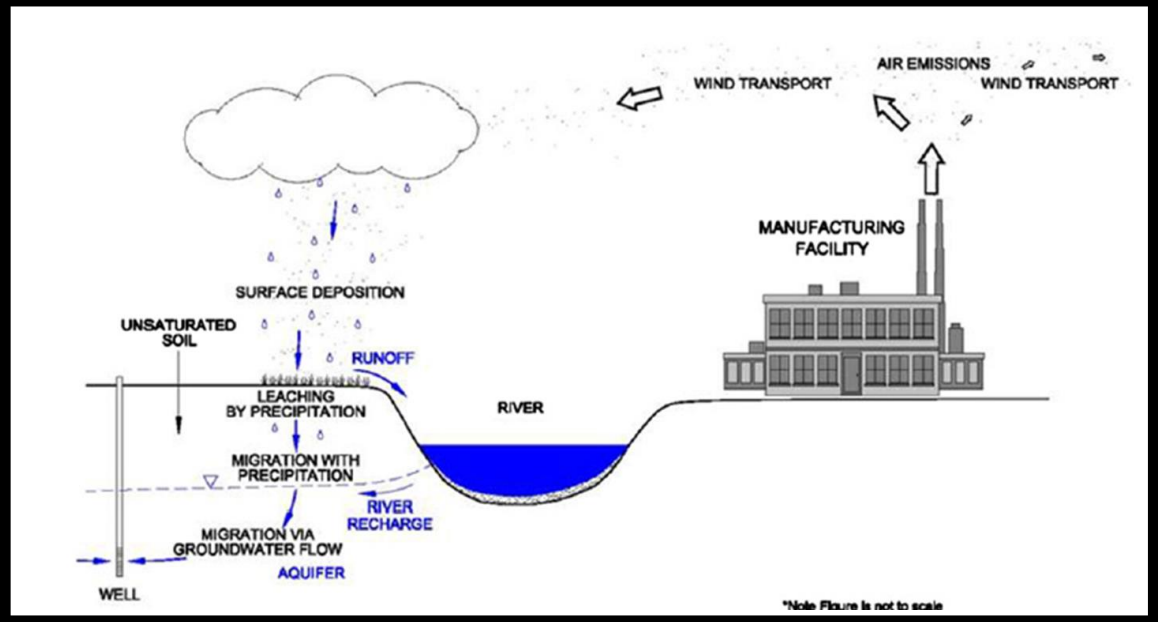


Massachusetts PFAS
Interagency Task Force

5th Task Force Virtual Hearing
August 3, 2021

PFAS AIR EMISSIONS:
NEW HAMPSHIRE'S EXPERIENCE

Cathy Beahm, Administrator
NHDES Air Resources Division
(603) 271-6793 catherine.a.beahm@des.nh.gov

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

WHERE MIGHT PFAS BE FOUND IN AIR EMISSIONS?

