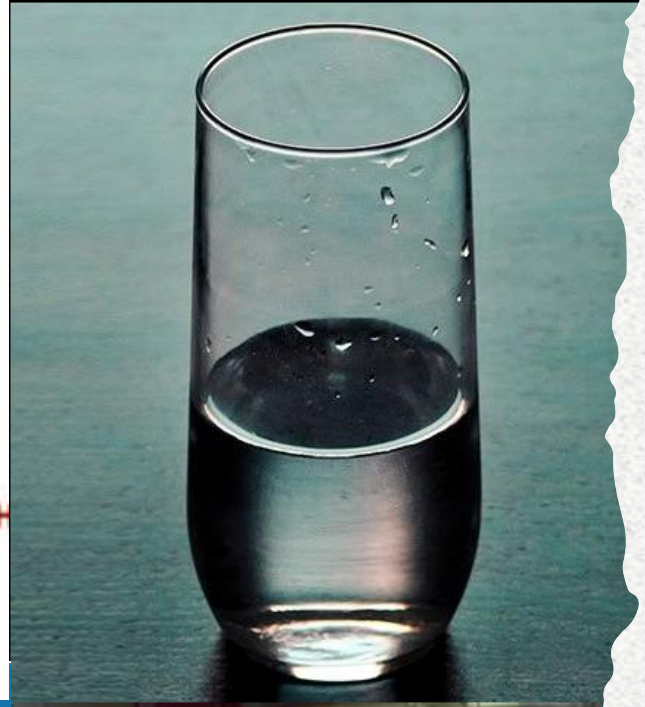


PFOA - perfluorooctanoic acid



PFOS - perfluorooctanesulfonic acid





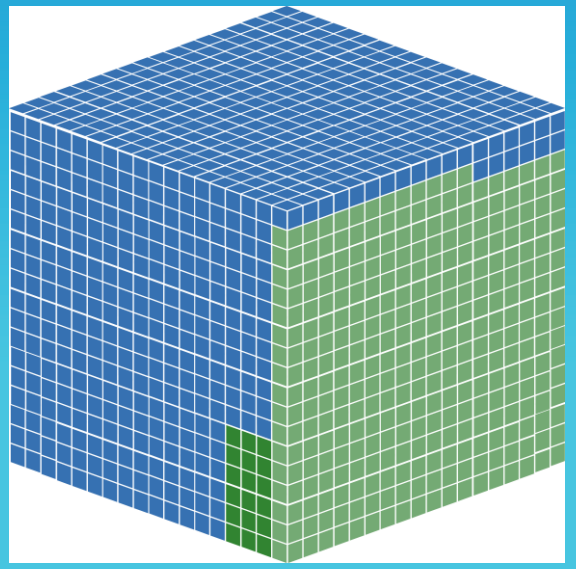
Some Questions We Have …

- Where did PFAS come from?
- How many PFAS compounds are there?
- Why are PFAS a health concern?
- Where are they found?
- Where is the state of *science* primarily focused?
- Where is the state of *regulatory development* primarily focused?
- How do the presence of PFAS affect our Clients?
- What happens when PFOA and PFOS are declared "Hazardous Substances" under CERCLA?
- What does a PFAS Due Diligence project look like?
- What are PFAS deal strategies available today?

Terracon STINSON

Per- and Polyfluoroalkyl Substances (PFAS) 101 and the "PFAS Puzzle"

- Manmade compounds not found in nature
- Developed primarily for water/oil repellency.
- "Forever Chemicals" because they don't break down
- Health implications are heightening concerns
- Found across the globe and at the poles
- Ingestion is primary pathway for exposure
- 98% of Americans have detectable PFAS in their bloodstream
- Estimates vary from 5,000 to 8,000+ different PFAS exist



History and Use

PFAS History

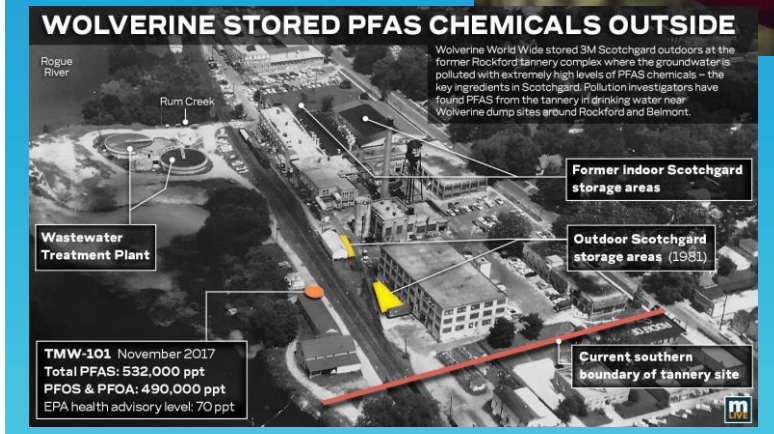
History and Use of Per- and Polyfluoroalkyl Substances (PFAS) *continued*

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

PFAS[1]	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[2])
PFOA		Initial Production		Protective Coatings				
PFNA					Initial Production	Architectural Resins		
Fluoro-telomers					Initial Production	Firefighting Foams		Predominant form of firefighting foam
Dominant Process[3]		Electrochemical Fluorination (ECF)						Fluoro-telomerization (shorter chain ECF)
Pre-Invention of Chemistry /			Initial Chemical Synthesis / Production			Commercial Products Introduced and Used		

Notes:
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.

Sources: Prevedouros et al. 2006; Concawe 2016; Chemours 2017; Gore-Tex 2017; US Naval Research Academy 2017



