PFAS Testing at Chemours

Department of Environmental Quality
Division of Air Quality
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A Brief History

The air emissions testing program begun in January 2018 was initiated as a result of the discovery of PFAS (GenX) in the Cape Fear River near Wilmington, NC

Although their wastewater treatment plant discharged PFAS to the river (south of Fayetteville), data indicated that air emissions were affecting ground water and GenX concentrations in the river

Chemours Chemistry

- Fayetteville Works is primarily a perfluorinated vinyl ethers intermediates production facility
  - HFP oxidized to HFPO and other partial oxidation products as the building blocks for vinyl ether intermediates
  - Process areas Vinyl Ethers South and Vinyl Ethers North
  - Reactions of HFPO form “GenX” as an intermediate in vinyl ethers production

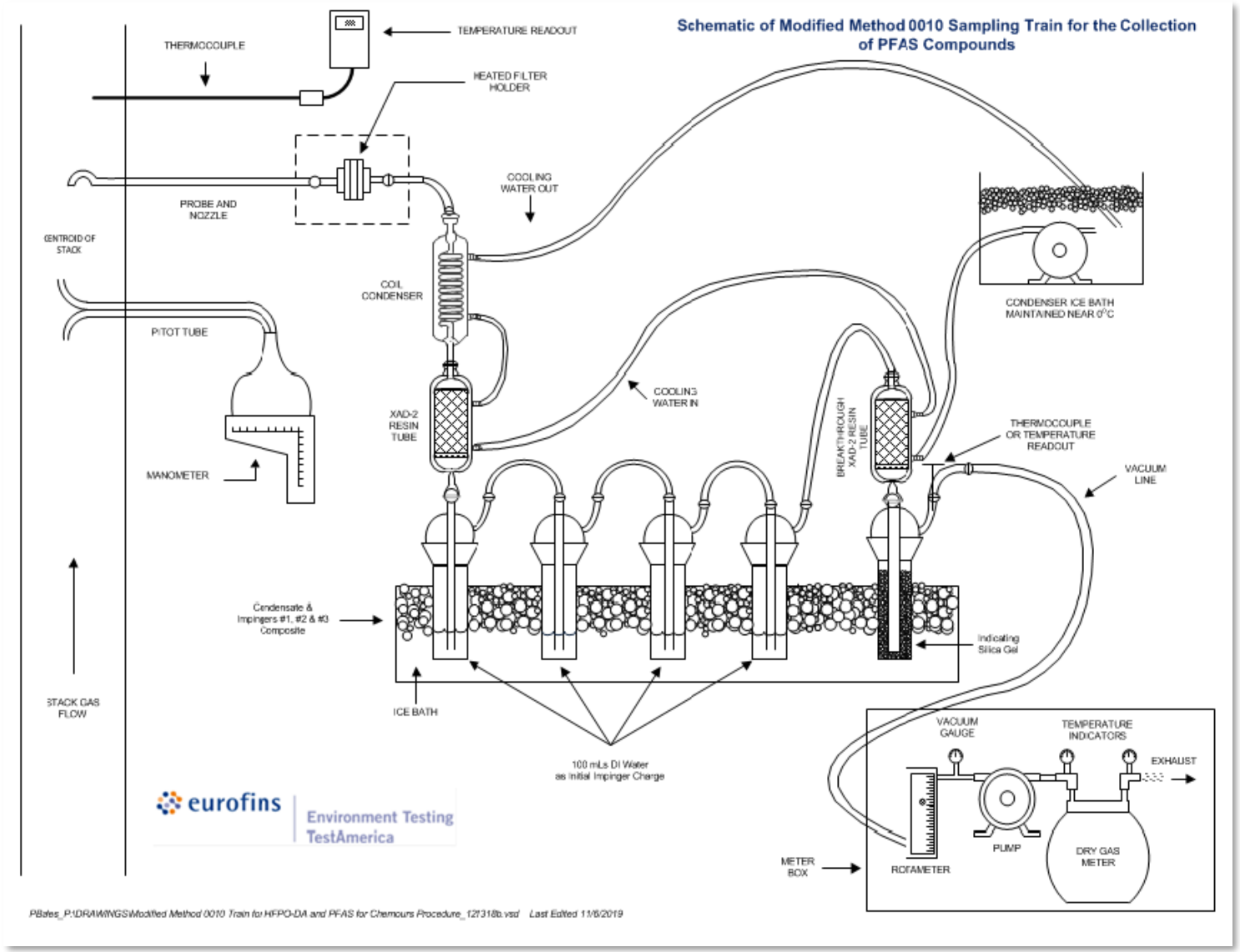
- Ion Exchange Membrane film (NAFION) is produced in the polymers area (reaction of TFE with certain vinyl ethers)

