C. **Total Fugitive Emissions**

Emission Source	Stack Emissions lb VOC	Non-Stack Emissions lb VOC	Total Emissions lb VOC
Condensation Tower	1,649		1,649
Agitated Bed Reactor & Refining		2,855	2,855
AN		1,525	1,525
Total	**1,649**	**4,379**	**6,028**

D. **Speciated Equipment Emissions Summary**

Nafion® Compound	PMVE/PEVE Emissions (lbs)		PMVE Emissions (lbs)		PPVE Emissions (lbs)		Total Emissions (lbs)	
	Stack	Equip.	Stack	Equip.	Stack	Equip.	Stack	Equip.
PAF	181	62.5	248	85.5	0	0.0	429	148
PMPF	189	65.2	329	113.3	0	0.0	518	179
PEPF	794	273.9	0	0.0	0	0.0	794	274
PPF	0	0.0	0	0.0	0	0.0	0	0
PMVE	1	0.2	0	0.0	0	0.0	1	0
PEVE	0	0.0	0	0.0	0	0.0	0	0
PPVE	0	0.0	0	0.0	0	0.0	0	0
HFP	7,211	2486.7	1,261	434.8	0	0.0	8,472	2,922
TFE	1,534	529.0	135	46.4	0	0.0	1,669	575
HFPO	0	0.0	0	0.0	0	0.0	0	0
C4	0	0.0	0	0.0	0	0.0	0	0
C5	0	0.0	0	0.0	0	0.0	0	0
AN		762.3		762.3			0	1,525
COF2	932	321.6	245	84.6	0	0.0	1,178	406
TOTAL	**10,842**	**4,501**	**2,217**	**1,527**	**0**	**0**	**13,060**	**6,028**

Note: Speciated equipment emissions were estimated by assuming that each compound's equipment emission concentration was equal to that compound's stack emission fraction of the total stack emission. For example, the stack emission of PAF from the PM/PE process was 130 lb., with the total stack emission from the Vinyl Ethers South processes being 13,877 pounds. The total equipment emissions were 3,534 pounds.

Therefore, the PAF equipment emissions from the PM/PE process were determined by:

$$181 \text{ lb. PAF} \times \frac{6{,}028 \text{ lb. Total equipment emissions}}{13{,}060 \text{ lb. Total stack emmisions}} = 83.6 \text{ lb. PAF}$$

2004 Maintenance Emission Determination

A. Background

Periodically, vessels in the VE-South Plant are emptied for campaign switches and maintenance activity. Periodically, the process vessels in the VE-South plant are emptied for campaign switches and for maintenance. During the deinventory process, the liquid is transferred to another process vessel and then the gases are evacuated to the division waste gas scrubber. The amount of gasses from the PAF column, the condensation reactor, stripper column and low boiler column are already included in the vent flowmeter readings used to calculate emissions in previous sections. This section estimates maintenance emissions for the rest of the major process vessels.

B. Condensation Tower

Assume:

a) void fraction in distillation columns is 40%
b) ideal gas behavior
c) vessels are at atmospheric pressure
d) ambient temperature (25 deg C)
e) gasses are 90% acid fluorides and 10% non-acid Fluorides
f) average MW for acid fluoride component based on the respective acid fluoride for each campaign multiplied by the percentage of the total operating hours for each campaign = 250
g) average MW for non-acid fluoride component = 150 (assumed to be HFP)
h) number of deinventory events during the year = 3

List of Process Vessels

Condensation Tower	Volume (ft^3)	Volume (gal)
Reactor Decanter	9	70
A/F Column	5	37
A/F Decanter	2	16
A/F Overhead Receiver	25	184
Total Volume	**41**	**306**

VOC Emissions

n = PV/RT, where P = 14.7 psia, R = 10.7 psia-ft^3/lb-mol degR, V = 41 ft^3, T = 537 degrees R

$$n = \frac{PV}{RT} = \frac{14.7 \text{ psia}}{10.73 \frac{\text{psia-ft}^3}{\text{lbmol-degR}}} \times \frac{41 \text{ ft}^3}{537 \text{ degR}} = 0.10 \frac{\text{lb-mol gas}}{\text{deinventory event}}$$

$$0.10 \frac{\text{lb-mol gas}}{\text{deinventory event}} \times 3 \frac{\text{deinventory events}}{\text{year}} = 0.31 \frac{\text{lb-mol gas}}{\text{year}}$$

$$0.31 \frac{\text{lb-mol gas}}{\text{year}} \times 10\% \text{ non-A/F} \times 150 \frac{\text{lb non A/F}}{\text{lb-mol gas}} = 4.7 \text{ lb non-A/F} = 4.7 \textbf{ lb VOC}$$

Before-control A/F vented from Condensation:

$$0.31 \frac{\text{lb-mol gas}}{\text{year}} \times 90\% \text{ A/F} \times 250 \frac{\text{lb A/F}}{\text{lb-mol gas}} = 70 \text{ lb A/F}$$

After-control emissions utilizing the 99.6% control efficient Waste Gas Scrubber (WGS):

		70 lb A/F
Waste Gas Scrubber	x	(100%-99.6%) control efficiency
	=	0.28 lb A/F = **0.28 lb VOC**
Total VOC Emissions		4.7 lb/yr non-A/F VOC
	+	0.28 lb/yr A/F VOC
	=	**5.0 lb VOC**

C. Agitated Bed Reactor & Refining

Assume: a) void fraction in distillation columns is 40%
b) ideal gas behavior
c) vessels are at atmospheric pressure
d) ambient temperature (25 deg C)
e) gasses are 100% vinyl ethers
f) average MW for vinyl ethers based on the respective vinyl ether for each campaign multiplied by the percentage of the total operating hours for each campaign = 186
g) number of deinventory events = 3

HF Potential
Vinyl ethers are VOCs without the potential to form HF

List of Process Vessels

Agitated Bed Reactor & Refining	Volume ft^3	Volume gal
Product Column	8	59
PMVE/PPVE Product Receiver	68	507
Total Volume	**76**	**566**

VOC Emissions

$n = PV/RT$, where $P = 14.7$ psia, $R = 10.7$ psia-ft^3/lb-mol degR
$V = 76$ ft^3, $T = 537$ degrees R

$$n = \frac{PV}{RT} = \frac{14.7 \text{ psia} \times 76 \text{ ft}^3}{10.73 \text{ psia-ft}^3\text{/lbmol/R} \times 537 \text{ R}} = 0.19 \frac{\text{lb-mol gas}}{\text{deinventory event}}$$

$$0.19 \frac{\text{lb-mol gas}}{\text{deinventory event}} \times \frac{3 \text{ deinventory events}}{\text{year}} = 0.58 \frac{\text{lb-mol gas}}{\text{year}}$$

VOC Emissions from ABR & Refining

$$0.58 \text{ lb mol} \times 186 \frac{\text{lb VOC}}{\text{lb-mol VOC}} = \textbf{108 lb VOC}$$

D. Total Maintenance Emissions

Emission Source	Emission lb VOC
Condensation Tower	5
Agitated Bed Reactor & Refining	108
Total Maintenance Emissions	**113**

E. Speciated Maintenance Emissions Summary

Nafion®	PM/PE Emissions (lbs)		PMVE Emissions (lbs)		PPVE Emissions (lbs)		Total Emissions (lbs)	
	Stack	Maint.	Stack	Maint.	Stack	Maint.	Stack	Maint.
PAF	181	1.6	248	2.1	0	0	429	4
PMPF	189	1.6	329	2.8	0	0	518	4
PEPF	794	6.9	0	0.0	0	0	794	7
PPF	0	0.0	0	0.0	0	0	0	0
PMVE	1	0.0	0	0.0	0	0	1	0
PEVE	0	0.0	0	0.0	0	0	0	0
PPVE	0	0.0	0	0.0	0	0	0	0
HFP	7,211	62.2	1,261	10.9	0	0	8,472	73
TFE	1,534	13.2	135	1.2	0	0	1,669	14
HFPO	0	0.0	0	0.0	0	0	0	0
C4	0	0.0	0	0.0	0	0	0	0
C5	0	0.0	0	0.0	0	0	0	0
COF2	932	8.0	245	2.1	0	0	1,178	10
TOTAL	**10,842**	**94**	**2,217**	**19**	**0**	**0**	**13,060**	**113**

Note: Speciated maintenance emissions were estimated by assuming that each compound's emission concentration from maintenance activities was equal to that compound's stack emission fraction of the total stack emission. For example, the stack emission of PAF from the PM/PE process was 130 lb., with the total stack emission from the Vinyl Ethers South processes being 13,877 pounds. The total maintenance emissions were 150 pounds.

Therefore, the PAF maintenance emissions from the PE/PM process were determined by:

$$181 \text{ lb. PAF} \times \frac{113 \text{ lb. Total maintenance emissions}}{13{,}060 \text{ lb. Total stack emmisions}} = 1.6 \text{ lb. PAF}$$

2004 Accidental Releases to Atmosphere

A. 2004-094 Date: 8/12/2004

			% of AF Release
1	**HFPO Dimer**	CAS No. **2062-98-8**	1%
2	**ED**	CAS No. **NA**	1%
3	**MD**	CAS No. **NA**	1%
4	**COF2**	CAS No. **353-50-4**	6%
5	**PAF**	CAS No. **354-34-7**	6%
6	**PMPF**	CAS No. **2927-83-5**	43%
7	**PEPF**	CAS No. **1682-78-6**	43%
8	**AN Solvent**	CAS No. **75-05-8**	Not AF

Material Released: Acid Fluorides (HFPO Dimer, Ethoxy-dimer, Methoxy-dimer, and COF2/PAF)
Quantity Released: 30 lbs

1. Perfluoro-2-Propoxy Propionyl Fluoride (HFPO Dimer)

Material Released: HFPO Dimer
Quantity Released: 0.14 kgs = 0.3 lbs of HFPO Dimer

Each mole of HFPO Dimer (MW = 332) can generate 1 mole of HF (MW = 20).

$$1\,kg\,Dimer\frac{1\,mole Dimer}{332g\,Dimer}\cdot\frac{20g\,HF}{1\,mole HF}\cdot\frac{1\,mole HF}{1\,mole Dimer}=0.06kg\,HF$$

Therefore, each 1 kg of HFPO Dimer generates 0.060 kg of HF

HF Potential:

	0.14	kgs HFPO Dimer
x	0.060	kg of HF
	0.01	kg of HF = 0.02 lbs of HF

2. Ethoxy Dimer (ED)

Material Released: ED
Quantity Released: 0.14 kg = 0.3 lbs of ED

Each mole of Ethoxy Dimer (MW = 448) can generate 1 mole of HF (MW = 20).

$$1\,kg\,Dimer\frac{1\,mole Dimer}{448g\,Dimer}\cdot\frac{20g\,HF}{1\,mole HF}\cdot\frac{1\,mole HF}{1\,mole Dimer}=0.045kg\,HF$$

Therefore, each 1 kg of Ethoxy Dimer generates 0.045 kg of HF

HF Potential:

	0.14	kgs Ethoxy Dimer
x	0.045	kg of HF
	0.01	kg of HF = 0.01 lbs of HF

3. Methoxy Dimer (MD)

Material Released: MD

Quantity Released: 0.14 kg = 0.3 lbs MD

Each mole of Methoxy Dimer (MW = 398) can generate 1 mole of HF (MW = 20).

$$1\,kg\,Dimer\frac{1\,moleDimer}{398g\,Dimer}\cdot\frac{20g\,HF}{1\,moleHF}\cdot\frac{1\,moleHF}{1\,moleDimer}=0.05kg\,HF$$

