NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date: DRAFT

Region: Fayetteville Regional Office
County: Bladen
NC Facility ID: 0900009
Inspector's Name: Gregory Reeves
Date of Last Inspection: 02/28/2018
Compliance Code: 3 / Compliance - inspection

Facility Data

Applicant (Facility's Name): Chemours Company - Fayetteville Works

Facility Address:
Chemours Company - Fayetteville Works
22828 NC Highway 87 West
Fayetteville, NC 28306

SIC: 2869 / Industrial Organic Chemicals,nec
NAICS: 32512 / Industrial Gas Manufacturing

Facility Classification: Before: Title V **After:** Title V
Fee Classification: Before: Title V **After:** Title V

Permit Applicability (this application only)

SIP:
NSPS:
NESHAP:
PSD:
PSD Avoidance:
NC Toxics:
112(r):
Other:

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Christel Compton Program Manager (910) 678-1213 22828 NC Highway 87 West Fayetteville, NC 28306	Brian Long Plant Manager (910) 678-1415 22828 NC Highway 87 West Fayetteville, NC 28306	Christel Compton Program Manager (910) 678-1213 22828 NC Highway 87 West Fayetteville, NC 28306

Application Data

Application Number: 0900009.18B
Date Received: 07/02/2018
Application Type: Modification
Application Schedule: TV-Sign-501(b)(2) Part I

Existing Permit Data

Existing Permit Number: 03735/T43
Existing Permit Issue Date: 12/14/2016
Existing Permit Expiration Date: 03/31/2021

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2017	0.2000	61.63	239.09	33.86	3.97	34.00	17.29 [Methanol (methyl alcohol)]
2016	0.2100	65.19	237.76	36.45	4.16	33.27	18.44 [Methanol (methyl alcohol)]
2015	0.2030	55.45	290.39	42.10	8.94	36.82	17.06 [Methanol (methyl alcohol)]
2014	1.95	76.26	332.17	38.10	8.60	33.58	19.57 [Methanol (methyl alcohol)]
2013	0.2100	80.13	312.90	30.45	9.47	33.71	19.93 [Methanol (methyl alcohol)]

Review Engineer: Heather Sands

Review Engineer's Signature: **Date:**

Comments / Recommendations:
Issue 03735/T44
Permit Issue Date:
Permit Expiration Date:

I. Purpose of Application

The Chemours Company – Fayetteville Works (Chemours) facility currently holds Title V Permit No. 03735T43 with an expiration date of March 31, 2021, for a chemical manufacturing company in Fayetteville, Bladen County, North Carolina. This permit application (No. 0900009.18B) is for the installation of a thermal oxidizer/scrubber system and a lime processing system.[1] This application is the first step of a two-step significant modification of their Title V permit being made under 15A NCAC 02Q .0501(b)(2). Under 15A NCAC 02Q .0501(b)(2), Chemours is required to obtain a construction and operation permit as specified in 15A NCAC 02Q .0504 and then file a complete application within 12 months after commencing operation to modify the construction and operation permit to meet the requirements of 02Q .0500.

This permit application is also providing the means by which Chemours will comply with a Proposed Consent Order[2] under which Chemours has agreed to permanently reduce emissions of GenX Compounds[3] from the entire facility. Section III has a detailed discussion on the Proposed Consent Order.

II. Application History

July 2, 2018	DAQ received Permit Application No. 0900009.18B from Chemours for the Thermal Oxidizer/Scrubber System Project.
July 11, 2018	Representatives from Chemours participated in a conference call with DAQ about setting up an "in-person" meeting to discuss the Thermal Oxidizer/Scrubber System Project.
July 19, 2018	Chemours employees and consultants met with DAQ to discuss Permit Application No. 0900009.18B for the Thermal Oxidizer/Scrubber System Project. During the meeting, DAQ requested that Chemours submit a description of shutdown/malfunction procedures; a copy of the spreadsheet used to calculate per- and polyfluoroalkyl substances (PFAS) emissions and emission reductions;
July 23, 2018	Ms. Heather Sands, the permit engineer responsible for modifying the permit, sent an email to Chemours asking about a statement in a news article that indicated liquid waste would be vaporized and sent through the thermal oxidizer; specifically, whether the stream referred to in the article was the scrubber effluent.
July 24, 2018	Chemours responded to the July 23, 2018 email that the stream discussed in the article was not the scrubber effluent and that it was something that will be handled separately and is not part of this permitting action.
July 27, 2018	Chemours submitted, via email, spreadsheets for the Thermal Oxidizer fuel combustion-related emissions and the emergency generator emissions.
August 16, 2018	Representatives from Chemours met with DAQ to discuss the PFAS spreadsheet. Chemours agreed to get approval to share the spreadsheet, submit sample calculations, provide a high level description of shutdown and malfunction procedures, document the handling of scrubber effluent and a discussion about how 2017 production compared to previous years.

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[1] The entire permit application is available online on the DEQ website at: https://files.nc.gov/ncdeq/GenX/Thermal-Oxidizer-Permit-Application-06292018.pdf

[2] "Proposed Consent Order" means the Proposed Consent Order issued for public notice on November 21, 2018, in connection with State of North Carolina, ex rel., Michael S. Regan, Secretary, North Carolina Department of Environmental Quality v. The Chemours Company FC, LLC, 17 CVS 580 (Bladen County).

[3] "GenX Compounds" means HFPO Dimer Acid, also known as C3 Dimer Acid (CAS No. 13252-13-6); HFPO Dimer Acid Fluoride, also known as C3 Dimer Acid Fluoride (CAS No. 2062-98-8); and HFPO Dimer Acid Ammonium Salt, also known as C3 Dimer Acid Ammonium Salt (CAS No. 62037-80-3).

August 23, 2018	Chemours submitted, via email, supporting documentation for the Thermal Oxidizer as requested in the August 16th meeting, including: sample emissions calculations, high level procedure for thermal oxidizer malfunctions; and documentation that the wastewater from the thermal oxidizer will either be part of an updated NPDES permitted discharge or shipped offsite for disposal.
August 23, 2018	Ms. Sands requested, via email, additional information regarding several items related to the permit application. Specifically, additional information was needed regarding: some of the tanks identified in the permit application; the lime processing system; the specific sources in the IXM Resins process that will be routed to the Thermal Oxidizer and how the IXM resins process is currently controlled; and clarification on the VEN control system as it is actually configured vs. the permit description. In addition, DAQ requested missing A2 forms, and a more clear version of Figure 2-2.
August 24, 2018	Chemour provided, via email, a qualitative description of the 2017 production relative to other typical years. Specifically, Chemours stated that in the monomers areas (HFPO, VEN, VES) the 2017 production was similar to 4 of the previous 5 years and therefore would be representative of typical recent operation. The outlook for HFPO is for continued similar operation, and the outlook for VE is increased production over the next few years. In the IXM polymer resins area the 2017 production was the highest annual production on record. This represents a 16% increase over the average of the prior five years. The outlook for IXM polymer production is to gradually increase capacity by 30% above the 2017 level over the next four years.
August 27, 2018	Chemours submitted form A2 as requested on August 23rd.
September 5, 2018	Chemours responded to the August 23th request for additional information and submitted the spreadsheet that was used to calculate PFAS emissions.
September 6, 2018	Ms. Sands requested, via email, additional information regarding the spreadsheet, current configuration of the uncontrolled sources, additional questions regarding IXM Resins and its control configuration, as well as some follow-up questions on the information received September 5.
September 13, 2018	Chemours responded to the September 6th request for additional information. Based on the information contained in this email, DAQ submitted, for Chemours approval, an option for illustrating the IXM Resins process and its control configuration in Section 1 of the permit.
September 19, 2018	Ms. Sands, via email, requested additional information regarding the lime silo bin vent baghouse to determine whether the control device was an inherent part of the system or and if not, DAQ would require the appropriate forms.
September 20, 2018	Chemours responded to the September 13th email regarding IXM Resins. DAQ responded to this email by asking what Chemours preferred wording of the IXM Resins control device was and Chemours immediately responded that the suggested wording was appropriate.
September 26, 2018	Chemours provided additional detail regarding the Lime Silo and submitted the application forms for this source.
September 26, 2018	Draft Permit and Permit Review submitted to applicant and Fayetteville Regional Office (FRO) for review.

October 3, 2018	FRO comments were received. See Section IX, below.
October 8, 2018	Comments from applicant were received. See Section IX, below.
October 26, 2018	DAQ sent an additional information request letter to Chemours. Additional information was requested to incorporate all aspects of the April 27, 2018, letter from Chemours detailing their approach to reducing GenX emissions.
November 6, 2018	DAQ sent an email to Chemours stating that the due date for the additional information requested October 26, 2018, was extended to November 16, 2018.
November 9, 2018	DAQ received Chemours' permit application addendum in response to the October 26, 2018 information request.
November 14, 2018	DAQ sent an email to Chemours requesting some clarification to the November 9, 2018, submittal.
November 21, 2018	Chemours signed a Proposed Consent Order with N.C. Department of Environmental Quality, which requires Chemours to reduce emissions of all PFAS, including GenX Compounds.
November 29, 2018	Chemours submitted clarification to items requested in the November 14, 2018, email from DAQ.
December 21, 2018	DAQ sent a draft of the permit and permit review to Chemours revised to incorporate the information received November 9, 2018.
January 4, 2019	Chemours submitted comments on the December 21, 2018, draft permit.
January 11, 2019	DAQ sent an email to Chemours with DAQ responses to the comments received January 4, 2019.
XXXX YY, 2019	Draft permit sent to public notice.
XXXX YY, 2019	Public comment period ends. ***Add comments received***
XXXX YY, 2019	Permit issued.

III. Facility and Project Description

Chemours Company – Fayetteville Works is a chemical manufacturing facility. The facility currently manufactures chemicals, plastic resins, plastic sheeting, and plastic film. Specific materials produced at Chemours include Nafion® Fluorocarbon membrane, fluorocarbon intermediates for Nafion® membranes and other fluorocarbon products, and fluoropolymer processing aids. The facility consists of two individual manufacturing plants (the FPS/IXM, or Nafion,® Process and the PPS Process), a boiler house and a waste treatment operation. Currently, no wastewater from the Chemours facility is discharged to the wastewater treatment plant (WWTP), except reject water from making filtered, deionized/degassed water at the power plant. The WWTP handles process and sanitary wastewater streams from two other facilities located on the site, Kuraray and DuPont. The facility also has two permanent boilers onsite, one permanent boiler which is permitted but not yet constructed, and one permitted temporary boiler. Chemours is a major source of criteria pollutants under the 40 CFR Part 70 (Title V) Operating Permit Program, a major source of hazardous air pollutants (HAP), and a major source under New Source Review (NSR).

A. Background of GenX Compounds Investigation

In June of 2017, the North Carolina Departments of Environmental Quality and Health and Human Services (DEQ and DHHS) began investigating the presence of perfluoro-2-propoxypropanoic acid,[4] the chemical compound known as GenX, in the Cape Fear River. The Chemours Fayetteville Works facility was identified as the company that produces the GenX chemical for industrial processes. This investigation initially focused on the protection of public health and drinking water.

In the subsequent months, the Division of Air Quality (DAQ) began investigating the contribution of air emissions to the presence of GenX in the groundwater and the Cape Fear River. DAQ and Chemours worked together to develop methodologies for sampling and analysis of sources of GenX. The methodologies were developed to test for perfluoro-2-propoxypropanoic acid specifically; however, because perfluoro-2-propoxypropanoic acid is formed in the presence of water from perfluoro-2-propoxy propionyl fluoride (also known as hexafluoropropylene epoxide dimer acid fluoride or HFPO DAF, CAS No. 2062-98-8), DAQ considers the sampling results to represent the emissions of perfluoro-2-propoxypropanoic acid and its precursors, collectively referred to in the remainder of this document as GenX or GenX Compounds. In January of 2018, at the direction of, and in coordination with DAQ, Chemours began a stack testing program using these new methods.

At the same time, DAQ also began a program of rainwater collection and analysis to determine GenX Compound concentrations present in rainwater. Based on information collected from the stack testing program in conjunction with the rainwater sampling, DAQ determined that the level of GenX Compound emissions being released into the air was higher than originally reported by Chemours.

B. Notification of Intention to Modify Chemours' Air Permit

On April 6, 2018, DAQ notified Chemours of its intent to modify their air quality permit (Permit No. 03735T43) within 60 days of the written notice, as allowed under North Carolina General Statute (N.C.G.S) 143-215.108(c)(3).[5] Per 15A NCAC 02Q. 0519(a)(2), the Director of DAQ is authorized to modify a permit for several reasons, including if "the conditions under which the permit or permit renewal was granted have changed," or if the Director finds that modification "…is necessary to carry out the purpose of N.C.G.S. 143, Article 21B" under 15A NCAC 02Q. 0519(a)(7). These provisions are incorporated into General Condition S of the existing permit.

In the April notification, DAQ stated its conclusion that the conditions under which the current permit (T43) was issued had changed, thereby authorizing modification of the air quality permit under 02Q .0519(a)(2). Specifically, DAQ had no knowledge that:

- Chemours was emitting GenX Compounds at the current rates, as determined by stack testing;
- the GenX Compounds emitted from the facility at these rates were being transmitted and deposited on the land surface by rainfall several miles away from the facility; or
- such deposition caused or contributed to widespread contamination of groundwater in violation of the State's groundwater standards.

Further, DAQ stated that modification of the permit is necessary to carry out the purpose of N.C.G.S. Chapter 143, Article 21B. As stated in the letter:

> DAQ believes N.C.G.S. §143-211 establishes a clear mandate for environmental protection and conservation of natural resources by DAQ. The statute endorses a "total environment of superior quality" and repeatedly speaks to coordinated protection of water and air resources. (Groundwater is included in

[4]Perfluoro-2-propoxypropanoic acid is a compound used in the GenX Process. It can be referred to as Hexafluoropropylene Epoxide Dimer Acid (HFPO DA), or C3 Dimer Acid but is commonly known as GenX.

[5] Letter from Abraczinskas, M.A., Director NC DEQ/DAQ, to B. Long, Plant Manager, Chemours Company – Fayetteville Works. 60-Day Notice of Intent to Modify Air Quality Permit No. 03735T43 – The Chemours Company, Fayetteville Works. April 6, 2018. 8 pages. Available on the DEQ website at https://files.nc.gov/ncdeq/GenX/2018_April6_Letter_to_Chemours_DAQ_FINAL_signed.pdf.

the definition of "waters" in N.C.G.S. §143-212.) A frequent refrain in this policy statement is prevention of damage and preservation of natural resources for the benefit of all citizens of the State, including preserving opportunities for "healthy industrial development" and encouraging "the expansion of employment opportunities." Overall, Article 21B directs DAQ to protect the public and North Carolina's endowment of natural resources.

According to DAQ, a causal link between GenX Compound emissions from Chemours and widespread degradation of groundwater has been confirmed and, therefore, DAQ is required to consider modification of the Chemours air permit to carry out the purposes of Article 21B. As such, DAQ submitted their April 6th notification letter. DAQ provided an opportunity for Chemours to show compliance by doing one of the following:

(1) respond to DAQ in writing and demonstrate to DAQ' s satisfaction that emissions of GenX Compounds from the Fayetteville Works under current conditions do not cause or contribute to violations of the groundwater rules; or
(2) respond to DAQ in writing and demonstrate to DAQ's satisfaction that emissions of GenX Compounds under alternate conditions proposed by Chemours will not cause or contribute to violations of the groundwater rules.

The letter further stated that if Chemours submitted a response under option (1) above and DAQ finds that Chemours has met its burden of demonstrating that emissions of GenX Compounds do not cause or contribute to groundwater violations under current operating conditions, DAQ will not modify the Permit. Should Chemours submit a response under option (2) above and DAQ finds that Chemours has met its burden of demonstrating that emissions of GenX Compounds will not cause or contribute to groundwater violations under the proposed alternate operating conditions proposed by Chemours, DAQ will modify the Permit. The modified permit will include enforceable conditions corresponding to the alternate operating conditions that will take effect on the date the permit is issued.

C. Proposed Alternate Operating Conditions

On April 27, 2018, Chemours submitted a response to the 60-day notification[6] with proposed alternate conditions. In their response, Chemours committed to reducing air emissions of GenX Compounds by taking the following actions:

- Installing state-of-the-art emission control technology. Chemours committed to installing a thermal oxidizer to destroy 99.99 percent of all PFAS and GenX Compound vapors coming from the Vinyl Ethers North, Vinyl Ethers South, and relevant portions of the Polymers Plants. Chemours estimated that the oxidizer alone would eliminate approximately 71 percent of the GenX Compounds emitted from the facility.
- Interim Measures. Because the thermal oxidizer was estimated to take 18 to 24 months to manufacture and install, Chemours committed to taking multiple interim measures to reduce GenX emissions, as follows:
    - By May 25, 2018, installation of carbon adsorption systems on the process and indoor air equipment emissions from the Polymer Processing Aid (PPA) facility and the indoor air equipment emissions at the Vinyl Ethers – North (VEN) facility.[7] Chemours stated than they expected to reduce GenX emissions from the PPA process by more than 97 percent and more than 90 percent from the VEN facility.[8,9]

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[6] Letter and attachments to Abraczinskas, M.A., Director – DAQ and W.F. Lane, General Counsel from J.M. Gross, Arnold & Porter Kaye Scholer LLP. *60-Day Notice of Intent to Modify Air Quality Permit No. 03735T43 – The Chemours Company, Fayetteville Works.* April 27, 2018. 30 pages. Available online at https://deq.nc.gov/news/hot-topics/genx-investigation/investigations-and-enforcement-actions

[7] On December 21, 2017, Chemours requested approval to install and operate indoor air emissions abatement systems. https://files.nc.gov/ncdeq/GenX/Chemours-Carbon-Trial-Request-122117.pdf

[8] DAQ authorized the installation and testing of the indoor air emissions abatement systems in a letter dated February 9. This letter is available online at https://files.nc.gov/ncdeq/GenX/DAQ%20Chemours%20Carbon%20Trial%20Ltr%20021218.pdf.

[9] On May 25, 2018, Chemours submitted an email notifying DAQ that these carbon absorbers were operational. https://files.nc.gov/ncdeq/GenX/Carbon-Bed-install-notice-052518.pdf

- Improvements to the Division Waste Gas Scrubber installed on VEN facility by October 2018 that Chemours estimated would reduce GenX emissions by between 40 and 80 percent.
- Implementation of enhanced leak detection and repair (LDAR) facility-wide. Specifically:
  - Implementation of pressure testing using a 0.5 psig pressure drop over a 30-minute interval;
  - Implementation of an enhanced audial, visual, olfactory (AVO) inspection procedure;
  - Performance of an experimental evaluation to verify that a Flame Ionization Detector (FID) TVA-1000B would detect GenX vapors;
  - Identification and tagging of new LDAR points in the VEN, Semi-Works, and PPA areas;
  - Evaluation of preferred method to implement enhanced area monitoring and increase the number of area monitoring sample locations near streams with the potential to include 1 percent by weight of GenX Compounds; and
  - Conduct an evaluation of the preferred methods to implement replacement or improvement of valves and connectors, and use the LDAR monitoring to initiate the replacement with low-emission technology.

D. Chemours' Permit Application

In response to DAQ's April 6, 2018, letter, Chemours proposed alternate conditions (discussed above) by which facility-wide GenX emissions would be reduced by 99 percent. DAQ evaluated the Chemours proposal and asked Chemours to submit a permit application by which DAQ will modify the permit to insert enforceable conditions corresponding to the alternate operating conditions. Chemours submitted a Permit Application No. 0900009.18B[10] to request a modification to their current permit (T43) to add a Thermal Oxidizer/Scrubber System and Lime Processing System along with other ancillary equipment. This permit application satisfied the first phase of the proposed operating conditions under which Chemours would operate to reduce GenX Compound Emissions. Chemours anticipates that the Thermal Oxidizer/Scrubber System and the associated equipment would be fully operational by December 2019. The following discussion describes the proposed project.