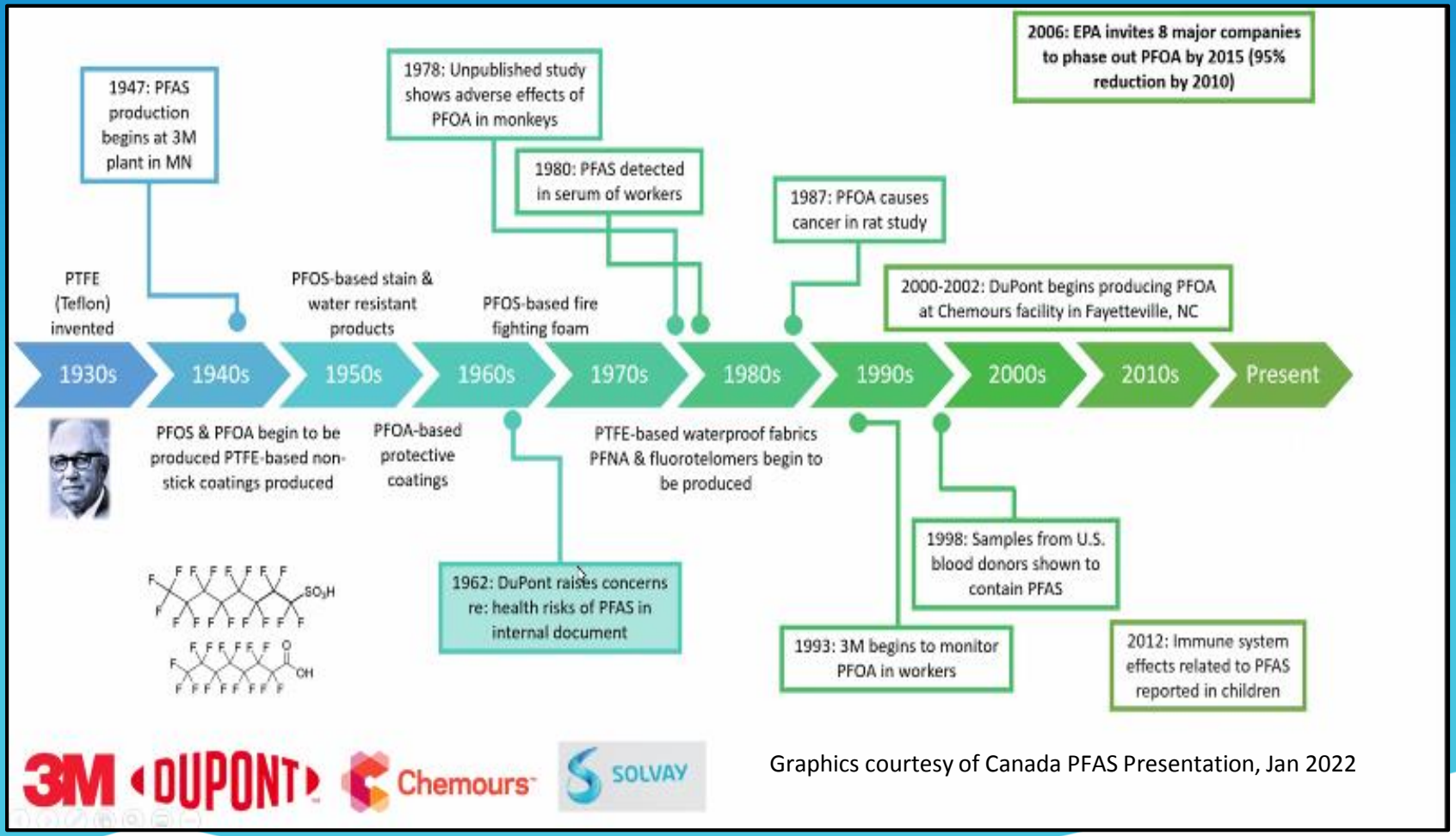
Explore with us

History and Use

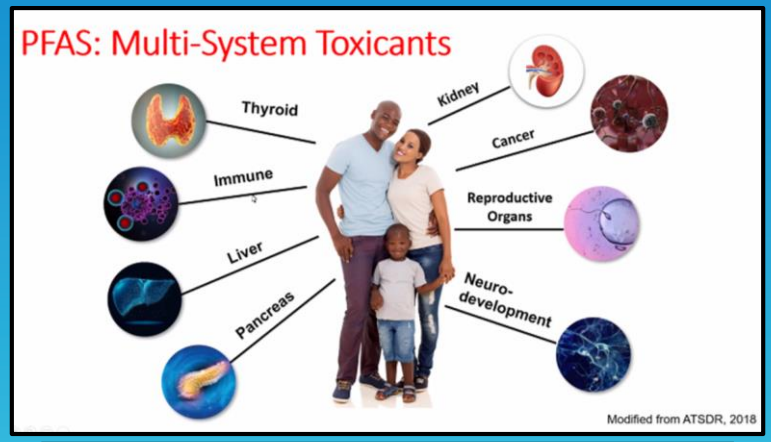
Tragedy Drives Innovation – Aqueous Film Forming Foam

Toxicity

PFAS-Exposure Related Health Concerns began in 1960s



Graphics courtesy of Canada PFAS Presentation, Jan 2022



Wide Range of Health Effects of PFAS

PFOS and/or PFOA

- Testicular cancer
- Kidney cancer
- Ulcerative colitis
- High cholesterol
- Pregnancy-induced hypertension
- Thyroid disruption
- Hormonal changes
- Liver malfunction
- Obesity
- Immunotoxicity, incl. interference with child and adult vaccine response
- Lower birth weight and size
- Delayed puberty, decreased fertility, early menopause
- Reduced testosterone
- Prostate cancer
- Ovarian cancer

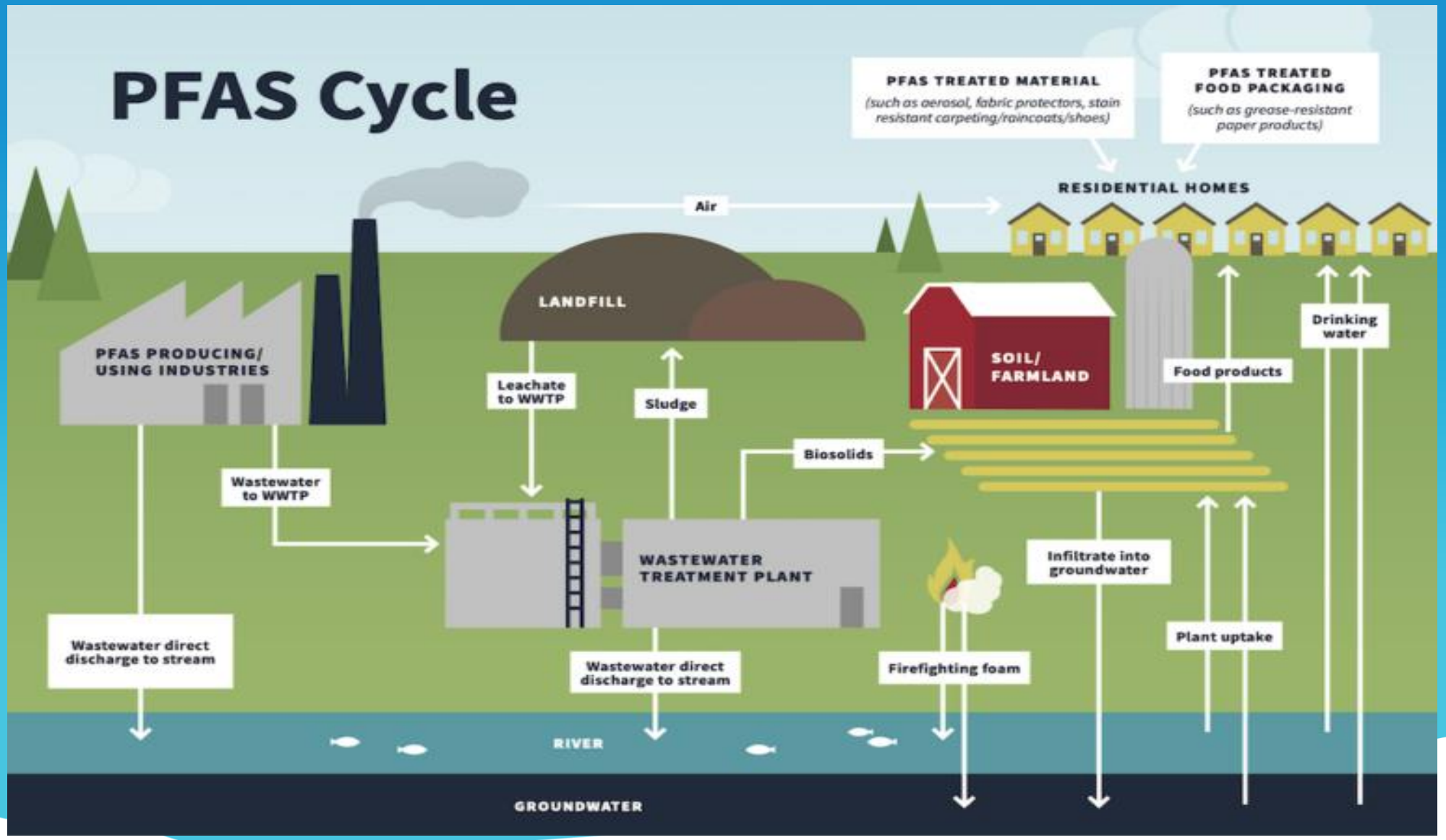
Terracon STINSON

Explore with us

Where Are PFAS Found?

