Air Quality Modeling for PFOA Deposition in New Hampshire

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Objectives of the Presentation

- Provide an overview of Per- and Polyfluoroalkyl Substances (PFAS)
  - Potential Sources
  - NH’s Air Emission Source Experience
- Air Quality Modeling for PFOA Deposition
  - Methodology
  - Inputs
- Lessons Learned thus far
**Introduction to PFAS**

- A large family of synthetic organic compounds that contain multiple Fluorine (F) atoms.
- The 2 most studied PFAS are
  - Perfluorooctanoic Acid (PFOA)
  - Perfluorooctane Sulfonate (PFOS)
- PFAS family = thousands of diverse compounds
- Ammonium perfluorooctanoate (APFO) converts to PFOA after application

![Example of molecular structure of Perfluorooctanoic Acid (PFOA)](image)

**Possible Sources of PFAS Releases**

- Used for decades to make products that resist heat, oils, grease, stains and water
  - Textiles, Upholstery, Apparel and Carpets
  - Paper, Packaging, Non Woven Fibers
  - Metal Plating (mist suppressant)
  - Semiconductor
  - Wire Coating
  - Firefighting Aqueous Film-Forming Foam

*From Oliaei 2013, Environmental Science Pollution Research*
Air Emission Source

NH Regulatory Standards

- **AAL** – Ambient Air Limits (Env-A 1400)
  - Ammonium perfluorooctanoate (APFO)
  - 0.050 µg/m³ (24-hr)
  - 0.024 µg/m³ (annual)

- **AGQS** – Ambient Groundwater Quality Standards (Env-Or 600)
  - PFOA, total of all isomers – 70 ng/L or ppt
  - PFOS, total of all isomers – 70 ng/L or ppt
  - Combined total PFOA + PFOS – 70 ng/L or ppt

- **Soil guidance** – direct contact
  - PFOA – 0.5 mg/kg (500 ppb)
  - PFOS – 0.5 mg/kg (500 ppb)
  - No leaching based standard

- **No surface water standard**
NH PFOA Air Dispersion Locations

- Two companies (located in three nearby cities) used APFO
- Merrimack, Amherst, Manchester, NH
- Merrimack facility notified NHDES that PFOA had been detected in their faucet water

Modeling Methodology

- AERMOD/AERMET Version 15181
- BPIIPPRM Version 04271 (downwash analysis)
- Rural dispersion coefficients
- Dry, wet and total deposition
Air Quality Modeling Inputs

- Site Characteristics
- Emission Information
- Particle Size Distribution
- Particle Density
- Meteorology
- Receptor Placement

Site Characteristics

Site Plan – Building, Property Boundary, Location of Stacks
Stack Parameters – Height, Diameter, Exhaust Flow, Temperature, Configuration
Emission Rates
Emission Information

- Historical Raw Material Usages – Application Rates
- Hours of Operation
- Safety Data Sheet Information about Constituents
- Stack Test Data
- Dispersion Processor Material Balance Project Final Report (February, 2005)\(^1\)
  - Control Equipment
  - Recirculating Ovens
  - Uncontrolled

Agency: Environmental Protection Agency

Emission Information Challenges

- Difficult to retrieve data from over 20 years ago
- Some data no longer exists
- Reformulation means new SDS; hard to find older data
- New coating towers added over time; others decommissioned
Particle Size Distribution

<table>
<thead>
<tr>
<th>Particle Size (microns)</th>
<th>Mass Fraction (%)</th>
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<tbody>
<tr>
<td>&lt;0.28</td>
<td>59.8</td>
</tr>
<tr>
<td>0.3</td>
<td>5.3</td>
</tr>
<tr>
<td>0.5</td>
<td>7.2</td>
</tr>
<tr>
<td>0.8</td>
<td>9.2</td>
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<tr>
<td>1.7</td>
<td>12.9</td>
</tr>
<tr>
<td>&gt;4.4</td>
<td>5.6</td>
</tr>
</tbody>
</table>

- Method 1 vs. Method 2


Particle Density

- Particle density of 0.65 g/cm³
- Also ran the models with a particle density of 1.8 g/cm³ – Specific gravity of APFO

**Meteorological Information**

Meteorology (processed with and without AERMINUTE - Version 15272)

**Deposition is Cumulative Over Time**

- Pollutant disperses into the environment
- Since the compound is stable, it doesn’t break down and works into the soil and water layers
- Each year adds a new layer
Conclusions from Air Deposition Model

- Results will potentially inform:
  - Spatial patterns of deposition due to historical emissions
  - Any addition well sampling/testing campaigns
  - Conceptual site model and site investigation(s)

- Limitations:
  - Once deposited, transport fate less certain (transported in aquifers, etc.)

- Please remember this is an on-going investigation subject to change

Current and Future Considerations

- Reviewing other potential source facilities
  - Information requests/inspections/sampling
  - Reviewing internal files/GIS

- Targeted public water supply sampling near high-risk activities

- 800 waste sites in NH will be sampling for PFAS

- Voluntary Public Water System Sampling Request

- Letter to fire departments, health officers and town administrators about Class B Firefighting Foam/AFFF to be issued soon
PFAS Information Needs

- Update NH Statutes to address air emissions that may contaminate drinking water
- Are there compounds other than PFAS that should be addressed? What about the replacement C6 compounds?
- Are emissions of PFAS with no health data appropriate?

PFAS Information Needs

- What levels of PFAS (especially PFOA) emitted in air will not result in additional drinking water impacts (surface and groundwater)
- PFAS reporting (Toxic Release Inventory, SDS) so that entities know where these compounds are being stored and used
- PFOA and PFOS in imported products – not addressed by the EPA C8 phase out agreement
Questions?

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