1. *Thermal Oxidizer/Scrubber System*

Chemours is proposing to install a control system that will be used to reduce all PFAS emissions, including GenX Compounds, from several existing sources at the facility. The Thermal Oxidizer/Scrubber System will reduce emissions of all PFAS, including GenX Compounds, as well as reducing any volatile organic compounds (VOC) present. Fluorinated compounds destroyed in the Thermal Oxidizer will generate hydrogen fluoride (HF) emissions that will be removed in the scrubber system. Similarly, any sulfur-containing compounds fed to the Thermal Oxidizer will generate sulfur dioxide (SO_2) emissions which will also be removed in the scrubber. This system will replace the currently permitted scrubbers installed on the Vinyl Ethers – North and South processes. Chemours stated in their permit application that this system will not accept any waste streams outside of the Fayetteville Works site boundary. The Thermal Oxidizer/Scrubber System includes the following equipment:

- **Thermal Oxidizer:** The natural gas-fired Thermal Oxidizer will be installed to destroy GenX, PFAS, and VOC emissions. The thermal oxidizer will operate as a high-temperature (1,800 degrees Fahrenheit, ^{O}F) thermal conversion unit for fluorinated hydrocarbon waste. The thermal oxidizer vendor guaranteed a 99.99 percent overall reduction efficiency.
- **Gas Accumulation Tanks:** The two gas accumulation tanks are hold-up tanks allowing for pressure swings for feed into the thermal oxidizer. The tanks will be sized to hold waste gas feed to the thermal oxidizer for 1 hour in the case of a flame-out or other control device malfunction to allow for the process to safely shut down and come to a steady state condition. These tanks will operate at a pressure of 30 pounds per square inch gauge (psig) at $25^{O}C$ and do not have an emission point.
- **Liquid Mist Separator:** The liquid mist separator separates rapid quench spray from gaseous combustion products (carbon dioxide and water). The combustion flue gas from the thermal oxidizer is rapidly quenched using an open pipe spray quencher and low concentration HF acid to rapidly drop the temperature of the combustion gases from 1800 degrees Fahrenheit (^{O}F) to $150^{O}F$. The quenched flue gas is introduced into the bottom of a Liquid Mist Separator which consists of a packed bed scrubber

[10] See Reference 1.

containing 10 feet of packing height with primary purpose to remove liquid mist from the open pipe spray quencher discharge.

- **Catch Tank:** This tank collects dilute (18 weight percent) aqueous hydrogen fluoride (HF) acid generated during the thermal conversion of fluorinated hydrocarbons. This tank will operate at a slightly negative pressure and does not have an emission point.
- **Acid Recirculation Cooler:** This non-contact heat exchanger is used to cool the recirculation acid used in the thermal oxidizer spray quench via cooling tower water. River water is the cooling fluid.
- **Acid Storage Tank:** The storage tank collects 18 weight percent aqueous HF acid prior to being pumped to the lime neutralization/calcium fluoride (CaF_2) recovery system. HF acid is also pumped from this tank to the Liquid Mist Separator and to the quench spray on the thermal oxidizer. The tank is sized to maintain thermal conversion operation during any minor upsets in the lime recovery system.
- **Caustic Scrubber:** The Thermal Oxidizer waste gases are fed to a four-stage packed column to neutralize any residual HF vapor carried over from the Liquid Mist Separator. The lower three stages use countercurrent scrubbing with demineralized water. Demineralized water is added to Stage 3. The HF is efficiently recovered from the flue gas. The bottom of Stage 1 contains 10 percent aqueous HF acid, Stage 2 reduces the concentration to 1 percent, and Stage 3 reduces the concentration to 0.1 percent. Stage 4 uses recirculated scrubbing with a pH basic solution. The pH is controlled by the addition of sodium hydroxide (caustic). Stage 4 removes residual HF not recovered by the countercurrent water scrubbing in the first three stages and effectively captures sulfur dioxide (SO_2), a combustion by-product. The scrubber vendor guaranteed that SO_2 and HF emissions generated in the thermal oxidizer will be reduced by 99.95 percent.

In the current facility control system, the existing VEN Waste Gas Scrubber and the VES Scrubber achieve emission reductions of approximately 99.1 and 99.8 percent, respectively, of acid fluoride compounds (e.g., carbonyl fluoride, perfluoroacetyl fluoride), including hexafluoropropylene oxide dimer acid fluoride (HFPO DAF) and HFPO dimer acid (HFPO DA), also known as GenX Compounds.[11] Non-acid fluoride compounds, such as hexafluoropropylene (HFP) and HFPO, do not react with water and therefore pass through the scrubbers uncontrolled. The Thermal Oxidizer/Scrubber System will replace the scrubbers installed on the Vinyl Ethers – North (VEN) and Vinyl Ether – South (VES) stacks. As a result, several sources (e.g., the HFPO, VEN, and VES Container Decontamination Processes) that are currently routed through the scrubbers but emissions from which are not controlled by the scrubber will be controlled in the Thermal Oxidizer. When the scrubbers are replaced with the Thermal Oxidizer/Scrubber System, the removal efficiency of all PFAS (both acid fluoride and non-acid fluoride), is expected to be at least 99.99 percent, based on manufacturer guarantees. In addition, several sources that are currently uncontrolled will be routed to the Thermal Oxidizer (such as the E-2 Process). Figure 1 illustrates the sources to be routed to the Thermal Oxidizer/Scrubber System as well as the layout of the current facility control system.

Table 1 presents the maximum potential emissions of PFAS, including GenX Compounds after installation of the Thermal Oxidizer/Scrubber System, by process. A summary of speciated compound emissions for each process are included in Attachment B. The post Thermal Oxidizer/Scrubber System potential emissions were calculated for each compound by determining which product campaign results in the highest emissions and process operation of 8,760 hours per year.[12]

In addition to the emissions from Thermal Oxidizer/Scrubber System related to process vents, the Thermal Oxidizer generates emissions due to the combustion of natural gas. These are summarized in Table 2. (NOTE: Table C-1 of the permit application presents a speciated estimate of HAP emissions from natural gas combustion.) The emissions were calculated based on a maximum heat input of 10 million British thermal units per hour (million Btu/hr) and were estimated using emission factors from EPA's AP-42. Table 2 also shows Chemours' estimates of the HF emissions generated by the destruction of fluorinated compounds and sulfur dioxide (SO_2)

[11] When in the presence of water, HFPO DAF is converted to HFPO DA, which is the compound being called GenX. Therefore, for this review, both compounds will be discussed as GenX Compounds.

[12] Chemours provided a detailed emissions spreadsheet showing calculations of the PFAS and VOC emissions. To be conservative, Chemours used compound-specific emission reductions to calculated controlled emissions from the Thermal Oxidizer. For the purposes of this permit review, the controlled emissions were recalculated using an the vendor-guarantee VOC emission reduction of 99.99 percent.

Figure 1. Chemours Control Systems

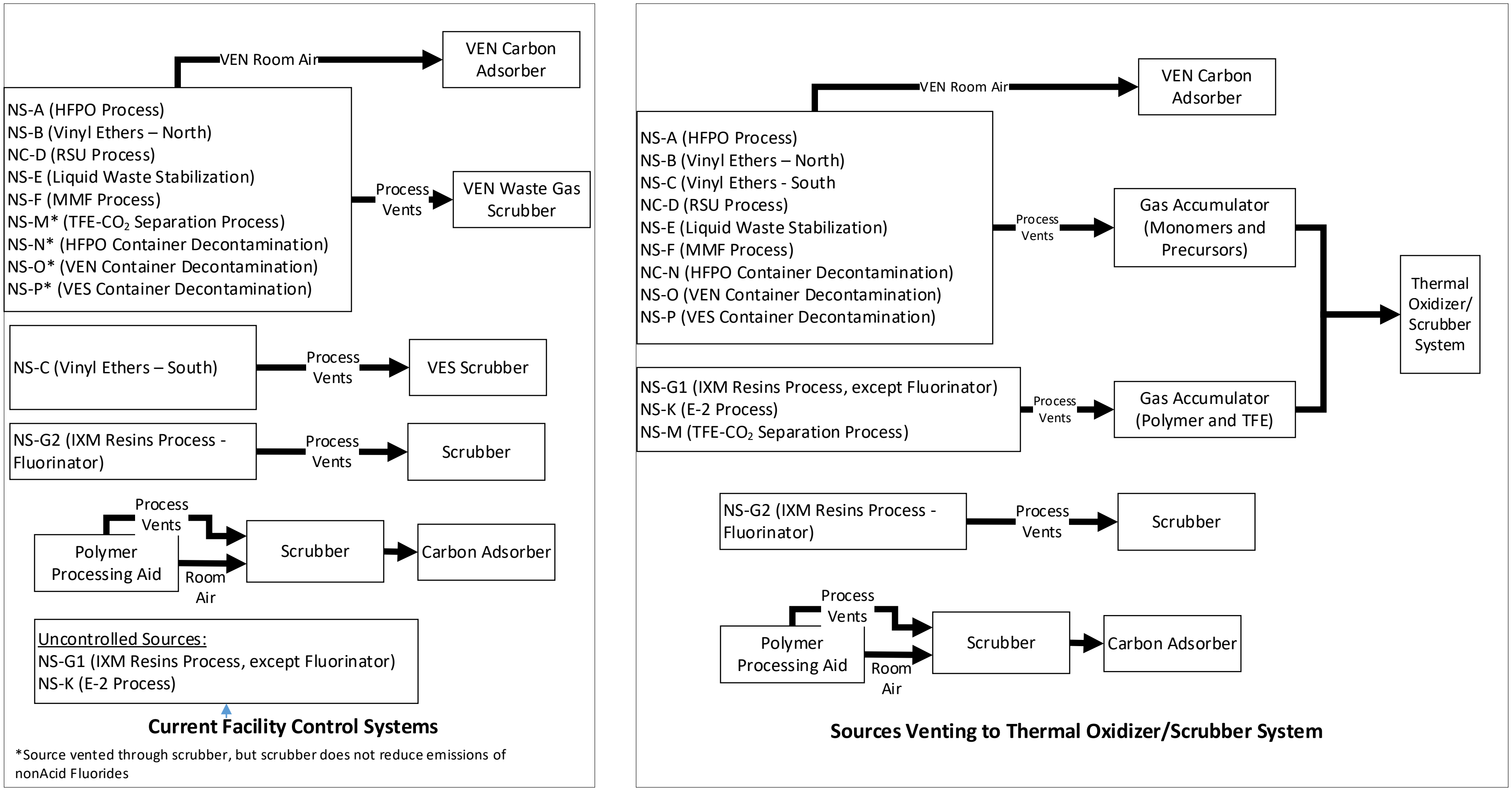

Table 1. Summary of Post-Thermal Oxidizer Fluorinated Compound and GenX Emissions

Process	Process Name	Maximum Potential Emissions (lb/yr)	
		All PFAS (including GenX) Compounds[a]	GenX Compounds (HFPO DA and HFPO DAF)
AS-A[b]	Polymers Processing Aid (PPA) Process	0.960	0.960
NS-A	HFPO Process	291	Not emitted from this process
NS-B	VEN Process	229	2.03
NS-C	VES Process	175	2.03
NS-D + NS-F	RSU and MMF Processes	25	Not emitted from this process
NS-G	IXM Resins Process	337	Not emitted from this process
NS-K	E-2 Process	0.21	Not emitted from this process
NS-M	Tetrafluoroethylene (TFE)/Carbonyl Fluoride (COF_2) Separation Process	117.5	Not emitted from this process
NS-N	HFPO Product Container Decontamination Process	9.64	Not emitted from this process
NS-O	VEN Product Container Decontamination Process	9.64	Not emitted from this process
NS-P	VES Product Container Decontamination Process	9.64	Not emitted from this process
	Total Emissions	**1,205**	**5.02**

[a] See Attachment B for speciated compounds. Does not include emissions of non-fluorinated compounds, such as methanol and hydrogen fluoride.
[b] Potential emissions for PPA Process provided by Chemours in November 6, 2018, response to DAQ additional information request.

Table 2. Summary of Potential Emissions from Thermal Oxidizer/Scrubber System Stack (lb/yr)

Pollutant	Maximum Potential Emissions	
	lb/yr	**ton/yr**
Process Emissions (assumed no removal in scrubber)		
VOC and fluorinated compounds[a]	1,208	0.604
Emissions due to combustion of natural gas[b]		
NO_X	8,540	4.27
CO	7,172	3.59
PM_{10}	649	0.324
$PM_{2.5}$	649	0.324
SO_2	51	0.0256
TOC	939	0.470
VOC	470	0.235
CO_2	10,247,337	5,124
Methane (CH_4)	193	0.0966
Nitrous Oxide (N_2O)	19	9.66e-03
CO_{2e}[c]	10,257,920	5,129
Total HAP[d]	161	0.0806
Acetaldehyde (H,T)	1.30E-03	6.49E-07
Acrolein (H,T)	1.54E-03	7.68E-07
Ammonia (T)	2.73E+02	1.37E-01
Arsenic (H,T)	1.71E-02	8.54E-06
Benzene (H,T)	1.79E-01	8.96E-05
Benzo(a)pyrene (H,T)	1.02E-04	5.12E-08
Beryllium (H,T)	1.02E-03	5.12E-07
Cadmium (H,T)	9.39E-02	4.70E-05
Chromic Acid (H,T)	1.20E-01	5.98E-05
Cobalt (H)	7.17E-03	3.59E-06
Formaldehyde (H,T)	6.40E+00	3.20E-03
n-Hexane (H,T)	1.54E+02	7.68E-02
Lead (H)	4.27E-02	2.13E-05
Manganese (H,T)	3.24E-02	1.62E-05
Mercury (H,T)	2.22E-02	1.11E-05
Napthalene (H)	5.21E-02	2.60E-05
Nickel (H,T)	1.79E-01	8.96E-05
Selenium (H)	2.05E-03	1.02E-06
Toluene (H,T)	2.90E-01	1.45E-04
Emissions generated in Thermal Oxidizer and removed in the Scrubber		
Hydrogen fluoride[e]	4,309	2.15
SO_2[e]	16.6	8.29E-03

[a] Potential fluorinated compound and VOC Emissions presented in the permit application (0.21 lb/hr) for the Thermal Oxidizer (Form C3) appear to have included non-VOC emissions, such as oxygen, etc. The emissions presented in this table correspond to the detailed emissions calculations from the spreadsheet provided by Chemours and do not include oxygen, carbon dioxide, sulfuric acid, and sulfur dioxide (See Attachment B, Table B-2).
[b] From Table C1 of Permit Application No. 0900009.18B (See Attachment C).
[c] Emission factors for greenhouse gases obtained from 40 CFR 98 Subpart C. Global warming potential = 1 for CO_2, 25 for CH_4 and 298 for N_2O.
[d] H = Hazardous Air Pollutant, T = Toxic Air Pollutant
[e] From spreadsheet provided by Chemours (See Attachment B, Table B-3 for detailed calculations).

emissions generated by the destruction of sulfur containing compounds (as presented in Permit Application Form C9 for the scrubber); both of which are removed in the Scrubber (99.95 percent efficiency). For the purposes of this permit review, the maximum HF emissions were calculated assuming a maximum annual operation of 8,760 hours per year and 100 percent conversion to HF. As shown in Table 2, the potential HF emissions are estimated to be 2.15 tons per year (tpy) and potential SO_2 emissions are $8.29x10^{-3}$ tpy.

2. *Lime Processing System*

Chemours is also proposing to install a lime processing system to process the weak hydrofluoric acid collected from the underflow of the scrubber system. Aqueous 18 percent, by weight, HF acid from the Thermal Oxidizer/Scrubber system is introduced to a Crystallizer with a lime slurry, where calcium fluoride (CaF_2) crystals are formed. The CaF_2 is dried in the filter press and the solids are loaded into trucks for offsite disposal. The facility receives pebble or hydrated calcium oxide (CaO), or lime, which is stored in a lime silo prior to being mixed into a wet, calcium hydroxide lime slurry in the Lime Slaker which is then fed to the Crystallizer. The following summaries describe the Lime Processing System equipment Chemours is proposing to install.

- **Lime Silo with Bin Vent:** The Lime Silo is a storage silo for pebble or hydrated lime. The Lime Silo will be equipped with a jet pulse bagfilter.
- **Lime Slaker with Scrubber:** The Lime Slaker is a mixing vessel for pebble lime and water to form a lime slurry of calcium hydroxide and water. Fugitive dust from mixing the pebble lime and water will be controlled by a wet scrubber.
- **Crystallizer:** The lime slurry from the slaker is mixed with 18 percent by weight hydrofluoric acid in an agitated vessel, the Crystallizer, to form CaF_2 crystals. The Crystallizer is a closed vessel and does not generate air emissions.
- **Filter Feed Tank:** This tank is a batch hold-up tank for the CaF_2 slurry to be transferred to the filter press. Tank separates system from continuous operation to batch operation. This equipment does not generate air emissions.
- **Filter Press and Truck Loading:** The Filter Press separates CaF_2 solids from filtrate (water). Dried CaF_2 is then loaded as a solid into trucks for disposal offsite.
- **Filtrate Tank:** Collects filtrate from the Filter Press and allows for sampling of filtrate prior to disposal.

Table 3 presents the emissions from the Lime Processing System equipment. The equipment in the lime processing system are sources of particulate matter (PM). Chemours conservatively estimated that the PM less than 10 microns (PM_{10}) and PM less than 2.5 microns ($PM_{2.5}$) emissions are equal to total PM emissions. Lime Slaker emissions were calculated using a preliminary scrubber inlet rate provided by the vendor of 6.17 pounds per hour (lb/hr) and a vendor-guaranteed control efficiency of 99.7 percent. Example calculations were included in the permit application.[13] The PM emissions from the Lime Silo were based on a load factor provided by the baghouse vendor and maximum air flow rate through the bagfilter.

Table 3. Potential to Emit for Lime Processing System

	Maximum Potential to Emit (tpy)			
	PM_{10}		$PM_{2.5}$	
Process	**Uncontrolled**	**Controlled**	**Uncontrolled**	**Controlled**
Lime Silo	106	0.11	106	0.11
Lime Slaker	27.02	0.0811	27.02	0.0811

[13]The entire permit application is available online on the DEQ website at: https://files.nc.gov/ncdeq/GenX/Thermal-Oxidizer-Permit-Application-06292018.pdf

3. *Ancillary Equipment*

In addition to the equipment identified above Chemours is proposing to install the following ancillary equipment:

- **Cooling Tower**: The cooling tower will be used to remove heat from the recirculating acid produced in the Thermal Oxidizer. The heat removed is from the heat of combustion and heat of solution to absorb the HF produced from the destruction of fluorinated compounds into the aqueous HF acid. The cooling tower water will also be used to remove the heat of neutralization that occurs when reacting the aqueous HF with calcium hydroxide to produce CaF_2 in the Lime Processing System. The cooling tower will also be used to cool various air compressors including plant air compressors. The cooling tower will be designed with a circulation rate of 6,000 gallons per minute (gpm), expandable to 8,000 gpm. Chemours provided a detailed calculation for PM emissions from the cooling tower, based on the following information:
    - Cooling tower circulation rate = 6000 gallons per minute
    - Drift factor = 0.005 percent
    - Makeup water total dissolved solids = 200 parts per million (ppm)
    - Cycles of concentration = 6
    - Water density = 8.34 pounds per gallon.

  According to the provided calculation, maximum PM emissions from the cooling tower were estimated to be 0.79 tpy. Therefore, this source is an insignificant activity under 15A NCAC 02Q .0503(8).
- **Emergency Generator:** Chemours is also proposing to install a 320-horsepower (hp) Diesel-Fired Emergency Engine. Chemours stated that the engine will be designed to meet the “Tier 3” emission standards under 40 CFR 89.112(a). The emergency generator will be installed to provide backup power to the Thermal Oxidizer/Scrubber System. Emissions from the emergency generator are presented in Table 4. Potential emissions were calculated using 500 hours per year maximum operation. As shown in Table 4, the potential emissions for NO_X, CO, PM_{total}, VOC, and SO_2 are all less than 5 tpy and the HAP emissions are less than 1,000 lb/year. Therefore, the emergency generator is an insignificant source under 15A NCAC 02Q .0503(8).

E. <u>Additional Information Request/Permit Application Addendum</u>

On October 26, 2018, DAQ sent a letter asking Chemours to submit additional information necessary to memorialize the alternate operating conditions identified in their April 27, 2018, letter but not included in the original permit application (No. 0900009.18B). The letter is included in Attachment A. Specifically, DAQ instructed Chemours to amend their permit application to include the following information about the interim measures identified in Section III.C, above, that were going to be implemented at the facility and would be of a permanent nature:

- Carbon adsorption units’ systems:
    - A summary of each system and its operation, including how Chemours will handle regeneration and/or disposal of spent carbon;
    - All relevant application forms;
    - Revisions to the tables in the permit application incorporating emission reductions; and
    - Suggested permit conditions.
- Enhanced LDAR program:
    - An updated and detailed description of the program;
    - Any expected emission reductions associated with the enhanced program; and
    - Proposed permit conditions.
- A commitment to DAQ in a binding agreement that, once installed, the proposed alternative operating conditions would reduce emissions from current levels by 99 percent.