Manufacturing Facility
Makes Raw Materials

Industrial Facility
Uses Raw Materials

Chrome Plater
Mist Suppressant

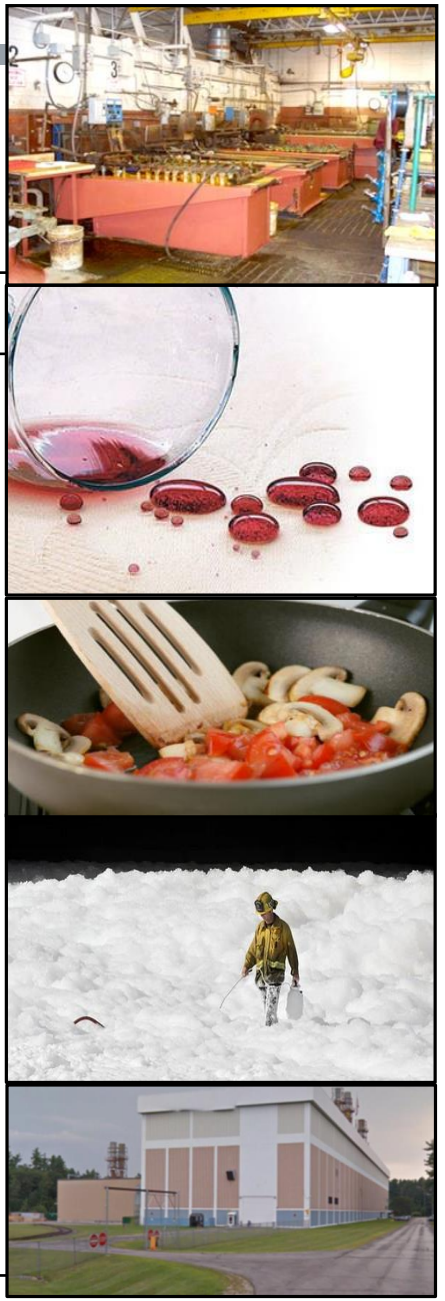
Landfills
Leachate, Dust, LFG

Waste Water Treatment Facilities
Influent, Effluent, Biosolids, SSI

DOD Sites/Airports
Fire Suppression

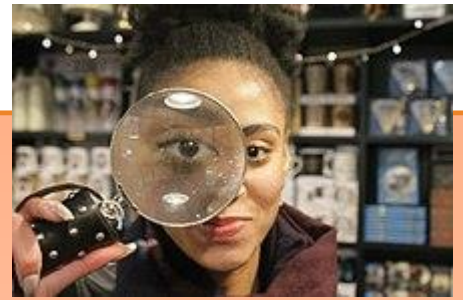
EXPANSIVE USES OF PFAS

Commercial Products	Industrial Uses
Cookware (Teflon®, Nonstick)	Photo Imaging
Fast Food Containers	Metal Plating (mist suppressant)
Candy Wrappers	Semiconductor Coatings
Microwave Popcorn Bags	Aviation Hydraulic Fluids
Personal Care Products (Shampoo, Dental Floss)	Medical Devices/Tubing
Cosmetics (Nail Polish, Eye Makeup)	Wire Coating
Paints and Varnishes	Class B Firefighting Foam (e.g., AFFF)
Stain Resistant Carpet	Insect Baits
Stain Resistant Chemicals (Scotchgard®)	Printer and Copy Machine Parts
Water Resistant Apparel (Gore-Tex®)	Chemically Driven Oil Production
Cleaning Products	Textiles, Upholstery, Apparel and Carpets
Electronics	Paper, Packaging, Non Woven Fibers
Ski Wax	Rubber and Plastics
Soil amendments	Pesticides
Pesticides	
Potting soils	



ITRC History and Use of PFAS

SOURCE IDENTIFICATION IN NH



Potential Commercial and Industrial Products that Use PFCs

SIC Code	Manufacturer	NAICS Code
2221	Broadwoven Fabric Mills, Manmade Fiber and Silk	313210
2262	Finishers of Broadwoven Fabrics of Manmade Fiber and Silk	313310
2273	Carpets and Rugs	314110
2295	Coated Fabrics, Not Rubberized	313320
2297	Non-woven Fabrics	313230
2299	Textile goods, Not Elsewhere Classified	313110
2385	Waterproof Outerwear	314999
2392	House furnishings, Except Curtains and Draperies	314999
2621	Paper Mills	322121
2656	Sanitary Food Containers, Except Folding	322219
2671	Packaging Paper and Plastics Film, Coated and Laminated	322220
2672	Coated and Laminated Paper, Not Elsewhere Classified	322220
2673	Plastics, Foil, and Coated Paper Bags	322220
2752	Commercial Printing, Lithographic	323111
2796	Platemaking and Related Services	323120
2824	Manmade Organic Fibers, Except Cellulosic	325220
2842	Specialty Cleaning, Polishing, and Sanitation Preparations	325612
2844	Perfumes, Cosmetics, and other Toilet Preparations	325611
2851	Paints, Varnishes, Lacquers, Enamels, and Allied Products	325510
2869	Industrial Organic Chemicals, Not Elsewhere Classified	325193
2899	Chemicals and Chemical Preparations, Not Elsewhere Classified	325199
2911	Petroleum Refining	324110
2992	Lubricating Oils and Greases	324191
3081	Unsupported Plastics Film and Sheet	326113
3082	Unsupported Plastics Profile Shapes	326121
3083	Laminated Plastics Plate, Sheet, and Profile Shapes	326130
3089	Plastics Products, Not Elsewhere Classified	326121
3471	Electroplating, Plating, Polishing, Anodizing, and Coloring	332813

List of Companies for Which No Further Investigation is Deemed Necessary by NHDES as Part of Southern NH PFOA in Drinking Water Investigation

(updated as of January 27, 2017)