Therefore, each 1 kg of Methoxy Dimer generates 0.050 kg of HF

HF Potential:

0.14	kgs Methoxy Dimer
x 0.050	kg of HF
0.01	kg of HF = 0.02 lbs of HF

4. Carbonyl Fluoride (COF2)

Material Released: COF2
Quantity Released: 0.82 kg = 1.80 lbs COF2

HF Potential:

Each mole of COF2 (MW = 66) can generate 2 moles of HF (MW = 20).

$$1\,kg\,COF_2\cdot\frac{1\,moleCOF_2}{66\,g\,COF_2}\cdot\frac{20\,g\,HF}{1\,moleHF}\cdot\frac{2\,molesHF}{1\,moleCOF_2}=0.606\,kg\,HF$$

Therefore, each kg of COF2 generates 0.606 kg HF

0.82	kg COF2
x 0.606	kg HF/kg COF2
0.495	kg HF = 0.22 lbs HF

5. Perfluoroacetyl Fluoride (PAF)

Material Released: PAF
Quantity Released: 0.82 kg = 1.80 lbs PAF

HF Potential:

Each mole of PAF (MW = 116) can generate 1 mole of HF (MW = 20).

$$1\,kg\,PAF\cdot\frac{1\,molePAF}{116g\,PAF}\cdot\frac{20g\,HF}{1\,moleHF}\cdot\frac{1\,moleHF}{1\,molePAF}=0.172kg\,HF$$

Therefore, each kg of PAF generates 0.172 kg HF

0.82	kg PAF
x 0.172	kg HF/kg PAF
0.141	kg HF = 0.06 lbs HF

6. Perfluoromethoxypropionyl fluoride (PMPF)

Material Released: PMPF
Quantity Released: 5.78 kg = 12.75 lbs PMPF

HF Potential:

Each mole of PMPF (MW = 232) can generate 1 mole of HF (MW = 20).

$$1\,kg\,PMPF \frac{1\,mole\,PMPF}{232g\,PMPF} \cdot \frac{20g\,HF}{1\,mole\,HF} \cdot \frac{1\,mole\,HF}{1\,mole\,PMPF} = 0.086\,kg\,HF$$

Therefore, each kg of PMPF generates 0.086 kg HF

	5.7833621 kg PMPF		
x	0.086 kg HF/kg PAF		
	0.499 kg HF	=	0.23 lbs HF

7. Perfluoroethoxypropionyl fluoride (PEPF)

Material Released: PEPF
Quantity Released: 5.78 kg = 12.75 lbs PEPF

HF Potential:

Each mole of PEPF (MW = 282) can generate 1 mole of HF (MW = 20).

$$1\,kg\,PEPF \frac{1\,mole\,PEPF}{282g\,PEPF} \cdot \frac{20g\,HF}{1\,mole\,HF} \cdot \frac{1\,mole\,HF}{1\,mole\,PEPF} = 0.071\,kg\,HF$$

Therefore, each kg of PEPF generates 0.071 kg HF

	5.7833621 kg PEPF		
x	0.071 kg HF/kg PAF		
	0.410 kg HF	=	0.19 lbs HF

8. Acetonitrile Solvent (AN)

Material Released: AN Solvent CAS No 75-05-8
Quantity Released: 120 lbs

AN is a VOC and Hazardous Air Pollutant without the potential to form HF.

Total HF Potential

Source	*lbs HF*
HFPO Dimer	0.02
ED	0.01
MD	0.02
COF2	0.22
PAF	0.06
PMPF	0.23
PEPF	0.19
Total	0.75

B. 2004-103 Date: 9/2/2004

Material Released:	COF2		CAS No. 353-50-4		
Quantity Released:	1	kg	=	0.45	lbs COF2

HF Potential:

Each mole of COF2 (MW = 66) can generate 2 moles of HF (MW = 20).

$$1\,kg\,COF_2 \cdot \frac{1\,mole COF_2}{66\,g\,COF_2} \cdot \frac{20\,g\,HF}{1\,mole HF} \cdot \frac{2\,moles HF}{1\,mole COF_2} = 0.606\,kg\,HF$$

Therefore, each kg of COF2 generates 0.606 kg HF

	1 kg COF2		
x	0.606 kg HF/kg COF2		
	0.606 kg HF	=	0.28 lbs HF

C. 2004-110 Date: 9/16/2004

Material Released:	PAF	CAS No. 354-34-7		
Quantity Released:	0.1	kg	=	0.05 lbs PAF

HF Potential:

Each mole of PAF (MW = 116) can generate 1 mole of HF (MW = 20).

$$1\,kg\,PAF \cdot \frac{1\,mole PAF}{116\,g\,PAF} \cdot \frac{20\,g\,HF}{1\,mole HF} \cdot \frac{1\,mole HF}{1\,mole PAF} = 0.172\,kg\,HF$$

Therefore, each kg of PAF generates 0.172 kg HF

	0.1 kg PAF			
x	0.172 kg HF/kg PAF			
	0.017 kg HF	=	0.01	lbs HF

D. Total Emissions from Accidental Releases

Source		lb MD	lb HFPO Dimer	lb ED	lb PMPF	lb PEPF	lb AN	lb COF2	lb PAF	lb/yr VOC Total	lb/yr HF
A.	2004-094	0.30	0.30	0.30	12.75	12.75	120	1.80	1.80	150	0.75
B.	2004-103							0.45		0.45	0.28
C.	2004-110								0.05	0.05	0.01
	Total	**0.30**	**0.30**	**0.30**	**12.75**	**12.75**	**120.00**	**2.25**	**1.85**	**150**	**1.03**

2004 Emission Summary

A. VOC Emissions Summary

Nafion® Compound	CAS Chemical Name	CAS No.	PE/PM Emissions (lbs)	PM Only Emissions (lbs)	PPVE Emissions (lbs)	Accidental Releases (lbs)	Total Emissions (lbs)
PAF	Perfluoroacetyl Fluoride	354-34-7	245	335	0	1.85	583
PMPF	Perfluoromethoxypropionyl fluoride	2927-83-5	256	445	0	12.75	713
PEPF	Perfluoroethoxypropionyl fluoride	1682-78-6	1,075	0	0	12.75	1,088
PPF	Perfluoropropionyl fluoride	422-61-7	0	0	0		0.0
PMVE	Perfluoromethyl vinyl ether	1187-93-5	1	0	0		1
PEVE	Perfluoroethyl vinyl ether	10493-43-3	0	0	0		0
PPVE	Perfluoropropyl vinyl ether	1623-05-8	0	0	0		0
HFP	Hexafluoroproplyene	116-15-4	9,760	1707	0		11,466
TFE	Tetrafluoroethylene	116-14-3	2,076	182	0		2,259
HFPO	Hexafluoroproplyene Epoxide	428-59-1	0	0	0		0.0
COF2	Carbonyl Fluoride	353-50-4	1,262	332	0	2.3	1,596.6
AN	Acetonitrile	75-05-8	762	762		120.0	1,644.6
ED	Ethoxy Dimer	NA				0.3	
MD	Methoxy Dimer	NA				0.3	
C4	Perfluoro-2-butene	360-89-4	0	0	0		0
C5	Perfluoropentene	376-87-4	0	0	0		0
	Total VOC Emissions (lbs)		**15,437**	**3,763**	**0**	**150**	**19,351**
	Total VOC Emissions (tons)		**7.7**	**1.9**	**0.0**	**0.1**	**9.7**

B. VOC Control Device Efficiency

VOCs Generated				VOCs Emitted After Control			
Point Source Generated (lbs)	Equipment Emissions (lbs)	Maintenance Emissions (lbs)	Total VOC Generated (lbs)	Point Source Emissions (lbs)	Equipment Emissions (lbs)	Maintenance Emissions (lbs)	Total VOC Emitted (lbs)
741,865	6,028	113	748,006	13,060	6,028	113	19,201

748,006 lb VOC generated
\- 19,201 lb VOC emitted
= 728,805 lb VOC removed in control device

728,805 lb VOC removed in control device
/ 748,006 lb VOC generated
= **97.43%** VOC control device efficiency

C. Toxic Air Pollutant and Hazardous Air Pollutant Summary (TAPS/HAPS)

Nafion® Compound	CAS Chemical Name	CAS No.	PE/PM Emissions (lbs)	PM Only Emissions (lbs)	PPVE Emissions (lbs)	Accidental Releases (lbs)	Total Emissions (lbs)
HF	Hydrogen Fluoride	7664-39-3	906	297	0	1.03	1,204
Acetonitrile	Acetonitrile	75-05-8	762	762	0	120.0	1,645

D. HF Control Device Efficiency

889 lb HF emitted from Point Sources
/ (100%-99.6%) Stack Efficiency
= 222,204 lb HF sent to control device from Point Sources

222,204 lb HF sent to control device from Point Sources
\- 1,204 lb HF emitted
= 221,000 lb HF removed in control device

221,000 lb HF removed in control device
/ 222,204 lb HF generated
= **99.46% HF control device efficiency**

Facility Name: DuPont Company – Fayetteville Works
22828 NC Highway 87 West
Fayetteville, NC 28302

Facility ID : 0900009
Permit : 03735
County : Bladen
DAQ Region : FRO

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory – Calendar Year 2004

1. **Emission Source ID (from permit) or Emission Source Group ID** NS–D
2. **Emission Source Description**: Nafion RSU process
3. **Operating Scenario ID/Description**: OS – 14/Nafion RSU process
4. **SCC Number/Description**: 30199998/*Other Organic Chemica Manufacture Not Listed
5. **Throughput/units in 2004**:
(e.g. production or fuel use):
6. **Fuel Information** (If fuel is used)

% Sulfur		% Ash		Heat Content (Btu/units)	

7. **Capture Efficiency**
(% of Emissions from this Process Vented to Control Device or Stack): 100

. **Control Device Information :**

Order	CS–ID	CD ID (as listed in permit)	Control Device Description
1	CS–6	NCD–Hdr–1	Baffle plate–type tower waste gas scrubber

9. **Emission Release Point (ERP) Information: (Sources vented to more than one ERP use additional entry lines):**

ERP ID	ERP Type	Height (in feet)	Diameter Circle (enter #): Rectangle (L x W) (in 0.1 feet)	Temperature (F)	Velocity (Feet/sec)	Volume Flow Rate (Acfm)	ERP Description
EP–NEP–Hdr1	VERTICAL STACK	85	3	75	58	24598.67	Nafion scrubber Hdr1

Operating Scenario: OS – 14 **Emission Source/Group ID:** NS–D

10. Operating Schedule: (Source/Operating Scenario that best characterizes Calendar Year 2004)
Hours per Day (24) Days per Week (7) Weeks per Year (52)

11. Typical Start & End Times For Operating Scenario: Start: 0 End: 2359

12. Seasonal Periods Percent Annual Throughput:

Jan–Feb + Dec 2004	25%	March–May 2004	25%	June–Aug. 2004	25%	Sept.–Nov. 2004	25%

13. Actual Emissions per Pollutant Listed :
Attach calculations and documentation of emission factors or other estimation methods used.

