



PFAS Overview

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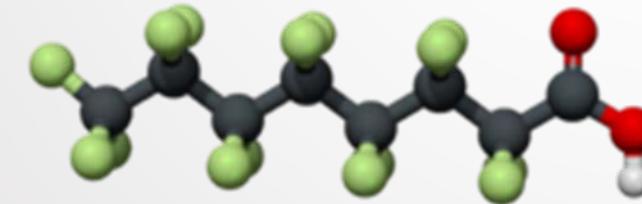
Solid Waste Management Advisory Committee
June 25, 2019



Overview

- ▶ What are PFAS and where are they found?
- ▶ Why should we care?
- ▶ What PFAS remediation technologies currently exist?
- ▶ What is EPA doing about PFAS?
- ▶ What is CT doing about PFAS?
- ▶ Resources

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PFOA



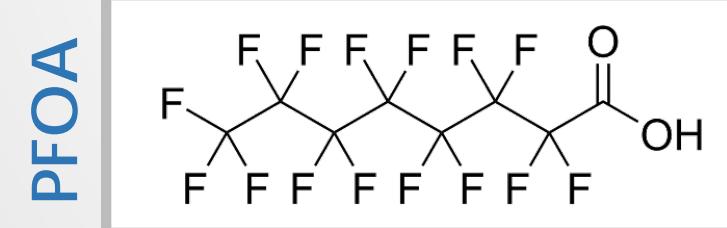
PFOS



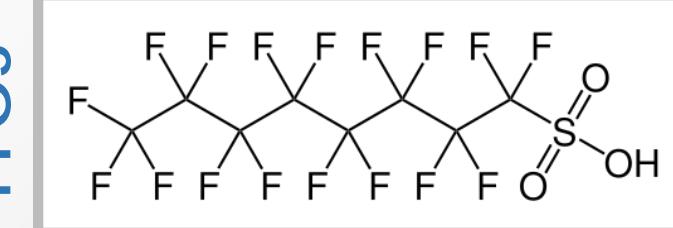
What Are PFAS?

PFAS = Per- and Polyfluorinated Alkyl Substances

- ▶ Over 4,700 “forever chemicals”
- ▶ Developed in the 1940s
- ▶ Ubiquitous in consumer products and industry
- ▶ PFOA and PFOS most well-known



Perfluorooctanoic acid



Perfluorooctane sulfonic acid

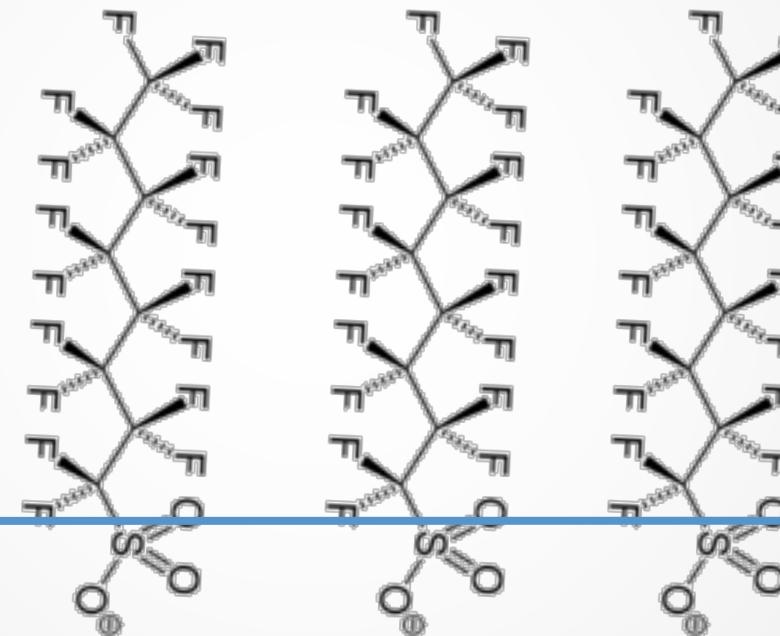
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PFAS Characteristics

Air

Water



Tail –
Not soluble in
oil or water

Head –
Water-soluble

Image Source: Bing Creative Commons



PFAS Characteristics

GOOD

- ▶ Resist oil, grease, water, heat
- ▶ Stable

BUT....