The addendum to Permit Application No. 0900009.18B was received by DAQ on November 9, 2018 to add the additional alternate operating conditions as requested by DAQ.

Table 4. Potential to Emit for Emergency Generator

Pollutant	Potential Emissions	
	lb/yr	**ton/yr**
Emissions based on Tier 3 Standards from 40 CFR 89.112		
NO_X	979	0.489
CO	917	0.459
PM_{total}	52.9	0.0265
PM_{10}[a]	52.9	0.0265
$PM_{2.5}$[a]	52.9	0.0265
VOC	79.4	0.0397
Emissions based on guidance from 40 CFR Part 98		
CO_2	122,053	61.0
Methane (CH_4)	0.473	2.37E-04
Nitrous Oxide (N_2O)	0.0473	2.37E-05
CO_{2e}[b]	122,079	61.0
Emissions from NC DAQ spreadsheet		
SO_2	3.03	1.52E-03
Total HAP[c]	4.49	2.24E-03
Acetaldehyde (H,T)	0.859	4.30E-04
Acrolein (H,T)	0.104	5.18E-05
Arsenic unlisted compounds (H,T)	4.48E-03	2.24E-06
Benzene (H,T)	1.04	5.22E-04
Benzo(a)pyrene (H,T)	2.11E-04	1.05E-07
Beryllium metal (unreacted) (H,T)	3.36E-03	1.68E-06
1,3-Butadiene (H,T)	0.0438	2.19E-05
Cadmium metal (elemental unreacted) (H,T)	3.36E-03	1.68E-06
Chromic Acid (VI) (H,T)	3.36E-03	1.68E-06
Formaldehyde (H,T)	1.32	6.61E-04
Lead unlisted compounds (H)	0.0101	5.04E-06
Manganese unlisted compounds (H,T)	6.72E-03	3.36E-06
Mercury vapor (H,T)	3.36E-03	1.68E-06
Napthalene (H)	0.0950	4.75E-05
Nickel metal (H,T)	3.36E-03	1.68E-06
Selenium compounds (H)	0.0168	8.40E-06
Total PAH (H)	0.188	9.41E-05
Toluene (H,T)	0.458	2.29E-04
Xylene (H,T)	0.319	1.60E-04

[a] PM_{10} and $PM_{2.5}$ assumed to be equal to the Tier 3 PM_{total} emission limit of 0.15 grams per horsepower-hour (g/hp-hr).
[b] Emissions calculating using global warming potential = 1 for CO_2, 25 for CH_4 and 298 for N_2O.
[c] Total HAP calculated as sum of compounds. Note that benzo(a)pyrene is a component of PAH emissions.
H = Hazardous Air Pollutant, T = Toxic Air Pollutant

F. Proposed Consent Order

On November 21, 2018, Chemours entered into a Proposed Consent Order under which Chemours agreed to permanently reduce annual air emissions of GenX Compounds by at least 99 percent from 2017 baseline levels (defined as 2,302.7 lb/yr) and control all PFAS, including GenX Compounds, from process streams routed to the Thermal Oxidizer/Scrubber System at an efficiency of 99.99 percent.

To incorporate the permanent emission reductions required by the Proposed Consent Order, DAQ is modifying the permit to include conditions as follows.

- For the Thermal Oxidizer/Scrubber System, the permit will include conditions requiring a 99.99 percent emission reduction of all PFAS, including GenX Compounds, and the necessary compliance requirements. The ancillary equipment described in Section D, above, will also be added to the permit.
- To ensure that the annual air emissions of GenX Compounds are reduced by at least 99 percent from the 2017 baseline of 2,302.7 lb/yr, Chemours will be required to:
  - comply with the conditions associated with the Thermal Oxidizer/Scrubber System,
  - operate and maintain the already installed carbon adsorbers to reduce GenX Compound emissions from the Polymers Processing Aid Process and Vinyl Ethers North Indoor equipment leaks; and
  - operate under an enhanced LDAR program.

IV. Permit Modifications

A. Summary of Changes to the Permit

Table 5 presents a summary of changes to the permit. These changes were also incorporated into the Title V Equipment Editor. See Section IV.B for a detailed discussion on changes to the permit under authority of 15A NCAC 02Q .0519.

B. Changes to Permit under Authority of 15A NCAC 02Q .0519

As discussed in Section III, above, Chemours has proposed alternate conditions under which they will operate to ensure that emissions of GenX will not cause or contribute to violations of the groundwater rules and has entered into a Proposed Consent Order under which they have committed to reducing GenX Compound emissions. Therefore, the permit will be modified to insert enforceable conditions corresponding to the proposed alternate operating conditions. The permit will be modified to include: (1) a condition requiring Chemours to install and operate the Thermal Oxidizer/Scrubber System to control all PFAS emissions, including GenX Compounds, and VOC emissions from the following sources: HFPO Process, VEN Process, VES Process, RSU Process, FPS Liquid Waste Stabilization Process, MMF Process, E-2 Process, TFE/CO2 Separation Process, HFPO Product Container Decontamination Process, VEN Product Decontamination Process, and VES Product Container Decontamination Process; (2) conditions for the Thermal Oxidizer/Scrubber System support equipment, including: lime slaker, lime silos, etc.; (3) a condition requiring a facility-wide GenX Compounds emission reduction to be achieved by complying with the Thermal Oxidizer/Scrubber System requirements, operating and maintaining the carbon adsorber systems, and implementing the enhanced LDAR program.

1. *Conditions Associated with the Thermal Oxidizer/Scrubber System*

According to their permit application, Chemours anticipates that the new equipment associated with the Thermal Oxidizer/Scrubber System will be fully operational by the end of 2019. Because the Thermal Oxidizer/Scrubber System will replace the existing scrubbers, the conditions associated with these existing control devices needed to be retained in the permit. Therefore, the conditions associated with the Thermal Oxidizer/Scrubber System will be included in the permit as an Alternative Operating Scenario (AOS), as allowed under 15A NCAC 02Q .0508(j) and the current permitted facility configuration will be identified as the Primary Operating Scenario (POS). The operating scenarios are defined as follows:

Table 5. Summary of Changes to Permit No. 03735T43

Old Page No.	New Page No.	Condition No.	Description of Change(s)
Cover letter	Cover letter	--	- Amended application type, permit revision numbers and dates.
Cover letter attachment	Cover letter attachment	Summary of changes to permit	- Updated with summary of changes to permit.
Cover letter attachment	Cover letter attachment	Insignificant activities list	- Added Cooling Tower (ID No. I-CT); and - Added Diesel-Fired Emergency Generator (ID No. I-RICE-04)
1	1	Permit Cover Page	- Updated permit revision number and permit issuance date
3 – 58	3 – 73	All	- Updated permit revision number in header; - Updated permit language to match permit shell.
3 – 4	3 – 4	Section 1.0	- Updated page numbers - Rearranged sources in the FPS/IXM Process Area to group those sources that will be controlled using similar control systems. - Renamed existing baffle plate scrubbers installed on FPS/IXM Process Area Sources as primary operating scenario (POS) - Added Thermal Oxidizer and 4-Stage Scrubber System as the control device under the alternative operating scenario for the FPS/IXM Process Area sources: HFPO Process, Vinyl Ethers North Process, Vinyl Ethers South Process, RSU Process, FPS Liquid Waste Stabilization Process, MMF Process, IXM Resins Process -except Fluorinator, E-2 Process, TFE/CO_2 Separation Process, HFPO Product Container Decontamination Process, VEN Product Decontamination Process, and VES Product Container Decontamination Process (ID Nos. NS-A, NS-B, NS-C, NS-D, NS-E, NS-F, NS-G-1, NS-K, NS-M, NS-N, NS-O, and NS-P) - Divided IXM Resins Process (ID No. NS-G) into two sources: NS-G-1 – IXM Resins Process (except Fluorinator) and NS-G-2 – IXM Resins Process Fluorinator; Changed reference to NS-G throughout the permit to incorporate this change. - Added sources from Lime Processing: Lime Silo (ID No. NS-R1) controlled by a bin vent baghouse (ID No. NCD-R1) and Lime Slaker (ID No. NS-R2) controlled by a wet particulate scrubber (ID No. NCD-R2) - Added VE-North Indoor Fugitives (NS-B-2) to be controlled by Carbon Adsorber (NCD-Q3). - Added Carbon Adsorber (ACD-2) as a control device to Polymers Processing Aid Process (AS-A)
21 – 35	21 – 39	Section 2.1 C	-Updated condition header to reflect the current facility configuration under the POS and the post-project configuration under the AOS. - Updated the summary of limits and conditions to include the GenX compounds. - Added Condition C.1 to define the AOS. Remaining conditions in Section 2.1 C were renumbered. - Added Condition C.3 for regulation 02D .0516, Sulfur Dioxide Emissions from Combustion Sources for the Thermal Oxidizer. - Added the outlet of the 4-State Scrubber (ID No. NCD-Q2) as an applicable source under regulation 02D .0521, Control of Visible Emissions. - Modified Conditions C.5, C.6, C.7 to add the POS and AOS to incorporate the Thermal Oxidizer. - Modified the POS calculation in Condition C.5 to correct the scrubber control efficiency from 99.6 percent to 99.1 percent. - Modified Condition C.6 and C.10 to change the affected sources from NS-G to NS-G-1 and G-2 to reflect the change in designation for this source. - Revised the equation in Condition C.7.c.iii to specify the 99.1 percent removal efficiency of the scrubber; - Reworded Condition C.7.c.iv to remove the scrubber phrase from the text in this condition. Added POS to account for the acid fluoride VOC removal

Table 5. Summary of Changes to Permit No. 03735T43

Old Page No.	New Page No.	Condition No.	Description of Change(s)
			efficiency of 99.1 percent and AOS to account for the 99.99 percent control efficiency of the thermal oxidizer/scrubber system. - Revised the VOC emission calculation in Condition C.8 to allow for the 99.99 percent VOC control efficiency of the Thermal Oxidizer. - Added Condition C.11 to include regulation 02Q .0519: Termination, Modification, Revocation of Permits. This condition addresses the compliance requirements for the Thermal Oxidizer and the 4-Stage Caustic Scrubber.
36	40	Section 2.1 D	- Updated the summary of limits and standards table to include GenX Compounds
N/A	45 – 47	Section 2.1 G	- Added Condition for the regulatory requirements associated with the Lime Silo (ID No. NS-R) and Lime Slaker (ID No. NS-R2).
45 – 46	52 – 53	Section 2.2 B.2	- Updated table of emission limits for HF to account for the Thermal Oxidizer.
N/A	55	Section 2.2 C.2	- Added a condition requiring the Permittee to submit a permit application for the second step of the significant modification within 1 year of normal operation.
N/A	56	Section 2.2 D	- Added a condition requiring the Permittee to comply with a GenX emissions limitation corresponding to the Consent Order.
49 – 58	64 – 72	Section 3.0	- Replaced General Conditions, version 4.0 (12/17/15) with version 5.3 (08/21/2018)

- Primary Operating Scenario:
  - The HFPO, Vinyl Ethers North, Vinyl Ethers South, RSU, FPS Liquid Waste Stabilization, and MMF Processes controlled by one of two baffle-plate scrubbers;The TFE-CO2 Separation, HFPO Container Decontamination, VEN Container Decontamination, and VES Container Decontamination Processes are routed to but not controlled by the baffle plate scrubbers; and
  - The IXM Resins Process – except Fluorinator and E-2 Process are uncontrolled.
- Alternative Operating Scenario: The HFPO Process, Vinyl Ethers North Process, Vinyl Ethers South Process, RSU Process, FPS Liquid Waste Stabilization Process, MMF Process, IXM Resins Process - except Fluorinator, E-2 Process, TFE/CO_2 Separation Process, HFPO Product Container Decontamination Process, VEN Product Decontamination Process, and VES Product Container Decontamination Process are controlled by the Thermal Oxidizer in series with the 4-Stage Scrubber.
- Under both the POS and AOS:
  - the IXM Resins Process – Fluorinator is controlled by a venturi vacuum jet caustic scrubber;
  - the IXM Membrane Process, IXM Membrane Coating, Semiworks Polymerization Operation, and Semiworks Laboratory Hood are uncontrolled.

The permit requires Chemours to notify DAQ within 10 days of switching to the AOS. By establishing the AOS and POS, once the Thermal Oxidizer/Scrubber System is operational, Chemours will be able to permanently switch to the AOS without needing to modify the permit, but will also allow some operational flexibility while transitioning from the use of the scrubbers to the Thermal Oxidizer/Scrubber System. This permit modification is being processed as the first step of a two-step significant permit modification under 15A NCAC 02Q .0501(b)(2). The second step will be required within 12 months of normal operation of the new equipment being installed. When the second step permit application is processed, the POS will be dropped and the AOS will remain in the permit as the permit condition under which Chemours will operate.

Chemours will be required to demonstrate compliance with a 99.99-percent reduction of all PFAS emissions, including GenX Compounds, routed to the Thermal Oxidizer/Scrubber System. Compliance will be demonstrated by performance testing to confirm the emission reductions and to establish continuous parameter monitoring system operating conditions under which the Thermal Oxidizer and Scrubber will be operated. Specifically, Chemours will be required to install the following continuous monitoring systems (CMS) to ensure the specified operational parameters are maintained:

- A temperature monitoring system to continuously record the Thermal Oxidizer combustion chamber temperature to ensure a minimum combustion chamber temperature of 1800 degrees Fahrenheit (^{O}F) on a 3-hour rolling average basis.
- A flow meter to continuously record the waste gas feed rate to the Thermal Oxidizer to ensure a maximum process vent gas feed rate of 2,200 lb/hr on a 3-hour rolling average basis.
- A flow meter to continuously record the liquor flow rate in the Scrubber to ensure a minimum scrubber liquor flow rate of 40 gallons per minute (instantaneous).
- A pH monitor to continuously record the pH of the Scrubber liquor to ensure a minimum scrubber liquor pH of 7.1 on a 3-hour rolling average basis.

The permit will state that the Thermal Oxidizer/Scrubber system will be required to be operating at all times that the processes are running. Therefore, Chemours will also be required to develop a Shutdown and Malfunction Plan (Plan) for the Thermal Oxidizer/Scrubber System. The permit will require Chemours to prepare and operate under an approved plan with specific procedures for operating the emissions sources routed to the Thermal Oxidizer/Scrubber System during periods of control device shutdown and malfunction. The Plan will specify corrective actions for malfunctioning processing and control systems. Chemours will also be required to keep records of all monitoring data, emissions calculations, inspections, and any process downtime. Quarterly summary reports will be required to be submitted to provide a summary of monitoring and recordkeeping activities during the reporting period.

2. *Conditions Required to Ensure Permanent Reduction of GenX Compound Emissions by 99 Percent*

A condition will also be added to the permit to require Chemours to reduce GenX Compounds to no more than 23.027 lb/yr, which was based on an emission reduction of 99 percent from the 2017 baseline of 2,302.7 lb/year. To demonstrate compliance with this limit, Chemours will be required to:

- calculate annual emissions on a monthly basis for the previous 12 months.
- comply with the Thermal Oxdizer/Scrubber System conditions (see Section IV.B.1, above).
- operate and maintain carbon adsorbers to reduce GenX Compound emissions from the Polymers Processing Aid Process and Vinyl Ethers North Indoor Fugitives.
  - Compliance will be demonstrated by conducting testing on a quarterly basis to establish a carbon replacement schedule. The replacement schedule can be based on hours of operation, production rate, or other approved parameter. Once the replacement schedule is established, Chemours will be required to conduct annual testing to demonstrate that the carbon adsorber is continuing to reduce emissions to the level necessary to achieve the facility-wide emission reduction.
  - A shutdown/malfunction plan will be required under which the PPA and Vinyl Ethers North Indoor Fugitives Carbon Adsorbers will operate. The systems will be equipped with differential pressure monitors that will trigger an alarm that will indicate if the carbon adsorber is not operating properly and will initiate the shutdown of the process. The emissions from these processes will not be allowed to be vented to the atmosphere without being controlled in the carbon adsorbers.
  - Chemours will be required to demonstrate continuous compliance by performing inspections, operating under a shutdown/malfunction plan, keeping the specified records, and submitting the required reports.
- develop and submit to DAQ an enhanced LDAR program which will be required to address the following elements in the LDAR program:
  - Pressure testing;
  - Enhanced audial, visual, and olfactory (AVO) inspections;
  - Routine Method 21 instrument monitoring;
  - Enhanced area monitoring; and
  - Replacement or improvement program for valves and connectors.

Chemours will be required to demonstrate initial compliance with the 23.027 lb/yr emission limit by submitting a report to DAQ by February 28, 2021 for the 12-month period beginning December 31, 2019. This date was chosen to align with the requirement in the Proposed Consent Order. Chemours will be required to quantify emissions for process vents, fugitives, maintenance and accidental emissions. Once the initial compliance report is submitted, Chemours will demonstrate continuous compliance by submitting quarterly reports scheduled to align with other reports they’re required to submit in the permit.

V. Regulatory Review – State Rules

The new process operations being installed as a part of this permitting action were evaluated for applicability to State Rules under 15A NCAC 02D and 02Q to determine whether any existing conditions needed to be modified or if new conditions needed to be added to the permit. The following discussion addresses the State Rules as they apply to the Thermal Oxidizer/Scrubber System, Lime Processing System, Ancillary Equipment, and Equipment Leak Components.

A. <u>15A NCAC 02D .0515: Particulates from Miscellaneous Industrial Processes</u>

This rule applies to stacks, vents, or outlets emitting particulates from industrial processes with no other applicable standards. Of the new sources being installed as a part of this project, the Lime Silo and the Lime Slaker are potential sources of particulate matter. The allowable emission rate is in terms of pounds per hour and is calculated using the following equation:

For process rates up to 30 tons per hour:
$E = 4.10(P)^{0.67}$

For process rates greater than 30 tons per hour:
$E = 55.0(P)^{0.11} - 40$

Where: E = Allowable emission rate in pounds per hour
P = Process weight in tons per hour

According to the permit application, the maximum process weights will be 1,072 lb/hr (or 0.536 ton/hr) for the Lime Slaker and 17 ton/hr for the Lime Silo. Therefore, the first equation will apply to both sources. The allowable PM emissions for the Lime Slaker will be 2.70 lb/hr, and allowable PM emissions for the Lime Silo will be 27.4 lb/hr.

Particulate emissions from the Lime Slaker are controlled using wet particulate scrubber. Chemours has provided an estimate that potential PM emissions from the Slaker will be 0.019 lb/hr. Compliance will be demonstrated by monitoring the scrubbing liquid flow rate. The permit will require the slaker scrubber to be equipped with a flowmeter and compliance will be demonstrated by maintaining the scrubbing liquid flowrate above the operating parameter set during performance tests.

Particulate emissions from the Lime Silo will be controlled using a bagfilter. Chemours has estimated that potential PM emissions from the Lime Silo will be 0.11 lb/hr. Compliance will be demonstrated by performing inspections and maintenance, including monthly visual inspection of the ductwork and filters and annual internal inspections to assess the structural integrity of the baghouse.

Based on the large margin between potential PM emissions and the allowable PM emissions, compliance with this regulation is expected.

B. <u>15A NCAC 02D .0516: Sulfur Dioxide Emissions from Combustion Sources</u>

This regulation applies to any source of combustion that emits sulfur dioxide, which is formed by the combustion of sulfur in fuels, wastes, ores, and other substances. The rule states that sulfur dioxide "…formed or reduced as a result of treating flue gases with sulfur trioxide or other materials shall also be accounted for when determining compliance with this standard." Sources subject to this standard have an emission limit of 2.3 pounds of sulfur dioxide per million Btu (lb/million Btu) heat input.

There are two combustion sources being installed as a part of this project: the natural gas-fired Thermal Oxidizer and the Emergency Diesel Engine. The diesel engine is an insignificant activity and the permit will not include conditions for this source.

The Thermal Oxidizer uses natural gas to oxidize emissions from the sources identified above. Although natural gas has an inherently low sulfur content, the sources being vented to the oxidizer include sulfur containing compounds from the Rearranged Sultone (RSU) Process. According to the permit application (see Form C9 for the Thermal Converter Flue Gas Scrubber), Chemours estimated that the sulfur dioxide emissions prior to the scrubber would be 3.8 lb/hr. This was calculated based on the maximum rate of emissions of sulfur containing fluorinated compounds to the Thermal Oxidizer at 100 percent destruction and conversion to sulfur dioxide. Using a maximum natural gas combustion rate of 10 million Btu/hr, the sulfur dioxide emissions correlate to an uncontrolled emissions of 0.379 lb/million Btu. Assuming a scrubber control efficiency of 99.95 percent, the outlet emissions are estimated to be approximately $1.90x10^{-4}$ lb/million Btu sulfur dioxide. The permit will include a 02D .0516 condition to address the Thermal Oxidizer/Scrubber system. Due to the large margin of compliance between the maximum potential to emit and the emission limit, no monitoring, recordkeeping, and reporting will be required under 02D .0516.

