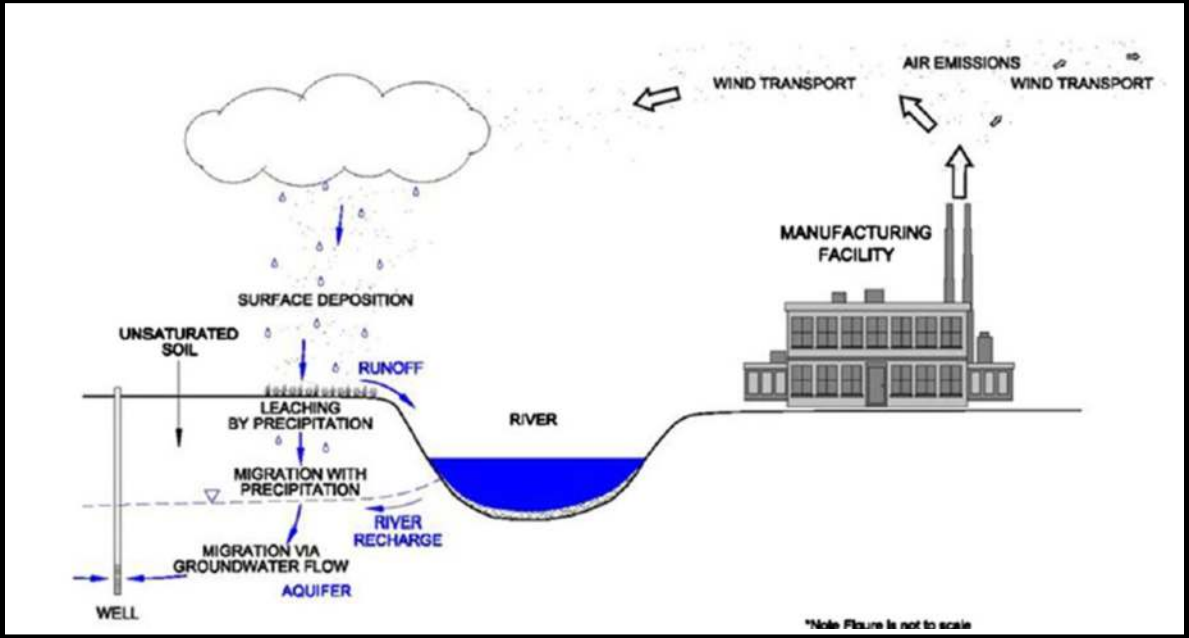

2020 NH Air & Water Regulatory Conference
September 17, 2020

PFAS PANEL DISCUSSION WITH NHDES
PFAS IN AIR

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

WHERE MIGHT PFAS BE FOUND IN AIR EMISSIONS?