- “GenX” is recovered from Vinyl Ethers North process and refined in the Polymer Processing Aid (PPA) area. Used in the production of PTFE and high temperature lubricants (KRYTOX). Reclaimed PPA is refined and reused in PTFE process

Timeline

- River water sampling results announced June 2017
- Began tracing the sources of GenX back upstream to Chemours
- WWTP NPDES permit suspended (transporting wastewater offsite)
- Began well sampling program around the plant. Concentration gradient looked a lot like the windrose for the location
- Determined that well contamination wasn't caused strictly by groundwater migration
- DAQ got involved in the investigation in October 2017
- Reviewed Chemours emission inventory for previous years (3.3 lbs GenX/year)
- Began working with Chemours and US EPA to select a method to measure GenX
- Selected SW-846 Method 0010 (modified) as the measurement technique
- First feasibility demonstration testing in January 2018

Modified SW-846, Method 0010



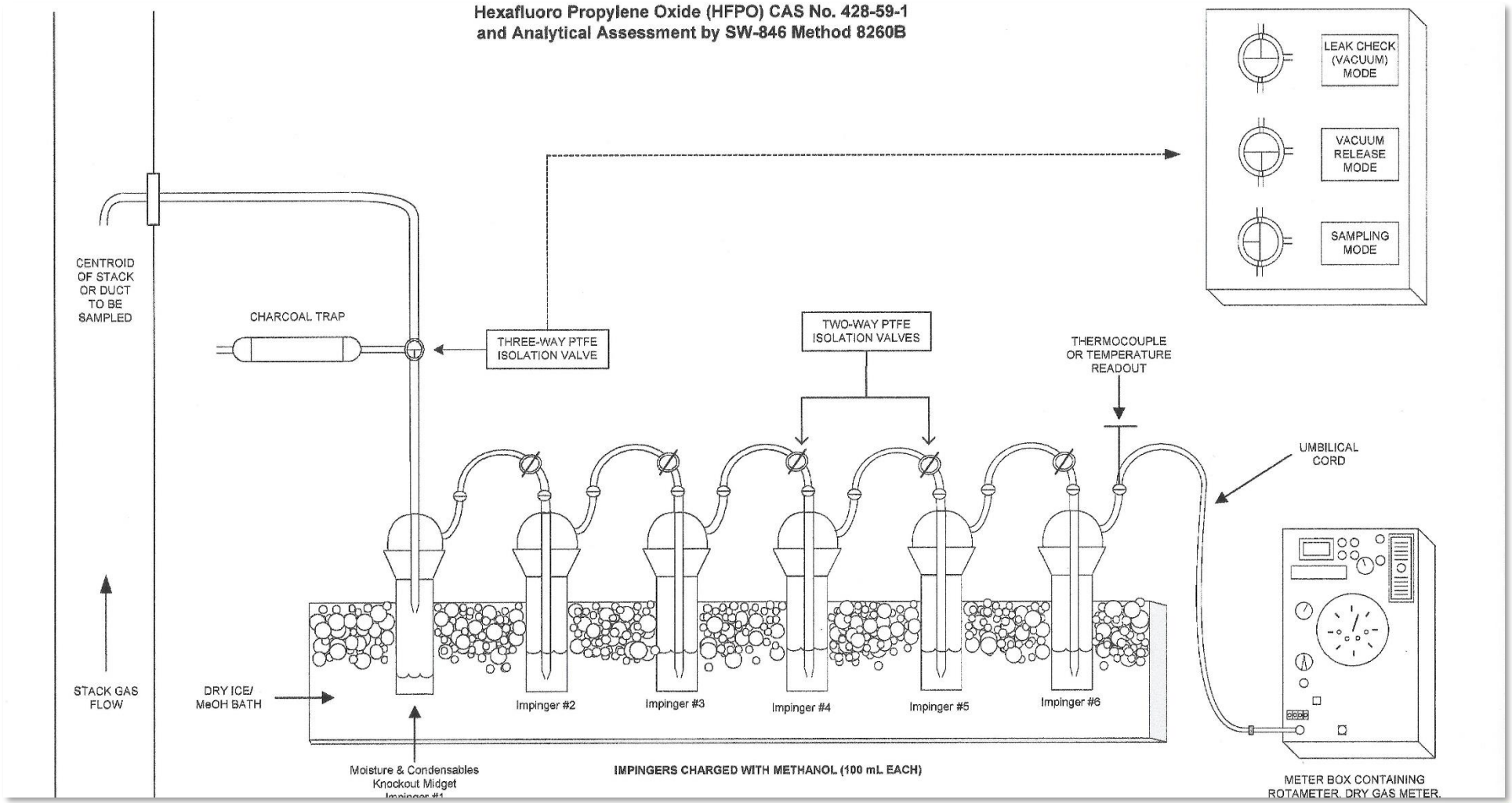
GenX Testing Modification

- Modified to add XAD-2 Resin trap
- GenX (13252-13-6) and Acid Fluoride (2062-98-8) form is captured
- No easy way to determine carboxylic acid from acid fluoride form
- Shorter sample run times (high concentrations)
- Found GenX from all emissions sources
- Estimated more than 2300 lb/yr (not 3.3)
- Tested at least one source/production campaign every month except October

