

NEWMOA Webinar  
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# PFAS AIR EMISSIONS: IMPACTS TO GROUNDWATER & STACK TESTING



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## 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

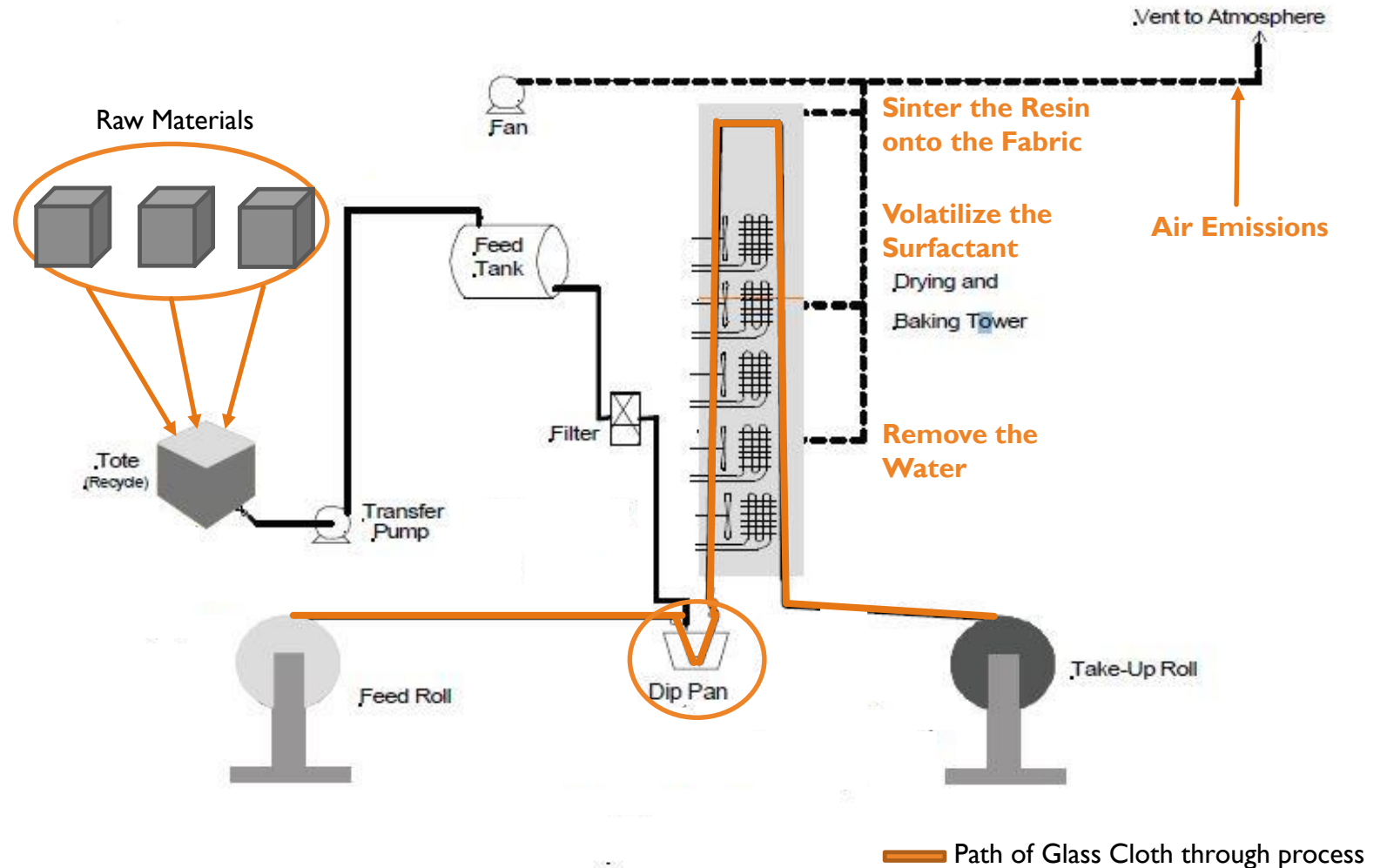




FACILITY  
OVERVIEW

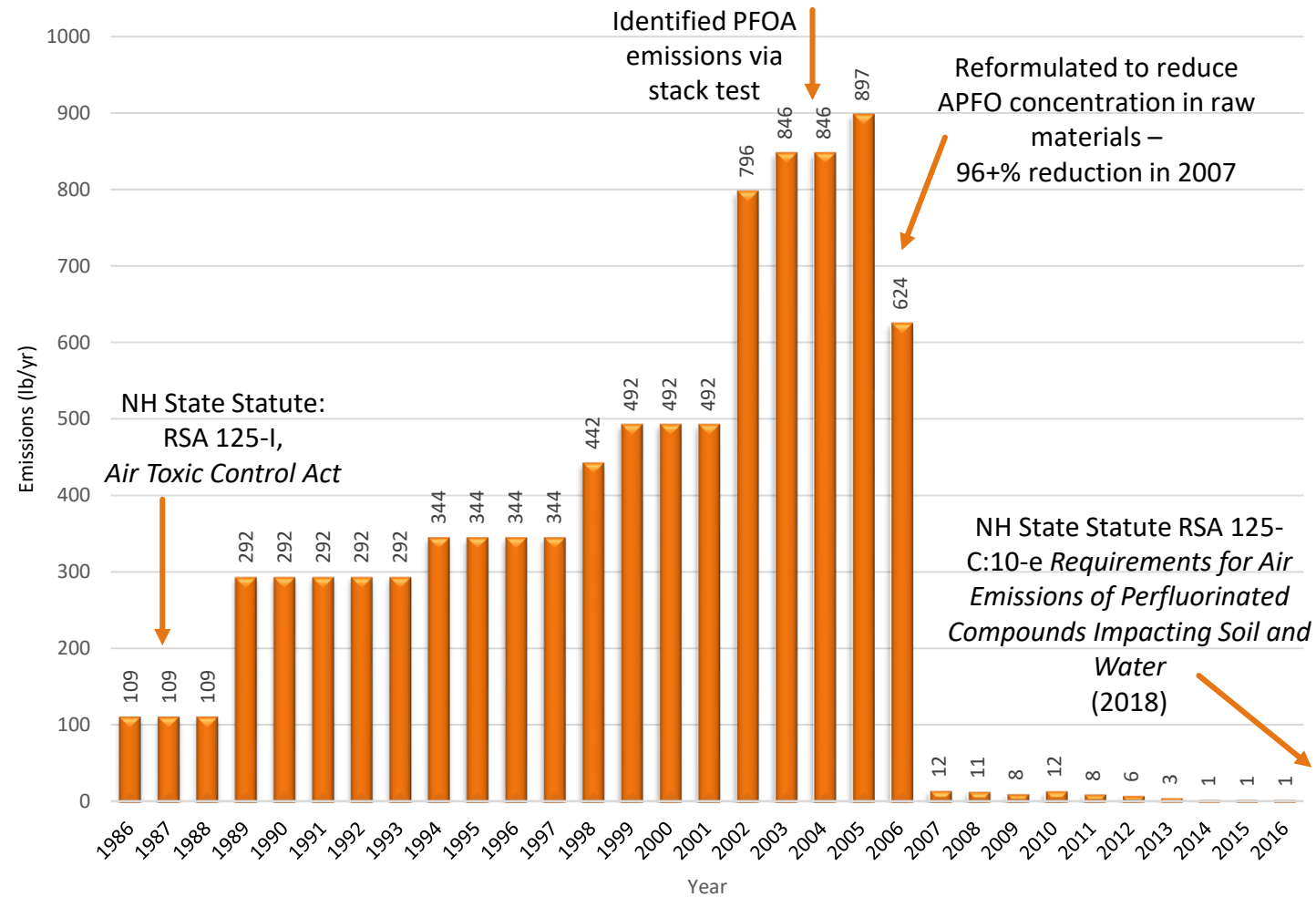
FABRIC COATERS

## TYPICAL GLASS CLOTH PROCESS DIAGRAM





## ESTIMATED HISTORICAL PFOA AIR EMISSIONS



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