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions– Criteria Pollutants (Tons/Year)	Emission Estimation Method Code (See Instructions)	Control Efficiency (Net after all controls)
		2004		
SO2	SO2	0	02	99.6
VOC	VOC	1.43	02	99.6
HAP/TAP Pollutants (In Alphabetical Order)	CAS (see instructions)	Emissions HAP/TAPS (Pounds/Year)	Emission Estimation Method Code (See Instructions)	Control Efficiency (Net after all controls)
		2004		
Hydrogen fluoride (hydrofluoric acid as mass of HF– Component of Fluorides)	7664–39–3	39.07	02	99.6
Sulfuric acid	7664–93–9	181.9	02	99.6

CONFIDENTIAL INFORMATION

Supporting documentation for the determination of air emissions from this emission source contains DuPont Confidential Business Information, which if made public would divulge the manufacturing method, process, and/or capacity, and has therefore been intentionally excluded from the Public Copy of this Air Emissions Inventory as allowed by North Carolina General Statutes §132-1.2, §143-215.3C(a), and §143-215.65.

2004 Air Emissions Inventory Supoorting Documentation

Emission Source ID No.: NS-D

Emission Source Description: Nafion RSU Process

Process and Emission Description:

The RSU process is a continuous manufacturing process. All emissions from this process vent to the Nafion Division Waste Gas Scrubber (WGS),Control Device ID No. NCD-Hdr1, which has a documented efficiency of 99.6%. The control of emissions of certain compounds will be addressed in the attached spreadsheet. Certain components (i.e. TFE) pass completely through the scrubber, therefore the efficiency is assumed to be 0%.

Basis and Assumptions:

The RSU process flowsheet #4 (W1207831) is used as a basis for relative compositions and flow rates of vent streams to the division WGS. A 30 kg/hr maximum RSU production rate is used as the basis for maximum vent rates.

Information Inputs and Source of Inputs:

Information Input	Source of Inputs
RSU production quantity	RSU Production Facilitator
Speciated emission rates	RSU Process Flowsheet #4 (W1207831)

Point Source Emissions Determination:

Point source emissions for individual components are given in the following pages. A detailed explanation of the calculations are attached.

Equipment Emissions and Fugitive Emissions Determination:

Emissions from equipment leaks which vent as stack (point source) emissions and true fugitive (non-point source) emissions have been determined using equipment component emission factors established by DuPont. The determination of those emissions are shown in a separate section of this supporting documentation.

Fugitive and Equipment Emissions Determination (Non-point Source):

Fugitive (FE) and Equipment Emissions (EE) are a function of the number of emission points in the plant (valves, flanges, pump seals). The inventory shown below is conservative and based on plant and process diagrams. Note that the calculations below include equipment emissions inside as well as equipment emissions outside (fugitive emissions).

A. Equipment emissions from SU Reactor, Rearranger, RSU Still and RSU Hold Tank:

Emissions are vented from equipment located inside the RSU barricade and are vented to a vent

Barricade:

Valve emissions:	250 valves x 0.00036 lb/hr/valve	=	0.090 lb/hr EE
Flange emissions:	550 flanges x 0.00018 lb/hr/flang	=	0.045 lb/hr EE
Total equipment emission rate		=	0.135 lb/hr EE

Days of operation = 93

On average 0.13 lbs of HF are produced for every 1 lb of RSU, SU or PAF.

VOC:

	0.135 lb/hr EE
x	24 hours/day
x	93 days/year
=	**300.5 lb/yr VOC from EE**

HF:

	0.135 lb/hr EE
x	24 hours/day
x	93 days/year
x	0.13 lb HF per lb VOC
=	**39.1 lb/yr HF from EE**

B. Fugitive Emissions From SO3 Storage Tank and Vaporizer

This equipment is not inside a building, therefore emissions are true Fugitive Emissions

Valve emissions:	85 valves x 0.00036 lb/hr/valve	=	0.031	lb/hr FE
Flange emissions:	180 flanges x 0.00018 lb/hr/flang	=	0.032	lb/hr FE
Total fugitive emission rate		=	0.063	lb/hr FE

SO3:

	0.063 lb. FE/hr
x	24 hours/day
x	93 days/year
=	**140.6 lb/yr SO3 from EE**

H2SO4:

	0.063	lb. FE/hr
x	24	hours/day
x	93	days/year
x	1.225	lb H2SO4 per lb SO3
=	**172.3**	**lb/yr H2SO4 from FE**

C. Fugitive Emissions From EDC Tank

This equipment is not inside a building, therefore emissions are true Fugitive Emissions

Valve emissions:	20 valves x 0.00036 lb/hr/valve	=	0.007	lb/hr FE
Flange emissions:	10 flanges x 0.00018 lb/hr/flange	=	0.002	lb/hr FE
Total fugitive emission rate		=	0.009	lb/hr FE

VOC:

	0.009 lb/hr FE
x	24 hours/day
x	93 days/year
=	**20.1 lb/yr VOC from FE**

HF: 0

D. Total RSU Plant Non-Point Source Emissions

	Equipment Emissions		Fugitive Emissions		
Emission Source	VOC lb/yr	HF lb/yr	VOC lb/yr	SO3 lb/yr	H2SO4 lb/yr
A. Equipment Emissions from SU Reactor, Rearranger, Still and Hold Tank	300.5	39.1	0	0	0
B. Fugitive Emissions From SO3 Storage Tank and Vaporizer	0	0	0	140.6	172.3
C. Fugitive Emissions From EDC Tank	0	0	20.1	0	0
Total for 2004	300.5	39.1	20.1	140.6	172.3

E. VOC Emission by Source Type

Nafion® Compound	Emissions from Stack (lb)	Equipment Emissions (lb)	Fugitive Emissions (lb)	Accidental Releases (lb)	Total Emissions (lb)
TFE	2520.0	298.6	0	0	2818.6
PAF	7.0	0.8	0	0	7.8
RSU	2.4	0.3	0	462.0	464.6
SU	7.0	0.8	0	0	7.8
EDC	0	0	20.1	0	20.1
Total	**2536.3**	**300.5**	**20.1**	**462.0**	**3318.9**

Note: Speciated equipment emissions were estimated by assuming that each compound's equipment emission concentration was equal to that compound's stack emission fraction of the total stack emission.

Example: The TFE equipment emissions were determined by the ratio of the TFE stack emission (1,997.9 lb) divided by the total stack emission (2,010.8 lb), multiplied by the total equipment emissions (229.4 lb).

Specifically: $\frac{2520.0}{2536.3} \times 300.5 = 298.6$ lb. TFE

Emission Summary

A. VOC Emissions by Compound and Source

Nafion® Compound	CAS Chemical Name	CAS No.	Point Source Emissions	Fugitive Emissions (lbs)	Equipment Emissions (lbs)	Accidental Emissions (lbs)	Total VOC Emissions (lbs)
TFE	Tetrafluoroethylene	116-14-3	2520.0	0	298.6	0	2818.6
PAF	Trifluoroacetyl Fluoride	354-34-7	7.0	0	0.8	0	7.8
RSU	Difluoro(Fluorosulfonyl)Acetyl Fluoride	677-67-8	2.4	0	0.3	0.0	2.6
SU	2-Hydroxytetrafluoroethane Sulfonic Acid Sultone	697-18-7	7.0	0	0.8	0	7.8
EDC	1,2-Dichloroethane	107-06-2	0	20.1	0	0	20.1
Total for 2004			**2536.3**	**20.1**	**300.5**	**0.0**	**2856.9**
						Tons	**1.43**

B. Toxic Air Pollutant Summary

Nafion® Compound	CAS Chemical Name	CAS No.	Point Source Emissions	Fugitive Emissions (lbs)	Equipment Emissions (lbs)	Accidental Emissions (lbs)	Total TAP Emissions (lbs)
HF	Hydrogen Fluoride	7664-39-3	2.23	0	39.1	0.0	**39.07**
H2SO4	Sulfuric Acid	7664-93-9	9.7	172.3	0	0	**181.9**

C. Criteria Air Pollutant Summary

Nafion® Compound	CAS Chemical Name	CAS No.	Point Source Emissions	Fugitive Emissions (lbs)	Equipment Emissions (lbs)	Accidental Emissions (lbs)	Total VOC Emissions (lbs)
SO2	Sulfur dioxide	7446-09-5	3.8	0	0	0	**3.8**

Facility Name: DuPont Company – Fayetteville Works
22828 NC Highway 87 West
Fayetteville, NC 28302

Facility ID : 0900009
Permit : 03735
County : Bladen
DAQ Region : FRO

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory – Calendar Year 2004

1. **Emission Source ID (from permit) or Emission Source Group ID** NS–E
2. **Emission Source Description:** Nafion liquid waste stabilization
3. **Operating Scenario ID/Description:** OS – 15/Nafion liquid waste stabilization
4. **SCC Number/Description:** 30199998/*Other Organic Chemica Manufacture Not Listed
5. **Throughput/units in 2004:** (e.g. production or fuel use): 1584381 LB/yr
6. **Fuel Information** (If fuel is used)

% Sulfur		% Ash		Heat Content (Btu/units)	

7. **Capture Efficiency** (% of Emissions from this Process Vented to Control Device or Stack): 100

8. **Control Device Information :**

Order	CS–ID	CD ID (as listed in permit)	Control Device Description
1	CS-6	NCD–Hdr–1	Baffle plate–type tower waste gas scrubber

9. **Emission Release Point (ERP) Information: (Sources vented to more than one ERP use additional entry lines):**

ERP ID	ERP Type	Height (in feet)	Diameter Circle (enter #): Rectangle (L x W) (in 0.1 feet)	Temperature (F)	Velocity (Feet/sec)	Volume Flow Rate (Acfm)	ERP Description
EP–NEP–Hdr1	VERTICAL STACK	85	3	75	58	24598.67	Nafion scrubber Hdr1

Operating Scenario: OS – 15 **Emission Source/Group ID:** NS–E

10. Operating Schedule: (Source/Operating Scenario that best characterizes Calendar Year 2004)
Hours per Day (24) Days per Week (7) Weeks per Year (52)

11. Typical Start & End Times For Operating Scenario: Start: 0 End: 2359

12. Seasonal Periods Percent Annual Throughput:

Jan–Feb + Dec 2004	25%	March–May 2004	25%	June–Aug. 2004	25%	Sept.–Nov. 2004	25%

13. Actual Emissions per Pollutant Listed :
Attach calculations and documentation of emission factors or other estimation methods used.

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions–Criteria Pollutants (Tons/Year)	Emission Estimation Method Code (See Instructions)	Control Efficiency (Net after all controls)
		2004		
VOC	VOC		02	99.6
HAP/TAP Pollutants (In Alphabetical Order)	**CAS** (see instructions)	**Emissions HAP/TAPS** (Pounds/Year)	**Emission Estimation Method Code** (See Instructions)	**Control Efficiency** (Net after all controls)
		2004		
Hydrogen chloride (hydrochloric acid)	7647–01–0	0	08	99.6
Hydrogen fluoride (hydrofluoric acid as mass of HF– Component of Fluorides)	7664–39–3	125.3	02	99.6

2004 AIR EMISSIONS INVENTORY SUPPORTING DOCUMENTATION

Emission Source ID No.: NS-E

Emission Source Description: Nafion Liquid Waste Stabilization

Process & Emission Description:

The Nafion liquid waste stabilization is a continuous system of storage with batch neutralization. To comply with the regulatory requirements of RCRA SubPart CC, neither the storage tank nor the reactor vent during normal operating conditions. All venting from this system occurs as a non-routine maintenance activity, which is detailed in the following pages. All emissions from this system are vented through the Nafion Division Waste Gas Scrubber (Control Device ID No. NCD-Hdr1) which has a documented control efficiency of 99.6% for acid fluoride compounds. The control of emissions of specific compounds will be addressed and detailed in the following pages.