BAD

- ▶ Extremely persistent – resist degradation
- ▶ Bioaccumulative
- ▶ Toxic
- ▶ Migrate easily
 - ▶ High solubility, low volatility, mobile in soil, leach to groundwater
 - ▶ Air emissions a source of soil & groundwater pollution



Some PFAS Uses

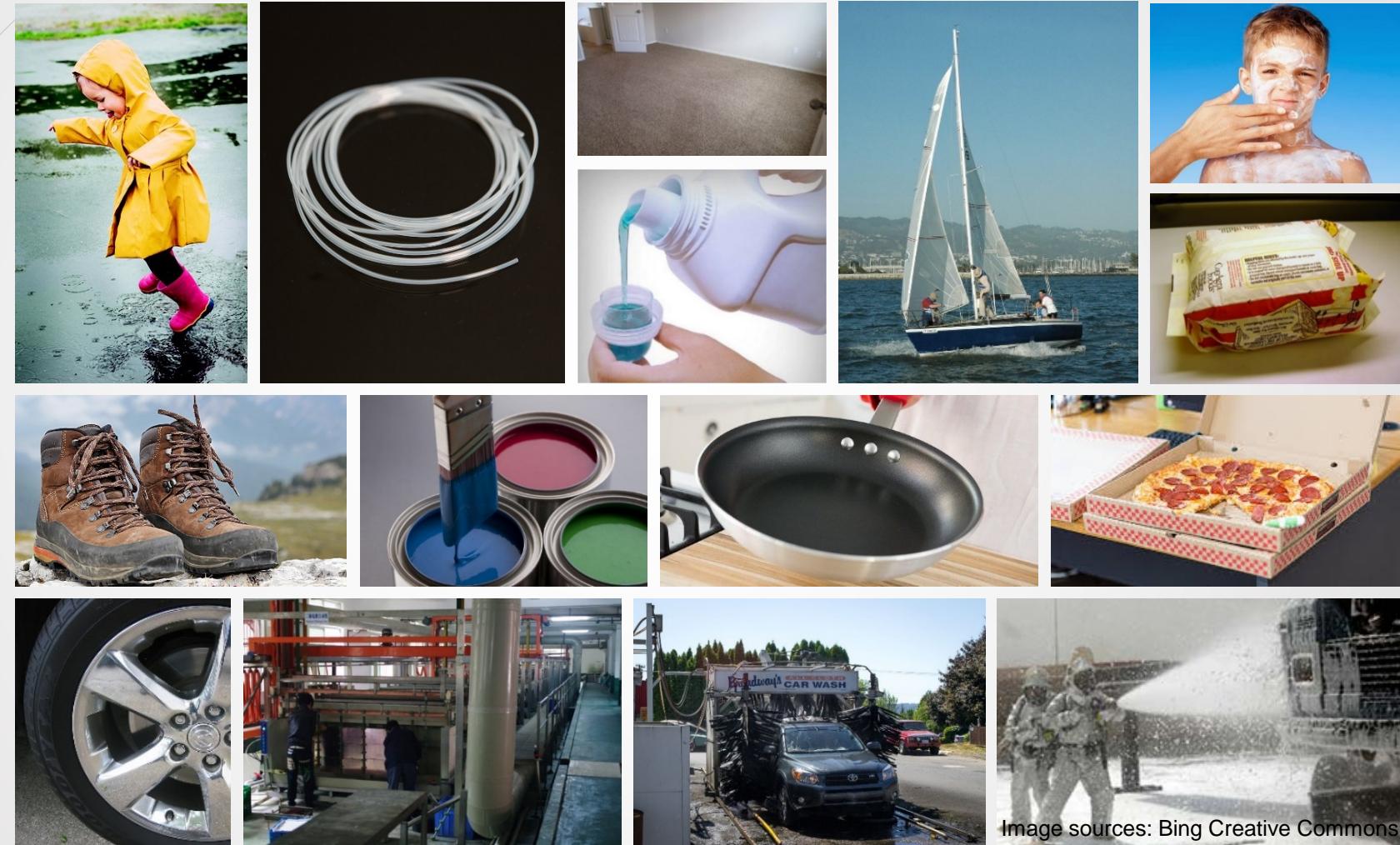


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Places Where We Might Find PFAS



