Enclosure 1

Plan Approval Application Forms

- **Combustion Turbines and Duct Burners**
- **Natural Gas Reciprocating Engines**
- **Diesel Reciprocating Engines**

Section B - Processes Information (Combustion Turbines/Duct Burners (3x))

1. Source Information

Source Description (give type, use, raw materials, product, etc). Attach additional sheets as necessary.
This section covers the Combustion turbines (CTs) equiped with duct burners (DBs) (3 Combined Cycle Units)

Manufacturer	Model No.	Number of Sources
GE	GE Frame 6B	3
Source Designation	Maximum Capacity	Rated Capacity
CT/DB with heat recovery steam generator		CT/DB:715.4 MMBtu/hr

Type of Material Processed
The three CTs/DBs are each fired with natural gas

Maximum Operating Schedule

Hours/Day	Days/Week	Days/Year	Hours/Year
24	7	365	8760

Operational restrictions existing or requested, if any (e.g., bottlenecks or voluntary restrictions to limit PTE)

Capacity (specify units)

Per Hour	Per Day	Per Week	Per Year

Operating Schedule

Hours/Day	Days/Week	Days/Year	Hours/Year
24	7	365	8760

Seasonal variations (Months) From to

If variations exist, describe them

2. Fuel

Type	Quantity Hourly	Annually	Sulfur	% Ash (Weight)	BTU Content
Oil Number _____	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Oil Number _____	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Natural Gas	CT/DB 701,000 SCFH	X 10^6 SCF	0.5 grain/100 SCF		1020 Btu/SCF
Gas (other) _____	SCFH	X 10^6 SCF	grain/100 SCF		Btu/SCF
Coal _____	TPH	Tons	% by wt		Btu/lb
Other * _____					
_____					
_____					

*Note: Describe and furnish information separately for other fuels in Addendum B.

Section B - Processes Information (Combustion Turbines/Duct Burners (3x)) (Continued)

3. Burner

Manufacturer	Type and Model No.	Number of Burners
Description:		
Rated Capacity	Maximum Capacity	

4. Process Storage Vessels

A. For Liquids:

Name of material stored		
Tank I.D. No.	Manufacturer	Date Installed
Maximum Pressure	Capacity (gallons/Meter^3)	
Type of relief device (pressure set vent/conservation vent/emergency vent/open vent)		
Relief valve/vent set pressure (psig)	Vapor press. of liquid at storage temp. (psia/kPa)	
Type of Roof: Describe:		
Total Throughput Per Year	Number of fills per day (fill/day): Filling Rate (gal./min.): Duration of fill hr./fill):	

B. For Solids

Type: ☐ Silo ☐ Storage Bin ☐Other, Describe	Name of Material Stored	
Silo/Storage Bin I.D. No.	Manufacturer	Date Installed
State whether the material will be stored in loose or bags in silos	Capacity (Tons)	
Turn over per year in tons	Turn over per day in tons	
Describe fugitive dust control system for loading and handling operations		
Describe material handling system		

5. Request for Confidentiality

Do you request any information on this application to be treated as "Confidential"? ☐ Yes ☐ No
If yes, include justification for confidentiality. Place such information on separate pages marked **"confidential"**.

Section B - Processes Information (Combustion Turbines/Duct Burners (3x)) (Continued)

6. Miscellaneous Information

Attach flow diagram of process giving all (gaseous, liquid and solid) flow rates. Also, list all raw materials charged to process equipment, and the amounts charged (tons/hour, etc.) at rated capacity (give maximum, minimum and average charges describing fully expected variations in production rates). Indicate (on diagram) all points where contaminants are controlled (location of water sprays, collection hoods, or other pickup points, etc.). Describe collection hoods location, design, airflow and capture efficiency. Describe any restriction requested and how it will be monitored.

Describe fully the facilities provided to monitor and to record process operating conditions, which may affect the emission of air contaminants. Show that they are reasonable and adequate.
N/A

Describe each proposed modification to an existing source.
N/A

Identify and describe all fugitive emission points, all relief and emergency valves and any by-pass stacks.
The facilities emissions points are unchanged as covered by PA-04-00740A.

Describe how emissions will be minimized especially during start up, shut down, process upsets and/or disruptions.
Limits covering startup and shut down are included in PA-04-00740A. No changes requested by this design update.

Anticipated Milestones:

i. Expected commencement date of construction/reconstruction/installation: 2015
ii. Expected completion date of construction/reconstruction/installation: 2020
iii. Anticipated date of start-up: 2020

Section C - Air Cleaning Device (Combustion Turbines/Duct Burners (3x))

1. Precontrol Emissions* Please refer to Table 2-1 and Appendix B of the Support Document

Pollutant	Maximum Emission Rate				Calculation/ Estimation Method
	Specify Units	Pounds/Hour	Hours/Year	Tons/Year	
PM					
PM_{10}					
SO_x					
CO					
NO_x					
VOC					
Others: (e.g., HAPs)	-----	-----	-----	-----	-----

* These emissions must be calculated based on the requested operating schedule and/or process rate, e.g., operating schedule for maximum limits or restricted hours of operation and/or restricted throughput. Describe how the emission values were determined. Attach calculations.

2. Gas Cooling

Water quenching ☐ Yes ☐ No Water injection rate _____ GPM

Radiation and convection cooling ☐ Yes ☐ No	Air dilution ☐ Yes ☐ No If yes, _____CFM
Forced Draft ☐ Yes ☐ No	Water cooled duct work ☐ Yes ☐ No
Other	
Inlet Volume _____ACFM @ _____°F _____% Moisture	Outlet Volume _____ACFM @ _____°F _____% Moisture

Describe the system in detail.

Section C - Air Cleaning Device (Combustion Turbines/Duct Burners (3x)) (Continued)

10. ☒ **Selective Catalytic Reduction (SCR)**
☐ **Selective Non-Catalytic Reduction (SNCR)**
☐ **Non-Selective Catalytic Reduction (NSCR)**

Equipment Specifications

Manufacturer	Type	Model No.
General Electric (GE)	Fibre reinforced Vanadium-tungsten-titania catalyst	GE Frame 6B

Design Inlet Volume (SCFM)	Design operating temperature (°F)
372,090	600-700ºF

Is the system equipped with process controls for proper mixing/control of the reducing agent in gas stream? If yes, give details.

Attach efficiency and other pertinent information (e.g., ammonia slip)

Operating Parameters

Volume of gases handled _____ (ACFM) @ _____ °F

Operating temperature range for the SCR/SNCR/NSCR system (°F) From 600 °F To 700 °F

Reducing agent used, if any	Oxidation catalyst used, if any
Ammonia	Yes

State expected range of usage rate and concentration.

17-28 lb/hr

Service life of catalyst	Ammonia slip (ppm)
	5 ppmvd @15% O2

Describe fully with a sketch giving locations of equipment, controls systems, important parameters and method of operation.

SCR and CO oxidation catalyst are designed to reduce NOx and CO emissions to the proposed BACT/LAER limits of 2 ppmvd @15% O2. Emissions calculations for each of the proposed turbine units are included in Appendix B of the Support Document.

Describe the warning/alarm system that protects against operation when unit is not meeting design requirements.

Emissions Data (Refer to the Support Document for emissions data)

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Combustion Turbines/Duct Burners (3x)) (Continued)

13. Other Control Equipment

Equipment Specifications

Manufacturer	Type	Model No.
GE	Lean Premix Dry Low NOx Combustor	GE Frame 6B

Design Volume (SCFM)	Capacity
372,090	

Describe pH monitoring and pH adjustment, if any.

Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any.

Attach efficiency curve and/or other efficiency information.

Attach any additional date including auxiliary equipment and operation details to thoroughly evaluate the control equipment.

Operation Parameters

Volume of gas handled

_____ ACFM @ _____°F _____% Moisture

Describe fully giving important parameters and method of operation.

Describe the warning/alarm system that protects against operation when unit is not meeting design requirements.

Emissions Data (Refer to the Support Document for emissions data)

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Combustion Turbines/Duct Burners (3x)) (Continued)

14. Costs

Indicate cost associated with air cleaning device and its operating cost (attach documentation if necessary)

Device	Direct Cost	Indirect Cost	Total Cost	Annual Operating Cost

15. Miscellaneous

Describe in detail the removal, handling and disposal of dust, effluent, etc. from the air cleaning device including proposed methods of controlling fugitive emissions.

Attach manufacturer's performance guarantees and/or warranties for each of the major components of the control system (or complete system).

Attach the maintenance schedule for the control equipment and any part of the process equipment that if in disrepair would increase air contaminant emissions.

Section D - Additional Information (Combustion Turbines/Duct Burners (3x))

Will the construction, modification, etc. of the sources covered by this application increase emissions from other sources at the facility? If so, describe and quantify.

No

If this project is subject to any one of the following, attach a demonstration to show compliance with applicable standards.
See original plan approval application submitted in 2015

a. Prevention of Significant Deterioration permit (PSD), 40 CFR 52? ☐ YES ☐ NO

b. New Source Review (NSR), 25 Pa. Code Chapter 127, Subchapter E? ☐ YES ☐ NO

c. New Source Performance Standards (NSPS), 40 CFR Part 60? ☐ YES ☐ NO
(If Yes, which subpart) _____

d. National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61? (If Yes, which subpart) _____ ☐ YES ☐ NO

e. Maximum Achievable Control Technology (MACT) 40 CFR Part 63? ☐ YES ☐ NO
(If Yes, which part) _____

Attach a demonstration showing that the emissions from any new sources will be the minimum attainable through the use of best available technology (BAT).

Provide emission increases and decreases in allowable (or potential) and actual emissions within the last five (5) years for applicable PSD pollutant(s) if the facility is an existing major facility (PSD purposes).

Section D - Additional Information (Combustion Turbines/Duct Burners (3x)) (Continued)

Indicate emission increases and decreases in tons per year (tpy), for volatile organic compounds (VOCs) and nitrogen oxides (NOx) for NSR applicability since January 1, 1991 or other applicable dates (see other applicable dates in instructions). The emissions increases include all emissions including stack, fugitive, material transfer, other emission generating activities, quantifiable emissions from exempted source(s), etc. **See Table 2-1**

Permit number (if applicable)	Date issued	Indicate ***Yes*** or ***No*** if emission increases and decreases were used previously for netting	Source I. D. or Name	VOCs		NOx	
				Emission increases in potential to emit (tpy)	Creditable emission decreases in actual emissions (tpy)	Emission increases in potential to emit (tpy)	Creditable emission decreases in actual emissions (tpy)

If the source is subject to 25 Pa. Code Chapter 127, Subchapter E, New Source Review requirements,

a. Identify Emission Reduction Credits (ERCs) for emission offsets or demonstrate ability to obtain suitable ERCs for emission offsets.

b. Provide a demonstration that the lowest achievable emission rate (LAER) control techniques will be employed (if applicable).

c. Provide an analysis of alternate sites, sizes, production processes and environmental control techniques demonstrating that the benefits of the proposed source outweigh the environmental and social costs (if applicable).

Attach calculations and any additional information necessary to thoroughly evaluate compliance with all the applicable requirements of Article III and applicable requirements of the Clean Air Act adopted thereunder The Department may request additional information to evaluate the application such as a standby plan, a plan for air pollution emergencies, air quality modeling, etc.

Section E - Compliance Demonstration (Combustion Turbines/Duct Burners (3x))

Note: Complete this section if source is not a Title V facility. Title V facilities must complete Addendum A.

Method of Compliance Type: Check all that apply and complete all appropriate sections below

☒ Monitoring ☒ Testing ☐ Reporting

☒ Recordkeeping ☒ Work Practice Standard

Monitoring:

a. Monitoring device type (Parameter, CEM, etc): NOx, CO, and CO2 CEMs; Stack test VOC and PM/PM10/PM2.5

b. Monitoring device location: SCR

c. Describe all parameters being monitored along with the frequency and duration of monitoring each parameter:

Continuous measurement of NOx, CO, and O2 concentration and volumetric flow rate, 5-year performance test for PM and VOC

Testing:

a. Reference Test Method: Citation EPA Method 18, 25, 5, and 202

b. Reference Test Method: Description Method 18-Measurement of Gaseous Organic Compound Emissions by Gas Chromatography; Method 25-Determination of Total Gaseous Nonmethane Organic Emissions as Carbon; Method 5 – Determination of Particulate Matter Emissions from Stationary Sources; Method 202 – Dry Impinger Method for Determining Condensable Particulate Matter from Stationary Sources.

Recordkeeping:

Describe what parameters will be recorded and the recording frequency:

Records kept for continuous measurement of NOx, CO, and O2 concentration and volumetric flow rate, 5 year performance test for PM and VOC

Reporting:

a. Describe what is to be reported and frequency of reporting:

b. Reporting start date: _____

Work Practice Standard:

Describe each: Good combustion design and operation for PM/PM10/PM2.5 control. Use of natural gas and energy efficient design for CO2e/GHG control.

Section F - Flue and Air Contaminant Emission (Combustion Turbines/Duct Burners (3x))

1. Estimated Atmospheric Emissions*

Pollutant	Maximum emission rate			Calculation/ Estimation Method
	specify units	lbs/hr	tons/yr.	
PM				
PM_{10}				
SO_x				
CO				
NO_x				
VOC				
Others: (e.g., HAPs)	-----	-----	-----	-----

* These emissions must be calculated based on the requested operating schedule and/or process rate e.g., operating schedule for maximum limits or restricted hours of operation and /or restricted throughput. Describe how the emission values were determined. Attach calculations. Refer to Appendix B of the Support Document for emissions calculations

2. Stack and Exhauster

Stack Designation/Number

List Source(s) or source ID exhausted to this stack:	% of flow exhausted to stack:

Stack height above grade (ft.) 213 Grade elevation (ft.) 795	Stack diameter (ft) or Outlet duct area (sq. ft.) 10	f. Weather Cap ☐ YES ☒ NO

Distance of discharge to nearest property line (ft.). Locate on topographic map.

Does stack height meet Good Engineering Practice (GEP)?
Yes

If modeling (estimating) of ambient air quality impacts is needed, attach a site plan with buildings and their dimensions and other obstructions. Refer to Section 5.0 of the Support Document

Location of stack** Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
CT/DB 1	40	40	3.0144	-80	20	17.16
CT/DB 2	40	40	4.3068	-80	20	15.191
CT/DB 3	40	40	505704	-80	20	13.207

Stack exhaust
Volume 373,000 ACFM Temperature 311 °F Moisture _____ %

Indicate on an attached sheet the location of sampling ports with respect to exhaust fan, breeching, etc. Give all necessary dimensions.

Exhauster (attach fan curves) _____ in. of water _____ HP @ _____RPM.

** If the data and collection method codes differ from those provided on the General Information Form-Authorization Application, provide the additional detail required by that form on a separate form.

Section B - Processes Information (Natural Gas Engines (4x))

1. Source Information

Source Description (give type, use, raw materials, product, etc). Attach additional sheets as necessary.
This section covers the four (4) natural gas-fired reciprocating internal combustion engines, rated at 158, 50, 113, and 210 BHP, used to drive emergency sanitary water pumps (2x) and emergency electrical generators (2x).

Manufacturer	Model No.	Number of Sources
GM, GM, GM, to be determined (TBD)	V-8 Vortec 5.7L, 4-cycle; Inline 4 Vortec 3.0L, 4-cycle; 5.7L, 4-cycle, V-8; and TBD	4
Source Designation	Maximum Capacity	Rated Capacity

Type of Material Processed

Maximum Operating Schedule

Hours/Day	Days/Week	Days/Year	Hours/Year
			100 (each

Operational restrictions existing or requested, if any (e.g., bottlenecks or voluntary restrictions to limit PTE)

Capacity (specify units)

Per Hour	Per Day	Per Week	Per Year

Operating Schedule

Hours/Day	Days/Week	Days/Year	Hours/Year

Seasonal variations (Months) From to

If variations exist, describe them

2. Fuel

Type	Quantity Hourly	Annually	Sulfur	% Ash (Weight)	BTU Content
Oil Number _____	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Oil Number _____	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Natural Gas	SCFH	X 10^6 SCF	0.5 grain/100 SCF		1020 Btu/SCF
Gas (other) _____	SCFH	X 10^6 SCF	grain/100 SCF		Btu/SCF
Coal _____	TPH	Tons	% by wt		Btu/lb
Other * _____					
_____					
_____					

*Note: Describe and furnish information separately for other fuels in Addendum B.

Section B - Processes Information (Natural Gas Engines (4x)) (Continued)

3. Burner

Manufacturer	Type and Model No.	Number of Burners
Description:		
Rated Capacity	Maximum Capacity	

4. Process Storage Vessels

A. For Liquids:

Name of material stored		
Tank I.D. No.	Manufacturer	Date Installed
Maximum Pressure	Capacity (gallons/Meter^3)	
Type of relief device (pressure set vent/conservation vent/emergency vent/open vent)		
Relief valve/vent set pressure (psig)	Vapor press. of liquid at storage temp. (psia/kPa)	
Type of Roof: Describe:		
Total Throughput Per Year	Number of fills per day (fill/day): Filling Rate (gal./min.): Duration of fill hr./fill):	

B. For Solids

Type: ☐ Silo ☐ Storage Bin ☐Other, Describe	Name of Material Stored	
Silo/Storage Bin I.D. No.	Manufacturer	Date Installed
State whether the material will be stored in loose or bags in silos	Capacity (Tons)	
Turn over per year in tons	Turn over per day in tons	
Describe fugitive dust control system for loading and handling operations		
Describe material handling system		

5. Request for Confidentiality

Do you request any information on this application to be treated as "Confidential"? ☐ Yes ☐ No
If yes, include justification for confidentiality. Place such information on separate pages marked **"confidential"**.

Section B - Processes Information (Natural Gas Engines (4x)) (Continued)

6. Miscellaneous Information

Attach flow diagram of process giving all (gaseous, liquid and solid) flow rates. Also, list all raw materials charged to process equipment, and the amounts charged (tons/hour, etc.) at rated capacity (give maximum, minimum and average charges describing fully expected variations in production rates). Indicate (on diagram) all points where contaminants are controlled (location of water sprays, collection hoods, or other pickup points, etc.). Describe collection hoods location, design, airflow and capture efficiency. Describe any restriction requested and how it will be monitored.

Describe fully the facilities provided to monitor and to record process operating conditions, which may affect the emission of air contaminants. Show that they are reasonable and adequate.
N/A

Describe each proposed modification to an existing source.
N/A

Identify and describe all fugitive emission points, all relief and emergency valves and any by-pass stacks.
The facilities emissions points are unchanged as covered by PA-04-00740A.

Describe how emissions will be minimized especially during start up, shut down, process upsets and/or disruptions.
N/A

Anticipated Milestones:

i. Expected commencement date of construction/reconstruction/installation: 2015
ii. Expected completion date of construction/reconstruction/installation: 2020
iii. Anticipated date of start-up: 2020

Section C - Air Cleaning Device (Natural Gas Engines (4x))

1. Precontrol Emissions* Work Practice

Pollutant	Maximum Emission Rate				Calculation/ Estimation Method
	Specify Units	Pounds/Hour	Hours/Year	Tons/Year	
PM					
PM_{10}					
SO_x					
CO					
NO_x					
VOC					
Others: (e.g., HAPs)	-----	-----	-----	-----	-----

* These emissions must be calculated based on the requested operating schedule and/or process rate, e.g., operating schedule for maximum limits or restricted hours of operation and/or restricted throughput. Describe how the emission values were determined. Attach calculations. Refer to Appendix B of the Support Document for emission calculations.

2. Gas Cooling

Water quenching ☐ Yes ☐ No Water injection rate _____ GPM

Radiation and convection cooling
☐ Yes ☐ No

Air dilution ☐ Yes ☐ No
If yes, _____CFM

Forced Draft ☐ Yes ☐ No

Water cooled duct work ☐ Yes ☐ No

Other

Inlet Volume _____ACFM
@ _____°F _____% Moisture

Outlet Volume _____ACFM
@ _____°F _____% Moisture

Describe the system in detail.

Section C - Air Cleaning Device (Natural Gas Engines (4x))(Continued)

10. ☐ **Selective Catalytic Reduction (SCR)**
☐ **Selective Non-Catalytic Reduction (SNCR)**
☒ **Non-Selective Catalytic Reduction (NSCR)**

Equipment Specifications

Manufacturer	Type	Model No.
GM, GNM, GM, and TBD		V-8 Vortex 5.7L, 4 cycle; Inline 4 Vortec 3.0L, 4-cycle; 5.7L, 4-cycle, V-8; and TBD

Design Inlet Volume (SCFM)	Design operating temperature (°F)

Is the system equipped with process controls for proper mixing/control of the reducing agent in gas stream? If yes, give details.

Attach efficiency and other pertinent information (e.g., ammonia slip)

Operating Parameters

Volume of gases handled _____ (ACFM) @ _____ °F

Operating temperature range for the SCR/SNCR/NSCR system (°F) From _____°F To _____°F

Reducing agent used, if any	Oxidation catalyst used, if any

State expected range of usage rate and concentration.

Service life of catalyst	Ammonia slip (ppm)

Describe fully with a sketch giving locations of equipment, controls systems, important parameters and method of operation.

The engine's emissions control systems are designed to minimize NOx, VOC, CO, and PM emissions.

Describe the warning/alarm system that protects against operation when unit is not meeting design requirements.

Emissions Data

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Natural Gas Engines (4x))(Continued)

13. Other Control Equipment

Equipment Specifications

Manufacturer	Type	Model No.

Design Volume (SCFM)	Capacity

Describe pH monitoring and pH adjustment, if any.

Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any.

Attach efficiency curve and/or other efficiency information.

Attach any additional date including auxiliary equipment and operation details to thoroughly evaluate the control equipment.

Operation Parameters

Volume of gas handled

_____ ACFM @ _____°F _____% Moisture

Describe fully giving important parameters and method of operation.

Describe the warning/alarm system that protects against operation when unit is not meeting design requirements.

Emissions Data

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Natural Gas Engines (4x))(Continued)

14. Costs

Indicate cost associated with air cleaning device and its operating cost (attach documentation if necessary)

Device	Direct Cost	Indirect Cost	Total Cost	Annual Operating Cost

15. Miscellaneous

Describe in detail the removal, handling and disposal of dust, effluent, etc. from the air cleaning device including proposed methods of controlling fugitive emissions.

Attach manufacturer's performance guarantees and/or warranties for each of the major components of the control system (or complete system).

Attach the maintenance schedule for the control equipment and any part of the process equipment that if in disrepair would increase air contaminant emissions.

Section D - Additional Information (Natural Gas Engines (4x))

Will the construction, modification, etc. of the sources covered by this application increase emissions from other sources at the facility? If so, describe and quantify.

No

If this project is subject to any one of the following, attach a demonstration to show compliance with applicable standards.

a. Prevention of Significant Deterioration permit (PSD), 40 CFR 52? ☐ YES ☐ NO

b. New Source Review (NSR), 25 Pa. Code Chapter 127, Subchapter E? ☐ YES ☐ NO

c. New Source Performance Standards (NSPS), 40 CFR Part 60? ☐ YES ☐ NO
(If Yes, which subpart) _____

d. National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61? (If Yes, which subpart) _____ ☐ YES ☐ NO

e. Maximum Achievable Control Technology (MACT) 40 CFR Part 63? ☐ YES ☐ NO
(If Yes, which part) _____

Attach a demonstration showing that the emissions from any new sources will be the minimum attainable through the use of best available technology (BAT).

Provide emission increases and decreases in allowable (or potential) and actual emissions within the last five (5) years for applicable PSD pollutant(s) if the facility is an existing major facility (PSD purposes).

Section D - Additional Information (Natural Gas Engines (4x))(Continued)

Indicate emission increases and decreases in tons per year (tpy), for volatile organic compounds (VOCs) and nitrogen oxides (NOx) for NSR applicability since January 1, 1991 or other applicable dates (see other applicable dates in instructions). The emissions increases include all emissions including stack, fugitive, material transfer, other emission generating activities, quantifiable emissions from exempted source(s), etc. **See Table 2-1**

Permit number (if applicable)	Date issued	Indicate ***Yes*** or ***No*** if emission increases and decreases were used previously for netting	Source I. D. or Name	VOCs		NOx	
				Emission increases in potential to emit (tpy)	Creditable emission decreases in actual emissions (tpy)	Emission increases in potential to emit (tpy)	Creditable emission decreases in actual emissions (tpy)

If the source is subject to 25 Pa. Code Chapter 127, Subchapter E, New Source Review requirements,

d. Identify Emission Reduction Credits (ERCs) for emission offsets or demonstrate ability to obtain suitable ERCs for emission offsets.

e. Provide a demonstration that the lowest achievable emission rate (LAER) control techniques will be employed (if applicable).

f. Provide an analysis of alternate sites, sizes, production processes and environmental control techniques demonstrating that the benefits of the proposed source outweigh the environmental and social costs (if applicable).

Attach calculations and any additional information necessary to thoroughly evaluate compliance with all the applicable requirements of Article III and applicable requirements of the Clean Air Act adopted thereunder The Department may request additional information to evaluate the application such as a standby plan, a plan for air pollution emergencies, air quality modeling, etc.

Section E - Compliance Demonstration (Natural Gas Engines (4x))(Continued)

Note: Complete this section if source is not a Title V facility. Title V facilities must complete Addendum A.

Method of Compliance Type: Check all that apply and complete all appropriate sections below

☒ Monitoring ☐ Testing ☐ Reporting

☒ Recordkeeping ☒ Work Practice Standard

Monitoring:

a. Monitoring device type (Parameter, CEM, etc):

b. Monitoring device location:

c. Describe all parameters being monitored along with the frequency and duration of monitoring each parameter:

Testing:

a. Reference Test Method: Citation

b. Reference Test Method: Description

Recordkeeping:

Describe what parameters will be recorded and the recording frequency:

Reporting:

a. Describe what is to be reported and frequency of reporting:

b. Reporting start date: _____

Work Practice Standard:

Describe each: Compliance with proposed limits for NOx, CO, $PM/PM_{10}/PM_{2.5}$, & CO met with purchase of certified engine

Section F - Flue and Air Contaminant Emission (Natural Gas Engines (4x))

1. Estimated Atmospheric Emissions*

Pollutant	Maximum emission rate			Calculation/ Estimation Method
	specify units	lbs/hr	tons/yr.	
PM				
PM_{10}				
SO_x				
CO				
NO_x				
VOC				
Others: (e.g., HAPs)	-----	-----	-----	-----

* These emissions must be calculated based on the requested operating schedule and/or process rate e.g., operating schedule for maximum limits or restricted hours of operation and /or restricted throughput. Describe how the emission values were determined. Attach calculations. Refer to Appendix B of the Support Document for emissions calculations.

2. Stack and Exhauster

Stack Designation/Number

List Source(s) or source ID exhausted to this stack:	% of flow exhausted to stack:

Stack height above grade (ft.) 6, 6, 6, & 6 Grade elevation (ft.) 795, 795, 784, & 795	Stack diameter (ft) or Outlet duct area (sq. ft.) 0.1, 0.2, 0.3, & TBD	f. Weather Cap ☐ YES ☒ NO

Distance of discharge to nearest property line (ft.). Locate on topographic map.

Does stack height meet Good Engineering Practice (GEP)?
Yes

If modeling (estimating) of ambient air quality impacts is needed, attach a site plan with buildings and their dimensions and other obstructions. Refer to Section 5.0 of the Support Document

Location of stack** Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Engine 1	40	40	4.494	-80	20	6.90
Engine 2	40	40	2.280	-80	20	18.805
Engine 3	40	39	37.537	-80	20	36.992
Engine 4	40	39	33.876	-80	20	37.421

Stack exhaust
Volume 1261, 250, 847, & TBD ACFM Temperature 392 (ALL) °F Moisture _____ %

Indicate on an attached sheet the location of sampling ports with respect to exhaust fan, breeching, etc. Give all necessary dimensions.

Exhauster (attach fan curves) _____ in. of water _____ HP @ _____RPM.

** If the data and collection method codes differ from those provided on the General Information Form-Authorization Application, provide the additional detail required by that form on a separate form.

Section B - Processes Information (Diesel Engines (2x))

1. Source Information

Source Description (give type, use, raw materials, product, etc). Attach additional sheets as necessary.

This section covers the two diesel-fired reciprocating internal combustion engines, each rated at 103 and 67 BHP, will be used to drive emergency electrical generators.

Manufacturer	Model No.	Number of Sources
Cummins & Kohler	QSB5-G3 4.5L, Inline 4; KDI 3404TM, Inline 4, 4-Cycle Turbo	2
Source Designation	Maximum Capacity	Rated Capacity

Type of Material Processed
Diesel fuel fired

Maximum Operating Schedule

Hours/Day	Days/Week	Days/Year	Hours/Year
			100 (each

Operational restrictions existing or requested, if any (e.g., bottlenecks or voluntary restrictions to limit PTE)

Capacity (specify units)

Per Hour	Per Day	Per Week	Per Year

Operating Schedule

Hours/Day	Days/Week	Days/Year	Hours/Year

Seasonal variations (Months) From to

If variations exist, describe them

2. Fuel

Type	Quantity Hourly	Annually	Sulfur	% Ash (Weight)	BTU Content
Oil Number _____	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Oil Number _____	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Natural Gas	SCFH	X 10^6 SCF	grain/100 SCF		Btu/SCF
Gas (other) _____	SCFH	X 10^6 SCF	grain/100 SCF		Btu/SCF
Coal _____	TPH	Tons	% by wt		Btu/lb
Other * Diesel _____			15 ppmw		
_____					
_____					

*Note: Describe and furnish information separately for other fuels in Addendum B.

Section B - Processes Information (Diesel Engines (2x))(Continued)

3. Burner

Manufacturer	Type and Model No.	Number of Burners
Description:		
Rated Capacity	Maximum Capacity	

4. Process Storage Vessels

A. For Liquids:

Name of material stored		
Tank I.D. No.	Manufacturer	Date Installed
Maximum Pressure	Capacity (gallons/Meter^3)	
Type of relief device (pressure set vent/conservation vent/emergency vent/open vent)		
Relief valve/vent set pressure (psig)	Vapor press. of liquid at storage temp. (psia/kPa)	
Type of Roof: Describe:		
Total Throughput Per Year	Number of fills per day (fill/day): Filling Rate (gal./min.): Duration of fill hr./fill):	

B. For Solids

Type: ☐ Silo ☐ Storage Bin ☐Other, Describe	Name of Material Stored	
Silo/Storage Bin I.D. No.	Manufacturer	Date Installed
State whether the material will be stored in loose or bags in silos	Capacity (Tons)	
Turn over per year in tons	Turn over per day in tons	
Describe fugitive dust control system for loading and handling operations		
Describe material handling system		

5. Request for Confidentiality

Do you request any information on this application to be treated as "Confidential"? ☐ Yes ☐ No
If yes, include justification for confidentiality. Place such information on separate pages marked **"confidential"**.

Section B - Processes Information (Diesel Engines (2x)) (Continued)

6. Miscellaneous Information

Attach flow diagram of process giving all (gaseous, liquid and solid) flow rates. Also, list all raw materials charged to process equipment, and the amounts charged (tons/hour, etc.) at rated capacity (give maximum, minimum and average charges describing fully expected variations in production rates). Indicate (on diagram) all points where contaminants are controlled (location of water sprays, collection hoods, or other pickup points, etc.). Describe collection hoods location, design, airflow and capture efficiency. Describe any restriction requested and how it will be monitored.

Describe fully the facilities provided to monitor and to record process operating conditions, which may affect the emission of air contaminants. Show that they are reasonable and adequate.
N/A

Describe each proposed modification to an existing source.
N/A

Identify and describe all fugitive emission points, all relief and emergency valves and any by-pass stacks.
The facilities emissions points are unchanged as covered by PA-04-00740A.

Describe how emissions will be minimized especially during start up, shut down, process upsets and/or disruptions.
N/A

Anticipated Milestones:

i. Expected commencement date of construction/reconstruction/installation: 2015
ii. Expected completion date of construction/reconstruction/installation: 2020
iii. Anticipated date of start-up: 2020

Section C - Air Cleaning Device ((Diesel Engines (2x)) (Continued)

1. Precontrol Emissions* Work Practice

Pollutant	Maximum Emission Rate				Calculation/ Estimation Method
	Specify Units	Pounds/Hour	Hours/Year	Tons/Year	
PM					
PM_{10}					
SO_x					
CO					
NO_x					
VOC					
Others: (e.g., HAPs)	-----	-----	-----	-----	-----

* These emissions must be calculated based on the requested operating schedule and/or process rate, e.g., operating schedule for maximum limits or restricted hours of operation and/or restricted throughput. Describe how the emission values were determined. Attach calculations. Refer to Appendix B of the Support Document for emission calculations.

2. Gas Cooling

Water quenching ☐ Yes ☐ No Water injection rate _____ GPM

Radiation and convection cooling
☐ Yes ☐ No

Air dilution ☐ Yes ☐ No
If yes, _____CFM

Forced Draft ☐ Yes ☐ No

Water cooled duct work ☐ Yes ☐ No

Other

Inlet Volume _____ACFM
@ _____°F _____% Moisture

Outlet Volume _____ACFM
@ _____°F _____% Moisture

Describe the system in detail.

Section C - Air Cleaning Device (Diesel Engines (2x)) (Continued)

10. ☐ **Selective Catalytic Reduction (SCR)**
☐ **Selective Non-Catalytic Reduction (SNCR)**
☐ **Non-Selective Catalytic Reduction (NSCR)**

Equipment Specifications

Manufacturer	Type	Model No.
GM, GNM, GM, and TBD		QSB5-G3 4.5L, Inline 4; KDI 3404TM, Inline 4, 4-Cycle Turbo

Design Inlet Volume (SCFM)	Design operating temperature (°F)

Is the system equipped with process controls for proper mixing/control of the reducing agent in gas stream? If yes, give details.

Attach efficiency and other pertinent information (e.g., ammonia slip)

Operating Parameters

Volume of gases handled _____ (ACFM) @ _____ °F

Operating temperature range for the SCR/SNCR/NSCR system (°F) From _____°F To _____°F

Reducing agent used, if any	Oxidation catalyst used, if any

State expected range of usage rate and concentration.

Service life of catalyst	Ammonia slip (ppm)

Describe fully with a sketch giving locations of equipment, controls systems, important parameters and method of operation.

The engine's emissions control systems are designed to minimize NOx, VOC, CO, and PM emissions.

Describe the warning/alarm system that protects against operation when unit is not meeting design requirements.

Emissions Data

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Diesel Engines (2x)) (Continued)

13. Other Control Equipment

Equipment Specifications

Manufacturer	Type	Model No.

Design Volume (SCFM)	Capacity

Describe pH monitoring and pH adjustment, if any.

Indicate the liquid flow rate and describe equipment provided to measure pressure drop and flow rate, if any.

Attach efficiency curve and/or other efficiency information.

Attach any additional date including auxiliary equipment and operation details to thoroughly evaluate the control equipment.

Operation Parameters

Volume of gas handled

_____ ACFM @ _____°F _____% Moisture

Describe fully giving important parameters and method of operation.

Describe the warning/alarm system that protects against operation when unit is not meeting design requirements.

Emissions Data

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Diesel Engines (2x)) (Continued)

14. Costs

Indicate cost associated with air cleaning device and its operating cost (attach documentation if necessary)

Device	Direct Cost	Indirect Cost	Total Cost	Annual Operating Cost

15. Miscellaneous

Describe in detail the removal, handling and disposal of dust, effluent, etc. from the air cleaning device including proposed methods of controlling fugitive emissions.

Attach manufacturer's performance guarantees and/or warranties for each of the major components of the control system (or complete system).

Attach the maintenance schedule for the control equipment and any part of the process equipment that if in disrepair would increase air contaminant emissions.

Section D - Additional Information (Diesel Engines (2x))

Will the construction, modification, etc. of the sources covered by this application increase emissions from other sources at the facility? If so, describe and quantify.

No

If this project is subject to any one of the following, attach a demonstration to show compliance with applicable standards.

a. Prevention of Significant Deterioration permit (PSD), 40 CFR 52? ☐ YES ☐ NO

b. New Source Review (NSR), 25 Pa. Code Chapter 127, Subchapter E? ☐ YES ☐ NO

c. New Source Performance Standards (NSPS), 40 CFR Part 60? ☐ YES ☐ NO
(If Yes, which subpart) _____

d. National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61? (If Yes, which subpart) _____ ☐ YES ☐ NO

e. Maximum Achievable Control Technology (MACT) 40 CFR Part 63? ☐ YES ☐ NO
(If Yes, which part) _____

Attach a demonstration showing that the emissions from any new sources will be the minimum attainable through the use of best available technology (BAT).