The Nafion liquid waste stabilization process emits compounds in the acid fluoride family. In the presence of water, these acid fluorides will eventually hydrolyse to hydrogen fluoride. For the purpose of this emissions inventory, a conservative approach will be take and the acid fluorides will be reported both as a VOC and as the equivalent quantity of hydrogen fluoride.

Basis and Assumptions:

- For the HF emissions the entire gas flow is assumed to be HF
- The VOC emissions are assumed to be 30% COF_2 and 70% TAF
- The reactor and storage tank are assumed to have the same concentration.
- The ideal gas law is used.

Information Inputs and Source Inputs:

Information Input	Source of Inputs
Weight of Tank	IP21 (H3450WG and H3606WG)
Category and Reason for Emission	Waste Mechanical Facilitator

Point Source Emissions Determination:

Shown on the following pages

Fugitive Emissions Determination:

Shown on the following pages.

Stack Emissions from Maintenance Activity

Background

Before performing maintenance on the reactor or storage tank, the pressure from the system is vented to the Division WGS. Each vent is recorded in IP21 by the weight before and after the vent. See chart below.

Date	Tank	Category	Reason	Tank Weight	
				Initial (kg)	Final (kg)
4/6/04	Storage Tank	Maintenance	RV RM	202	162
9/22/04	Reactor	Maintenance	RV RM	283	254
10/29/04	Storage Tank	Maintenance	RV RM	107	105
11/3/04	Reactor	Maintenance	RM	131	112
11/10/04	Storage Tank	Maintenance	RM	248	229

Sample calculation using maintenance activity dated 4/6/04

Initial Weight minus Final Weight equals kg vented to Division WGS

202 kg minus 162 kg equals 39 kg vented to WGS

Assume that all of the above is VOC emissions This assumption also overstates the true emissions as inerts, such as nitrogen are not counted.

After-control emissions utilizing the 99.6% control efficient Waste Gas Scrubber (WGS):

Percentage of acid fluoride VOCs removed by the WGS = 99.6%
Percentage of acid fluoride VOCs vented from the WGS = 100% minus 99.6%
Percentage of acid fluoride VOCs vented from the WGS = 0.4%

Therefore, VOCs vented to the atmosphere from the 4/6/04 maintenance activity is equal to:

Amount of VOCs vented to WGS: 39 kg of VOC
Percentage of VOCs vented from the WGS: x 0.4%
Quantity of VOCs vented from the WGS: = 0.1578 kg VOC
= **0.3479 lb VOC**

Stack Emissions from Maintenance Activity (cont.)

<u>VOC Emissions by Compound</u>

Assume that the vapor is 30% COF2 and 70% TAF. This assumption is based on process knowledge of the system.

Quantity of VOCs vented from the WGS (see previous page) = **0.3479 lb VOC**

COF2 (carbonyl fluoride) **CAS No. 353-50-4**

Sample calculation using maintenance activity dated 4/6/04

VOC emissions would be equal to:

$$\frac{0.348 \text{ lb VOC}}{} \left| \frac{0.30 \text{ lb COF2}}{\text{lb VOC}} \right. = 0.1044 \text{ lb COF2}$$

TAF (telomeric acid fluoride) **CAS No. 690-43-7**
(perfluoro-3,5,7, 9,11-pentaoxadodecanoyl fluoride)

Sample calculation using maintenance activity dated 4/6/04

VOC emissions would be equal to:

$$\frac{0.348 \text{ lb VOC}}{} \left| \frac{0.70 \text{ lb TAF}}{\text{lb VOC}} \right. = 0.2435 \text{ lb VOC}$$

Stack Emissions from Maintenance Activity (cont.)

<u>HF Potential</u>

Assume that the vapor is 30% COF2 and 70% TAF. This assumption is based on process knowledge of the system.

COF2 (carbonyl fluoride) **CAS No. 353-50-4**

Each mole of COF2 (MW = 66) can generate 2 moles of HF (MW =20)

$$\frac{1 \text{ lb COF2}}{} \left| \frac{1 \text{ mole COF2}}{66 \text{ lb COF2}} \right| \frac{20 \text{ lb HF}}{\text{mole HF}} \left| \frac{2 \text{ moles HF}}{1 \text{ mole COF2}} \right. = 0.606 \text{ lb of HF}$$

Therefore, each 1 lb of COF2 generates 0.606 lb of HF

TAF (telomeric acid fluoride) **CAS No. 690-43-7**
(perfluoro-3,5,7, 9,11-pentaoxadodecanoyl fluoride)

Each mole of TAF (MW = 330) can generate 1 mole of HF (MW =20)

$$\frac{1 \text{ lb TAF}}{} \left| \frac{1 \text{ mole TAF}}{330 \text{ lb TAF}} \right| \frac{20 \text{ lb HF}}{\text{mole HF}} \left| \frac{1 \text{ moles HF}}{1 \text{ mole TAF}} \right. = 0.061 \text{ lb of HF}$$

Therefore, each 1 lb of TAF generates 0.061 lb of HF

Sample calculation using maintenance activity dated 4/6/04

Quantity of VOCs vented from the WGS (see Page 2) = **0.3479 lb VOC**

HF equivalent emissions would be equal to:

$$\frac{0.348 \text{ lb VOC}}{} \left| \frac{0.30 \text{ lb COF2}}{\text{lb VOC}} \right| \frac{0.606 \text{ lb HF}}{\text{lb COF2}} = 0.0633 \text{ lb HF}$$

$$\frac{0.348 \text{ lb VOC}}{} \left| \frac{0.70 \text{ lb TAF}}{\text{lb VOC}} \right| \frac{0.061 \text{ lb HF}}{\text{lb TAF}} = 0.0148 \text{ lb HF}$$

Therefore, HF vented to the atmosphere from the 4/6/04 maintenance activity is equal to:

0.0633 lb HF + 0.0148 lb HF = 0.078 lb HF

Stack Emissions from Maintenance Activity (cont.)

Calculation page

Date	Tank	Category	Reason	Weight of Tank Initial (kg)	Weight of Tank Final (kg)	Emitted VOC (lb)	Emitted HF (lb)
4/6/04	Storage Tank	Maintenance	RV RM	202	162	0.348	0.078
9/22/04	Reactor	Maintenance	RV RM	283	254	0.259	0.058
10/29/04	Storage Tank	Maintenance	RV RM	107	105	0.018	0.004
11/3/04	Reactor	Maintenance	RM	131	112	0.168	0.038
11/10/04	Storage Tank	Maintenance	RM	248	229	0.167	0.037

Total Emissions	**0.96**	**0.21**

Total VOC = 0.96 lb

VOC = 0.000479 ton STACK EMISSIONS

Total HF = 0.21 lb STACK EMISSIONS

Speciated VOC Stack Emissions

The VOC emissions from the Waste Liquid Stabilization process is assumed to be comprised of 30% by weight of COF2 and 70% by weight of TAF. The emission of these compounds from each of the following events is determined simply by multiplying the total emitted VOC by 30% to determine the COF2 emission and 70% to determine the TAF emission.

Date	Tank	Category	Reason	Emitted VOC (lb)	Emitted COF2 (lb)	Emitted TAF (lb)
4/6/04	Storage Tank	Maintenance	RV RM	0.348	0.104	0.244
9/22/04	Reactor	Maintenance	RV RM	0.259	0.078	0.181
10/29/04	Storage Tank	Maintenance	RV RM	0.018	0.005	0.012
11/3/04	Reactor	Maintenance	RM	0.168	0.050	0.117
11/10/04	Storage Tank	Maintenance	RM	0.167	0.050	0.117

Total Emissions	**0.96**	**0.29**	**0.67**

Fugitive Emissions Leak Rates for Process Equipment

Using the following table, the Fugitive Emissions Rates will be calculated:

Component	Service	Emission Factors (lb/hr/component)
Pump Seals	Light Liquid	0.00115
Valves	Light Liquid	0.00036
Flanges	All	0.00018

VOC Fugitive Emissions from Equipment Components

2	Pump Seals	x	0	lb/hr/pumpseal	=	0.0023	lb/hr VOC
148	Valves	x	0	lb/hr/valve	=	0.0533	lb/hr VOC
45	Flanges	x	0	lb/hr/flange	=	0.0081	lb/hr VOC
	Total VOC Emissions from Equipment Leaks				=	0.0637	lb/hr VOC

Total Annual Fugitive VOC Emissions:

0.0637 lb/hr VOC x 8760 hr/year = 557.84 lb VOC for 2003
0.2789 tons VOC

Speciated Fugitive VOC Emissions by Compound:

Assume that the emissions are 30% COF2 and 70% TAF. This assumption is based on process knowledge of the system.

$$\frac{557.8 \text{ lb VOC}}{} \left| \frac{0.30 \text{ lb COF2}}{\text{lb VOC}} \right. = \mathbf{167.35 \text{ lb COF2}}$$

$$\frac{557.8 \text{ lb VOC}}{} \left| \frac{0.70 \text{ lb TAF}}{\text{lb VOC}} \right. = \mathbf{390.49 \text{ lb TAF}}$$

See Page 3 for HF equivalents calculation:

$$\frac{557.8 \text{ lb VOC}}{} \left| \frac{0.30 \text{ lb COF2}}{\text{lb VOC}} \right| \frac{0.606 \text{ lb HF}}{\text{lb COF2}} = 101.42 \text{ lb HF}$$

$$\frac{557.8 \text{ lb VOC}}{} \left| \frac{0.70 \text{ lb TAF}}{\text{lb VOC}} \right| \frac{0.061 \text{ lb HF}}{\text{lb TAF}} = 23.666 \text{ lb HF}$$

101.42 lb HF + 23.666 lb HF = **125.1 lb HF**

Emission Summary

A. VOC Emissions by Compound and Source

Nafion® Compound	CAS Chemical Name	CAS No.	Stack Emissions (lbs)	Fugitive Emissions (lbs)	Total Emissions (lbs)
COF2	Carbonyl fluoride	116-14-3	0.29	167.4	167.6
TAF	Perfluoro-3,5,7, 9,11-pentaoxadodecanoyl fluoride	690-43-7	0.67	390.5	391.2
			Total VOC (lb)		**558.8**
			Total VOC (ton)		**0.28**

B. Toxic Air Pollutant Summary

Nafion® Compound	CAS Chemical Name	CAS No.	Stack Emissions (lbs)	Fugitive Emissions (lbs)	Total Emissions (lbs)
HF	Hydrogen fluoride	7664-39-3	0.21	125.1	125.3

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Facility ID : 0900009
Permit : 03735
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North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory – Calendar Year 2004

1. Emission Source ID (from permit) or Emission Source Group ID NS–F

2. Emission Source Description: Nafion MMF process

3. Operating Scenario ID/Description: OS – 16/Nafion MMF process

4. SCC Number/Description: 30199998/*Other Organic Chemica Manufacture Not Listed

5. Throughput/units in 2004:
(e.g. production or fuel use):

6. Fuel Information (If fuel is used)

% Sulfur		% Ash		Heat Content (Btu/units)	

7. Capture Efficiency
(% of Emissions from this Process Vented to Control Device or Stack): 100

8. Control Device Information :

Order	CS–ID	CD ID (as listed in permit)	Control Device Description
1	CS–6	NCD–Hdr–1	Baffle plate–type tower waste gas scrubber

9. Emission Release Point (ERP) Information: (Sources vented to more than one ERP use additional entry lines):

ERP ID	ERP Type	Height (in feet)	Diameter Circle (enter #): Rectangle (L x W) (in 0.1 feet)	Temperature (F)	Velocity (Feet/sec)	Volume Flow Rate (Acfm)	ERP Description
EP–NEP–Hdr1	VERTICAL STACK	85	3	75	58	24598.67	Nafion scrubber Hdr1

10. Operating Schedule: (Source/Operating Scenario that best characterizes Calendar Year 2004)
Hours per Day (24) Days per Week (7) Weeks per Year (52)

11. Typical Start & End Times For Operating Scenario: Start: 0 End: 2359

12. Seasonal Periods Percent Annual Throughput:

Jan–Feb + Dec 2004	38%	March–May 2004	62%	June–Aug. 2004	0%	Sept.–Nov. 2004	0%

13. Actual Emissions per Pollutant Listed :
Attach calculations and documentation of emission factors or other estimation methods used.