Facility	City	Response Received	Determination[1]
Aero Dynamics Inc.	Seabrook	Y	No further investigation necessary
Albany Engineered Composites Inc	Rochester	Y	No further investigation necessary
Alden Broden	Nashua	NA	Inspected 05/27/16; No further investigation
Amatex Corporation	Laconia	Y	Sampling conducted; Results obtained; No further investigation necessary[2]
Amatex Corporation	Meredith	Y	No further investigation necessary
Chemtan Co, Inc.	Lee	Y	No further investigation necessary
Foss Manufacturing Company LLC	Hampton	Y	Sampling conducted; Results obtained; No further investigation necessary[2]
Hayden Kerk Motion Products	Milford	Y	No further investigation necessary
Hayden Kerk Motion Products	Hollis	Y	No further investigation necessary
Ingeniven USA	Hampton	Y	No further investigation necessary
J & E Specialty Inc	Dover	Y	No further investigation necessary
Kluber Lubrication North America L.P.	Londonderry	Y	No further investigation necessary
NEMO Equipment, Inc.	Dover	Y	No further investigation necessary
New England Wire Technologies	Lisbon	Y	Inspection 06/16/16; Sampling conducted; Results obtained; No further investigation necessary[2]
New Hampshire Ball Bearings Inc.	Peterborough	Y	No further investigation necessary
New Hampshire Ball Bearings Inc.	Laconia	NA	Inspected 05/11/16; Sampling conducted; Results obtained; No further investigation necessary[2]
North East Precision CNC	Dover	Y	No further investigation necessary
PlasTech	Bow	Y	No further investigation necessary
SEALPRO, Inc.	Manchester	Y	No further investigation necessary
Smiths Tubular	Laconia	Y	No further investigation necessary
Sturm Ruger & Company, Inc.	Newport	Y	Sampling conducted; Results obtained; No further investigation necessary[2]
Tech NH, Inc.	Merrimack	Y	No further investigation necessary
Teleflex Medical Incorporated	Jaffrey	Y	Sampling conducted; Results obtained; No further investigation necessary[2]

PFAS TESTING ACROSS ALL MEDIA

Statewide Water Quality Data

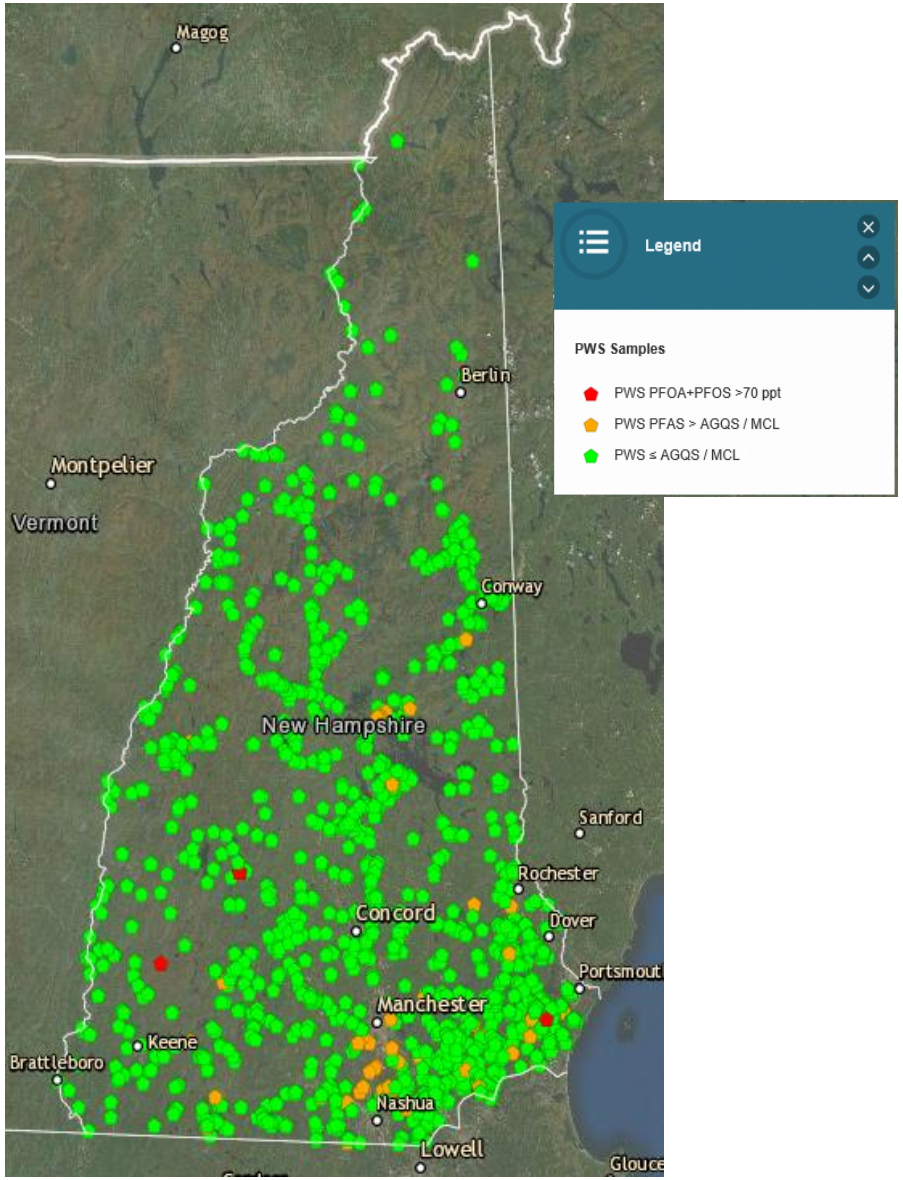
- Public Water Supplies
- Private Drinking Water
- Groundwater
- Surface Water