Provide emission increases and decreases in allowable (or potential) and actual emissions within the last five (5) years for applicable PSD pollutant(s) if the facility is an existing major facility (PSD purposes).

Section D - Additional Information (Natural Gas Engines (4x))(Continued)

Indicate emission increases and decreases in tons per year (tpy), for volatile organic compounds (VOCs) and nitrogen oxides (NOx) for NSR applicability since January 1, 1991 or other applicable dates (see other applicable dates in instructions). The emissions increases include all emissions including stack, fugitive, material transfer, other emission generating activities, quantifiable emissions from exempted source(s), etc. **See Table 2-1**

Permit number (if applicable)	Date issued	Indicate ***Yes*** or ***No*** if emission increases and decreases were used previously for netting	Source I. D. or Name	VOCs		NOx	
				Emission increases in potential to emit (tpy)	Creditable emission decreases in actual emissions (tpy)	Emission increases in potential to emit (tpy)	Creditable emission decreases in actual emissions (tpy)

If the source is subject to 25 Pa. Code Chapter 127, Subchapter E, New Source Review requirements,

g. Identify Emission Reduction Credits (ERCs) for emission offsets or demonstrate ability to obtain suitable ERCs for emission offsets.

h. Provide a demonstration that the lowest achievable emission rate (LAER) control techniques will be employed (if applicable).

i. Provide an analysis of alternate sites, sizes, production processes and environmental control techniques demonstrating that the benefits of the proposed source outweigh the environmental and social costs (if applicable).

Attach calculations and any additional information necessary to thoroughly evaluate compliance with all the applicable requirements of Article III and applicable requirements of the Clean Air Act adopted thereunder The Department may request additional information to evaluate the application such as a standby plan, a plan for air pollution emergencies, air quality modeling, etc.

Section E - Compliance Demonstration (Diesel Engines (2x)) (Continued)

Note: Complete this section if source is not a Title V facility. Title V facilities must complete Addendum A.

Method of Compliance Type: Check all that apply and complete all appropriate sections below

☒ Monitoring ☐ Testing ☐ Reporting

☒ Recordkeeping ☒ Work Practice Standard

Monitoring:

a. Monitoring device type (Parameter, CEM, etc):

b. Monitoring device location:

c. Describe all parameters being monitored along with the frequency and duration of monitoring each parameter:

Testing:

a. Reference Test Method: Citation

b. Reference Test Method: Description

Recordkeeping:

Describe what parameters will be recorded and the recording frequency:

Reporting:

a. Describe what is to be reported and frequency of reporting:

b. Reporting start date: _____

Work Practice Standard:

Describe each: Compliance with proposed limits for NOx, CO, PM/PM_{10}/$PM_{2.5}$, & CO met with purchase of certified engine

Section F - Flue and Air Contaminant Emission (Diesel Engines (2x))

1. Estimated Atmospheric Emissions*

Pollutant	Maximum emission rate			Calculation/ Estimation Method
	specify units	lbs/hr	tons/yr.	
PM				
PM_{10}				
SO_x				
CO				
NO_x				
VOC				
Others: (e.g., HAPs)	-----	-----	-----	-----

* These emissions must be calculated based on the requested operating schedule and/or process rate e.g., operating schedule for maximum limits or restricted hours of operation and /or restricted throughput. Describe how the emission values were determined. Attach calculations. Refer to Appendix B of the Support Document for emissions calculations.

2. Stack and Exhauster

Stack Designation/Number

List Source(s) or source ID exhausted to this stack:	% of flow exhausted to stack:

Stack height above grade (ft.) 5 & 6 Grade elevation (ft.) 850	Stack diameter (ft) or Outlet duct area (sq. ft.) 0.3 & 0.2	f. Weather Cap ☐ YES ☒ NO

Distance of discharge to nearest property line (ft.). Locate on topographic map.

Does stack height meet Good Engineering Practice (GEP)? Yes

If modeling (estimating) of ambient air quality impacts is needed, attach a site plan with buildings and their dimensions and other obstructions. Refer to Section 5.0 of the Support Document

Location of stack** Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Generator 1	40	40	53.4636	-80	20	5.215
Generator 2	40	39	52.362	-80	20	5.226

Stack exhaust

Volume: 665 & 286 ACFM Temperature: 778 & 914 °F Moisture _____ %

Indicate on an attached sheet the location of sampling ports with respect to exhaust fan, breeching, etc. Give all necessary dimensions.

Exhauster (attach fan curves) _____ in. of water _____ HP @ _____RPM.

** If the data and collection method codes differ from those provided on the General Information Form-Authorization Application, provide the additional detail required by that form on a separate form.

Enclosure 2

Plan Approval Application Cross Referencing Suggestions

Enclosure 2

Plan Approval Application Cross Referencing Suggestions

Appendix/ Page	Existing Cross Reference	Proposed Cross Reference
Appendix C: Air Dispersion Modeling and Class II Visibility Analysis		
4-2	Section 5.5	Section 5.6
4-12	Section 5-3	Section 4.4
4-2	Attachment A	Attachment A of this appendix
4-5	Attachment A	Attachment A of this appendix
4-13	Attachment A	Attachment A of this appendix
5-4	Attachment A	Attachment A of this appendix
5-6	Attachment A	Attachment A of this appendix
6-1	Attachment A	Attachment A of this appendix
6-6	Attachment A	Attachment A of this appendix
8-1	Attachment A	Attachment A of this appendix
Appendix D: Inhalation Risk Assessment		
Attachment A: Emissions Estimates[1]		
A-1	Table 1	Table 1 of Appendix D, Attachment A
A-1	Table 2 and Table 3, respectively	Table 2 and Table 3 of Appendix D, Attachment A, respectively
A-1	Table 4 through Table 7	Table 4 through Table 7 of Appendix D Attachment A
A-1	Table 8	Table 8 of Appendix D, Attachment A
A-1	Table 9	Table 9 of Appendix D, Attachment A
A-2	Table 10	Table 10 of Appendix D, Attachment A
A-2	Table 11	Table 11 of Appendix D, Attachment A
A-2	Table 12	Table 12 of Appendix D, Attachment A
A-2	Table 13 and Table 14, respectively	Table 13 and Table 14 of Appendix D Attachment A, respectively
A-3	Table 15	Table 15 of Appendix D, Attachment A
A-3	Table 16	Table 16 of Appendix D, Attachment A
A-3	Table 17 and Table 18	Table 17 and Table 18 of Appendix D Attachment A
A-3	Table 19	Table 19 of Appendix D, Attachment A

[1] It should be noted that all of the tables in Attachment A of Appendix D are located following the introductory text that is provided on page A-1 through page A-3

Appendix/ Page	Existing Cross Reference	Proposed Cross Reference
Attachment B: Dispersion Modeling Analysis		
B-3	Figure 1	Figure 1 of Appendix D Attachment B
B-3	Figure 2	Figure 2 of Appendix D Attachment B
B-7	Table 1	Table 1 of Appendix D Attachment B
B-7	Table 2 of Attachment A	Table 2 in Attachment A of Appendix D
B-7	Figure 3	Figure 3 of Appendix D Attachment B
B-7	Figure 4	Figure 4 of Appendix D Attachment B
B-12	Table 2	Table 2 of Appendix D Attachment B
B-12	Table 2 of Attachment A	Table 2 in Attachment A of Appendix D
B-12	Figure 5	Figure 5 in Appendix D Attachment B
B-15	Figure 6	Figure 6 in Appendix D Attachment B
B-15	Figure 7	Figure 7 in Appendix D Attachment B
B-17	Table 3	Table 3 of Appendix D Attachment B
B-18	Figures 8 and 9, respectively	Figures 8 and 9 of Appendix D Attachment B, respectively
B-21	Figure 10	Figure 10 in Appendix D Attachment B
B-21	Figure 11	Figure 11 in Appendix D Attachment B
B-21	Figure 12	Figure 12 in Appendix D Attachment B
B-25	Figure 13	Figure 13 in Appendix D Attachment B
B-28	Table 4	Table 4 of Appendix D Attachment B
B-28	Table 5	Table 5 of Appendix D Attachment B
Attachment C: Inhalation Risk Assessment Analysis		
C-1	Table 1	Table 1 of Appendix D, Attachment C
C-1	Figure 1	Figure 1 of Appendix D, Attachment C
C-2	Table 1	Table 1 of Appendix D, Attachment C
C-2	**Table 2**	**Table 3** of Appendix D, Attachment A

Enclosure 3

Summaries of Unit-by-Unit Potential to Emit (PTE)

Enclosure E3. Summary of Unit-by-Unit Potential to Emits (PTEs)

		PTE (tons/yr)							
Source ID	Source Description	PM	PM_{10}	$PM_{2.5}$	VOC	NO_X	SO_2	CO	CO_2e
031	Ethane Cracking Furnace #1	4.87	12.40	12.40	4.63	25.90	0.51	95.77	149,810
032	Ethane Cracking Furnace #2	4.87	12.40	12.40	4.63	25.90	0.51	95.77	149,810
033	Ethane Cracking Furnace #3	4.87	12.40	12.40	4.63	25.90	0.51	95.77	149,810
034	Ethane Cracking Furnace #4	4.87	12.40	12.40	4.63	25.90	0.51	95.77	149,810
035	Ethane Cracking Furnace #5	4.87	12.40	12.40	4.63	25.90	0.51	95.77	149,810
036	Ethane Cracking Furnace #6	4.87	12.40	12.40	4.63	25.90	0.51	95.77	149,810
037	Ethane Cracking Furnace #7	4.87	12.40	12.40	4.63	25.90	0.51	95.77	149,810
101	Combustion Turbines 1	5.84	20.68	20.68	11.03	23.45	4.61	15.00	366,921
102	Combustion Turbines 2	5.84	20.68	20.68	11.03	23.45	4.61	15.00	366,921
103	Combustion Turbines 3	5.84	20.68	20.68	11.03	23.45	4.61	15.00	366,921
C205A	Ground Flare 1	0.54	2.15	2.15	118.57	19.61	0.42	106.73	38,062
C205B	Ground Flare 2	0.54	2.15	2.15	118.57	19.61	0.42	106.73	38,062
C205C	HP Elevated Flare	0.01	0.04	0.04	0.03	0.33	0.01	1.81	572
C204A	LP Incinerator	0.89	3.48	3.48	16.42	31.80		38.51	68,260
C206	Caustic Oxidizer	0.09	0.35	0.35	1.42	3.19	4.13	3.87	5869.97
TBD	Rail to Truck Talc Transfer	0.00	0.00	0.00					
203	Process Cooling Tower	6.49	4.12	0.01	38.88				
104	Cogen Cooling Tower	1.62	1.03	0.00					
106	Fire Water Pump 1	0.01	0.01	0.01	0.02	0.15	0.00	0.14	27.95
106	Fire Water Pump 2	0.01	0.01	0.01	0.02	0.15	0.00	0.14	27.95
TBD	Generator 1	6.81E-04	6.54E-04	6.13E-04	4.54E-04	2.65E-02	5.60E-05	2.95E-02	5.90E+00
TBD	Generator 2	1.65E-03	1.59E-03	1.49E-03	6.06E-04	2.03E-02	3.65E-05	1.92E-02	3.84E+00
TBD	Generator 3	6.73E-04	1.37E-03	1.37E-03	2.23E-02	4.46E-02	4.17E-05	1.58E-02	1.40E+01
TBD	Generator 4	1.44E-06	1.85E-04	1.85E-04	2.20E-03	2.95E-02	1.10E-05	1.43E-01	3.68E+00
TBD	Generator 5	2.82E-06	3.62E-04	3.62E-04	4.31E-03	6.20E-02	2.15E-05	2.54E-01	7.21E+00

		PTE (tons/yr)							
Source ID	**Source Description**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**NO_X**	**SO_2**	**CO**	**CO_2e**
TBD	Generator 6	8.94E-04	1.83E-03	1.83E-03	2.97E-02	5.93E-02	5.54E-05	3.50E-01	1.86E+01
202	Catalyst Heater 1	2.99E-04	2.99E-04	2.99E-04					
202	Catalyst Heater 2	2.99E-04	2.99E-04	2.99E-04					
202	PE Unit 3 Process Vents	1.50	1.50	1.50					
202	Pellet VOC				88.2				
406	Tanks				0.02				
302 - 305	LPG Loading + OL Loading				0.52				
301	PE Blending Silos	3.52	1.20	1.20					
301	PE Rail Loading Silos	2.83	0.96	0.96					
301	PE Truck Loading Silos	1.96	0.67	0.67					
202	LDPE Vents	1.06	1.06	1.06					
202	LDPE Vents	1.06	1.06	1.06					
C204B	Multipoint Ground Flare	0.05	0.19	0.19	0.10	1.76	0.04	9.55	3,141
503	PE Roads	0.46	0.09	0.02					
TBD	Talc Haul Road	0.02	0.00	0.00					
501	PE Unit 1 & 2 Fugitives				36.6				
501	PE Unit 3 Fugitives				8.27				
501	Ethane Cracking Fugitives				17.45				101.81
501	OSBL Fugitives				5.57				35.78
502	Wastewater Treatment Fugitives				0.04				
	TOTAL	**74.3**	**168.9**	**163.7**	**516.2**	**328.5**	**22.4**	**983.7**	**2,303,645**

Enclosure 4

Update to February 14, 2020 Plan Approval Application

- **Table 2-1 (April 2020 Revision)**
- **Table 2-1 Values to Appendix B Detailed Calculation Cross Reference**
- **Plan Approval Application Appendix B (April 2020 Revision)**

Enclosure 4 - Update to February 14, 2020 Plan Approval Application

Table 2-1. Summary of Updates to the Shell Polymers Monaca Site Design (April 2020 Revision)[1]

Description of Change	Source ID	PM	PM_{10}	$PM_{2.5}$	VOC	NO_X	SO_2	CO	CO_2e
Equipment Additions									
Four additional natural gas-fired emergency engines	105	0	0	0	0.06	0.2	0	0.76	43.4
Two additional diesel-fired emergency engines	105	0	0	0	0	0.05	0	0.05	9.7
Two additional emergency engine diesel storage tanks	406				0				
Two additional vehicle fuel diesel storage tanks	406				0				
Transport of talc to site by railcar instead of truck[2]	202	0	0	0					
Methanol storage vessels and associated components[3]	201				0				
LPG loading	304				0				
Polyethylene Unit 3 Intermittent Particulate Vents	202	0.53	0.53	0.53					
Equipment Changes (Removed or Downsized)									
Removed four diesel-fired emergency generators	105	(0.41)	(0.40)	(0.37)	(0.65)	(12.1)	0	(7.24)	(1152)
Removed four emergency generator diesel storage tanks	406	0	0	0	0	0	0	0	0
Removed one firewater pump engine	106	(0.01)	(0.01)	(0.01)	(0.02)	(0.27)	0	(0.25)	(40.0)
Removed one firewater pump engine diesel storage tank	405	0	0	0	0	0	0	0	0
Decreased rating of remaining firewater pump engines (700 to 488 bhp)	106	(0.01)	(0.01)	(0.01)	0.08	(0.33)	0	(0.22)	(24.1)
Spent caustic vent thermal incinerator from 8 to 2.5 tonnes/hr (Heat input unchanged)	206	0	0	0	0	0	0	0	0
Decrease process cooling water tower rate from 305 to 295.9 MMgal/min	203	(0.2)	(0.13)	0	(1.2)				
Decrease in blending silo PE rate (increase in exhaust rate)	301	0.36	0.12	0.12					
Deduster vent removal (Elutriator wash air)	301	(0.96)	(0.02)	(0.02)					
Decrease in light gasoline loading rate	403				(0.13)				
Decrease in C3+ emissions	304				(17.3)				
Decrease in PE3 activated catalyst vent emissions	202	(0.02)	(0.02)	(0.02)					
Road length updated from 0.97 to 0.49 miles		(0.29)	(0.06)	(0.01)					
Increased Equipment Capacities									
Combustion turbine heat input (475 to 481.4 MMBtu/hr, each) (3x)	101-103	0.16	0.56	0.56	0.3	0.63	0.12	0.3	9,847
Duct burner heat input (189 to 234 MMBtu/hr, each)		1.1	3.9	3.9	2.08	4.42	0.87	2.7	69,240
Recovered oil & flow equal. & removal tank capacity	401				<0.01				
Increase in railcar handling and storage PE rates	301	1.23	0.42	0.42					
Increase in truck handling and storage PE rates	301	1.62	0.55	0.55					
Increase in railcar loading PE rates	301	0.02	0.02	0.02					
Increase in truck loading PE rates	301	0.01	0.02	0.02					
Increase in pyrolysis fuel oil loading	303				(0.01)				
Increase in Cogen cooling water tower circ. rate	104	0	0	0					
Flare gas comp. changes & sweep gas rate decreases									
High pressure ground flare (HPGF)	205	0.33	1.32	1.32	11.11	12.01	0.26	65.33	23,300
Multipoint ground flare (MPGF)	204	0.02	0.09	0.09	0.04	0.78	0.02	4.26	1,399.82
Low pressure thermal incinerator (LPTI)	204	(0.25)	(1.09)	(1.09)	0.95	(9.93)	0	(12.0)	(21,322
High pressure elevated flare (HPEF)	205	(0.41)	(1.65)	(1.65)	(1.19)	(15.1)	(0.3)	(82)	(25,947)
Proposed Project's Emissions Increase[3]		2.82	4.13	4.33	(5.93)	(19.61)	0.93	(28.33)	55,355
NSR Significance Threshold		25	15	10	40	40	40	100	
Subject to PSD or NSR Review		No	No	No	No	No	No	No	

[1] All values expressed in units of tpy. Parenthetical values are decreases.

[2] The 2015 emissions estimate basis for talc transfer to surge bins is 24 hrs/day, 333 days/yr operation of both surge bins (Table B-21). Transfer can only occur to one bin at a time. Thus, the 2015 estimate is high by a factor of two and the emissions associated with transfer from railcar to truck are already included.

[3] The methanol vessels will be under positive pressure with no emissions. The 2015 plan approval application accounts for the tank equipment components.

[4] For a new project at an existing major stationary source that comprises new emission units, the source must estimate the change in potential to emit (PTE) of the NSR pollutants. If the change in PTE for one or more NSR regulated pollutants is found to be significant (*i.e.,* greater than its pollutant specific significant level as defined at 40 CFR 52.21(b)(23)), the proposed project must undergo PSD review. The values presented in this table represent the change in PTE.

Table 2-1 Values to Appendix B Detailed Calculation Cross Reference

Description of Change	2020 Update Application
Equipment Additions	
Four additional natural gas-fired emergency engines	See Table B-1 & Table B-3
Two additional diesel-fired emergency engines	See Table B-2 & Table B-3
Two additional emergency engine diesel storage tanks	See Table B-4
Two additional vehicle fuel diesel storage tanks	See Table B-4
Transport of talc to site by railcar instead of truck[2]	See Table B-5
Methanol storage vessels and associated components	The methanol vessels will be maintained under positive pressure with no emissions and the equipment components associated with that tank were accounted for in the 2015 plan approval application.
LPG loading	See Table B-6
Polyethylene Unit 3 Intermittent Particulate Vents	See Table B-7
Equipment Changes (Removed or Downsized)	
Removed four diesel-fired emergency generators	Table 2-1 shows decreases that are equal to emissions estimate presented in Table B-9 of 2015 application as amended by PaDEP.[1]
Removed four emergency generator diesel storage tanks	Table 2-1 shows decreases that are equal to emissions estimate presented in Table B-26 of 2015 application.
Removed one firewater pump engine	Table 2-1 shows decrease that are equal to emissions estimate presented in Table B-11 of 2015 application as amended by PaDEP [1]
Removed one firewater pump engine diesel storage tank	Table 2-1 shows decreases that are equal to emissions estimate presented in Table B-26 of 2015 application.
Decreased rating of remaining firewater pump engines (700 to 488 bhp)	Table 2-1 shows decreases that are equal to the difference between Table B-8 emissions estimates for two 488 bhp engines and the 2015 Table B-11 emissions estimated for three 700 bhp engines.

Description of Change	2020 Update Application
Spent caustic vent thermal incinerator from 8 to 2.5 tonnes/hr (Heat input unchanged)	The emissions estimates for the spent caustic vent incinerator presented in Table B-35 of the 2015 application are based on the unit's design heat input rate. Thus, the change in unit capacity from 8 to 2.6 tonnes/yr does not result in change to the unit's heat input rate and the change in emissions rates presented in Table 2-1 are zero (0).
Decrease process cooling water tower rate from 305 to 295.9 MMgal/min	Table 2-1 shows decreases that are equal to the difference between the Table B-10 emissions estimates for a 295.9 Mgal/min circulation rate and the 2015 Table B-31 emissions estimated for a 305 Mgal/min circulation rate.
Decrease in blending silo emissions (0.01 to 0.005 gr/dscf)	Table 2-1 shows decreases that are equal to the difference between the Table B-12 blending silo emissions estimates that are based on a 0.005 gr/dscf grain loading and pellet loading rate of 2,400,000 MT/yr and the 2015 Table B-24 blending silo emissions estimated, which is based on a 0.01 gr/dscf loading and pelet loading rate of 3,000,000 MT/yr as amended.[1]
Deduster vent removal (Elutriator wash air)	Table 2-1 shows decreases equal to the 2015 Table B-24 deduster vent emissions rate as amended.[1] Elutriator wash air is still accounted for as an input to the total pellet handling emissions.
Decrease in light gasoline loading rate	Table 2-1 shows a VOC emission decrease that is equal to the difference between the Table B-13 light gasoline loading emissions estimate based on a 6,025 Mgal/yr loading rate and the 2015 Table B-33 emissions estimate that is based on a 8,048 Mgal/yr rate and updated vapor pressure data.
Decrease in C3+ emissions	See Table B-6
Decrease in PE3 activated catalyst vent emissions	See Polyethylene Unit 3 Intermittent Particulate Vents above.
Road length update	Table 2-1 shows the emissions decrease from the difference between the Table B-20 emissions estimate and the 2015 Table B-42 emissions estimate.
Increased Equipment Capacities	
Combustion turbine heat input (475 to 481.4 MMBtu/hr, each) (3x)	Table 2-1 shows emissions increases that result from the difference between the Table B-14 emissions estimates that are based on a

Description of Change	2020 Update Application
Duct burner heat input (189 to 234 MMBtu/hr, each)	combined (CT + DB) maximum heat input of 715.4 MMBtu/hr and the 2015 Table B-7 emissions estimates that were based on combined maximum heat input of 664 MMBtu/hr.
Recovered oil & flow equalization & removal tank capacity	No change in emissions assumed.
Increase in railcar handling and storage PE rates	Table 2-1 shows the emissions increases that result from the difference between the Table B-12 emissions estimates for railcar handling and storage, truck handling and storage, railcar loading, and truck loading that are based on updated information on the overall loading rates, partitioning between railcars and trucking, and the grain loading and the 2015 Table B-24 emissions estimates for these polyethylene handling and loadout activities as ammeded.[1]
Increase in truck handling and storage PE rates	
Increase in railcar loading PE rates	
Increase in truck loading PE rates	
Increase in pyrolysis fuel oil loading	Table 2-1 shows the VOC emissions increase that results from the difference between the Table B-13 emissions estimate that is based on an updated annual loading rate and emissions factor inputs and the Table B-33 emissions estimate.
Increase in Cogen cooling water tower circ. rate	Table 2-1 shows emissions rate increases that result from the difference between the Table B-16 emissions estimates updated for a 74,060 gal/min circulation rate and the 2015 Table B-29 emissions estimated for a 74,000 gal/min circulation rate.

Description of Change	2020 Update Application
Flare Gas Composition & Sweep Gas Rate Changes	
High pressure ground flare (HPGF)	Table 2-1 shows emissions rate increases and decreases that result from the difference between the Table B-18 emissions estimates updated for changes in vent gas composition and sweep gas rates and the 2015 Table B-39 emissions estimates.
Multipoint ground flare (MPGF)	
Low pressure thermal incinerator (LPTI)	Table 2-1 shows emissions rate increases and decreases that result from the difference between the Table B-19 emissions estimates updated for changes in the design heat input rate, vent gas composition, sweep gas rates and the 2015 Table B-37 emissions estimates as amended.[1]
High pressure elevated flare (HPEF)	Table 2-1 shows emissions rate decreases that result from the difference between the Table B-18 emissions estimates updated for changes in vent gas composition and sweep gas rates and the 2015 Table B-39 emissions estimates. [1]

1 - Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015.

Enclosure 4
Update to February 14, 2020 Plan Approval Application

Plan Approval Application Appendix B
(April 2020 Revision)

Certain information contained in this appendix constitutes Trade Secret and/or Confidential Proprietary Information as defined in the Pennsylvania Right to Know Law

1.0 GENERAL DISCUSSION

For purposes of evaluating applicability of PSD and NSR nonattainment and determining the potential to emit of the "as built" updates to the proposed facility, the methodology used for evaluating emissions increases is the actual-to-potential test described at 40 CFR § 52.21(a)(2)(d) and incorporated by reference at 25 Pa. Code §127.83. For a project at an existing major stationary source that includes new emission units, the source must estimate the change in the potential to emit of the NSR pollutants.

The following discussion provides a summary of the methodology used to determine the potential to emit from all units to be constructed and/or modified.

1.1 Emissions Units

Table 1-1 lists the categories of emissions units to be constructed or modified as part of the project and identifies the general methodology used to estimate the potential to emit for each unit type. Not listed are equipment identified in this Plan Approval Application in Section 2.0 that are being removed. Refer to the February 2015 Plan Approval Application for emissions associated with these units. A specific discussion of each of the calculation methodologies is provided in the following subsections. An index of the detailed calculation in Appendix B-2 is also provided.

Table 1-1. List of Affected Emissions Units and Emissions Estimation Methods

EU Description	Project Description	Methodology	Calculation Location in Appendix B-2
Natural Gas-fired Emergency Engines	Addition of four new units	(Emission Factor/Proposed Limit) x (Capacity) x (Op. Hours)	B-1, B-3
Diesel-fired Emergency Engines	Addition of two new units	(Emission Factor/Proposed Limit) x (Capacity) x (Op. Hours)	B-1, B-2
Tanks VOC (not vented to flare)	Addition of four new diesel storage units	(TANKS 4.09d) x (1 – Ctrl. Efficiency)	B-4
Talc Transport[1]	Inclusion of railcar delivery		B-5

EU Description	Project Description	Methodology	Calculation Location in Appendix B-2
C3+ Loading	Inclusion of loading C3+ and other LPG materials and correction to emission factor to more accurately reflect loading configuration	(Emission Factor) x (Throughput)	B-6
PE3 Particulate Emissions	PE3 intermittent particulate vents activated catalyst vent emissions	(Emission Factor/Proposed Limit) x (Capacity/Flowrate) x (Op. Hours)	B-7
Fire Water Pump Engine	Decrease rating from 700 to 488 bhp	(Emission Factor/Proposed Limit) x (Capacity) x (Op. Hours)	B-8
Spent Caustic and Low Pressure Thermal Incinerators	Decrease load of Spent Caustic Thermal Incinerator from 8 to 2.5 tonnes/hr and at both incinerators changes in vent gas composition and sweep gas rates	(Emission Factor) x (Capacity)	B-9, B-19
Process Cooling Tower PM/VOC	Decrease cooling water circulation rate from 305 to 295.9 Mgal/min	AP-42 Methodology; PSD from Reisman & Frisbie	B-10, B-11
Cooling Tower VOC	Increase cooling water circulation rate from 74,000 to 74,056 gal/min	(Proposed Limit) x (Circulation Rate)	B-16, B-17
PE Handling, Storage & Loading PM	Decrease in blending silo emissions (0.01 to 0.005 gr/dscf) and deduster vent removal. Increase in railcar and truck storage and handling PE rates.	(Emission Factor) x (Throughput-Based Air Flows)	B-12

EU Description	Project Description	Methodology	Calculation Location in Appendix B-2
Organic Liquid Loading	Decrease in light gasoline loading rate. Increase in pyrolysis fuel oil loading.	AP-42 Methodology (Chapter 5, Section 2)	B-13
Combustion Turbines	Combustion turbines heat input (475 to 481.4 MMBtu/hr, each) and duct burner heat input (189 to 234 MMBtu/hr, each)	(Emission Factor/Proposed Limit) x (Firing Rate)	B-14
WWTP Units (not vented to TI)	Recovered oil &flow equalization & removal tank capacity	EPA WATER9 Model	B-15
Flares	Flare gas composition changes, and sweep gas rate change of location and decreases	(Emission Factor) x (Maximum Expected Flaring Rate)	B-18

[1] Shell's original estimate of emissions from talc transfer to surge bins is based on 24 hours/day, 333 days/yr operation for both surge bins. Transfer can only occur to one bin at a time. As a result, the original estimate is high by a factor of two. Thus, the emissions associated with transfer from railcar to truck are already accounted for.

1.2 Natural Gas-Fired Emergency Engines

A total of four (4) new emergency natural gas-fueled internal combustion engines will be constructed. Normal (i.e., non-emergency) operation of these units is limited to 100 hours per year or less. Potential emissions from these units are estimated based on proposed BACT/LAER limits applied to the maximum firing rate assuming 100 hours per year of operation. See Tables B-1 and B-3 for complete documentation of the emissions factors used as well as the calculation methodology.

1.3 Diesel-fired Emergency Engines

Two (2) new emergency diesel-fueled internal combustion engines will be constructed and the four (4) emergency generators in the original design will be removed. The size of all new emergency combustion engines is less than those being removed. Normal (i.e., non-emergency) operation of these units is limited to 100 hours per year or less. Potential emissions from these units are estimated based on proposed BACT/LAER limits applied to the maximum firing rate

assuming 100 hours per year of operation. See Tables B-1 and B-2 for complete documentation of the emissions factors used as well as the calculation methodology.

1.4 Storage Tank Emissions

Two (2) new emergency engine diesel storage tanks and two (2) new vehicle fuel diesel storage tanks will be constructed. The four (4) emergency generator diesel storage tanks in the original design will be removed. The size and throughputs of the new tanks are significantly less than those being removed. Emissions from the new tanks were estimated by scaling the throughputs of the original tanks by that of the new tanks. Table B-4 provides the revised estimates. In addition, one firewater pump engine diesel storage tank will also be removed. Refer to the February 2015 Plan Approval Application for further details of the original estimates.

1.5 Talc Transport

The original design provided that talc, which is used as a comonomer in the polyethylene polymerization process, would be delivered to the site via trucks. The proposed changes will allow talc to also be delivered to the site via railcar. Once onsite, talc will be offloaded to a truck and then transported across the site to the already approved talc storage bins. Talc will be moved through pneumatic transfer and all transfer points controlled by fabric filter with outlet grain loading not to exceed 0.005 gr/dscf. Shell's original estimate of emissions from talc transfer to surge bins was based on 24 hours/day, 333 days/yr operation for both surge bins. Transfer can only occur to one bin at a time. As a result, the original estimate is high by a factor of two. Thus, the emissions associated with transfer from railcar to truck are already included. See Table B-5 for documentation of the calculation methodology used to estimate emissions.

1.6 C3+ Liquid Loading

Emissions estimates for C3+ liquid loading have been revised to include the loading of LPG materials other than C3+ (*i.e.,* butene, hexene, isobutane, isopentane, and C3+ refrigerant) that were identified as part of the 2015 Plan Approval Application as stored materials but not loaded. Additionally, the estimates have been revised to more accurately portray the current loading configuration. VOC emissions from these operations have been estimated based on vendor-provided emission factors for liquid loss from Shell's dry disconnect couplings. The factor of 13.3 lb VOC per railcar loaded used in the 2015 Plan Approval Application assumed emissions from bleeder valves which are not present in Shell's loading configuration and did not have vendor-specific disconnect loss emission factors. Residual liquid in loading lines will be cleared by flow of nitrogen to the thermal oxidizer, and low-leak couplings will be used on each hose. The emission factor has been corrected to 0.63 and 0.35 ml of liquid lost per hose disconnect with three (3) hoses (two product and one vapor) per railcar loading event. See Table B-6 for documentation of the calculation methodology used to estimate emissions.

No routine emissions, other than fugitive emissions from equipment components, are estimated from pressurized storage tanks (*i.e.*, the C3+ storage spheres). These tanks are sealed and

pressurized so that working and breathing losses do not occur. Emissions from storage tanks with vents routed to the flare headers are accounted for in the estimated emissions from the LP Thermal and Spent Caustic Vent Thermal Incinerators.

1.7 Road Length Update

The 2015 OM emissions estimates for transport truck road emissions was based on a road length of 0.967 miles. With this action the road length is being updated to 0.49 miles in length. In addition, a change was made to the estimated emissions as PaDEP's review. The updated emissions estimate is provided in Table B-20.

1.8 Polyethylene Unit 3 Intermittent Particulate Vent Emissions

A small quantity of particulate will be emitted from operations within the three PE production units. Particulate and polyethylene fines will be controlled by fabric, sintered metal, or HEPA filter before discharge to the atmosphere with outlet grain loading not to exceed 0.005 gr/dscf.

Additional intermittent particulate matter vents associated with intermittent particulate vents in PE3 were not included as part of the 2015 plan approval application. Estimates of these emissions are summarized in Table B-7.

Improved vendor information regarding the activated catalyst vent emissions for PE3 have been used to revise the particulate emissions estimates from this unit. Estimates of these emissions are also summarized in Table B-7.

1.9 Firewater Pump Engines

One (1) firewater pump engine will be removed. The remaining two engines will be resized from 700 to 488 bhp. Normal (i.e., non-emergency) operation of these units is limited to 100 hours per year or less. Potential emissions from these units are estimated based on proposed BACT/LAER limits applied to the maximum firing rate assuming 100 hours per year of operation. See Table B-8 for complete documentation of the emissions factors used as well as the calculation methodology.

1.10 Thermal Incinerators

Two thermal incinerators will be used to control certain VOC emissions sources within the proposed plant: 1) a spent caustic vent thermal incinerator (SCVTI); and, 2) a low pressure thermal incinerator (LPTI). Emissions from these incinerators are estimated based on the expected maximum vent rates to the control devices, the design VOC destruction efficiency of the controls, and emissions factors for various pollutants produced during the combustion process. Emissions consist of products of combustion (*e.g.*, NOx) along with unoxidized VOC and non-VOC organic compounds (e.g., CH_4). Changes to these units are: 1) the capacity of the SCVTI will reduce from 8 to 2.5 tonnes per hour; and 2) changes to the composition of the gas controlled by the LPTI, as well as, sweep gas rate changes. See Tables B-9 and B-19 for

documentation of the emissions factors as well as the calculation methodology used to estimate emissions from these control devices.

1.11 Process and Cogen Cooling Towers

Particulate emissions for the Process and Cogen Cooling Towers are estimated based on the design drift rate, the cooling water recirculation rate, the TDS of the cooling water, an estimated dry particle size distribution, and assumed full-time operation (i.e., 8,760 hours per year) of the towers. The "Reisman and Frisbie" methodology for determining the PM_{10} and $PM_{2.5}$ size distribution of the PM emissions is used to estimate fine particulate emissions.[1]

VOC emissions from the process cooling tower are estimated based on the existing VOC LAER limit and the design cooling water circulation rate.

There will be slight changes to the cooling water circulation rates at both cooling towers. See Tables B-10 and B-11, and Tables B-16 and B-17, for documentation of the calculation methodology used to estimate emissions from the Process and Cogen Cooling Towers, respectively.

1.12 PE Pellet Handling, Storage, and Loadout

A small quantity of particulate will be emitted from operations involving handling, storage, blending, and loadout of the product PE pellets. In general, these operations are relatively dust-free. However, some particulate is created in the processing and handling of the PE pellets. Particulate emissions from these operations are estimated based on an assumed particulate mass loading multiplied by an estimate of the ratio of exhaust air flows required or created by these operations to the potential PE pellet production capacity of the proposed plant. Changes to the emissions estimates include the increase in control of the blending silo emissions, removal of a deduster vent, and increases to the handling and storage rates. See Table B-12 for complete documentation of the emissions factors used as well as the calculation methodology.

1.13 Organic Liquid Loading

VOC emissions from loading of organic liquids (Recovered Oil, Coke Residue/Tar, Light Gasoline, and Pyrolysis Fuel Oil) into transport trucks and/or railcars are estimated using the methodology found in AP-42, Chapter 5, Section 2. The VOC emissions estimates from loading of low vapor pressure liquids are based on an assumed VOC vapor pressure of 0.5 psia, a surrogate VOC vapor molecular weight, and the use of submerged loading. Vapors from Pyrolysis Fuel Oil and Light Gasoline loading are controlled by the Low Pressure Thermal Incinerator. Changes to the emissions estimates from Organic Liquid Loading address an increase in pyrolysis fuel oil loading from 1.5 MMgal/yr to 5.3 MMgal/yr and a decrease in light

[1] See *"Calculating Realistic PM_{10} Emissions from Cooling Towers,"* Joel Reisman and Gordon Frisbie, Environmental Progress (Vol. 21, No. 2), July 2002, p. 127 – 129.

gasoline loading rate from 8.0 MMgal/yr to 6.0 MMgal/yr. See Table B-13 for documentation of the calculation methodology used to estimate emissions.