- Drinking water
- Soil and water at or near waste sites
- Fire extinguishing foam
- Manufacturing or chemical production facilities that produce or use PFAS
- Food
- Food packaging
- Household products and dust
- Personal care products
- Biosolids

Conceptual Site Model



Source: ITRC

Explore with us

Conceptual Site Model

Where is PFAS Contamination Found?

- Airports
- POTWs
- DOD sites
- Chemical Manufacturing Sites
- Fire Response Sites (fire training)
- Landfills

Sites with PFAS Contamination

Site Category	Sites	% possible PFAS contamination	Est. Sites PFAS contamination
NPL: Superfund	2,000	20-30%	500
RCRA Corrective Action	4,000	20-30%	1,000
RCRA UST	140,000	3-5%	5,600
DOD	6,400	65-70%	4,288
DOE	5,000	10-15%	600
Civilian Agencies	3,000	25-30%	810
State Sites	120,000	5-10%	8,400
Chemical Mfg Sites	2,000	30-35%	660
Manufacturing Sites	280,000	5-10%	19,600
POTWs 10 MGD+	500	70-80%	375
POTWs <10 MGD	15,000	30-40%	5,250
Landfills	7,000	40-50%	3,150
Airports	500	70-80%	375
Airports: Regional	1,000	30-40%	350
Other	50,000	5-10%	3,500
Total	636,400	9%	54,458
Source: EBI PFAS site model 2019			

Conceptual Site Model

Facilities with PFAS Production, Use or Pass Throughs

Environmental Science Processes & Impacts

ROYAL SOCIETY OF CHEMISTRY

PAPER

View Article Online
View Journal | View Issue

Check for updates

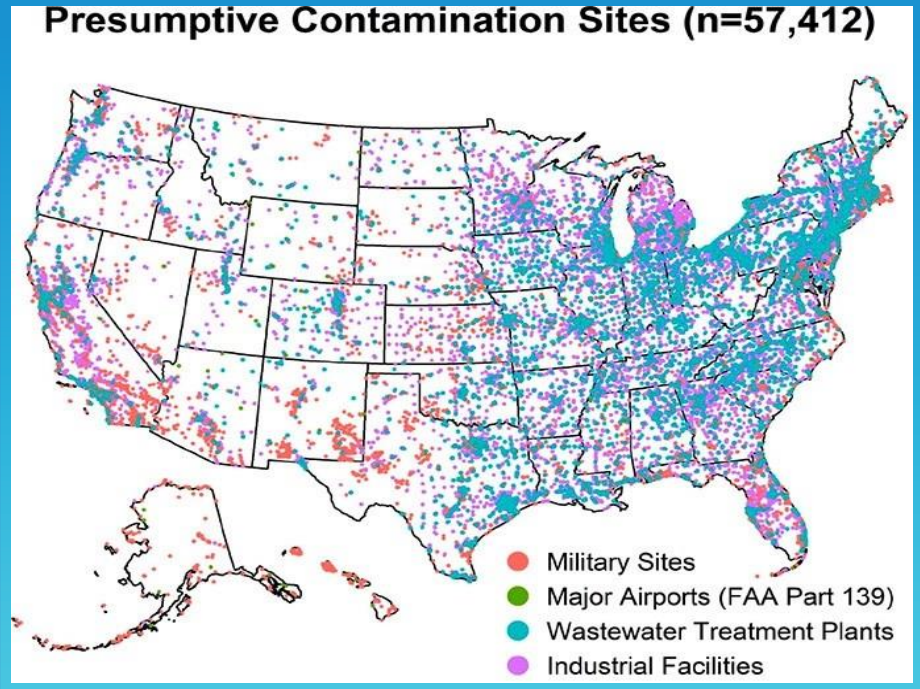
Cite this: *Environ. Sci.: Processes Impacts*, 2020, **22**, 2345

An overview of the uses of per- and polyfluoroalkyl substances (PFAS)†

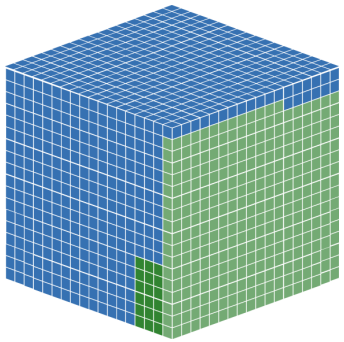
Juliane Glüge,[*a] Martin Scheringer,[a] Ian T. Cousins,[b] Jamie C. DeWitt,[c] Gretta Goldenman,[d] Dorte Herzke,[ef] Rainer Lohmann,[g] Carla A. Ng,[h] Xenia Trier[i] and Zhanyun Wang[j]

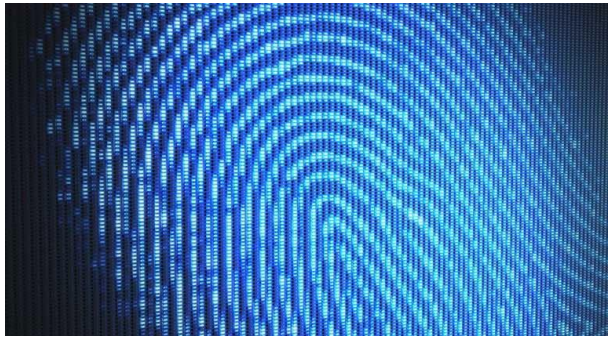
Per- and polyfluoroalkyl substances (PFAS) are of concern because of their high persistence (or that of their degradation products) and their impacts on human and environmental health that are known or can be deduced from some well-studied PFAS. Currently, many different PFAS (on the order of several thousands) are used in a wide range of applications, and there is no comprehensive source of information on the many individual substances and their functions in different applications. Here we provide a broad overview of many use categories where PFAS have been employed and for which function; we also specify which PFAS have been used and discuss the magnitude of the uses. Despite being non-exhaustive, our study clearly demonstrates that PFAS are used in almost all industry branches and many consumer products. In total, more than 200 use categories and subcategories are identified for more than 1400 individual PFAS. In addition to well-known categories such as textile impregnation, fire-fighting foam, and electroplating, the identified use categories also include many categories not described in the scientific literature, including PFAS in ammunition, climbing ropes, guitar strings, artificial turf, and soil remediation. We further discuss several use categories that may be prioritised for finding

Received 2nd July 2020



Source: Collaborative on Health and Environment (November 2022)





Where is the state of *science* focused?