Statewide Waste Quality Data

- Wastewater
- Wastewater Sludge and Biosolids
- Landfill Leachate

Site-Specific Data

- Soil
- Sediment
- Storm Water
- Fish
- Shellfish
- Loon Eggs
- Air
- Stack Residue



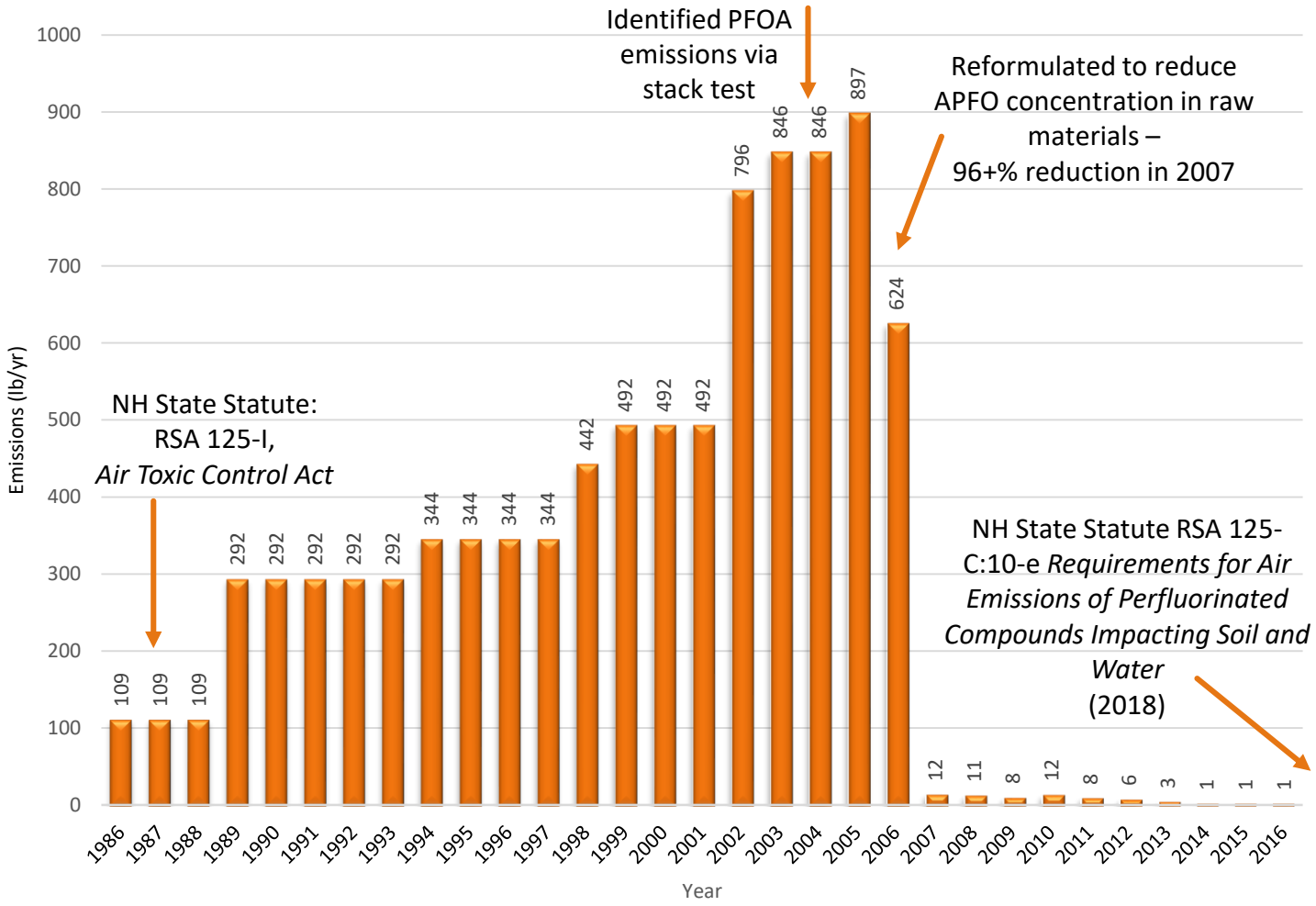
NEW HAMPSHIRE DEPARTMENT OF Environmental Services