1.14 Combustion Turbine/Cogen Units

Changes to the three Cogen Units include a change in heat input from 475 to 481.4 MMBtu/hr each and an increase in each duct burner heat input from 189 to 234 MMBtu/hr. These units are expected to operate at or near maximum capacity for most of the year. With the exception of NOx and CO, potential emissions from these units are estimated based on existing BACT/LAER limits applied to the maximum firing rate assuming full-time (i.e., 8,760 hours per year) operation at that rate. In the case of NOx and CO, emissions during startup are expected to be significantly higher (on a pound per hour basis) than emissions during normal full-load operation. Thus, for purposes of estimating potential emissions of these pollutants, the maximum startup emissions rates were assumed to occur for 7 hours per year, with the remaining hours per year (i.e., 8,753) assumed to be at full-load. See Table B-14 for the complete documentation of the emissions factors used as well as the calculation methodology.

1.15 Wastewater Treatment Plant Emissions

The recovered oil and flow equalization and removal tank capacities will increase from 24 to 521kgal and 742 to 878 kgal, respectively. Uncontrolled emissions from the wastewater treatment unit operations are estimated using EPA's WATER9 air emissions model. Emissions from certain controlled WWTP tanks were estimated using EPA's TANKS software. These emissions are accounted for in the controlled emissions estimates from the Spent Caustic Vent Thermal Incinerator. A summary of the emissions estimate is presented in Table B-15. As shown, this change does not result in a quantifiable increase in VOC emissions.

1.16 Flares

Changes to the four flares to be constructed to control VOC emissions from the proposed plant include changes to the flare gas composition and decreases in the sweep gas rates. Emissions from the flares are estimated based on the expected maximum vent rates to the flares, the VOC destruction efficiency of the flares, and emissions factors for various pollutants produced during the combustion process. Emissions consist of products of combustion (*e.g.*, NOx) along with unoxidized VOC and non-VOC organic compounds (e.g., CH_4). For the most part, these flares are only used for short periods during startup, shutdown, or emergency events. Potential emissions from these control devices are estimated based on a number of worst-case assumptions about the flaring rates expected to occur during routine, foreseeable operations. See Table B-18 for documentation of the emissions factors as well as the calculation methodology used to estimate emissions from the flares.

Enclosure E4 - Tables

Certain information contained in this appendix constitutes Trade Secret and/or Confidential Proprietary Information as defined in the Pennsylvania Right to Know Law

Table B-1. Summary of Emergency Engine Emissions Estimates

Summary Emergency Engine Emissions Calculations

Input Parameters - Emission Factors

Diesel Engines **100 hrs/yr operation each**

Engine		Size (bhp)	PM	PM10	PM2.5	VOC	NOx	SO2	CO	CO2	CH4	N2O	CO2e	H2SO4	Comment
			Emission Factor (lb/bhp-hr)												
Cummins QSB5-G3		103	1.32E-04	1.27E-04	1.19E-04	8.818E-05	5.14E-03	1.09E-05	5.73E-03	1.14	4.63E-05	9.26E-06	1.15	4.37E-07	Mfg Data Sheet - HC, CO, PM; NOx based on proposed combined LAER Nox+VOC limit of 2.37 g/bhp-hr. See example calculation for Cummins for methodology.
Kohler KDI 3404 TM		67	4.94E-04	4.74E-04	4.44E-04	1.81E-04	6.06E-03	1.09E-05	5.73E-03	1.14	4.63E-05	9.26E-06	1.15	4.37E-07	Mfg Data Sheet - HC, CO, PM; NOx based on proposed combined LAER NOx+VOC limit of 2.37 g/bhp-hr. See example calculation for Cummins for methodology.

Input Parameters - Emission Factors

Natural Gas-fired Engines **100 hrs/yr operation each**

Engine	Size (bhp)	Fuel Required (cfh)	PM	PM10	PM2.5	VOC	NOx	SO2	CO	CO2	CH4	N2O	CO2e	H2SO4	Comment
			Emission Factor (lb/MMBtu)												
GM Vortec 5.7L V-8	158	1389	9.50E-03	1.94E-02	1.94E-02	0.31	0.63	5.88E-04	2.23E-01	191.22	2.30E-01	2.20E-04	1.97E+02	2.36E-05	AP-42 Table 3.2-2; Proposed LAER limit - NOx + VOC; Mfg Data Sheet - CO, CO2 (conservatively used higher LP emission factors); 40 CFR Part 98 Table C-1 C-2 - N2O; 1020 Btu/scf
GM Vortec 3.0L I-4	50	366	7.71E-05	9.89E-03	9.89E-03	0.118	1.58	5.88E-04	7.68	208.82	1.25	2.20E-04	1.97E+02	2.36E-05	AP-42 Table 3.2-2; Proposed LAER limit - NOx + VOC; Mfg Data Sheet - CO, CO2 (conservatively used higher LP emission factors); 40 CFR Part 98 Table C-1 C-2 - N2O; 1020 Btu/scf
GM 5.7L V-8	113	717	7.71E-05	9.89E-03	9.89E-03	0.118	1.70	5.88E-04	6.95	110	1.25E+00	2.20E-04	1.97E+02	2.36E-05	AP-42 Table 3.2-2; Proposed LAER limit - NOx + VOC; Mfg Data Sheet - CO, CO2 (conservatively used higher LP emission factors); 40 CFR Part 98 Table C-1 C-2 - N2O; 1020 Btu/scf
TBD	210	1846.14	9.50E-03	1.94E-02	1.94E-02	0.31	0.63	5.88E-04	3.72	110	0.23	2.20E-04	1.97E+02	2.36E-05	AP-42 Table 3.2-2; Proposed LAER limit - NOx + VOC; Mfg Data Sheet - CO, CO2 (conservatively used higher LP emission factors); 40 CFR Part 98 Table C-1 C-2 - N2O; 1020 Btu/scf

Output Calculations

Engine		Units	PM	PM10	PM2.5	VOC	NOx	SO2	CO	CO2	CH4	N2O	CO2e	H2SO4
			Emissions											
Cummins QSB5-G3		lb/hr-max	1.36E-02	1.31E-02	1.23E-02	9.08E-03	5.29E-01	1.12E-03	5.90E-01	1.18E+02	4.77E-03	9.54E-04	1.18E+02	4.50E-05
Kohler KDI 3404 TM		lb/hr-max	3.31E-02	3.17E-02	2.98E-02	1.21E-02	4.06E-01	7.29E-04	3.84E-01	7.65E+01	3.10E-03	6.20E-04	7.67E+01	2.93E-05
GM Vortec 5.7L V-8		lb/hr-max	1.35E-02	2.75E-02	2.75E-02	4.46E-01	8.92E-01	8.33E-04	3.16E-01	2.71E+02	3.26E-01	3.12E-04	2.79E+02	3.34E-05
GM Vortec 3.0L I-4		lb/hr-max	2.88E-05	3.69E-03	3.69E-03	4.41E-02	5.90E-01	2.20E-04	2.87E+00	7.80E+01	4.67E-01	8.23E-05	7.36E+01	8.81E-06
GM 5.7L V-8		lb/hr-max	5.64E-05	7.23E-03	7.23E-03	8.63E-02	1.24E+00	4.30E-04	5.09E+00	8.04E+01	9.14E-01	1.61E-04	1.44E+02	1.73E-05
TBD		lb/hr-max	1.79E-02	3.66E-02	3.66E-02	5.93E-01	1.19E+00	1.11E-03	7.00E+00	2.07E+02	4.33E-01	4.15E-04	3.71E+02	4.44E-05
Cummins QSB5-G3		tpy	6.81E-04	6.54E-04	6.13E-04	4.54E-04	2.65E-02	5.60E-05	2.95E-02	5.88E+00	2.38E-04	4.77E-05	5.90E+00	2.25E-06
Kohler KDI 3404 TM		tpy	1.65E-03	1.59E-03	1.49E-03	6.06E-04	2.03E-02	3.65E-05	1.92E-02	3.82E+00	1.55E-04	3.10E-05	3.84E+00	1.46E-06
GM Vortec 5.7L V-8		tpy	6.73E-04	1.37E-03	1.37E-03	2.23E-02	4.46E-02	4.17E-05	1.58E-02	1.35E+01	1.63E-02	1.56E-05	1.40E+01	1.67E-06
GM Vortec 3.0L I-4		tpy	1.44E-06	1.85E-04	1.85E-04	2.20E-03	2.95E-02	1.10E-05	1.43E-01	3.90E+00	2.33E-02	4.12E-06	3.68E+00	4.41E-07
GM 5.7L V-8		tpy	2.82E-06	3.62E-04	3.62E-04	4.31E-03	6.20E-02	2.15E-05	2.54E-01	4.02E+00	4.57E-02	8.06E-06	7.21E+00	8.63E-07
TBD		tpy	8.94E-04	1.83E-03	1.83E-03	2.97E-02	5.93E-02	5.54E-05	3.50E-01	1.04E+01	2.17E-02	2.08E-05	1.86E+01	2.22E-06
		Total	3.91E-03	5.99E-03	5.85E-03	5.95E-02	2.42E-01	2.22E-04	8.12E-01	4.15E+01	1.07E-01	1.27E-04	5.31E+01	8.91E-06
Cummins QSB5-G3		lb/hr-annualized	1.56E-04	1.49E-04	1.40E-04	1.04E-04	6.04E-03	1.28E-05	6.74E-03	1.34E+00	5.44E-05	1.09E-05	1.35E+00	5.14E-07
Kohler KDI 3404 TM		lb/hr-annualized	3.77E-04	3.62E-04	3.40E-04	1.38E-04	4.63E-03	8.32E-06	4.38E-03	8.73E-01	3.54E-05	7.08E-06	8.76E-01	3.34E-07
GM Vortec 5.7L V-8		lb/hr-annualized	1.54E-04	3.14E-04	3.14E-04	5.09E-03	1.02E-02	9.51E-06	3.61E-03	3.09E+00	3.72E-03	3.57E-06	3.19E+00	3.82E-07
GM Vortec 3.0L I-4		lb/hr-annualized	3.29E-07	4.21E-05	4.21E-05	5.03E-04	6.73E-03	2.51E-06	3.27E-02	8.90E-01	5.33E-03	9.40E-07	8.40E-01	1.01E-07
GM 5.7L V-8		lb/hr-annualized	6.44E-07	8.25E-05	8.25E-05	9.85E-04	1.42E-02	4.91E-06	5.81E-02	9.18E-01	1.04E-02	1.84E-06	1.64E+00	1.97E-07
TBD		lb/hr-annualized	2.04E-04	4.17E-04	4.17E-04	6.77E-03	1.35E-02	1.26E-05	8.00E-02	2.36E+00	4.94E-03	4.74E-06	4.24E+00	5.07E-07

Table B-2. Example Diesel Engine Emissions Estimates

Emission Unit(s) ID	=	EGEN Cummins		Emergency Generator IC Engines - Cummins QSB5-G3
Parameter		**Value**	**Units**	**Source / Basis**
Calculation Inputs				
Rated Horsepower, each engine	=	103	bhp	= (Gen-Set Output MWe) x (1,341 bhp/MWm) / (Gen-Set Efficiency)
No. of Engines	=	1		Design basis of project
Rated Horsepower, Total	=	103	bhp	= (Rated Horsepower, each engine) x (No. of Engines)
PM EF	=	1.32E-04	lb/bhp-hr	Manufacturer Data Sheet
PM10 EF	=	1.27E-04	lb/bhp-hr	PM10 = 96% of PM from AP-42, Table B.2-2, Category 1.
PM2.5 EF		1.19E-04	lb/bhp-hr	PM2.5 = 90% of PM from AP-42, Table B.2-2, Category 1.
VOC EF	=	8.82E-05	lb/bhp-hr	Manufacturer Data Sheet
NOx EF	=	5.14E-03	lb/bhp-hr	Based on combined NOX+VOC LAER limit of 2.37 g/bhp-hr.
SO2 EF	=	1.09E-05	lb/bhp-hr	Based on: fuel sulfur = 15 ppmw; 7,000 Btu/hp-hr; oil HHV = 19,300 Btu/lb.
CO EF	=	1.10E-03	lb/bhp-hr	Manufacturer Data Sheet
CO2 EF	=	1.14E+00	lb/bhp-hr	40 CFR 98, Table C-1 (Fuel Oil No. 2) @ 7,000 Btu/bhp-hr.
CH4 EF	=	4.63E-05	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
N2O EF	=	9.26E-06	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
CO2e EF	=	1.15E+00	lb/bhp-hr	Sum of CO2, N2O, & CH4 adjusted for GWP.
H2SO4 EF	=	4.37E-07	lb/bhp-hr	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
Annual Operating Hours	=	100	hrs/yr/engine	Proposed permit limit.
Hourly Emissions Calculations (each engine)				
PM Hourly Max	=	0.01	lb/hr	= (Rated Horsepower, each engine) x (PM EF)
PM10 Hourly Max	=	0.01	lb/hr	= (Rated Horsepower, each engine) x (PM10 EF)
PM2.5 Hourly Max	=	0.01	lb/hr	= (Rated Horsepower, each engine) x (PM2.5 EF)
VOC Hourly Max	=	0.01	lb/hr	= (Rated Horsepower, each engine) x (VOC EF)
NOx Hourly Max	=	0.53	lb/hr	= (Rated Horsepower, each engine) x (NOx EF)
SO2 Hourly Max	=	0.00	lb/hr	= (Rated Horsepower, each engine) x (SO2 EF)
CO Hourly Max	=	0.11	lb/hr	= (Rated Horsepower, each engine) x (CO EF)
CO2 Hourly Max	=	118	lb/hr	= (Rated Horsepower, each engine) x (CO2 EF)
CH4 Hourly Max	=	0.005	lb/hr	= (Rated Horsepower, each engine) x (CH4 EF)
N2O Hourly Max	=	0.001	lb/hr	= (Rated Horsepower, each engine) x (N2O EF)
CO2e Hourly Max	=	118	lb/hr	= (Rated Horsepower, each engine) x (CO2e EF)
H2SO4 Hourly Max	=	0.000	lb/hr	= (Rated Horsepower, each engine) x (H2SO4 EF)
Annual Emissions Calculations (all engines)				
PM PTE	=	0.00	tpy	= (PM Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM10 PTE	=	0.00	tpy	= (PM10 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM2.5 PTE	=	0.00	tpy	= (PM2.5 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
VOC PTE	=	0.00	tpy	= (VOC Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
NOx PTE	=	0.03	tpy	= (NOx Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
SO2 PTE	=	0.00	tpy	= (SO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO PTE	=	0.01	tpy	= (CO Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2 PTE	=	6	tpy	= (CO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CH4 PTE	=	0.000	tpy	= (CH4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
N2O PTE	=	0.000	tpy	= (N2O Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2e PTE	=	6	tpy	= (CO2e Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
H2SO4 PTE	=	0.0000	tpy	= (H2SO4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)

Summary of Results

		Potential Emissions (tons per year)									
		PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
Diesel GenSet Emissions	=	0.00	0.00	0.00	0.000	0.026	0.000	0.006	6	6	0.000

Table B-3. Example Natural Gas Engine Emissions Estimates

Emission Unit(s) ID =	EGEN GM Vortec		Emergency Generator IC Engines -GM Vortec 5.7L V-8
Parameter	***Value***	***Units***	***Source / Basis***
Calculation Inputs			
Heat Input, each engine =	1.42	MMBtu/hr	Design basis of project
Engine Size =	158	bhp	Design basis of project
PM EF =	9.50E-03	lb/MMBtu	AP-42 Table 3.2-3; 4-stroke rich burn engine
PM10 EF =	1.94E-02	lb/MMBtu	AP-42 Table 3.2-3; 4-stroke rich burn engine
PM2.5 EF	1.94E-02	lb/MMBtu	AP-42 Table 3.2-3; 4-stroke rich burn engine
VOC EF =	3.15E-01	lb/MMBtu	LAER 1.0 g/bhp-hr for engines >130 HP
NOx EF =	6.30E-01	lb/MMBtu	LAER 2.0 g/bhp-hr for engines >130 HP
SO2 EF =	5.88E-04	lb/MMBtu	AP-42 Table 3.2-3; 4-stroke rich burn engine
CO EF =	2.23E-01	lb/MMBtu	Manufacturer Data Sheet; @ 7,000 Btu/bhp-hr.
CO2 EF =	1.91E+02	lb/MMBtu	Manufacturer Data Sheet; @ 7,000 Btu/bhp-hr.
CH4 EF =	2.30E-01	lb/MMBtu	AP-42 Table 3.2-3; 4-stroke rich burn engine
N2O EF =	2.20E-04	lb/MMBtu	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
CO2e EF =	1.97E+02	lb/MMBtu	Sum of CO2, N2O, & CH4 adjusted for GWP.
H2SO4 EF =	2.36E-05	lb/MMBtu	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
Annual Operating Hours =	100	hrs/yr/engine	Proposed permit limit.
Hourly Emissions Calculations (each engine)			
PM Hourly Max =	0.01	lb/hr	= (Heat Input, each engine) x (PM EF)
PM10 Hourly Max =	0.03	lb/hr	= (Heat Input, each engine) x (PM10 EF)
PM2.5 Hourly Max =	0.03	lb/hr	= (Heat Input, each engine) x (PM2.5 EF)
VOC Hourly Max =	0.45	lb/hr	= (Heat Input, each engine) x (VOC EF)
NOx Hourly Max =	0.89	lb/hr	= (Heat Input, each engine) x (NOx EF)
SO2 Hourly Max =	0.00	lb/hr	= (Heat Input, each engine) x (SO2 EF)
CO Hourly Max =	0.32	lb/hr	= (Heat Input, each engine) x (CO EF)
CO2 Hourly Max =	271	lb/hr	= (Heat Input, each engine) x (CO2 EF)
CH4 Hourly Max =	0.326	lb/hr	= (Heat Input, each engine) x (CH4 EF)
N2O Hourly Max =	0.000	lb/hr	= (Heat Input, each engine) x (N2O EF)
CO2e Hourly Max =	279	lb/hr	= (Heat Input, each engine) x (CO2e EF)
H2SO4 Hourly Max =	0.000	lb/hr	= (Heat Input, each engine) x (H2SO4 EF)
Annual Emissions Calculations (all engines)			
PM PTE =	0.00	tpy	= (PM Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
PM10 PTE =	0.00	tpy	= (PM10 Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
PM2.5 PTE =	0.00	tpy	= (PM2.5 Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
VOC PTE =	0.02	tpy	= (VOC Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
NOx PTE =	0.04	tpy	= (NOx Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
SO2 PTE =	0.00	tpy	= (SO2 Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
CO PTE =	0.02	tpy	= (CO Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
CO2 PTE =	14	tpy	= (CO2 Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
CH4 PTE =	0.016	tpy	= (CH4 Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
N2O PTE =	0.000	tpy	= (N2O Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
CO2e PTE =	14	tpy	= (CO2e Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)
H2SO4 PTE =	0.0000	tpy	= (H2SO4 Hourly Max) x (Engine Size) x (Annual Operating Hours) / (2000 lb/ton)

Summary of Results

	Potential Emissions (tons per year)									
	PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
NG Engine Emissions =	0.00	0.00	0.00	0.022	0.045	0.000	0.016	14	14	0.000

Table B-4. Tanks Emissions Estimates

Tank Name	EU ID	Tank Type	Volume [m3]	Dianeter [m]	Height / Length [m]	Operating Temperature [°C]	Surrogate Liquid	Annual Throughput (gal/yr)	Emission Control	Uncontrolled VOC/HAP Emissions* (T/yr)	Control Efficiency (%)	Controlled VOC /HAP Emissions* (T/yr)
Diesel Locomotive Fuel	NA	Horizonal Fixed Roof	38	2.4	8.2	38.0	No. 2 Oil	412,000	Carbon Canister	2.7E-03	95%	1.3E-04
Emergency Generator Diesel Fuel	NA	Horizonal Fixed Roof	2	1.5	1.5	38.0	No. 2 Oil	2,000	Carbon Canister	3.8E-05	95%	1.9E-06
Emergency Generator Diesel Fuel	NA	Horizonal Fixed Roof	2	1.5	1.5	38.0	No. 2 Oil	2,000	Carbon Canister	3.8E-05	95%	1.9E-06
Vehicle Diesel Fuel	NA	Horizonal Fixed Roof	68	2.6	12.2	38.0	No. 2 Oil	100,000	Carbon Canister	1.9E-03	95%	9.4E-05
Vehicle Diesel Fuel	NA	Horizonal Fixed Roof	68	2.6	12.2	38.0	No. 2 Oil	100,000	Carbon Canister	1.9E-03	95%	9.4E-05
Spent Caustic Storage Tank	T-53501	Vertical Fixed Roof	900	10.7	10.0	20.0	Jet Kerosene	26,151,000	Carbon Canister	1.0E-01	95%	5.0E-03
Unoxidized Spent Caustic Storage Tank	T-53502	Vertical Fixed Roof	8,630	26.2	16.0	20.0	Jet Kerosene	26,151,000	Carbon Canister	2.7E-01	95%	1.3E-02
Fire Water Pump Diesel Fuel	T-59101A	Horizonal Fixed Roof	7	1.6	3.7	38.0	No. 2 Oil	7,200	Carbon Canister	1.8E-04	95%	8.8E-06
Fire Water Pump Diesel Fuel	T-59101B	Horizonal Fixed Roof	7	1.6	3.7	38.0	No. 2 Oil	7,200	Carbon Canister	1.8E-04	95%	8.8E-06
									Totals =	**3.77E-01**		**1.88E-02**
									2015 Plan Approval Total=	**3.77E-01**		**1.88E-02**
									Net Change in Emissions=	**-3.01E-04**		**-1.51E-05**

**** NOTES:***

- This sheet summarizes emissions from those tanks not vented to a common control device.
- The tanks listed in this sheet are vented to individual carbon canisters installed on each tank.
- As a conservative assumption, 100% of VOC emissions from these tanks are assumed to be HAP.
- PFO and Light Gasoline tanks vent to the LPTI. Emissions from these tanks already accounted for in LPTI calc.

Table B-5 Railcar to Truck Transfer Emissions Estimate

Railcar to Truck Talc Transfer Calculations			
Input Variables			
Parameter	Value	Units	Comments
Truck Vent Dust Loading	0.01	gr/dscf	Conservative estimate.
Conveyance gas flow rate	1000	ft3/min	Estimated 800 to 1000 ft3/min
Load Duration	60	mins	Email 3/27/18 Snyder to May
Truck Loads/Railcar	4		Email 3/27/18 Snyder to May
Railcar Deliveries per year	12		20% buffer on reported 10 occurences/yr in 3/27/18 email from Snyder to May
grains/lb	7000	gr/lb	conversion
Stack Configuration	horizontal		
Stack Diameter	7	inches	outlet diameter
Height of discharge	12	feet	
Temperature of discharge	70	F	Ambient
Stack Velocity	0.433	ft/sec	Calculated from conveyance gas flow rate and stack diameter
Output Calculations PM/PM10/PM2.5			
Max Short term emission rate	0.086	lb/hr	=Conveyance gas flow rate*60 mins/hr*Truck Vent Dust Loading/(grains/lb)
Avg 24-hr emission rate	0.014	lb/hr	=Max Short term emission rate*Load Duration/(60 mins/hr)*Truck Loads/Railcar/(24 hrs/day)
Annual emissions	4.11	lb/yr	=Max Short term emission rate*Load Duration/(60 mins/hr)*Truck Loads/Railcar*Railcar Deliveries per year
Annual Emissions	0.0021	TPY	
Annualized hourly rate	0.00047	lb/hr	=Annual emissions/(8760 hrs/yr)

Notes:

Assume PM=PM10=PM2.5

Shell's original estimate of emissions from talc transfer to surge bins is based on 24 hours/day, 333 days/yr operation for both surge bins. Transfer can only occur to one bin at a time. As a result, the original estimate is high by a factor of two. Thus, the emissions associated with transfer from railcar to truck are already accounted for.

Table B-6 LPG Loading Emissions Estimates

Emission Unit(s) ID =	C3+LOAD		Propane Railcars Loading/Unloading Emissions
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
Annual Railcars Loaded and/or Unloaded =	3,278	event/yr	Design Basis plus 10%
No. of Hose Coupling Disconnects per Event =	3	coupling/event	3 hoses in each loading arm (2 product, 1 vapor return)
H_2O Emission Factor =	0.35	ml/coupling	2 inch TODO Gas DN50 coupling (vendor data)
H2O Density =	8.34	lb/gal	
C3+ Density =	4.88	lb/gal	Basis C3+ Compositions
C3+ to H2O =	0.58	lb_{C3+}/lb_{H2O}	Ratio of C3+ density to H2O density
VOC Emission Factor =	0.00045	lb_{C3+}/coupling	= H2O Emission Factor (ml/coupling) * 1 (g/ml) / 453.6 (g/lb)
Annual Emissions Calculations			
VOC PTE =	0.002	tpy	= VOC Emission Factor (lb/coupling) x Annual Railcars Loaded and/or Unloaded (event/yr) x No. of Hose Coupling Disconnects per Event (coupling/event) / 2,000 (lb/ton)

Emission Unit(s) ID =	C4LOAD		Butene and Isobutane Railcars Loading/Unloading Emissions
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
Annual Railcars Loaded and/or Unloaded =	1,023	event/yr	Design Basis plus 10%
No. of Hose Coupling Disconnects per Event =	3	coupling/event	3 hoses in each loading arm (2 product, 1 vapor return)
H_2O Emission Factor =	0.35	ml/coupling	2 inch TODO Gas DN50 coupling (vendor data)
H2O Density =	8.34	lb/gal	
C4 Density =	4.84	lb/gal	AP-42 Appendix A
C4 to H2O =	0.58	lb_{C4}/lb_{H2O}	Ratio of C4/H2O densities
VOC Emission Factor =	0.00045	lb_{C4}/coupling	= H2O Emission Factor (ml/coupling) * 1 (g/ml) / 453.6 (g/lb)
Annual Emissions Calculations			
VOC PTE =	0.001	tpy	= VOC Emission Factor (lb/coupling) x Annual Railcars Loaded and/or Unloaded (event/yr) x No. of Hose Coupling Disconnects per Event (coupling/event) / 2,000 (lb/ton)

NOTES:

- Butane liquids contain no OHAP.

Emission Unit(s) ID =	C6LOAD		Hexene and Isopentane Railcars Loading/Unloading Emissions
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
Annual Railcars Loaded and/or Unloaded =	1,135	event/yr	Design Basis plus 10%
No. of Hose Coupling Disconnects per Event =	3	coupling/event	3 hoses in each loading arm (2 product, 1 vapor return)
H_2O Emission Factor =	0.63	ml/coupling	2 inch TODO Mastic DN50 coupling (vendor data)
H2O Density =	8.34	lb/gal	
C6 Density =	5.46	lb/gal	Websearch liquid hexane
C6 to H2O =	0.65	lb_{C6}/lb_{H2O}	Ratio of C6/H2O densities
VOC Emission Factor =	0.00091	lb/event	= H2O Emission Factor (ml/coupling) * 1 (g/ml) / 453.6 (g/lb)
Annual Emissions Calculations			
VOC PTE =	0.002	tpy	= VOC Emission Factor (lb/coupling) x Annual Railcars Loaded and/or Unloaded (event/yr) x No. of Hose Coupling Disconnects per Event (coupling/event) / 2,000 (lb/ton)

NOTES:

- Hexene liquids contain no OHAP.

Summary of 2020 revisons/updates

Total VOC PTE =	0.004 tpy	=C3LOAD+C4LOAD+C6LOAD
2015 Plan Approval C3+ VOC PTE =	17.26 tpy	Erroneously based on bleeder valve emission factor and only loadout operations.
Net Change due to LPG Loading =	0.00	Change in LPG loading rate at new emissions rate
Net Change due to Factor Change =	-17.25	New emissions rate in C3

Table B-7. Polyethylene Unit 3 Process Vent Particulate Emissions Estimates

PE Unit 3 Process Vent Particulate Emissions Estimates						
Line 3 Vent Descriptions	EU IDs	Permit Limit (gr/dscf)	Short Term Max Exhaust Rate (Nm3/hr)	Normal Exhaust Rate (Nm3/hr)	24-hr Avg PM/PM10 Rate (lb/hr)	PM/PM10/PM2.5 Emissions (T/yr)
[redacted]	[redacted]	0.002	485	200	0.005	0.009
[redacted]	[redacted]	0.002	485	200	0.005	0.009
[redacted]	[redacted]	0.005	700	700	0.019	0.083
[redacted]	[redacted]	0.005	700	700	0.019	0.083
[redacted]	[redacted]	0.005	700	700	0.019	0.083
[redacted]	[redacted]	0.005	700	700	0.019	0.083
[redacted]	[redacted]	0.005	2,000	2,000	0.054	0.237
[redacted]	[redacted]	0.005	75	75	0.002	0.009
[redacted]	[redacted]	0.005	75	75	0.002	0.009
[redacted]	[redacted]	0.005	75	75	0.002	0.009
[redacted]	[redacted]	0.005	75	75	0.002	0.009
[redacted]	[redacted]	0.005	920	920	0.025	0.109
[redacted]	[redacted]	0.01	24,700	24,700	0.156	0.682
[redacted]	[redacted]0	0.005	678	678	0.018	0.080
				Totals =	**0.348**	**1.496**
				2015 Plan Approval Total=	**0.221**	**0.968**
				Net Emissions Change=	**0.127**	**0.528**

Notes:

- All vents are assumed to be continuous although many are intermittant.
- Permit limits per Plan Approval 04-00740A
- Short term and annual rates based on vendor emissions rates and exhaust rates at normal conditions (i.e., 0°C) and permitted grain loading for filterable particulate at standard conditions (i.e., 20°C).

Table B-8. Firewater Pump Engines Emissions Estimate

Emission Unit(s) ID =	FWP1/2		Fire Pump IC Engines
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
Rated Horsepower, each engine =	488	bhp	C18 ACERT™ Fire Pump
No. of Engines =	2		Design basis of project
Rated Horespower, Total =	976	bhp	= (Rated Horsepower, each engine) x (No. of Engines)
PM EF =	3.31E-04	lb/bhp-hr	NSPS Subpart IIII limit.
PM10 EF =	3.17E-04	lb/bhp-hr	PM10 = 96% of PM from AP-42, Table B.2-2, Category 1.
PM2.5 EF	2.98E-04	lb/bhp-hr	PM2.5 = 90% of PM from AP-42, Table B.2-2, Category 1.
VOC EF =	6.43E-04	lb/bhp-hr	AP-42; 10/96; Table 3.3-1
NOx EF =	5.97E-03	lb/bhp-hr	NSPS Subpart IIII; Table 4; 600 - 750 HP; 2009+; assumes NOx = NMHC + NOx - VOC EF.
SO2 EF =	1.09E-05	lb/bhp-hr	Based on: fuel sulfur = 15 ppmw; 7,000 Btu/hp-hr; oil HHV = 19,300 Btu/lb.
CO EF =	5.73E-03	lb/bhp-hr	NSPS Subpart IIII; Table 4; 600 - 750 HP; 2009+.
CO2 EF =	1.14E+00	lb/bhp-hr	40 CFR 98, Table C-1 (Fuel Oil No. 2) @ 7,000 Btu/bhp-hr.
CH4 EF =	4.63E-05	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
N2O EF =	9.26E-06	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
CO2e EF =	1.15E+00	lb/bhp-hr	Sum of CO2, N2O, & CH4 adjusted for GWP.
H2SO4 EF =	4.37E-07	lb/bhp-hr	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
Annual Operating Hours =	100	hrs/yr/engine	Proposed permit limit.
Hourly Emissions Calculations (each engine)			
PM Hourly Max =	0.161	lb/hr	= (Rated Horsepower, each engine) x (PM EF)
PM10 Hourly Max =	0.155	lb/hr	= (Rated Horsepower, each engine) x (PM10 EF)
PM2.5 Hourly Max =	0.145	lb/hr	= (Rated Horsepower, each engine) x (PM2.5 EF)
VOC Hourly Max =	0.314	lb/hr	= (Rated Horsepower, each engine) x (VOC EF)
NOx Hourly Max =	2.914	lb/hr	= (Rated Horsepower, each engine) x (NOx EF)
SO2 Hourly Max =	0.005	lb/hr	= (Rated Horsepower, each engine) x (SO2 EF)
CO Hourly Max =	2.797	lb/hr	= (Rated Horsepower, each engine) x (CO EF)
CO2 Hourly Max =	557.0	lb/hr	= (Rated Horsepower, each engine) x (CO2 EF)
CH4 Hourly Max =	0.023	lb/hr	= (Rated Horsepower, each engine) x (CH4 EF)
N2O Hourly Max =	0.005	lb/hr	= (Rated Horsepower, each engine) x (N2O EF)
CO2e Hourly Max =	558.9	lb/hr	= (Rated Horsepower, each engine) x (CO2e EF)
H2SO4 Hourly Max =	0.000	lb/hr	= (Rated Horespower, Total) x (H2SO4 EF)
Annual Emissions Calculations (all engines)			
PM PTE =	0.016	tpy	= (PM Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM10 PTE =	0.015	tpy	= (PM10 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM2.5 PTE =	0.015	tpy	= (PM2.5 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
VOC PTE =	0.031	tpy	= (VOC Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
NOx PTE =	0.291	tpy	= (NOx Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
SO2 PTE =	0.001	tpy	= (SO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO PTE =	0.280	tpy	= (CO Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2 PTE =	55.7	tpy	= (CO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CH4 PTE =	0.002	tpy	= (CH4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
N2O PTE =	0.000	tpy	= (N2O Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2e PTE =	55.9	tpy	= (CO2e Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
H2SO4 PTE =	0.0000	tpy	= (H2SO4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)

Summary of Results

	Potential Emissions (tons per year)									
	PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
Fire Pump ICE Emissions (2 units) =	0.02	0.02	0.01	0.031	0.291	0.001	0.280		56	0.000
2015 Plan Approval (3 units @ 700 bhp) =	0.035	0.033	0.031	0.07	0.63	0.001	0.60		120	0.00
Updated per 2015 PaDEP Review* =	0.04	0.04	0.04	0.07	0.80	0.001	0.75		120	
Net Change in Emissions =	-0.02	-0.02	-0.03	-0.04	-0.51	0.00	-0.47		-64.11	0.00

*Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 7.