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions– Criteria Pollutants (Tons/Year)	Emission Estimation Method Code (See Instructions)	Control Efficiency (Net after all controls)
		2004		
VOC	VOC	0.62	02	99.6
HAP/TAP Pollutants (In Alphabetical Order)	**CAS** (see instructions)	**Emissions HAP/TAPS** (Pounds/Year)	**Emission Estimation Method Code** (See Instructions)	**Control Efficiency** (Net after all controls)
		2004		
Hydrogen fluoride (hydrofluoric acid as mass of HF– Component of Fluorides)	7664–39–3	83.53	02	99.6

CONFIDENTIAL INFORMATION

Supporting documentation for the determination of air emissions from this emission source contains DuPont Confidential Business Information, which if made public would divulge the manufacturing method, process, and/or capacity, and has therefore been intentionally excluded from the Public Copy of this Air Emissions Inventory as allowed by North Carolina General Statutes §132-1.2, §143-215.3C(a), and §143-215.65.

2004 Air Emissions Inventory Supporting Documentation

Emission Source ID No.: NS-F

Emission Source Description: Nafion MMF Process

Process and Emission Description:

The MMF process is a batch/semi-batch manufacturing process. All emissions from this process vent to the Nafion Division Waste Gas Scrubber (WGS), Control Device ID No. NCD-Hdr1, which has a documented efficiency of 99.6%. The control of emissions of certain compounds will be addressed in the following spreadsheets. Some compounds (i.e. TFE) pass completely through the scrubber, therefore the efficiency is assumed to be zero percent (0%).

Basis and Assumptions:

The MMF process flowsheets #9599 and #5600 are used as a basis for relative compositions and flow rates of vent streams to the division WGS. A 7.2 kg/hr maximum MMF production rate is used as the basis for maximum vent rates.

Information Inputs and Source of Inputs:

Information Input	Source of Inputs
MMF production quantity	MMF Production Facilitator
Speciated emission rates	MMF Process Flowsheets

Point Source Emissions Determination:

Point source emissions for individual components are given in the following pages. A detailed explanation of the calculations are attached.

Equipment Emissions and Fugitive Emissions Determination:

Emissions from equipment leaks which vent as stack (point source) emissions and true fugitive (non-point source) emissions have been determined using equipment component emission factors established by DuPont. The determination of those emissions are shown in a seperate section of this supporting documentation.

Fugitive and Equipment Emissions Determination (Non-point Source):

Fugitive (FE) and Equipment Emissions (EE) are a function of the number of emission points in the plant (valves, flanges, pump seals). The inventory shown below is conservative and based on plant and process diagrams. Note that the calculations below include the following: (1) equipment emissions emissiions not inside buildings, which are "fugitive" in nature and will be reported as such, and (2) equipment emissiion in side buildings, which are not "fugitive" in nature and will be reported as equipment emissions only.

A. Fugitive emissions from MMF equipment outside of the barricade:

Emissions from this equipment are not inside a building and are therefore "fugitive" in nature.

Valve emissions:	552 valves x 0.00036 lb/hr/valve	=	0.199 lb/hr EE
Flange emissions:	100 flanges x 0.00018 lb/hr/flange	=	0.018 lb/hr EE
Total equipment emission rate		=	0.217 lb/hr EE

Days of operation = 107

On average 0.13 lbs of HF are produced for every 1 pound of process material released

VOC: 0.217 lb/hr EE
x 24 hours/day
x 107 days/year
= **556.5 lb/yr VOC from EE**

HF: 0.217 lb/hr EE
x 24 hours/day
x 107 days/year
x 0.13 lb HF per lb VOC
= **72.3 lb/yr HF from EE**

B. Equipment Emissions From MMF Reactor and Transfer Tank

This equipment is inside a building, therefore emissions are not true Fugitive Emissions

Valve emissions:	88 valves x 0.00036 lb/hr/valve	=	0.032 lb/hr FE
Flange emissions:	10 flanges x 0.00018 lb/hr/flange	=	0.002 lb/hr FE
Total fugitive emission rate		=	0.033 lb/hr FE

VOC: 0.033 lb. FE/hr
x 24 hours/day
x 107 days/year
= **86.0 lb/yr VOC from EE**

HF: 0.033 lb. FE/hr
x 24 hours/day
x 107 days/year
x 0.13 lb HF per lb VOC
= **11.2 lb/yr HF from EE**

C. Total RSU Plant Non-Point Source Emissions

	Fugitive Emissions		Equipment Emissions	
	VOC lb/yr	**HF lb/yr**	**VOC lb/yr**	**HF lb/yr**
Emission Source				
A. Fugitive emissions from MMF equipment outside of the barricade:	556.5	72.3	0	0
B. Equipment Emissions From MMF Reactor and Transfer Tank	0	0	86.0	11.2
Total for 2002	**556.5**	**72.3**	**86.0**	**11.2**

E. VOC Emission by Source Type

Nafion® Compound	Emissions from Stack (lb)	Fugitive Emissions (lb)	Equipment Emissions (lb)	Accidental Releases (lb)	Total Emissions (lb)
DMC	500.1	462.2	0	0	962.2
DME	0.2	0.1	0	0	0.3
MTVE	0.03	0.03	0	0	0.05
MTFE	0.04	0.04	0	0	0.08
MTP	0.03	0.03	0	0	0.06
BMTK	0.003	0.003	0	0	0.005
MTP Acid	0.0009	0.001	0	0	0.002
TFE	76.4	70.6	0	0	147.0
CH3F	25.5	23.5	18.9	0	67.9
MMF	0	0	67.1	0	67.1
Total	**602.1**	**556.5**	**86.0**	**0.0**	**1244.7**

Note: Speciated equipment emissions were estimated by assuming that each compound's equipment emission concentration was equal to that compound's stack emission fraction of the total stack emission.

Example: The DMC equipment emissions were determined by the ratio of the DMC stack emission (254.7 lb) divided by the total stack emission (306.7 lb), multiplied by the total equipment emissions (358.9 lb).

Specifically: $\frac{500.1}{602.1} \times 556.5 = 462.2$ lb. DMC

Emission Summary

A. VOC Emissions by Compound and Source

Nafion® Compound	CAS Chemical Name	CAS No.	Point Source Emissions (lbs)	Fugitive Emissions (lbs)	Equipment Emissions (lbs)	Accidental Emissions (lbs)	Total VOC Emissions (lbs)
DMC	Carbonic Acid, Dimethy Ester	616-38-6	500.1	462.2	0	0	962.2
DME	Dimethyl ether	115-10-6	0.2	0.1	0	0	0.3
MTVE	Methyl Trifluorovinyl Ether	3823-94-7	0.03	0.03	0	0	0.1
MTFE	1-methoxy-1,1,2,2-tetrafluoroethane	425-88-7	0.04	0.04	0	0	0.1
MTP	Methyl-3-methoxy-	755-73-7	0.03	0.03	0	0	0.1
BMTK	Bis(2-methoxytetrafluoroethyl)ketone	1422-71-5	0.00	0.003	0	0	0.0
MTP Acid	MTP Acid	93449-21-9	0.00	0.001	0	0	0.0
TFE	Tetrafluoroethylene	116-14-3	76.4	70.6	0	0	147.0
CH3F	Methyl Fluoride	593-53-3	25.5	23.5	18.9	0	67.9
MMF	Propanoic Acid, 2,2,3-Trifluoro-3-oxo,methyl ester	69116-71-8	0	0.0	67.1	0	67.1
Total VOC for 2004			**602.1**	**556.5**	**86.0**	**0**	**1,244.7**
						VOC (Tons)	**0.62**

B. Toxic Air Polluntant Summary

Nafion® Compound	CAS Chemical Name	CAS No.	Point Source Emissions (lbs)	Fugitive Emissions (lbs)	Equipment Emissions (lbs)	Accidental Emissions (lbs)	Total Emissions (lbs)
HF	Hydrogen Fluoride	7664-39-3	0	72.3	11	0	83.5

Facility Name: DuPont Company – Fayetteville Works
22828 NC Highway 87 West
Fayetteville, NC 28302

Facility ID : 0900009
Permit : 03735
County : Bladen
DAQ Region : FRO

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory – Calendar Year 2004

1. **Emission Source ID (from permit) or Emission Source Group ID** NS–G
2. **Emission Source Description:** Nafion SR/CR resin process
3. **Operating Scenario ID/Description:** OS – 17/Nafion SR/CR resin process
4. **SCC Number/Description:** 30199998/*Other Organic Chemica Manufacture Not Listed
5. **Throughput/units in 2004:** (e.g. production or fuel use):
6. **Fuel Information** (If fuel is used)

% Sulfur		% Ash		Heat Content (Btu/units)	

7. **Capture Efficiency** (% of Emissions from this Process Vented to Control Device or Stack): 100

8. **Control Device Information :None**

Order	CS–ID	CD ID (as listed in permit)	Control Device Description

9. **Emission Release Point (ERP) Information: (Sources vented to more than one ERP use additional entry lines):**

ERP ID	ERP Type	Height (in feet)	Diameter Circle (enter #): Rectangle (L x W) (in 0.1 feet)	Temperature (F)	Velocity (Feet/sec)	Volume Flow Rate (Acfm)	ERP Description
EP–NEP–G	VERTICAL STACK	70	2.2	75	54	12316.29	SR/CR resin process

Operating Scenario: OS – 17 | Emission Source/Group ID: NS–G

10. Operating Schedule: (Source/Operating Scenario that best characterizes Calendar Year 2004)
Hours per Day (24) Days per Week (7) Weeks per Year (52)

11. Typical Start & End Times For Operating Scenario: Start: 0 End: 2359

12. Seasonal Periods Percent Annual Throughput:

Jan–Feb + Dec 2004	26%	March–May 2004	29%	June–Aug. 2004	33%	Sept.–Nov. 2004	12%

13. Actual Emissions per Pollutant Listed :
Attach calculations and documentation of emission factors or other estimation methods used.

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions– Criteria Pollutants (Tons/Year)	Emission Estimation Method Code (See Instructions)	Control Efficiency (Net after all controls)
		2004		
VOC	VOC	30	02	
HAP/TAP Pollutants (In Alphabetical Order)	**CAS** (see instructions)	**Emissions HAP/TAPS** (Pounds/Year)	**Emission Estimation Method Code** (See Instructions)	**Control Efficiency** (Net after all controls)
		2004		
CFC– 113 (Trichloro–1,2,2–trifluoroethane, 1,1,2–)	76–13–1	8535	02	
Hydrogen fluoride (hydrofluoric acid as mass of HF– Component of Fluorides)	7664–39–3	0.5	02	
Methanol	67–56–1	417	02	

CONFIDENTIAL INFORMATION

Supporting documentation for the determination of air emissions from this emission source contains DuPont Confidential Business Information, which if made public would divulge the manufacturing method, process, and/or capacity, and has therefore been intentionally excluded from the Public Copy of this Air Emissions Inventory as allowed by North Carolina General Statutes §132-1.2, §143-215.3C(a), and §143-215.65.

