

NEWMOA PFAS Working Group – March 16, 2017

## Air Quality Modeling for PFOA Deposition in New Hampshire

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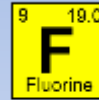
## Objectives of the Presentation

- ▶ 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

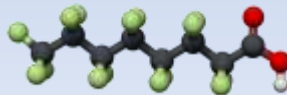


## Introduction to PFAS

- ▶ 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



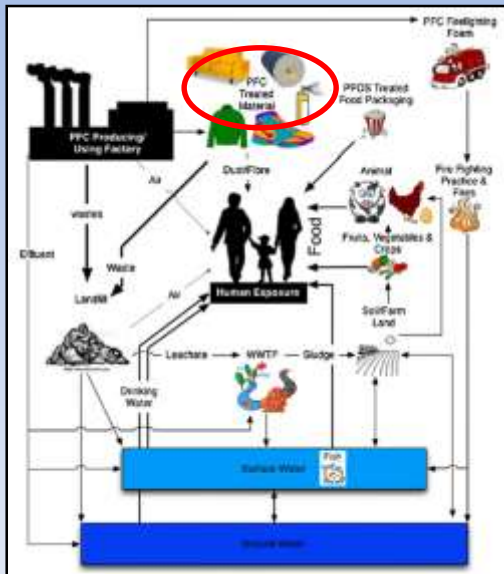
Example of molecular structure of Perfluorooctanoic Acid (PFOA)



Chernospider



## Possible Sources of PFAS Releases



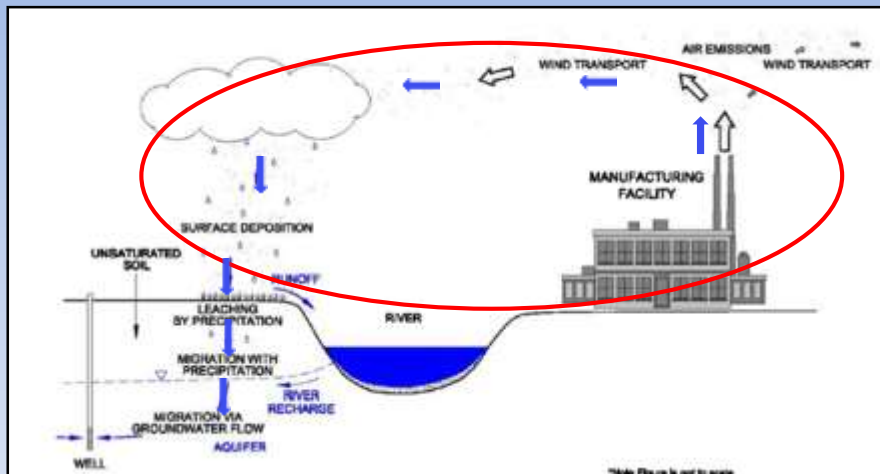
Used for decades to make products that resist heat, oils, grease, stains and water

- ▶ 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



Lewis et al., 2007, Chemosphere

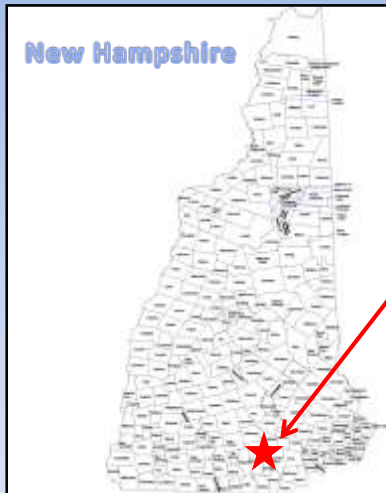


## NH Regulatory Standards

- ▶ AAL – Ambient Air Limits (Env-A 1400)
  - Ammonium perfluorooctanoate (APFO)
  - $0.050 \mu\text{g}/\text{m}^3$  (24-hr)
  - $0.024 \mu\text{g}/\text{m}^3$  (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

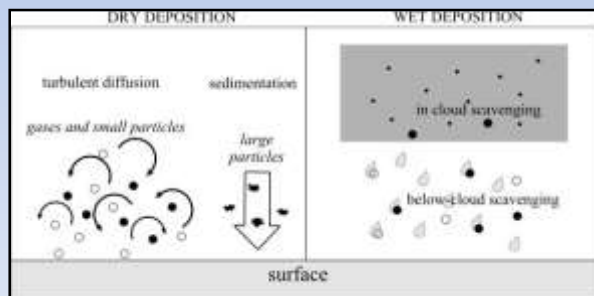


- ▶ Two companies (located in three nearby cities) used APFO
- ▶ Merrimack, Amherst, Manchester, NH
- ▶ Merrimack facility notified NHDES that PFOA had been detected in their faucet water



## Modeling Methodology

- ▶ AERMOD/AERMET Version 15181
- ▶ BPIPRM Version 04271 (downwash analysis)
- ▶ Rural dispersion coefficients
- ▶ Dry, wet and total deposition