Other PFAS, Understanding the Chemistry

- HFPO (hexafluropropylene oxide) from Hexafluropropylene (HFP) reaction. Passed through scrubbers without being captured
- HFPO reaction also produced carbonyl fluoride, perfluoro-acetyl fluoride from partial oxidation of HFP
- A modified “Method 18” for capture of HFPO in a chilled methanol midget impinger system. Methanol/dry ice to maintain temperature at less than -73°C to condense HFPO in the impingers.
- Reacts with methanol to make 2-MTP (Methyl-2-methoxy-tetrafluoro-propionate, #10186-63-7)
- Expanded to handle dimer acid fluoride, carbonyl fluoride, fluoroether E-1 (esterification reaction with methanol)
- Better suited to higher (uncontrolled) concentrations

Modified Method 18



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Consent Decree

- PFAS are unregulated emerging compounds (air)
- NC DEQ had the ability to regulate PFAS because of contaminated groundwater
- Air pathway was demonstrated through rainwater analysis (wet deposition)
- Chemours began controlling additional sources and installed additional controls beginning May 2018
- Draft Consent Order in November 2018. Final consent order February 26, 2019. Codified interim control requirements and 99.99% control of PFAS by no later than 12/31/2019
- Thermal oxidizer designed and installed during 2019. Began operation on 12/27/2019
- “Dress rehearsal test” conducted on 1/3-4/2020.
- “Compliance test” conducted 2/28-29/2020