Point Source Emission Determination

A. HF
Hydrogen Fluoride — **CAS No. 7664-39-3**

HF Potential:

Some SR polymer is fluorinated with a mixture of 10% F2 90% N2.
Each mole of Fluorine (F2) reacts with one mole of SR polymer in the Fluorinator to produce 1 mole of HF.

$$R - CF_2 - H + F_2 \rightarrow HF + R - CF_3$$

Quantity Released:

Vapor released to scrubber during initial fluorine charge:

F2 introduced during the initial fluorine charge to Fluorinator:

$$\frac{2.2\ lb\ F_2}{h}\ x\ 0.1\ F_2\ x\ 0.5\ hour = 0.11\ lb\ F_2$$

Estimate 75% of initial fluorine reacts with polymer during each batch:

$$0.75\ x\ 0.11\ lb\ F_2\ x\ \frac{1\ lbmol\ HF}{1\ lbmol\ F_2}\ x\ \frac{1\ lbmol\ F_2}{38\ lb\ F_2}\ x\ \frac{20\ lbHF}{1\ lbmol\ HF} = 0.0434\ lb\ HF$$

Vapors released to scrubber during initial fluorine charge: 0.0434 lb HF per batch

Vapor released to scrubber during remainder of fluorination cycle:

F2 feed :

$$0.88\ lb/h\ F_2\ x\ 0.10\ F_2\ x\ 12\ hours = 1.056\ lb\ F_2$$

Estimate 60% of fluorine reacts with polymer:

$$0.60\ x\ 1.056\ lb\ F_2\ x\ \frac{1\ lbmol\ HF}{1\ lbmol\ F_2}\ x\ \frac{1\ lbmol\ F_2}{38\ lb\ F_2}\ x\ \frac{20\ lbHF}{1\ lbmol\ HF} = 0.3335\ lb\ HF$$

Vapors released to scrubber during fluorination cycle: 0.3335 lb HF per batch

Unreacted Fluorine released to scrubber: 0.4499 lb F2 per batch

Total vapors to scrubber: 0.0434 + 0.3335 + 0.4499 = 0.8268 lb HF and F2 per fluorination batch

Emissions per batch utilizing 99% fluorine scrubber efficiency:

NOTE: 99% conversion based on studies of Washington Works' Fluorine Scrubbers

	0.8268 lb HF and F2 per fluorination batch
x	(1 - 0.99)
=	0.0083 lb HF and F2 per fluorination batch

After-Control HF and F2 Emissions: 55 fluorination batches x 0.0083 lb HF and F2 per fluorination batch = 0.455 lb HF and F2

B. MeOH
Methanol

CAS No. 67-56-1

Methanol can potentially be emitting from two tank vents in Polymerization. The Recovery Tank operates at a low enough temperature that no methanol exists in the vapor space, thus no methanol is released. The Recirculation Tank vents whenever condensed liquid is introduced into the tank. This calcuation is based on a Vapor-Liquid Equilibrium calculation for E2, VE, and methanol.

Recirculation Tank Vent Rate:

Recirc Tank Vapor Space: 180`gal x $\frac{3.79 \text{ L}}{1 \text{ gal}}$ x 0.50 level = 341 L in vapor space

Recirc Tank Vent Rate: Assume vent rate is directly proportional to volume of liquid displacing the gas = $\frac{425 \text{ kg/h}}{1.67 \text{ kg/L}}$ (Recycle Feed Rate / Specific Gravity of Liquid) = 254.49 L/h

$\frac{21.37 \text{ mol}}{341 \text{ L in vapor space}}$ x $\frac{254.49 \text{ L}}{1 \text{ h}}$ = 15.9 mol/h

Mass Flow Rate of Methanol:

15.9 mol/h x 0.057 vol% MeOH x $\frac{31.034 \text{ g MeOH}}{1 \text{ mol MeOH}}$ = 28.2 g/h MeOH

Methanol Emissions: 28.2 g/h MeOH x 6720 hours = 189530 g MeOH
417 lb MeOH

D. E2 CAS No. 3330-14-1
2H-Perfluoro(5-Methyl-3,6-Dioxanonane)

Example of monthly calculation (by mass balance):

1. E2 Consumed during SR: 0 kg E2

2. E2 Losses to Filters & Sieves during SR: 10 kg E2

3. E2 Emitted From Finishing during SR: 0 kg E2

4. E2 Mass Balance (SR Only):
0 kg E2 Consumed
\- 10 kg E2 losses to Filters & Sieves
\+ 0 kg E2 emitted in Finishing
-10 kg E2 emission

9. Total E2 Emission (SR & CR):
-10 kg E2 emission during SR
\+ 0 kg emission during CR
-10 kg E2 Emission during SR & CR

5. E2 Consumed during CR: 0 kg E2

6. E2 Losses to Filters & Sieves during CR: 0 kg E2

7. E2 Emitted From Finishing during CR: 0 kg E2

8. E2 Mass Balance (CR Only):
0 kg E2 Consumed
0 kg E2 losses to Filters & Sieves
\+ 0 kg E2 emitted in Finishing
0 kg E2 emission

Monthly & Yearly Calcuation--SR

Month	E2 Consumed	E2 Losses to Filters/Sieves	Finishing E2 Emission	E2 Emission
Dec-03	0	10	0	-10
Jan-04	1126.2	719	0	407
Feb-04	0	0	0	0
Mar-04	0	0	0	0
Apr-04	1221	961	0	260
May-04	1355	751	0	604
Jun-04	1788	1264	0	524
Jul-04	1685	831	0	854
Aug-04	878	960	0	-82
Sep-04	1688.8	856	0	833
Oct-04	805.32	575	0	231
Nov-04	0	0	0	0

SR E2 Emission = 3622 kg E2
7984 lb E2

Monthly & Yearly Calcuation--CR

Month	E2 Consumed	E2 Losses to Filters/Sieves	Finishing E2 Emission	E2 Emission
Dec-03	0	0	0	0
Jan-04	0	0	0	0
Feb-04	956	987	0	-31
Mar-04	1529.4	1322	0	207
Apr-04	0	0	0	0
May-04	0	0	0	0
Jun-04	0	0	0	0
Jul-04	0	0	0	0
Aug-04	0	0	0	0
Sep-04	0	0	0	0
Oct-04	0	0	0	0
Nov-04	0	0	0	0

CR E2 Emission = 176 kg E2
389 lb E2

Total E2 Emission--SR & CR Combined

Month	E2 Emission (kg)
Dec-03	1803
Jan-04	407
Feb-04	-31
Mar-04	207
Apr-04	260
May-04	604
Jun-04	524
Jul-04	854
Aug-04	-82
Sep-04	833
Oct-04	231
Nov-04	0

E2 Em. = 5611 kg E2
12370 lb E2

E. F-113 CAS No. 76-13-1
Trichloro-1,2,2-trifluoro-1,1,2 Ethane

1. E2 Mass Balance:
7690 kg F-113 Beginning Inventory
\+ 0 kg F-113 Shipments
\+ 4656 kg F-113 used with 3P in Polymerization
\+ 0 kg F-113 used with 3P in Semi-Works
\- 0 kg F-113 waste sent off plant
\- 4897 kg F-113 Ending Inventory
7449 kg F-13 emission between SW & Polymerization

2. Division of Emissions between SW & Polymerization
4897 kg F-113 Ending Inventory
0 kg F-113 Shipments
0 kg F-113 used with 3P in Semi-Works
4897 kg F-113 used by Semi-Works

4656 kg F-113 used with 3P in Polymerization
642 kg Refined by Polymerization in Recycle Still
5298 kg F-113 used by Polymerization

Polymerization % = (5298 kg F-113 used by Polymerization / 10195 kg F-113 Total) x 100 = 52.0 %

3. E2 Emission from Polymerization: (52.0 % / 100) x 7449 kg F-113 Emission = 3871 kg F-113 emission from Polymerization
8535 lb F-113 emission from Polymerization

Yearly Emission Summary

A. VOC Compound Summary

NS-G SR/CR Resins Manufacturing Process			
Nafion® Compound	**CAS Chemical Name**	**CAS No.**	**Emission (lbs)**
PSEPVE	Perfluoro-2-(2-Fluorosulfonylethoxy) Propyl Vinyl Ether	16090-14-5	7,384
EVE	Propanoic Acid, 3-[1-[Difluoro[(Trifluoroethenyl)oxy]Methyl]-1,2,2,2-Tetrafluoroethoxy]-2,2,3,3-Tetrafluoro-Methyl Ester	63863-43-4	0
TFE	Tetrafluoroethylene	116-14-3	39,755
MeOH	Methanol	67-56-1	417
E-2	2H-Perfluoro(5-Methyl-3,6-Dioxanonane)	3330-14-1	12,370
		Total VOC Emissions (lbs)	**59,926**
		Total VOC Emissions (tons)	**30.0**

B. Toxic Air Pollutant Summary

NS-G SR/CR Resins Manufacturing Process			
Nafion® Compound	**CAS Chemical Name**	**CAS No.**	**Emission (lbs)**
F-113	Trichloro-1,2,2-trifluoro-1,1,2 Ethane	76-13-1	8,535
HF	Hydrogen Fluoride	7664-39-3	0.5
MeOH	Methanol	67-56-1	417

Facility Name: DuPont Company – Fayetteville Works
22828 NC Highway 87 West
Fayetteville, NC 28302

Facility ID : 0900009
Permit : 03735
County : Bladen
DAQ Region : FRO

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory – Calendar Year 2004

1. **Emission Source ID (from permit) or Emission Source Group ID** NS–H
2. **Emission Source Description:** Nafion resin membrane treatment process
3. **Operating Scenario ID/Description:** OS – 18/Nafion resin membrane treatment process
4. **SCC Number/Description:** 30199998/*Other Organic Chemica Manufacture Not Listed

5. **Throughput/units in 2004:**
(e.g. production or fuel use):
6. **Fuel Information** (If fuel is used)

% Sulfur		% Ash		Heat Content (Btu/units)	

7. **Capture Efficiency**
(% of Emissions from this Process Vented to Control Device or Stack): 100

8. **Control Device Information :None**

Order	CS–ID	CD ID (as listed in permit)	Control Device Description

9. **Emission Release Point (ERP) Information: (Sources vented to more than one ERP use additional entry lines):**

ERP ID	ERP Type	Height (in feet)	Diameter Circle (enter #): Rectangle (L x W) (in 0.1 feet)	Temperature (F)	Velocity (Feet/sec)	Volume Flow Rate (Acfm)	ERP Description
EP–NEP–H1	VERTICAL STACK	50	2	70	48	9047.78	Nafion resin membrane

Operating Scenario: OS – 18 **Emission Source/Group ID:** NS–H

10. Operating Schedule: (Source/Operating Scenario that best characterizes Calendar Year 2004)
Hours per Day (24) Days per Week (6) Weeks per Year (49)

11. Typical Start & End Times For Operating Scenario: Start: 0 End: 2359

12. Seasonal Periods Percent Annual Throughput:

Jan–Feb + Dec 2004	24%	March–May 2004	20%	June–Aug. 2004	28%	Sept.–Nov. 2004	28%

13. Actual Emissions per Pollutant Listed :
Attach calculations and documentation of emission factors or other estimation methods used.