Lab Methods

- EPA Method 1633
- Battelle "PFAS Fingerprint" Forensic Source Differentiation

Toxicity

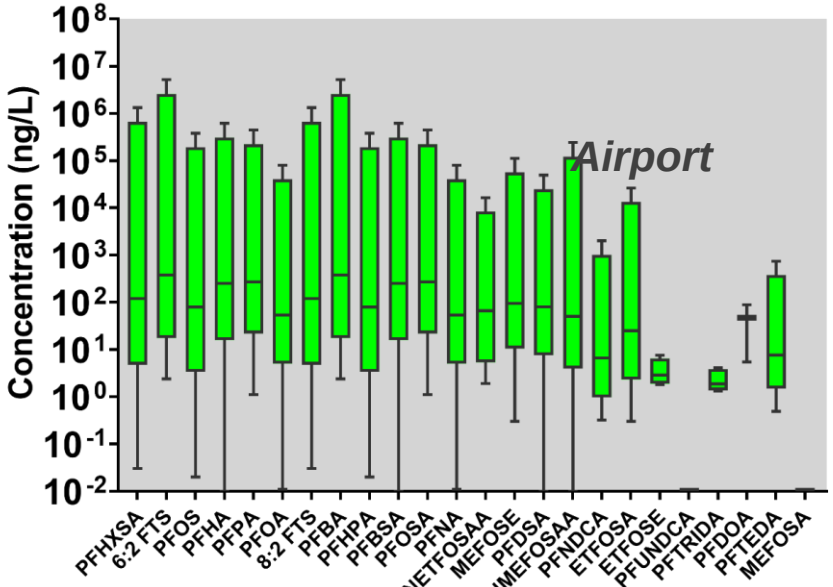
- EPA continues to assess and publish tox values

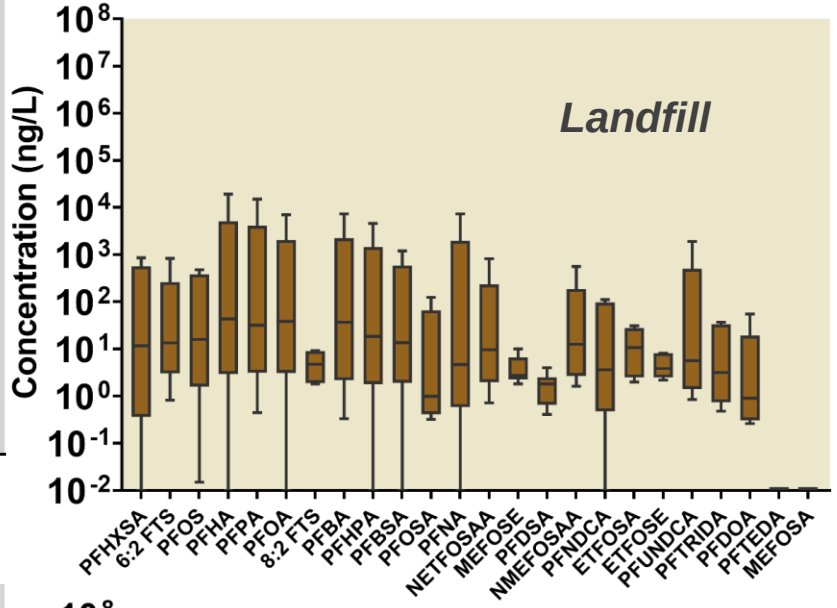
Remediation

- Lots of intense focus on destruction; not simply media transference

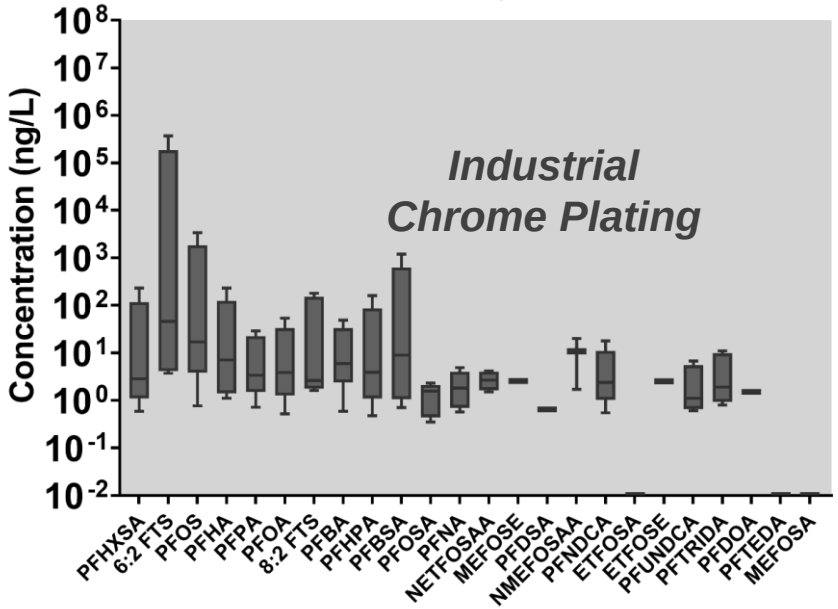
Profile and Concentration Distributions

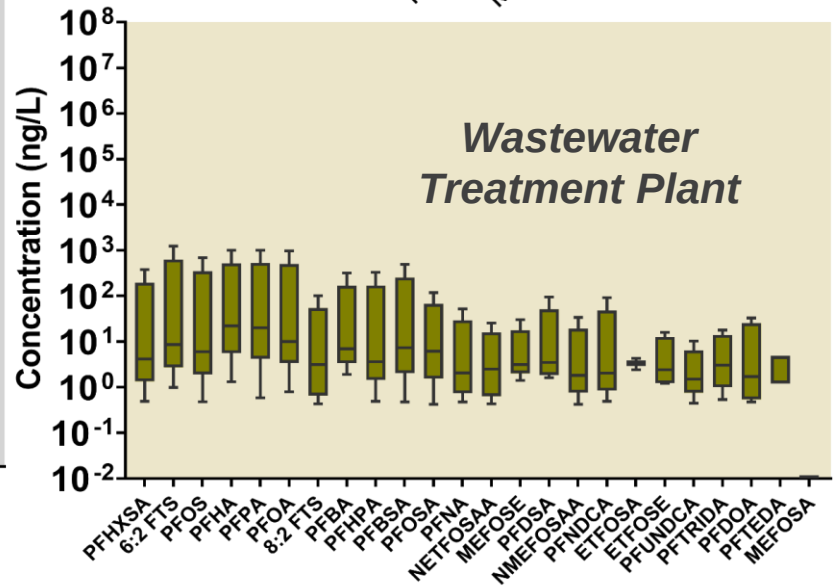
Lab Methods





- Perfluorobutanoic acid (PFBA)
- Perfluoropentanoic acid (PFPeA)
- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluoropentanesulfonic acid (PFPeS)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluoroheptanesulfonic Acid (PFHpS)
- Perfluorooctanesulfonic acid (PFOS)