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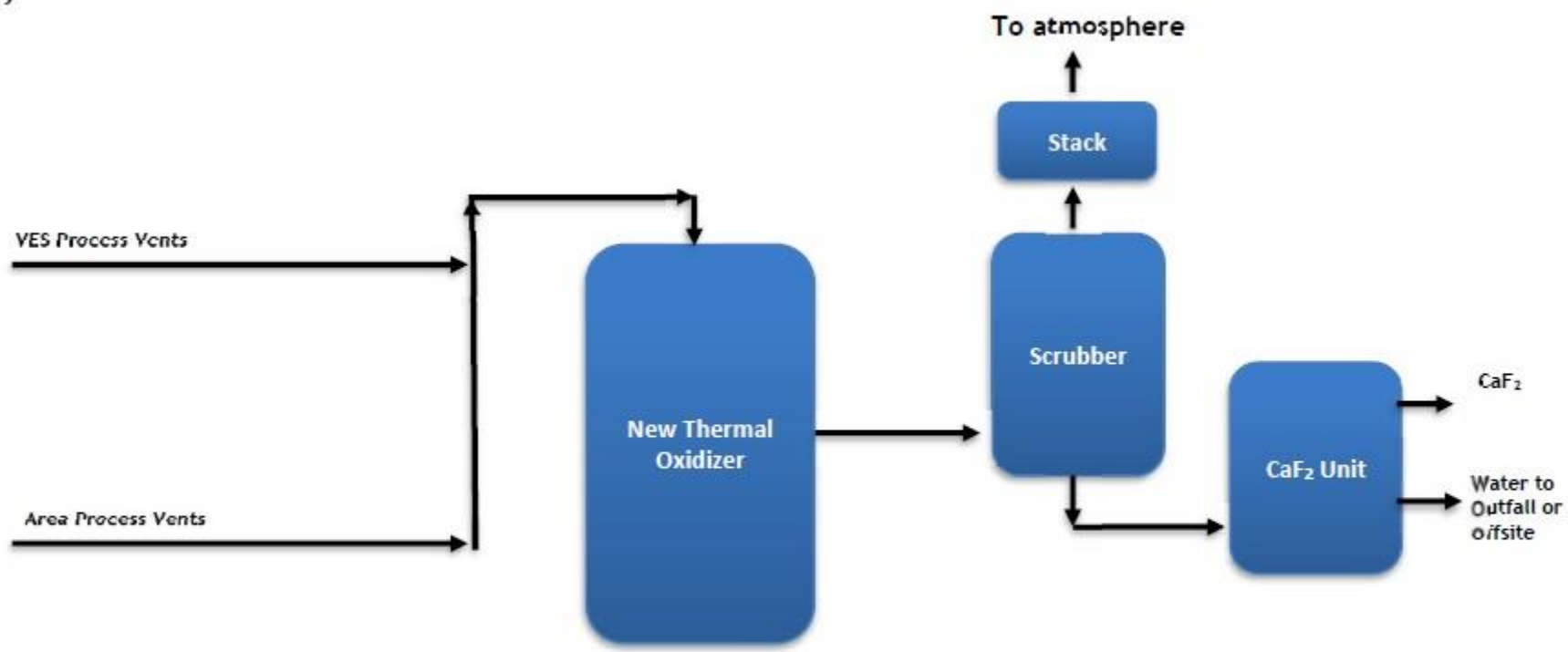
Key Components of the Thermal Oxidizer

