Urban Redevelopment: Building Stronger Communities
November 7, 2019

NYSDEC Regulatory Updates: Sampling and Remediation Concerns for Per- and Poly-Fluoroalkyl Substances (PFAS)

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Why the PFAS Fuss

More than 4,000 PFAS compounds

Man-made compounds
  • Thermally stable (strong C - F molecular bond)
  • Chemically stable (low reactivity)
  • Persistent in the environment – Does not degrade/break down
    • Found in all environmental media (including human blood)
    • Found world-wide
  • Accumulate over time (2 to 8 years in humans)
  • “Tail” end - they repel water (hydrophobic) and oil/fat (lipophobic)
  • “Head” end - they attract/dissolve in water (hydrophilic)
    • Nonreactive
    • Non-stick
Sources of PFAS

- Fire-fighting foams (AFFF)
  - Airports, training facilities, terminals
- Industrial facilities
  - Electroplating (mist suppressants)
  - Semiconductor manufacturing
  - Aerospace & electronic applications
  - Automobile
- Landfills
  - Leachate
  - Consumer products
- Wastewater treatment plants
  - Effluent discharges
  - Biosolids
- Consumer Products
  - Water Repellents
  - Stain-resistant textiles
  - Teflon cookware
  - Cosmetics
# History of PFAS

<table>
<thead>
<tr>
<th>PFAS¹</th>
<th>Development Time Period</th>
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<tbody>
<tr>
<td></td>
<td>1930s</td>
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<tr>
<td>PTFE</td>
<td>Invented</td>
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<tr>
<td>PFOS</td>
<td>Initial Production</td>
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<tr>
<td>PFOA</td>
<td>Initial Production</td>
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<tr>
<td>PFNA</td>
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<tr>
<td>Fluorotelomers</td>
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<td>Dominant Process³</td>
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<td>Pro-Invention of Chemistry / Initial Chemical Synthesis / Production</td>
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2006 – EPA commitment to phase out PFOA & PFOS
2010 - 95% reduction of PFOA & PFOS
2015 – PFOA & PFOS - fully phased out

Table 2 History and Use Fact Sheet
Exposure Routes

PFAS EXPOSURE PATHWAYS

ATMOSPHERIC DISCHARGES

INDUSTRY

LEACHING FIELD

WASTEWATER TREATMENT PLANT (WWTP)

GROUNDWATER

SURFACE WATER, SEDIMENT & BIOTA

FIRE FIGHTING FOAMS

ATMOSPHERIC DISCHARGES

DUST

SOIL

CROPS & FOOD

WATER SUPPLIES (DRINKING / IRRIGATION)

HUMAN EXPOSURE

KEY:
COLORED LINES - PRIMARY PATHWAYS
BLACK LINES - INDIRECT PATHWAYS

SOURCE: MODIFIED FROM - SCIENTIFIC EVIDENCE AND RECOMMENDATIONS FOR MANAGING PFAS CONTAMINATIONS IN MICHIGAN, DECEMBER 7, 2016.

Everywhere

PFAS CHEMICALS MOVE FROM FOOD PACKAGING

TO LANDFILLS AND COMPOST

TO CROPS

TO THE ENVIRONMENT

TO PEOPLE

TO FOOD
Human Health Effects

• Potential Human PFAS Effects

  • Increased cholesterol
  • Liver damage
  • Reproductive/Developmental
    • Pregnancy-induced hypertension/preeclampsia
    • Decreased fertility
    • Decrease in birth weight
    • Behavioral
  • Increased risk of thyroid disease
  • Immunologic effects
  • Kidney and testicular cancer
One gram of PFOA can impact 3.7 million gallons of water above 70 ppt.
New York issued an Emergency Rule (January 2016) that became a Final Rule on March 3, 2017 defining PFOA/PFOS as a “hazardous substance”.
  • This provides NYSDEC the legal authority to hold polluters accountable.

Requires all environmental media (soil, groundwater, surface water, sediments, and biota) to be analyzed for PFAS at NYSDEC sites (series of memos dated February 2018, February 2019, and June 2019)
  • Analysis of 21 PFAS compounds (and 1,4-dioxane)

Required to sample soil imported for reuse
  • PFOA or PFOS > 1 ppb triggers SPLP testing
  • Soil rejected if SPLP results greater than 70 ppt PFOA/S

NYC Office of Environmental Remediation (OER)/NYC Department of Environmental Protection (DEP)
  • Follow NYSDEC guidance for soil and groundwater sampling of PFAS
Cross-Contamination – Sampling Issues

GZA employs stringent sampling protocols to reduce potential cross-contamination providing defensible data quality.

- Clean hands/Dirty hands
- Quality control including
  - Filed blanks
  - Trip blanks
  - Equipment blanks
- Exclusion zones
- Use of only PFAS free equipment
- Staff avoids contact with PFAS materials prior and during sampling.
Currently only one EPA analytical Method 537 Rev. 1.1 (April 2019)
  • Applicable to Drinking Water, 18-PFAS compounds (includes GenX & ADONA)
ASTM Methods (alkaline extractions)
  • ASTM D7968 – solid phase extraction
  • ASTM D7979 – sludge
EPA is developing wastewater and soil methods to include:
  • Method 8327 - non-drinking water (24-compounds) – June 2019
    ○ (DoD considers Method 8327 to be a screening method and should not be used for the collection of definitive data)
  • Method 8328 – solid phase extraction-isotope extraction/non-drinking water & solid

Laboratories have modified the method to include up to 32 compounds
  • These are considered “Modified” Method 537.1 and includes
  • Total Oxidizable Precursors (TOP) Analysis
  • Varies by laboratories (makes validation difficult)
Assess if, where, and how to sample
- Develop a plan of action with QA/QC protocols to reduce the potential for false positives

Develop a Conceptual Site Model (CSM) that takes PFAS in mind
- Migration pathways
- Lithologic conditions/grain-size
- Complex chemical interactions
- Complex groundwater quality interactions
- Sensitive receptors

Develop a Communication Strategies that anticipates Public Concerns
Water Supply Remedies

• Point-of-entry treatment (POET)
  • Granular Activated Carbon (GAC)
    • Pre- and post 5-micron filters
    • Will not remove arsenic or other compounds
    • Effective on long-chain PFAS
    • Need to evaluate change-out of GAC based upon short-chain PFAS
  • Other contaminants (VOC) will compete with GAC sorption

• Point-of-Use (POU)
  • Granular activated carbon (GAC) or reverse osmosis (RO)
    • RO better at tap location, GAC better for home water
    • RO uses additional water as part of the process

• Water Supply Facilities
  • Consider treatment trains - GAC and ion exchange resins
**Soil Remediation Strategies**

- **Excavation and Disposal**
  - Transfer of liability to landfill
  - Leachate potential
  - PFAS liability may exceed lifespan of the landfill
  - Better for low concentrations

- **Incineration**
  - Temperature >1,200°C, Hawley et al., 2012
  - Better for higher concentrations

- **Capping/In situ Stabilization Strategies**
  - Environmentally isolating the source
  - Long-term maintenance and groundwater monitoring
  - Requires land use restriction
Conclusions

• PFAS are Ubiquitous

• Due to low regulatory thresholds - if site history suggests PFAS, then likely present at regulated concentrations
  • Manage your risks by developing a plan

• No one remediation silver bullet
  • Development of treatment trains for groundwater
  • Thermal destruction or retain soil long-term liability

• Potential financial and litigation liabilities

• Potential need for public relations, especially if there are water supply receptors
Thank You

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