C. 15A NCAC 02D .0521: Control of Visible Emissions

This regulation applies to fuel burning operations and industrial processes where visible emissions can be reasonably expected to occur. Sources manufactured after July 1, 1971, have a visible emissions limit of 20 percent opacity when averaged over a 6-minute period. The 6-minute averaging periods may exceed 20 percent if no 6-min periods exceed 87 percent opacity, no more than one six-minute period exceeds 20 percent opacity in one hour, and no more than four 6-minute periods exceed 20 percent in any 24-hour period.

Chemours is proposing to install two fuel burning operations as a part of this project: the Thermal Oxidizer and the Emergency Diesel Engine. As previously stated, the engine is an insignificant activity and will not be addressed in the permit. The Thermal Oxidizer burns natural gas a fuel and is a control device being installed to control several sources of VOC (which includes PFAS) emissions: HFPO Process, VEN Process, VES Process, RSU Process, Liquid Waste Stabilization Process, MMF Process, IXM Resins Process, E-2 Process, TFE/CO2 Separation Process, HFPO Product Container Decontamination Process, VEN Product Decontamination Process, and VES Product Container Decontamination Process. These sources are not reasonably expected to generate visible emissions and are therefore are not subject to 02D .0521. The natural gas combustion in the Thermal Oxidizer does have the potential to generate visible emissions and is routed to the 4-Stage Scrubber. Visible emissions would be measured at the scrubber outlet and the scrubber will be added as a source to the 02D .0521 condition associated with this process area in Section 2.1 C.3. Since visible emissions from natural gas combustion are inherently low, no monitoring, recordkeeping, and reporting will be required to demonstrate compliance with the visible emissions standards.

Additionally, two sources being installed as a part of this project, the Lime Silo and the Lime Slaker, are potential sources of visible emissions. The Lime Slaker and Lime Silo are both subject to the 20-percent opacity limit under 02D .0521. These sources will be subject to weekly visible emissions monitoring. Chemours will be required to maintain records of each visible emissions monitoring observation and submit semiannual summary reports. Due to the low PM emissions from these sources, compliance with 02D .0521 is expected.

D. 15A NCAC 02D .0524: New Source Performance Standards

The proposed project has one source potentially subject to NSPS under 40 CFR part 60. The Emergency Diesel Engine, which will be subject to Subpart IIII, the NSPS for Stationary Compression Ignition Internal Combustion Engines. See section VI for further discussion regarding the NSPS.

E. 15A NCAC 02D .0530: Prevention of Significant Deterioration

Chemours is a major source with respect to prevention of significant deterioration (PSD), and modifications at the facility are required to be analyzed to determine whether they result in significant increases in emissions over the PSD significant emissions rate (SER) thresholds. See Section VI.C, below, for a detailed discussion on the PSD analysis as it relates to this project.

Additionally, Chemours has conditions in their permit to avoid 15A NCAC 02D .0530, Prevention of Significant Deterioration (PSD) by limiting VOC emissions from the VEN Process, the IXM Resins Process, the HFPO process; and the HFPO product container decontamination process per consecutive 12-month period. Changes to these conditions will also be discussed further in Section VI.C, below.

F. 15A NCAC 02D .1111: Maximum Achievable Control Technology (MACT)

The proposed project has the potential to impact two MACT standards under 40 CFR Part 63:

- National Emission Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines [40 CFR Part 63, Subpart ZZZZ]. The Emergency Generator is subject to the provisions in Subpart ZZZZ; and

- NESHAP for Miscellaneous Organic Chemical Manufacturing (MON), 40 CFR Part 63, Subpart FFFF. Chemours operates four processes that are defined as miscellaneous organic chemical manufacturing process units (MCPU) under Subpart FFFF.

See Section VI.B, below for a detailed discussion on these rules.

G. 15A NCAC 02D .1806: Control and Prohibition of Odorous Emissions

Under this regulation, facilities are required to implement management practices or install odor control equipment to prevent odors from the facility from crossing the facility's boundaries and resulting in objectionable odors outside the facility. This condition is applicable facility wide. Chemours has installed odor controls in the wastewater treatment area and is required to conduct inspections and perform maintenance to ensure compliance. The sources being installed as a part of this project will not impact the existing odor controls at the facility. No changes to the facility wide condition will be necessary as a result of this project.

H. 15A NCAC 02Q .0700: Toxic Air Pollutant Procedures and 02D .1100: Control of Toxic Air Pollutants

Prior to this permit application, Chemours triggered a toxics review for over 100 toxic air pollutants. The current Chemours permit (T43) contains allowable emission limits for 103 toxic air pollutants. See Section VII for further discussion regarding air toxics.

VI. Regulatory Review - Federal Rules (NSPS, NESHAP/MACT, NSR/PSD)

A. New Source Performance Standards

Of the equipment being installed as a part of this project, only one source is potentially subject to NSPS. Chemours is proposing to install a 320 hp diesel-powered, compression ignition (CI), emergency generator, which will be subject to 40 CFR Part 60, Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (Subpart IIII). This NSPS applies to new stationary compression ignition internal combustion engines (ICE), defined as ICE that commenced construction after July 11, 2005, but were manufactured after April 1, 2006.

Under Subpart IIII, the engine is required to meet the emission standards under 40 CFR 89.112 [40 CFR 60.4025(b) and 60.4022(a)(2)]. According to the permit application, Chemours is planning to install a 320-hp/200 kilowatt (kW) diesel fired generator. The emission standards in Table 1 of 40 CFR 89.112 corresponding to a post-2006 model year generator of this size are as follows:

- CO = 3.5 grams per kilowatt-hour (g/kW-hr);
- Nonmethane hydrocarbons (NMHC) and NOX = 4.0 g/kW-hr; and
- PM = 0.20 g/kW-hr.

As shown in Table 4, above, the potential emissions for the 320-bhp emergency engine being installed at the Chemours facility were calculated based on 500 hours per year and no pollutants will be emitted greater than 5 tpy or 1,000 lb/yr for HAP.[14] Therefore, this new emergency generator is an insignificant activity as defined under 02D .0503(8) and will be added to the insignificant activities table as an attachment to the permit. Although the emergency generator will have to comply with Subpart IIII, it will not be included as a condition in the permit.

B. National Emission Standards for Hazardous Air Pollutants/Maximum Acheivable Control Technology

There are two NESHAP under 40 CFR Part 63 that potentially apply to the equipment being installed as a part of this project: Subpart ZZZZ (Reciprocating Internal Combustion Engine MACT) and Subpart FFFF (Miscellaneous Organic Chemicals NESHAP). The following is a summary of the applicability of these regulations.

[14] It should be noted that the text of the original permit application indicates that annual PTE was based on 100 hours per year of operation. However, the calculations provided were based on 500 hours per year. The 500-hr/yr estimates correspond to DAQ guidance on calculating PTE for emergency engines.

Reciprocating Internal Combustion Engine (RICE) MACT, Subpart ZZZZ

The Emergency Generator meets the definition of a stationary reciprocating internal combustion engine (RICE) and is subject to the NESHAP for Stationary RICE under 40 CFR Part 63, Subpart ZZZZ. However, as discussed above, the Emergency Generator is subject to NSPS Subpart IIII and according to Subpart ZZZZ [40 CFR 63.6590(c)], a CI stationary RICE with a site rating less than or equal to 500 hp must meet the requirements of Part 63 by meeting the requirements of 40 CFR Part 60, Subpart IIII. No further requirements apply for such engines under Part 63. As stated above, this Emergency Generator is an insignificant activity and will not be included in the permit.

Miscellaneous Organic Chemicals NESHAP (MON), Subpart FFFF

The MON applies to each miscellaneous organic chemical manufacturing process unit (MCPU) that produces material or family of materials of organic chemicals classified using specific SIC codes, including SIC code 282 for Plastics Materials and Synthetic Resins. Chemours has four processes that are considered MCPU under Subpart FFFF: (1) the HFPO manufacturing process; (2) the VEN process; (3) the VES process; and (4) the IXM Resins process. Generally, the MON has requirements for Group 1 and 2 process vents, Group 1 storage tanks, transfer racks, equipment leaks, and Group 1 and 2 wastewater streams. The MCPU at Chemours do not include Group 1 or Group 2 process vents. Similarly, all of the MACT-affected storage tanks at Chemours are Group 2 storage tanks. The Chemours facility does not have any transfer racks. The current permit (T43) includes MACT requirements for the following within each MCPU: Equipment Leaks; Group 2 Wastewater; and Heat Exchange Systems.

With this project, Chemours is not proposing to install any new equipment that would be subject to the MON. The Thermal Oxidizer is being installed to control VOC and PFAS emissions from process vents located within the four MCPU but it is not being installed to comply with Subpart FFFF. The existing scrubbers were not installed for MACT compliance and therefore, replacing these scrubbers with the Thermal Oxidizer does not impact any of the requirements in the permit. Finally, the enhanced LDAR program that Chemours will operate under is not being incorporated into the permit to comply with the MON. None of the MON requirements will be changed as a part of this enhanced program and, therefore, no changes to the MON conditions are needed. As a result, no changes to the Subpart FFFF requirements in the permit are necessary as a part of this permitting action.

C. New Source Review/Prevention of Significant Deterioration

Chemours is located in Bladen County, which is designated as an attainment/unclassifiable area for all pollutants regulated by the NSR permitting program. The PSD regulations apply to new major stationary sources or existing major sources that propose a major modification. Chemical manufacturing is listed as one of the 28 source categories under federal PSD regulation as being subject to regulation with potential emissions greater than 100 tpy of any PSD-regulated pollutant. Chemours emits more than 100 tpy of VOC, and as such, Chemours is a major source under PSD.

Project Netting Analysis

A project is considered a major modification if there is a physical change in or a change in the method of operation of a major stationary source that would result in both a significant emissions increase and a significant net emissions increase. In order to determine whether a project results in a significant net increase, the NC regulations under 15A NCAC 02D .0530 allow for project netting. Under project netting, emission increases and decreases from all emission units at the facility that are defined as the project are used and compared to the significant emission rates.

The new sources being installed as a part of this project emit the following PSD pollutants: VOC, NO_X, CO, SO_2, PM_{10}, $PM_{2.5}$, and CO_2e. It should be noted that fluorinated hydrocarbon compounds and hydrogen fluoride have been determined not to be considered PSD pollutants.[15] The emissions from the Thermal Oxidizer/Scrubber System include the VOC emissions from the process as well as emissions associated with the combustion of natural gas (See Table 2). For all of the new equipment being installed, the project netting compares actual emissions to potential to emit to determine whether the increase in emissions is greater than the SER. Table 6 presents the project netting analysis for the all of the equipment in the Thermal Oxidizer/Scrubber and Lime Handling Systems, as well as the Ancillary Equipment.

As previously discussed, this project includes the replacement of the VEN and VES scrubbers installed on existing sources with a thermal oxidizer that will achieve a VOC emission reduction of 99.99 percent. This is a higher removal efficiency than the VEN and VES scrubbers, which remove VOC emissions with a control efficiency of 99.1 and 99.8 percent, respectively. Additionally, the carbon adsorbers installed on the PPA Process and from VEN Indoor Fugitives will reduce VOC emissions. To be conservative, by not calculating the impact of control device replacement on the existing sources, Chemours did not take any credit for the reduction of VOC emissions expected to be realized by using the Thermal Oxidizer/Scrubber System and the carbon adsorbers. Therefore, only project increases were calculated to determine whether a PSD analysis was required. As shown in Table 6, there are no pollutants for which the project emission increases exceed the PSD SER. By comparing potential to emit to the PSD SER and demonstrating that the project increases are well below these thresholds, it can be determined that this project is not considered a significant modification under PSD and no permit conditions are necessary.

Existing PSD Avoidance Permit Conditions

The current permit (T43) has conditions to avoid PSD by limiting VOC emissions from the VEN Process, the IXM Resins Process, the HFPO process, and the HFPO product container decontamination process per consecutive 12-month period. The following discussion addresses each of these conditions and the changes to the permit that will result from this project.

1. *PSD Avoidance for Vinyl Ethers North Process*

The VEN process has a VOC emissions limit of 68.9 tpy per 12-month consecutive period that was included in their permit to avoid PSD applicability. To demonstrate compliance with this limitation, within 30 days of the end of each calendar month, Chemours is required to calculate VOC emissions for the previous calendar month as follows:

- Calculate process vent mass flow rate of non-acid fluoride VOC (Q_{nAF}) and acid fluoride VOC (Q_{AF})
- Calcuate the VOC emissions (E_V) from the process vents using the following equation:

$$E_V = Q_{nAF} + 0.004(Q_{AF})$$

Where:	E_V	=	VOC Emissions from VEN process vents (lb/month);
	Q_{nAF}	=	Process vent mass flow rate of non-acid fluoride VOC (lb/month);
	Q_{AF}	=	Process vent mass flow rate of acid fluoride VOC (lb/month);
	0.004	=	1 – the emission control efficiency of the scrubber/100

- Calculate solvent VOC emissions (E_S) using a mass balance of solvent mass used and solvent mass waste generation as follows:

$$E_S = M - W$$

[15] Letter from van der Vaart, D., NC DENR, Chief, Permits Section, to M. Johnson, DuPont Fluoroproducts, Environmental Engineer. July 17, 2008. Determination that HF is excluded from the "fluorides" category and that the category only means elemental fluorine and inorganic fluorine-containing compounds. Available online at https://files.nc.gov/ncdeq/Air%20Quality/permits/psd/docs/NSR_Fluorides.pdf.

Table 6. Emission Increases Associated with the Thermal Oxidizer/Scrubber System Project

Source	VOC	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Baseline Actual Emissions							
Lime Silo	*Baseline Actual Emissions for these sources were not calculated*[a]						
Lime Slaker							
Thermal Oxidizer/Scrubber							
Emergency Generator							
Cooling Tower							
Potential Emissions							
Lime Silo					0.75	0.75	
Lime Slaker					0.081	0.081	
Thermal Oxidizer/Scrubber[b]	0.79	4.27	3.59	0.04	0.32	0.32	15,136
Emergency Generator	0.040	0.49	0.46	0.0015	0.026	0.026	61
Cooling Tower					0.79	0.79	
Total Project Emission Increase	**0.83**	**4.8**	**4.1**	**0.042**	**1.97**	**1.97**	**15,197**
PSD Significant Emission Rate (SER)	40	40	100	40	15	10	75,000
Increase Greater than SER?	**No**	**No**	**No**	**No**	**No**	**No**	**No**

[a]Chemours did not estimate baseline actual emissions for these sources. For the new sources, baseline emissions are zero. For existing sources, baseline emissions are higher than the potential to emit because Chemours is replacing an existing control device with one that achieves a higher emission reduction. By not including baseline actual emissions in the netting analysis, Chemours is not taking credit for emission reductions in VOC emissions due to the replacement of the scrubbers with the Thermal Oxidizer/Scrubber System. The large margin between the emission increases and the SER calculated without subtracting baseline actuals, illustrates that this project is not a significant modification under PSD.
[b]Includes VOC emissions from the combustion of process vent emissions (0.550 tpy) and VOC emissions from natural gas combustion (0.24 tpy). See Table 2, above.

Where: E_S = VOC Emissions from VEN solvent (lb/month);
M = Total solvents used (lb/month)
W = Total solvent waste generation (lb/month)

- Calculate the VOC emissions from maintenance activities (E_M), in lb/month;
- Calculate fugitive VOC emissions (E_F) using accepted practices, in lb/month;
- Record VOC emission from accidental releases (E_A), in lb/month; and
- Calculate total process VOC emissions (E) using the following equation:
  $E = (E_V + E_S + E_M + E_F + E_A)/\left(2{,}000\, {}^{lb}/_{ton}\right)$
- Calculate the 12-month rolling VOC emissions from VEN by summing monthly VOC emissions (E) for the previous consecutive 12 months.

The equation to calculate the VOC emissions from the VEN process vents (E_V) takes into account a 99.6 percent scrubber control efficiency (i.e., the 0.004 term in the equation). Therefore, since the Thermal Oxidizer is replacing the existing scrubber, the equation for E_V needs to be modified to take into account the thermal oxidizer emission reduction. The permit was modified to add equations associated with the POS and AOS conditions for calculating VEN process vents (E_V). The equation for E_V under the AOS will take into account the thermal oxidizer/scrubber system control of both non-acid fluoride and acid fluoride VOC as follows:

$$E_V = 0.0001 \times (Q_{nAF} + Q_{AF})$$

According to Chemours, the scrubber control efficiency in the POS equation should have been associated with 99.1 percent, rather than 99.6 percent. Therefore, at the request of Chemours, the POS equation was also modified to correct the scrubber control efficiency (i.e., replacing 0.004 with 0.009).

$$E_V = Q_{nAF} + 0.009 \times Q_{AF}$$

The other equations for E_S, E_M, E_F, and E_A, above, will remain as they are in the permit and no other changes will be made to this condition.

2. *PSD Avoidance for IXM Resins Process*

The IXM Resins Process has a VOC emissions limit of 40 tpy per 12-month consecutive period that was included in their permit to avoid PSD applicability. To demonstrate compliance with this limitation, within 30 days of the end of each calendar month, Chemours is required to calculate VOC emissions for the previous calendar month as follows:

- Record the total raw materials fed (M) to the affected facility during the previous calendar month (in kg/month);
- Record the total transformed materials collected (P) for the affected facility during the previous calendar month (in kg/month);
- Record the total untransformed materials collected (W) for the affected facility during the previous calendar month (in kg/month);
- Determine the VOC emissions from the filling of storage tanks (S) for the affected facility during the previous calendar month (in kg/month);
- Calculate the VOC emissions (E) from the affected facility during the previous calendar month (in ton/month) using the following equation:
  $$E = (M - P - W + S) * \left(2.2\, {}^{lb}/_{kg}\right) / \left(2{,}000\, {}^{lb}/_{ton}\right)$$
- Calculate the 12-month rolling VOC emissions from the affected facility by summing the monthly VOC emissions (E) for the previous consecutive 12-months.

The existing IXM Resins Process does not use a control device to reduce VOC emissions. The primary purpose of the existing caustic scrubber in the IXM Resins Process is to neutralize unreacted fluorine exiting the Fluorinator and a secondary purpose is to neutralize HF that is liberated during the fluorination process. As a part of this project, most of the process vents from the IXM Resins Process will be routed through the Thermal Oxidizer. The

Fluorinator will continue to be controlled with the caustic scrubber and due to the HF being emitted, this source will not be vented to the oxidizer. Therefore, the permit will therefore be modified to incorporate the Thermal Oxidizer/Scrubber System emission reduction by changing the equation for E to reduce the VOC emissions by 99.99 percent. The POS will use the equation for E in the current permit. The new AOS equation will be as follows:

$$E = (1 - 0.9999) * (M - P - W + S) * \left(2.2\ ^{lb}/_{kg}\right) / \left(2{,}000\ ^{lb}/_{ton}\right)$$

3. *PSD Avoidance for HFPO Process*

The current permit includes a VOC emissions limit of 85.3 tons of VOC per 12-month consecutive period from the HFPO process. To demonstrate compliance with this limit, Chemours is required to calculate VOC emissions from the process each calendar month, as follows:

- Record the total raw material HFP consumed (M_{HFP});
- Record the average vent flow rate and composition from the AF Column (Q_{AC}) and Stripper Column (Q_{SC});
- Using a combination of ratios of vent rates (Q_{AC} and Q_{SC}) to HFP consumption (M_{HFP}), determine the process VOC emissions (E_P, in lb/month) from the AF column (E_{AC}), stripper column (E_{SC}), solvent recycle tank (E_{SRT}), solvent reclamation converters (E_{SRC}), and routine decontamination of HFP unloading system (E_{DC}) through the baffle plate scrubber as follows:
  $E_P = (E_{AC} + E_{SC} + E_{SRT} + E_{SRC} + E_{DC})$;
- Calculate the VOC emissions (in lb/month) from maintenance activity (E_M) based on vessel volumes and vapor density for each occurrence of this activity;
- Calculate the VOC emissions (in lb/month) from fugitive emissions (E_F) using accepted practices during the previous calendar month;
- Record VOC emissions (in lb/month) from any accidental releases (E_A) during the previous calendar month;
- Calculate the VOC emissions (E) during the previous calendar month (in ton/month) using the following equation:
  $E = (E_P + E_M + E_F + E_A) / \left(2{,}000\ ^{lb}/_{ton}\right)$; and
- Calculate the 12-month rolling VOC emissions from the HFPO process by summing monthly VOC emissions (E) for the previous consecutive 12 months.