PFAS AIR EMISSION STACK TESTING IN NH

Saint Gobain Performance Plastics, Merrimack (2004 & 2007)

- PFOA emissions only. Method developed by testing company. One tower tested.
- Results combined with air dispersion modeling indicated exceedances of NH Ambient Air Limit for APFO. Company reformulated to reduce PFOA emissions by +96%.

ESTIMATED HISTORICAL PFOA AIR EMISSIONS



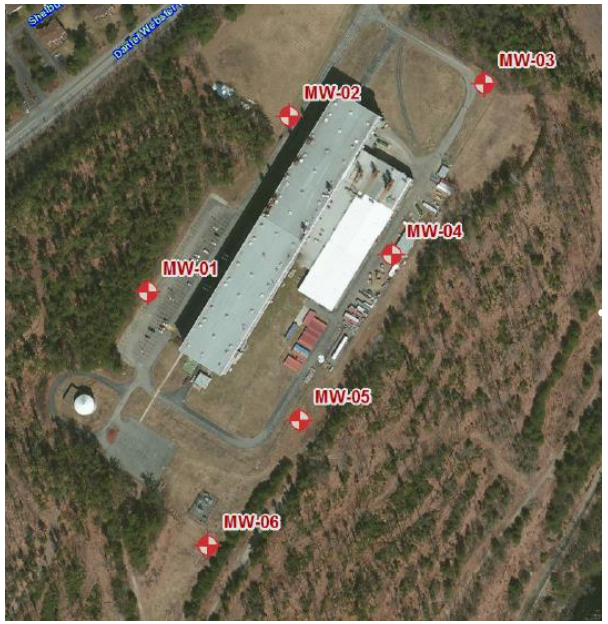
* Estimated PFOA emissions only (no other PFAS, precursors or PICs) and based on 2004 stack test results

Air Deposition Modeling of Historical PFOA Emissions

- To identify where additional private well sampling should be done
- To determine the size/shape of deposition area
- Identification places to further evaluate during the site investigation (e.g. soil or groundwater testing)

