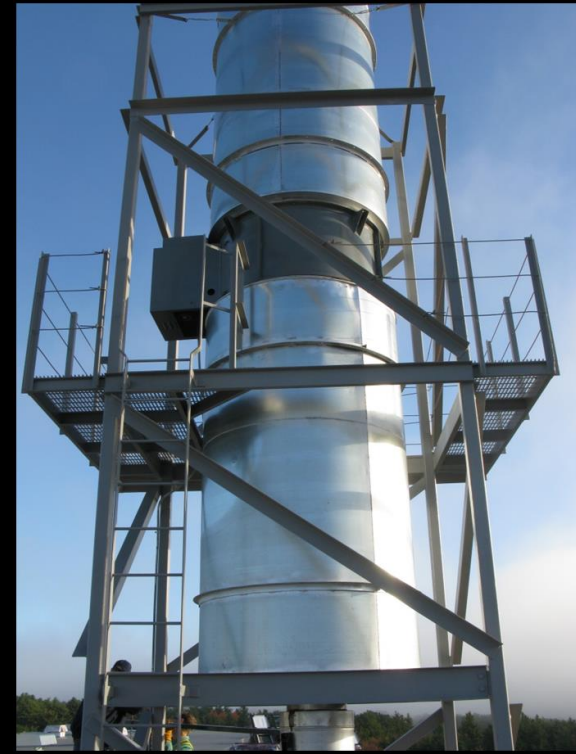


2020 ECOS STEP Meeting
Partnering on PFAS
July 29, 2020



LIGHTENING ROUND 1: DETECTING AND REGULATING PFAS IN DIFFERENT MEDIA

PFAS IN AIR

Catherine Beahm, Administrator

NHDES Air Resources Division

(603) 271-6793

catherine.beahm@des.nh.gov



WHERE MIGHT PFAS BE FOUND AS A SOURCE OF 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