The HFPO process vent emissions (E_P) are currently vented through the scrubber. The scrubber does not remove non-acid fluoride VOC emissions. Although the equations above do not specify a control device efficiency, it was assumed that the calculation of E_P incorporated a removal of acid fluoride VOCs. To incorporate the emission reductions associated with routing the HFPO process vent emissions to the oxidizer, the permit will be modified to specify that process vent emission (E_P) should take into account the POS (whereby these sources are routed through the scrubber with a control efficiency of 99.1 percent) and the AOS (whereby these sources are routed through the thermal oxidizer with a control efficiency of 99.99 percent).

4. *PSD Avoidance for HFPO Product Decontamination Process*

The current permit includes a VOC emissions limit of 40.0 tons per consecutive 12-month period from the HFPO Container Decontamination Process.

- Create a record of each container received at the facility including:
  - The date the container was decontaminated; and,
  - The total mass of VOC released from the container (in lb).
- Calculate the VOC emissions from the process during the previous calendar month (in lb/month) by summing the quantity of VOC released from each container decontaminated during the previous calendar month; and
- Calculate the VOC emissions from the process during the previous consecutive 12-month period (in tons/12-months) by summing the quantity of VOC released for the previous twelve (12) calendar months.

The only compound emitted from this process is HFPO, which is a non-acid fluoride VOC. Therefore, although this process is vented through the existing VEN Scrubber, the scrubber does not reduce the HFPO emissions and the current permit does not include emission reductions. The HFPO Product Decontamination Process will be vented through the Thermal Oxidizer/Scrubber System. To account for the emission reductions associated with the oxidizer, the permit will be modified to specify that, under the AOS, the VOC emissions from the process should be calculated by taking into account the Thermal Oxidizer control efficiency (99.99 percent).

D. Compliance Assurance Monitoring

The compliance assurance monitoring (CAM) rule requires owners and operators to conduct monitoring to provide a reasonable assurance of compliance with applicable requirements under the Clean Air Act. Monitoring focuses on emissions units that rely on pollution control device equipment to achieve compliance with applicable standards. An emission unit is subject to CAM, under 40 CFR Part 64, if all of the following three conditions are met:

- The unit is subject to any (non-exempt, e.g., pre-November 15, 1990, Section 111 or 112 standard) emission limitation or standard for the applicable regulated pollutant.
- The unit uses any control device to achieve compliance with any such emission limitation or standard.
- The unit's pre-control potential emission rate exceeds 100 percent of the amount required for a source to be classified as a major source; i.e., either 100 tpy (for criteria pollutants) or 10 tpy of any individual/25 tpy of any combination of HAP.

The sources being installed as a part of this project for which a control device is being used to comply with an emission limitation or standard are the Lime Slaker and Lime Silo. The Lime Slaker and Lime Silo are subject to an emission limitation for particulate matter 02D .0515. The Lime Slaker uses a scrubber to comply with this standard and the Lime Silo uses a bagfilter. As shown in Table 3, the pre-controlled potential PM emissions from the Lime Slaker are less than 30 tpy, which is less than the 100-tpy major source threshold. Therefore, information no CAM review is required for the Lime Slaker.

Under CAM, owners of large pollutant-specific units (i.e., sources with the potential to emit, considering control devices, greater than or equal to the amount required for a source to be classified as a major source under Part 70[16]) are required to submit information under CAM as part of an application for a significant Title V permit revision [40 CFR 64.5(a)]. Information under CAM for all other pollutant-specific units is required as part of an application for renewal. The pre-controlled potential PM emissions from the Lime Silo are greater than 100 tpy. Therefore, information regarding CAM is required at the next permit renewal.

VII. Facility Wide Air Toxics

The current Chemours permit (T43) contains allowable emission limits for 103 toxic air pollutants (TAPs). For 89 of these TAP, the allowable emission limits were based on a 1995 modeling demonstration. This modeling demonstration was revised in 2001 to add several TAPs, including metals and hydrogen chloride, and to revise limits for aniline, ethylenediamine, methylene chloride (lb/hr), and tetrachlorodibenzo-p-dioxin. The analyses were based on a "worst case stack," which was used to define the worst-case ambient concentration in $\mu g/m^3$ associated with an emission rate of 1 lb/hr as a conservative modeling approach for facility-wide emissions. Allowable emissions were then back-calculated such that the predicted impact was 95 percent of the associated acceptable ambient level (AAL).

Table 7 presents a comparison of 2017 actual emissions to the permit limits for all TAPs emitted from the facility not including fluorides and HF, which will be discussed below. As shown in Table 7, the margin of compliance ranges from 1.4×10^{-7} percent of the allowable limit for methyl chloroform (daily limit) to 35.8 percent for arsenic (annual limit). The proposed Thermal Oxidizer/Scrubber System project is expected to reduce TAP emissions

[16] Part 70 defines a major source as one that has the potential to emit 10 tpy of any individual HAP, 25 tpy of any combination of HAP, and 100 tpy or more of any air pollutant subject to regulation.

Table 7. Impact of Thermal Oxidizer/Scrubber System Project on Allowable TAP Emissions

Toxic Air Pollutant	Permitted Allowable		2017 Actual Emissions[17]		Percent of Allowable	TAP Increases in Actual Emissions due to Project[18,19]		*Post-Project Potential TAP Emissions		Post Project Percent of Allowable
Acetaldehyde	395	lb/hr	3.03E-03	lb/hr	0.001%	1.72E-03	lb/hr	4.75E-03	lb/hr	0.001%
Acetic Acid	54.1	lb/hr	0.182	lb/hr	0.337%			0.182	lb/hr	0.337%
Acrolein	1.17	lb/hr	4.81E-04	lb/hr	0.041%	2.07E-04	lb/hr	6.88E-04	lb/hr	0.059%
Acrylonitrile	240	lb/yr	not emitted from current facility							
Ammonia	39.5	lb/hr	3.91	lb/hr	9.904%	0.0312	lb/hr	3.94	lb/hr	9.983%
Ammonium Chromate	0.54	lb/day	not emitted from current facility							
Ammonium Dichromate	0.54	lb/day	not emitted from current facility							
Aniline	14.6	lb/hr	not emitted from current facility							
Arsenic and Inorganic Arsenic Compounds	0.37	lb/yr	0.132	lb/yr	35.765%	0.0216	lb/yr	0.154	lb/yr	41.591%
Aziridine	5.26	lb/day	not emitted from current facility							
Benzene	192	lb/yr	9.61	lb/yr	5.006%	1.22	lb/yr	10.84	lb/yr	5.644%
Benzidine and Salts	0.02	lb/yr	not emitted from current facility							
Benzo(a)pyrene	52.8	lb/yr	8.30E-04	lb/yr	0.002%	3.13E-04	lb/yr	1.14E-03	lb/yr	0.002%
Benzyl Chloride	7.31	lb/yr	not emitted from current facility							
Beryllium	6.56	lb/yr	8.64E-03	lb/yr	0.132%	4.38E-03	lb/yr	1.30E-02	lb/yr	0.199%
Beryllium Chloride	6.56	lb/yr	not emitted from current facility							
Beryllium Fluoride	6.56	lb/yr	not emitted from current facility							
Beryllium Nitrate	6.56	lb/yr	not emitted from current facility							
Bis-Chloromethyl Ether	0.59	lb/yr	not emitted from current facility							
Bromine	2.92	lb/hr	2.97E-03	lb/hr	0.102%			2.97E-03	lb/hr	0.102%
1,3-Butadiene	272	lb/yr	9.97E-03	lb/yr	0.004%	0.0438	lb/yr	5.38E-02	lb/yr	0.020%
Cadmium	8.8	lb/yr	0.724	lb/yr	8.230%	0.0973	lb/yr	0.821	lb/yr	9.335%
Cadmium Acetate	8.8	lb/yr	not emitted from current facility							
Cadmium Bromide	8.8	lb/yr	not emitted from current facility							

[17] 2017 Approved Annual Emission Inventory
[18] Does not include reductions in TAP emissions from the control of process vents in the Thermal Oxidizer/Scrubber System.
[19] TAP Emissions from the combustion of natural gas in the Thermal Oxidizer and diesel fuel in the Emergency Engine calculated by Chemours and provided in the Permit Application and revised via email. See Attachement C.

Table 7. Impact of Thermal Oxidizer Project on Allowable TAP Emissions (continued)

Toxic Air Pollutant	Permitted Allowable		2017 Actual Emissions[17]		Percent of Allowable	TAP Increases in Actual Emissions due to Project[18,19]		*Post-Project Potential TAP Emissions		Post Project Percent of Allowable
Calcium Chromate	0.13	lb/yr	not emitted from current facility							
Carbon Disulfide	163	lb/day	not emitted from current facility							
Carbon Tetrachloride	10,723	lb/yr	not emitted from current facility							
Chlorine	13.1	lb/hr	0.186	lb/hr	1.419%			0.186	lb/hr	1.419%
	32.9	lb/day	4.47	lb/day	13.594%			4.47	lb/day	13.594%
Chlorobenzene	1,929	lb/day	not emitted from current facility							
Chloroform	6,882	lb/yr	not emitted from current facility							
Chloroprene	51.1	lb/hr	not emitted from current facility							
	386	lb/day	not emitted from current facility							
Chromic Acid	0.54	lb/day	2.79E-03	lb/day	0.517%	4.89E-04	lb/day	3.28E-03	lb/day	0.607%
Chromium (VI)	0.13	lb/yr	not emitted from current facility							
Cresol	32.15	lb/hr	not emitted from current facility							
p-Dichlorobenzene	965	lb/hr	not emitted from current facility							
Dichlorodifluoromethane	217,477	lb/day	not emitted from current facility							
Dichlorofluoromethane	438	lb/day	not emitted from current facility							
Di(2-ethylhexyle)phthalate	26.3	lb/day	not emitted from current facility							
Dimethyl Sulfate	2.63	lb/day	not emitted from current facility							
1,4-Dioxane	491	lb/day	not emitted from current facility							
Epichlorohydrin	132,832	lb/yr	not emitted from current facility							
Ethyl Acetate	2,046	lb/hr	1.94E-03	lb/hr	0.00009%			1.94E-03	lb/hr	0.000%
Ethylenediamine	36.5	lb/hr	not emitted from current facility							
	263	lb/day	not emitted from current facility							
Ethylene Dibromide	640	lb/yr	not emitted from current facility							
Ethylene Dichloride	6,081	lb/yr	541	lb/yr	8.897%			541	lb/yr	
Ethylene Glycol Monoethyl Ether	27.8	lb/hr	0.925	lb/hr	3.326%			0.925	lb/hr	
	105	lb/day	7.50	lb/day	7.143%			7.50	lb/day	
Ethylene Oxide	43.2	lb/yr	not emitted from current facility							

Table 7. Impact of Thermal Oxidizer Project on Allowable TAP Emissions (continued)

Toxic Air Pollutant	Permitted Allowable		2017 Actual Emissions[17]		Percent of Allowable	TAP Increases in Actual Emissions due to Project[18,19]		*Post-Project Potential TAP Emissions		Post Project Percent of Allowable
Ethyl Mercaptan	1.46	lb/hr	not emitted from current facility							
Fluorides	3.65	lb/hr	not emitted from current facility[20]							
	14.03	lb/day	not emitted from current facility[20]							
Formaldehyde	2.19	lb/hr	0.0124	lb/hr	0.564%	3.37E-03	lb/hr	0.0157	lb/hr	0.7182%
Hexachlorocyclopentadiene	0.15	lb/hr	not emitted from current facility							
	0.53	lb/day	not emitted from current facility							
Hexachlorodibenzo-p-dioxine	0.12	lb/yr	not emitted from current facility							
n-Hexane	965	lb/day	3.80	lb/day	0.394%	0.421	lb/day	4.23	lb/day	0.438%
Hexane Isomers	5,262	lb/hr	not emitted from current facility							
Hydrazine	0.53	lb/day	not emitted from current facility							
Hydrogen Chloride	10.2	lb/hr	1.71E-03	lb/hr	0.017%			1.71E-03	lb/hr	0.017%
Hydrogen Cyanide	16.1	lb/hr	not emitted from current facility							
	123	lb/day	not emitted from current facility							
Hydrogen Sulfide	30.7	lb/hr	0.0160	lb/hr	0.052%			0.0160	lb/hr	0.052%
Maleic Anhydride	1.46	lb/hr	not emitted from current facility							
	10.5	lb/day	not emitted from current facility							
Manganese & Compounds	27.2	lb/day	8.31E-04	lb/day	0.003%	4.11E-04	lb/day	1.24E-03	lb/day	0.005%
Manganese Cyclopentadienyl Tricarbonyl	0.53	lb/day	not emitted from current facility							
Manganese Tetroxide	5.44	lb/day	not emitted from current facility							
Mercury, Alkyl	0.05	lb/day	not emitted from current facility							
Mercury, Aryl & Inorganic	0.53	lb/hr	not emitted from current facility							
Mercury, vapor	0.53	lb/hr	4.42E-05	lb/hr	0.008%	9.25E-06	lb/hr	5.35E-05	lb/hr	0.010%
Methyl Chloroform	3,581	lb/hr	7.50E-06	lb/hr	0.000%			7.50E-06	lb/hr	0.000%
	10,523	lb/day	1.50E-05	lb/day	0.000%			1.50E-05	lb/day	0.000%
Methylene Chloride	24.85	lb/hr	0.791	lb/hr	3.185%			0.791	lb/hr	3.185%

[20] As discussed in Section VI.C, above, this category of compounds excludes HF and is only considered to include fluorine ions and inorganic fluorine-containing compounds. It should be noted that the only reason Chemours reports fluorides emissions in the AEI is that it is a requirement of the AERO program, in which emissions are entered.

Table 7. Impact of Thermal Oxidizer Project on Allowable TAP Emissions (continued)

Toxic Air Pollutant	Permitted Allowable		2017 Actual Emissions[17]		Percent of Allowable	TAP Increases in Actual Emissions due to Project[18,19]		*Post-Project Potential TAP Emissions		Post Project Percent of Allowable
	38,409	lb/yr	19.0	lb/yr	0.050%			19.0	lb/yr	0.050%
Methyl Ethyl Ketone	1,293	lb/hr	4.88	lb/hr	0.378%			4.88	lb/hr	0.378%
	3,245	lb/day	37.0	lb/day	1.139%			37.0	lb/day	1.139%
Methyl Isobutyl Ketone	438	lb/hr	not emitted from current facility							
	2,245	lb/day	not emitted from current facility							
Methyl Mercaptan	0.73	lb/hr	3.54E-04	lb/hr	0.048%			3.54E-04	lb/hr	0.048%
Nickel Carbonyl	0.53	lb/day	not emitted from current facility							
Nickel Metal	5.26	lb/day	4.19E-03	lb/day	0.080%	6.53E-04	lb/day	4.84E-03	lb/day	0.092%
Nickel, Soluble Compounds as Nickel	5.26	lb/day	not emitted from current facility							
Nickel Subsulfide	3.36	lb/yr	not emitted from current facility							
Nitric Acid	14.6	lb/hr	0.0124	lb/hr	0.085%			0.0124	lb/hr	0.085%
Nitrobenzene	7.31	lb/hr	not emitted from current facility							
	52.6	lb/day	not emitted from current facility							
n-Nitrosodimethlamine	80.0	lb/yr	not emitted from current facility							
Pentachlorophenol	0.37	lb/hr	not emitted from current facility							
	2.63	lb/day	not emitted from current facility							
Perchloroethylene	304,073	lb/yr	not emitted from current facility							
Phenol	13.9	lb/hr	not emitted from current facility							
Phosgene	2.19	lb/day	not emitted from current facility							
Phosphine	1.90	lb/hr	not emitted from current facility							
Polycholinated Biphenyls	133	lb/yr	not emitted from current facility							
Potassium Chromate	0.54	lb/day	not emitted from current facility							
Potassium Dichromate	0.54	lb/day	not emitted from current facility							
Sodium Chromate	0.54	lb/day	not emitted from current facility							
Sodium Dichromate	0.54	lb/day	not emitted from current facility							
Strontium Chromate	0.13	lb/yr	not emitted from current facility							
Styrene	155	lb/hr	not emitted from current facility							

Table 7. Impact of Thermal Oxidizer Project on Allowable TAP Emissions (continued)

Toxic Air Pollutant	Permitted Allowable		2017 Actual Emissions[17]		Percent of Allowable	TAP Increases in Actual Emissions due to Project[18,19]		*Post-Project Potential TAP Emissions		Post Project Percent of Allowable
Sulfuric Acid	1.46	lb/hr	0.101	lb/hr	6.940%			0.101	lb/hr	6.94%
	10.5	lb/day	2.43	lb/day	23.171%			2.43	lb/day	23.21%
Tetrachlorodibenzo-p-dioxin	0.0048	lb/yr	not emitted from current facility							
1,1,1,2-Tetrachloro-2,2-Difluoroethane	45,600	lb/day	not emitted from current facility							
1,1,2,2,-Tetrachloro-1,2-Difluoroethane	45,600	lb/day	not emitted from current facility							
1,1,1,2-Tetrachloroethane	10,082	lb/yr	not emitted from current facility							
Toluene	818	lb/hr	14.7	lb/hr	1.796%	9.49E-04	lb/hr	14.7	lb/hr	1.80%
	4,122	lb/day	72.6	lb/day	1.762%	0.0228	lb/day	72.6	lb/day	1.76%
Toluene-2,4-diisocyanate	0.22	lb/hr	not emitted from current facility							
	0.44	lb/day	not emitted from current facility							
Trichloroethylene	94,423	lb/yr	not emitted from current facility							
Trichlorofluoromethane	8,185	lb/hr	not emitted from current facility							
1,1,2-Trichloro-1,2,2-Trifluoroethane	13,885	lb/hr	not emitted from current facility							
Vinyl Chloride	608	lb/yr	not emitted from current facility							
Vinylidene Chloride	105	lb/day	not emitted from current facility							
Xylene	950	lb/hr	44.4	lb/hr	4.674%	6.38E-04	lb/hr	44.4	lb/hr	4.67%
	2,368	lb/day	329	lb/day	13.891%	0.0153	lb/day	329	lb/day	13.9%
Zinc Chromate	0.13	lb/yr	not emitted from current facility							
				Max	**35.765%**				**Max**	**41.6%**
				Min	**1.43E-07%**				**Min**	**1.43E-07%**

from all sources being controlled in the system. Small increases in TAP emissions associated with natural gas combustion, as well as increases in TAP emissions from the new diesel-fired emergency generator will be expected and these increases are shown in Table 7. The post-project potential emissions after the installation of the Thermal Oxidizer/Scrubber System were estimated as the potential emissions from the combustion of natural gas in the Thermal Oxidizer and the combustion of diesel fuel in the Emergency Generator and did not take into account reductions in TAP emissions from process vents being controlled in the thermal oxidizer. As shown in Table 7, the post project emissions are still well below the permitted allowable TAP limits; therefore no further analysis is necessary. It should be noted that there are permitted allowable limits for several TAPs presented in Table 7 that are not currently emitted from the facility. At their last permit renewal, Chemours declined to have the toxics limits evaluated and they remain in the permit.

Hydrogen Fluoride

In addition to the TAP limits discussed above, Chemours is also a source of HF. The destruction of PFAS emissions in the Thermal Oxidizer will generate HF, which will be controlled in the caustic Scrubber. As a result, HF emissions are expected to increase as a result of this project. The HF emission limits in the current permit (T43) are as follows:

Emission Source	**Toxic Air Pollutant**	**Emission Limits**
High dispersion stacks **(ID Nos. NEP-Hdr-1, NEP-Hdr-2, AEP-A1, and FEP-A1)**	Hydrogen Fluoride	7.28 lb/hr; 52.45 lb/day
All other sources	Hydrogen Fluoride	2.7 lb/hr; 19.4 lb/day

The emission limit for “high dispersion stacks” applies to processes vent emissions from the processes identified below. The emission limit for “all other sources” applies to the sources of HF at the Chemours facility not named below, including fugitive sources.