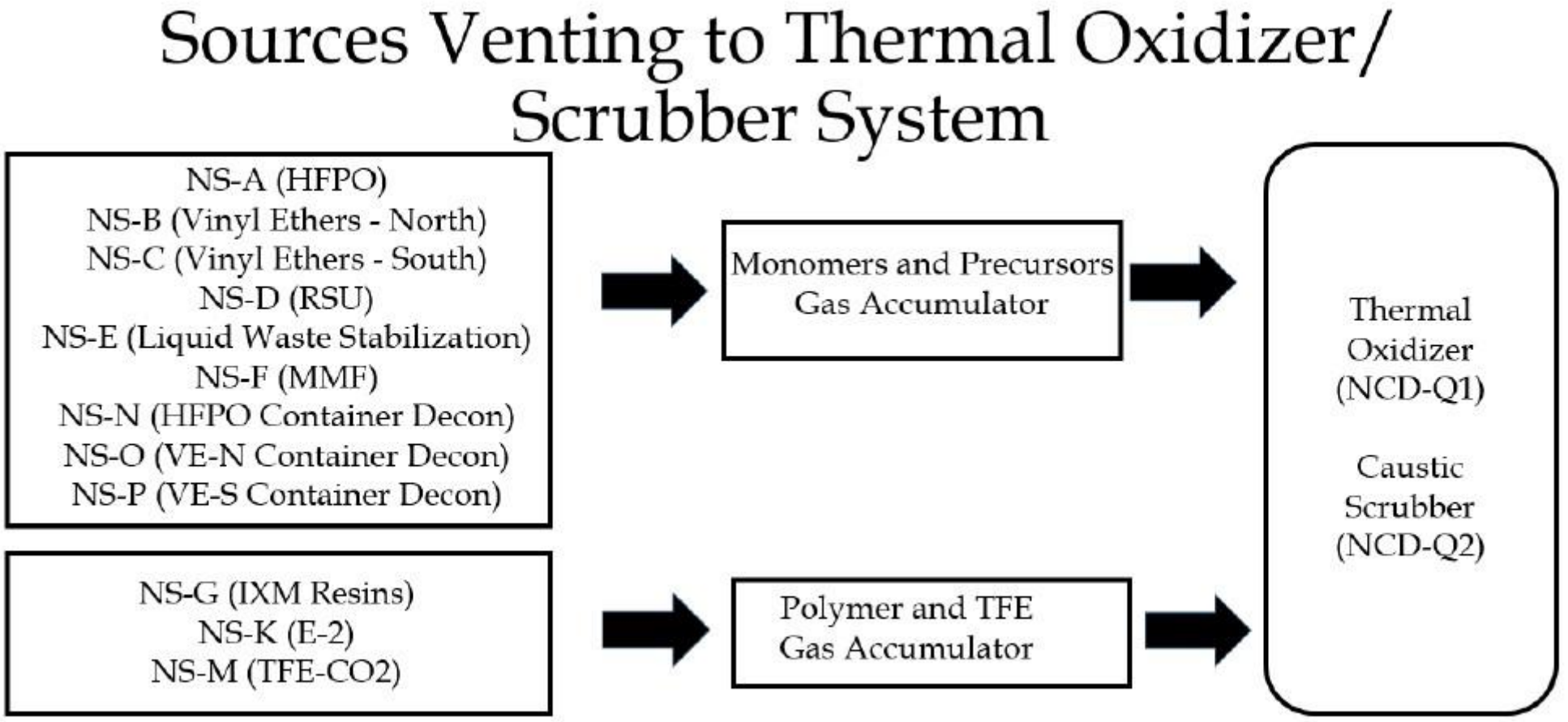
- Separate feed lines for monomers and polymers areas
- Separate accumulators for each line
- 10 MMBtu/hr Natural Gas downflow thermal oxidizer
- Premixed NG burner system for high hydrogen availability and uniform temperature in the flame zone
- Operating temperature 1050°C, controlled with demineralized water injection
- PFAS are cracked to form HF & CO_2 (very little H_2O from PFAS)
- Rapid quench with 10-18% strength HF liquid
- 4-stage counterflow packed bed scrubber to capture/control HF emissions
- Scrubber liquid pumped to neutralizing area
- Reaction with slaked lime to produce CaF_2
- Filter cake is trucked offsite (landfill)