Table B-9. Spent Caustic Incinerator Emissions Estimates

Emission Unit(s) ID	=	A5401		Spent Caustic Vent Incinerator
Parameter		**Value**		**Source / Basis**
Calcuation Inputs				
Design Heat Input [HHV]	=	10.7	MMBtu/hr	Preliminary design basis based on treated gas flow and composition (VOC + NG)
Heat Input from VOC [HHV]	=	0.7	MMBtu/hr	Preliminary design basis based on treated gas flow and composition (VOC only)
Design DRE	=	99%	wt. %	Preliminary design basis based on treated gas flow and composition.
PM EF	=	0.0019	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM10 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM2.5 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
VOC EF	=	0.0303	lb/MMBtu	Controlled EF: based on 3.2 g/Nm3 VOC in offgas to oxidizer and 99% DRE.
NOx EF	=	0.0680	lb/MMBtu	AP-42, Table 13.5-1, 9/91.
SO2 EF	=	0.0879	lb/MMBtu	Based on 0.05 g/Nm3 H2S in offgas to oxidizer.
CO EF	=	0.0824	lb/MMBtu	AP-42, Table 13.5-1, 9/91.
CO2 EF	=	124.8	lb/MMBtu	40 CFR 98, Table C-1 (as of July-2013); EF for natural gas + 8.4 g/Nm3 CO2 in influent gas.
N2O EF	=	2.2E-04	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
CH4 EF	=	2.2E-03	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
H2SO4 EF	=	3.5E-03	lb/MMBtu	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
HAP EF	=	0.0303	lb/MMBtu	Controlled EF; conservatively assumes HAP is 100% of VOC.
Annual Hours	=	8,760	hr/yr	Assumed full-time operation.
Annual Emissions Calculations				
PM Emissions	=	0.09	T/yr	= (Design Heat Input [HHV]) x (PM EF) x (Annual Hours) / (2000 lb/T)
PM10 Emissions	=	0.35	T/yr	= (Design Heat Input [HHV]) x (PM10 EF) x (Annual Hours) / (2000 lb/T)
PM2.5 Emissions	=	0.35	T/yr	= (Design Heat Input [HHV]) x (PM2.5 EF) x (Annual Hours) / (2000 lb/T)
VOC Emissions	=	1.42	T/yr	= (Design Heat Input [HHV]) x (VOC EF) x (Annual Hours) / (2000 lb/T)
NOx Emissions	=	3.2	T/yr	= (Design Heat Input [HHV]) x (NOx EF) x (Annual Hours) / (2000 lb/T)
SO2 Emissions	=	4.13	T/yr	= (Design Heat Input [HHV]) x (SO2 EF) x (Annual Hours) / (2000 lb/T)
CO Emissions	=	3.9	T/yr	= (Design Heat Input [HHV]) x (CO EF) x (Annual Hours) / (2000 lb/T)
CO2 Emissions	=	5,864	T/yr	= (Design Heat Input [HHV]) x (CO2 EF) x (Annual Hours) / (2000 lb/T)
N2O Emissions	=	0.01	T/yr	= (Design Heat Input [HHV]) x (N2O EF) x (Annual Hours) / (2000 lb/T)
CH4 Emissions	=	0.10	T/yr	= (Design Heat Input [HHV]) x (CH4 EF) x (Annual Hours) / (2000 lb/T)
H2SO4 Emissions	=	0.17	T/yr	= (Design Heat Input [HHV]) x (H2SO4 EF) x (Annual Hours) / (2000 lb/T)
HAP Emissions	=	1.42	T/yr	= (Design Heat Input [HHV]) x (HAP EF) x (Annual Hours) / (2000 lb/T)
CO2e Emissions	=	5,870	T/yr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs.
Short-Term Emissions Calculations				
PM Emissions	=	0.02	lb/hr	= (Design Heat Input [HHV]) x (PM EF)
PM10 Emissions	=	0.08	lb/hr	= (Design Heat Input [HHV]) x (PM10 EF)
PM2.5 Emissions	=	0.08	lb/hr	= (Design Heat Input [HHV]) x (PM2.5 EF)
VOC Emissions	=	0.32	lb/hr	= (Design Heat Input [HHV]) x (VOC EF)
NOx Emissions	=	0.73	lb/hr	= (Design Heat Input [HHV]) x (NOx EF)
SO2 Emissions	=	0.94	lb/hr	= (Design Heat Input [HHV]) x (SO2 EF)
CO Emissions	=	0.88	lb/hr	= (Design Heat Input [HHV]) x (CO EF)
CO2e Emissions	=	1,339	lb/hr	= (Design Heat Input [HHV]) x (CO2 EF)
N2O Emissions	=	0.00	lb/hr	= (Design Heat Input [HHV]) x (N2O EF)
CH4 Emissions	=	0.02	lb/hr	= (Design Heat Input [HHV]) x (CH4 EF)
H2SO4 Emissions	=	0.04	lb/hr	= (Design Heat Input [HHV]) x (H2SO4 EF)
HAP Emissions	=	0.32	lb/hr	= (Design Heat Input [HHV]) x (HAP EF)
CO2e Emissions	=	1,340	lb/hr	= sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 .

Summary of Results

		Potential Emissions (tons per year)									
		PM	**PM10**	**PM2.5**	**VOC/HAP**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
Caustic TO PTE	=	0.09	0.35	0.35	1.42	3.19	4.13	3.87	5,864	5,870	0.17

Table B-10. Process Cooling Tower Emissions Estimates

Emission Unit(s) ID =	PCT		Process Cooling Tower
Parameter	***Value***		***Source / Basis***
Calculation Inputs			
Number of Cells =	26		Design Specification
Cell Circulation Rate =	11,381	gal/min/cell	=(Cooling Water Rate)/(Number of Cells)
Annual Operating Hours =	8,760	hrs/yr	Maximum potential use.
Drift Loss Factor =	0.00050%	wt. %	Design specification. Basis for proposed BACT limit.
Cooling Water Rate =	295,900	gal/min	Maximum Water Flow Rate (gpm)
Cooling Water TDS =	2,000	ppmw	Annual average BACT/LAER proposal.
VOC Emissions Limit =	0.50	lb/MMgal	Proposed LAER limit.
OHAP Fraction of VOC =	10%	wt. %	ROM estimate; few HAP-containing streams in process.
Calculation Results			
Hourly VOC PTE [per cell] =	0.34	lb/hr	= (Cell Circulation Rate - gpm) x (60 min/hr) x (VOC Emissions Limit - lb/MMGal) / (1,000,000)
Annual VOC PTE [total] =	38.9	T/yr	= (Hourly VOC PTE [per cell]) x (Annual Operating Hours) / (2,000 lb/T) x (Number of Cells)
Annual HAP PTE [total] =	3.9	T/yr	= (OHAP Fraction of VOC) x (Annual VOC PTE [total])
PM10 Fraction of PM =	63.5%	wt. %	See particle size distribution calculation -->
PM2.5 Fraction of PM =	0.21%	wt. %	See particle size distribution calculation -->
Hourly PM PTE [per cell] =	0.1	lb/hr	= (Cell Circulation Rate) x (60 min/yr) x (8.34 lb/gal) x (Drift Loss Factor) x (Cooling Water TDS) / (1,000,000)
Annual PM PTE [total] =	6.5	tpy	= (Hourly PM PTE [per cell]) x (Annual Operating Hours) / (2,000 lb/T) x (Number of Cells)
Hourly PM10 PTE [per cell] =	0.036	lb/hr	= (PM10 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM10 PTE [total] =	4.1	tpy	= (PM10 Fraction of PM) x (Annual PM PTE [total])
Hourly PM2.5 PTE [per cell] =	0.0001	lb/hr	= (PM2.5 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM2.5 PTE [total] =	0.0138	tpy	= (PM2.5 Fraction of PM) x (Annual PM PTE [total])

2015 Plan Approval Annual VOC PTE	=	40.1	T/yr	Reference February 2015 Plan Approval Application
Net Change in Emissions	=	-1.2		
2015 Plan Approval Annual PM PTE	=	6.7	tpy	Reference February 2015 Plan Approval Application
Net Change in Emissions	=	-0.2	tpy	
2015 Plan Approval Annual PM10 PTE	=	4.2	tpy	Reference February 2015 Plan Approval Application
Net Change in Emissions	=	-0.1	tpy	
2015 Plan Approval Annual PM2.5 PTE	=	0.0143	tpy	Reference February 2015 Plan Approval Application
Net Change in Emissions	=	-0.0004	tpy	

Table B-11. Process Cooling Tower Particle Size Calculation

Emission Unit(s) ID	=	PCT	Process Cooling Tower					
Wet Droplet Diameter (µm)	Wet Droplet Volume (μm^3)	Wet Droplet Mass (µg)	Dry Particle Mass (µg)	Dry Particle Volume (μm^3)	Dry Particle Diameter (um)	wt. % Mass Smaller Than Droplet	Wt% PM_{10} in PM Emissions	Wt% $PM_{2.5}$ in PM Emissions
10	524	5.24E-04	1.05E-06	0	0.97	0.000		
20	4189	4.19E-03	8.38E-06	4	1.94	0.196		
30	14137	1.41E-02	2.83E-05	13	2.91	0.226		0.2
40	33510	3.35E-02	6.70E-05	30	3.87	0.514		
50	65450	6.54E-02	1.31E-04	59	4.84	1.806		
60	113097	1.13E-01	2.26E-04	103	5.81	5.702		
70	179594	1.80E-01	3.59E-04	163	6.78	21.348		
90	381704	3.82E-01	7.63E-04	347	8.72	49.812		
110	696910	6.97E-01	1.39E-03	634	10.66	70.509	63.5	
130	1150347	1.15E+00	2.30E-03	1046	12.59	82.023		
150	1767146	1.77E+00	3.53E-03	1606	14.53	88.012		
180	3053628	3.05E+00	6.11E-03	2776	17.44	91.032		
210	4849048	4.85E+00	9.70E-03	4408	20.34	92.468		
240	7238229	7.24E+00	1.45E-02	6580	23.25	94.091		
270	10305995	1.03E+01	2.06E-02	9369	26.16	94.689		
300	14137167	1.41E+01	2.83E-02	12852	29.06	96.288		
350	22449298	2.24E+01	4.49E-02	20408	33.91	97.011		
400	33510322	3.35E+01	6.70E-02	30464	38.75	98.340		
450	47712938	4.77E+01	9.54E-02	43375	43.59	99.071		
500	65449847	6.54E+01	1.31E-01	59500	48.44	99.071		
600	113097336	1.13E+02	2.26E-01	102816	58.12	100.000		

Specific Gravity of Water =	**1.00**	g/cc
Specific Gravity of Dried Solids =	**2.20**	g/cc
Cooling Tower Design TDS =	**2,000**	ppmw
PM10 fraction of PM =	**63.50**	wt. %
PM2.5 fraction of PM =	**0.21**	wt. %

From "Calculating Realistic PM10 Emissions from Cooling Towers"; Reisman & Frisbie (uses EPRI wet droplet size distribution).

Table B-12. PE Handling & Loadout PM PTE

PE Pellet Transport, Storage, Blending and Loading Operations								
Parameter	Units	Blending Silo	Railcar Handling & Storage	Truck Handling & Storage	Elutriator Wash Air*	Railcar Loading	Truck Loading	Source / Basis
Calculation Inputs: **(rates for all three lines)**								
Annual Rate	MT/yr	2,400,000	1,600,000	685,714		1,600,000	685,714	Based on 1.6 MM MT/yr production w/ 100% max via rail and 43% max by truck.
Max PE Pellet Rate	MT/hr	300	300	300		300	300	Preliminary design: 24-hr average max rates.
Normal PE Pellet Rate	MT/hr	300	300	300		300	300	Prelimiary design: annual average rates.
Pellet-to-Air Ratio	lb/lb	10	9.55	6.99		467	467	Loading air displacement based on 1 scf air per ft3 PE loaded.
PM Exit Grain Loading	gr/dscf	0.005	0.005	0.005		0.005	0.005	LAER Limit updated from 0.01 to 0.005 gr/dscfr.
PM10/2.5 Exit Grain Loading	gr/dscf	0.0017	0.0017	0.0017		0.005	0.005	Equivalent to proposed hourly emission limit at max rates.
Annual Operating Hours	hr/yr	8,000	5,333	2,286		5,333	2,286	Annual operating hours at normal rates. Hours may be higher if rates are lower.
Calculated Values:								
Max Exhaust Rate	scfh	1,233,188	1,487,454	2,396,454		18,934	18,934	= (Max PE Pellet Rate) x (2,204.6 lb/MT) / (Pellet-to-Air Ratio) / (28.84 lb/lb-mol) x (385.57 scf/lb-mol)+Elutriator exhaust*
Normal Exhaust Rate	scfh	1,233,188	1,487,454	2,396,454		18,934	18,934	= (Normal PE Pellet Rate) x (2,204.6 lb/MT) / (Pellet-to-Air Ratio) / (28.84 lb/lb-mol) x (385.57 scf/lb-mol)+Elutriator exhaust*
24-hr PM10 Rate	lb/hr	0.299	0.36	0.58		0.01	0.01	= (PM10/2.5 Exit Grain Loading) x (Max Exhaust Rate) / (7,000 gr/lb)
Annual Average PM10 Rate	lb/hr	0.27	0.22	0.15		0.01	0.00	= (PM10/2.5 Exit Grain Loading) x (Normal Exhaust Rate) / (7,000 gr/lb) x (Annual Operating Hours) / (8760 hr/yr)
Annual PM PTE	T/yr	3.52	2.83	1.96		0.04	0.02	= (Normal Exhaust Rate) x (Annual Operating Hours) x (PM Exit Grain Loading) / (7,000 gr/lb) / (2000 lb/T)
Annual PM10/2.5 PTE	T/yr	1.20	0.96	0.67		0.04	0.02	= (Normal Exhaust Rate) x (Annual Operating Hours) x (PM10/2.5 Exit Grain Loading) / (7,000 gr/lb) / (2000 lb/T)
2015 Plan Approval PTE (PaDEP Review)*								
Annual PM PTE	T/yr	3.16	1.60	0.34	0.96	0.02	0.00	
Annual PM10/2.5 PTE	T/yr	0.54	0.27	0.06	0.16	0.02	0.00	
Annual PM10/2.5 PTE (Revised)	T/yr	1.07	0.54	0.11	0.02	0.02	0.00	Revised PM/10/PM2.5 loading for silo and handling should be 0.0017 gr/dscf
Net Change in PM PTE	T/yr	0.36	1.23	1.62	-0.96	0.02	0.01	
Net Change in PM10/PM2.5 PTE	T/yr	0.12	0.42	0.55	-0.02	0.02	0.02	
EU List and Notes:								
Blending Silos:	PE1BLEND A/B/C/D/E; PE2BLEND A/B/C/D/E; V7001A; V7001B; V7001C; V7001D							
Railcar Handling & Storage:	PE1RAILSILO - A/B/C/D, PE2RAILSILO - A/B/C/D; PE3RAILSILO - A/B/C/D							
Truck Handling & Storage:	PE1TRUCKSILO- A/B/C/D/E/F/G/H/I/J; PE2TRUCKSILO- A/B/C/D/E/F/G/H/I/J; PE3TRUCKSILO- A/B/C/D/E/F/G/H/I/J1/K/L/M/N/O/P/Q/R							
***Elutriator:**	Elutriator exhaust shares control device with the pellet handling silos (i.e., Blending Silo, Railcar Handling and Storage, and Truck Handling and Storage)							
Railcar Loading:	PE1RAILLOADA/B; PE2RAILLOADA/B; PE3RAILLOADA/B;							
Truck Loading:	PE1TRUCKLOAD A/B/C/D/E; PE1TRUCKLOAD A/B/C/D/E; PE3TRUCKLOADA/B/C/D/E/F/G/H/I							

* Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 14.

Table B-13. Organic Liquid Loadout Operations Emissions Estimates

Organic Liquid Loadout Operations						
	Low Vapor Pressure Liquids					
Parameter	Recovered Oil Loading	Coke Residue and Tar	Pyrolysis Fuel Oil (PFO) Loading	Light Gasoline Loading	Units	Source / Basis
Material Loaded	Recovered Oil	Asphalt & Heavy Oil	Heavy Gasoline	Light Gasoline		
Surrogate Material	Jet Kerosene	No. 6 Residual Oil	No. 6 Residual Oil	Gasoline		Selected as conservatively volatile species representing actual materials.
Material Temperature	30	30	80	40	°C	Heavy Gasoline is heated; Slop Oil is ≈ maximum daily avg temperature in July
Material Temperature	546	546	636	564	°R	= (Material Temperature - °C) x (1.8) + (32) + (460)
VOC Vapor Pressure	0.5000	0.5000	4.0600	7.5000	psia	Proposed LAER/BACT vapor pressure limit for low vapor pressure organic liquids is 0.5 psi.
VOC Vapor MW	130	190	190	66	lb/lb-mole	TANKS 4.09D value for surrogate material.
Type of Loadout Operation	RAIL & TRUCK	Truck	RAIL	RAIL		
Type of Loading System	SUBMERGED	SUBMERGED	SUBMERGED	SUBMERGED		Proposed design/work practice.
Annual Loading Rate	210	504	5,334	6,025	10^3gal/yr	Loading rates are from preliminary facility design basis - 525 bbls/day Lt. gas and 101 bbls/day PFO
Saturation Factor	0.60	0.60	0.60	0.60		S from AP-42 eqation (see below)
VOC Loading Loss Factor	0.992	1.449	10.680	7.401	lbs/10^3gal	L_L from AP-42 eqation (see below) using LAER limit Vp.
Control Efficiency	0%	0%	99.9%	99.9%	wt. %	No controls applied due to low Vp. Control of PFO and Light Gas increased to 99.9% from 99.5% assumed in 2015.
Annual VOC Emissions	0.10	0.37	0.0285	0.02	T/yr	= (Annual Loading Rate) x (VOC Loading Loss Factor) x (1 - Control Efficiency) / (2000 lb/T)
VOC Vapor Pressure	3.45	3.45	27.99	51.71	kPa	= (6.895 kPa/psi) x (VOC Vapor Pressure)
Estimated HAP Fraction	100%	100%	100%	100%	wt. %	Worst-case estimate.
Annual HAP Emissions	0.10	0.37	0.03	0.02	T/yr	= (Annual VOC Emissions) x (Estimated HAP Fraction)

2015 Plan Approval Annual VOC Emissions	0.10	0.37	0.0349	0.15	T/yr	Reference February 2015 Plan Approval Application
Net Change in Emissions	0.00	0.00	-0.01	-0.13	T/yr	

Emissions Estimates based on Equation 1 in AP-42, Chapter 5, Section 2 (Jan-1995 version):

$$L_L = 12.46 \frac{SPM}{T}$$

where:

L_L = loading loss, pounds per 1000 gallons (lb/10^3 gal) of liquid loaded
S = a saturation factor (see Table 5.2-1)
P = true vapor pressure of liquid loaded, pounds per square inch absolute (psia) (see Figure 7.1-5, Figure 7.1-6, and Table 7.1-2)
M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole) (see Table 7.1-2)
T = temperature of bulk liquid loaded, °R (°F + 460)

Table B-14. Combustion Turbine and Duct Burner Emissions Estimates

Emission Unit(s) ID	=	CT1/2/3		Combustion Turbine & Duct Burner PTE
Parameter		**Value**		**Source / Basis**
Calculation Inputs:				
Max Heat Input [HHV]	=	715.4	MMBtu/hr	Total maximum heat input to each GE Frame 6B turbine/duct burner unit.
Turbine/Duct Burner PM EF	=	0.0019	lb/MMBtu	AP-42, 3.1-2a (filterable only).
Turbine/Duct Burner PM10 EF	=	0.0066	lb/MMBtu	Proposed BACT limit.
Turbine/Duct Burner PM2.5 EF	=	0.0066	lb/MMBtu	Proposed LAER limit.
Turbine/Duct Burner VOC EF	=	0.00352	lb/MMBtu	Equivalent to proposed LAER limit at max load (based on 1 ppmvd @ 15% O2 as C3H8).
Turbine/Duct Burner NOx EF	=	0.00736	lb/MMBtu	Equivalent to proposed LAER limit at max load (based on 2 ppmvd @ 15% O2 as NO2).
Turbine/Duct Burner SO2 EF	=	0.0015	lb/MMBtu	Based on max NG sulfur content; see "Constants" sheet for details.
Turbine/Duct Burner CO EF	=	0.00448	lb/MMBtu	Equivalent to proposed LAER limit at max load (based on 2 ppmvd @ 15% O2).
Turbine/Duct Burner CO2 EF	=	117.0	lb/MMBtu	40 CFR 98, Table C-1; EF for natural gas.
Turbine/Duct Burner N2O EF	=	2.2E-04	lb/MMBtu	40 CFR 98, Table C-2; EF for natural gas.
Turbine/Duct Burner CH4 EF	=	2.2E-03	lb/MMBtu	40 CFR 98, Table C-2; EF for natural gas.
Turbine/Duct Burner H2SO4 EF	=	5.9E-05	lb/MMBtu	AP-42, Table 1.3-1; estimated based on SO3-to-SO2 emissions ratio for distillate oil.
Turbine/Duct Burner Pb EF	=	4.9E-07	lb/MMBtu	AP-42, Table 1.4-2.
Turbine/Duct Burner Fluoride EF	=	0	lb/MMBtu	Not emitted.
Startup NOx EF	=	113	lb/hr	Design estimate.
Startup CO EF	=	276	lb/hr	Design estimate.
Startup Hours	=	7	hr/yr	Worst-case estimate.
Annual Hours	=	8,760	hr/yr	
Annual Emissions Calculations (for 1 unit):				
PM Emissions	=	5.84	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM EF) x (Annual Hours) / (2000 lb/T)
PM10 Emissions	=	20.68	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM10 EF) x (Annual Hours) / (2000 lb/T)
PM2.5 Emissions	=	20.68	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM2.5 EF) x (Annual Hours) / (2000 lb/T)
VOC Emissions	=	11.03	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner VOC EF) x (Annual Hours) / (2000 lb/T)
NOx Emissions	=	23.4	T/yr	= [(Max Heat Input [HHV]) x (Turbine/Duct Burner NOx EF) x (Annual Hours - Startup Hours) + (Startup NOx EF) x (Startup Hours)] / (2000 lb/T)
SO2 Emissions	=	4.61	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner SO2 EF) x (Annual Hours) / (2000 lb/T)
CO Emissions	=	15.0	T/yr	= [(Max Heat Input [HHV]) x (Turbine/Duct Burner CO EF) x (Annual Hours - Startup Hours) + (Startup CO EF) x (Startup Hours)] / (2000 lb/T)
CO2 Emissions	=	366,542	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CO2 EF) x (Annual Hours) / (2000 lb/T)
N2O Emissions	=	0.69	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner N2O EF) x (Annual Hours) / (2000 lb/T)
CH4 Emissions	=	6.91	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CH4 EF) x (Annual Hours) / (2000 lb/T)
H2SO4 Emissions	=	0.18	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner H2SO4 EF) x (Annual Hours) / (2000 lb/T)
Pb Emissions	=	0.00	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Pb EF) x (Annual Hours) / (2000 lb/T)
Fluoride Emissions	=	0.00	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Fluoride EF) x (Annual Hours) / (2000 lb/T)
CO2e Emissions	=	366,921	T/yr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.
Short-Term Emissions (for 1 unit):				
PM Emissions	=	1.33	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM EF)
PM10 Emissions	=	4.72	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM10 EF)
PM2.5 Emissions	=	4.72	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM2.5 EF)
VOC Emissions	=	2.52	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner VOC EF)
NOx Emissions	=	5.354	lb/hr	= Annual Average Value for Modeling Purposes.
SO2 Emissions	=	1.05	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner SO2 EF)
CO Emissions	=	276	lb/hr	= Startup Max Rate for Modeling Purposes
CO2 Emissions	=	83,685	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CO2 EF)
N2O Emissions	=	0.16	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner N2O EF)
CH4 Emissions	=	1.58	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CH4 EF)
H2SO4 Emissions	=	0.04	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner H2SO4 EF)
Pb Emissions	=	0.00	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Pb EF)
Fluoride Emissions	=	0.00	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Fluoride EF)
CO2e Emissions	=	83,772	lb/hr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.

Summary of Results

		Potential Emissions (tons per year)									
		PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
One Unit	=	5.8	20.7	20.7	11.03	23.4	4.61	15.0	366,550	366,921	0.18
Three Units	=	17.5	62.0	62.0	33.10	70.3	13.82	45.0	1,099,650	1,100,762	0.55
2015 Plan Approval PTE (3 units)	=	16.3	57.6	57.6	30.72	65.4	12.83	42.0	1,020,642	1,021,675	0.52
Net Change in Emissions	=	1.3	4.5	4.5	2.4	5.0	1.0	3.0	79,008	79,087	0.04

Table B-15. Wastewater Treatment Emissions Estimates

WWTP Equipment (W-1001) - Emissions Summary								
	Maximum Rate	Emission Factor	Short Term Max Emissions	Annualized Emissions			Calculation/ Estimation Method	Emission Factor Reference
Pollutant	million gal/day	lb/million gal	lb/hr	lb/hr	hrs/year	TPY		
VOC	N/A	N/A	0.048	0.010	8,760	4.22E-02	Emissions model	EPA WATER9
Benzene	N/A	N/A	0.048	0.010	8,760	4.22E-02	Emissions model	EPA WATER9
Phenol	N/A	N/A	3.7E-06	7.5E-07	8,760	3.29E-06	Emissions model	EPA WATER9

WWTP Equipment (W-1001) include:
Biotreater Aeration Tank, two Secondary Clarifiers, Biosludge Holding Tank, Biosludge Dewatering Tank, Centrate Sump, Sand Filter, Sand Filter Backwash Receiver and Outfall. The Flow Equalization and Oil Removal Tanks (T-5307A/B) are vented to the Spent Caustic Vent Incinerator (A5401).

Basis:
Emissions were modeled under worst-case conditions of dry weather flow. Short term maximum emissions based on peak concentrations to the WWTP. Annualized emissions based on annual average concentrations.

Example Calculations:
0.42 ton VOC/yr = (0.097 lb/hr) x (8,760 hrs/year) / (2,000 lb/ton)

Table B-16. Cogen Cooling Tower Emissions Estimates

Emission Unit(s) ID =	CogenCWT	Cogen Cooling Tower
Parameter	***Value***	***Source / Basis***
Calculation Inputs		
Number of Cells =	6	Design Specification (See Below)
Cell Circulation Rate =	12,343 gal/min/cell	=(Cooling Water Rate)/(Number of Cells)
Annual Operating Hours =	8,760 hrs/yr	Maximum potential use.
Drift Loss Factor =	0.00050% wt. %	Design specification. Basis for proposed BACT limit.
Cooling Water Rate =	74,056 gal/min	Maximum Water Flow Rate (gpm) (See Below)
Cooling Water TDS =	2,000 ppmw	Annual average BACT/LAER proposal.
Calculation Results		
PM10 Fraction of PM =	63.5% wt. %	See particle size distribution calculation -->
PM2.5 Fraction of PM =	0.21% wt. %	See particle size distribution calculation -->
Hourly PM PTE [per cell] =	0.1 lb/hr	= (Cell Circulation Rate) x (60 min/yr) x (8.34 lb/gal) x (Drift Loss Factor) x (Cooling Water TDS) / (1,000,000)
Annual PM PTE [total] =	1.6 tpy	= (Hourly PM PTE [per cell]) x (Annual Operating Hours) / (2,000 lb/T) x (Number of Cells)
Hourly PM10 PTE [per cell] =	0.0392 lb/hr	= (PM10 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM10 PTE [total] =	1.0 tpy	= (PM10 Fraction of PM) x (Annual PM PTE [total])
Hourly PM2.5 PTE [per cell] =	0.0001 lb/hr	= (PM2.5 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM2.5 PTE [total] =	0.00346 tpy	= (PM2.5 Fraction of PM) x (Annual PM PTE [total])

2015 Plan Approval Annual PM PTE	=	1.6	tpy	Reference February 2015 Plan Approval Application
Net Change in Emissions	=	0.0	tpy	
2015 Plan Approval Annual PM10 PTE	=	1.0	tpy	Reference February 2015 Plan Approval Application
Net Change in Emissions	=	0.0	tpy	
2015 Plan Approval Annual PM2.5 PTE	=	0.0035	tpy	Reference February 2015 Plan Approval Application
Net Change in Emissions	=	0.0	tpy	

Table B-17. Cogen Cooling Water Tower Particle Size Calculation

Emission Unit(s) ID	=	CogenCWT	Cogen Cooling Water Tower					
Wet Droplet Diameter (µm)	Wet Droplet Volume (μm^3)	Wet Droplet Mass (µg)	Dry Particle Mass (µg)	Dry Particle Volume (μm^3)	Dry Particle Diameter (um)	wt. % Mass Smaller Than Droplet	Wt% PM_{10} in PM Emissions	Wt% $PM_{2.5}$ in PM Emissions
10	524	5.24E-04	1.05E-06	0	0.97	0.000		
20	4189	4.19E-03	8.38E-06	4	1.94	0.196		
30	14137	1.41E-02	2.83E-05	13	2.91	0.226		0.2
40	33510	3.35E-02	6.70E-05	30	3.87	0.514		
50	65450	6.54E-02	1.31E-04	59	4.84	1.806		
60	113097	1.13E-01	2.26E-04	103	5.81	5.702		
70	179594	1.80E-01	3.59E-04	163	6.78	21.348		
90	381704	3.82E-01	7.63E-04	347	8.72	49.812		
110	696910	6.97E-01	1.39E-03	634	10.66	70.509	63.5	
130	1150347	1.15E+00	2.30E-03	1046	12.59	82.023		
150	1767146	1.77E+00	3.53E-03	1606	14.53	88.012		
180	3053628	3.05E+00	6.11E-03	2776	17.44	91.032		
210	4849048	4.85E+00	9.70E-03	4408	20.34	92.468		
240	7238229	7.24E+00	1.45E-02	6580	23.25	94.091		
270	10305995	1.03E+01	2.06E-02	9369	26.16	94.689		
300	14137167	1.41E+01	2.83E-02	12852	29.06	96.288		
350	22449298	2.24E+01	4.49E-02	20408	33.91	97.011		
400	33510322	3.35E+01	6.70E-02	30464	38.75	98.340		
450	47712938	4.77E+01	9.54E-02	43375	43.59	99.071		
500	65449847	6.54E+01	1.31E-01	59500	48.44	99.071		
600	113097336	1.13E+02	2.26E-01	102816	58.12	100.000		

Specific Gravity of Water =	**1.00**	g/cc
Specific Gravity of Dried Solids =	**2.20**	g/cc
Cooling Tower Design TDS =	**2,000**	ppmw
PM10 fraction of PM =	**63.50**	wt. %
PM2.5 fraction of PM =	**0.21**	wt. %

From "Calculating Realistic PM10 Emissions from Cooling Towers"; Reisman & Frisbie (uses EPRI wet droplet size distribution).

Table B-18. Flare Emissions Estimates

FLARE EMISSIONS CALCULATIONS																	
VOC to Flare	Basis			NSR POLLUTANT EMISSION FACTORS (lb/MMBtu)													
	MMBtu/hr	VOC to Flare	VOC DRE	NOx	SO2	PM2.5	VOC	CO2	CH4	N2O	CO2e	CO	PM	PM10	H2SO4	HAP	Pb
HP Ground Flares / Short-Term Max	2,725	31 MT/hr		0.068								0.37		0.0075			
HP Ground Flares / Annual Average	131.7	1.23 MT/hr	98.0% DRE	0.068	0.0015	0.0075	0.4111	131.4	0.0066	0.0013	132.0	0.37	0.0019	0.0075	0.00006	0.00185	4.9E-07
HP Elevated Flare / Normal Ops	1.1	NG only		0.068	0.0015	0.0075	0.0054	117.0	0.0022	0.0002	117.1	0.37	0.0019	0.0075	0.00006	0.00185	4.9E-07
MP Ground Flare / Normal Ops	4.1	0 MT/hr		0.068	0.0015	0.0075	0.0054	117.0	0.0022	0.0002	117.1	0.37	0.0019	0.0075	0.00006	0.00185	4.9E-07
MP Ground Flare / Short-Term Max	102	0 MT/hr		0.068								0.37		0.0075			
MP Ground Flare/PE Normal Ops	1.8	NG Only	98.0% DRE	0.068	0.0015	0.0075	0.0000	131.4	0.0066	0.0013	132.0	0.37	0.0019	0.0075	0.00006	0.00185	4.9E-07
FLARE / FLARING MODE		Basis		NSR POLLUTANT RATES USED IN AMBIENT IMPACT MODELING (lb/hr)													
		MMBtu/hr	NOTES	NOx								CO		PM10			
HP Ground Flares / Short-Term Max		2,725	[A]	37.1								1,008		20.3			
HP Ground Flares / Annual Average		132	[B]	9.0										0.98			
HP Elevated Flare / Normal Ops		1.1	[C]	0.1								0.4		0.01			
MP Ground Flare / Normal Ops		4.1	[D]	0.3								1.5		0.03			
MP Ground Flare / Short-Term Max		102	[E]	1.4								37.6		0.76			
MP Ground Flare/PE Normal Ops		1.8	[F]	0.1								0.7		0.01			
FLARE / FLARING MODE		Basis		NSR POLLUTANT PTE (T/yr)													
		Hours/yr	MMBtu/yr	NOx	SO2	PM2.5	VOC	CO2	CH4	N2O	CO2e	CO	PM	PM10	H2SO4	HAP	Pb
HP Ground Flares / Annual Average		8,760	1,153,791	39.2	0.85	4.30	237.1	75,801	3.82	0.76	76,124	213.5	1.07	4.30	0.03	1.07	2.8E-04
HP Elevated Flare / Normal Ops		8,760	9,774	0.33	0.01	0.04	0.03	572	0.01	0.00	572	1.81	0.01	0.04	0.00	0.01	2.4E-06
MP Ground Flare / Normal Ops		8,760	35,754	1.22	0.03	0.13	0.10	2,091	0.04	0.00	2,093	6.61	0.03	0.13	0.00	0.03	8.8E-06
MP Ground Flare/PE Normal Ops		8,760	15,882	0.54	0.01	0.06	0.00	1,043	0.05	0.01	1,048	2.94	0.01	0.06	0.00	0.01	3.9E-06

FLARE / FLARING MODE		Basis		2015 Plan Approval NSR Pollutant PTE and Net Emissions Change (T/yr)													
		Hours/yr	MMBtu/yr	NOx	SO2	PM2.5	VOC	CO2	CH4	N2O	CO2e	CO	PM	PM10	H2SO4	HAP	Pb
HP Ground Flares / Annual Average	PTE	8,760	800,635	27.2	0.59	2.98	226.0	52,600	2.65	0.53	52,824	148.1	0.75	2.98	0.02	0.74	2.0E-04
HP Elevated Flare / Normal Ops	PTE	8,760	452,947	15.40	0.33	1.69	1.22	26,492	0.50	0.05	26,520	83.80	0.42	1.69	0.01	0.42	1.1E-04
MP Ground Flare / Normal Ops	PTE	8,760	19,871	0.68	0.01	0.07	0.05	1,162	0.02	0.00	1,163	3.68	0.02	0.07	0.00	0.02	4.9E-06
MP Ground Flare/PE Normal Ops	PTE	8,760	8,760	0.30	0.01	0.03	0.00	576	0.03	0.01	578	1.62	0.01	0.03	0.00	0.01	2.1E-06
HP Ground Flares / Annual Average	Δ tpy			12.0	0.3	1.3	11.11	23,201.5	1.2	0.2	23,300.3	65.3	0.3	1.3	0.0	0.3	0.0
HP Elevated Flare / Normal Ops	Δ tpy			-15.1	-0.3	-1.7	-1.2	-25,920.5	-0.5	0.0	-25,947.3	-82.0	-0.4	-1.7	0.0	-0.4	0.0
MP Ground Flare / Normal Ops	Δ tpy			0.5	0.0	0.1	0.0	928.9	0.0	0.0	929.9	2.9	0.01	0.1	0.0	0.0	0.0
MP Ground Flare/PE Normal Ops	Δ tpy			0.2	0.0	0.0	0.0	467.9	0.0	0.0	469.9	1.3	0.01	0.0	0.0	0.0	0.0

Table B-19. VOC Control System Low Pressure Thermal Incinerator Emissions Estimates

Emission Unit(s) ID	=	LPINCINERATOR	LP Thermal Incinerator
Parameter		**Value**	**Source / Basis**
Calculation Inputs			
Potential Heat Input [HHV]	=	107 MMBtu/hr	Preliminary design basis 10 tph capacity at 22,000 BTU/lb
Design DRE	=	99.9% wt. %	Preliminary design basis.
PM EF	=	0.0019 lb/MMBtu	AP-42, Table 1.4-2, 7/98 & proposed BACT limit.
PM10 EF	=	0.0075 lb/MMBtu	AP-42, Table 1.4-2, 7/98 & proposed BACT limit.
PM2.5 EF	=	0.0075 lb/MMBtu	AP-42, Table 1.4-2, 7/98 & proposed LAER limit.
VOC EF	=	0.0351 lb/MMBtu	Preliminary design basis of 1.9 T/hr VOC to TI and a DRE of 99.90%.
NOx EF	=	0.0680 lb/MMBtu	Preliminary design basis.
SO2 EF	=	0 lb/MMBtu	No sulfur in PE vents.
CO EF	=	0.0824 lb/MMBtu	AP-42, Table 1.4-1, 7/98.
CO2 EF	=	145.4 lb/MMBtu	40 CFR 98, Table C-1 (as of July-2013); EF for ethylene.
N2O EF	=	1.3E-03 lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for fuel gas.
CH4 EF	=	6.6E-03 lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for fuel gas.
H2SO4 EF	=	0 lb/MMBtu	No sulfur in PE vents.
HAP EF	=	1.9E-03 lb/MMBtu	Based on the total of all AP-42 HAP emissions factors for external combustion of natural gas.
Annual Hours	=	8,760 hr/yr	Assumed full-time operation at max rate as worst-case.
Annual Emissions Calculations			
PM Emissions	=	0.89 T/yr	= (Potential Heat Input [HHV]) x (PM EF) x (Annual Hours) / (2000 lb/T)
PM10 Emissions	=	3.48 T/yr	= (Potential Heat Input [HHV]) x (PM10 EF) x (Annual Hours) / (2000 lb/T)
PM2.5 Emissions	=	3.48 T/yr	= (Potential Heat Input [HHV]) x (PM2.5 EF) x (Annual Hours) / (2000 lb/T)
VOC Emissions	=	16.42 T/yr	= (Potential Heat Input [HHV]) x (VOC EF) x (Annual Hours) / (2000 lb/T)
NOx Emissions	=	31.8 T/yr	= (Potential Heat Input [HHV]) x (NOx EF) x (Annual Hours) / (2000 lb/T)
SO2 Emissions	=	0.00 T/yr	= (Potential Heat Input [HHV]) x (SO2 EF) x (Annual Hours) / (2000 lb/T)
CO Emissions	=	38.5 T/yr	= (Potential Heat Input [HHV]) x (CO EF) x (Annual Hours) / (2000 lb/T)
CO2 Emissions	=	67,998 T/yr	= (Potential Heat Input [HHV]) x (CO2 EF) x (Annual Hours) / (2000 lb/T)
N2O Emissions	=	0.62 T/yr	= (Potential Heat Input [HHV]) x (N2O EF) x (Annual Hours) / (2000 lb/T)
CH4 Emissions	=	3.09 T/yr	= (Potential Heat Input [HHV]) x (CH4 EF) x (Annual Hours) / (2000 lb/T)
H2SO4 Emissions	=	0.00 T/yr	= (Potential Heat Input [HHV]) x (H2SO4 EF) x (Annual Hours) / (2000 lb/T)
HAP Emissions	=	0.87 T/yr	= (Potential Heat Input [HHV]) x (HAP EF) x (Annual Hours) / (2000 lb/T)
CO2e Emissions	=	68,260 T/yr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.
Short-Term Emissions Calculations			
PM Emissions	=	0.20 lb/hr	= (Potential Heat Input [HHV]) x (PM EF)
PM10 Emissions	=	0.80 lb/hr	= (Potential Heat Input [HHV]) x (PM10 EF)
PM2.5 Emissions	=	0.80 lb/hr	= (Potential Heat Input [HHV]) x (PM2.5 EF)
VOC Emissions	=	3.75 lb/hr	= (Potential Heat Input [HHV]) x (VOC EF)
NOx Emissions	=	7.26 lb/hr	= (Potential Heat Input [HHV]) x (NOx EF)
SO2 Emissions	=	0.00 lb/hr	= (Potential Heat Input [HHV]) x (SO2 EF)
CO Emissions	=	8.79 lb/hr	= (Potential Heat Input [HHV]) x (CO EF)
CO2e Emissions	=	15,525 lb/hr	= (Potential Heat Input [HHV]) x (CO2 EF)
N2O Emissions	=	0.14 lb/hr	= (Potential Heat Input [HHV]) x (N2O EF)
CH4 Emissions	=	0.71 lb/hr	= (Potential Heat Input [HHV]) x (CH4 EF)
H2SO4 Emissions	=	0.00 lb/hr	= (Potential Heat Input [HHV]) x (H2SO4 EF)
HAP Emissions	=	0.20 lb/hr	= (Potential Heat Input [HHV]) x (HAP EF)
CO2e Emissions	=	15,584 lb/hr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.