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions– Criteria Pollutants (Tons/Year)	Emission Estimation Method Code (See Instructions)	Control Efficiency (Net after all controls)
		2004		
VOC	VOC	5.1	03	
HAP/TAP Pollutants (In Alphabetical Order)	**CAS** (see instructions)	**Emissions HAP/TAPS** (Pounds/Year)	**Emission Estimation Method Code** (See Instructions)	**Control Efficiency** (Net after all controls)
		2004		
Acetic acid	64–19–7	258	03	
Hydrogen fluoride (hydrofluoric acid as mass of HF– Component of Fluorides)	7664–39–3	89	02	

CONFIDENTIAL INFORMATION

Supporting documentation for the determination of air emissions from this emission source contains DuPont Confidential Business Information, which if made public would divulge the manufacturing method, process, and/or capacity, and has therefore been intentionally excluded from the Public Copy of this Air Emissions Inventory as allowed by North Carolina General Statutes §132-1.2, §143-215.3C(a), and §143-215.65.

AIR EMISSIONS INVENTORY SUPPORTING DOCUMENTATION

Emission Source ID No.: NS-H (NS-11) MEMBRANE TREATMENT

Emission Source Description: Nafion® resin membrane treatment process

Process Description: OS-18 / Nafion® resin membrane treatment processes

The resin membrane treatment process (hydrolysis) is carried out continuously by passing the film resin or laminated resin membrane through a succession of tanks containing the necessary reagent chemicals to complete the hydrolysis reaction. Chemically, the objective is to expose the membrane to the reagent solution under conditions of time, temperature, concentration and agitation which are sufficient to complete the desired reaction. Mechanically, the objective is to convey the sheet, that is changing in dimension as it reacts, through a series of vertical passes, in a number of tanks, in a straight line, at a constant tension, without folding, creasing or tearing.
The resin membrane treatment process is contained in a enclosed room. All emissions are contained within the room and vent through emission control stacks. Air is supplied into the room and vented on a once
The resin membrane treatment process (extrusion) is carried out continuouly by melting resin polymer pellets into an single screw extruder, heating to high temperatures so as to melt the resin polymer and extruded into film sheet form.
The resin membrane treatment process (extrusion) is contained in an enclosed room. All emissions are contained within the room and vented through emission control stacks. Air is supplied into the room and vented on a once through basis.

Basis and Assumptions:

- vent to atmosphere via stack
- No fugitive emissions due to all emissions vented through stack.
- DMSO vapor pressure = 0.46 mm Hg @ 20°C
- KOH vapor pressure = 2.6 mm Hg @ 20°C
- HNO3 vapor pressure = 9 to 28 mm Hg @ 25°C
- CH3COOH or HOAc vapor pressure = 11.4 mm Hg @ 20°C
- DEG vapor pressure = 1 mm Hg @ 92°C
- NaOH vapor pressure = 13 mm Hg @ 60°C
- Molar volume of an Ideal Gas @ 0°C and 1 atm = 359 ft3/(lb-mole)
- Molecular Weight of DMSO = 78 (78 lb DMSO / mole DMSO)
- DMSO waste storage tank 6000 gallons.
- DMSO received in 55 gal drums, each drum weighing 500 lbs.

Emission Source ID No.: NS-H (NS-11) MEMBRANE TREATMENT

Information Inputs and Source of Inputs:

Information	Source
Total shipped DMSO waste (lb/yr) (#5 on State Inventory Form)	Catherine Bass, Global Supply Support, in 2003 DMSO waste material was internally disposed of by the site waste treatment plant. Pumping to waste treatment is covered below.
Vapor pressure	MSDS sheets for each chemical.
Waste in storage tank end of year	Ned Highsmith, maintenance facilitator end of year (Near 12/31) Starting in 2003 the inventory or tank level can be obtained from IP 21 7403LG tag.
Storage tank size	Procedure PR-70, W1535321, or NBPF000351
DMSO waste to waste treatment	The material in the waste storage tank is routinely pumped to waste treatment facility. This occurs at a rate of 5 gpm. The pumping is tracked in the IP21 by tank inventory reductions. And Noted by the area ATO. The pumping is continuous.
Waste content in storage tank	From Procedure PR-70 soc's
DMSO inventory beginning of year	Shipping and Material Coordinator (Renee Wilkerson)
DMSO inventory end of year	Shipping and Material Coordinator (Renee Wilkerson)
DMSO drums received during the year	Shipping and Material Coordinator (Renee Wilkerson)
Acetic Acid emissions	Debra Kaufman, Nafion® Products Technical ATO qrtly report
Acetic Acid emissions rate	TA NF-01-1240 study by Lee Ann Kessler in 1999
Hydrolysis Product Produced (m2) by qrt	Master Production Scheduler (David Garwood) via SAP BW Reporting
Hydrolysis Surface Treatment Product Produced (m2) by qrt	Master Production Scheduler (David Garwood) via SAP BW Reporting
Hydrolysis hours of operation by qrt	Master Production Scheduler (David Garwood) via SAP BW Reporting
SR resin extruded	Extrusion ATO, from Extrusion yield calculations
CR resin extruded	Extrusion ATO, from Extrusion yield calculations
HF formed from extruded resin	TA NF-01-1240 study by Lee Ann Kessler in 1999
VOC emission calculations	Nafion Membrane Treatment Process AEI calcs excel spreadsheet in Nafion(r), everyone, scarrepa, environmental, AEI calc NS-H & NS-I hydro extr & spray master form.

Emission source/Operating Scenario Data

1. Emission Source ID No.

Actual emissions per pollutant listed for source/process identified on page 1:

Criteria (NAAQS) pollutants	Pollutant code	Emissions-Criteria pollutants (tons/yr)				Emission estimation method code	control efficiency
		2001	2002	2003	2004		
Carbon Monoxide	CO	0	0	0	0	8	
NOx	NOx	0	0	0	0	8	
TSP	TSP	0	0	0	0	8	
PM 2.5	PM-2.5	0	0	0	0	8	
PM 10	PM-10	0	0	0	0	8	
SO2	SO2	0	0	0	0	8	
VOC	VOC	18.8	9.3	9.6	5.1	8	0%
HAP/TAP pollutants	CAS #	Emissions HAP/TAPs lbs/yr					
Acetic Acid	64-19-7	50	78	166	258	8	0%
Hydrogen Fluoride	7664-39-03	96	89	66	89	8	0%

Facility Name: DuPont Company – Fayetteville Works
22828 NC Highway 87 West
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North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory – Calendar Year 2004

1. **Emission Source ID (from permit) or Emission Source Group ID** NS–I
2. **Emission Source Description:** Nafion membrane coating process
3. **Operating Scenario ID/Description:** OS – 19/Nafion membrane coating process
4. **SCC Number/Description:** 30199998/*Other Organic Chemica Manufacture Not Listed
5. **Throughput/units in 2004:** (e.g. production or fuel use):
6. **Fuel Information** (If fuel is used)

% Sulfur		% Ash		Heat Content (Btu/units)	

7. **Capture Efficiency** (% of Emissions from this Process Vented to Control Device or Stack): 100

8. **Control Device Information :None**

Order	CS–ID	CD ID (as listed in permit)	Control Device Description

9. Emission Release Point (ERP) Information: (Sources vented to more than one ERP use additional entry lines):

ERP ID	ERP Type	Height (in feet)	Diameter Circle (enter #): Rectangle (L x W) (in 0.1 feet)	Temperature (F)	Velocity (Feet/sec)	Volume Flow Rate (Acfm)	ERP Description
EP–NEP–1	VERTICAL STACK	50	2	70	0.4	75.39	Nafion membrane coating

Operating Scenario: OS – 19 **Emission Source/Group ID:** NS–I

10. Operating Schedule: (Source/Operating Scenario that best characterizes Calendar Year 2004)
Hours per Day (24) Days per Week (7) Weeks per Year (52)

11. Typical Start & End Times For Operating Scenario: Start: 0 End: 2359

12. Seasonal Periods Percent Annual Throughput:

Jan–Feb + Dec 2004	24%	March–May 2004	29%	June–Aug. 2004	25%	Sept.–Nov. 2004	21%

13. Actual Emissions per Pollutant Listed :
Attach calculations and documentation of emission factors or other estimation methods used.

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions– Criteria Pollutants (Tons/Year)	Emission Estimation Method Code (See Instructions)	Control Efficiency (Net after all controls)
		2004		
TSP	TSP	0.17	02	
PM10	PM10	0.17	02	
PM2.5	PM2.5	0.17	02	
VOC	VOC	15.1	02	
HAP/TAP Pollutants (In Alphabetical Order)	**CAS** (see instructions)	**Emissions HAP/TAPS** (Pounds/Year)	**Emission Estimation Method Code** (See Instructions)	**Control Efficiency** (Net after all controls)
		2004		

AIR EMISSIONS INVENTORY SUPPORTING DOCUMENTATION

Emission Source ID No.: NS-I MEMBRANE SPRAYBOOTH

Emission Source Description: Nafion® resin membrane spray booth treatment process

Process Description: OS-19 / Nafion® resin membrane spray booth treatment processes

The spray coating process supplies a thin uniform layer of coating (pigment & resin) solution to the surface of Nafion® membrane. This is accomplished in the following process Binder solution (Polymer and alcohol) is handled in 55 gallon drums and stored in an enclosed paint preparation room or temporarily on an outside pad prior to use. Pigment is received in 100 kg fiber packs and stored in the paint preparation area again prior to use.

The coating (or paint) solution is prepared by adding measured amounts of binder solution, a wetting agent, pigment and alcohol to an agitated premix tank. The coating solution is then tested per specification. If acceptable, the material is put into carboys. If not acceptable, the material is blended or processed though various equipment until tested within specifications. The acceptable coating solution is stored in carboys in the paint preparation area until needed for spray coating process. In the spray coating process the resin membrane is feed continuously through the spray booth while the coating material is "sprayed" onto the membrane. An automatic transverse machine carries two air jet spray guns back and forth in front of the membrane and applies a thin coating.

The volatile paint alcohol is evaporated in the top section of the spray booth and in the exit enclosure behind the top section of the spray booth, leaving a dry pigment/binder coating on the membrane's surface.

The resin membrane spray coating and coating preparation process is contained in a enclosed room. All emissions are contained within the room and vent through emission control stacks. Air is supplied into the rooms and vented on a once through basis. The ventilation system is designed for 2 to 5 minute air exchange rate.

Basis and Assumptions:

- vent to atmosphere via stack
- No fugitive emissions due to all emissions vented through stack.
- Total Suspended Particles are pigment and larger than 10 micron PM.
- Maximum coating rate is 180cc/min per spray gun design basis with air pressure at max soc's. For these calculations the products area is using a 10% above factor to ensure emissions are not under reported. Thus 200 cc/min is basis for rate.
- Density of coating material is 7.928 lbs/gal average. This is soc aim. Actual lab analysis is performed with verifies this average over annual time frame. Thus basis of calculation assumes 7.928 SOC average vs lab reported average.
- Density of coating material is 7.928 lbs/gal average. This is soc aim. Actual lab analysis is performed with varifies this average over annual time frame. Thus basis of calculation assumes 7.928 SOC average vs lab reported average.
- Solution make up alcohol concentrations are soc specification averages. COA's verify actual concentrations are at soc averages. Thus basis of calculation assumes soc average for solution concentrations.
- Coating solution solid concentrations are soc specification averages. Lab analysis is performed and verifies this average over annual time frame. Thus the basis of calculation assumes 18% solids in coating batch.
- Paint applications emissions arrestor efficiency is 95% based on equipment design specification. 5% of total solids are lost as air emissions.