Image sources: Bing Creative Commons



Aqueous Film-Forming Foam (AFFF)

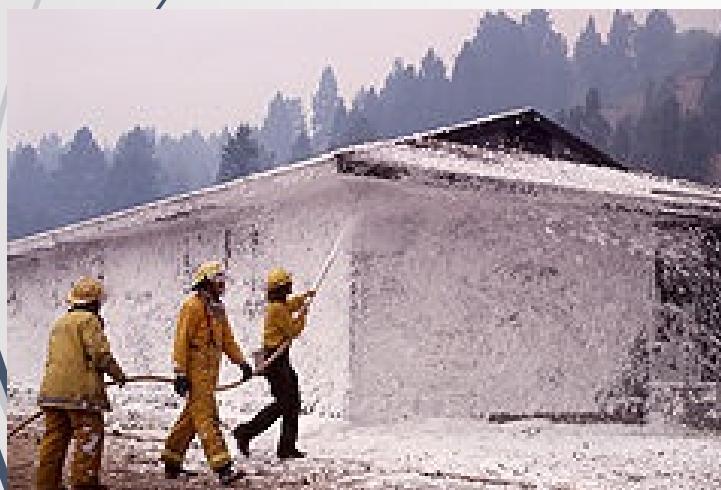
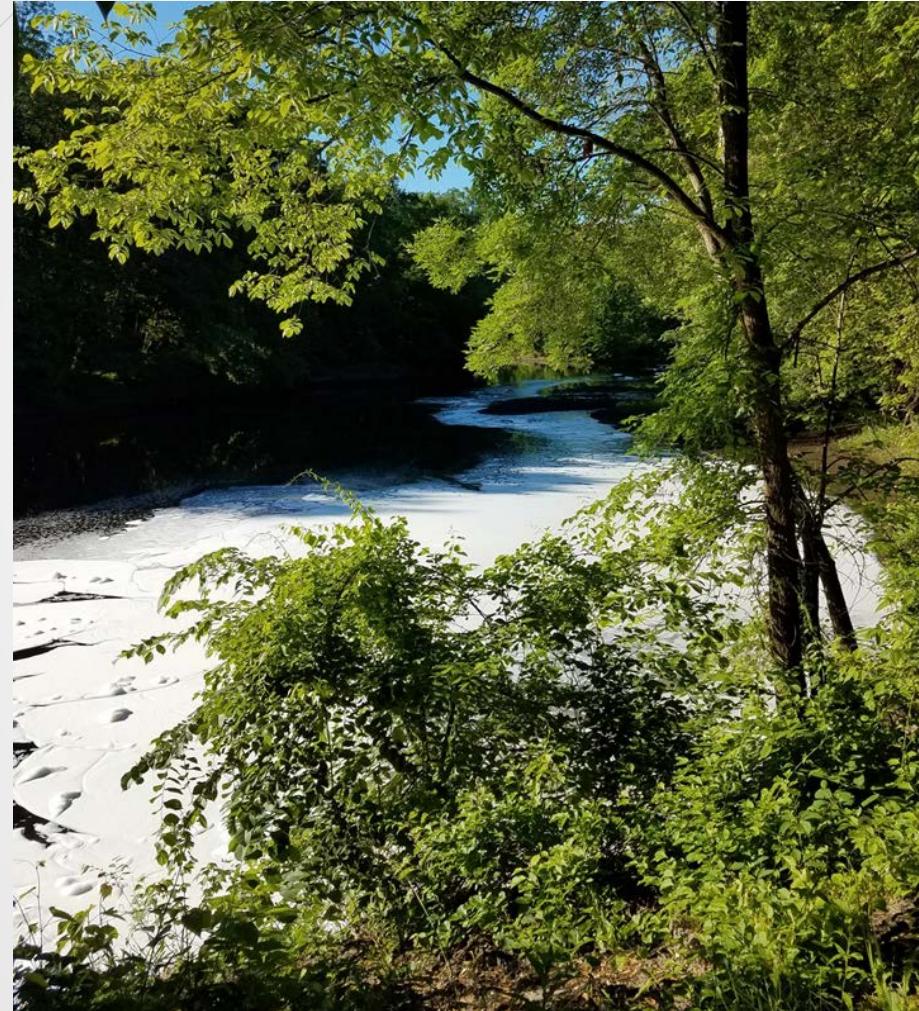