Summary of Results

		Potential Emissions (tons per year)										
		PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**	**HAP**
LP TI PTE	=	0.89	3.48	3.48	16.42	31.80	0.00	38.51	68,002	68,260	0.00	0.87
2015 Plan Approval LP TI PTE*	=	1.14	4.57	4.57	15.46	41.73	0.00	50.54	89,244	89,582	0.00	1.14
Net Emissions Change	=	-0.25	-1.09	-1.09	0.95	-9.93	0.00	-12.03	-21,241	-21,322	0.00	-0.27

* Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 8.

Table B-20. Truck Transport Road PM Emissions Estimates

TRANSPORT TRUCK ROAD PARTICULATE MATTER EMISSIONS (Annual Rate)			
Parameter	**Value**		**Reference & Calculation Basis**
Calculation based based on paved Road	***Equation from AP-42 section 13.2.1 for hourly emissions***		
k for PM	0.011	lb/VMT	AP-42, Table 13.2.1-1
k for PM10	0.0022	lb/VMT	AP-42, Table 13.2.1-1
k for PM2.5	0.00054	lb/VMT	AP-42, Table 13.2.1-1
sL	0.20	g/m2	Estimated value based on application of LAER controls.
W	25	tons	average weight (tons) of the vehicles traveling the road.
P	150	days	Number of days with rain fall greater than 0.01 inch
N	365	days	Number of days in the averaging period.
EF for PM*	0.059	lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
EF for PM10*	0.0119	lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
EF for PM2.5*	0.00292	lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
Vehicles per day	44	vehicles/day	Design estimate (1).
Hours per day of vehicle traffic	24	hr/day	Annual average value.
Road Length	0.49	miles	Round trip distance from current plot plan.
VMT hourly =	0.9	VMT/hr	= (Vehicles per day) / (Hours per day of vehicle traffic) x (Road Length)
PM Emissions [hourly]	0.05340	lb/hr	= (VMT hourly =) x (EF for PM*)
PM10 Emissions [hourly]	0.011	lb/hr	= (VMT hourly =) x (EF for PM10*)
PM2.5 Emissions [hourly]	0.003	lb/hr	= (VMT hourly =) x (EF for PM2.5*)
PM Emissions [annual]	0.234	tpy	= (PM Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM10 Emissions [annual]	0.047	tpy	= (PM10 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM2.5 Emissions [annual]	0.011	tpy	= (PM2.5 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
Note: (1) Original logistics of 10% truck shipments updated to 20% per Volume X Version D.			
PaDEP Review PM Emissions [annual]*	0.52	tpy	Updated based on PaDEP Review
PaDEP Review PM10 Emissions [annual]*	0.10	tpy	Updated based on PaDEP Review
PaDEP Review PM2.5 Emissions [annual]*	0.03	tpy	Updated based on PaDEP Review
Net change in PM	-0.286	tpy	
Net change in PM10	-0.057	tpy	
Net change in PM2.5	-0.015	tpy	

*Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 19.

Enclosure 5

2015 Plan Approval Application Appendix B (April 2020 Revision)

Revisions as noted in the memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04- 00740A, April 1, 2015, Table 7.

Certain information contained in this appendix constitutes Trade Secret and/or Confidential Proprietary Information as defined in the Pennsylvania Right to Know Law

1.0 GENERAL DISCUSSION

For purposes of evaluating applicability of PSD and NSR nonattainment and determining the potential to emit of the proposed facility, the methodology used for evaluating emissions increases is the actual-to-potential test described at 40 CFR § 52.21(a)(2)(d) and incorporated by reference at 25 Pa. Code §127.83. Since this project is a greenfield facility, emissions increases under the actual-to-potential test are equal to the potential to emit of all of the equipment that will be constructed as part of the project. Baseline actual emissions from all units are zero.

The following discussion provides a summary of the methodology used to determine the potential to emit from all units to be constructed.

1.1 Emissions Units

Table 1-1 lists the categories of emissions units to be constructed as part of the project and identifies the general methodology used to estimate the potential to emit for each unit type. A specific discussion of each of the calculation methodologies is provided in the following subsections.

Table 1-1. List of Emissions Units and Emissions Estimation Methods

EU Description	Methodology
Ethane Cracking Furnaces	(Emission Factor/Proposed Limit) x (Firing Rate)
Combustion Turbines	(Emission Factor/Proposed Limit) x (Firing Rate)
Emergency Generator Engine	(Emission Factor/Proposed Limit) x (Capacity) x (Op. Hours)
Fire Water Pump Engine	(Emission Factor/Proposed Limit) x (Capacity) x (Op. Hours)
Fugitive Equipment Leaks	(SOCMI Leak Factors) x (Component Counts) x (1 – Ctrl. Efficiency) x (Component Pollutant Concentration)
PEU Particulate Emissions	Vendor Estimates of Potential Emissions
PE Handling, Storage & Loading PM	(Emission Factor) x (Throughput-Based Air Flows)
PE Handling, Storage & Loading VOC	(Emission Factor/Proposed Limit) x (Throughput)
Tanks VOC (not vented to flare)	(TANKS 4.09d) x (1 – Ctrl. Efficiency)
WWTP Units (not vented to TI)	EPA WATER9 Model
Cooling Tower PM	AP-42 Methodology; PSD from Reisman & Frisbie
Cooling Tower VOC	(Proposed Limit) x (Circulation Rate)
Organic Liquid Loading	AP-42 Methodology (Chapter 5, Section 2)
C3+ Loading	(Emission Factor) x (Throughput)
Caustic and LP TI	(Emission Factor) x (Capacity)
Flares	(Emission Factor) x (Maximum Expected Flaring Rate)
Plant Haul Roads	AP-42 Methodology (Chapter 13, Section 2)

1.2 Ethane Cracking Furnaces

Seven ethane cracking furnaces will be constructed. During normal operation, six of the furnaces will be operating at max capacity while the seventh will be in some other mode of operation related to decoking, etc. For some pollutants, the alternative modes of operation have different emission characteristics than normal operations. To address this situation, a model was developed that estimates the amount of time each year that a furnace will be in the various operating modes. Emissions are estimated based on the expected average annual time in each operating mode multiplied by the average firing rate in that mode multiplied by a mode-specific emissions factor. The emissions estimates are dominated by normal operations at the maximum firing rates. See Tables B-4 through B-6 for the complete documentation of the emissions factors used as well as the calculation methodology.

1.3 Combustion Turbine/Cogen Units

Three Cogen Units will be constructed. These units are expected to operate at or near maximum capacity for most of the year. With the exception of NOx and CO, potential emissions from these units are estimated based on proposed BACT/LAER limits applied to the maximum firing rate assuming full-time (i.e., 8,760 hours per year) operation at that rate. In the case of NOx and CO, emissions during startup are expected to be significantly higher (on a pound per hour basis) than emissions during normal full-load operation. Thus, for purposes of estimating potential emissions of these pollutants, the maximum startup emissions rates were assumed to occur for 7 hours per year, with the remaining hours per year (i.e., 8,753) assumed to be at full-load. See Tables B-7 and B-8 for the complete documentation of the emissions factors used as well as the calculation methodology.

1.4 Emergency Use Engines

A total of seven (7) emergency diesel-fueled internal combustion engines will be constructed. Normal (i.e., non-emergency) operation of these units is limited to 100 hours per year or less. Potential emissions from these units are estimated based on proposed BACT/LAER limits applied to the maximum firing rate assuming 100 hours per year of operation. See Tabled B-9 through B-12 for complete documentation of the emissions factors used as well as the calculation methodology.

1.5 Fugitive Equipment Leaks (SOCMI Leak Factors)

U.S. EPA developed methodologies for estimating fugitive emissions of VOC from various components (e.g., valves, flanges, pump seals, etc.) in organic chemical manufacturing plants, petroleum refineries, and petroleum marketing operations. Some of these methodologies provide estimates of fugitive emissions based on the service-type of (e.g., vapor) each component and the number and types of components in a facility. U.S. EPA's analysis and the various methodologies developed are documented in a report titled *Protocol for Equipment Leak Emission Estimates*.[1]

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[1] See: *Protocol for Equipment Leak Emission Estimates*, U.S. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711, EPA-453/R-95-017, 1995.

The default factors for the synthetic organic chemical manufacturing industry (SOCMI) are used to estimate fugitive emissions from equipment leaks. The 1995 Protocol does not provide for any adjustment in the emissions from connectors in light or heavy liquid service. To account for these service types, the factors provided by Texas Commission on Environmental Quality (TCEQ) in "Emissions Factors for Equipment Leak Fugitive Components (Addendum to RG-360A, Jan. 2008)" are used. To account for the effect of emissions control resulting from implementing an LDAR program on these emissions sources, control efficiencies developed by the TCEQ have been applied to the uncontrolled SOCMI emissions factors for various components.[2]

Estimates are made of fugitive emissions of VOC, CH_4, and HAP. These estimates are based on the controlled leak rate from a component and the concentration of the relevant species in the gas or liquid serviced by the component. See Tables B-13 through B-20 for complete documentation of the emissions factors used as well as the component counts, control efficiencies, and species concentrations used in estimating these emissions.

1.6 PE Unit Particulate Emissions

A small quantity of particulate will be emitted from operations within the three PE production units. Estimates of these emissions have been provided by prospective process licensors and these estimates are summarized in Tables B-21 and B-23. Where appropriate, the licensor estimates have been scaled-up to 8,760 hours per year of operation. Certain assumptions regarding operating schedules were made to estimate short-term emissions from these operations for purposes of air quality modeling.

1.7 PE Pellet Handling, Storage, and Loadout

A small quantity of particulate will be emitted from operations involving handling, storage, blending, and loadout of the product PE pellets. In general, these operations are relatively dust-free. However, some particulate is created in the processing and handling of the PE pellets. Particulate emissions from these operations are estimated based on an assumed particulate mass loading multiplied by an estimate of the ratio of exhaust air flows required or created by these operations to the potential PE pellet production capacity of the proposed plant. See Table B-24 for complete documentation of the emissions factors used as well as the calculation methodology.

In the case of VOC emissions from these operations, potential emissions are estimated based on a maximum residual VOC concentration in the pellets multiplied by the potential pellet production rate. This estimation approach conservatively assumes that 100% of the residual VOC is emitted in the handling, storage, or loadout operations.

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[2] See: *TCEQ – Control Efficiencies for TCEQ Leak Detection and Repair Programs*, Revised 07/11 (APDG 6129v2) available at: http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/control_eff.pdf

1.8 Storage Tank Emissions

Uncontrolled emissions from certain fixed-roof atmospheric storage tanks (Tables B-26 and B-27) are estimated using U.S. EPA's TANKS 4.09d software. This software implements the emissions estimation methodology outlined in AP-42, Chapter 7, Section 1. Controlled emissions from these tanks are estimated by assigning a 95% control efficiency based on the use of carbon canisters that will be installed on the vents from these tanks. An example of the software output is provided in Appendix F.

No routine emissions, other than fugitive emissions from equipment components, are estimated from pressurized storage tanks (*i.e.*, the C3+ storage spheres). These tanks are sealed and pressurized so that working and breathing losses do not occur. Emissions from storage tanks with vents routed to the flare headers are accounted for in the estimated emissions from the LP Thermal and Spent Caustic Vent Thermal Incinerators.

1.9 Wastewater Treatment Plant Emissions

Uncontrolled emissions from the wastewater treatment unit operations are estimated using EPA's WATER9 air emissions model. An example of the WATER9 model outputs is provided in Appendix F. Emissions from certain controlled WWTP tanks were estimated using EPA's TANKS software. These emissions are accounted for in the controlled emissions estimates from the Spent Caustic Vent Thermal Incinerator. A summary of the emissions estimate is presented in Table B-28.

1.10 Process and Cogen Cooling Towers

Particulate emissions for the Process and Cogen Cooling Towers are estimated based on the design drift rate, the cooling water recirculation rate, the TDS of the cooling water, an estimated dry particle size distribution, and assumed full-time operation (i.e., 8,760 hours per year) of the towers. The "Reisman and Frisbie" methodology for determining the PM_{10} and $PM_{2.5}$ size distribution of the PM emissions is used to estimate fine particulate emissions.[3] For the TDS level in the plant cooling water systems, the PM_{10} fraction predicted by this methodology is 57.2 wt. % and the $PM_{2.5}$ fraction is 0.21 wt. %.

VOC emissions from the process cooling tower are estimated based on the proposed VOC LAER limit and the design cooling water circulation rate.

See Tables B-29 through B-32 for documentation of the calculation methodology used to estimate PM and VOC emissions.

1.11 Organic Liquid Loading

VOC emissions from loading of organic liquids (Recovered Oil, Coke Residue/Tar, Light Gasoline, and Pyrolysis Fuel Oil) into transport trucks and/or railcars are estimated using the

[3] See *"Calculating Realistic PM_{10} Emissions from Cooling Towers,"* Joel Reisman and Gordon Frisbie, Environmental Progress (Vol. 21, No. 2), July 2002, p. 127 – 129.

methodology found in AP-42, Chapter 5, Section 2. The VOC emissions estimates from loading of low vapor pressure liquids are based on an assumed VOC vapor pressure of 0.5 psia, a surrogate VOC vapor molecular weight, and the use of submerged loading. Vapors from Pyrolysis Fuel Oil and Light Gasoline loading are controlled by the Low Pressure Thermal Incinerator. See Table B-33 for documentation of the calculation methodology used to estimate emissions.

1.12 C3+ Liquid Loading

C3+ liquids will be stored in pressure spheres and loaded into pressurized transport vehicles. VOC emissions from these operations have been estimated based on a study of LPG loading conducted by the South Coast Air Quality Management District (SCAQMD) in California.[4] An emissions factor of 13.3 lb VOC per railcar loaded was derived from the SCAQMD study and applied to the maximum expected volume of C3+ that will be shipped from the proposed plant. See Table B-34 for documentation of the calculation methodology used to estimate emissions.

1.13 Thermal Incinerators

Two thermal incinerators will be used to control certain VOC emissions sources within the proposed plant. Emissions from these incinerators are estimated based on the expected maximum vent rates to the control devices, the design VOC destruction efficiency of the controls, and emissions factors for various pollutants produced during the combustion process. Emissions consist of products of combustion (*e.g.*, NOx) along with unoxidized VOC and non-VOC organic compounds (e.g., CH_4). See Tables B-35 and B-38 for documentation of the emissions factors as well as the calculation methodology used to estimate emissions from these control devices.

1.14 Flares

Four flares will be constructed to control VOC emissions from the proposed plant. Emissions from the flares are estimated based on the expected maximum vent rates to the flares, the VOC destruction efficiency of the flares, and emissions factors for various pollutants produced during the combustion process. Emissions consist of products of combustion (*e.g.*, NOx) along with unoxidized VOC and non-VOC organic compounds (e.g., CH_4). For the most part, these flares are only used for short-periods during startup, shutdown, or emergency events. Potential emissions from these control devices are estimated based on a number of worst-case assumptions about the flaring rates expected to occur during routine, foreseeable operations. See Tables B-38 through B-40 for documentation of the emissions factors as well as the calculation methodology used to estimate emissions from the flares.

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[4] See *Final Staff Report Proposed Rule 1177 – Liquefied Petroleum Gas Transfer and Dispensing*, South Coast Air Quality Management District, June 2012; available at: http://www.aqmd.gov/hb/attachments/2011-2015/2012Jun/2012-Jun1-031.pdf; (see Attachment F)

1.15 Plant Roads

Particulate emissions from plant roads are estimated using the methodology described in AP-42, Chapter 13, Section 2.1 – Paved Roads. Specifically, Equation 2 in this section is used to determine a paved road emissions factor and then that factor is applied to the estimated truck travel distance based on the estimated maximum number of trucks that will enter and leave the facility. The derivation of the pollutant-specific emissions factors are documented in the spreadsheet printouts provided in Tables B-41 and B-42.

Attachment B1 - Tables

Certain information contained in this appendix constitutes Trade Secret and/or Confidential Proprietary Information as defined in the Pennsylvania Right to Know Law

Original (uncorrected) 2015 summary for reference. See individual tables noted in the response summary for corrected PTE, and Enclosure 3 for corrected site PTE

Table B-1. Summary of Potential Annual Emissions

Potential Annual Emissions (tons per year)								
Pollutant	**Cracking Furnaces**	**PE Units**	**Combined Cycle Units**	**Flares & Incinerators**	**Tanks & Loadout**	**Fugitives**	**Support Units**	**Total**
Carbon Monoxide	670	-	42.0	292	-	-	6.4	1,010
Nitrogen Oxides	181	-	65.4	88.5	-	-	5.0	340
PM	34.1	15.3	16.3	5.9	-	-	9.1	81
PM10	86.8	4.9	57.6	9.7	-	-	5.7	165
PM2.5	86.8	4.9	57.6	9.7	-	-	0.4	159
Sulfur Dioxide	3.6	-	12.8	5.1	-	-	0.0	21
VOC	32.4	96.6	30.7	244	17.7	68.0	46.0	536
CO2e	1,048,668	-	1,021,675	176,537	-	138	1,272	2,248,289
Sulfuric Acid Mist	0.1	-	0.5	0.2	-	-	0.0	0.8
§112 HAP	18.2	0.0	0.9	3.7	0.0	3.8	4.1	30.8

Support Units include: fire pump and emergency generator engines, cooling towers, wastewater treatment and plant roads.
Polyethylene Units include: PE processing equipment excluding fugitive, flare, and incinerator emissions.

Original (uncorrected) 2015 summary for reference. See individual tables noted in the response summary for corrected PTE, Enclosure 3 for corrected site PTE, and Appendix D for HAP PTE

Table B-2. Summary of Potential Hazardous Air Pollutant Emissions

Potential Annual Emissions (tons per year)										
Pollutant	Cracking Furnaces	PE Units	Combined Cycle Units	Flares & Incinerators	Tanks & Loadout	Fugitives	Diesel Engines	WWTP	Cooling Tower	Total
1,3-Butadiene			3.75E-04	6.60E-02		2.37E-01				3.04E-01
2-Methylnaphthalene	2.31E-04			3.05E-05						2.62E-04
3-Methylchloranthrene	1.73E-05			2.29E-06						1.96E-05
7,12-Dimethylbenz(a)anthracene	1.54E-04			2.04E-05						1.74E-04
Acenaphthene	1.73E-05			2.29E-06			3.64E-05			5.60E-05
Acenaphthylene							7.17E-05			7.17E-05
Acetaldehyde			3.49E-02				1.96E-04			3.51E-02
Acrolein			5.58E-03				6.13E-05			5.65E-03
Anthracene	2.31E-05			3.05E-06			9.56E-06			3.57E-05
Arsenic	1.93E-03			2.54E-04						2.18E-03
Benzene	2.02E-02		1.05E-02	4.88E-01		4.20E-01	6.03E-03	4.22E-02		9.86E-01
Benzo(a)anthracene	1.73E-05			2.29E-06			4.84E-06			2.45E-05
Benzo(a)pyrene	1.16E-05			1.53E-06			2.00E-06			1.51E-05
Benzo(b)fluoranthene	1.73E-05			2.29E-06			8.63E-06			2.82E-05
Benzo(g,h,i)perylene	1.16E-05			1.53E-06						1.31E-05
Benzo(g,h,l)perylene							4.32E-06			4.32E-06
Benzo(k)fluoranthene	1.73E-05			2.29E-06			1.69E-06			2.13E-05
Beryllium	1.16E-04			1.53E-05						1.31E-04
Biphenyl					9.28E-09	6.14E-05				6.14E-05
Cadmium	1.06E-02			1.40E-03						1.20E-02
Chromium	1.35E-02	1.90E-03								1.54E-02
Chrysene	1.73E-05			2.29E-06			1.19E-05			3.15E-05
Cobalt	8.09E-04			1.07E-04						9.16E-04
Dibenzo(a,h)anthracene	1.16E-05			1.53E-06			2.69E-06			1.58E-05
Dichlorobenzene	1.16E-02			1.53E-03						1.31E-02
Ethylbenzene			2.79E-02	3.38E-04	2.64E-04	1.58E-02				4.44E-02
Fluoranthene	2.89E-05			3.82E-06			3.13E-05			6.40E-05
Fluorene	2.70E-05			3.56E-06			9.95E-05			1.30E-04
Formaldehyde	7.22E-01		6.19E-01	9.54E-02			6.13E-04			1.44E+00
Hexane	1.73E+01			2.29E+00		2.38E+00			4.01	2.60E+01
Indeno(1,2,3-cd)pyrene	1.73E-05			2.29E-06			3.22E-06			2.28E-05
Lead	4.81E-03									4.81E-03
Manganese	3.66E-03			4.83E-04						4.14E-03
Mercury	2.50E-03			3.31E-04						2.83E-03
Methanol						2.13E-01				2.13E-01
Naphthalene	5.87E-03		1.13E-03	7.80E-03	2.72E-07	2.98E-01	1.01E-03			3.13E-01
Nickel	2.02E-02			2.67E-03						2.29E-02
PAH			1.92E-03							1.92E-03
Phenanthrene	1.64E-04			2.16E-05			3.17E-04			5.02E-04
Phenol								3.29E-06		3.29E-06
Propylene Oxide			2.53E-02							2.53E-02
Pyrene	4.81E-05			6.36E-06			2.88E-05			8.33E-05
Selenium	2.31E-04			3.05E-05						2.62E-04
Styrene				1.92E-03		8.90E-02				9.09E-02
Toluene	3.27E-02		1.13E-01	8.31E-03	1.51E-04	1.85E-01	2.18E-03			3.41E-01
Xylenes			5.58E-02	1.28E-04		5.92E-03	1.50E-03			6.34E-02
TOTAL HAP	1.82E+01	1.90E-03	8.96E-01	2.96	4.15E-04	3.84E+00	1.22E-02	4.22E-02	4.01	2.99E+01

Support Units include: fire pump and emergency generator engines, cooling towers, wastewater treatment and plant roads.
Polyethylene Units include: PE processing equipment excluding fugitive, flare, and incinerator emissions.

Table B-3. Constants

Parameter		Value		Source/Basis
Standard Conversion Factors and Constants:				
grams per pound	=	453.6	g/lb	standard conversion factor
pounds per kilo	=	2.205	lb/kg	standard conversion factor
Hydrogen HHV	=	61,000	Btu/lb	http://en.wikipedia.org/wiki/Heat_of_combustion
Ethylene HHV	=	21,884	Btu/lb	http://www.engineeringtoolbox.com/heating-values-fuel-gases-d_823.html
Butane HHV	=	20,900	Btu/lb	http://en.wikipedia.org/wiki/Heat_of_combustion
Pentane HHV	=	20,908	Btu/lb	http://www.engineeringtoolbox.com/heating-values-fuel-gases-d_823.html
Ethane HHV	=	22,400	Btu/lb	http://en.wikipedia.org/wiki/Heat_of_combustion
Methane HHV	=	23,900	Btu/lb	http://en.wikipedia.org/wiki/Heat_of_combustion
Natural Gas HHV	=	23,000	Btu/lb	http://en.wikipedia.org/wiki/Heat_of_combustion
Natural Gas HHV	=	1,020	Btu/SCF	AP-42, Table 1.4-1 (footnote "a").
Butene HHV	=	20,780	Btu/lb	http://www.engineeringtoolbox.com/heating-values-fuel-gases-d_823.html
Hexene HHV	=	47,500	KJ/kg	https://www.sfsb.hr/test/testhome/Test/solve/basics/tables-old/tablesComb/hhv.html
iC4 HHV	=	21,047	Btu/lb	http://www.engineeringtoolbox.com/combustion-values-d_411.html
kW per bhp	=	0.7457	kW/bhp	standard conversion factor
Molecular Weight of Air	=	28.84	lb/lb-mole	Based on 21% O2 & 79% N2.
Gas Law Constant R	=	10.732	ft3·psi/°R·lb-mol	standard conversion factor
Standard Pressure	=	14.696	psia	standard for environmental calculations
Standard Temperature	=	68	°F	standard for environmental calculations
Molar Volume	=	385.6	scf/lb-mole	Molar volume at 14.696 psia and 68 °F.
VOC Molecular Weight	=	44	lb/lb-mole	VOC assumed to be propane for purposes of calculating mass emissions from ppmv values.
Tons per Metric Tonne	=	1.102	T/MT	standard conversion factor
Gallons per Cubic Meter	=	264.2	gal/m3	standard conversion factor
Horsepower per Megawatt (mechanical)	=	1,341	hp/MWm	standard conversion factor
ICE Avg Brake-specific Fuel Consumption	=	7,000	Btu/hp-hr	AP-42, Table 3.3-1, footnote 'a'.
Standard Emissions Factors:				
CH4 Global Warming Potential	=	25	lb/lb CO2	40 CFR 98, Table A-1.
N2O Global Warming Potential	=	298	lb/lb CO2	40 CFR 98, Table A-1.
Natural Gas CO2 Emissions Factor	=	117.0	lb/MMBtu	40 CFR 98, Table C-1 (HHV basis).
Natural Gas CH4 Emissions Factor	=	2.2E-03	lb/MMBtu	40 CFR 98, Table C-2 (HHV basis).
Natural Gas N2O Emissions Factor	=	2.2E-04	lb/MMBtu	40 CFR 98, Table C-2 (HHV basis).
Natural Gas CO2e Emissions Factor	=	117.1	lb/MMBtu	Sum of CO2, CH4, and N2O factors adjusted for global warming potentials.
Natural Gas CO2e-toCO2 Ratio	=	1.001	lb CO2e/lb CO2	= (Natural Gas CO2e Emissions Factor) / (Natural Gas CO2 Emissions Factor)
Ethane CO2 Emissions Factor	=	131.4	lb/MMBtu	40 CFR 98, Table C-1 (HHV basis).
Fuel Gas N2O Emissions Factor	=	1.3E-03	lb/MMBtu	40 CFR 98, Table C-2 (HHV basis).
Fuel Gas CH4 Emissions Factor	=	6.6E-03	lb/MMBtu	40 CFR 98, Table C-2 (HHV basis).
Methane CO2 Emissions Factor	=	114.8	lb/MMBtu	Based on a methane HHV of 23,900 Btu/lb.
Fuel Gas CO2 Emissions Factor	=	130.1	lb/MMBtu	40 CFR 98, Table C-1 (HHV basis).
Natural Gas Condensable PM10/PM2.5 EF	=	0.0056	lb/MMBtu	AP-42, Table 1.4-2 (condensable only); Smokeless flare assumed to produce no filterable PM.
Natural Gas Filterable PM/PM10/PM2.5 EF		0.0019	lb/MMBtu	AP-42, Table 1.4-2 (filterable only); Smokeless flare assumed to produce no filterable PM.
Natural Gas VOC EF	=	0.0054	lb/MMBtu	AP-42, Table 1.4-2.
Natural Gas CO EF	=	0.0824	lb/MMBtu	AP-42, Table 1.4-1.
Natural Gas Lead EF	=	4.9E-07	lb/MMBtu	AP-42, Table 1.4-2.

Natural Gas F-Factor Conversion	=	2.3E-05	lb-mol/MMBtu-ppmvd	40 CFR 60, Table 19-2; dry basis, 0% O2, 68°F.
Project-Specific Constants & Factors:				
Specific Gravity of LDPE	=	57.28	lb/ft3	Industry standard value.
natural gas sulfur content	=	5,000	gr/MMSCF	Preliminary design specification.
Natural Gas SO2 EF	=	0.0015	lb/MMBtu	Based on sulfur content and AP-42, Table 1.4-2, Footnotes "a" and "d".
Natural Gas H2SO4 EF	=	0.0001	lb/MMBtu	AP-42, Table 1.3-1; estimated based on SO3-to-SO2 emissions ratio for distillate oil.
Avg. % H2 used to fire Cracking Furnaces	=		wt. %	Preliminary design basis.
Flare Pilot Burner Size	=	1	MMBtu/hr	Preliminary design specification.
HP Flare Header Sweep Gas Rate	=	1	MT/hr	Based on use of natural gas as sweep gas in flare header.
Annual PE Pellet Production Capacity	=	1,600,000	MT/yr	Facility design basis (metric tonnes).
Annual PE Pellet Production Capacity	=	1,763,696	T/yr	Facility design basis (short tons).
Max PE Out by Rail	=	95%	wt. %	A max-case estimate of the mass of pellets that will be loaded out by rail.
Max PE Out by Truck	=	20%	wt. %	A max-case estimate of the mass of pellets that will be loaded out by truck.
ECU Maximum Firing Rate	=	620	MMBtu/hr	Preliminary design basis @ 110% of nominal rate.
NG to TG Header	=	9.4	T/hr	NG added to TG header at ECU design firing rate of 620 MMBtu/hr & 6 furnaces operating.
CO2 Emissions from Decoking	=	1,461	lb/hr	Preliminary design basis; excludes CO2 from NG combustion.
Tail Gas HHV	=	461	Btu/scf	Excludes NG that is added to tail gas; based on TG composition below.
Tail Gas H2 Content	=	48.3%	% of HHV	Based on 79 mol% H2 in tail gas and 9.4 tons per hour NG to TG header @ design firing rate.
Tail Gas CH4 Content	=	40.1%	% of HHV	Based on 21 mol% CH4 in tail gas and 9.4 tons per hour NG to TG header @ design firing rate.
Tail Gas NG Content	=	11.6%	% of HHV	Based on 9.4 T/hr NG added to TG header at design firing rate.
VOC Content of Gases to HP Ground Flare	=	60%	wt. %	Preliminary design specification (average ethylene content)

Table B-4. Cracking Furnace Emissions Estimates

Furnace Operating Modes	Heat Input MMBtu/hr	Fuel Source	Event Frequency # per yr	Duration per Event hrs	Annual Event Duration hrs/yr	NOx Emissions lb/hr	PM10 Emissions lb/hr	CO Emissions lb/hr
Normal Operation (ST)	620	TG				9.30	3.10	21.7
Normal Operation (LT)	620	TG			7,509	6.20	3.10	21.7
Decoking	180	TG	12	36	432	2.70	1.86	52.2
Feed In	277	NG	12	2	24	4.16	1.39	9.70
Feed Out	277	NG	12	2	24	4.16	1.39	9.70
Hot Steam Standby	173	NG	12	60	723	4.33	0.87	6.06
Startup	86.5	NG	1	24	24	15.57	0.43	25.1
Shutdown	86.5	NG	1	24	24	15.57	0.43	25.1
Annual Emissions =								
Decoking Cycle ST Rates =						4.33	1.86	52.2
Normal Ops ST Rates =						9.30	3.10	21.7
Normal Ops LT Rates =						6.20	3.10	21.7
Average Annual Rates =						5.91	2.83	21.9

Furnace Operating Modes	NOx EF lb/MMBtu	PM EF lb/MMBtu	PM10/ PM2.5 EF lb/MMBtu	CO EF lb/MMBtu	SO2 EF lb/MMBtu	VOC EF lb/MMBtu	CO2 EF lb/MMBtu	CH4 EF lb/MMBtu	N2O EF lb/MMBtu	CO2e EF lb/MMBtu	H2SO4 EF lb/MMBtu	Pb EF lb/MMBtu
Normal Operation (ST)	0.015	0.002	0.0050	0.035	0.0002	0.0019	59.5	0.0011	0.00022	59.6	6.8E-06	5.7E-08
Normal Operation (LT)	0.010	0.002	0.0050	0.035	0.0002	0.0019	59.5	0.0011	0.00022	59.6	6.8E-06	5.7E-08
Decoking	0.015	0.010	0.0103	0.290	0.0002	0.0019	67.7	0.0011	0.00022	67.8	6.8E-06	5.7E-08
Feed In	0.015	0.002	0.0050	0.035	0.0015	0.0019	117.0	0.0011	0.00022	117.1	6.8E-06	5.7E-08
Feed Out	0.015	0.002	0.0050	0.035	0.0015	0.0019	117.0	0.0011	0.00022	117.1	6.8E-06	5.7E-08
Hot Steam Standby	0.025	0.002	0.0050	0.035	0.0015	0.0019	117.0	0.0011	0.00022	117.1	6.8E-06	5.7E-08
Startup	0.180	0.002	0.0050	0.290	0.0015	0.0019	117.0	0.0011	0.00022	117.1	6.8E-06	5.7E-08
Shutdown	0.180	0.002	0.0050	0.290	0.0015	0.0019	117.0	0.0011	0.00022	117.1	6.8E-06	5.7E-08
Annual Emissions =												
Decoking Cycle ST Rates =												
Normal Ops ST Rates =												
Normal Ops LT Rates =												
Average Annual Rates =												

Furnace Operating Modes	NOx Emissions T/yr	PM Emissions T/yr	PM10/2.5 Emissions T/yr	CO Emissions T/yr	SO2 Emissions T/yr	VOC Emissions T/yr	CO2 Emissions T/yr	CH4 Emissions T/yr	N2O Emissions T/yr	CO2e Emissions T/yr	H2SO4 Emissions T/yr	Pb Emissions T/yr
Normal Operation (ST)												
Normal Operation (LT)	23.28	4.34	11.64	81.47	0.40	4.42	138,613	2.65	0.51	138,832	1.6E-02	1.3E-04
Decoking	0.58	0.40	0.40	11.28	0.01	0.07	2,631	0.04	0.01	2,634	2.7E-04	2.2E-06
Feed In	0.05	0.01	0.02	0.12	0.00	0.01	389	0.00	0.00	389	2.3E-05	1.9E-07
Feed Out	0.05	0.01	0.02	0.12	0.00	0.01	389	0.00	0.00	389	2.3E-05	1.9E-07
Hot Steam Standby	1.56	0.12	0.31	2.19	0.09	0.12	7,316	0.07	0.01	7,322	4.3E-04	3.6E-06
Startup	0.19	0.00	0.01	0.30	0.00	0.00	121	0.00	0.00	122	7.1E-06	5.9E-08
Shutdown	0.19	0.00	0.01	0.30	0.00	0.00	121	0.00	0.00	122	7.1E-06	5.9E-08
Annual Emissions =	25.9	4.87	12.4	95.8	0.51	4.63	149,580	2.78	0.54	149,810	1.7E-02	1.4E-04
Decoking Cycle ST Rates =												
Normal Ops ST Rates =												
Normal Ops LT Rates =												
Average Annual Rates =												

Table B-5. Ethylene Cracking Furnace Calculation Notes

ETHYLENE CRACKING FURNACE CALCULATION NOTES/BASIS
General:
• Cracking Furnace Emission Unit IDs = F-11101, F-12101, F-13101 ,F-14101, F-15101, F-16101, F-17101.
• Calculation is for 1 furnace.
• ST = short-term; this mode represents the possibility of reduced SCR performance due to short-term process fluctuations. No more than 2 furnaces expected to be in this mode at any one time.
• LT = long-term; this mode represents the average NOx limit achievable by the SCR system including short-term fluctuations.
• Furnace operating mode parameters are estimated based on 7 furnaces with 6 in normal operation at all times.
• Each furnace is assumed to require decoking a maximum of 12 times per year.
• Each furnace is assumed to undergo one startup/shutdown cycle per year.
• Heat input estimates for decoking-related operating modes are the average for an activity over the period (e.g., "Feed In" value is average of 160 MMBtu/hr at start and 395 MMBtu/hr at end of "Feed In").
• Annual Emissions (T/yr) = (Mode Heat Input - MMBtu/hr) x (Hours/Year in Mode) x (EF - lb/MMBtu) / (2,000 lb/T)
• Hourly Emissions (lb/hr) = (Mode Heat Input - MMBtu/hr) x (EF - lb/MMBtu)
BASIS OF EMISSION FACTORS:
NOx:
• Normal Operation: ST and LT rates based on proposed LAER limits. • Decoking, Feed In, Feed Out, Hot Standby and Shutdown: based on preliminary vendor data / expected SCR performance. • Startup = SCR Offline.
CO:
• Normal Operation, Feed In, Feed Out and Hot Steam Standby = Proposed BACT limit. • Decoking, Startup, Shutdown: factors equivalent to proposed lb/hr BACT limit for decoking.
SO2/H2SO4:
• All Modes: SO2 EF based on a natural gas sulfur content of 5,000 gr/MMSCF and an average NG firing rate of 11.6% of heat input to furnace (remainder is Tail Gas). • All Modes: Tail Gas fired in furnace does not contain any sulfur. • All Modes: H2SO4-to-SO2 ratio is assumed equal to ratio for firing distillate oil (see AP-42, Table 1.3-1).
VOC
• All modes: VOC EF is equivalent to proposed LAER limit at max firing rate.
PM/PM10/PM2.5:
• PM emissions do not include condensable particulate. • Normal Operation, Feed In, Feed Out, Hot Standby, Startup and Shutdown: EF based on preliminary vendor data. • Decoking: based on preliminary vendor data; hourly emissions during decoking are estimated at 1.86 lb/hr; value shown is normalized to lb/MMBtu for consistency with calculation methodology.
GHGs
• All modes except decoking: emissions factors for CO2, CH4, and N2O are from 40 CFR 98, Tables C-1 and C-2. • Firing H2 does not produce any CO2 or CH4 emissions so CO2 and CH4 emissions factors are adjusted to account for Tail Gas H2 concentration of 48.3% where applicable. • N2O emissions factor for NG used for both Tail Gas and Natural Gas firing. • CO2e emissions during decoking include emissions from fuel combustion as well as emissions from coke burn-off. See 'Constants' sheet for coke burn-off emissions rate. • CO2e emissions equal total of CO2, CH4, and N2O emissions adjusted for global warming potentials of 1, 25, and 298 respectively.
Lead
• All Modes = Pb EF based on a AP-42 natural gas emissions factor (see Table 1.4-2) and an average NG firing rate of 12% of gas fired in furnace (remainder is Tail Gas). • All Modes = Tail Gas fired in furnace does not contain any lead.