- Stack ID No. NEP-Hdr-1: FPS/IXM Manufacturing Process Area routed through baffle plate scrubber (ID No. NCD-Hdr1) including: HFPO, Vinyl Ethers North, RSU, FPS Liquid Waste Stabilization, MMF, TFE-CO_2 Separation, HFPO Container Decontamination, VEN Container Decontamination, and VES Container Decontamination Processes;
- Stack ID No. NEP-Hdr-2: FPS/IXM Manufacturing Process Area routed through VES scrubber, including: Vinyl Ethers South (ID No. NS-C);
- Stack ID No. AEP-A1: PPA Process Stack including indoor fugitive emissions and process vents; and
- Stack ID No. FEP-A1: Polyvinyl Fluoride Process Stack

To determine whether modeling would be required to adjust the HF limits in the permit due to the proposed Thermal Oxidizer/Scrubber Project, the following approach was used. First, actual 2017 emissions, by process, were collected. Then, post-project potential emissions[21] were calculated using the emissions spreadsheet provided by Chemours and applying the hours of operation included in the spreadsheet to convert hourly emissions to daily and annual emissions.[22] The post-project total emissions from the sources that will be vented through the Thermal Oxidizer/Scrubber Stack plus HF emissions from the Polymers Processing Aid Process carbon adsorber and the Vinyl Ether’s North – Room Air carbon adsorber were compared to the “high dispersion stacks” allowable limit. Detailed emissions calculations are presented in Tables B-3 and B-4 of Attachment B. This approach is conservative because:

[21] NOTE: The potential HF emissions from the Scrubber were presented in the permit application (Form C9) as 3.37 tons per year (see Table 2) and were calculated based on 8,760 hr/yr of operation from all sources.
[22] In an email, dated 08/24/2018, Chemours stated that the 2017 level of production for HFPO, VEN, and VES was similar to four of the previous five years and that it was representative of normal operation. For the IXM polymer resins area, the 2017 level of production was the highest annual production on record.

- the original limits were developed by modeling a worst case stack, and back calculating the allowable emissions from the unit impact modeled from this worst case stack such that the allowable emissions were 95 percent of the allowable;
- although 15A NCAC 02Q .0706 requires an analysis to demonstrate that a permit application to comply with 15A NCAC 02D .1100 is not necessary if there is no net increase in actual emissions, the post-project emissions were calculated using potential emissions;
- as shown in Figure B-1 of Chemours' permit application, the new Thermal Oxidizer/Scrubber System Stack will be located approximately 400 meters further away from the property boundary than the current stacks (DIV_STACK, also known as Stack NEP-Hdr-1 and VE_S, also known as Stack NEP-Hdr-2) thereby reducing the potential impact;
- one of the sources that was subject to the allowable limit for "high dispersion stacks," the polyvinyl fluoride process, is no longer owned and operated by Chemours; and
- in addition to the sources currently being routed through the existing scrubbers (Stacks NEP-Hdr-1 and NEP-Hdr-2), which will be routed to the new Thermal Oxidizer/Scrubber System, process vents from the IXM Resins Process (except the Fluorinator) and the E-2 Process will be controlled in the Thermal Oxidizer/Scrubber System and will be subject to the allowable limit for high dispersion stacks.

According to the 2017 approved Annual Emission Inventory (AEI), facility-wide HF emissions were 4,344 lb/yr. Table 8 presents a comparison of 2017 HF emissions and the post-project potential HF emissions (after the installation of the Thermal Oxidizer/Scrubber System) to the allowable permit limits for HF. As shown in Table 8, the post-project potential emissions are well below the allowable emissions. The post-project HF emissions are 10.4 percent of the 1-hour HF limit and 23 percent of the 24-hour HF limit for the "high dispersion stacks." Post-project HF emissions from "all other sources" are estimated to be 2.19 percent of the 1-hour HF limit and 6.75 percent of the 24-hour HF limit. Because large margin of compliance with the existing HF permit limits and considering the conservative approach, no changes to the permit limits will be needed to ensure that there is no unacceptable risk from increases in HF emissions due to the Thermal Oxidizer/Scrubber Project.

The permit was revised to provide some additional clarity to the HF emission limit table in Section 2.2 B.2. The reference to the polyvinyl fluoride stack (FEP-A1) was removed since this source is no longer owned or operated by Chemours. The specific processes associated with each stacks were also added to the table.

The current permit requires Chemours to submit quarterly emissions reports for all TAPs for which there are allowable limits in the permit. The recordkeeping and reporting conditions in the permit will be retained so that DAQ can continue to monitor the HF and fluorides emissions from Chemours to ensure that the TAP limits are not exceeded.

VIII. Facility Emissions Review

The table on the first page of this permit review presents the criteria pollutant (plus total HAP) from the latest available reviewed facility emissions inventory (2017). Chemours has requested this permit modification as a pollution prevention project, where they expect to significantly reduce the actual VOC emissions from their facility. Specifically, the addition of the Thermal Oxidizer/Scrubber System will significantly reduce the level of GenX and PFAS emitted to the atmosphere from processes. Additionally, there will be small increases in PM_{10} emissions due to the installation of the Lime Processing System. These increases, when added to the 2017 actual emissions would not increase PM_{10} emissions above the highest level over the last five years.

Table 8. Impact of Thermal Oxidizer/Scrubber System Project on Permitted Allowable Hydrogen Fluoride Limits

		1-hour Averaging Period				24-hour Averaging Period			
Process ID	Process Description	Allowable Emissions (lb/hr)	2017 Actual Emissions (lb/hr)[a]	Post-Project Emissions (lb/hr)[a]	Percent of Allowable after Project (%)	Allowable Emissions (lb/day)	2017 Actual Emissions (lb/day)[a]	Post Project Emissions (lb/day)[a]	Percent of Allowable after Project (%)
High Dispersion Stacks[b]									
AS-A	PPA Process								
NS-C	Vinyl Ethers South								
NS-A	HFPO Process								
NS-B	Vinyl Ethers North								
NS-D	RSU Process								
NS-E	FPS Liquid Waste Stabilization								
NS-F	MMF Process	7.28	0.459	0.774	10.6	52.45	10.9	12.2	23.2
NS-G1	IXM Resins Process (except Fluorinator)[c]								
NS-M	TFE-CO2 Separation								
NS-N	HFPO Container Decontamination								
NS-O	VEN Container Decontamination								
NS-P	VES Container Decontamination								
NS-K	E-2 Process[c]								
All Other Sources[d]									
NS-A	HFPO Process - fugitives								
NS-B	Vinyl Ethers North - fugitives								
NS-C	Vinyl Ethers South - fugitives								
NS-D	RSU Process - fugitives								
NS-E	FPS Liquid Waste Stabilization - fugitives	2.7	0.0611	0.0591	2.19	19.4	1.36	1.31	6.75
NS-F	MMF Process - fugitives								
NS-G2	IXM Resins Process (fluorinator)[c]								
NS-H	IXM Membrane Process								
SW-1	Semiworks polymerization process								

[a]Actual Emissions were reported in the 2017 Annual Emission Inventory. Post Project Emissions were provided in a spreadsheet by Chemours on September 5, 2018. See Attachment B, Tables B-3 and B-4 for detailed calculations.

[b]The following are considered high dispersion stacks and the combined emissions from these sources are subject to the allowable limit in the current permit: (1) *Stack ID No. NEP-Hdr-1*: HFPO, Vinyl Ethers North, RSU, FPS Liquid Waste Stabilization, MMF, TFE-CO_2 Separation, HFPO Container Decontamination, VEN Container Decontamination, and VES Container Decontamination Processes; (2) *Stack ID No. NEP-Hdr-2*: Vinyl Ethers South (ID No. NS-C); and (3) *Stack ID No. AEP-A1*: PPA Process Stack, including indoor fugitive emissions and process vents. The original allowable limit also applied to the polyvinyl fluoride process stack (Stack ID No. FEP-A1). This source is no longer owned and operated by Chemours.

[c]The IXM Resins Process and E-2 Process were not subject to the high dispersion stacks allowable limit prior to the Thermal Oxidizer/Scrubber Project. After the project, the E-2 Process and all sources in the IXM Resins Process except for the Fluorinator will be routed through the thermal oxidizer. In the 2017 Emission Inventory, fluorinated compounds emitted from the IXM Resins Process (except the Fluorinator) and the E-2 Process do not readily convert to HF and therefore did not contribute to HF from "All Other Sources." The fluorinated compounds emitted from the IXM Resins Process (except the Fluorintaor) and the E-2 Process will be converted to HF in the thermal oxidizer and will be subject to the allowable limit for high dispersion stacks.

[d]Although not defined in the current permit, the point sources that were covered by the allowable limit include any point source not identified above. The allowable limit in the current permit applies to the following: Nafion Process Fugitives, E-2 Process, IXM Resins Process, IXM Membrane Process, and Semiworks Polymerization Process.

I. Facility Compliance Status

DAQ has reviewed the compliance status of this facility with respect to its Title V Air Permit. The most recent inspection of the facility was conducted on February 28, 2018 by Mr. Greg Reeves with the Fayetteville Regional Office (FRO). No problems were discovered during the physical inspection of the sources and during records review at the facility. During the onsite inspection, the facility was operating in compliance. It should be noted that the Chemours facility is currently undergoing compliance issues with respect to their water and wastewater permits, and this compliance status does not address those issues.

II. Draft Permit Review Summary

The Permittee was sent a draft of the permit and permit review on September 26, 2018 and again on December 21, 2018. Chemours provided comments on the initial draft on October 8, 2018 and provided comments on the December 2018, draft on January 4, 2019. Comments were incorporated into the permit as appropriate. ***Update to address comments received.***

Copies of the draft permit and permit review were sent to the FRO September 26, 2018 and again on December 14, 2018. Comments on the initial draft were received on October 3, 2018. Comments on the second draft were received December 14, 2018. The comments were primarily editorial in nature and were incorporated into the permit.

III. Public Notice/EPA and Affected State(s) Review

This permit action is for the first step of a two-step process as per 15A NCAC 2Q .0501(b)(2) and public notice is not required. However, as allowed under 15A NCAC 02Q .0521(a), the DAQ Director has determined that a public notice opportunity for comments and a hearing is in the best interest of the public. Therefore notice of the draft Title V Permit was issued on XXXX YY, 2019. The notice will provide for a 30-day comment period, and will announce the date of the public hearing.

Public Notice of the DRAFT Title V Permit ran from XXXX YY, 2019, to XXXX YY, 2019. ***Summary of comments received.***

IV. Conclusions, Comments and Recommendations

PE Seal

Pursuant to 15A NCAC 02Q .0112 "Application requiring a Professional Engineering Seal," a professional engineer's seal (PE Seal) is required to seal technical portions of air permit applications for new sources and modifications of existing sources as defined in Rule .0103 of this Section that involve:

(1) design;
(2) determination of applicability and appropriateness; or
(3) determination and interpretation of performance; of air pollution capture and control systems.

A professional engineer's seal (PE Seal) **WAS** required for this modification and was provided on Form D5.

Zoning

A Zoning Consistency Determination per 2Q .0304(b) **WAS** required for this proposed modification. The permit application and zoning request were submitted to the Bladen County, NC, Planning Department on June 29, 2018. Proof of the submittal was included in the permit application.

Recommendations

This permit modification application has been reviewed by NC DAQ to determine compliance with all procedures and requirements. NC DAQ has determined that this facility is expected to comply with all applicable requirements.

Recommend Issuance of Permit No. 03735T44. FRO has received a copy of this permit and submitted comments that were incorporated as described in Section X.

ATTACHMENT A

October 26, 2018, Additional Information Request Letter

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

MICHAEL ABRACZINSKAS
Director

NORTH CAROLINA
Environmental Quality

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

7017 0190 0000 1635 7533

October 26, 2018

Mr. Brian D. Long
Plant Manager
Chemours Company – Fayetteville Works
22828 NC Highway 87 West
Fayetteville, NC 28306

SUBJECT: Additional Information Request
Application No. 0900009.18B
Chemours Company – Fayetteville Works
Facility ID: 0900009, Fayetteville, Bladen County
Permit No. 03735T43

Dear Mr. Long:

Reference is made to your Air Quality Permit Application No. 0900009.18B received on July 2, 2018 for the above subject facility.

During our review of your application and our comparison of your Permit Application No. 0900009.18B to your April 27, 2018, letter committing to alternate operating conditions which are to be memorialized in your air permit, it was determined that additional information is required to continue processing the referenced Air Quality Permit application. The following discussion identifies the additional information we are requesting.

Carbon Adsorption Units

In your April 27, 2018, letter you acceded to the modification of the permit to include conditions to install and operate two carbon adsorption systems by May 25, 2018 to control and reduce Polymer Processing Aid (PPA) process emissions and indoor equipment leak emissions from the PPA Process and the Vinyl Ethers North (VEN) Process.

Permit Application No. 0900009.18B did not include application forms for the Carbon Absorption Systems. To include the Carbon Absorption Systems in the permit DAQ will require the following information:

- A summary description of the system and its operation. This should include how you will handle carbon regeneration/disposal;
- All relevant permit application forms;
- Revised Tables 3-1 and 3-2 (from Permit Application No. 0900009.18B) incorporating the emissions reductions associated with the installation of the PPA and VEN systems.
- Revised Permit Application No. 0900009.18B Section 5.0 containing suggested permit conditions, particularly for monitoring.

Enhanced Leak Detection and Repair

In addition to the carbon absorption systems, you acceded to the modification of your permit to include conditions under which you will operate the Fayetteville Works facility in accordance with the Enhanced Leak Detection and Repair (LDAR) program set forth in the report dated January 31, 2018, developed by your consultant, ERM, and attached to your April 27, 2018, response as Exhibit 3.

According to the ERM report, several opportunities for additional enhanced work practices were identified that could further reduce emissions of Hexafluoropropylene Oxide Dimer Acid Fluoride (HFPO DAF) and HFPO Dimer Acid (DA), i.e., GenX compounds. These practices include controlling indoor equipment leaks, enhanced pressure testing, enhanced audial/visual/olfactory (AVO) inspections, supplemental instrument monitoring, and improvements to the area monitoring program. The report also identified longer-term emission reduction options such as increased connection/flange welds and replacement of existing equipment with low-leak technology for valves and connectors.

In order to incorporate the Enhanced LDAR program, DAQ requires an updated and detailed description of the program. Please provide any expected emission reductions associated with this program. In addition, please submit an update to Section 5.0 of Permit Application No. 0900009.18B with proposed LDAR permit conditions.

Installation and Operation of Air Pollution Control Equipment and Commitment to Emissions Reductions

With the installation and operation of the thermal oxidizer, carbon adsorption units and the institution of the enhanced LDAR program, pursuant to Chemours April 27, 2018 submittal, Chemours shall:

- Commit to DAQ in a binding agreement that, once installed, this technology will ensure that overall air emissions of GenX compounds are reduced from current levels by 99%.
- This will have the effect of reducing GenX emissions from a baseline of 2,302.7 pounds per year to 27.2 pounds per year no later than April 30, 2020. After April 30, 2020, under no circumstances shall emissions exceed 27.2 pounds per year.
- Chemours shall include these agreed to parameters in the revised permit application.

Comments on Draft Permit

On October 2, 2018, DAQ submitted a draft of Air Permit No. 03735T44 for your review. You submitted comments, via email on October 9, 2018. DAQ has reviewed these comments and most have been incorporated into the permit as requested. However, there are some comments to which DAQ has responded that will not be incorporated and in some cases DAQ requires additional information before determining whether to incorporate the comments. The attachment to this letter contains DAQ's responses to your comments. Along with the above information, please provide the information requested in the attachment.

Please respond to this request for additional information no later than November 2, 2018. Until the above information is received, your application will be placed on hold.

Should you have any questions with reference to the above matter, please do not hesitate to contact me at 919-707-8726 or by email at william.willets@ncdenr.gov.

Sincerely,

William Willets, P.E., Chief, Permitting Section
Division of Air Quality, NCDEQ

Attachments

cc: Fayetteville Regional Office
Central Files

ATTACHMENT

Thermal Oxidizer
Chemours Comments on 9/26/18 Draft Permit and Review Documents

1. ✓ Cover Letter – Plant manager's name of Brian D Long
2. ✓ Page 5 – Section C - NS-P – Emissions Source Description should also reference NS-P (vs NS-O).
3. ✓ Page 5 – Section 1 – table typo – "Hexafluoropropylene epoxide"
4. ✓ Page 23 at the bottom of the page – change "....venturi vacuum jet caustic scrubber..." for ID No. NCD G2 to ".....caustic scrubber....".
5. ✓ Page 24 – Section 2.1.C.1 - last sentence – same comment as #3 above.
6. Page 26 – For permit conditions listed in Sections 2.1.C.5, 2.1.C.6, 2.1.C.7 and 2.1.C.8, the draft permit does not allow for reductions from the thermal oxidizer when calculating the VOC emissions to demonstrate compliance with PSD avoidance limits. Chemours believes that the emission calculations used to demonstrate compliance with the PSD avoidance limits should include the thermal oxidizer reductions. By not including the thermal oxidizer reductions, the permit is reducing the permit limits under PSD that were developed at the time of the modifications associated with each area. This permit application should not have any impact on previously established PSD avoidance limits. **DAQ RESPONSE:** ***We need to understand how the calculation in Section 2.1 C.6.v should change. Which of the sources represented in the equation will be routed to the TO are included in this calculation?***
7. Page 28 – Section 2.1.C.7.c.iv – VOCs – includes acid fluorides? **DAQ RESPONSE:** ***Would your concerns be addressed if I add something to the condition about the TO as follows:***

    iv. Calculate the VOC emissions (in lb/month) through the one of the control devices as specified below from maintenance activity (EM) based on vessel volumes and vapor density for each occurrence of this activity during the previous calendar month:

    (A) POS: the baffle-plate scrubber (ID No. NCD-Hdr1 or NCD-Hdr2); or

    (B) AOS: the Thermal Oxidizer (ID No. NCD-Q1)

8. Page 39 – Section 2.1.C.11.b – 2nd sentence – "The permittee shall test for perfluoro-2-propoxy propionyl fluoride, measured in emissions testing protocol as perfluoro-2-propoxypropanoic acid, hexafluoropropylene (HFPO), VOC, HF and SO2 emissions at the inlet to the Thermal oxidizer and exit the four-stage scrubber." At the Chemours Washington Works plant, we do not have to sample the flue gas prior to scrubbing. We do not have to prove scrubber removal efficiency of HF, HCl, SO2, Cl2, or I2 in the scrubber by sampling the inlet and outlet. In the Washington Works stack testing, we must establish compliance relative to stack emissions in concentration, lbs/hr, and lbs/yr. Much of the HF at Fayetteville will be removed by the Diabon rapid quench and Liquid Mist Separator Scrubber. It would be very difficult to get a gas sample since this will be under negative pressure relative to atmosphere.

    The standard EPA test methods utilized at Washington Works: EPA Method 29, EPA Method 10, 10A, or 10B, EPA Method 23, EPA Method 26, EPA Method 9, EPA Method 7, 7A, 7C, 7D, or 7E, EPA Method 5 and EPA Method 6. DAQ RESPONSE: *Generally, we believe that the only way to ensure that the scrubber removal efficiency is in compliance with the emission limit is to test at its inlet and outlet. Since the testing methods for determining the Fluoride compound loading to the TO do not identify the universe of possible compounds present in the inlet stream, it is not possible to do a mass balance that would demonstrate compliance with the HF emission reduction. If you would like to propose a methodology for ensuring that the emission reduction of the scrubber is being achieved using an alternative method (for example setting scrubber outlet limits indicative of this reduction) we can evaluate that.*

9. ✓ Page 39 – Section 2.1.C.11.b – what is the purpose of testing for VOCs? DAQ RESPONSE: *Your permit application addresses VOC emission reduction.*

10. ✓ Page 39 – Section 2.1.C.11.d.ii – "The Permittee shall conduct a performance test within 90-days whenever permanent changes are made...."

11. Page 39 – Section 2.1.C.11.d. add iii – The conditions of d.ii do not apply during periods of testing and research and development activities. DAQ RESPONSE: *DAQ is evaluating this request.*

12. ✓*(No changes are necessary to incorporate the flame scanners)* Page 40 – Section 2.1.C.11.f.i – there are two (2) flame scanners to detect the flame in the thermal oxidizer. These will be used to meet the hourly check provision.