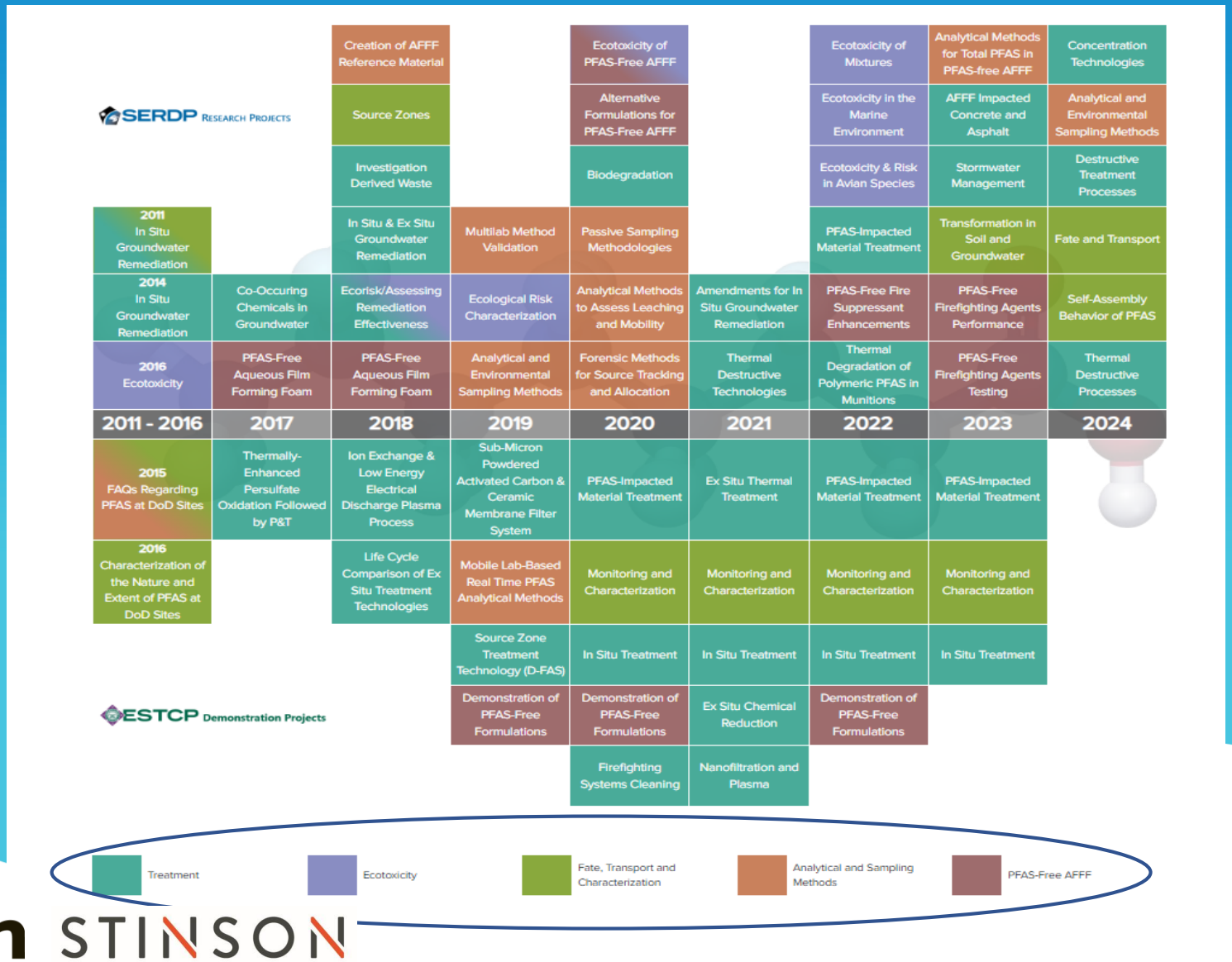
- Analyte list differs slightly (e.g., platers)
- Airport concentrations are generally higher
- Identified that PFHxS and PFOS ratios may be helpful

Terracon STINSON

Explore with us

Remediation

Where is the state of *science* focused?

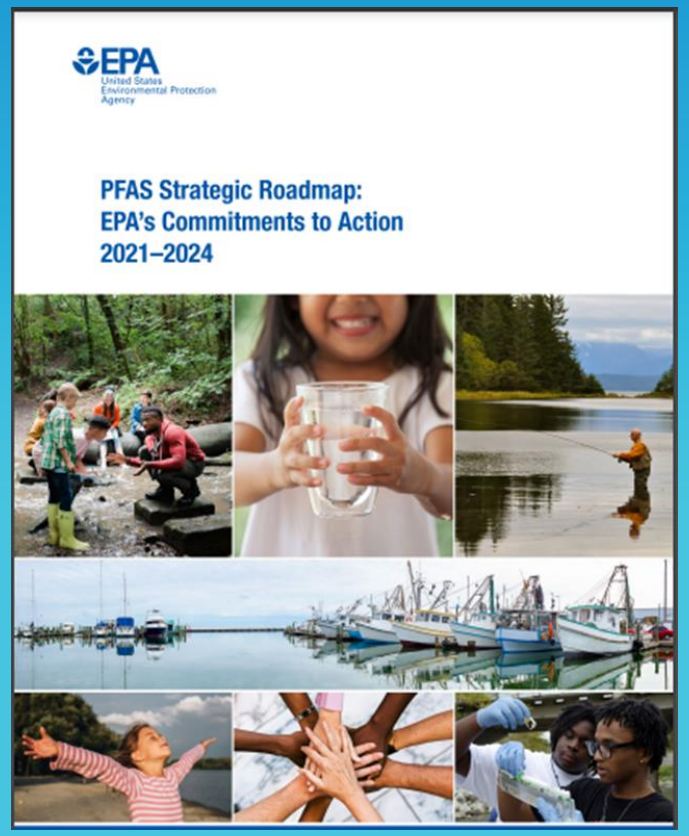


Current research and demonstration projects are related to PFAS treatment

Terracon STINSON

Explore with us

Where is the federal regulatory framework focused?



Addressing PFAS in the Environment

AGENCY: Environmental Protection Agency (EPA).

ACTION: Advance notice of proposed rulemaking (ANPRM).

SUMMARY: The Environmental Protection Agency (EPA or the Agency) is seeking public input and data to assist in the consideration of potential development of future regulations pertaining to per- and polyfluoroalkyl substances (PFAS) under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). The Agency is seeking input and data regarding potential future hazardous substance designation under CERCLA of: Seven PFAS, besides perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), and their salts and structural isomers, or some subset thereof; precursors (a precursor is a chemical that is transformed into another compound through the course of a degradation process) to PFOA, PFOS, and seven other PFAS; and/or categories of PFAS.

DATES: Comments must be received on or before June 12, 2023. Under the Paperwork Reduction Act, comments on the information collection provisions are best assured of consideration if the Office of Management and Budget (OMB) receives a copy of your comments on or before May 15, 2023.

https://www.govinfo.gov/content/pkg/FR-2023-04-13/pdf/2023-07535.pdf

Where is the federal regulatory framework focused?