Table B-6. Cracking Furnace Hazardous Air Pollutant Emission Estimates

Emission Unit IDs=		***F-11101 - F17010***		***Ethylene Cracking Furnace HAP PTE***		
Max CH4+NG Input =		320 (MMBtu/hr)		Based on 620 MMBtu/hr and 51.7% of heat in from CH4+NG.*		
Annual Hours @ 100% Load =		8,760 hr/yr		Conservatively assumes full-time at 100% load.		
Hourly Emissions =		(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)				
Annual Emissions =		(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/T)				
Pollutant	**EF (lb/MMSCF)**	**EF Source (AP-42)**	**EF (lb/MMBtu)**	**§112 HAP?**	**PTE 1 Cracking Furnace (lb/hr)**	**PTE 1 Cracking Furnace (T/yr)**
2-Methylnaphthalene	2.40E-05	Table 1.4-3.	2.35E-08	YES	7.54E-06	3.30E-05
3-Methylchloranthrene	<1.8E-06	Table 1.4-3.	<1.76E-09	YES	<5.65E-07	<2.48E-06
7,12-Dimethylbenz(a)anthracene	<1.6E-05	Table 1.4-3.	<1.57E-08	YES	<5.02E-06	<2.20E-05
Acenaphthene	<1.8E-06	Table 1.4-3.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Anthracene	<2.4E-06	Table 1.4-3.	<2.35E-09	YES	<7.54E-07	<3.30E-06
Benzo(a)anthracene	<1.8E-06	Table 1.4-3.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Benzene	2.10E-03	Table 1.4-3.	2.06E-06	YES	6.59E-04	2.89E-03
Benzo(a)pyrene	<1.2E-06	Table 1.4-3.	<1.18E-09	YES	<3.77E-07	<1.65E-06
Benzo(b)fluoranthene	<1.8E-06	Table 1.4-3.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Benzo(g,h,i)perylene	<1.2E-06	Table 1.4-3.	<1.18E-09	YES	<3.77E-07	<1.65E-06
Benzo(k)fluoranthene	<1.8E-06	Table 1.4-3.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Butane	2.10E+00	Table 1.4-3.	2.06E-03	NO	6.59E-01	2.89E+00
Chrysene	<1.8E-06	Table 1.4-3.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Dibenzo(a,h)anthracene	<1.2E-06	Table 1.4-3.	<1.18E-09	YES	<3.77E-07	<1.65E-06
Dichlorobenzene	1.20E-03	Table 1.4-3.	1.18E-06	YES	3.77E-04	1.65E-03
Ethane	3.10E+00	Table 1.4-3.	3.04E-03	NO	9.73E-01	4.26E+00
Fluoranthene	3.00E-06	Table 1.4-3.	2.94E-09	YES	9.42E-07	4.13E-06
Fluorene	2.80E-06	Table 1.4-3.	2.75E-09	YES	8.79E-07	3.85E-06
Formaldehyde	7.50E-02	Table 1.4-3.	7.35E-05	YES	2.35E-02	1.03E-01
Hexane	1.80E+00	Table 1.4-3.	1.76E-03	YES	5.65E-01	2.48E+00
Indeno(1,2,3-cd)pyrene	<1.8E-06	Table 1.4-3.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Naphthalene	6.10E-04	Table 1.4-3.	5.98E-07	YES	1.92E-04	8.39E-04
Pentane	2.60E+00	Table 1.4-3.	2.55E-03	NO	8.16E-01	3.58E+00
Phenanthrene	1.70E-05	Table 1.4-3.	1.67E-08	YES	5.34E-06	2.34E-05
Propane	1.60E+00	Table 1.4-3.	1.57E-03	NO	5.02E-01	2.20E+00
Pyrene	5.00E-06	Table 1.4-3.	4.90E-09	YES	1.57E-06	6.88E-06
Toluene	3.40E-03	Table 1.4-3.	3.33E-06	YES	1.07E-03	4.68E-03
Arsenic	2.00E-04	Table 1.4-4	1.96E-07	YES	6.28E-05	2.75E-04
Barium	4.40E-03	Table 1.4-4	4.31E-06	NO	1.38E-03	6.05E-03
Beryllium	<1.2E-05	Table 1.4-4	<1.18E-08	YES	<3.77E-06	<1.65E-05
Cadmium	1.10E-03	Table 1.4-4	1.08E-06	YES	3.45E-04	1.51E-03
Chromium	1.40E-03	Table 1.4-4	1.37E-06	YES	4.40E-04	1.93E-03
Cobalt	8.40E-05	Table 1.4-4	8.24E-08	YES	2.64E-05	1.16E-04
Copper	8.50E-04	Table 1.4-4	8.33E-07	NO	2.67E-04	1.17E-03
Lead	5.00E-04	Table 1.4-4	4.90E-07	YES	1.57E-04	6.88E-04
Manganese	3.80E-04	Table 1.4-4	3.73E-07	YES	1.19E-04	5.23E-04
Mercury	2.60E-04	Table 1.4-4	2.55E-07	YES	8.16E-05	3.58E-04
Molybdenum	1.10E-03	Table 1.4-4	1.08E-06	NO	3.45E-04	1.51E-03
Nickel	2.10E-03	Table 1.4-4	2.06E-06	YES	6.59E-04	2.89E-03
Selenium	<2.4E-05	Table 1.4-4	<2.35E-08	YES	<7.54E-06	<3.30E-05
Vanadium	2.30E-03	Table 1.4-4	2.25E-06	NO	7.22E-04	3.16E-03
Zinc	2.90E-02	Table 1.4-4	2.84E-05	NO	9.11E-03	3.99E-02
Total §112 HAPs from 1 Cracking Furnace =					**<5.93E-01**	**<2.60E+00**
Total §112 HAPs from 7 Cracking Furnaces =					**<4.15E+00**	**<1.82E+01**

* No HAP emissions have been attributed to combustion of H2 in the cracking furnaces.
**All Chromium emitted from the ethylene cracking furnaces conservatively assumed to be hexavalent.

Table B-7. Combustion Turbine & Duck Burner Emission Estimates

Emission Unit(s) ID	=	CT1/2/3		Combustion Turbine & Duct Burner RNSRP PTE
Parameter		**Value**		**Source / Basis**
Calculation Inputs:				
Max Heat Input [HHV]	=	664	MMBtu/hr	Total maximum heat input to each GE Frame 6B turbine/duct burner unit.
Turbine/Duct Burner PM EF	=	0.0019	lb/MMBtu	AP-42, 3.1-2a (filterable only).
Turbine/Duct Burner PM10 EF	=	0.0066	lb/MMBtu	Proposed BACT limit.
Turbine/Duct Burner PM2.5 EF	=	0.0066	lb/MMBtu	Proposed LAER limit.
Turbine/Duct Burner VOC EF	=	0.00352	lb/MMBtu	Equivalent to proposed LAER limit at max load (based on 1 ppmvd @ 15% O2 as C3H8).
Turbine/Duct Burner NOx EF	=	0.00736	lb/MMBtu	Equivalent to proposed LAER limit at max load (based on 2 ppmvd @ 15% O2 as NO2).
Turbine/Duct Burner SO2 EF	=	0.0015	lb/MMBtu	Based on max NG sulfur content; see "Constants" sheet for details.
Turbine/Duct Burner CO EF	=	0.00448	lb/MMBtu	Equivalent to proposed LAER limit at max load (based on 2 ppmvd @ 15% O2).
Turbine/Duct Burner CO2 EF	=	117.0	lb/MMBtu	40 CFR 98, Table C-1; EF for natural gas.
Turbine/Duct Burner N2O EF	=	2.2E-04	lb/MMBtu	40 CFR 98, Table C-2; EF for natural gas.
Turbine/Duct Burner CH4 EF	=	2.2E-03	lb/MMBtu	40 CFR 98, Table C-2; EF for natural gas.
Turbine/Duct Burner H2SO4 EF	=	5.9E-05	lb/MMBtu	AP-42, Table 1.3-1; estimated based on SO3-to-SO2 emissions ratio for distillate oil.
Turbine/Duct Burner Pb EF	=	4.9E-07	lb/MMBtu	AP-42, Table 1.4-2.
Turbine/Duct Burner Fluoride EF	=	0	lb/MMBtu	Not emitted.
Startup NOx EF	=	113	lb/hr	Design estimate.
Startup CO EF	=	276	lb/hr	Design estimate.
Startup Hours	=	7	hr/yr	Worst-case estimate.
Annual Hours	=	8,760	hr/yr	
Annual Emissions Calculations (for 1 unit):				
PM Emissions	=	5.42	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM EF) x (Annual Hours) / (2000 lb/T)
PM10 Emissions	=	19.19	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM10 EF) x (Annual Hours) / (2000 lb/T)
PM2.5 Emissions	=	19.19	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM2.5 EF) x (Annual Hours) / (2000 lb/T)
VOC Emissions	=	10.24	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner VOC EF) x (Annual Hours) / (2000 lb/T)
NOx Emissions	=	21.8	T/yr	= [(Max Heat Input [HHV]) x (Turbine/Duct Burner NOx EF) x (Annual Hours - Startup Hours) + (Startup NOx EF) x (Startup Hours)] / (2000 lb/T)
SO2 Emissions	=	4.28	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner SO2 EF) x (Annual Hours) / (2000 lb/T)
CO Emissions	=	14.0	T/yr	= [(Max Heat Input [HHV]) x (Turbine/Duct Burner CO EF) x (Annual Hours - Startup Hours) + (Startup CO EF) x (Startup Hours)] / (2000 lb/T)
CO2 Emissions	=	340,207	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CO2 EF) x (Annual Hours) / (2000 lb/T)
N2O Emissions	=	0.64	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner N2O EF) x (Annual Hours) / (2000 lb/T)
CH4 Emissions	=	6.41	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CH4 EF) x (Annual Hours) / (2000 lb/T)
H2SO4 Emissions	=	0.17	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner H2SO4 EF) x (Annual Hours) / (2000 lb/T)
Pb Emissions	=	0.00	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Pb EF) x (Annual Hours) / (2000 lb/T)
Fluoride Emissions	=	0.00	T/yr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Fluoride EF) x (Annual Hours) / (2000 lb/T)
CO2e Emissions	=	340,558	T/yr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.
Short-Term Emissions (for 1 unit):				
PM Emissions	=	1.24	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM EF)
PM10 Emissions	=	4.38	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM10 EF)
PM2.5 Emissions	=	4.38	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner PM2.5 EF)
VOC Emissions	=	2.34	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner VOC EF)
NOx Emissions	=	4.975	lb/hr	= Annual Average Value for Modeling Purposes.
SO2 Emissions	=	0.98	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner SO2 EF)
CO Emissions	=	276	lb/hr	= Startup Max Rate for Modeling Purposes
CO2 Emissions	=	77,673	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CO2 EF)
N2O Emissions	=	0.15	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner N2O EF)
CH4 Emissions	=	1.46	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner CH4 EF)
H2SO4 Emissions	=	0.04	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner H2SO4 EF)
Pb Emissions	=	0.00	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Pb EF)
Fluoride Emissions	=	0.00	lb/hr	= (Max Heat Input [HHV]) x (Turbine/Duct Burner Fluoride EF)
CO2e Emissions	=	77,753	lb/hr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.

Summary of Results

		Potential Emissions (tons per year)									
-		**PM**	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
One Unit	=	5.4	19.2	19.2	10.24	21.8	4.28	14.0	340,214	340,558	0.17
Three Units	=	16.3	57.6	57.6	30.72	65.4	12.83	42.0	1,020,642	1,021,675	0.52

Table B-8. Combustion Turbine &Duct Burner HAP Emission Estimates

Emission Unit(s) ID	=	CT1/2/3		Combustion Turbine & Duct Burner HAP PTE		
Max CH4+NG Input	:	664	(MMBtu/hr)	Total heat input to turbines plus duct burners.*		
Annual Hours @ 100% Load	:	8,760	hr/yr	Conservatively assumes full-time at 100% load.		
CO Oxidizer DRE	:	90	%	http://jmsec.com/Library/Brochures/jm_sec_data_gas_turbine_033012m.pdf		
Hourly Emissions	:	(Max Heat Input - MMBtu/hr) x (EF - lb/MMBtu)				
Annual Emissions	:	(Max Heat Input - MMBtu/hr) x (EF - lb/MMBtu) x (Annual Operating Hours) / (2,000 lb/T)				
Pollutant		**EF Source**	**Uncontrolled EF (lb/MMBtu)**	**§112 HAP?**	**Controlled PTE 1 CT/DB (lb/hr)**	**Controlled PTE 1 CT/DB (T/yr)**
1,3-Butadiene	:	AP42; Table 3.1-3; 4/00.	<4.30E-07	YES	<2.86E-05	<1.25E-04
Acetaldehyde	:	AP42; Table 3.1-3; 4/00.	4.00E-05	YES	2.66E-03	1.16E-02
Acrolein	:	AP42; Table 3.1-3; 4/00.	6.40E-06	YES	4.25E-04	1.86E-03
Benzene	:	AP42; Table 3.1-3; 4/00.	1.20E-05	YES	7.97E-04	3.49E-03
Ethylbenzene	:	AP42; Table 3.1-3; 4/00.	3.20E-05	YES	2.12E-03	9.31E-03
Formaldehyde	:	AP42; Table 3.1-3; 4/00.	7.10E-04	YES	4.71E-02	2.06E-01
Naphthalene	:	AP42; Table 3.1-3; 4/00.	1.30E-06	YES	8.63E-05	3.78E-04
PAH	:	AP42; Table 3.1-3; 4/00.	2.20E-06	YES	1.46E-04	6.40E-04
Propylene Oxide	:	AP42; Table 3.1-3; 4/00.	<2.90E-05	YES	<1.93E-03	<8.43E-03
Toluene	:	AP42; Table 3.1-3; 4/00.	1.30E-04	YES	8.63E-03	3.78E-02
Xylenes	:	AP42; Table 3.1-3; 4/00.	6.40E-05	YES	4.25E-03	1.86E-02
Total §112 HAPs from 1 Cogen Unit =					**<6.82E-02**	**<2.99E-01**
Total §112 HAPs from 3 Cogen Units =					**<2.05E-01**	**<8.96E-01**

* HAP emissions from duct burners assumed to have the same profile as HAP emissions from the turbines.
** AP-42 factors adjusted for controlled emissions due to 90% DRE of CO Oxidizer.
Ref. http://jmsec.com/Library/Brochures/jm_sec_data_gas_turbine_033012m.pdf

Table B-9. Emergency Generator Emission Estimates

Emission Unit(s) ID =	EGEN1/2/3/4		Emergency Generator IC Engines
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
Gen-Set Output =	3.0	MWe	Design basis of project
Gen-Set Efficiency =	80%	kWe/kWm	Standard gen-set efficiency.
Rated Horsepower, each engine =	5,028	bhp	= (Gen-Set Output MWe) x (1,341 bhp/MWm) / (Gen-Set Efficiency)
No. of Engines =	4		Design basis of project
Rated Horsepower, Total =	20,110	bhp	= (Rated Horsepower, each engine) x (No. of Engines)
PM EF =	3.31E-04	lb/bhp-hr	= 2X Vendor's "Nominal Emissions" value.
PM10 EF =	3.17E-04	lb/bhp-hr	PM10 = 96% of PM from AP-42, Table B.2-2, Category 1.
PM2.5 EF	2.98E-04	lb/bhp-hr	PM2.5 = 90% of PM from AP-42, Table B.2-2, Category 1.
VOC EF =	5.60E-03	lb/bhp-hr	= (Proposed NOx+VOC LAER limit) - (NOx EF)
NOx EF =	4.54E-03	lb/bhp-hr	= Max allowed for GP-9 exemption 100 lbs/hr
SO2 EF =	1.09E-05	lb/bhp-hr	Based on: fuel sulfur = 15 ppmw; 7,000 Btu/hp-hr; oil HHV = 19,300 Btu/lb.
CO EF =	5.73E-03	lb/bhp-hr	= BACT Limit for CO.
CO2 EF =	1.14E+00	lb/bhp-hr	40 CFR 98, Table C-1 (Fuel Oil No. 2) @ 7,000 Btu/bhp-hr.
CH4 EF =	4.63E-05	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
N2O EF =	9.26E-06	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
CO2e EF =	1.15E+00	lb/bhp-hr	Sum of CO2, N2O, & CH4 adjusted for GWP.
H2SO4 EF =	4.37E-07	lb/bhp-hr	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
Annual Operating Hours =	100	hrs/yr/engine	Proposed permit limit.
Hourly Emissions Calculations (each engine)			
PM Hourly Max =	1.66	lb/hr	= (Rated Horsepower, each engine) x (PM EF)
PM10 Hourly Max =	1.60	lb/hr	= (Rated Horsepower, each engine) x (PM10 EF)
PM2.5 Hourly Max =	1.50	lb/hr	= (Rated Horsepower, each engine) x (PM2.5 EF)
VOC Hourly Max =	28.16	lb/hr	= (Rated Horsepower, each engine) x (VOC EF)
NOx Hourly Max =	22.82	lb/hr	= (Rated Horsepower, each engine) x (NOx EF)
SO2 Hourly Max =	0.05	lb/hr	= (Rated Horsepower, each engine) x (SO2 EF)
CO Hourly Max =	28.82	lb/hr	= (Rated Horsepower, each engine) x (CO EF)
CO2 Hourly Max =	5,738	lb/hr	= (Rated Horsepower, each engine) x (CO2 EF)
CH4 Hourly Max =	0.233	lb/hr	= (Rated Horsepower, each engine) x (CH4 EF)
N2O Hourly Max =	0.047	lb/hr	= (Rated Horsepower, each engine) x (N2O EF)
CO2e Hourly Max =	5,758	lb/hr	= (Rated Horsepower, each engine) x (CO2e EF)
H2SO4 Hourly Max =	0.002	lb/hr	= (Rated Horsepower, each engine) x (H2SO4 EF)
Annual Emissions Calculations (all engines)			
PM PTE =	0.33	tpy	= (PM Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM10 PTE =	0.32	tpy	= (PM10 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM2.5 PTE =	0.30	tpy	= (PM2.5 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
VOC PTE =	5.63	tpy	= (VOC Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
NOx PTE =	4.56	tpy	= (NOx Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
SO2 PTE =	0.01	tpy	= (SO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO PTE =	5.76	tpy	= (CO Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2 PTE =	1,148	tpy	= (CO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CH4 PTE =	0.047	tpy	= (CH4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
N2O PTE =	0.009	tpy	= (N2O Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2e PTE =	1,152	tpy	= (CO2e Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
H2SO4 PTE =	0.0004	tpy	= (H2SO4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)

Summary of Results

	Potential Emissions (tons per year)									
	PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
GenSet Emissions (4 units) =	0.33	0.32	0.30	5.632	4.565	0.011	5.764	1148	1,152	0.000
Updated per 2015 PaDEP Review* =	0.41	0.40	0.37	0.65	12.1	0.01	7.24		1,152	

*Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 7.

Table B-10. Emergency Generator HAP Emission Estimates

Emergency Generator Diesel ICE HAP PTE - EGEN1/2/3/4 (total for all engines)					
Pollutant	**EF (lb/MMBtu)**	**Source**	**§112 HAP?**	**Emissions Rate (lb/hr)**	**Emissions Rate (T/yr)**
Acetaldehyde	2.52E-05	AP42; Table 3.4-3; 10/96.	YES	3.55E-03	1.77E-04
Acrolein	7.88E-06	AP42; Table 3.4-3; 10/96.	YES	1.11E-03	5.55E-05
Benzene	7.76E-04	AP42; Table 3.4-3; 10/96.	YES	1.09E-01	5.46E-03
Formaldehyde	7.89E-05	AP42; Table 3.4-3; 10/96.	YES	1.11E-02	5.55E-04
Propylene	2.79E-03	AP42; Table 3.4-3; 10/96.	NO	3.93E-01	1.96E-02
Toluene	2.81E-04	AP42; Table 3.4-3; 10/96.	YES	3.96E-02	1.98E-03
Xylenes	1.93E-04	AP42; Table 3.4-3; 10/96.	YES	2.72E-02	1.36E-03
Naphthalene	1.30E-04	AP42; Table 3.4-4; 10/96.	YES	1.83E-02	9.15E-04
Acenaphthylene	9.23E-06	AP42; Table 3.4-4; 10/96.	YES	1.30E-03	6.50E-05
Acenaphthene	4.68E-06	AP42; Table 3.4-4; 10/96.	YES	6.59E-04	3.29E-05
Fluorene	1.28E-05	AP42; Table 3.4-4; 10/96.	YES	1.80E-03	9.01E-05
Phenanthrene	4.08E-05	AP42; Table 3.4-4; 10/96.	YES	5.74E-03	2.87E-04
Anthracene	1.23E-06	AP42; Table 3.4-4; 10/96.	YES	1.73E-04	8.66E-06
Fluoranthene	4.03E-06	AP42; Table 3.4-4; 10/96.	YES	5.67E-04	2.84E-05
Pyrene	3.71E-06	AP42; Table 3.4-4; 10/96.	YES	5.22E-04	2.61E-05
Benzo(a)anthracene	6.22E-07	AP42; Table 3.4-4; 10/96.	YES	8.76E-05	4.38E-06
Chrysene	1.53E-06	AP42; Table 3.4-4; 10/96.	YES	2.15E-04	1.08E-05
Benzo(b)fluoranthene	1.11E-06	AP42; Table 3.4-4; 10/96.	YES	1.56E-04	7.81E-06
Benzo(k)fluoranthene	<2.18E-07	AP42; Table 3.4-4; 10/96.	YES	<3.07E-05	<1.53E-06
Benzo(a)pyrene	<2.57E-07	AP42; Table 3.4-4; 10/96.	YES	<3.62E-05	<1.81E-06
Indeno(1,2,3-cd)pyrene	<4.14E-07	AP42; Table 3.4-4; 10/96.	YES	<5.83E-05	<2.91E-06
Dibenzo(a,h)anthracene	<3.46E-07	AP42; Table 3.4-4; 10/96.	YES	<4.87E-05	<2.44E-06
Benzo(g,h,l)perylene	<5.56E-07	AP42; Table 3.4-4; 10/96.	YES	<7.83E-05	<3.91E-06
Total PAH	<1.68E-04	AP42; Table 3.4-4; 10/96.	NO	<2.36E-02	<1.18E-03
			Total § 112 HAP =	<2.22E-01	<1.11E-02
Calculation Basis:	Hourly Emissions = EF x Max Heat In x No. of Engines				
	Annual Emissions = Hourly x 100 Hrs/yr / 2000.				

Table B-11. Fire Water Pump Emission Estimates

Emission Unit(s) ID =	FWP1/2		Fire Pump IC Engines
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
Rated Horsepower, each engine =	700	bhp	C18 ACERT™ Fire Pump
No. of Engines =	3		Design basis of project
Rated Horespower, Total =	2,100	bhp	= (Rated Horsepower, each engine) x (No. of Engines)
PM EF =	3.31E-04	lb/bhp-hr	NSPS Subpart IIII limit.
PM10 EF =	3.17E-04	lb/bhp-hr	PM10 = 96% of PM from AP-42, Table B.2-2, Category 1.
PM2.5 EF	2.98E-04	lb/bhp-hr	PM2.5 = 90% of PM from AP-42, Table B.2-2, Category 1.
VOC EF =	2.51E-03	lb/bhp-hr	AP-42; 10/96; Table 3.3-1
NOx EF =	4.10E-03	lb/bhp-hr	NSPS Subpart IIII; Table 4; 600 - 750 HP; 2009+; assumes NOx = NMHC + NOx - VOC EF.
SO2 EF =	1.09E-05	lb/bhp-hr	Based on: fuel sulfur = 15 ppmw; 7,000 Btu/hp-hr; oil HHV = 19,300 Btu/lb.
CO EF =	5.73E-03	lb/bhp-hr	NSPS Subpart IIII; Table 4; 600 - 750 HP; 2009+.
CO2 EF =	1.14E+00	lb/bhp-hr	40 CFR 98, Table C-1 (Fuel Oil No. 2) @ 7,000 Btu/bhp-hr.
CH4 EF =	4.63E-05	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
N2O EF =	9.26E-06	lb/bhp-hr	40 CFR 98, Table C-2 @ 7,000 Btu/bhp-hr.
CO2e EF =	1.15E+00	lb/bhp-hr	Sum of CO2, N2O, & CH4 adjusted for GWP.
H2SO4 EF =	4.37E-07	lb/bhp-hr	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
Annual Operating Hours =	100	hrs/yr/engine	Proposed permit limit.
Hourly Emissions Calculations (each engine)			
PM Hourly Max =	0.231	lb/hr	= (Rated Horsepower, each engine) x (PM EF)
PM10 Hourly Max =	0.222	lb/hr	= (Rated Horsepower, each engine) x (PM10 EF)
PM2.5 Hourly Max =	0.208	lb/hr	= (Rated Horsepower, each engine) x (PM2.5 EF)
VOC Hourly Max =	1.760	lb/hr	= (Rated Horsepower, each engine) x (VOC EF)
NOx Hourly Max =	2.870	lb/hr	= (Rated Horsepower, each engine) x (NOx EF)
SO2 Hourly Max =	0.008	lb/hr	= (Rated Horsepower, each engine) x (SO2 EF)
CO Hourly Max =	4.012	lb/hr	= (Rated Horsepower, each engine) x (CO EF)
CO2 Hourly Max =	799.0	lb/hr	= (Rated Horsepower, each engine) x (CO2 EF)
CH4 Hourly Max =	0.032	lb/hr	= (Rated Horsepower, each engine) x (CH4 EF)
N2O Hourly Max =	0.006	lb/hr	= (Rated Horsepower, each engine) x (N2O EF)
CO2e Hourly Max =	801.7	lb/hr	= (Rated Horsepower, each engine) x (CO2e EF)
H2SO4 Hourly Max =	0.001	lb/hr	= (Rated Horespower, Total) x (H2SO4 EF)
Annual Emissions Calculations (all engines)			
PM PTE =	0.035	tpy	= (PM Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM10 PTE =	0.033	tpy	= (PM10 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
PM2.5 PTE =	0.031	tpy	= (PM2.5 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
VOC PTE =	0.264	tpy	= (VOC Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
NOx PTE =	0.430	tpy	= (NOx Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
SO2 PTE =	0.001	tpy	= (SO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO PTE =	0.602	tpy	= (CO Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2 PTE =	119.8	tpy	= (CO2 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CH4 PTE =	0.005	tpy	= (CH4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
N2O PTE =	0.001	tpy	= (N2O Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
CO2e PTE =	120.3	tpy	= (CO2e Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
H2SO4 PTE =	0.0001	tpy	= (H2SO4 Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)

Summary of Results

	Potential Emissions (tons per year)									
	PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
2015 Plan Approval (3 units @ 700 bhp) =	0.03	0.03	0.03	0.264	0.430	0.001	0.602		120	0.000
Updated per 2015 PaDEP Review* =	0.04	0.04	0.04	0.07	0.80	0.001	0.75		120	

*Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 7.

Table B-12. Fire Water Pump HAP Emission Estimates

Fire Pump ICE HAP PTE - FWP1/2/3 (total for all engines)					
Pollutant	**EF (lb/MMBtu)**	**Source**	**§112 HAP?**	**Emissions Rate (lb/hr)**	**Emissions Rate (T/yr)**
Acetaldehyde	2.52E-05	AP42; Table 3.4-3; 10/96.	YES	3.70E-04	1.85E-05
Acrolein	7.88E-06	AP42; Table 3.4-3; 10/96.	YES	1.16E-04	5.79E-06
Benzene	7.76E-04	AP42; Table 3.4-3; 10/96.	YES	1.14E-02	5.70E-04
Formaldehyde	7.89E-05	AP42; Table 3.4-3; 10/96.	YES	1.16E-03	5.80E-05
Propylene	2.79E-03	AP42; Table 3.4-3; 10/96.	NO	4.10E-02	2.05E-03
Toluene	2.81E-04	AP42; Table 3.4-3; 10/96.	YES	4.13E-03	2.07E-04
Xylenes	1.93E-04	AP42; Table 3.4-3; 10/96.	YES	2.84E-03	1.42E-04
Naphthalene	1.30E-04	AP42; Table 3.4-4; 10/96.	YES	1.91E-03	9.56E-05
Acenaphthylene	9.23E-06	AP42; Table 3.4-4; 10/96.	YES	1.36E-04	6.78E-06
Acenaphthene	4.68E-06	AP42; Table 3.4-4; 10/96.	YES	6.88E-05	3.44E-06
Fluorene	1.28E-05	AP42; Table 3.4-4; 10/96.	YES	1.88E-04	9.41E-06
Phenanthrene	4.08E-05	AP42; Table 3.4-4; 10/96.	YES	6.00E-04	3.00E-05
Anthracene	1.23E-06	AP42; Table 3.4-4; 10/96.	YES	1.81E-05	9.04E-07
Fluoranthene	4.03E-06	AP42; Table 3.4-4; 10/96.	YES	5.92E-05	2.96E-06
Pyrene	3.71E-06	AP42; Table 3.4-4; 10/96.	YES	5.45E-05	2.73E-06
Benzo(a)anthracene	6.22E-07	AP42; Table 3.4-4; 10/96.	YES	9.14E-06	4.57E-07
Chrysene	1.53E-06	AP42; Table 3.4-4; 10/96.	YES	2.25E-05	1.12E-06
Benzo(b)fluoranthene	1.11E-06	AP42; Table 3.4-4; 10/96.	YES	1.63E-05	8.16E-07
Benzo(k)fluoranthene	<2.18E-07	AP42; Table 3.4-4; 10/96.	YES	3.20E-06	<1.60E-07
Benzo(a)pyrene	<2.57E-07	AP42; Table 3.4-4; 10/96.	YES	3.78E-06	<1.89E-07
Indeno(1,2,3-cd)pyrene	<4.14E-07	AP42; Table 3.4-4; 10/96.	YES	6.09E-06	<3.04E-07
Dibenzo(a,h)anthracene	<3.46E-07	AP42; Table 3.4-4; 10/96.	YES	5.09E-06	<2.54E-07
Benzo(g,h,l)perylene	<5.56E-07	AP42; Table 3.4-4; 10/96.	YES	8.17E-06	<4.09E-07
Total PAH	<1.68E-04	AP42; Table 3.4-4; 10/96.	NO	2.47E-03	<1.23E-04
			Total § 112 HAP =	<2.31E-02	<1.16E-03
Calculation Basis:	Hourly Emissions = EF x Max Heat In x No. of Engines				
	Annual Emissions = Hourly x 100 Hrs/yr / 2000.				