13. ✓ Page 40 – Section 2.1.C.11.fi – iv – Propose that we do the required inspections after the first year of service and every two (2) years thereafter. This is the schedule that the Washington Works thermal oxidizer is on. DAQ RESPONSE: *DAQ believes that annual equipment inspections are appropriate and is consistent with our permit shell language for similar types of sources and emission control systems.*

    ✓ What does "all associated instrumentation" mean? We assume it to be the critical equipment where we also calculate the 3 hour averages (temperature, pH and flow). DAQ RESPONSE: *Correct*

14. ✓ Page 40 – Section 2.1.1C.1.g.i – verifying that calculating 3 hour average every hour meets the intent of this requirement. DAQ RESPONSE: *Correct*

15. ✓ Page 40 – Section 2.1.C.11.h.iii – should _temperature" be "pH" here? DAQ RESPONSE: *Correct*

16. ✓ Page 40 – Section 2.1.C.11.j.i – This doesn't appear to be part of Shutdown and Malfunction. Should this be moved to Section 2.1.C.11.g or h? DAQ RESPONSE: *DAQ added text to clarify that the maintenance instructions listed in Section 2.1 C.11.g and h are the ones we are referring to. However, we want this to be in the plan to ensure that malfunctions are minimized.*

17. ✓ Page 40 – Section 2.1.C.11.j.ii – we would use a DCS/IP-21 report to comply with this requirement. However, we also have 97% uptime conditions in Section 2.1.C.11.g.iii and 2.1.C.11.h.iii. This condition appears redundant. DAQ RESPONSE: *The schedule needs to be in the plan.*

18. ✓ Page 40 – Section 2.1.C.11.k.i – double check referenced sections – should be g and h vs f and g? DAQ RESPONSE: *Correct*
19. ✓ Page 40 – Section 2.1.C.11.k.ii – this appears to be part of shutdown and malfunction to prove that all units are down. DAQ RESPONSE: *Correct*
20. Page 41 – Section 2.1.C.11.l – we would like condition to be monthly for those areas that are currently in PSD avoidance in POS and annual for all other areas. DAQ RESPONSE: ***We are evaluating this condition and will update later.***

    ✓ HF and sulfur dioxide are not generated in the operating areas noted. Those two compounds will be generated in thermal oxidizer and CaF2 unit. DAQ RESPONSE: ***The sentence was rearranged to separate the sources of the emissions as follows:***

    > Calculations of the 12-month rolling average VOC (calculated as the sum of acid fluoride compounds, measured as GenX,Error! Bookmark not defined. and nonacid fluoride compounds, measured as HFPO) emissions from the ... and the hydrogen fluoride and sulfur dioxide emissions post Thermal Oxidizer (ID No. NCD-Q1) shall be recorded monthly in a logbook (written or electronic format), maintained on-site and made available to officials of the Division of Air Quality, upon request. The Permittee must keep each entry in the logbook and all required records on file for a minimum of five years.

21. ✓ Page 49 – Section G.2.c.i(A) – is the monitoring period one (1) week? What is the action if the unit is not operating? DAQ RESPONSE: ***The monitoring period is each calendar week. Since visible emissions would only be seen during operation. The records required in Section 2.1 C.11.d.ii are the results of each observation and/or test. If the source is not operational during that calendar week the records should note that. General Condition LL also addresses reporting requirements for nonoperating sources.***
22. ✓ Page 56 – table does not have HF limits listed for the AOS. DAQ RESPONSE: ***This has been updated***

ATTACHMENT B

Thermal Oxidizer/Scrubber System Project
Summary of Speciated Compound Emissions for Each Process

Information in the following tables summarize a spreadsheet that was provided by Chemours via email on September 5, 2018.

Table B-1. Maximum Hourly PFAS and VOC Emissions to Thermal Oxidizer*

Chemical Name	Common Name	CAS#		Maximum Hourly PFAS and VOC Emissions to Thermal Oxidizer by Source I.D. (lb/hr)									
			NS-A	NS-B	NS-C	NS-D + NS-F	NS-G	NS-K	NS-M	NS-N	NS-O	NS-P	Grand Total
C_4F_{10}	**n-perfluorobutane**	355-25-9		45									**45**
COF_2	**carbonyl fluoride**	353-50-4	162		85								**247**
COF_2 (from TFF)	**carbonyl fluoride**	353-50-4	8										**8**
DA	**Tetrafluoro-2[Hexafluoro-2-(Tetrafluoro-2-{Fluorosulfonyl}Ethoxy) Propoxy Propionyl Fluoride**	4089-58-1		9									**9**
DAE	**Methyl Perfloro (8-(Fluoroformyl)-5-methyl-4,7-Dioxanonanoate)**	69116-73-0		15									**15**
E1	Freon E1 Fluorocarbon	3330-15-2						2					**2**
E2	Freon E2 fluorocarbon	3330-14-1					147	2					**149**
E3	Freon E3 Fluorocarbon	3330-16-3						0					**0**
EVE	**Propanoic Acid, 3-[1-[Difluoro [(Trifluoroethenyl oxy] Methyl]-1,2,2,2-Tetrafluoroethoxy] -2,2,3,3-Tetrafluoro-, Methyl**	63863-43-4		17									**17**
F-23	**HFC-23**	75-46-7	5										5
HFP	**hexafluoropropylene**	116-15-4	2	25	2								**29**
HFPO	**hexafluoropropylene oxide**	428-59-1	4	37	2					11			**53**
HFPO-DIMER	**Perfluoro-2-Propoxy Propionyl Fluoride**	2062-98-8		2	2								**5**
iso-EVE	**Methyl Perfluoro-6-Methyl-4,7-Dioxanon-8 Eneoate**	73122-14-2		3									**3**
MA	**Tetrafluoro-2-[Tetrafluoro-2-(Fluorosulfonyl)Ethoxy]-Propanoyl Fluoride**	4089-57-2		4									**4**
MAE	**Methyl Perfluoro (5-(Fluoroformyl)-4-Oxahexanoate)**	69116-72-9		10									**10**
Methanol	**methanol**	67-56-1					4						**4**
MMF	**Methyl-2,2-Difluoromalonyl Fluoride**	69116-71-7		3									**3**
N1AF			35.5										**41**

Table B-1. Maximum Hourly PFAS and VOC Emissions to Thermal Oxidizer*

Chemical Name	Common Name	CAS#		Maximum Hourly PFAS and VOC Emissions to Thermal Oxidizer by Source I.D. (lb/hr)									
			NS-A	NS-B	NS-C	NS-D + NS-F	NS-G	NS-K	NS-M	NS-N	NS-O	NS-P	Grand Total
PAF	**perfluoroacetyl fluoride**	354-34-7	94		67	0							**175**
PEPF	**Perfluoroethoxypropionyl fluoride**	1682-78-6			18								**18**
PEVE	**Perfluoroethyl vinyl ether**	10493-43-3			1								**1**
PMCP			3										**3**
PMPF	**Perfluoromethoxypropionyl fluoride**	2927-83-5			20								**20**
PMVE	**Perfluoromethyl vinyl ether**	1187-93-5			4								**4**
PMVE, PEVE, and PPVE	**Perfluoropropyl vinyl ether (Note: other vinyl ethers not listed)**	1623-05-8										11	**11**
PPF	**Perfluoropropionyl fluoride**	422-61-7		40									**40**
PPVE	**Perfluoropropyl vinyl ether**	1623-05-8		7									**7**
PPVE, PFEPVE, EVE	**Perfluoropropyl vinyl ether (Note: other vinyl ethers not listed)**	1623-05-8									11		**11**
PSEPVE		16090-14-5		9			47						**55**
RSU						0							**0**
SU	**2-Hydroxytetrafluoroethane Sulfonic Acid Sultone**	697-18-7				0							**0**
TFE	**Tetrafluoroethylene**	116-14-3		37		28	190		667				**923**
		Grand Total (lb/hr)	**333**	**262**	**200**	**29**	**388**	**4**	**667**	**11**	**11**	**11**	**1,915**

*Uncontrolled VOC Emissions (2,098 lb/hr) presented in the permit application for the Thermal Oxidizer (Form C3) appear to have included non-VOC emissions, such as freon, oxygen, etc. The emissions presented in this table correspond to the emissions from a spreadsheet provided by Chemours with detailed calculations. The following compounds from the spreadsheet are not included in this table: carbon dioxide, sulfuric acid, hydrogen fluoride, N2/TFE/Water, oxygen, and sulfur dioxide.

Table B-2. Maximum Annual Fluorocarbon and VOC Emissions by Source ID

Chemical Name	Common Name	CAS#	Thermal Oxidizer Control Efficiency (%)*	Maximum Annual PFAS and VOC Emissions After Thermal Oxidizer, by Source ID (lbs/yr)										
				NS-A	NS-B	NS-C	NS-D + NS-F	NS-G	NS-K	NS-M**	NS-N	NS-O$^{\Delta}$	NS-P$^{\Delta}$	Grand Total
C_4F_{10}	n-perfluorobutane	355-25-9	99.99		39.5									39.5
COF_2	carbonyl fluoride	353-50-4	99.99	149		74.4								224
DA	Tetrafluoro-2[Hexafluoro-2-(Tetrafluoro-2-{Fluorosulfonyl}Ethoxy) Propoxy Propionyl Fluoride	4089-58-1	99.99		8.13									8.13
DAE	Methyl Perfloro (8-(Fluoroformyl)-5-methyl-4,7-Dioxanonanoate)	69116-73-0	99.99		13.3									13.3
E1	Freon E1 Fluorocarbon	3330-15-2	99.99						0.120					0.120
E2	Freon E2 fluorocarbon	3330-14-1	99.99					129	0.0924					129
E3	Freon E3 Fluorocarbon	3330-16-3	99.99						6.00E-04					6.00E-04
EVE	Propanoic Acid, 3-[1-[Difluoro [(Trifluoroethenyl oxy] Methyl]-1,2,2,2-Tetrafluoroethoxy] -2,2,3,3-Tetrafluoro-, Methyl	63863-43-4	99.99		14.5									14.5
F-23	HFC-23	75-46-7	99.99	4.41										4.41
HFP	hexafluoropropylene	116-15-4	99.99	2.13	21.8	1.38								25.3
HFPO	hexafluoropropylene oxide	428-59-1	99.99	3.34	32.2	1.53					9.64			46.7
HFPO-DIMER	Perfluoro-2-Propoxy Propionyl Fluoride	2062-98-8	99.99		2.03	2.03								4.06
iso-EVE	Methyl Perfluoro-6-Methyl-4,7-Dioxanon-8 Eneoate	73122-14-2	99.99		2.42									2.42
MA	Tetrafluoro-2-[Tetrafluoro-2-(Fluorosulfonyl)Ethoxy]-Propanoyl Fluoride	4089-57-2	99.99		3.49									3.49
MAE	Methyl Perfluoro (5-(Fluoroformyl)-4-Oxahexanoate)	69116-72-9	99.99		8.49									8.49
Methanol	methanol	67-56-1	99.99					3.42						3.40
MMF	Methyl-2,2-Difluoromalonyl Fluoride	69116-71-7	99.99		2.42									2.42

Table B-2. Maximum Annual Fluorocarbon and VOC Emissions by Source ID

Chemical Name	Common Name	CAS#	Thermal Oxidizer Control Efficiency (%)*	Maximum Annual PFAS and VOC Emissions After Thermal Oxidizer, by Source ID (lbs/yr)										
				NS-A	NS-B	NS-C	NS-D + NS-F	NS-G	NS-K	NS-M**	NS-N	NS-O[Δ]	NS-P[Δ]	Grand Total
N1AF	**N1AF**	Not provided	99.99	35.5										35.5
PAF	**perfluoroacetyl fluoride**	354-34-7	99.99	94.0		58.8	0.0754							153
PEPF	**Perfluoroethoxypropionyl fluoride**	1682-78-6	99.99			15.6								15.6
PEVE	**Perfluoroethyl vinyl ether**	10493-43-3	99.99			0.865								0.865
PMCP	**PMCP**		99.99	2.63										2.63
PMPF	**Perfluoromethoxypropionyl fluoride**	2927-83-5	99.99			17.3								17.3
PMVE	**Perfluoromethyl vinyl ether**	1187-93-5	99.99			3.52								3.52
PPF	**Perfluoropropionyl fluoride**	422-61-7	99.99		34.7									34.7
PPVE	**Perfluoropropyl vinyl ether**	1623-05-8	99.99		5.93							9.64	9.64	25.2
PSEPVE	**Perfluoro (4-methyl-3, 6-dioxaoct-7-ene) sulfonyl fluoride**	16090-14-5	99.99		7.55			40.8						48.4
RSU	**2,2-difluoro-2-(fluorosulfonyl) acetyl fluoride**	677-67-8	99.99				0.0251							0.0251
SU	**2-Hydroxytetrafluoroethane Sulfonic Acid Sultone**	697-18-7	99.99				0.0754							0.0754
TFE	**Tetrafluoroethylene**	116-14-3	99.99		32.7		24.9	167		117				233
			Grand Total (lb/yr)	**291**	**229**	**175**	**25.1**	**340**	**0.213**	**117**	**9.64**	**9.64**	**9.64**	**1,208**
			Grand Total (lb/hr)	**0.0333**	**0.0262**	**0.0200**	**2.86E-03**	**0.0388**	**3.55E-04**	**0.0791**	**0.0011**	**0.0011**	**0.0011**	**0.192**

* In the spreadsheet provided by Chemours, in order to estimate worst case maximum emissions, compound-specific thermal oxidizer emissions reductions were used. For the purposes of this permit review, and to be consistent with the required emission reductions, the overall thermal oxidizer emission reduction of 99.99 percent was applied to all compounds to calculate post-control oxidizer emissions.

**The TFE/COF_2 Separation Process has one batch operation that Chemours has estimated to operate 36 hours per year. The remaining operations run 8,760 hours per year. According to the Chemours spreadsheet, the E-2 process operates 600 hours per year. The Grand Total hourly emissions take this operating schedule into account.

[Δ] According to the spreadsheet provided by Chemours, NS-O emits PPVE, PSEPVE, and EVE and NS-P emits PPVE, PMVE, and PEVE. However, Chemours calculated emissions as PPVE. Therefore, this table presents these emissions as PPVE emissions from NS-O and NS-P.

Table B-3. Hydrogen Fluoride Potential To Emit

Source ID	Common Name	Chemical Name	Maximum Hourly Uncontrolled Emissions of Fluoride-Containing Compounds (lb/hr)	Molecular Weight	Number of F in Fluoride-containing Compound	Maximum HF Produced in Thermal Oxidizer (lb/hr)[a,b,c]	Max Potential HF Emissions (99.95% Scrubber Efficiency)		
							(lb/hr)	(lb/day)	(lb/yr)
Sources Routed through the Thermal Oxidizer/Scrubber System									
NS-A	**carbonyl fluoride**	COF2	171	66	2	103	0.0517	1.24	453
	hexafluoropropylene	HFP	2.43	150	6	1.94	9.72E-04	0.0233	8.51
	hexafluoropropylene oxide	HFPO	3.82	166	6	2.76	1.38E-03	0.0331	12.1
	HFC-23	F-23	5.04	70	3	4.32	2.16E-03	0.0518	18.9
	perfluoroacetyl fluoride	PAF	107.3	116	4	74.0	0.0370	0.888	324
	N1AF	N1AF	40.5	248	8	26.1	0.0131	0.314	115
	PMCP	PMCP	3.00	200	8	2.40	1.20E-03	0.0288	10.5
						Total NS-A Emissions	**0.107**	**2.58**	**941**
NS-B	**hexafluoropropylene**	HFP	24.9	150	6	19.9	0.010	0.239	87.3
	hexafluoropropylene oxide	HFPO	36.7	166	6	26.6	0.0133	0.319	116
	Methyl Perfloro (8-(Fluoroformyl)-5-methyl-4,7-Dioxanonanoate)	DAE	15.2	488	15	9.36	4.68E-03	0.112	41.0
	Methyl Perfluoro (5-(Fluoroformyl)-4-Oxahexanoate)	MAE	9.69	322	9	5.42	2.71E-03	0.0650	23.7
	Methyl Perfluoro-6-Methyl-4,7-Dioxanon-8 Eneoate	iso-EVE	2.77	422	13	1.71	8.53E-04	0.0205	7.47
	Methyl-2,2-Difluoromalonyl Fluoride	MMF	2.77	156	3	1.06	5.32E-04	0.0128	4.66
	n-perfluorobutane	C4F10	45.1	238	10	37.9	0.0190	0.455	166
	Perfluoro-2-Propoxy Propionyl Fluoride	HFPO-DIMER	2.32	332	12	1.68	8.38E-04	0.0201	7.34
	Perfluoropropionyl fluoride	PPF	39.6	166	6	28.6	0.0143	0.344	125
	Perfluoropropyl vinyl ether	PPVE	6.77	266	10	5.09	2.55E-03	0.0611	22.3
	Propanoic Acid, 3-[1-[Difluoro [(Trifluoroethenyl oxy] Methyl]-1,2,2,2-Tetrafluoroethoxy] -2,2,3,3-Tetrafluoro-, Methyl	EVE	16.6	422	13	10.2	5.12E-03	0.123	44.8
	Tetrafluoro-2[Hexafluoro-2-(Tetrafluoro-2-{Fluorosulfonyl}Ethoxy) Propoxy Propionyl Fluoride	DA	9.29	512	16	5.80	2.90E-03	0.0696	25.4
	Tetrafluoro-2-[Tetrafluoro-2-(Fluorosulfonyl)Ethoxy]-Propanoyl Fluoride	MA	3.98	346	10	2.30	1.15E-03	0.0276	10.1
	Tetrafluoroethylene	TFE	37.4	100	4	29.9	0.0149	0.3587	131
	Perfluoro (4-methyl-3, 6-dioxaoct-7-ene) sulfonyl fluoride	PSEPVE	8.62	396	12	5.23	2.61E-03	0.0627	22.9
						Total NS-B Emissions	**0.0954**	**2.29**	**836**
NS-C	**carbonyl fluoride**	COF2	85.0	66	2	51.5	0.0257	0.618	226
	hexafluoropropylene	HFP	1.57	150	6	1.26	6.28E-04	0.0151	5.50
	hexafluoropropylene oxide	HFPO	1.74	166	6	1.26	6.30E-04	0.0151	5.52

Table B-3. Hydrogen Fluoride Potential To Emit

Source ID	Common Name	Chemical Name	Maximum Hourly Uncontrolled Emissions of Fluoride-Containing Compounds (lb/hr)	Molecular Weight	Number of F in Fluoride-containing Compound	Maximum HF Produced in Thermal Oxidizer (lb/hr)[a,b,c]	Max Potential HF Emissions (99.95% Scrubber Efficiency)		
							(lb/hr)	(lb/day)	(lb/yr)
	Perfluoro-2-Propoxy Propionyl Fluoride	HFPO-DIMER	2.32	332	12	1.68	8.38E-04	0.0201	7.34
	perfluoroacetyl fluoride	PAF	67.2	116	4	46.3	0.0232	0.556	203
	Perfluoroethoxypropionyl fluoride	PEPF	17.8	282	10	12.6	6.30E-03	0.151	55.2
	Perfluoroethyl vinyl ether	PEVE	0.988	216	8	0.732	3.66E-04	0.0088	3.20
	Perfluoromethoxypropionyl fluoride	PMPF	19.8	232	8	13.6	6.81E-03	0.163	59.7
	Perfluoromethyl vinyl ether	PMVE	4.02	166	6	2.91	1.45E-03	0.0349	12.7
						Total NS-C Emissions	**0.0659**	**1.58**	**578**
NS-D + NS-F	2-Hydroxytetrafluoroethane Sulfonic Acid Sultone	SU	0.0861	180	4	0.038	1.91E-05	4.59E-04	0.168
	Hydrogen Fluoride	HF	0.0287	20	1	2.87E-02	1.43E-05	3.44E-04	0.1257
	perfluoroacetyl fluoride	PAF	0.0861	116	4	0.0594	2.97E-05	7.12E-04	0.260
	Tetrafluoroethylene	TFE	28.4	100	4	22.7	0.0114	0.273	100
	RSU	RSU	0.0287	180	4	0.0127	6.37E-06	1.53E-04	0.0558
						Total NS-D and NS-F Emissions	**0.0114**	**0.274**	**100**
NS-E[j]	Carbonyl fluoride	COF2	11.9	66	2	7.22	8.02E-04	3.61E-03	3.61E-03
	Perfluoro-3,5,7,9,11-pentaoxadodecanoyl fluoride	TAF	27.8	446	14	17.4	8.72E-03	0.0392	0.0392
	Perfluoro-2,5-dimethyl-3,6-dioxanonanoyl fluoride	HFPO Trimer	17.1	498	18	12.4	6.20E-03	0.0279	0.0279
						Total NS-E Emissions	0.0185	0.0834	0.0834
NS-G[d]	Freon E2 fluorocarbon	E2	147	452	17	111	0.0555	1.33	486
	Tetrafluoroethylene	TFE	190	100	4	152	0.0761	1.83	666
	Perfluoro (4-methyl-3, 6-dioxaoct-7-ene) sulfonyl fluoride	PSEPVE	46.6	396	12	28.2	0.0141	0.3387	124
						Total NS-G Emissions	**0.146**	**3.50**	**1276**
NS-K	Freon E1 Fluorocarbon	E1	2.00	283	11	1.55	7.77E-04	0.0187	0.466
	Freon E2 fluorocarbon	E2	1.54	452	17	1.16	5.79E-04	0.0139	0.347
	Freon E3 Fluorocarbon	E3	0.0100	618	23	7.44E-03	3.72E-06	8.93E-05	2.23E-03
						Total NS-K Emissions	**1.36E-03**	**0.0326**	**0.816**
NS-M	Tetrafluoroethylene	TFE	791	100	4	633	0.316	1.53	470
NS-N	hexafluoropropylene oxide	HFPO	11.0	166	6	7.95	3.98E-03	0.0954	34.8
NS-O	Perfluoropropyl vinyl ether	PPVE	11.0	266	10	8.27	4.14E-03	0.0992	36.2
NS-P	Perfluoropropyl vinyl ether	PPVE	11.0	266	10	8.27	4.14E-03	0.0992	36.2
Total HF Emissions from Thermal Oxidizer/Scrubber Stack			**2,035**			**1,511**	**0.757**	**12.1**	**4,309**
Sources not controlled in the Thermal Oxidizer									
NS-A fugitives[f]	Hydrogen Fluoride equivalent	HF	0.0151	N/A	N/A	N/A	0.0151	0.363	132