Image sources: Bing Creative Commons



Aqueous Film-Forming Foam (AFFF)

Farmington River, 6/9/19





Why Should We Care?

- ➡ Possible health effects
 - Developmental effects to fetuses and infants
 - Kidney and testicular cancer
 - Liver, thyroid, cholesterol, immune system effects
- ➡ Present in human blood worldwide
- ➡ Have polluted drinking water supplies worldwide
- ➡ Discovery in wastewater treatment plants, biosolids, landfills, soil, surface water, fish tissue, animals, cow's milk, and plants
- ➡ Replacement chemicals also a problem (GenX)



How Can PFAS Be Remediated?

WATER

- ▶ Granular activated carbon (GAC)
 - Shorter-chain PFAS break through faster
 - Effectiveness depends on type of GAC
- ▶ Ion-exchange resins
- ▶ Reverse osmosis



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SOIL

- ▶ Capping
- ▶ Excavation and disposal
- ▶ Sorption and stabilization (e.g., PlumeStop)TM



S. Pociu, CT DEEP



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EPA Actions Related to PFAS



- ▶ Beginning in 2000 – Phase-out of PFOA and PFOS
- ▶ 2013-2015 – Third Unregulated Contaminant Monitoring Rule (UCMR3)
 - Nationwide testing of large public water systems for 6 PFAS
 - 1.3% of all public water systems had PFOA + PFOS > 70 ppt
- ▶ 2014 - Added fish tissue monitoring to survey of urban rivers
- ▶ May 2016 - Lifetime Health Advisory for **PFOA + PFOS** in drinking water
 - **70 nanograms per liter (ng/L) or parts per trillion (ppt)... BUT NO MCL**
- ▶ National Leadership Summit convened in May 2018 followed by regional listening sessions



National PFAS Action Plan - February 2019 – Highlights



- Propose regulatory determination for PFOA/PFOS by end of 2019 (MCL process)
- Move forward with listing as “hazardous substance” under CERCLA
 - Develop interim groundwater cleanup standards (May)
 - Consider use reporting on Toxics Release Inventory
 - Continued new chemical review under Toxic Substances Control Act
 - Expand PFAS research
 - Develop PFAS Communication Toolbox

Will take time...



CT DPH Actions for Drinking Water

- ▶ Drinking Water Action Level for the Sum of 5 PFAS (Nov. 2016)
 - 70 parts per trillion (ppt) or nanograms per liter (ng/L)
 - PFOA, PFOS, PFNA, PFHpA & PFHxS
 - May change in the future as new toxicological data is developed and reviewed
- ▶ Fact sheets and new webpage
- ▶ DPH now granting provisional certification for labs based on proficiency testing
- ▶ DPH Lab not currently equipped to test for PFAS

The screenshot shows a webpage with a blue header containing the DPH logo and the title. The main content is divided into sections: 'What are These Chemicals?' with an image of water droplets, and 'How do PFAS get into Drinking Water?' with an image of a water molecule. The text in these sections provides information about the properties and sources of PFAS. At the bottom, there is a footer with the DPH contact information.

Perfluoroalkyl Substances (PFAS) in Drinking Water: Health Concerns

Environmental & Occupational Health Assessment Program • October 2017

What are These Chemicals?