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

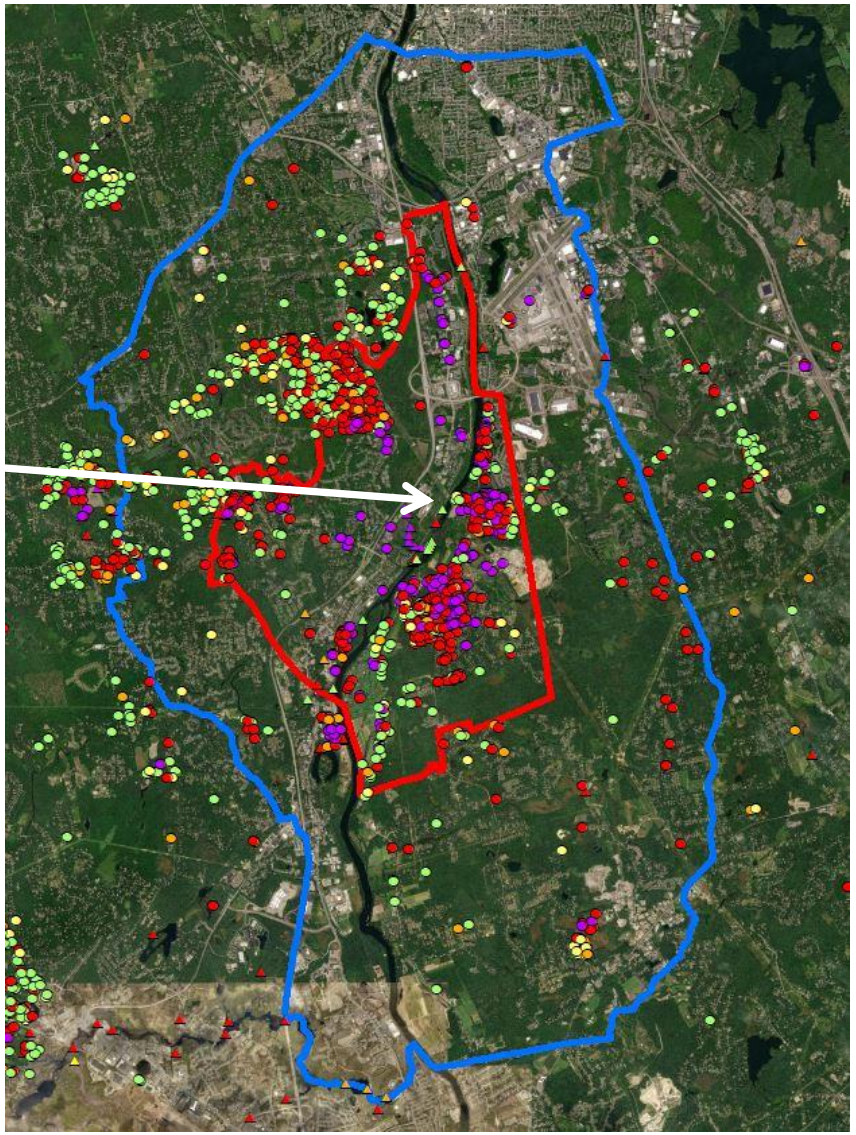
SAINT-GOBAIN FACILITY IMPACT / CONSENT DECREE BOUNDARIES



Groundwater Sample PFOA Results

PFOA Concentration (ng/L)

- 0 - 6
- >6 - 9
- >9 - 12
- >12 - 70
- >70



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SGPP (2016)

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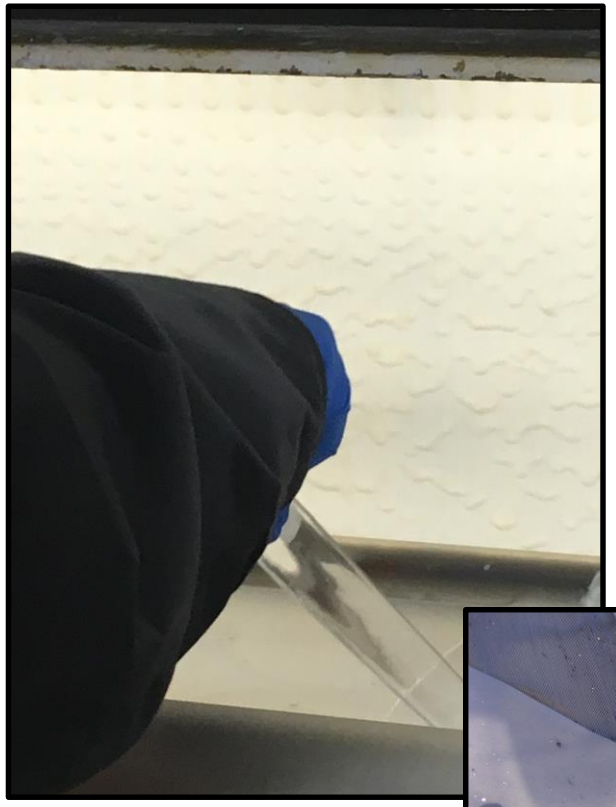
- PFAS emissions were still high enough to trigger NH BACT Law.
- EPA ORD detected 190 different PFAS and tentatively identified 89 compounds in some of the fractions of the stack test samples and 12 PFAS in the SUMMA canisters.

NH'S INDUSTRIAL FACILITY



Raw Materials

Stack Emissions

Stack Residue/Char

Roof Top

Dust

EPA ORD reports on non targeted analysis results for raw materials, char and emissions.

NH STATE STATUTE RSA 125-C:10-e *Requirements for Air Emissions of Perfluorinated Compounds Impacting Soil and Water*