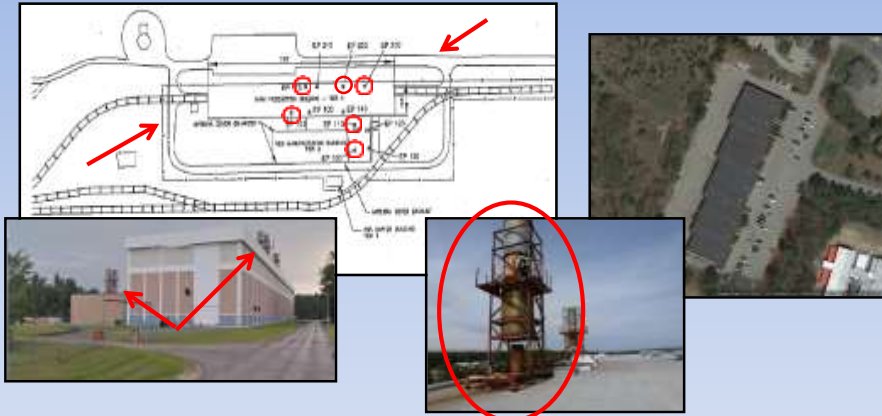
## Air Quality Modeling Inputs



- ▶ 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)<sup>1</sup>
  - Control Equipment
  - Recirculating Ovens
  - Uncontrolled

<sup>1</sup> Complete report available at [www.regulations.gov](http://www.regulations.gov) Docket: EPA-HQ-OPPT-2003-0012  
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

Particle Size (microns)	Mass Fraction (%)
<0.28	59.8
0.3	5.3
0.5	7.2
0.8	9.2
1.7	12.9
>4.4	5.6

### ▶ Method 1 vs. Method 2

Barton, C. A., et. al., "Characterizing Perfluorooctanoate in Ambient Air near the Fence Line of a Manufacturing Facility: Comparing Modeled and Monitored Values", Journal of the Air & Waste Management Association, Volume 56, January 2006.



## Particle Density

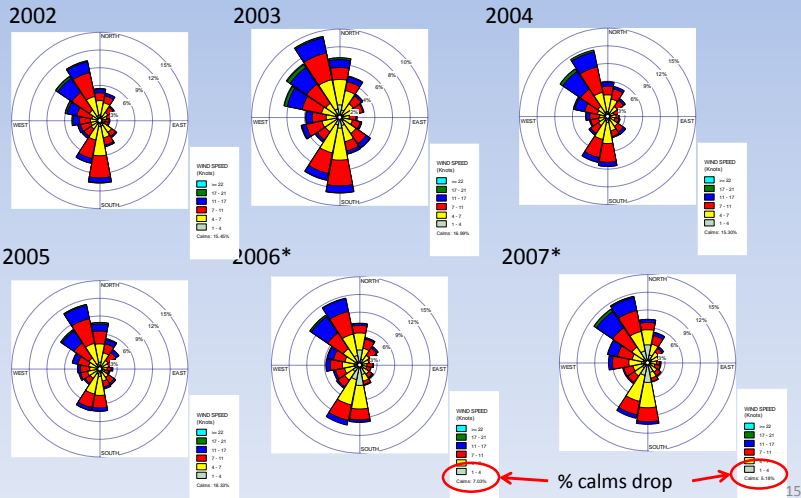
- ▶ Particle density of  $0.65 \text{ g/cm}^3$
- ▶ Also ran the models with a particle density of  $1.8 \text{ g/cm}^3$  – Specific gravity of APFO

Barton, C. A., et. al., "Characterizing Perfluorooctanoate in Ambient Air near the Fence Line of a Manufacturing Facility: Comparing Modeled and Monitored Values", Journal of the Air & Waste Management Association, Volume 56, January 2006.



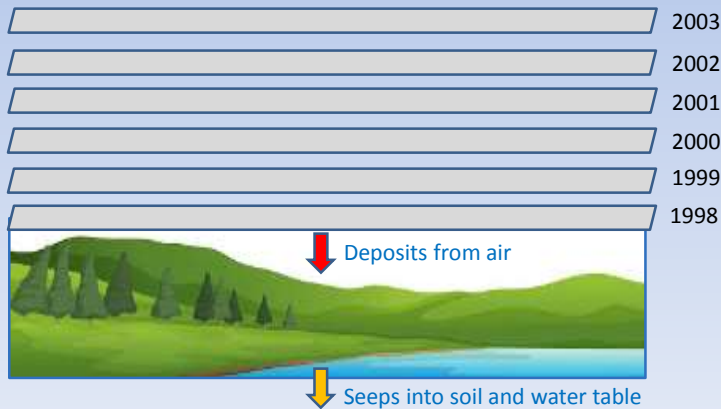
# Meteorological Information

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 additional 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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