Information Inputs and Source of Inputs:

Information	Source
Paint batches made	Spray coating run sheets & lab numbering system for each batch made.
Gallons/batch	PR-81 process SOC
Paint batches remade	Spray coating run sheets & lab numbering system for each batch made. Note that the lab numbering system will indicate R for remade batches.
Gallons added/remade batch	PR-81 process SOC
Coating Density	PR-81 process SOC
Binder solution make up	PR-81 process SOC
% Ethanol	PR-81 process SOC
% Methanol	PR-81 process SOC
% 1-Propanol	PR-81 process SOC
Coating % solid pigment	PR-81 process SOC
Paint Arrestor efficiency	PR-81 process SOC
CA membrane Coated	Master Production Scheduler (David Garwood) via SAP BW Reporting
Total hours of operation	Master Production Scheduler (David Garwood) via SAP BW Reporting
% Hours operation per quarter	Master Production Scheduler (David Garwood) via SAP BW Reporting

Emission source/Operating Scenario Data for year 2004

1. Emission Source ID No.	NS-I
2. Emission Source Description:	Nafion® Resin Membrane Coating process
3. Operating Scenario Description:	OS-19 Nafion® Resin Membrane coating process
4. SCC Number/Description:	301 999 98 / * other organic chemical manufacture not listed.
5. Through put in CY kgs:	4875 gal
6. Fuel Information:	N/A

7: Capture Efficiency:	100%
8. Control Device Information	none vented through stack

9. Stack or emission release point information:

stack ID	stack height feet	stack diameter feet	temperature deg. F.	velocity feet/sec	volume flow rate (acfm)	release point description	ERP description
NEP-1	50	2	ambient	0.4	75	Vertical	Nafion® membrane coating

10. Operating Schedule: OS-19	Hours per last year	3134				
	hours/day 24	days/wk 7	wks/yr 52			
11. Typical Start & End times for Operating Scenario:	Continuous when used					

12. Seasonal periods percent annual throughput:	Jan-Mar	24%	April-June	29%	July-Sept	25%	Oct-Dec	21%

Emission source/Operating Scenario Data

1. Emission Source ID No. NS-I

Actual emissions per pollutant listed for source/process identified on page 1:

Criteria (NAAQS) pollutants	Pollutant code	Emissions-Criteria pollutants (tons/yr)				Emission estimation method code	Control efficiency
		2001	2002	2003	2004		
Carbon Monoxide	CO	0	0	0	0	8	
NOx	NOx	0	0	0	0	8	
TSP	TSP	0.15	0.13	0.15	0.17	8	0%
PM 2.5	PM-2.5	0.15	0.13	0.15	0.17	8	0%
PM 10	PM-10	0.15	0.13	0.15	0.17	8	0%
SO2	SO2	0	0	0	0	8	
VOC	VOC	12.7	10.9	13.1	15.1	8	0%
HAP/TAP pollutants	CAS #	Emissions HAP/TAPs lbs/yr					

NS-I Membrane Spraybooth summary. **2004**

Coating Process

Max Spray Coat Rate	cc/min (2 guns)	400		From PR-81 in process specification spray gun maximum capability
Max Process Rate	gal/hr	6.3		=cc/min * 2.64E-4 gal/cc * 60 min/hr, conversion for cc/min to gal/hr
Paint Batches	batch	193	from spraycoating paint & binder lab results	From spraycoating run sheets on how many batches were made during the year. Note that lab sample analysis numbering system provides last 3 numbers which equals number of batches made and tested during the year ie 3FWC169 means that 169 batches were made in 2003.
Gallons/batch	gals	25		From PR-81 process specifications for batch size.
Gallons from Original batches	gals	4825		calculation from batch size * number of batches
Remade batches	batchs	10	from spraycoating paint & binder lab results NG first samples.	In 2003 we stopped tracking remade batchs as a separate process and combined this with the paint batch number. From spraycoating run sheets on how many batches were remade during the year. Note that the lab numbering system will indicate R for remade batches.
Gallons added/batch	gals	5		From PR-81 process specifications for remake batch size.
Gallons added to remake batches	gals	50		Calculation from gallons added * number of remade batches
Annual Process Throughput	gals/yr	4875		addition of original batches + remade batch gals producted. *This number is brought to NS-I summary sheet*
Coating Density	lb/gal	7.928		From PR-81 process specifications for coating batches
Coating Consumed	lbs/yr	38649		calculation of coating density * gals per year
	% change	15.38		
VOC Emissions				
Ethanol	wt %	69%		From PR-81 process specification for binder solution make up
Methanol	wt %	1%		From PR-81 process specification for binder solution make up
1-Propanol	wt %	8%		From PR-81 process specification for binder solution make up
Annual VOC Emissions	lbs/yr	30146		calculation of voc components % * coating consumed
	tons/yr	15.1		conversion to tons lbs/2000lbs per ton. *This number is brought to NS-I summary sheet*

TSP Emissions	% change			
Coating Solids	wt %	18%		From PR-81 process specifictions for coatings batch.
Paint Arrestor Effic	%	95%		From PR-81 equipment specifictions for coatings paint arrestor efficiency.
Solids Produced	lb/yr	6957		calculation of % coatings solids * coating consumed
Annual TSP Emissions	lbs/yr	347.8		=lbs/yr of coating consumed * wt% coating solids * (1-efficiency of arrestors) , calculation of emissions due to paint arrestor efficiency not 100%
total suspended particles	tons/yr	0.17		calculation from lbs per year to tons per year. *This number is brought to NS-I summary sheet*
	% change	15.38		
CA membrane Coated.	m2	158849	from molly cognos report	from Master Production Scheduler (David Garwood) via SAP BW Reporting.
	% change	77.27		

Throughput (production)

Coating Consumed	lbs/yr % change	38649 15.38		from above calculations
Total Hours of operations	hrs	3134	from Membrane Process Times spread sheet	from Master Production Scheduler (David Garwood) via SAP BW Reporting. *This number is brought to NS-I summary sheet.*

1st qrt % hrs of operations	24.3%
2nd qrt % hrs of operations	29.3%
3rd qrt % hrs of operations	25.1%
4th qrt % hrs of operations	21.3%

from molly's cognos report

This number is brought to NS-I summary sheet.

see process time spreadsheet for hours

Facility Name: DuPont Company – Fayetteville Works
22828 NC Highway 87 West
Fayetteville, NC 28302

Facility ID : 0900009
Permit : 03735
County : Bladen
DAQ Region : FRO

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory – Calendar Year 2004

1. Emission Source ID (from permit) or Emission Source Group ID NS–J3

2. Emission Source Description: Nafion Semiworks A/E Laboratory NS–J3

3. Operating Scenario ID/Description: OS – 26/Nafion Semiworks A/E Laboratory NS–J3

4. SCC Number/Description: 30199999/*Other Organic Chemica Manufacture Not Listed

5. Throughput/units in 2004: 15 GAL/yr
(e.g. production or fuel use):

6. Fuel Information (If fuel is used)

% Sulfur		% Ash		Heat Content (Btu/units)	

7. Capture Efficiency 100
(% of Emissions from this Process Vented to Control Device or Stack):

. Control Device Information :None

Order	CS–ID	CD ID (as listed in permit)	Control Device Description

9. Emission Release Point (ERP) Information: (Sources vented to more than one ERP use additional entry lines):

ERP ID	ERP Type	Height (in feet)	Diameter Circle (enter #): Rectangle (L x W) (in 0.1 feet)	Temperature (F)	Velocity (Feet/sec)	Volume Flow Rate (Acfm)	ERP Description
EP–NEP–J2	VERTICAL STACK	26	1.9	70	23	3912.69	Nafion Semiworks SW–2

Operating Scenario: OS – 26 **Emission Source/Group ID:** NS–J3

10. Operating Schedule: (Source/Operating Scenario that best characterizes Calendar Year 2004)
Hours per Day (8) Days per Week (5) Weeks per Year (52)

11. Typical Start & End Times For Operating Scenario: Start: 800 End: 1600

12. Seasonal Periods Percent Annual Throughput:

Jan–Feb + Dec 2004	**25%**	**March–May 2004**	**25%**	**June–Aug. 2004**	**25%**	**Sept.–Nov. 2004**	**25%**

13. Actual Emissions per Pollutant Listed :
Attach calculations and documentation of emission factors or other estimation methods used.

Criteria (NAAQS) Pollutants	**Pollutant Code**	**Emissions– Criteria Pollutants (Tons/Year)**	**Emission Estimation Method Code** (See Instructions)	**Control Efficiency** (Net after all controls)
		2004		
VOC	**VOC**	0.02	03	
HAP/TAP Pollutants (In Alphabetical Order)	**CAS** (see instructions)	**Emissions HAP/TAPS** (Pounds/Year)	**Emission Estimation Method Code** (See Instructions)	**Control Efficiency** (Net after all controls)
		2004		

AIR EMISSIONS INVENTORY SUPPORTING DOCUMENTATION

Emission Source ID No.: NS-J3

Emission Source Description: Nafion Semiworks A/E Lab

Process Description:
The Nafion Semiworks A/E lab occasionally hydrolyzes Nafion® membrane. The solution used to hydrolyze the membrane is a mixture of DMSO/Water/KOH. This operation is carried out in a five (5) gallon stainless steel tank that is heated to an operating temperature of between 75 deg C and 80 deg C. This process is conducted in a lab hood and all emissions are vented through the hood (NEP-J3). This process is run on an as needed basis with a total annual throughput of 20-40 square meters of Nafion® Membrane.

This process will emit DMSO. For the purpose of this emissions inventory, a very liberal approach will be taken as to the total amount of DMSO used is liberated to the atmosphere via evaporation. In reality, DMSO is a very non-volatile compound, with a vapor pressure of 0.5 mm Hg at 25 deg C, and therefore only a fraction of it would volatilize.

Basis and Assumptions:

(1) All DMSO in the hydrolysis solution is volatilized. This assumption is obviously a gross overstatement of the actual emissions.

(2) The 5 gal stainless steel tank is operated at 50% capacity (2.5 gal) and the hydrolysis solution is changed out every 2 months. This equates to a total of 15 gallons per year used in this operation.

Information Inputs and Source of Inputs:

Information Input	Source of Inputs
DMSO Solution Quantity	A/E Lab Technician

Point Source Emissions Determination:
The point source emissions are given on the following page.

Dimethyl Sulfoxide (DMSO) **CAS No. 67-68-5**

Quantity of DMSO Generated:

The hydrolysis solution is composed of 30% DMSO, 60% Water; and 10% KOH on a weight ba:
The density of the solution is approximately 9 lbs. per gallon.
Total yearly consumption of solution is 15 gallons.
On a weight basis, this is equivalent to 135 lbs of solution (15 gal. x 9 lbs./gal.)
Therefore, the total amount of possible DMSO emitted is 40 lbs (135 lbs. x 30% = 40 lbs.)
40 lbs./yr. of DMSO is equivalent to 0.020 tons/yr. of DMSO emitted.

Fugitive Emissions Determination:
N/A

Emissions Summary:

NS-J3 Nafion® Semiworks No. 3			
Nafion® compound	CAS Chemical name	CAS No.	Emission (pounds)
DMSO	Dimethyl Sulfoxide	67-68-5	40
		Total VOC Emissions (pounds)	40
		Total VOC Emissions (tons)	0.02