Manufacturing Facility
Makes Raw Materials

Industrial Facility
Uses Raw Materials

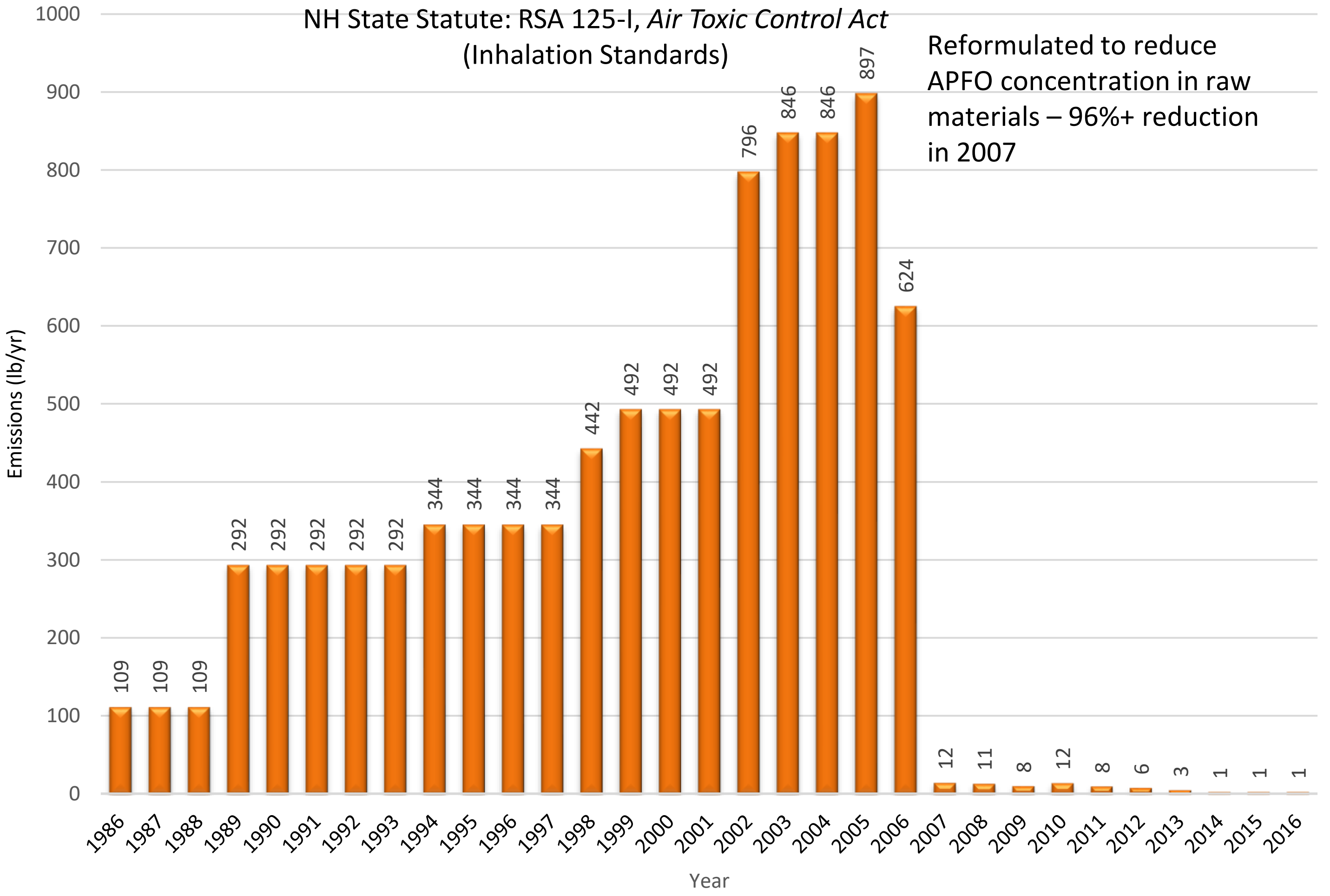
Chrome Plater
Mist Suppressant

Landfills
Leachate, Dust, LFG

Waste Water Treatment Facilities
Influent, Effluent, Biosolids, SSI

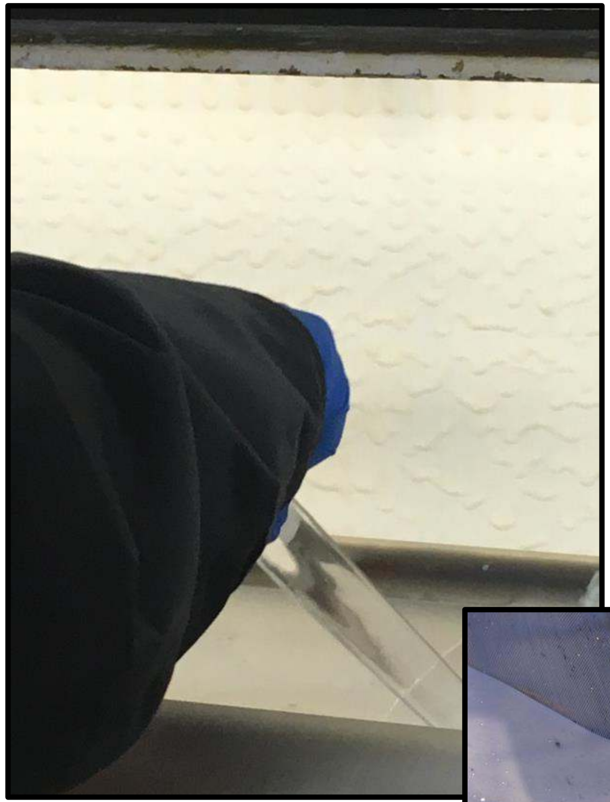
DOD Sites/Airports
Fire Suppression

ESTIMATED HISTORICAL PFOA AIR EMISSIONS



NH State Statute RSA 125-C:10-e *Requirements for Air Emissions of Perfluorinated Compounds Impacting Soil and Water*
(BACT Law)