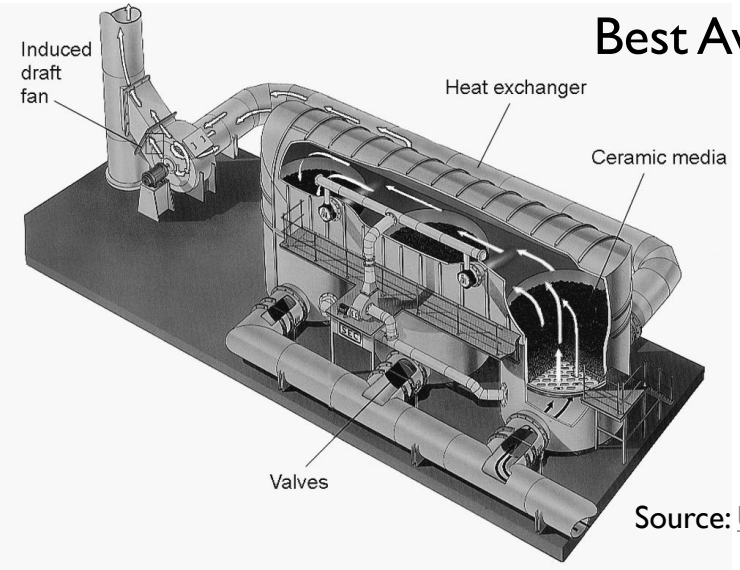
BACT Requirement

- A device that emits to the air any PFCs or precursors that have caused or contributed to an exceedance of an AGQS or SWQS as a result of the deposition of any such PFCs or precursors from the air, shall be subject to the determination and application of BACT.
- The construction, installation, or modification of any device that has the potential, based on an applicability threshold adopted by the department, to cause or contribute to an exceedance of an AGQS or SWQS as a result of the deposition of any such PFCs or precursors from the air, shall be prohibited without first applying for and obtaining a permit from the department that establishes emission limitations for such device based on BACT.

Cause/Contribute Requirement

- The application of BACT cannot cause or contribute to or have the potential to cause or contribute to an exceedance of an AGQS or SWQS, as a result of the deposition from the air.