Perfluoroalkyl substances (PFAS) are a family of man-made chemicals with many useful properties including the ability to repel water, prevent staining and increase heat resistance. PFAS have many industrial and consumer uses including the coating of fabrics and non-stick cookware, in food packaging (e.g., microwave popcorn bags), in some types of paper, in chrome plating, and in firefighting foam used by firemen to put out petroleum fires, but not typically in home fire extinguishers.

The most studied PFAS are per-fluorooctanoic acid (PFOS) and per-fluorooctane sulfonate (PFOS). While we know the most about the harmful effects and environmental fate of these two PFAS, several others of high concern are also discussed in this fact sheet, perfluorooctane sulfonate (PFNA), perfluorohexane sulfonate (PFHxS) and perfluorooctane sulfide (PFHxS). PFOS and PFNA have been phased out of production but the other three PFAS have not. Further, these are very persistent chemicals which can remain in the environment for long periods after being removed from the marketplace.

How do PFAS get into Drinking Water?

The way in which these chemicals reach groundwater is still being investigated. Drinking water contamination has occurred near industries manufacturing or using these chemicals to make consumer products. PFAS use at chrome plating facilities for mist suppressant can also be a source of groundwater contamination. Because of their use in firefighting foams, it is possible that PFAS may appear in airports and sites where there was a major fire may have released PFAS. Once on the ground, these chemicals can gradually migrate down through the soil when it rains and affect groundwater.

Connecticut Department of Public Health
PO Box 340308, Hartford, CT 06134-0308
<http://www.ct.gov/dph>



CT Public Water Systems



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- ▶ **2013-2015 – UCMR3 results for large CT systems**
 - No PFAS detections in 40 large water systems serving >10,000 people
 - Represents service to more than 2.4 million customers
- ▶ **DPH Drinking Water Section Circular Letter (Sept. 2018)**
 - Requires Source Water Protection Plan updates for systems serving >1,000 people by 3/31/19
 - Sanitary inspections of suspect PFAS facilities by 3/1/20
 - Recommends all source waters be sampled



Regional Drinking Water Standards as of 6/7/19

| State | Standard/Guidance Nomenclature | Drinking Water Level (ppt) |
|---------------|---|---|
| Connecticut | Action Level | 70 Σ (PFOA, PFOS, PFNA, PFHxS, PFHpA) |
| Maine | Health Advisory | 70 Σ (PFOA, PFOS) |
| Massachusetts | Proposed Groundwater Quality Standard (currently in rulemaking process) | 20 Σ (PFOA, PFOS, PFNA, PFHxS, PFHpA, PFDA) |
| New Hampshire | Proposed Maximum Contaminant Level (MCL)/ Ambient Groundwater Quality Standards (currently in rulemaking process) | 38 PFOA 70 PFOS / Σ (PFOA, PFOS) 85 PFHxS 23 PFNA |
| New Jersey | Drinking Water Quality Institute Recommended MCL (currently in rulemaking process) | 13 PFOS, PFNA 14 PFOA |
| New York | Drinking Water Quality Council Recommended MCL (currently in rulemaking process) | 10 PFOA 10 PFOS |
| Rhode Island | Groundwater Quality Standard | 70 Σ (PFOA, PFOS) |
| Vermont | Health Advisory | 20 Σ (PFOA, PFOS, PFNA, PFHxS, PFHpA) |



CT DEEP PFAS Actions

- ▶ **Initial evaluation of possible PFAS sites based on AFFF use and SIC codes for industry**
 - Military sites prioritizing PFAS investigation through DoD
- ▶ **Working closely with DPH**
 - Drinking Water Section, Private Well Program, and Environmental & Occupational Health Assessment Program
 - Drinking water sampling in Greenwich, Windham - community and private wells
 - Joint outreach to CT Airport Authority and Dept. of Emergency Services and Public Protection regarding AFFF
- ▶ **Involvement in Regional and National workgroups**



CT DEEP PFAS Actions (cont.)

- ▶ **Cleanup Criteria** for soil and groundwater at Remediation Sites available for use
- ▶ **Outreach** at Remediation Roundtable, June 2017– Treat as a Contaminant of Concern if warranted based on site history
- ▶ **AFFF Initiatives**
 - Coordination with DESPP Commission on Fire Prevention and Control – Committee established to select a fluorine-free firefighting foam
 - Possible AFFF Take-Back Program?