NH'S INDUSTRIAL FACILITY



Raw Materials

Stack Emissions

Roof Top

Stack Residue/Char

Dust

NH AIR EMISSION STACK TESTING

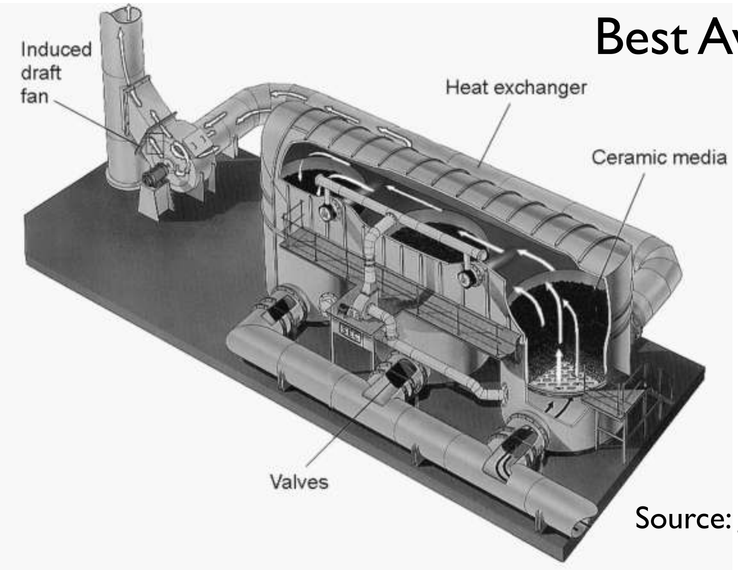
Observations from 2018 stack tests:

- At least one fraction of the sample train had detections of PFAS compounds including:

PFBA	PFPeA	PFHxA	PFHpA
PFOA	PFNA	PFBS	PFHxS
PFOS	HPFO-DA		

- Pilot-scale pollution control device was not effective for all PFAS.
- 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
- PFAS emissions were still high enough to trigger NH State Statute RSA 125-C:10-e *Requirements for Air Emissions of Perfluorinated Compounds Impacting Soil and Water* (BACT Law)

Best Available Control Technology: 3-chamber RTO



Source: US EPA APTI 415: Control of Gaseous Emission

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.

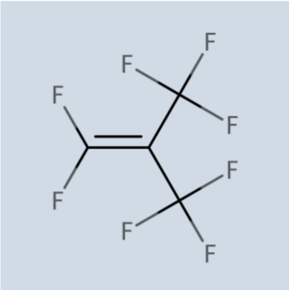
1 U.S. Environmental Protection August 2019

EPA OFFICE OF RESEARCH AND DEVELOPMENT

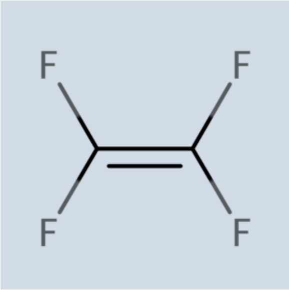
<u>Research and Methods Development:</u>

- EPA ORD is working on OTM-45 which is a quantitative method for polar PFAS compounds and fluorotelomer alcohols (2020 Q4)
- EPA ORD also looking at a destruction efficiency test using CF_4 or C_2F_6 as surrogates
- Thermal treatment of PFAS-contaminated soils (2021 Q1)
- Case Study: PFAS fate and transport/air dispersions (2020 Q4)
- PFAS fate from reactivation/thermal treatment of spent GAC and IX (2021 Q1)
- PFAS behavior in incineration environments (2021 Q2)
- Innovative Ways to Destroy PFAS Technical Challenge (August 2020)

WHERE DO WE GO FROM HERE?

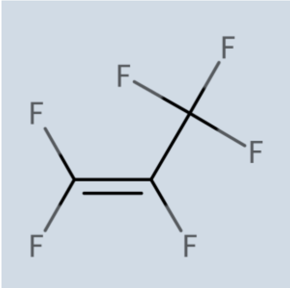


PFIB

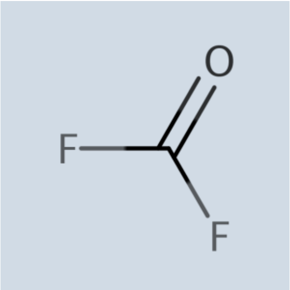


TFE

- Installation, operation and testing of RTO.
- Further investigation of other industrial facilities including stack testing, evaluation of stack test results, reviewing national data
- Conduct a rainwater study of PFAS background levels – NADP sites
- Continue work with EPA ORD on methods development and validation
- Review TRI data next year and determine other potential sites.



HFP



Carbonyl Fluoride

Hydrogen Fluoride