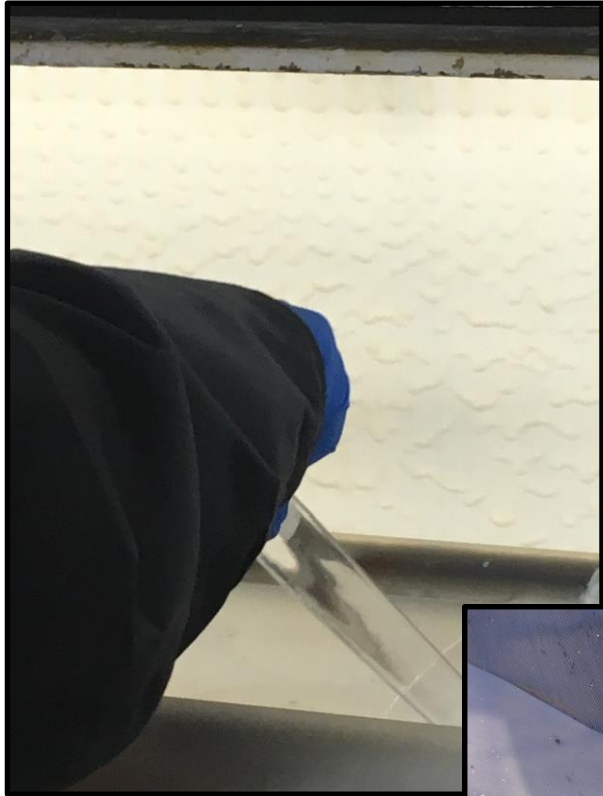


# Air Deposition Modeling of Historical PFOA Emissions

- 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)



## NH'S INDUSTRIAL FACILITY



Raw Materials



Stack Emissions



Stack Residue/Char



Roof Top



Dust



# NH AIR EMISSION STACK TESTING



## Observations from 2016 stack tests:

- PFOA, PFHxA and PFPeA emissions at low levels.
- Emissions occurred even when product not being run.
- Cleaning the ovens and replacing duct work, stack and dilution fan reduced PFOA emissions by 67%.