National Primary Drinking Water Regulation: Maximum Contaminant Levels

Summary

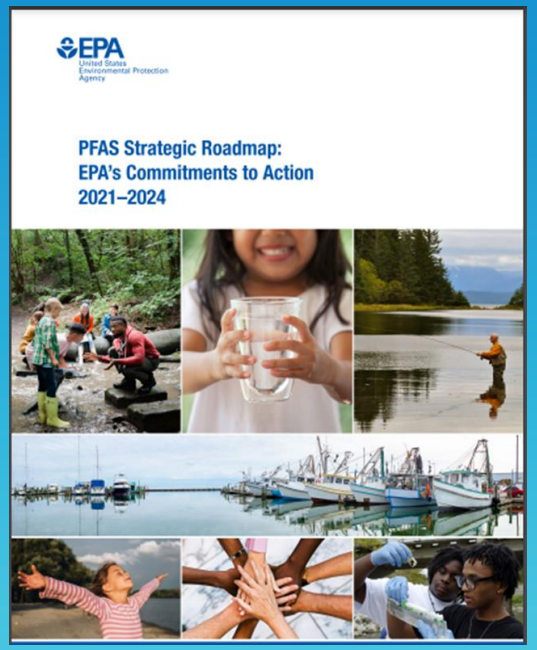
EPA is proposing a National Primary Drinking Water Regulation (NPDWR) to establish legally enforceable levels, called Maximum Contaminant Levels (MCLs), for six PFAS in drinking water. PFOA and PFOS as individual contaminants, and PFHxS, PFNA, PFBS, and HFPO-DA (commonly referred to as GenX Chemicals) as a PFAS mixture. EPA is also proposing health-based, non-enforceable Maximu Contaminant Level Goals (MCLGs) for these six PFAS.

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

The proposed rule would also require public water systems to:

- Monitor for these PFAS
- Notify the public of the levels of these PFAS
- Reduce the levels of these PFAS in drinking water if they exceed the proposed standards.

https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas



Where is the regulatory framework development at the state level primarily focused?

- States have their own regulations and guidance which supersedes federal guidance
- States are choosing "Notification", "Guidance" or MCL" development
- Some states use Rules to implement; others choose Regulations

Notification	A corporate representative must inform an appropriate state official that a drinking water concentration in a water source owned or operated by the corporation (public well, supply tank, etc.) is above the limit. A water supply system also may have to inform its customers if there are any samples that exceed the PFAS values.
Guidance	The state establishes recommended concentration limits for one or more PFAS substances, but no notification or other action is required if concentrations exceed the recommended limits.
MCL	MCLs establish the maximum amount of a PFAS compound that can be present in drinking water. Treatment facilities that supply drinking water must ensure that these limits are met by treating and filtering the drinking water, and also by limiting the discharge of PFAS compounds through permits.

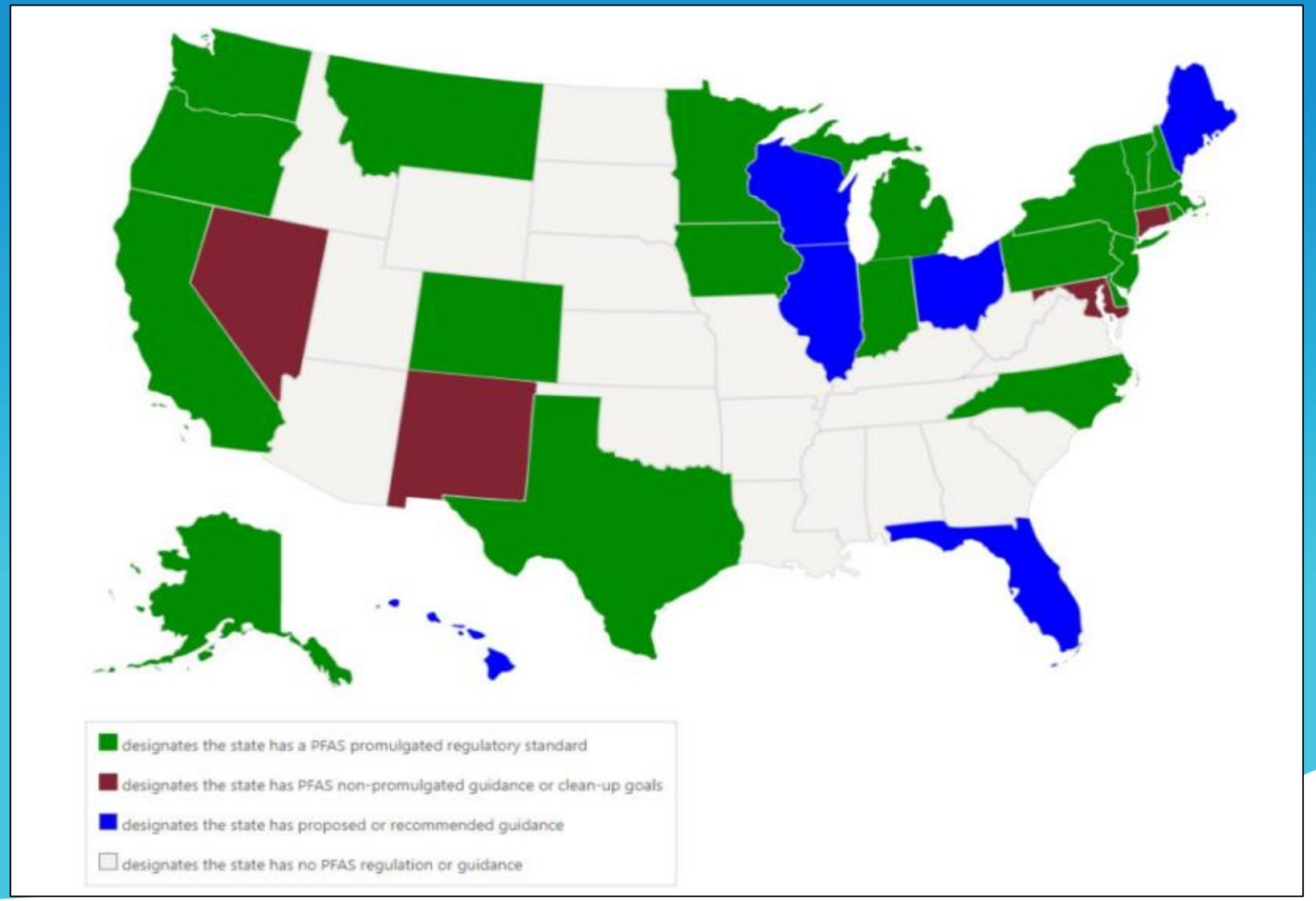
Explore with us

Terracon STINSON

Pending Legislation

Where is the regulatory development at the state level primarily focused?

PFAS State Survey



Source: ITRC, March 2023

Terracon STINSON

Explore with us

What happens when PFOA and PFOS are declared "Hazardous Substances" under CERCLA?

Due Diligence Impacts

- Cost recovery from Potentially Responsible Parties (PRP)
- Joint and Several Liability for PRPs
- Enforcement mechanism
- Possible "NFA" re-opener for the discovery of PFAS (similar to VI concerns)

Broader Superfund Program Impacts

- Expand existing site investigations and enforcement action to include PFOA and PFOS
- Possible re-evaluation of remedies at ongoing cleanup sites
- Potentially re-open sites currently in monitoring and maintenance
- You are not done yet!