Table B-13. Fugitive Emissions Estimate - Cracking Furnaces

CRACKER FUGITIVE EMISSION COUNTS & VOC/CH4 EMISSIONS								
Equipment	Service	SOCMI Average Emissions Factor	VOC	CH4	LAER Control Efficiency	Component Count	EMISSIONS (tpy)	
		(lb/hr/src)	(wt. %)	(wt. %)	%	#	VOC	CH4
Valves	Gas/Vapor	0.0132	100.0	0.0	97	67	0.12	0.00
	Gas/Vapor	0.0132	100.0	0.0	97	34	0.06	0.00
	Gas/Vapor	0.0132	100.0	0.0	97	846	1.47	0.00
	Gas/Vapor	0.0132	98.2	1.8	97	179	0.30	0.01
	Gas/Vapor	0.0132	95.0	5.0	97	890	1.47	0.08
	Gas/Vapor	0.0132	92.4	7.6	97	315	0.50	0.04
	Gas/Vapor	0.0132	33.2	66.8	97	1111	0.64	1.29
	Light Liquid	0.0089	100.0	0.0	97	946	1.11	0.00
	Light Liquid	0.0089	100.0	0.0	97	226	0.26	0.00
	Light Liquid	0.0089	100.0	0.0	97	901	1.05	0.00
	Light Liquid	0.0089	98.7	1.3	97	94	0.11	0.00
	Light Liquid	0.0089	92.4	7.6	97	92	0.10	0.01
	Heavy liquid	0.0005	100.0	0.0	0	234	0.51	0.00
Connectors/Flanges	Gas/Vapor	0.0039	100.0	0.0	97	180	0.09	0.00
	Gas/Vapor	0.0039	100.0	0.0	97	96	0.05	0.00
	Gas/Vapor	0.0039	100.0	0.0	97	2265	1.16	0.00
	Gas/Vapor	0.0039	98.2	1.8	97	480	0.24	0.00
	Gas/Vapor	0.0039	95.0	5.0	97	3288	1.60	0.08
	Gas/Vapor	0.0039	92.4	7.6	97	887	0.42	0.03
	Gas/Vapor	0.0039	33.2	66.8	97	3431	0.58	1.17
	Light Liquid	0.0005	100.0	0.0	97	2720	0.18	0.00
	Light Liquid	0.0005	100.0	0.0	97	715	0.05	0.00
	Light Liquid	0.0005	100.0	0.0	97	2596	0.17	0.00
	Light Liquid	0.0005	98.7	1.3	97	211	0.01	0.00
	Light Liquid	0.0005	92.4	7.6	97	252	0.02	0.00
	Heavy liquid	0.00007	100.0	0.0	30	710	0.15	0.00
Relief Valves	Gas/Vapor	0.2293	100.0	0.0	97	35	1.05	0.00
	Gas/Vapor	0.2293	33.2	66.8	97	35	0.35	0.70
Pumps	Light liquid	0.0439	100.0	0.0	93	26	0.35	0.00
	Light liquid	0.0439	92.4	7.6	93	4	0.05	0.00
	Heavy liquid	0.0190	100.0	0.0	0	4	0.33	0.00
Compressor Seals	Gas/Vapor	0.5027	100.0	0.0	95	14	1.54	0.00
	Gas/Vapor	0.5027	95.0	5.0	95	10	1.05	0.06
	Gas/Vapor	0.5027	33.2	66.8	95	8	0.29	0.59
						Total Cracker Fugitive Emissions =	17.4	4.1

Calculation Basis:

- Average Emission Factors from: Protocol for Equipment Leak Emission Estimates (EPA-453/R-95-017), Table 2-1.
- Connector average emission Factors from: Texas Commission on Environmental Quality (TCEQ) document entitled,"Emissions Factors for Equipment Leak Fugitive Components"
- Component counts derived from preliminary design estimates for ethylene cracker unit equipment.
- Emissions = (Component Count) x (EF - lb/hr/scr) x (1 - Control Efficiency) x (wt. % compound in stream)
- LAER control efficiency based on TCEQ 28 LAER LDAR program control effectiveness. http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/control_eff.pdf
- Pump and compressor counts doubled to account for 2 seals per unit.
- 10 relief valves per furnace assumed.

Table B-14. Fugitive HAP Emissions - Cracking Furnaces

Ethylene Manufacturing Fugitives Area Designation*	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equip. Count	Composition (wt%)	Emissions (lb/hr)
1	Valves	Gas/Vapor	0.0132	97	1,3-Butadiene	442	1	0.002
1	Connectors	Gas/Vapor	0.0039	97	1,3-Butadiene	1908	1	0.002
2	Valves	Gas/Vapor	0.0132	97	1,3-Butadiene	160	1	0.001
2	Connectors	Gas/Vapor	0.0039	97	1,3-Butadiene	504	1	0.001
3	Valves	Gas/Vapor	0.0132	97	1,3-Butadiene	70	1	0.000
3	Valves	Light Liquid	0.0089	97	1,3-Butadiene	430	0.48	0.001
3	Valves	Light Liquid	0.0089	97	Benzene	430	25.31	0.029
3	Valves	Light Liquid	0.0089	97	Naphthalene	430	16	0.018
3	Valves	Light Liquid	0.0089	97	Toluene	430	13.09	0.015
3	Valves	Light Liquid	0.0089	97	Styrene	430	6.31	0.007
3	Valves	Light Liquid	0.0089	97	Xylenes	430	0.42	0.000
3	Valves	Light Liquid	0.0089	97	Ethylbenzene	430	1.11	0.001
3	Connectors	Gas/Vapor	0.0039	97	1,3-Butadiene	209	1	0.000
3	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	1324	0.48	0.000
3	Connectors	Light Liquid	0.0005	97	Benzene	1324	25.31	0.005
3	Connectors	Light Liquid	0.0005	97	Naphthalene	1324	16	0.003
3	Connectors	Light Liquid	0.0005	97	Toluene	1324	13.09	0.003
3	Connectors	Light Liquid	0.0005	97	Styrene	1324	6.31	0.001
3	Connectors	Light Liquid	0.0005	97	Xylenes	1324	0.42	0.000
3	Connectors	Light Liquid	0.0005	97	Ethylbenzene	1324	1.11	0.000
4	Valves	Gas/Vapor	0.0132	97	1,3-Butadiene	187	1	0.001
4	Valves	Light Liquid	0.0089	97	1,3-Butadiene	171	0.48	0.000
4	Valves	Light Liquid	0.0089	97	Benzene	171	25.31	0.012
4	Valves	Light Liquid	0.0089	97	Naphthalene	171	16	0.007
4	Valves	Light Liquid	0.0089	97	Toluene	171	13.09	0.006
4	Valves	Light Liquid	0.0089	97	Styrene	171	6.31	0.003
4	Valves	Light Liquid	0.0089	97	Xylenes	171	0.42	0.000
4	Valves	Light Liquid	0.0089	97	Ethylbenzene	171	1.11	0.001

Ethylene Manufacturing Fugitives Area Designation*	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equip. Count	Composition (wt%)	Emissions (lb/hr)
4	Connectors	Gas/Vapor	0.0039	97	1,3-Butadiene	583	1	0.001
4	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	400	0.48	0.000
4	Connectors	Light Liquid	0.0005	97	Benzene	400	25.31	0.002
4	Connectors	Light Liquid	0.0005	97	Naphthalene	400	16	0.001
4	Connectors	Light Liquid	0.0005	97	Toluene	400	13.09	0.001
4	Connectors	Light Liquid	0.0005	97	Styrene	400	6.31	0.000
4	Connectors	Light Liquid	0.0005	97	Xylenes	400	0.42	0.000
4	Connectors	Light Liquid	0.0005	97	Ethylbenzene	400	1.11	0.000
4	Pumps	Light Liquid	0.0439	93	Naphthalene	4	28	0.003
5	Valves	Gas/Vapor	0.0132	97	1,3-Butadiene	31	1	0.000
5	Valves	Light Liquid	0.0089	97	1,3-Butadiene	28	0.48	0.000
5	Valves	Light Liquid	0.0089	97	Benzene	28	25.31	0.002
5	Valves	Light Liquid	0.0089	97	Naphthalene	28	16	0.001
5	Valves	Light Liquid	0.0089	97	Toluene	28	13.09	0.001
5	Valves	Light Liquid	0.0089	97	Styrene	28	6.31	0.000
5	Valves	Light Liquid	0.0089	97	Xylenes	28	0.42	0.000
5	Valves	Light Liquid	0.0089	97	Ethylbenzene	28	1.11	0.000
5	Connectors	Gas/Vapor	0.0039	97	1,3-Butadiene	84	1	0.000
5	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	61	0.48	0.000
5	Connectors	Light Liquid	0.0005	97	Benzene	61	25.31	0.000
5	Connectors	Light Liquid	0.0005	97	Naphthalene	61	16	0.000
5	Connectors	Light Liquid	0.0005	97	Toluene	61	13.09	0.000
5	Connectors	Light Liquid	0.0005	97	Styrene	61	6.31	0.000
5	Connectors	Light Liquid	0.0005	97	Xylenes	61	0.42	0.000
5	Connectors	Light Liquid	0.0005	97	Ethylbenzene	61	1.11	0.000
6	Valves	Gas/Vapor	0.0132	97	1,3-Butadiene	67	0.48	0.000
6	Valves	Gas/Vapor	0.0132	97	Benzene	67	25.31	0.007
6	Valves	Gas/Vapor	0.0132	97	Naphthalene	67	16	0.004
6	Valves	Gas/Vapor	0.0132	97	Toluene	67	13.09	0.003

Ethylene Manufacturing Fugitives Area Designation*	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equip. Count	Composition (wt%)	Emissions (lb/hr)
6	Valves	Gas/Vapor	0.0132	97	Styrene	67	6.31	0.002
6	Valves	Gas/Vapor	0.0132	97	Xylenes	67	0.42	0.000
6	Valves	Gas/Vapor	0.0132	97	Ethylbenzene	67	1.11	0.000
6	Valves	Light Liquid	0.0089	97	Benzene	163	0.02	0.000
6	Valves	Light Liquid	0.0089	97	Naphthalene	163	16.62	0.007
6	Valves	Light Liquid	0.0089	97	Toluene	163	0.01	0.000
6	Valves	Light Liquid	0.0089	97	Styrene	163	0.01	0.000
6	Connectors	Gas/Vapor	0.0039	97	1,3-Butadiene	180	0.48	0.000
6	Connectors	Gas/Vapor	0.0039	97	Benzene	180	25.31	0.005
6	Connectors	Gas/Vapor	0.0039	97	Naphthalene	180	16	0.003
6	Connectors	Gas/Vapor	0.0039	97	Toluene	180	13.09	0.003
6	Connectors	Gas/Vapor	0.0039	97	Styrene	180	6.31	0.001
6	Connectors	Gas/Vapor	0.0039	97	Xylenes	180	0.42	0.000
6	Connectors	Gas/Vapor	0.0039	97	Ethylbenzene	180	1.11	0.000
6	Connectors	Light Liquid	0.0005	97	Benzene	485	0.02	0.000
6	Connectors	Light Liquid	0.0005	97	Naphthalene	485	16.62	0.001
6	Connectors	Light Liquid	0.0005	97	Toluene	485	0.01	0.000
6	Connectors	Light Liquid	0.0005	97	Styrene	485	0.01	0.000
6	Pumps	Light Liquid	0.0439	93	Naphthalene	12	16.62	0.006
6	Pumps	Light Liquid	0.0439	93	Benzene	8	0.02	0.000
6	Pumps	Light Liquid	0.0439	93	Toluene	8	0.01	0.000
6	Pumps	Light Liquid	0.0439	93	Styrene	8	0.01	0.000
6	Pumps	Light Liquid	0.0439	93	1,3-Butadiene	4	0.48	0.000
6	Pumps	Light Liquid	0.0439	93	Benzene	4	25.31	0.003
6	Pumps	Light Liquid	0.0439	93	Toluene	4	13.09	0.002
6	Pumps	Light Liquid	0.0439	93	Styrene	4	6.31	0.001
6	Pumps	Light Liquid	0.0439	93	Xylenes	4	0.42	0.000
6	Pumps	Light Liquid	0.0439	93	Ethylbenzene	4	1.11	0.000
7	Valves	Light Liquid	0.0089	97	1,3-Butadiene	174	31.8	0.015

Ethylene Manufacturing Fugitives Area Designation*	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equip. Count	Composition (wt%)	Emissions (lb/hr)
7	Valves	Light Liquid	0.0089	97	Benzene	174	10.1	0.005
7	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	553	31.8	0.003
7	Connectors	Light Liquid	0.0005	97	Benzene	553	10.1	0.001
8	Valves	Light Liquid	0.0089	97	Methanol	34	100	0.009
8	Connectors	Light Liquid	0.0005	97	Methanol	106	100	0.002
9	Valves	Light Liquid	0.0089	97	Methanol	102	100	0.027
9	Connectors	Light Liquid	0.0005	97	Methanol	304	100	0.005
9	Pumps	Light Liquid	0.0439	93	1,3-Butadiene	4	31.8	0.004
9	Pumps	Light Liquid	0.0439	93	Benzene	4	10.1	0.001
9	Pumps	Light Liquid	0.0439	93	Methanol	2	100	0.006
10	Valves	Light Liquid	0.0089	97	1,3-Butadiene	18	0.48	0.000
10	Valves	Light Liquid	0.0089	97	Benzene	18	25.31	0.001
10	Valves	Light Liquid	0.0089	97	Naphthalene	18	16	0.001
10	Valves	Light Liquid	0.0089	97	Toluene	18	13.09	0.001
10	Valves	Light Liquid	0.0089	97	Styrene	18	6.31	0.000
10	Valves	Light Liquid	0.0089	97	Xylenes	18	0.42	0.000
10	Valves	Light Liquid	0.0089	97	Ethylbenzene	18	1.11	0.000
10	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	40	0.48	0.000
10	Connectors	Light Liquid	0.0005	97	Benzene	40	25.31	0.000
10	Connectors	Light Liquid	0.0005	97	Naphthalene	40	16	0.000
10	Connectors	Light Liquid	0.0005	97	Toluene	40	13.09	0.000
10	Connectors	Light Liquid	0.0005	97	Styrene	40	6.31	0.000
10	Connectors	Light Liquid	0.0005	97	Xylenes	40	0.42	0.000
10	Connectors	Light Liquid	0.0005	97	Ethylbenzene	40	1.11	0.000
11	Pumps	Light Liquid	0.0439	93	1,3-Butadiene	2	0.48	0.000
11	Pumps	Light Liquid	0.0439	93	Benzene	2	25.31	0.002
11	Pumps	Light Liquid	0.0439	93	Naphthalene	2	16.62	0.001
11	Pumps	Light Liquid	0.0439	93	Toluene	2	13.09	0.001
11	Pumps	Light Liquid	0.0439	93	Styrene	2	6.31	0.000

Ethylene Manufacturing Fugitives Area Designation*	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equip. Count	Composition (wt%)	Emissions (lb/hr)
11	Pumps	Light Liquid	0.0439	93	Xylenes	2	0.42	0.000
11	Pumps	Light Liquid	0.0439	93	Ethylbenzene	2	1.11	0.000

*Code for Fugitives Area Designation provided in Table B-15.

Table B-15. Key Code for Ethylene Cracking Unit Fugitive HAP Emission Locations

Ethane Cracking Fugitives Area Key Code	
Area Designation	**Area Description**
1	[redacted]
2	[redacted]
3	[redacted]
4	[redacted]
5	[redacted]
6	[redacted]
7	[redacted]
8	[redacted]
9	[redacted]
10	[redacted]
11	F[redacted]
Trade Secret and/or confidential proprietary information as defined in the Pennsylvania Right to Know Law	

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Table B-16. Fugitive Emissions Estimate - Polyethylene Units

POLYETHYLENE UNITS 1 & 2					
Equipment	**Service**	**SOCMI Average Emissions Factor lb/hr/src**	**LAER Control Efficiency %**	**Component Count**	**VOC Emissions (tpy)**
Valves	Gas/Vapor	0.0132	97	8,568	14.86
	Light Liquid	0.0089	97	1,992	2.33
Relief Valves	Gas/Vapor	0.2293	97	180	5.42
Pumps	Light Liquid	0.0439	93	32	0.43
Compressor Seals	Gas/Vapor	0.5027	95	8	0.88
Connectors/Flanges	Gas/Vapor	0.0039	97	23,990	12.29
	Light Liquid	0.0005	97	5,578	0.37
Subtotal of PE 1 & 2 VOC Emissions (total for 2 units) =					**36.6**
POLYETHYLENE UNIT 3					
Valves	Gas/Vapor	0.0132	97	1,116	1.94
	Light Liquid	0.0089	97	957	1.12
Relief Valves	Gas/Vapor	0.2293	97	50	1.51
Pumps	Light Liquid	0.0439	93	32	0.43
Compressor Seals	Gas/Vapor	0.5027	95	4	0.44
Agitators	Light Liquid	0.0439	93	3	0.04
Connectors/Flanges	Gas/Vapor	0.0039	97	5,197	2.66
	Light Liquid	0.0005	97	2,090	0.14
	Heavy Liquid	0.00007	30	0	0.00
Subtotal of PE 3 VOC Emissions =					**8.27**
Total VOC Emissions from PE Units 1 - 3 =					**44.9**

Calculation Basis:

- Component counts derived from preliminary design estimates for PE ISBL equipment. See below.
- PE 1 and 2 instrumentation valve count assumed to be 0.25 * valve count. See reference below
- Emissions = (Component Count) x (EF - lb/hr/scr) x (1 - Control Efficiency)
- LAER control efficiency based on TCEQ 28 LAER LDAR program control effectiveness.
  http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/control_eff.pdf
- Agitator seal control efficiency assumed equal to pump seal LAER efficiency.
- VOC content of streams assumed equal to 100% as conservative estimate.
- An additional 20% buffer in the valve and connector component counts is included.

Table B-17. Fugitive HAP Emissions - Polyethylene Units

POLYETHYLENE UNITS 1 & 2 (emissions and counts shown are for each unit)							
Equipment	**Service**	**SOCMI Average Emissions Factor lb/hr/src**	**LAER Control Efficiency %**	**Component Count**	**Hexane Composition1 (wt %)**	**Hexane Emissions (lb/hr)**	**Hexane Emissions (tpy)**
Valves	Gas/Vapor	0.0132	97	8,568	5.7	0.19	0.85
	Light Liquid	0.0089	97	1,992	5.7	0.03	0.13
Relief Valves	Gas/Vapor	0.2293	97	180	5.7	0.071	0.31
Pumps	Light Liquid	0.0439	93	32	5.7	0.0056	0.02
Compressor Seals	Gas/Vapor	0.5027	95	8	5.7	0.011	0.05
Connectors/Flanges	Gas/Vapor	0.0039	97	23,990	5.7	0.160	0.70
	Light Liquid	0.0005	97	5,578	5.7	0.005	0.02
Subtotal of PE 1 & 2 Hexane Emissions (total for 2 units) =						**0.48**	**2.09**
POLYETHYLENE UNIT 3							
Valves	Gas/Vapor	0.0132	97	1,116	3.5	0.015	0.068
	Light Liquid	0.0089	97	10	43.4	0.001	0.005
	Light Liquid	0.0089	97	947	3.5	0.009	0.039
Relief Valves	Gas/Vapor	0.2293	97	50	3.5	0.012	0.053
Pumps	Light Liquid	0.0439	93	32	3.5	0.003	0.015
Compressor Seals	Gas/Vapor	0.5027	95	4	3.5	0.004	0.015
Agitators	Light Liquid	0.0439	93	3	3.5	0.00032	0.001
Connectors/Flanges	Gas/Vapor	0.0039	97	5,197	3.5	0.021	0.093
	Light Liquid	0.0005	97	2,090	3.5	0.001	0.005
	Heavy Liquid	0.00007	30	0	3.5	0.000	0.000
Subtotal of PE 3 Hexane Emissions =						**0.07**	**0.29**
Total Hexane Emissions =						**0.54**	**2.38**

[1] For PE 1 & 2, equipment counts were provided by the Licensor by area with a 20% increase in the valve and connector counts as a conservative estimate. All components assumed to be in service of a stream with 5.7% hexane. For PE 3, equipment counts were provided as total counts for the unit. Preliminary design information indicates the various hexane-containing streams range in content from 0.01% to 43.36%. The highest stream hexane composition of 43.46% applies to at most 10 valves per proposed design documentation. For the purposes of the fugitives emission rate estimate, it is assumed that the second highest stream composition of 3.5% applies to the remaining components.

Table B-18. Fugitive Emissions Estimate - OSBL

OSBL FUGITIVE EMISSION COUNTS & VOC/CH4 EMISSIONS						
Equipment	**Service**	**SOCMI Average Emissions Factor (lb/hr/src)**	**Pollutant**	**LAER Control Efficiency (%)**	**Component Count**	**EMISSIONS (tpy)**
Valves	Fuel/NG	0.0132	CH4	97	284	0.49
	Gas/Vapor	0.0132	VOC	97	355	0.62
	Light liquid	0.0089	VOC	97	618	0.72
	Heavy liquid	0.0005	VOC	0	68	0.15
Relief Valves	Fuel/NG	0.2293	CH4	97	4	0.12
	Gas/Vapor	0.2293	VOC	97	37	1.11
	Light liquid	0.0089	VOC	97	37	0.04
	Heavy liquid	0.0089	VOC	97	5	0.01
Open-ended Lines	Fuel/NG	0.0037	CH4	97	185	0.09
	Gas/Vapor	0.0037	VOC	97	147	0.07
	Light liquid	0.0037	VOC	97	90	0.04
	Heavy liquid	0.0037	VOC	97	5	0.00
Pumps	Light liquid	0.0439	VOC	93	56	0.75
	Heavy liquid	0.0190	VOC	0	6	0.50
Compressor Seals	Gas/Vapor	0.5027	VOC	95	6	0.66
Connectors/Flanges	Fuel/NG	0.0039	CH4	97	1419	0.73
	Gas/Vapor	0.0039	VOC	97	1617	0.83
	Light liquid	0.0005	VOC	97	2235	0.15
	Heavy liquid	0.00007	VOC	30	234	0.05
					VOC Emissions =	**5.7**
					CH4 Emissions	**1.4**

Calculation Basis:

- Average Emission Factors from: Protocol for Equipment Leak Emission Estimates (EPA-453/R-95-017), Table 2-1.
- Component counts derived from preliminary design estimates for OSBL equipment.
- Emissions = (Component Count) x (EF - lb/hr/scr) x (1 - Control Efficiency)
- LAER control efficiency based on TCEQ 28 LAER LDAR program control effectiveness: http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/control_eff.pdf
- HAP content of streams assumed equal to 10% as conservative estimate.
- Ratio of connectors to values assumed equal to 3.

Table B-19. Fugitive HAP Emissions - OSBL

OSBL Fugitives Area Designation*	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equipment Count	Composition (wt %)	Emissions (lb/hr)
1	Valves	Gas /Vapor	0.0132	97	Benzene	2	25.31	2.00E-04
1	Valves	Gas /Vapor	0.0132	97	Naphthalene	2	16.62	1.32E-04
1	Valves	Gas /Vapor	0.0132	97	Toluene	2	13.09	1.04E-04
1	Valves	Gas /Vapor	0.0132	97	Styrene	2	6.31	5.00E-05
1	Valves	Gas /Vapor	0.0132	97	Ethylbenzene	2	1.11	8.79E-06
1	Valves	Gas /Vapor	0.0132	97	1,3-Butadiene	2	0.48	3.80E-06
1	Valves	Gas /Vapor	0.0132	97	Xylenes	2	0.42	3.33E-06
1	Valves	Light Liquid	0.0089	97	Benzene	86	25.31	5.81E-03
1	Valves	Light Liquid	0.0089	97	Naphthalene	86	16.62	3.82E-03
1	Valves	Light Liquid	0.0089	97	Toluene	86	13.09	3.01E-03
1	Valves	Light Liquid	0.0089	97	Styrene	86	6.31	1.45E-03
1	Valves	Light Liquid	0.0089	97	Ethylbenzene	86	1.11	2.55E-04
1	Valves	Light Liquid	0.0089	97	1,3-Butadiene	86	0.48	1.10E-04
1	Valves	Light Liquid	0.0089	97	Xylenes	86	0.42	9.64E-05
1	Connectors	Gas /Vapor	0.0039	97	Benzene	6	25.31	1.78E-04
1	Connectors	Gas /Vapor	0.0039	97	Naphthalene	6	16.62	1.17E-04
1	Connectors	Gas /Vapor	0.0039	97	Toluene	6	13.09	9.19E-05
1	Connectors	Gas /Vapor	0.0039	97	Styrene	6	6.31	4.43E-05
1	Connectors	Gas /Vapor	0.0039	97	Ethylbenzene	6	1.11	7.79E-06
1	Connectors	Gas /Vapor	0.0039	97	1,3-Butadiene	6	0.48	3.37E-06
1	Connectors	Gas /Vapor	0.0039	97	Xylenes	6	0.42	2.95E-06
1	Connectors	Light Liquid	0.0005	97	Benzene	294	25.31	1.12E-03
1	Connectors	Light Liquid	0.0005	97	Naphthalene	294	16.62	7.33E-04
1	Connectors	Light Liquid	0.0005	97	Toluene	294	13.09	5.77E-04
1	Connectors	Light Liquid	0.0005	97	Styrene	294	6.31	2.78E-04
1	Connectors	Light Liquid	0.0005	97	Ethylbenzene	294	1.11	4.90E-05
1	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	294	0.48	2.12E-05
1	Connectors	Light Liquid	0.0005	97	Xylenes	294	0.42	1.85E-05
1	Pumps	Light Liquid	0.0439	93	Benzene	8	25.31	6.22E-03
1	Pumps	Light Liquid	0.0439	93	Naphthalene	8	16.62	4.09E-03
1	Pumps	Light Liquid	0.0439	93	Toluene	8	13.09	3.22E-03
1	Pumps	Light Liquid	0.0439	93	Styrene	8	6.31	1.55E-03
1	Pumps	Light Liquid	0.0439	93	Ethylbenzene	8	1.11	2.73E-04

OSBL Fugitives Area Designation*	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equipment Count	Composition (wt %)	Emissions (lb/hr)
1	Pumps	Light Liquid	0.0439	93	1,3-Butadiene	8	0.48	1.18E-04
1	Pumps	Light Liquid	0.0439	93	Xylenes	8	0.42	1.03E-04
2	Valves	Gas /Vapor	0.0132	97	1,3-Butadiene	3	31.8	3.78E-04
2	Valves	Gas /Vapor	0.0132	97	Benzene	3	10.1	1.20E-04
2	Valves	Light Liquid	0.0089	97	1,3-Butadiene	27	31.8	2.29E-03
2	Valves	Light Liquid	0.0089	97	Benzene	27	10.1	7.28E-04
2	Connectors	Gas /Vapor	0.0039	97	1,3-Butadiene	9	31.8	3.35E-04
2	Connectors	Gas /Vapor	0.0039	97	Benzene	9	10.1	1.06E-04
2	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	81	31.8	3.86E-04
2	Connectors	Light Liquid	0.0005	97	Benzene	81	10.1	1.23E-04
2	Pumps	Light Liquid	0.0439	93	1,3-Butadiene	2	31.8	1.95E-03
2	Pumps	Light Liquid	0.0439	93	Benzene	2	10.1	6.21E-04
3	Valves	Light Liquid	0.0089	97	Benzene	20	0.138	7.37E-06
3	Valves	Light Liquid	0.0089	97	Xylenes	20	0.138	7.37E-06
3	Valves	Light Liquid	0.0089	97	Styrene	20	0.0753	4.02E-06
3	Valves	Light Liquid	0.0089	97	Biphenyl	20	0.0437	2.33E-06
3	Connectors	Light Liquid	0.0005	97	Benzene	84	0.138	1.74E-06
3	Connectors	Light Liquid	0.0005	97	Xylenes	84	0.138	1.74E-06
3	Connectors	Light Liquid	0.0005	97	Styrene	84	0.0753	9.49E-07
3	Connectors	Light Liquid	0.0005	97	Biphenyl	84	0.0437	5.51E-07
3	Pumps	Light Liquid	0.0439	93	Benzene	8	0.138	3.39E-05
3	Pumps	Light Liquid	0.0439	93	Xylenes	8	0.138	3.39E-05
3	Pumps	Light Liquid	0.0439	93	Styrene	8	0.0753	1.85E-05
3	Pumps	Light Liquid	0.0439	93	Biphenyl	8	0.0437	1.07E-05
4	Valves	Gas /Vapor	0.0132	97	1,3-Butadiene	32	31.8	4.03E-03
4	Valves	Gas /Vapor	0.0132	97	Benzene	32	10.1	1.28E-03
4	Valves	Light Liquid	0.0089	97	1,3-Butadiene	18	31.8	1.53E-03
4	Valves	Light Liquid	0.0089	97	Benzene	18	10.1	4.85E-04
4	Connectors	Gas /Vapor	0.0039	97	1,3-Butadiene	108	31.8	4.02E-03
4	Connectors	Gas /Vapor	0.0039	97	Benzene	108	10.1	1.28E-03
4	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	54	31.8	2.58E-04
4	Connectors	Light Liquid	0.0005	97	Benzene	54	10.1	8.18E-05

*Code for Fugitives Area Designation provided in Table B-20.

Table B-20. Key Code for OSBL HAP Fugitive Emission Locations

OSBL Fugitives Area Key Code	
Area Designation	**Area Description**
1	[redacted]
2	[redacted]
3	[redacted]
4	[redacted]
Trade Secret and/or confidential proprietary information as defined in the Pennsylvania Right to Know Law	

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Table B-21. Polyethylene Units 1 & 2 Process Vent Particulate Matter Emissions Estimates

PEU 1 & 2 Process Vent Particulate Emissions Estimates					
Line 1/2 Vent Descriptions	**Emission Point IDs**	**Vent Type**	**PM/PM10/PM2.5 Emissions (T/yr/line)**	**24-hr Avg PM/PM10 Rate (lb/hr/line)**	**Basis / Discussion**
[redacted]	[redacted]	Intermittent	0.0209	0.0052	Annual rate based on preliminary vendor data; 24-hour rates estimated based on 333 days per year of operation.
[redacted]	[redacted]	Continuous	0.1835	0.0419	Annual rate based on preliminary vendor data scaled to 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
[redacted]	[redacted]	Intermittent	0.1185	0.0297	Annual rate based on preliminary vendor data; 24-hour rates estimated based on 333 days per year of operation.
[redacted]	[redacted]	Intermittent	0.0002	0.0001	Annual rate based on preliminary vendor data; 24-hour rates estimated based on 333 days per year of operation.
[redacted]	[redacted]	Continuous	0.0966	0.0220	Annual rate based on preliminary vendor data scaled to 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
[redacted]	[redacted]	Continuous	0.6639	0.152	Annual rate based on preliminary vendor data scaled to 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
		Totals per Line =	**1.0836**	**0.2505**	**Total of above rates.**
		Totals Line 1 + Line 2 =	**2.1671**	**0.5009**	**2X above totals.**

NOTES:

- Assumed operating days for intermittent vents = 333 days/yr
- 24-hr Rate for Intermittent Vents = (Annual Emissions - T/yr) x (2,000 lb/T) / (333 days/yr * 24 hr/day)
- 24-hr Rate for Continuous Vents = (Annual Emissions - T/yr) x (2,000 lb/T) / (8,760 hr/yr)

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Table B-22. Polyethylene Unit 3 Process Vent Particulate Matter Emissions Estimates

PE Unit 3 Process Vent Particulate Emissions Estimates				
Line 3 Vent Descriptions	**EU IDs**	**PM/PM10/PM2.5 Emissions (T/yr)**	**24-hr Avg PM/PM10 Rate (lb/hr)**	**Basis / Discussion**
[redacted]	[redacted]	0.037	0.008	Annual rate based on preliminary vendor data @ 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
[redacted]	[redacted]	0.000	0.000	Vented to LP Flare. Emissions accounted for at flare.
[redacted]	[redacted]	0.062	0.014	Annual rate based on preliminary vendor data @ 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
[redacted]	[redacted]	0.005	0.001	Annual rate based on preliminary vendor data @ 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
[redacted]	[redacted]	0.126	0.029	Annual rate based on preliminary vendor data @ 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
[redacted]	[redacted]	0.664	0.152	Annual rate based on preliminary vendor data scaled to 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
[redacted]	[redacted]	0.039	0.009	Annual rate based on preliminary vendor data @ 8,760 hr/yr; 24-hour rates estimated based on 8,760 hr/yr of operation.
	Totals =	**0.932**	**0.213**	**Total of above rates.**

NOTES:

- All vents are assumed to be continuous although many are intermittent.
- 24-hr Rate = (Annual Emissions - T/yr) x (2,000 lb/T) / (8,760 hr/yr)

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Table B-23. PE Units 1 & 2 PM HAP Emissions Estimate

Catalyst Activation Heater Cr VI Calc

Parameter	*Value*	*Unit*
MW air	28.97	g/mol
Mol Volume 0C	22.4	m3/kmole
Mol Volume 20C	24.0	m3/kmole
Stack Diameter	0.33	ft
Constant	35.3145	ft3/m3

Calculation

Process Step	Conc. (mg/Nm3)	% CrVI	Mass Rate (kg/hr)	Temp. (˚ C)	Vol. Flow Rate (Nm3/hr)	Actual Vol. Flow Rate (m3/hr)	Vol. Flow Rate (ft3/hr)	Velocity (ft/sec)	Short Term Max CrVI Emission Rate (mg/hr)	Short Term Max CrVI Emission Rate (lb/hr)	Duration (hr)	Occ/yr	Annualized lb/hr
Loading	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Heat Ramp Step	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Activation Step	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cooling Step	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
									Total (lb/hr)	2.9E-04		Total	2.2E-04

Concentration is consistent with proposed LAER PM limit of 0.005 gr/dscf

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Table B-24. PE Handling & Loadout PM PTE

PE Pellet Transport, Storage, Blending and Loading Operations								
Parameter	Units	Blending Silo	Railcar Handling & Storage	Truck Handling & Storage	Deduster Vent	Railcar Loading	Truck Loading	Source / Basis
Calculation Inputs: **(rates for all three lines)**								
Annual Rate	MT/yr	3,000,000	1,520,000	320,000	1,600,000	1,520,000	320,000	Based on 1.6MM MT/yr production w/ 95% mas via rail and 20% max by truck
Max PE Pellet Rate	MT/hr	410	240	160	400	200	130	Preliminary design: 24-hr average max rates.
Normal PE Pellet Rate	MT/hr	375	190	60	250	190	60	Prelimiary design: annual average rates.
Pellet-to-Air Ratio	lb/lb	10	10	10	22	766	766	10:1 ratio for conveying; 22:1 for DeDuster; Loading air displacement based on 1 scf air per ft3 PE loaded
PM Exit Grain Loading	gr/dscf	0.010	0.010	0.010	0.010	0.010	0.010	LAER Limit updated from 0.01 to 0.005 gr/dscfr.
PM10/2.5 Exit Grain Loading	gr/dscf	0.0017	0.0017	0.0017	0.0001	0.010	0.010	Equivalent to proposed hourly emission limit at max rates.
Annual Operating Hours	hr/yr	8,000	8,000	5,333	8,000	8,000	5,333	Annual operating hours at normal rates. Hours may be higher if rates are lower.
Calculated Values:								
Max Exhaust Rate	scfh	1,208,429	707,373	471,582	535,889	7,696	5,002	= (Max PE Pellet Rate) x (2,204.6 lb/MT) / (Pellet-to-Air Ratio) / (28.84 lb/lb-mol) x (385.57 scf/lb-mol)
Normal Exhaust Rate	scfh	1,105,271	560,004	176,843	334,930	7,311	2,309	= (Normal PE Pellet Rate) x (2,204.6 lb/MT) / (Pellet-to-Air Ratio) / (28.84 lb/lb-mol) x (385.57 scf/lb-mol)
24-hr PM10 Rate	lb/hr	0.293	0.17	0.11	0.01	0.01	0.01	= (PM10/2.5 Exit Grain Loading) x (Max Exhaust Rate) / (7,000 gr/lb)
Annual Average PM10 Rate	lb/hr	0.25	0.12	0.03	0.00	0.01	0.00	= (PM10/2.5 Exit Grain Loading) x (Normal Exhaust Rate) / (7,000 gr/lb) x (Annual Operating Hours) / (8760 hr/yr)
Annual PM PTE	T/yr	6.32	3.20	0.67	1.91	0.04	0.01	= (Normal Exhaust Rate) x (Annual Operating Hours) x (PM Exit Grain Loading) / (7,000 gr/lb) / (2000 lb/T)
Annual PM10/2.5 PTE	T/yr	1.07	0.54	0.11	0.02	0.04	0.01	= (Normal Exhaust Rate) x (Annual Operating Hours) x (PM10/2.5 Exit Grain Loading) / (7,000 gr/lb) / (2000 lb/T)
2015 Plan Approval PTE (PaDEP Review)*								
Annual PM PTE	T/yr	3.16	1.60	0.34	0.96	0.02	0.00	
Annual PM10/2.5 PTE	T/yr	0.54	0.27	0.06	0.16	0.02	0.00	
Annual PM10/2.5 PTE (Revised)	T/yr	1.07	0.54	0.11	0.02	0.02	0.00	Revised PM/10/PM2.5 loading for silo and handling should be 0.0017 gr/dscf
EU List and Notes:								
Blending Silos:	PE1BLEND A/B/C/D/E; PE2BLEND A/B/C/D/E; V7001A; V7001B; V7001C; V7001D							
Railcar Handling & Storage:	PE1RAILSILO - A/B/C/D, PE2RAILSILO - A/B/C/D; PE3RAILSILO - A/B/C/D							
Truck Handling & Storage:	PE1TRUCKSILO- A/B/C/D/E/F/G/H/I/J; PE2TRUCKSILO- A/B/C/D/E/F/G/H/I/J; PE3TRUCKSILO- A/B/C/D/E/F/G/H/I/J/K/L/M/N/O/P/Q/R							
Deduster Vents	PE1RAILDEDUSTA/B; PE2RAILDEDUSTA/B; PE1TRUCKDEDUST A/B/C/D/E; PE2TRUCKDEDUST A/B/C/D/E; PE3RAILDEDUSTA/B; PE3TRUCKDEDUST A/B/C/D/E/F/G/H/I							
Railcar Loading:	PE1RAILLOADA/B; PE2RAILLOADA/B; PE3RAILLOADA/B;							
Truck Loading:	PE1TRUCKLOAD A/B/C/D/E; PE1TRUCKLOAD A/B/C/D/E; PE3TRUCKLOADA/B/C/D/E/F/G/H/I							

* Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 14.