Best Available Control Technology: 3-chamber RTO



Source: US EPA APTI 415: Control of Gaseous Emission

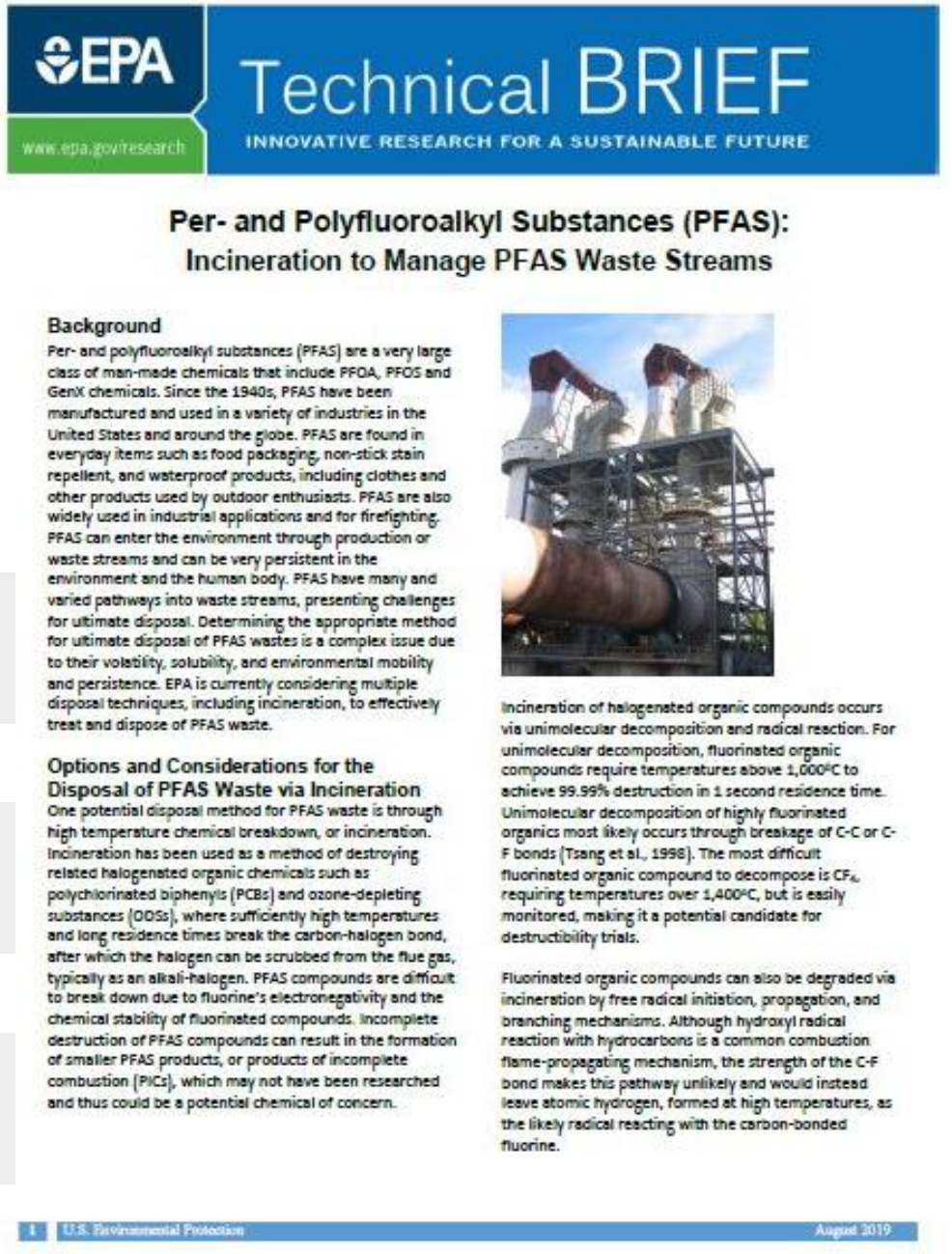
$5.3 million dollar project

Over a year to design and construct

Temperature — Minimum temperature of 1832°F (1000°C)

Time and Turbulence — Minimum gas residence time of 1 second
Inlet flow rate not to exceed 70,000 scfm

Oxidizes PFAS — Oxidizes PFAS regardless of regulatory limits
Concern about PICs and HF formation



EPA www.epa.gov/research

Technical BRIEF
INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

Per- and Polyfluoroalkyl Substances (PFAS): Incineration to Manage PFAS Waste Streams

Background

Per- and polyfluoroalkyl substances (PFAS) are a very large class of man-made chemicals that include PFOA, PFOS and GenX chemicals. Since the 1940s, PFAS have been manufactured and used in a variety of industries in the United States and around the globe. PFAS are found in everyday items such as food packaging, non-stick stain repellent, and waterproof products, including clothes and other products used by outdoor enthusiasts. PFAS are also widely used in industrial applications and for firefighting. PFAS can enter the environment through production or waste streams and can be very persistent in the environment and the human body. PFAS have many and varied pathways into waste streams, presenting challenges for ultimate disposal. Determining the appropriate method for ultimate disposal of PFAS wastes is a complex issue due to their volatility, solubility, and environmental mobility and persistence. EPA is currently considering multiple disposal techniques, including incineration, to effectively treat and dispose of PFAS waste.

Options and Considerations for the Disposal of PFAS Waste via Incineration

One potential disposal method for PFAS waste is through high temperature chemical breakdown, or incineration. Incineration has been used as a method of destroying related halogenated organic chemicals such as polychlorinated biphenyls (PCBs) and ozone-depleting substances (ODSs), where sufficiently high temperatures and long residence times break the carbon-halogen bond, after which the halogen can be scrubbed from the flue gas, typically as an alkali-halogen. PFAS compounds are difficult to break down due to fluorine's electronegativity and the chemical stability of fluorinated compounds. Incomplete destruction of PFAS compounds can result in the formation of smaller PFAS products, or products of incomplete combustion (PICs), which may not have been researched and thus could be a potential chemical of concern.

Incineration of halogenated organic compounds occurs via unimolecular decomposition and radical reaction. For unimolecular decomposition, fluorinated organic compounds require temperatures above 1,000°C to achieve 99.99% destruction in 1 second residence time. Unimolecular decomposition of highly fluorinated organics most likely occurs through breakage of C-C or C-F bonds (Tsang et al., 1998). The most difficult fluorinated organic compound to decompose is CF_4, requiring temperatures over 1,400°C, but is easily monitored, making it a potential candidate for destructibility trials.

Fluorinated organic compounds can also be degraded via incineration by free radical initiation, propagation, and branching mechanisms. Although hydroxyl radical reaction with hydrocarbons is a common combustion flame-propagating mechanism, the strength of the C-F bond makes this pathway unlikely and would instead leave atomic hydrogen, formed at high temperatures, as the likely radical reacting with the carbon-bonded fluorine.

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SGPP (2021)

- Stack testing control equipment for extensive list of PFAS (volatile, semi-volatile, polar, non-polar, PICs, FTOH), inlet and outlet of device, HF post-RTO emissions, VOC RACT, RTAPs, capture efficiency, raw materials.

NEXT STEPS AND RECOMMENDATIONS

- Stack testing of RTO in September, 2021.
- Rainwater study of PFAS background levels.
- Continue work with EPA ORD on methods development and validation including potentially:
  - OTM-45: quantitative method for polar PFAS compounds and fluorotelomer alcohols;
  - Evaluation of a sequential extraction method to get both polar and non-polar PFAS for targeted and non-targeted analysis; and
  - "Other destruction efficiency test method" using CF_4 or C_2F_6 as surrogates
- Further investigation of other industrial facilities including stack testing, evaluation of stack test results, reviewing national data.
- Review TRI data next year and determine other potential sites.

QUESTIONS?

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NHDES AIR RESOURCES DIVISION