Thermal Oxidizer System Schematic

Project Schematic

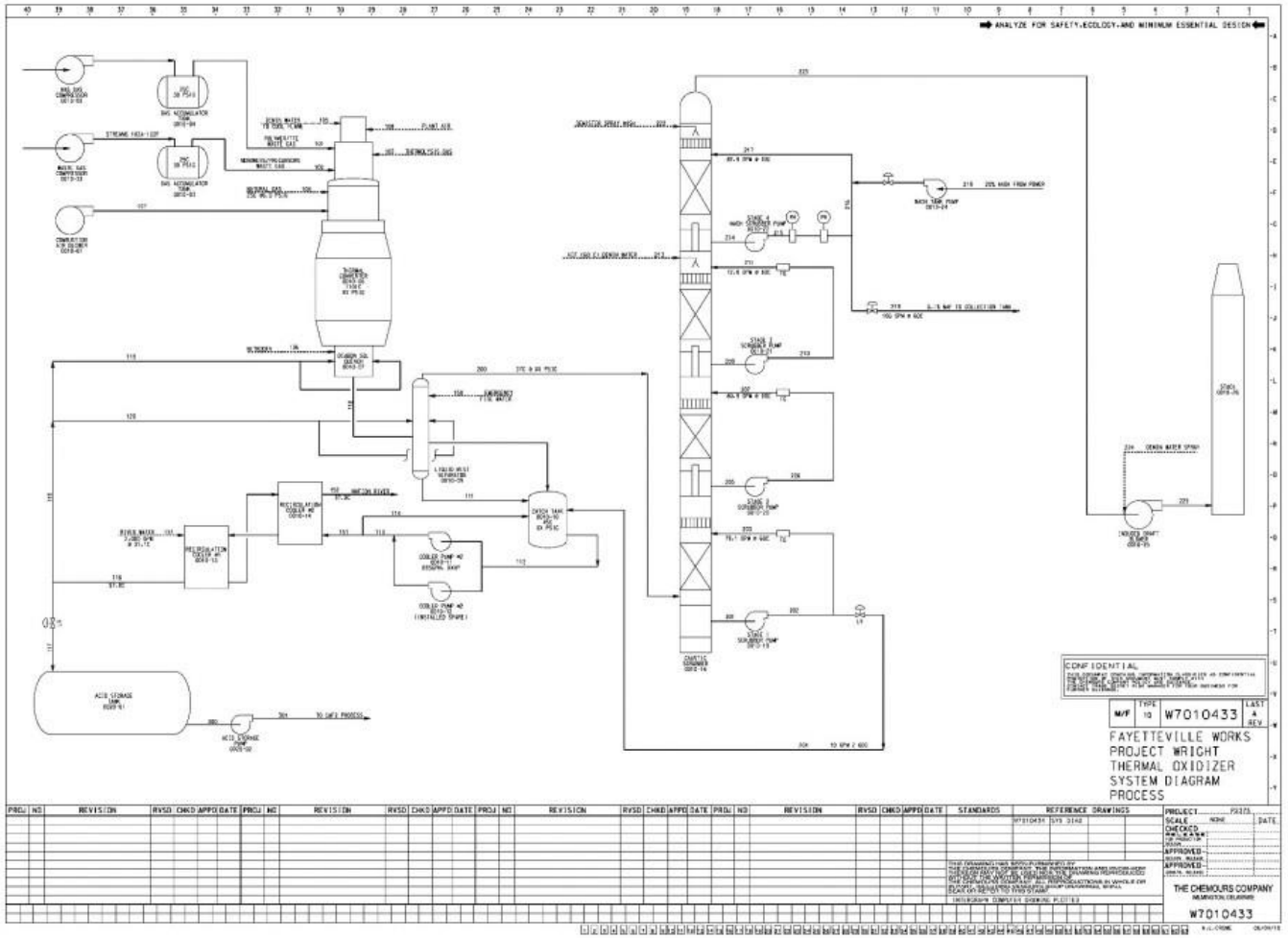


Sources to Thermal Oxidizer



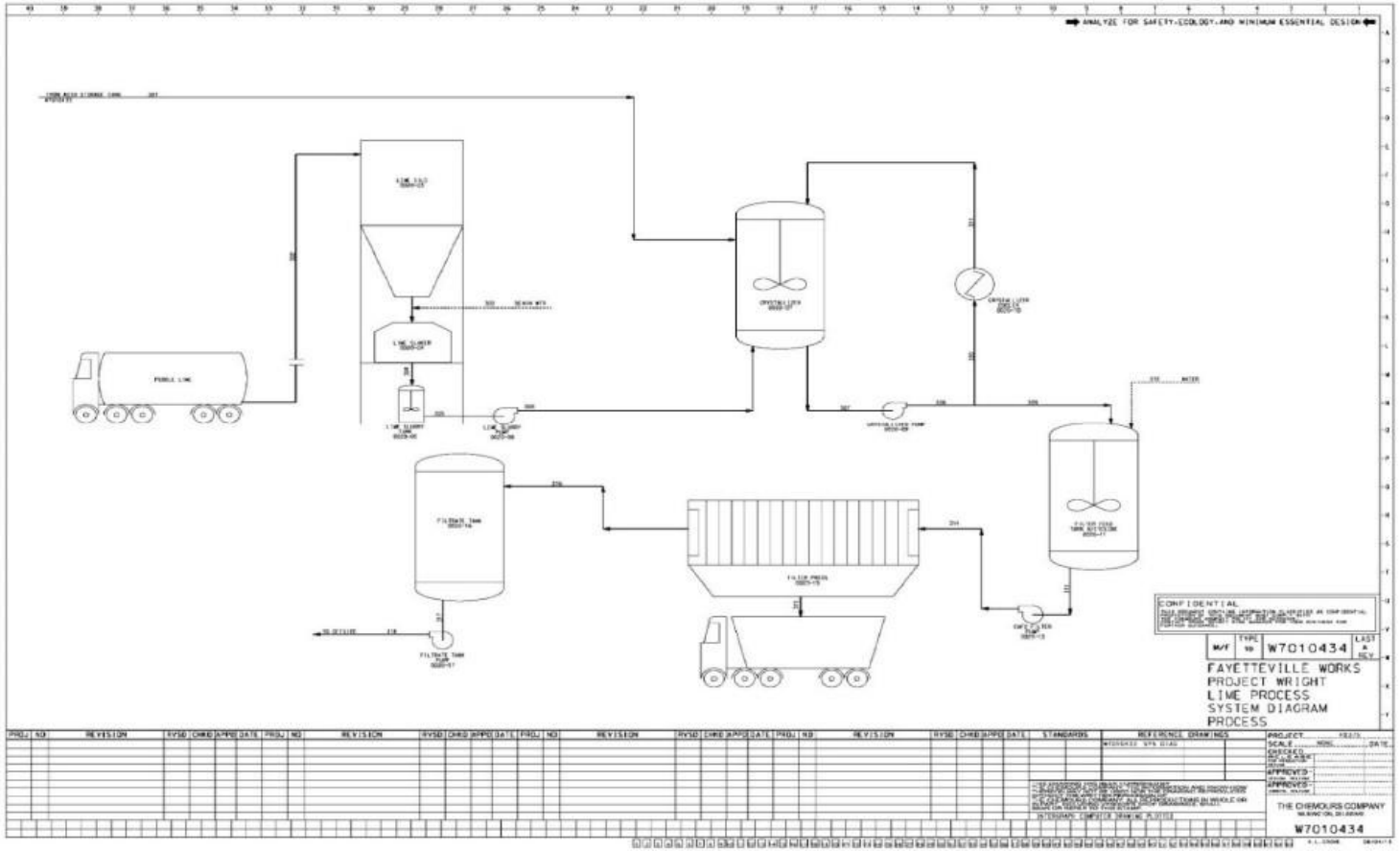
Thermal Oxidizer Schematic (from Permit Application)

Figure 2-2: Thermal Oxidizer/Scrubber System Diagram



Lime System and CaF_2 Handling

Figure 2-4: Lime Handling System Diagram



Thermal Oxidizer Tower & 2 Accumulators

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Thermal Oxidizer (left) and Scrubber (tall column at front corner of the tower)

Thermal Oxidizer System at Night

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Summary Test Results & Efficiency

Pollutant	Run 1 (lb/hr)	Run 2 (lb/hr)	Run 3 (lb/hr)
HFPO-DAF	<3.88E-05	<4.85E-05	<3.22E-05
HFPO Monomer	<1.75E-06	<2.18E-06	<1.46-06
HFPO-DA	1.20E-06*	9.60E-07*	6.90E-07*
Fluoroether E-1	<2.01E-06	<2.18E-06	<1.67E-06
Carbonyl Fluoride	<1.18E-04	<1.46E-04	<9.79E-05

	Inlet	Stack	Control Efficiency
	Lb/hr	Lb/hr	%
Run 1	9.06E+01	≤1.62E-04	≥99.99982
Run 2	7.83E+01	≤2.00E-04	≥99.99974
Run 3	9.55E+01	≤1.34E-04	≥99.99986
Average	8.81E+01	≤1.65E-04	≥99.99981

NC DEQ & NC DAQ Website Resources

- NC DEQ : https://deq.nc.gov/news/key-issues/genx-investigation
- NCDAQ: https://deq.nc.gov/news/key-issues/genx-investigation/air-quality-sampling

Contact Information

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Thank you – Questions?

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