PFAS Resources on the Web

[DPH Drinking Water Section PFAS webpage](#)

[DEEP Emerging Contaminants webpage](#)

[EPA PFAS webpage](#)

[EPA PFAS Action Plan](#)

[Interstate Technology and Regulatory Council \(ITRC\)
PFAS Fact Sheets](#)



Closing Remarks on PFAS

- ❖ PFAS have emerged! Many possible sources!
- ❖ We need to be alert for releases in areas with wells. This includes areas with public water where not everyone has connected.
- ❖ Analysis is tricky, but costs are coming down over time as more labs come online.
- ❖ Expect standards to change in the future – possibly lower numeric standards or additional PFAS included as new toxicological data is developed.
- ❖ Future legislation is possible.



Questions or Comments?

Thanks for your attention!

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860-424-3550



Remediation Standard Regulations

From June 20, 2017
Remediation
Roundtable Meeting

- ▶ If PFAS are COCs based on site history/operations, they should be included in site characterization.
- ▶ PFAS must be addressed as Additional Polluting Substances at Remediation Sites.
 - ▶ Utilize EPA's RfD of 0.00002 mg/kg/day
 - ▶ Soil Direct Exposure Criteria – use equations in RSR Section 22a-133k-2(b)(5)
 - ▶ Groundwater Protection – Adopts CT DPH's DWAL of 70 ppt for \sum PFOA, PFOS, PFHxS, PFNA, and PFHpA
 - ▶ OR Calculate Site-Specific Criteria for DEEP review and approval



Additional Polluting Substance Criteria

| Remediation Standard | Criterion |
|--|----------------|
| Residential Direct Exposure Criterion | 1.35 mg/kg |
| Industrial/Commercial Direct Exposure Criterion | 41 mg/kg |
| GA Pollutant Mobility Criterion | 1.4 µg/kg |
| GB Pollutant Mobility Criterion | 14 µg/kg |
| Groundwater Protection Criterion (Adopting DPH's Drinking Water Action Level for Σ PFOA, PFOS, PFHxS, PFNA, and PFHpA) | 70 ng/L |
| Surface Water Protection Criterion | In Development |

Applies to Σ PFOA, PFOS, PFHxS, PFNA, & PFHpA



Significant Environmental Hazards

CGS Section 22a-6u(c) – Drinking Water Well has Contamination Detected at Any Level

After July 1, 2015, if a TEP in the course of investigating and remediating pollution on or emanating from a parcel determines pollution has affected a public or private drinking water supply well...with any substance from the release for which there is no RSR criterion,

- ▶ TEP shall notify client and owner of property within 7 days of finding well contamination.
- ▶ Owner of parcel that is source of pollution to a drinking water well shall
 1. Notify Commissioner in writing within 30 days of becoming aware, and
 2. Perform confirmatory sampling of well and submit report to Commissioner with a plan for further action within 30 days.



General Permit for Groundwater Remediation Wastewater

- ▶ Issued 2/21/18, includes Emerging Contaminants
- ▶ Authorization Sec. 3(b)(1)(B)(xii) – Requires:
 - 1) Complete and sufficient registration, AND
 - 2) Commissioner issues an Approval of Registration if the commissioner determines ECs “are present at levels that require development of site specific monitoring requirements and/or discharge limitations.”
- ▶ Conditions Sec. 5(a) Screening Analysis Requirements
 - ▶ Sec. 5(a)(2)(F) – Requires screening analysis for ECs with Clean Water Act approved methods. On-going screening or effluent monitoring required if directed in writing by Commissioner.
 - ▶ Sec. 5(a)(2)(G) – Requires analysis of wastewater for any pollutant “toxic, hazardous, or detrimental” or “having the potential to bioaccumulate, bioconcentrate or adversely affect aquatic life” that has been “handled, stored, released, or disposed of at or adjacent to the site where wastewater originates.”