Raw Materials



Stack Emissions



Stack Residue/Char

NH'S INDUSTRIAL FACILITY



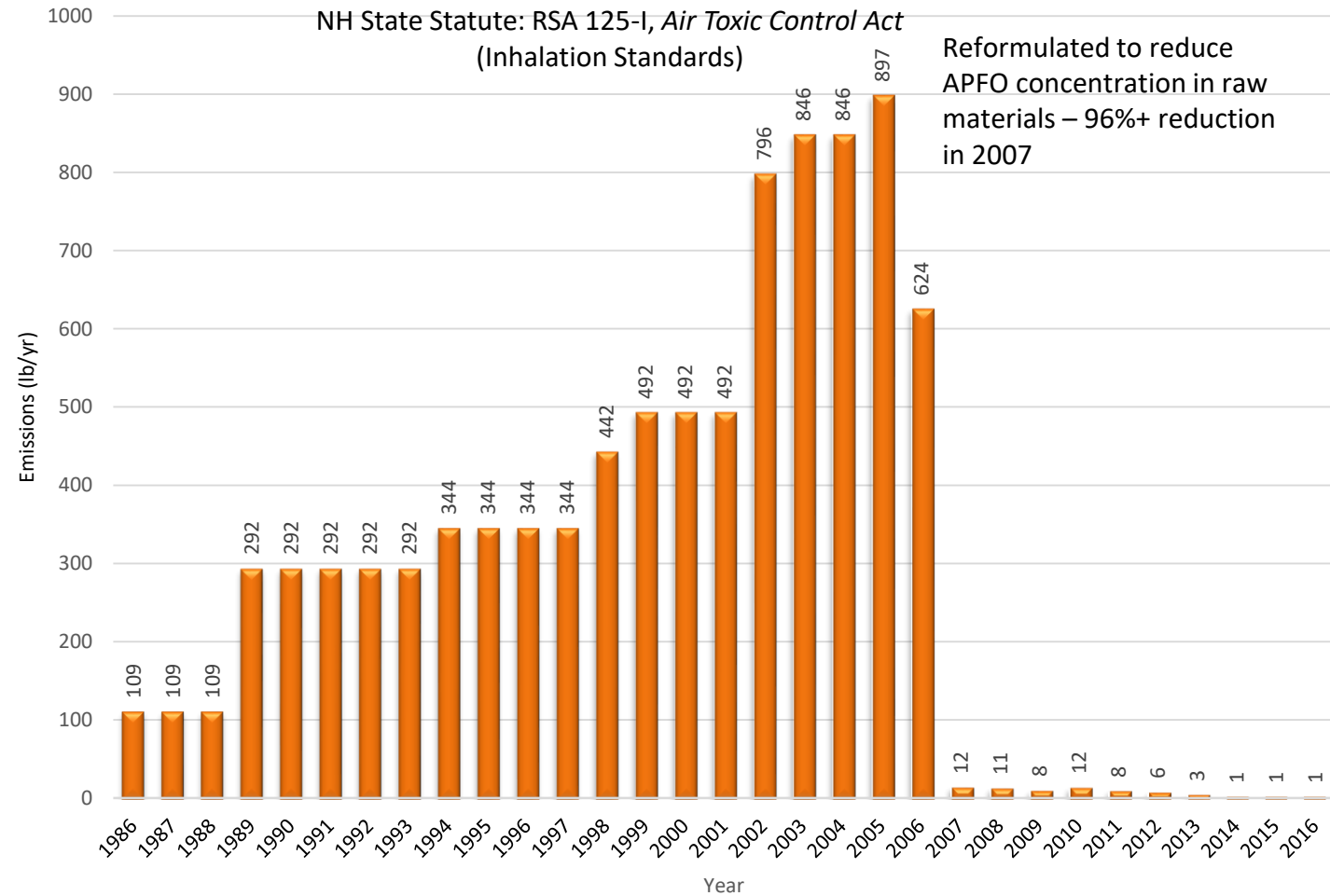
Roof Top



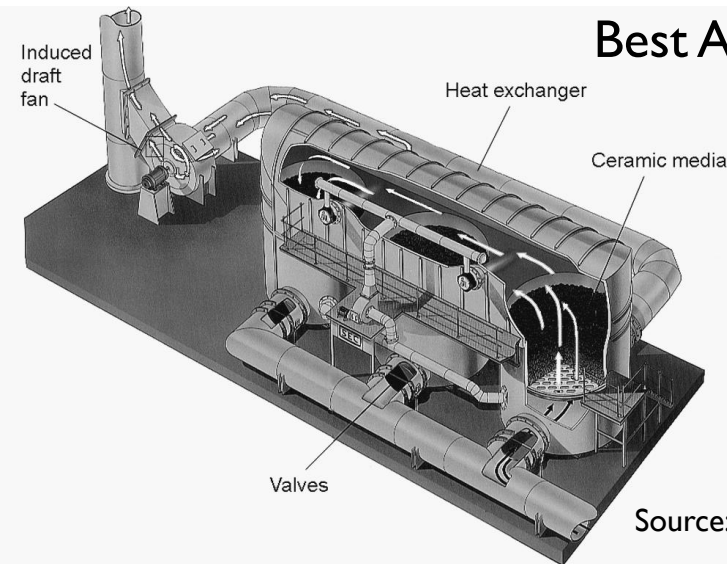
Dust



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)



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



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.

AIR EMISSION STACK TESTING AND METHODS DEVELOPMENT

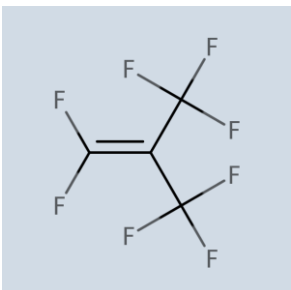
Observations from 2018 stack tests:

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

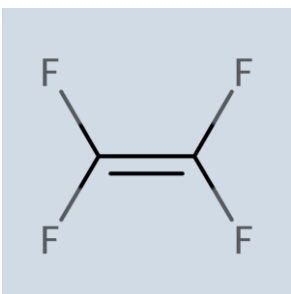
PFBA	PFPeA	PFHxA	PFHpA
PFOA	PFNA	PFBS	PFHxS
PFOS	HPFO-DA		

- 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
- EPA ORD is working on OTM 45 – quantitative method for targeted analytes and fluorotelomer alcohols (OAQPS end September 2020)
- EPA ORD also looking at a destruction efficiency test using CF_4 or C_2F_6 as surrogates





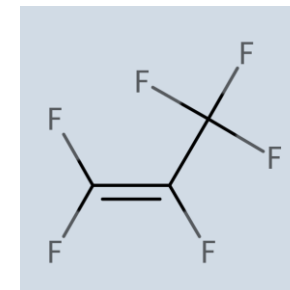
PFIB



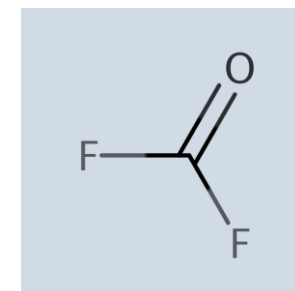
TFE

WHERE DO WE GO FROM HERE?

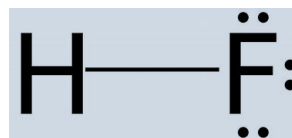
- Installation, operation and testing of RTO.
- Further investigation of other industrial facilities including stack testing, evaluation of stack test results, national data
- Conduct a rainwater study of PFAS background levels – NADP sites
- Continue work with EPA ORD on methods development and validation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



HFP



Carbonyl
Fluoride



Hydrogen Fluoride