## Observations from 2018 stack tests:

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

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 BACT Law

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

## **BACT Requirement**

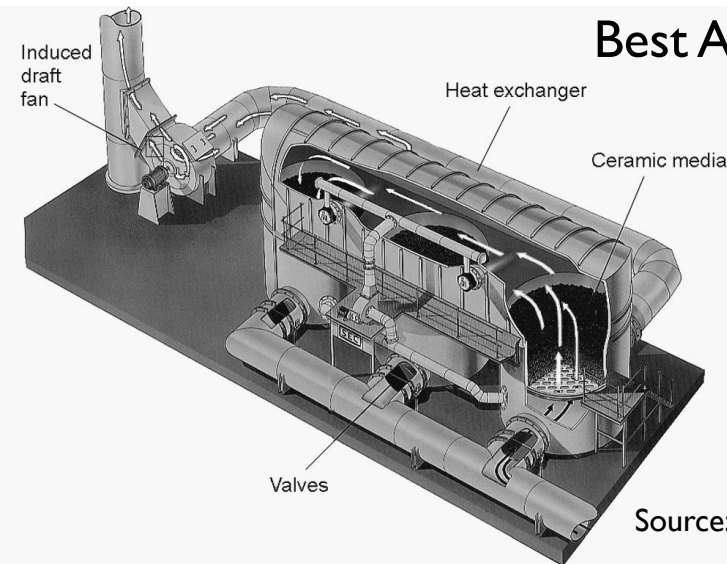
- A device that emits to the air any PFCs or precursors that have caused or contributed to an exceedance of an AGQS or SWQS as a result of the deposition of any such PFCs or precursors from the air, shall be subject to the determination and application of BACT.
- The construction, installation, or modification 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](#)

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.

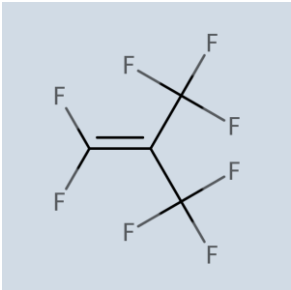
### Options and Considerations for the Disposal of PFAS Waste via Incineration

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.

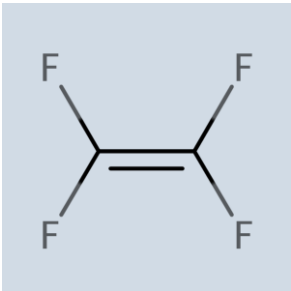


Incineration of halogenated organic compounds occurs via unimolecular decomposition and radical reaction. For unimolecular decomposition, fluorinated organic compounds require temperatures above 1,000°C to achieve 99.99% destruction in 1 second residence time. Unimolecular decomposition of highly fluorinated 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.

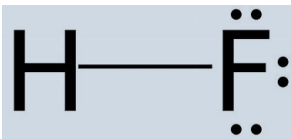
Fluorinated organic compounds can also be degraded via incineration by free radical initiation, propagation, and branching mechanisms. Although hydroxyl radical reaction with hydrocarbons is a common combustion flame-propagating mechanism, the strength of the C-F bond makes this pathway unlikely and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



PFIB



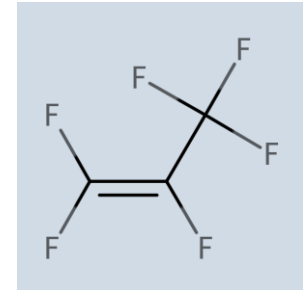
TFE



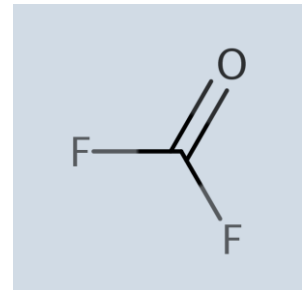
Hydrogen Fluoride

## WHERE DO WE GO FROM HERE?

- Installation, operation and testing of RTO.
- Further evaluation of NH Air Toxics Rule compliance using raw material PFAS content data, review of material balance, and RTO stack test results.
- Conduct a rainwater study of PFAS background levels.
- Continue work with EPA ORD on methods development and validation including:
  - OTM-45 which is a quantitative method for polar PFAS compounds and fluorotelomer alcohols; and
  - “Other destruction efficiency test method” using  $\text{CF}_4$  or  $\text{C}_2\text{F}_6$  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.



HFP



Carbonyl  
Fluoride



# QUESTIONS?

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