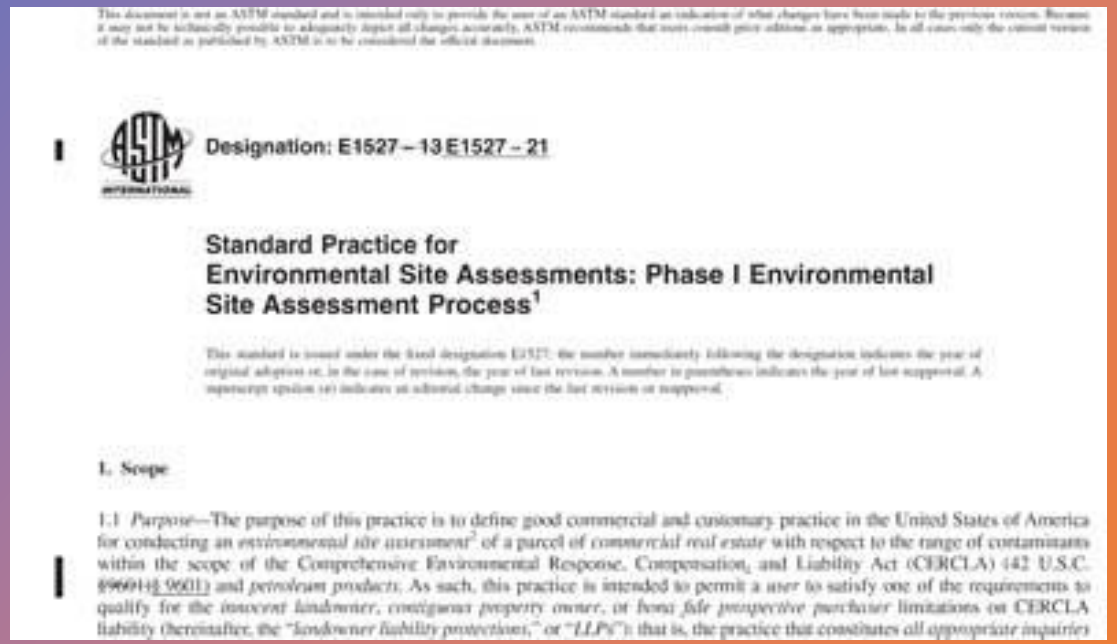
Terracon STINSON

What happens when PFOA and PFOS are declared "Hazardous Substances" under CERCLA?

Phase I/LSI Considerations

- PFAS would change from additional scope consideration component of BER to REC
- "Innocent Landowner Defense" will be challenged for Phase Is not adequately addressing PFAS sources
- Mitigation would be needed to address the REC (Investigation, remediation and regulatory resolution are challenging, time intensive and expensive)
- Potential stigma associated with PFAS on site for both Purchaser and Buyer whether deal is completed or not
- Release reporting requirements
- "Continuing Obligations" and "Reasonable Steps": not required to remediate but must control migration

Terracon STINSON



Designation: E1527 – 13 E1527 – 21

Standard Practice for
Environmental Site Assessments: Phase I Environmental
Site Assessment Process[1]

1. Scope

ASTM E1527-21 – What's Different from ASTM E1527-13?

- Revises the definitions of RECs, Controlled RECs and Historic RECs
- Modifies the scope of historical reviews for adjacent properties
- Expands title search standards
- Addresses Emerging Contaminants like PFOA/PFOS
- Reporting and Clarifications related to procedures and definitions
- Incremental in nature and generally consistent with our current practices.

How does the presence of PFAS affect our Clients?

Terracon STINSON

Explore with us

PFAS Approach

- Frame the Problem
- Understand PFAS Usage
- Establish Discharge Pathways
- Identify Receptors
- Evaluate Risk
- Determine Restoration Alternative

Due Diligence Practice

- ASTM E1527-21 and include PFAS from the “Non-Scope” menu – especially if PFAS is regulated at the State level, but even if not regulated and the target site is industrial or surrounded by industrial uses.
- Discussion of PFAS as an emerging contaminant with the client and in the ESA proposal
- Site-specific risks including the use and state regulatory framework are important factors.
- Caveat: Be cautious about potentially establishing a “false” baseline.
- Once PFAS is added as a “Hazardous Substance” under CERCLA, it will automatically be an in-scope consideration.

Due Diligence Practice

Phase I ESA Approach

- Reported as Additional Service
- PFAS-related language in Executive Summary, Regulatory Review, and Additional Services
- Regulatory Database Review
- Historical Review
- Site Reconnaissance
- PFAS Questionnaire
- Findings workflow similar to REC, but result in “potential environmental concern” or BER

Due Diligence Beyond Phase I ESA

- In addition to Phase I ESA, more analysis will be required because at this stage PFAS databases and other documentation are limited.
- Work with Environmental Professional concerning whether a Phase II investigation is warranted.
- Phase I ESA is only one component of environmental due diligence – especially when an emerging contaminant (PFAS) has such an evolving status from a scientific and legal/regulatory perspective.
- Documentation: SDS, Waste Manifests, NFA/CNS, AULs.
- Other key diligence components: contractual agreements, covenants, representations and warranties, indemnifications.

Is Additional Assessment Required?

- Phase I ESA is not definitive. It should be viewed as part of the Risk Profile, along with other considerations.
- Phase II Investigation should not be automatic
- Broader analysis is required to refine the Risk Profile
- Evaluate EPA's "Continuing Obligations" and "Reasonable Steps"
- LSI for absence/presence or attempt to understand its genesis/extent and magnitude

Due Diligence

EBA 2023 Phase II Study

Contamination Discovery Rates (CDR)

Property Type	Total # of Sites (n)	Contamination	Above Residential Reg.	Above Commercial Reg.	Above Industrial Reg.
ASTs – Bulk Storage	87	45%	24%	11%	1%
Auto Service	634	66%	27%	19%	2%
Commercial Print Shops	84	48%	26%	14%	10%
Dry Cleaners	655	71%	40%	27%	3%
Heating Oil USTs	42	45%	26%	17%	0%
Historic Manufacturing	636	72%	38%	26%	5%
Metal Fabrication	81	72%	46%	26%	11%
Off-Site Issues	259	85%	47%	30%	3%
PFAS	13	31%	23%	0%	0%
Plating	55	82%	51%	27%	2%
USTs	1,177	65%	30%	15%	2%

What if you find something?

Considerations: through PFAS science and policy lens

- Proposed Use?
- Future Sale Considerations: Resale Planning
- Possible Source: Site Origin? Nearby Origins?
- Concentrations Observed: Contamination Levels?
- Physical Setting? Media Affected?
- Source Extent and Magnitude: Release Scale?
- Drinking Water: Potable Sources?
- Continuing Obligations?
- Reasonable Steps?
- 3rd Party Actions: External interference potential?
- Regulatory Framework: Regulatory action? Liability protections?

How far do you take an investigation?