Table B-3. Hydrogen Fluoride Potential To Emit

Source ID	Common Name	Chemical Name	Maximum Hourly Uncontrolled Emissions of Fluoride-Containing Compounds (lb/hr)	Molecular Weight	Number of F in Fluoride-containing Compound	Maximum HF Produced in Thermal Oxidizer (lb/hr)[a,b,c]	Max Potential HF Emissions (99.95% Scrubber Efficiency)		
							(lb/hr)	(lb/day)	(lb/yr)
NS-B fugitives[f]	**Hydrogen Fluoride equivalent**	HF	1.36E-03	N/A	N/A	N/A	1.36E-03	0.0327	11.9
NS-C fugitives[f]	**Hydrogen Fluoride equivalent**	HF	5.18E-04	N/A	N/A	N/A	5.18E-04	0.0124	4
NS-D fugitives[f]	**Hydrogen Fluoride equivalent**	HF	0.0053	N/A	N/A	N/A	0.0053	0.126	46
NS-E fugitives[f]	**Hydrogen Fluoride equivalent**	HF	0.0121	N/A	N/A	N/A	0.0121	0.290	106
NS-F fugitives[f]	**Hydrogen Fluoride equivalent**	HF	3.12E-03	N/A	N/A	N/A	3.12E-03	0.0750	27.3
NS-G2	**Hydrogen Fluoride equivalent**	HF	3.49E-04	N/A	N/A	N/A	3.49E-04	8.37E-03	1.70
NS-H	**Hydrogen Fluoride equivalent**	HF	0.0144	N/A	N/A	N/A	0.0144	0.346	126
AS-A[g]	**HFPO Dimer Acid Fluoride[h]**	HFPO DAF	3.65E-03	332.04	1	N/A	6.63E-06	1.59E-04	0.0578
SW-1	**Hydrogen Fluoride equivalent**	HF	6.94E-03	N/A	N/A	N/A	6.94E-03	0.0556	2.50
NS-B (room air)[i]	**HFPO Dimer Acid Fluoride**	HFPO DAF	0.0218	332.04	1	N/A	9.16E-05	2.31E-03	0.807
Potential Emissions from Sources not Routed to Thermal Oxidizer							**0.0592**	**1.31**	**458**
TOTAL POTENTIAL HYDROGEN FLUORIDE EMISSIONS							**0.816**	**13.4**	**4,767**

[a]Assumes that 100 percent of the fluorine atoms present in the uncontrolled PFAS vent stream are converted to HF. This conservatively overestimates HF emissions because the Thermal Oxidizer is proposed to reduce emissions by 99.99 percent.

[b] Calculated using the following equation $E_{HF} = E_{F\,CMPDS} * \left[\frac{MW_{HF}(^{lb}/_{lbmole})}{MW_{F\,CMPDS}(^{lb}/_{lbmole})}\right] * F$

where: E_{HF} = HF Emissions (lb/hr); $E_{F\,CMPDS}$ = Emissions of fluorinated compounds (lb/hr); MW_{HF} = Molecular weight of HF, 20 lb/lbmole; $MW_{F\,CMPDS}$ = Molecular weight of fluorinated compounds (lb/lb-mole); and F=Number of fluorine atoms in fluorinated compounds.

[c] In the spreadsheet provided by Chemours, controlled emissions were calculated using compound-specific emission reductions in the Thermal Oxidizer. Because the thermal oxidizer is supposed to reduce emissions of PFAS by 99.99 percent, the controlled emissions were recalculated using 99.99 percent.

[d]Does not include HF Emissions from the Fluorinator.

[e]Controlled emissions calculated using a scrubber control efficiency of 99.95 percent.

[f]Hydrogen fluoride emissions from these sources are assumed equal to emissions reported in 2017 AEI, except for NS-B fugitives. Using information in 2017 Inventory, outdoor fugitives are 40% of total. Therefore, NS-B Fugitives Potential was calculated by taking 40% of total reported fugitives. Indoor fugitives are represented under NS-B Room Air, which is presented separately.

[g] PPA Process assumed to operate 24 hr/day, 7 days/week, 50 week/year (per forms provided by Chemours). HFPO DAF Uncontrolled emissions of 3.65E-03 lb/hr and controlled emissions of 1.1E-04 lb/hr and 0.96 lb/yr provided by Chemours in 11/06/2018 response to Add Info.

[h]HFPO Dimer Acid Fluoride hydrolizes to form HFPO Dimer Acid and HF. For each mole of HFPO DAF, one mole of HF is formed during hydrolysis.

[i]VEN Room Air (NS-B, Room Air) assumed to operate 24 hr/day, 7 days/week, 50 week/year (per forms provided by Chemours). HFPO DAF Uncontrolled emissions of 2.18E-02 lb/hr and controlled emissions of 1.52E-03 lb/hr and 13.4 lb/yr provided by Chemours in 11/06/2018 response to Add Info.

[j]Chemous provided information about the stack emissions from this source. Emissions occur over a 4.5 hour period each year. Therefore, the maximum of annual emissions reported in the 2016 and 2017 AEIs were used to estimate potentials.

Table B-4. Actual Hydrogen Fluoride Emissions From 2017 Annual Emission Inventory by Process

Operating Scenario	Process ID	Process Description	2017 Operating Schedule				2017 Total Actual HF Emissions		
			hr/day	day/week	week/year	hr/yr	lb/day[a]	lb/hr[a]	lb/yr
Sources that will be Routed to the Thermal Oxidizer/Scrubber System									
OS-11	NS-A	HFPO Process	24	7	52	8760	8.86	0.368	3225
OS-12	NS-B	Vinyl Ethers North	24	7	52	8760	0.23	0.009	83
OS-13	NS-C	Vinyl Ethers South	24	7	46	7728	1.60	0.067	514
OS-14	NS-D	RSU Process	24	7	52	8760	0.0190	7.90e-04	6.92
OS-15	NS-E	FPS Liquid Waste Stabilization	4.5	1	1	4.5	0.0278	6.17E-03	0.0278
OS-16	NS-F	MMF Process	24	7	52	8760	0	0	0
OS-17	NS-G1	IXM Resins Process (except Fluorinator)	24	7	29	4872	In the 2017 AEI, the only HF emissions from this process were from the fluorinator. The remaining compounds were PFAS that did not readily form HF.		
OS-54	NS-M	TFE-CO_2 Separation	24	7	52	8760	In the 2017 AEI, these sources were not considered sources of HF because the PFAS emitted did not readily form HF. However, the PFAS will be destroyed in the Thermal Oxidizer and, as a result they become sources of HF.		
OS-58	NS-N	HFPO Container Decontamination	20	3	21	1260			
OS-59	NS-O	VEN Container Decontamination	4	1	52	208			
OS-60	NS-P	VES Container Decontamination	5	2	52	520			
OS-27	NS-K	E-2 Process	24	7	52	8760			
Total Emissions from Sources that will be routed to the thermal oxidizer							***10.7***	***0.445***	***3858***
Sources that will NOT be Routed to the Thermal Oxidzer/Scrubber System									
OS-11	NS-A	HFPO Process - fugitives	24	7	52	8760	0.363	0.0151	132
OS-12	NS-B	Vinyl Ethers North - fugitives	24	7	52	8760	8.19E-02	3.40E-03	29.8
OS-13	NS-C	Vinyl Ethers South - fugitives	24	7	46	7728	0.0124	5.18E-04	4.00
OS-14	NS-D	RSU Process - fugitives	24	7	52	8760	0.126	0.0053	46.0
OS-15	NS-E	FPS Liquid Waste Stabilization - fugitives	24	7	52	8760	0.290	0.0121	106

Table B-4. Actual Hydrogen Fluoride Emissions From 2017 Annual Emission Inventory by Process

Operating Scenario	Process ID	Process Description	2017 Operating Schedule				2017 Total Actual HF Emissions		
			hr/day	day/week	week/year	hr/yr	lb/day[a]	lb/hr[a]	lb/yr
OS-16	NS-F	MMF Process - fugitives	24	7	52	8760	0.0750	3.12E-03	27.3
OS-17	NS-G2	IXM Resins Process (fluorinator)	24	7	29	4872	8.37E-03	3.49E-04	1.70
OS-18	NS-H	IXM Membrane Process	24	7	52	8760	0.346	0.0144	126
OS-42	AS-A	PPA Process	24	7	32	5376	0.182	7.57E-03	40.7
OS-24	SW-1	Semiworks polymerization process	8	5	9	360	0.0556	6.94E-03	2.50
Total Emissions from Sources that will NOT be routed to the thermal oxidizer							***1.54***	***0.0687***	***516***
Total							**12.2**	**0.514**	**4,344**

Calculation

Emissions from high dispersion stacks = total emissions of sources that will be controlled in the oxidizer plus PPA emissions.
Daily emissions from high dispersion stacks = 10.7 lb/day + 0.182 lb/day **= 10.9 lb/day**

Hourly emissions from high dispersion stacks = 0.445 lb/hr + 7.57E-03 lb/hr **= 0.452 lb/hr**

Emissions from "all other sources" = total emissions of sources that will NOT be controlled in the oxidizer minus PPA emissions
Daily emissions from "all other sources" = 1.54 lb/day – 0.182 lb/day = **1.36 lb/day**

Hourly emissions from "all other sources" = 0.0687lb/hr – 7.57E-03 lb/hr **= 0.0611 lb/hr**

Post project emissions from high dispersion stacks = total potential HF Emissions (from Table B-3) + PPA potential emissions (from 11/6/2018 response to Add Info, see Table B-3) + VEN Room Air Emissions (from 11/6/2018 response to Add Info, see Table B-3)

Daily Emissions from high dispersion stacks = 12.1 lb/day + 1.59E-04 lb/day + 2.31E-03 lb/day **= 12.1 lb/day**

Hourly Emissions from high dispersion stacks = 0.757 lb/hr + 6.63E-06 lb/hr + 9.16E-05 lb/hr **= 0.757 lb/hr**

Post-project emissions from "all other sources" = total emissions of sources that will not be controlled in the oxidizer minus PPA Emissions minus VEN Room Air

Daily Emissions from "all other sources" = 1.31b/day - 1.59E-04 lb/day - 2.31E-03 lb/day = **1.31 lb/day**

Hourly Emissions from "all other sources" = 0.0592 - 6.63E-06 lb/hr - 9.16E-05 lb/hr = **0.0591 lb/hr**

ATTACHMENT C

Thermal Oxidizer/Scrubber System Project
TAP Emissions from Thermal Oxidizer Natural Gas Combustion
and from Diesel-Fired Emergency Generator

Information in the following tables are revisions by Chemours via email on November 27, 2018, to emissions originally provided in Permit Application No. 0900009.18B.

Table C-1. Emissions from Natural Gas Combustion in Thermal Oxidizer

POLLUTANT	Emission Factor[a]	Emissions[b]	
	lb/10^6scf	lb/yr	tpy
NO_X	100	8,538	4.27
CO	84	7,172	3.59
PM_{10}	7.6	649	0.32
$PM_{2.5}$	7.6	649	0.32
SO_2	0.6	51	0.03
TOC	11	939	0.47
VOC	5.5	470	0.23
CO_2	120,020	10,247,337	5,124
Methane	2.26	193	0.0966
Nitrous Oxide	0.23	19	0.0097
CO2e[c]	-	10,257,920	5,129
HAP/TAP			
Acetaldehyde (H,T)	1.52E-05	1.30E-03	6.49E-07
Acrolein (H,T)	1.80E-05	1.54E-03	7.68E-07
Ammonia (T)[d]	3.20E+00	2.73E+02	1.37E-01
Arsenic (H,T)	2.00E-04	1.71E-02	8.54E-06
Benzene (H,T)	2.10E-03	1.79E-01	8.96E-05
Benzo(a)pyrene (H,T)	1.20E-06	1.02E-04	5.12E-08
Beryllium (H,T)	1.20E-05	1.02E-03	5.12E-07
Cadmium (H,T)	1.10E-03	9.39E-02	4.70E-05
Chromic Acid (VI) (H,T)	1.40E-03	1.20E-01	5.98E-05
Cobalt (H)	8.40E-05	7.17E-03	3.59E-06
Formaldehyde (H,T)	7.50E-02	6.40E+00	3.20E-03
n-Hexane (H,T)	1.80E+00	1.54E+02	7.68E-02
Lead (H)	5.00E-04	4.27E-02	2.13E-05
Manganese (H,T)	3.80E-04	3.24E-02	1.62E-05
Mercury (H,T)	2.60E-04	2.22E-02	1.11E-05
Naphthalene (H)	6.10E-04	5.21E-02	2.60E-05
Nickel (H,T)	2.10E-03	1.79E-01	8.96E-05
Selenium (H)	2.40E-05	2.05E-03	1.02E-06
Toluene (H,T)	3.40E-03	2.90E-01	1.45E-04
Total HAPs	1.89E+00	1.61E+02	8.06E-02

[a] Emissions factors are from AP-42 except as noted.
[b] Emissions based on 10 MMBtu/hr and 8.54 MMft^3/year
[c] Emission factors for greenhouse gases obtained from 40 CFR 98 Subpart C. Global warming potential - 1 for CO_2, 25 for CH_4 and 298 for N_2O.
[d] From DAQs spreadsheet.

Table C-2. Emissions from Diesel-Fired Emergency Generator

Potential to Emit

Source	Stack ID	Heat Rating				Total Hrs of Operation	Total million Btu/yr	Total MW/yr
		kW	MW	hp	MMBtu/hr			
I- RICE-4	NEP-RICE 4	200	0.20	320	2.1	500	1,043	100

NO_x						CO			
EF Source	g/hp-hr	(lb/hr)	(lb/yr)	(tons/yr)	EF Source	g/hp-hr	(lb/hr)	(lb/yr)	(tons/yr)
Tier 3 Stnd[a]	2.77	1.96	979	0.489	Tier 3 Stnd	2.60	1.83	917	0.459
PM_{Total}					PM_{10}				
EF Source	g/hp-hr	lb/hr	(lb/yr)	(tons/yr)	EF Source	g/hp-hr	(lb/hr)	(lb/yr)	(tons/yr)
Tier 3 Stnd	0.15	0.106	52.9	0.0265	Tier 3 Stnd[b]	0.15	0.106	52.9	0.0265
$PM_{2.5}$					SO_2				
EF Source	g/hp-hr	(lb/hr)	(lb/yr)	(tons/yr)	EF Source	lb/MMBtu	(lb/hr)	(lb/yr)	(tons/yr)
Tier 3 Stnd[b]	0.15	0.11	52.9	0.0265	NCDAQ[c]	1.52E-03	6.06E-03	3.03	1.52E-03
VOC					CO_2				
EF Source	g/hp-hr	(lb/hr)	(lb/yr)	(tons/yr)	EF Source	kg/MMBtu	(lb/hr)	(lb/yr)	(tons/yr)
Tier 3 Stnd[a]	0.23	0.16	79.4	0.0397	40 CFR 98	53.06	244	122,053	61.0
CH_4					N_2O				
EF Source	kg/MMBtu	(lb/hr)	(lb/yr)	(tons/yr)	EF Source	kg/MMBtu	(lb/hr)	(lb/yr)	(tons/yr)
40 CFR 98	1.00E-03	9.47E-04	0.473	2.37E-04	40 CFR 98	1.00E-04	9.47E-05	0.0473	2.37E-05
Total HAPs					CO_{2e}				
EF Source	g/hp-hr	(lb/hr)	(lb/yr)	(tons/yr)			(lb/hr)	(lb/yr)	(tons/yr)
NCDAQ[c]	1.27E-02	8.98E-03	4.49	2.244E-03			244	122,079	61.0

[a] The emission factor for NO_X and VOC was based on the Tier 3 emission limit of 3.0 g/hp-hr and the ratio of the AP-42 emission factors.

[b] PM_{10} and $PM_{2.5}$ assumed to be equal to the Tier 3 emission limit of 0.15 g/hp-hr.

[c] HAP emissions based on the DAQ spreadsheet obtained from - https://deq.nc.gov/about/divisions/air-quality/air-quality-permits/application-forms-instructions/application-forms-air-quality-permit-construct-operate-non-title-v-title-v-facilities/spreadsheets

Table C-3. Speciated Emissions from Diesel-Fired Emergency Generator

Source	Stack ID	Heat Rating				Total Hrs of Operation	Total million Btu/yr	Total MW/yr
		kW	MW	hp	MMBtu/hr			
I- RICE-4	NEP-RICE 4	200	0.20	320	2.09	500*	1,043	100

*NOTE: Spreadsheet provided by Chemours used 100 hours per year of operation. The values presented in this table were calculated using 500 hours per year.

Pollutant	CAS #	Source of Emission Factor	Emission Factor		Emissions	
			lb/hp-hr	lb/MMBtu	lb/hr	tpy
Acetaldehyde (H,T)	75070	AP-42	5.37E-06	7.67E-04	1.72E-03	4.30E-04
Acrolein (H,T)	107028	AP-42	6.48E-07	9.25E-05	2.07E-04	5.18E-05
Arsenic unlisted compounds (H,T)	ASC-Other	AP-42	2.80E-08	4.00E-06	8.96E-06	2.24E-06
Benzene (H,T)	71432	AP-42	6.53E-06	9.33E-04	2.09E-03	5.22E-04
Benzo(a)pyrene (H,T)	50328	AP-42	1.32E-09	1.88E-07	4.21E-07	1.05E-07
Beryllium metal (unreacted) (H,T)	7440417	AP-42	2.10E-08	3.00E-06	6.72E-06	1.68E-06
1,3-Butadiene (H,T)	106990	AP-42	2.74E-07	3.91E-05	8.76E-05	2.19E-05
Cadmium metal (elemental unreacted) (H,T)	7440439	AP-42	2.10E-08	3.00E-06	6.72E-06	1.68E-06
Chromic Acid (VI) (H,T)	7738945	AP-42	2.10E-08	3.00E-06	6.72E-06	1.68E-06
Formaldehyde (H,T)	50000	AP-42	8.26E-06	1.18E-03	2.64E-03	6.61E-04
Lead unlisted compounds (H)	PBC-Other	AP-42	6.30E-08	9.00E-06	2.02E-05	5.04E-06
Manganese unlisted compounds (H,T)	MNC-Other	AP-42	4.20E-08	6.00E-06	1.34E-05	3.36E-06
Mercury vapor (H,T)	7439976	AP-42	2.10E-08	3.00E-06	6.72E-06	1.68E-06
Napthalene (H)	91203	AP-42	5.94E-07	8.48E-05	1.90E-04	4.75E-05
Nickel metal (H,T)	7440020	AP-42	2.10E-08	3.00E-06	6.72E-06	1.68E-06
Selenium compounds (H)	SEC	AP-42	1.05E-07	1.50E-05	3.36E-05	8.40E-06
Total PAH (H)		AP-42	1.18E-06	1.68E-04	3.76E-04	9.41E-05
Toluene (H,T)	108883	AP-42	2.86E-06	4.09E-04	9.16E-04	2.29E-04
Xylene (H,T)	1330207	AP-42	2.00E-06	2.85E-04	6.38E-04	1.60E-04
Highest HAP (Formaldehyde)	50000	AP-42	8.26E-06	1.18E-03	2.64E-03	6.61E-04
Total HAPs		AP-42	2.81E-05	4.01E-03	8.98E-03	2.24E-03
Aldehydes		AP-42	4.63E-04	7.00E-02	1.48E-01	3.70E-02