- A potential impact to drinking water sources – significantly escalates the risk and liability analysis.
- There will be scenarios that may prescribe additional delineation on-site
- Off-site investigation can be challenging
- Timing of additional delineation may also be a function of whether a site could be enrolled in a Voluntary Cleanup Program

Whether to Proceed with Transaction

Decisions involving how far to take an investigation and whether to proceed with the Transaction must also include analysis of:

- Lease vs Purchase
- Continuation of existing use? If so, ensure that all PFAS products have been eliminated, evaluate release pathways (e.g., floor drains) and eliminate, if possible, confirm that potential PFAS sources (e.g., detention basin) have been contained, remediated and/or removed.
- Expansion and Redevelopment? If so, consider management and disposal of PFAS-impacted materials and incremental costs

PFAS Risk Scenario

Moderate Risk Scenario: Buy and use as is.

- Site is impacted by what is documented to be a migrating deep groundwater release from off-site.
- Confirm no on-site detections in soil to eliminate possibility of on-site source.
- No documented receptors based upon depth to groundwater and concentrations.
- Confirm that there is no on-site drinking water source.
- Regulatory framework to address liability.
- Discussion of intended use and a continuing obligation to avoid exacerbating the release.
- Risk might be deemed acceptable given the proposed use and the client decides to move forward.

PFAS Risk Scenario

Moderate/High-Risk Scenario: Proposed Redevelopment

- Site impacted by what is determined to be a migrating shallow groundwater release from off-site.
- Potential dewatering needs for construction.
- Possible soil spoils requiring off-site management for the development.
- No drinking water receptors. Determine if VI is a concern.
- Is there a responsible party for the release?
- What is the regulatory framework?
- Develop an approach and cost to address impacts in the context of the deal.
- Client may decide to walk-away without liability protections.

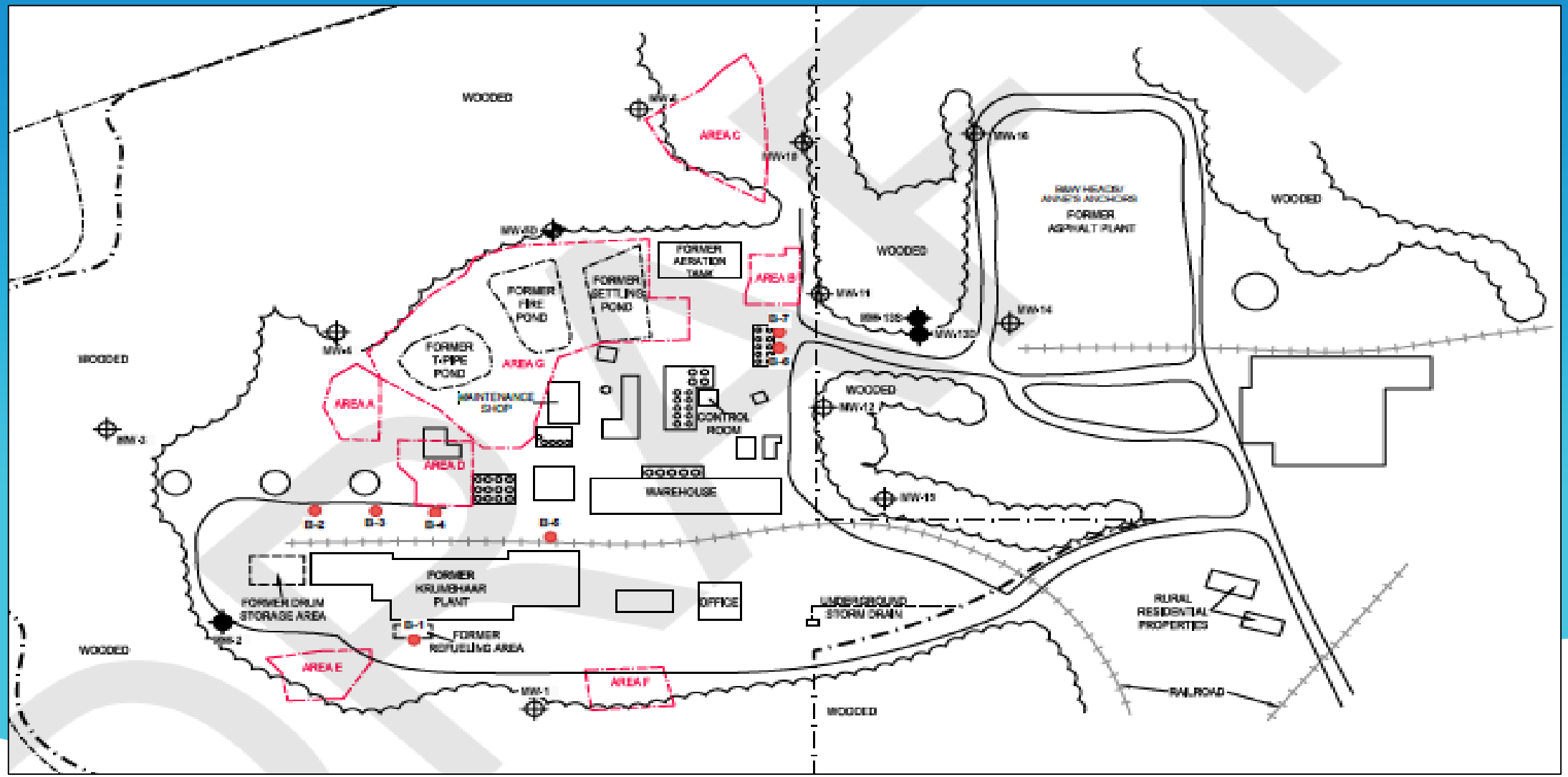
PFAS Risk Scenario

High-Risk Scenario:

- Site impacted by an on-site release.
- Extensive soil and groundwater impacts are present.
- Drinking water receptor noted downgradient.
- Unlikely that further testing is going to change the opinion of risk.

Due Diligence

Case Study #1



Terracon STINSON

Explore with us

Case Study #2

Medical Office Building Denver, CO

- REC: Historical use as part of AFB BER: PFAS
- Engagement with Client on Cost/Benefit of assessing REC and possible presence of PFAS.
- Seller and their consultant were receptive and understood reason for further review.
- Scope included up and downgradient monitoring wells.

Case Study #2

Findings:

- Background metals concentrations in the soil and groundwater.
- VOCs in the groundwater, below Colorado regulatory limits.
- PFAS detections in soil and groundwater, total PFAS slightly exceeding the current health advisory.

Resolution:

- AFB noted as PRP, in the event of any actions.
- Property use not affected.
- Structured price reduction in the deal.

PFAS Due Diligence Recap:

Educate	Client and deal team on PFAS and risks
Consult	Client on costs and benefits of assessing PFAS in their transaction.
Consider	Stakeholders, schedule, regulatory state of play and viable resolutions in your evaluation.
Check out	Latest PFAS related federal, state and local regulations, analytical techniques and remedial technologies

Explore with us

We’re here to help!
Thank you for your time.

Kyle Foote, Partner
Partner
Stinson
D (816) 691-3391
Kyle.foote@stinson.com

Dana Wagner, CHMM
National Director
Environmental Due Diligence
Sector Lead- Financial Legal
Investment
D (763) 489-3161
M (612) 709-7193
Dana.Wagner@terracon.com

STINSON

Terracon
Explore with us