Table B-25. Residual VOC Estimate

Emission Unit(s) ID = See Note			VOC Emissions from Pellet Handling Operations
Parameter	***Value***	***Units***	***Source / Basis***
Calculation Inputs			
Pellets Produced =	1,931,247	T/yr	Design basis of Franklin plant ratioed to 8,760 hrs/yr.
Residual VOC =	50	ppmw	Proposed LAER limit.
Fraction of VOC Emitted =	100%	%	Worst-case assumption.
Annual Emissions Calculations			
VOC PTE =	96.6	T/yr	= (Pellets Produced - T/yr) x (Residual VOC - ppmw) x (Fraction of VOC Emitted) / (1,000,000 ppmw)
PaDEP Review PTE* =	88.2	T/yr	8000 hrs/yr operation

* Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 13.

NOTES:

- Refer to Tables D-2 and D-3 of Appendix D for Listing pf EUs covered by this estimate.
- Residual VOC in PE pellets contain no OHAP.

Table B-26. Storage Tank Emissions Estimates

Tank Name	EU ID	Tank Type	Volume [m3]	Diameter [m]	Height / Length [m]	Operating Temp. [°C]	Surrogate Liquid	Annual Throughput (gal/yr)	Control	Uncontrolled VOC Emissions* (T/yr)	Control Efficiency (%)	Controlled VOC Emissions* (T/yr)
Diesel Locomotive Fuel	NA	Horizontal Fixed Roof	38	2.4	8.2	38.0	No. 2 Oil	412,000	Carbon Canister	2.7E-03	95%	1.3E-04
Emergency Generator Diesel Fuel	T-58901A	Horizontal Fixed Roof	38	2.4	8.2	38.0	No. 2 Oil	55,000	Carbon Canister	1.0E-03	95%	5.2E-05
Emergency Generator Diesel Fuel	T-58901B	Horizontal Fixed Roof	38	2.4	8.2	38.0	No. 2 Oil	55,000	Carbon Canister	1.0E-03	95%	5.2E-05
Emergency Generator Diesel Fuel	T-58901C	Horizontal Fixed Roof	38	2.4	8.2	38.0	No. 2 Oil	55,000	Carbon Canister	1.0E-03	95%	5.2E-05
Emergency Generator Diesel Fuel	T-58901D	Horizontal Fixed Roof	38	2.4	8.2	38.0	No. 2 Oil	55,000	Carbon Canister	1.0E-03	95%	5.2E-05
Spent Caustic Storage Tank	T-53501	Vertical Fixed Roof	900	10.7	10.0	20.0	Jet Kerosene	26,151,000	Carbon Canister	1.0E-01	95%	5.0E-03
Oxidized Spent Caustic Storage Tank	T-53502	Vertical Fixed Roof	8,630	26.2	16.0	20.0	Jet Kerosene	26,151,000	Carbon Canister	2.7E-01	95%	1.3E-02
Fire Water Pump Diesel Fuel	T-59101A	Horizontal Fixed Roof	7	1.6	3.7	38.0	No. 2 Oil	7,200	Carbon Canister	1.8E-04	95%	8.8E-06
Fire Water Pump Diesel Fuel	T-59101B	Horizontal Fixed Roof	7	1.6	3.7	38.0	No. 2 Oil	7,200	Carbon Canister	1.8E-04	95%	8.8E-06
									Totals =	**0.38**		**0.02**

**** NOTES:***

- This sheet summarizes emissions from those tanks not vented to a common control device.
- The tanks listed in this sheet are vented to individual carbon canisters installed on each tank.
- PFO and Light Gasoline tanks vent to the LPTI. Emissions from these tanks already accounted for in LPTI calc.

Table B-27. Storage Tank HAP Emissions Estimates

Parameter	Biphenyl	Naphthalene	Toluene	Ethyl Benzene
Zli Wt. Fraction in liquid, lb/lb*	4.37E-04	7.53E-04	1.38E-03	1.29E-02
ML Mol Wt Fuel	188	188	188	188
Mi Mol Wt Component	154.21	128.17	92.14	106.17
Mv Mol Wt Vapor	130	130	130	130
xi Liquid Mol Fraction	5.33E-04	1.10E-03	2.81E-03	2.29E-02
P Vapor Pressure, psia	0.0002011	0.0034	1.04	0.19
Pi Partial Pressure	1.07E-07	3.78E-06	2.92E-03	4.43E-03
Pv Total Vapor Pressure of liquid	0.0049	0.0049	0.0049	0.0049
Yi Vapor Mol Fraction	2.19E-05	7.72E-04	5.96E-01	9.03E-01
Zvi Wt fraction in vapor, lb/lb	2.59E-05	7.61E-04	4.23E-01	7.38E-01
Lti lb/yr Diesel Locomotive	6.9E-06	2.0E-04	1.1E-01	2.0E-01
Lti lb/yr Emer Gen Diesel Total	1.07E-05	3.15E-04	1.75E-01	3.05E-01
Lti lb/yr Firewater Total	9.1E-07	2.7E-05	1.5E-02	2.6E-02
Diesel Locomotive, lb/hr	7.9E-10	2.3E-08	1.3E-05	2.2E-05
Emer Gen Diesel Total, lb/hr	1.2E-09	3.6E-08	2.0E-05	3.5E-05
Firewater Diesel Total, lb/hr	1.0E-10	3.0E-09	1.7E-06	2.9E-06

* Low sulfur diesel fuel constituents reference, J. Environ. Monit. , 2005, 7, pp. 983-988

Table B-28. Wastewater Treatment Emissions Summary

WWTP Equipment (W-1001) - Emissions Summary								
	Maximum Rate	Emission Factor	Short Term Max Emissions	Annualized Emissions			Calculation/ Estimation Method	Emission Factor Reference
Pollutant	million gal/day	lb/million gal	lb/hr	lb/hr	hrs/year	TPY		
VOC	N/A	N/A	0.048	0.010	8,760	4.22E-02	Emissions model	EPA WATER9
Benzene	N/A	N/A	0.048	0.010	8,760	4.22E-02	Emissions model	EPA WATER9
Phenol	N/A	N/A	3.7E-06	7.5E-07	8,760	3.29E-06	Emissions model	EPA WATER9

WWTP Equipment (W-1001) include:
Biotreater Aeration Tank, two Secondary Clarifiers, Biosludge Holding Tank, Biosludge Dewatering Tank, Centrate Sump, Sand Filter, Sand Filter Backwash Receiver and Outfall. The Flow Equalization and Oil Removal Tanks (T-5307A/B) are vented to the Spent Caustic Vent Incinerator (A5401).

Basis:
Emissions were modeled under worst-case conditions of dry weather flow. Short term maximum emissions based on peak concentrations to the WWTP. Annualized emissions based on annual average concentrations.

Example Calculations:
0.42 ton VOC/yr = (0.097 lb/hr) x (8,760 hrs/year) / (2,000 lb/ton)

Table B-29. Cogen Cooling Tower Emission Estimates

Emission Unit(s) ID	=	***CogenCWT***		***Cogen Cooling Tower***
Parameter		***Value***		***Source / Basis***
Calculation Inputs				
Number of Cells	=	6		Design Specification (See Below)
Cell Circulation Rate	=	12,333	gal/min/cell	=(Cooling Water Rate)/(Number of Cells)
Annual Operating Hours	=	8,760	hrs/yr	Maximum potential use.
Drift Loss Factor	=	0.00050 %	wt. %	Design specification. Basis for proposed BACT limit.
Cooling Water Rate	=	74,000	gal/min	Maximum Water Flow Rate (gpm) (See Below)
Cooling Water TDS	=	2,000	ppmw	Annual average BACT/LAER proposal.
Calculation Results				
PM10 Fraction of PM	=	63.5%	wt. %	See particle size distribution calculation -->
PM2.5 Fraction of PM	=	0.21%	wt. %	See particle size distribution calculation -->
Hourly PM PTE [per cell]	=	0.1	lb/hr	= (Cell Circulation Rate) x (60 min/yr) x (8.34 lb/gal) x (Drift Loss Factor) x (Cooling Water TDS) / (1,000,000)
Annual PM PTE [total]	=	1.6	tpy	= (Hourly PM PTE [per cell]) x (Annual Operating Hours) / (2,000 lb/T) x (Number of Cells)
Hourly PM10 PTE [per cell]	=	0.0392	lb/hr	= (PM10 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM10 PTE [total]	=	1.0	tpy	= (PM10 Fraction of PM) x (Annual PM PTE [total])
Hourly PM2.5 PTE [per cell]	=	0.0001	lb/hr	= (PM2.5 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM2.5 PTE [total]	=	0.00346	tpy	= (PM2.5 Fraction of PM) x (Annual PM PTE [total])

Table B-30. Cogen Cooling Tower Particle Size Estimate

Emission Unit(s) ID	=	CogenCWT	Cogen Cooling Tower					
Wet Droplet Diameter (µm)	**Wet Droplet Volume (µm3)**	**Wet Droplet Mass (µg)**	**Dry Particle Mass (µg)**	**Dry Particle Volume (µm3)**	**Dry Particle Diameter (um)**	**wt. % Mass Smaller Than Droplet**	**Wt% PM10 in PM Emissions**	**Wt% PM2.5 in PM Emissions**
10	524	5.24E-04	1.05E-06	0	0.97	0.000		
20	4189	4.19E-03	8.38E-06	4	1.94	0.196		
30	14137	1.41E-02	2.83E-05	13	2.91	0.226		0.2
40	33510	3.35E-02	6.70E-05	30	3.87	0.514		
50	65450	6.54E-02	1.31E-04	59	4.84	1.806		
60	113097	1.13E-01	2.26E-04	103	5.81	5.702		
70	179594	1.80E-01	3.59E-04	163	6.78	21.348		
90	381704	3.82E-01	7.63E-04	347	8.72	49.812		
110	696910	6.97E-01	1.39E-03	634	10.66	70.509	63.5	
130	1150347	1.15E+00	2.30E-03	1046	12.59	82.023		
150	1767146	1.77E+00	3.53E-03	1606	14.53	88.012		
180	3053628	3.05E+00	6.11E-03	2776	17.44	91.032		
210	4849048	4.85E+00	9.70E-03	4408	20.34	92.468		
240	7238229	7.24E+00	1.45E-02	6580	23.25	94.091		
270	10305995	1.03E+01	2.06E-02	9369	26.16	94.689		
300	14137167	1.41E+01	2.83E-02	12852	29.06	96.288		
350	22449298	2.24E+01	4.49E-02	20408	33.91	97.011		
400	33510322	3.35E+01	6.70E-02	30464	38.75	98.340		
450	47712938	4.77E+01	9.54E-02	43375	43.59	99.071		
500	65449847	6.54E+01	1.31E-01	59500	48.44	99.071		
600	113097336	1.13E+02	2.26E-01	102816	58.12	100.000		
			Specific Gravity of Water =	**1.00**	g/cc			
			Specific Gravity of Dried Solids =	**2.20**	g/cc			
			Cooling Tower Design TDS =	**2,000**	ppmw			
			PM10 fraction of PM =	**63.50**	wt. %			
			PM2.5 fraction of PM =	**0.21**	wt. %			

From "Calculating Realistic PM10 Emissions from Cooling Towers"; Reisman & Frisbie (uses EPRI wet droplet size distribution).

Table B-31. Process Cooling Tower Emission Estimates

Emission Unit(s) ID	=	PCT		Process Cooling Tower
Parameter		**Value**		**Source / Basis**
Calculation Inputs				
Number of Cells	=	28		Design Specification
Cell Circulation Rate	=	10,893	gal/min/cell	=(Cooling Water Rate)/(Number of Cells)
Annual Operating Hours	=	8,760	hrs/yr	Maximum potential use.
Drift Loss Factor	=	0.00050%	wt. %	Design specification. Basis for proposed BACT limit.
Cooling Water Rate	=	305,000	gal/min	Maximum Water Flow Rate (gpm)
Cooling Water TDS	=	2,000	ppmw	Annual average BACT/LAER proposal.
VOC Emissions Limit	=	0.50	lb/MMgal	Proposed LAER limit.
OHAP Fraction of VOC	=	10%	wt. %	ROM estimate; few HAP-containing streams in process.
Calculation Results				
Hourly VOC PTE [per cell]	=	0.33	lb/hr	= (Cell Circulation Rate - gpm) x (60 min/hr) x (VOC Emissions Limit - lb/MMGal) / (1,000,000)
Annual VOC PTE [total]	=	40.1	T/yr	= (Hourly VOC PTE [per cell]) x (Annual Operating Hours) / (2,000 lb/T) x (Number of Cells)
Annual HAP PTE [total]	=	4.0	T/yr	= (OHAP Fraction of VOC) x (Annual VOC PTE [total])
PM10 Fraction of PM	=	63.5%	wt. %	See particle size distribution calculation -->
PM2.5 Fraction of PM	=	0.21%	wt. %	See particle size distribution calculation -->
Hourly PM PTE [per cell]	=	0.1	lb/hr	= (Cell Circulation Rate) x (60 min/yr) x (8.34 lb/gal) x (Drift Loss Factor) x (Cooling Water TDS) / (1,000,000)
Annual PM PTE [total]	=	6.7	tpy	= (Hourly PM PTE [per cell]) x (Annual Operating Hours) / (2,000 lb/T) x (Number of Cells)
Hourly PM10 PTE [per cell]	=	0.035	lb/hr	= (PM10 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM10 PTE [total]	=	4.2	tpy	= (PM10 Fraction of PM) x (Annual PM PTE [total])
Hourly PM2.5 PTE [per cell]	=	0.0001	lb/hr	= (PM2.5 Fraction of PM) x (Hourly PM PTE [per cell])
Annual PM2.5 PTE [total]	=	0.0143	tpy	= (PM2.5 Fraction of PM) x (Annual PM PTE [total])

Table B-32. Process Cooling Tower Particle Size Calculation

Emission Unit(s) ID	=	PCT	Process Cooling Tower					
Wet Droplet Diameter (µm)	**Wet Droplet Volume (µm3)**	**Wet Droplet Mass (µg)**	**Dry Particle Mass (µg)**	**Dry Particle Volume (µm3)**	**Dry Particle Diameter (um)**	**wt. % Mass Smaller Than Droplet**	**Wt% PM10 in PM Emissions**	**Wt% PM2.5 in PM Emissions**
10	524	5.24E-04	1.05E-06	0	0.97	0.000		
20	4189	4.19E-03	8.38E-06	4	1.94	0.196		
30	14137	1.41E-02	2.83E-05	13	2.91	0.226		0.2
40	33510	3.35E-02	6.70E-05	30	3.87	0.514		
50	65450	6.54E-02	1.31E-04	59	4.84	1.806		
60	113097	1.13E-01	2.26E-04	103	5.81	5.702		
70	179594	1.80E-01	3.59E-04	163	6.78	21.348		
90	381704	3.82E-01	7.63E-04	347	8.72	49.812		
110	696910	6.97E-01	1.39E-03	634	10.66	70.509	63.5	
130	1150347	1.15E+00	2.30E-03	1046	12.59	82.023		
150	1767146	1.77E+00	3.53E-03	1606	14.53	88.012		
180	3053628	3.05E+00	6.11E-03	2776	17.44	91.032		
210	4849048	4.85E+00	9.70E-03	4408	20.34	92.468		
240	7238229	7.24E+00	1.45E-02	6580	23.25	94.091		
270	10305995	1.03E+01	2.06E-02	9369	26.16	94.689		
300	14137167	1.41E+01	2.83E-02	12852	29.06	96.288		
350	22449298	2.24E+01	4.49E-02	20408	33.91	97.011		
400	33510322	3.35E+01	6.70E-02	30464	38.75	98.340		
450	47712938	4.77E+01	9.54E-02	43375	43.59	99.071		
500	65449847	6.54E+01	1.31E-01	59500	48.44	99.071		
600	113097336	1.13E+02	2.26E-01	102816	58.12	100.000		

Specific Gravity of Water =	**1.00**	g/cc
Specific Gravity of Dried Solids =	**2.20**	g/cc
Cooling Tower Design TDS =	**2,000**	ppmw
PM10 fraction of PM =	**63.50**	wt. %
PM2.5 fraction of PM =	**0.21**	wt. %

From "Calculating Realistic PM10 Emissions from Cooling Towers"; Reisman & Frisbie (uses EPRI wet droplet size distribution).

Table B-33. Organic Liquid Loadout Operations Emissions Estimates

Organic Liquid Loadout Operations						
	Low Vapor Pressure Liquids					
Parameter	Recovered Oil Loading	Coke Residue and Tar	Pyrolysis Fuel Oil Loading	Light Gasoline Loading	Units	Source / Basis
Material Loaded	Recovered Oil	Asphalt & Heavy Oil	Heavy Gasoline	Light Gasoline		
Surrogate Material	Jet Kerosene	No. 6 Residual Oil	No. 6 Residual Oil	Gasoline		Selected as conservatively volatile species representing actual materials.
Material Temperature	30	30	180	30	°C	Heavy Gasoline is heated; Slop Oil is ≈ maximum daily avg temperature in July
Material Temperature	546	546	816	546	°R	= (Material Temperature - °C) x (1.8) + (32) + (460)
VOC Vapor Pressure	0.5000	0.5000	4.0600	7.5000	psia	Proposed LAER/BACT vapor pressure limit for low vapor pressure organic liquids is 0.5 psi.
VOC Vapor MW	130	190	190	66	lb/lb-mole	TANKS 4.09D value for surrogate material.
Type of Loadout Operation	RAIL & TRUCK	Truck	RAIL	RAIL		
Type of Loading System	SUBMERGED	SUBMERGED	SUBMERGED	SUBMERGED		Proposed design/work practice.
Annual Loading Rate	210	504	1,548	8,048	10^3gal/yr	Loading rates are from preliminary facility design basis - 525 bbls/day Lt. gas and 101 bbls/day PFO
Saturation Factor	0.60	0.60	0.60	0.60		S from AP-42 equation (see below)
VOC Loading Loss Factor	0.992	1.449	9.011	7.552	lbs/10^3gal	L_L from AP-42 equation (see below) using LAER limit Vp.
Control Efficiency	0%	0%	99.5%	99.5%	wt. %	No controls applied due to low Vp
Annual VOC Emissions	0.10	0.37	0.03	0.15	T/yr	= (Annual Loading Rate) x (VOC Loading Loss Factor) x (1 - Control Efficiency) / (2000 lb/T)
VOC Vapor Pressure	3.45	3.45	27.99	51.71	kPa	= (6.895 kPa/psi) x (VOC Vapor Pressure)
Estimated HAP Fraction	100%	100%	100%	100%	wt. %	Worst-case estimate.
Annual HAP Emissions	0.10	0.37	0.03	0.15	T/yr	= (Annual VOC Emissions) x (Estimated HAP Fraction)

Emissions Estimates based on Equation 1 in AP-42, Chapter 5, Section 2 (Jan-1995 version):

$$L_L = 12.46 \frac{SPM}{T}$$

where:

L_L = loading loss, pounds per 1000 gallons (lb/10^3 gal) of liquid loaded
S = a saturation factor (see Table 5.2-1)
P = true vapor pressure of liquid loaded, pounds per square inch absolute (psia) (see Figure 7.1-5, Figure 7.1-6, and Table 7.1-2)
M = molecular weight of vapors, pounds per pound-mole (lb/lb-mole) (see Table 7.1-2)
T = temperature of bulk liquid loaded, °R (°F + 460)

Table B-34. C3+ Loading Emission Estimate

Emission Unit(s) ID	=	***C3LOAD***		***C3+ Loading Emissions***
Parameter		***Value***	***Units***	***Source / Basis***
Calculation Inputs				
C3+ Produced	=	297,840	m3/yr	Design basis of plant.
Volume of 1 Railcar	=	115	m3	Standard railcar volume
Annual Railcars Filled	=	2,590	#/yr	= (C3+ Produced) / (Volume of 1 Railcar)
VOC EF -g/fill	=	6,044	g/fill	SCAQMD Controlled Emission Factor for LPG vehicle loading.
VOC EF - lb/fill	=	13.3	lb/fill	= (VOC EF -g/fill) / (453.6 g/lb)
Annual Emissions Calculations				
VOC PTE	=	17.3	tpy	= (VOC EF - lb/fill) x (Annual Railcars Filled - #/yr) / (2,000 lb/ton)

NOTES:

- C3+ liquids contain no OHAP.
- EF source: Final Staff Report Proposed Rule 1177 – Liquefied Petroleum Gas Transfer and Dispensing (June 2012).

Table B-35. Spent Caustic Vent Thermal Incinerator Emissions Estimates

Emission Unit(s) ID	=	A5401		Spent Caustic Vent Incinerator
Parameter		**Value**		**Source / Basis**
Calculation Inputs				
Design Heat Input [HHV]	=	10.7	MMBtu/hr	Preliminary design basis based on treated gas flow and composition (VOC + NG)
Heat Input from VOC [HHV]	=	0.7	MMBtu/hr	Preliminary design basis based on treated gas flow and composition (VOC only)
Design DRE	=	99%	wt. %	Preliminary design basis based on treated gas flow and composition.
PM EF	=	0.0019	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM10 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
PM2.5 EF	=	0.0075	lb/MMBtu	AP-42, Table 1.4-2, 7/98.
VOC EF	=	0.0302	lb/MMBtu	Controlled EF: based on 3.2 g/Nm3 VOC in offgas to oxidizer and 99% DRE.
NOx EF	=	0.0680	lb/MMBtu	AP-42, Table 13.5-1, 9/91.
SO2 EF	=	0.0879	lb/MMBtu	Based on 0.05 g/Nm3 H2S in offgas to oxidizer.
CO EF	=	0.0824	lb/MMBtu	AP-42, Table 13.5-1, 9/91.
CO2 EF	=	124.8	lb/MMBtu	40 CFR 98, Table C-1 (as of July-2013); EF for natural gas + 8.4 g/Nm3 CO2 in influent gas.
N2O EF	=	2.2E-04	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
CH4 EF	=	2.2E-03	lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for natural gas.
H2SO4 EF	=	3.5E-03	lb/MMBtu	AP-42, Table 1.3-1; estimated at based on SO3-to-SO2 emissions ratio for distillate oil.
Annual Hours	=	8,760	hr/yr	Assumed full-time operation.
Annual Emissions Calculations				
PM Emissions	=	0.09	T/yr	= (Design Heat Input [HHV]) x (PM EF) x (Annual Hours) / (2000 lb/T)
PM10 Emissions	=	0.35	T/yr	= (Design Heat Input [HHV]) x (PM10 EF) x (Annual Hours) / (2000 lb/T)
PM2.5 Emissions	=	0.35	T/yr	= (Design Heat Input [HHV]) x (PM2.5 EF) x (Annual Hours) / (2000 lb/T)
VOC Emissions	=	1.42	T/yr	= (Design Heat Input [HHV]) x (VOC EF) x (Annual Hours) / (2000 lb/T)
NOx Emissions	=	3.2	T/yr	= (Design Heat Input [HHV]) x (NOx EF) x (Annual Hours) / (2000 lb/T)
SO2 Emissions	=	4.13	T/yr	= (Design Heat Input [HHV]) x (SO2 EF) x (Annual Hours) / (2000 lb/T)
CO Emissions	=	3.9	T/yr	= (Design Heat Input [HHV]) x (CO EF) x (Annual Hours) / (2000 lb/T)
CO2 Emissions	=	5,864	T/yr	= (Design Heat Input [HHV]) x (CO2 EF) x (Annual Hours) / (2000 lb/T)
N2O Emissions	=	0.01	T/yr	= (Design Heat Input [HHV]) x (N2O EF) x (Annual Hours) / (2000 lb/T)
CH4 Emissions	=	0.10	T/yr	= (Design Heat Input [HHV]) x (CH4 EF) x (Annual Hours) / (2000 lb/T)
H2SO4 Emissions	=	0.17	T/yr	= (Design Heat Input [HHV]) x (H2SO4 EF) x (Annual Hours) / (2000 lb/T)
CO2e Emissions	=	5,870	T/yr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs.
Short-Term Emissions Calculations				
PM Emissions	=	0.02	lb/hr	= (Design Heat Input [HHV]) x (PM EF)
PM10 Emissions	=	0.08	lb/hr	= (Design Heat Input [HHV]) x (PM10 EF)
PM2.5 Emissions	=	0.08	lb/hr	= (Design Heat Input [HHV]) x (PM2.5 EF)
VOC Emissions	=	0.32	lb/hr	= (Design Heat Input [HHV]) x (VOC EF)
NOx Emissions	=	0.73	lb/hr	= (Design Heat Input [HHV]) x (NOx EF)
SO2 Emissions	=	0.94	lb/hr	= (Design Heat Input [HHV]) x (SO2 EF)
CO Emissions	=	0.88	lb/hr	= (Design Heat Input [HHV]) x (CO EF)
CO2e Emissions	=	1,339	lb/hr	= (Design Heat Input [HHV]) x (CO2 EF)
N2O Emissions	=	0.00	lb/hr	= (Design Heat Input [HHV]) x (N2O EF)
CH4 Emissions	=	0.02	lb/hr	= (Design Heat Input [HHV]) x (CH4 EF)
H2SO4 Emissions	=	0.04	lb/hr	= (Design Heat Input [HHV]) x (H2SO4 EF)
CO2e Emissions	=	1,340	lb/hr	= sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 .

Summary of Results

-		Potential Emissions (tons per year)									
		PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**
Caustic TO PTE	=	0.09	0.35	0.35	1.42	3.19	4.13	3.87	5,864	5,870	0.17

Table B-36. Spent Caustic HAP Emissions Estimates

SCTI HAP EMISSIONS CALCULATIONS*										
Potential Heat Input (HHV)		11	MMBtu/hr Proposed design basis							
Max Short Term Heat Input (HHV)		11	MM Btu/hr based on 10 tph capacity at 22,000 Btu/lb							
Annual Hours @ 100% Load =		8,760	hr/yr							
DRE =		99.0	%							
Hourly Emissions =		(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)								
Annual Emissions =		(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/T)								
					Combustion Product		**Process Gas**		**Total**	
Pollutant	**EF (lb/MMSCF)**	**EF Source (AP-42 7/98 Table #)**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**
1,3-Butadiene	N/A			YES			1.50E-02	1.50E-02	1.50E-02	1.50E-02
2-Methylnaphthalene	2.40E-05	1.4-3	2.35E-08	YES	2.52E-07	2.52E-07			2.52E-07	2.52E-07
3-Methylchloranthrene	<1.8E-06	1.4-3	<1.76E-09	YES	1.89E-08	1.89E-08			1.89E-08	1.89E-08
7,12 Dimethylbenz(a) anthracene	<1.6E-05	1.4-3	<1.57E-08	YES	1.68E-07	1.68E-07			1.68E-07	1.68E-07
Acenaphthene	<1.8E-06	1.4-3	<1.76E-09	YES	1.89E-08	1.89E-08			1.89E-08	1.89E-08
Anthracene	<2.4E-06	1.4-3	<2.35E-09	YES	2.52E-08	2.52E-08			2.52E-08	2.52E-08
Benzo(a)anthracene	<1.8E-06	1.4-3	<1.76E-09	YES	1.89E-08	1.89E-08			1.89E-08	1.89E-08
Benzene	2.10E-03	1.4-3	2.06E-06	YES	2.21E-05	2.21E-05	1.09E-01	1.09E-01	1.09E-01	1.09E-01
Benzo(a)pyrene	<1.2E-06	1.4-3	<1.18E-09	YES	1.26E-08	1.26E-08			1.26E-08	1.26E-08
Benzo(b)fluoranthene	<1.8E-06	1.4-3	<1.76E-09	YES	1.89E-08	1.89E-08			1.89E-08	1.89E-08
Benzo(g,h,i)perylene	<1.2E-06	1.4-3	<1.18E-09	YES	1.26E-08	1.26E-08			1.26E-08	1.26E-08
Benzo(k)fluoranthene	<1.8E-06	1.4-3	<1.76E-09	YES	1.89E-08	1.89E-08			1.89E-08	1.89E-08
Butane	2.10E+00	1.4-3	2.06E-03	NO	2.21E-02	2.21E-02			2.21E-02	2.21E-02
Chrysene	<1.8E-06	1.4-3	<1.76E-09	YES	1.89E-08	1.89E-08			1.89E-08	1.89E-08
Dibenzo(a,h)anthracene	<1.2E-06	1.4-3	<1.18E-09	YES	1.26E-08	1.26E-08			1.26E-08	1.26E-08
Dichlorobenzene	1.20E-03	1.4-3	1.18E-06	YES	1.26E-05	1.26E-05			1.26E-05	1.26E-05
Ethane	3.10E+00	1.4-3	3.04E-03	NO	3.26E-02	3.26E-02			3.26E-02	3.26E-02
Ethylbenzene	N/A			YES						

SCTI HAP EMISSIONS CALCULATIONS*										
Potential Heat Input (HHV)		11	MMBtu/hr Proposed design basis							
Max Short Term Heat Input (HHV)		11	MM Btu/hr based on 10 tph capacity at 22,000 Btu/lb							
Annual Hours @ 100% Load =		8,760	hr/yr							
DRE =		99.0	%							
Hourly Emissions =		(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)								
Annual Emissions =		(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/T)								
					Combustion Product		**Process Gas**		**Total**	
Pollutant	**EF (lb/MMSCF)**	**EF Source (AP-42 7/98 Table #)**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**
Ethylene Oxide	N/A			YES						
Fluoranthene	3.00E-06	1.4-3	2.94E-09	YES	3.15E-08	3.15E-08			3.15E-08	3.15E-08
Fluorene	2.80E-06	1.4-3	2.75E-09	YES	2.94E-08	2.94E-08			2.94E-08	2.94E-08
Formaldehyde	7.50E-02	1.4-3	7.35E-05	YES	7.89E-04	7.89E-04			7.89E-04	7.89E-04
Hexane	1.80E+00	1.4-3	1.76E-03	YES	1.89E-02	1.89E-02			1.89E-02	1.89E-02
Indeno(1,2,3-cd)pyrene	<1.8E-06	1.4-3	<1.76E-09	YES	1.89E-08	1.89E-08			1.89E-08	1.89E-08
Naphthalene	6.10E-04	1.4-3	5.98E-07	YES	6.41E-06	6.41E-06			6.41E-06	6.41E-06
Pentane	2.60E+00	1.4-3	2.55E-03	NO	2.73E-02	2.73E-02			2.73E-02	2.73E-02
Phenanthrene	1.70E-05	1.4-3	1.67E-08	YES	1.79E-07	1.79E-07			1.79E-07	1.79E-07
Propane	1.60E+00	1.4-3	1.57E-03	NO	1.68E-02	1.68E-02			1.68E-02	1.68E-02
Pyrene	5.00E-06	1.4-3	4.90E-09	YES	5.26E-08	5.26E-08			5.26E-08	5.26E-08
Styrene	N/A			YES						
Toluene	3.40E-03	1.4-3	3.33E-06	YES	3.58E-05	3.58E-05			3.58E-05	3.58E-05
Xylenes	N/A			YES						
Arsenic	2.00E-04	1.4-4	1.96E-07	YES	2.10E-06	2.10E-06			2.10E-06	2.10E-06
Barium	4.40E-03	1.4-4	4.31E-06	NO	4.63E-05	4.63E-05			4.63E-05	4.63E-05
Beryllium	<1.2E-05	1.4-4	<1.18E-08	YES	1.26E-07	1.26E-07			1.26E-07	1.26E-07
Cadmium	1.10E-03	1.4-4	1.08E-06	YES	1.16E-05	1.16E-05			1.16E-05	1.16E-05
Chromium	1.40E-03	1.4-4	1.37E-06	YES	1.47E-05	1.47E-05			1.47E-05	1.47E-05
Cobalt	8.40E-05	1.4-4	8.24E-08	YES	8.83E-07	8.83E-07			8.83E-07	8.83E-07

SCTI HAP EMISSIONS CALCULATIONS*

Potential Heat Input (HHV)	11	MMBtu/hr Proposed design basis
Max Short Term Heat Input (HHV)	11	MM Btu/hr based on 10 tph capacity at 22,000 Btu/lb
Annual Hours @ 100% Load =	8,760	hr/yr
DRE =	99.0	%
Hourly Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)	
Annual Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/T)	

					Combustion Product		Process Gas		Total	
Pollutant	**EF (lb/MMSCF)**	**EF Source (AP-42 7/98 Table #)**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**	**Short Term Max (lb/hr)**	**Annual Ave. (lb/hr)**
Copper	8.50E-04	1.4-4	8.33E-07	NO	8.94E-06	8.94E-06			8.94E-06	8.94E-06
Manganese	3.80E-04	1.4-4	3.73E-07	YES	4.00E-06	4.00E-06			4.00E-06	4.00E-06
Mercury	2.60E-04	1.4-4	2.55E-07	YES	2.73E-06	2.73E-06			2.73E-06	2.73E-06
Molybdenum	1.10E-03	1.4-4	1.08E-06	NO	1.16E-05	1.16E-05			1.16E-05	1.16E-05
Nickel	2.10E-03	1.4-4	2.06E-06	YES	2.21E-05	2.21E-05			2.21E-05	2.21E-05
Selenium	<2.4E-05	1.4-4	<2.35E-08	YES	2.52E-07	2.52E-07			2.52E-07	2.52E-07
Vanadium	2.30E-03	1.4-4	2.25E-06	NO	2.42E-05	2.42E-05			2.42E-05	2.42E-05
Zinc	2.90E-02	1.4-4	2.84E-05	NO	3.05E-04	3.05E-04			3.05E-04	3.05E-04
Total §112 HAPs					<1.99E-02	<1.99E-02	<1.24E-01	<1.24E-01	<1.44E-01	<1.44E-01

* Emissions from the combustion of process gases based on natural gas combustion emission factors and heat input values consistent with those presented in the April 2014 Plan Approval Application and September 2014 Technical Supplement.

Table B-37. VOC Control System Low Pressure Thermal Incinerator Emissions Estimates

Emission Unit(s) ID	=	LPINCINERATOR	LP Thermal Incinerator
Parameter		**Value**	**Source / Basis**
Calcuation Inputs			
Potential Heat Input [HHV]	=	140 MMBtu/hr	Preliminary design basis 10 tph capacity at 22,000 BTU/lb
Design DRE	=	99.9% wt. %	Preliminary design basis.
PM EF	=	0.0075 lb/MMBtu	AP-42, Table 1.4-2, 7/98 & proposed BACT limit.
PM10 EF	=	0.0075 lb/MMBtu	AP-42, Table 1.4-2, 7/98 & proposed BACT limit.
PM2.5 EF	=	0.0075 lb/MMBtu	AP-42, Table 1.4-2, 7/98 & proposed LAER limit.
VOC EF	=	0.0268 lb/MMBtu	Preliminary design basis of 1.9 T/hr VOC to TI and a DRE of 99.90%.
NOx EF	=	0.0680 lb/MMBtu	Preliminary design basis.
SO2 EF	=	0 lb/MMBtu	No sulfur in PE vents.
CO EF	=	0.0824 lb/MMBtu	AP-42, Table 1.4-1, 7/98.
CO2 EF	=	145.4 lb/MMBtu	40 CFR 98, Table C-1 (as of July-2013); EF for ethylene.
N2O EF	=	1.3E-03 lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for fuel gas.
CH4 EF	=	6.6E-03 lb/MMBtu	40 CFR 98, Table C-2 (as of July-2013); EF for fuel gas.
H2SO4 EF	=	0 lb/MMBtu	No sulfur in PE vents.
HAP EF	=	1.9E-03 lb/MMBtu	Based on the total of all AP-42 HAP emissions factors for external combustion of natural gas.
Annual Hours	=	8,760 hr/yr	Assumed full-time operation at max rate as worst-case.
Annual Emissions Calculations			
PM Emissions	=	4.60 T/yr	= (Potential Heat Input [HHV]) x (PM EF) x (Annual Hours) / (2000 lb/T)
PM10 Emissions	=	4.57 T/yr	= (Potential Heat Input [HHV]) x (PM10 EF) x (Annual Hours) / (2000 lb/T)
PM2.5 Emissions	=	4.57 T/yr	= (Potential Heat Input [HHV]) x (PM2.5 EF) x (Annual Hours) / (2000 lb/T)
VOC Emissions	=	16.42 T/yr	= (Potential Heat Input [HHV]) x (VOC EF) x (Annual Hours) / (2000 lb/T)
NOx Emissions	=	41.7 T/yr	= (Potential Heat Input [HHV]) x (NOx EF) x (Annual Hours) / (2000 lb/T)
SO2 Emissions	=	0.00 T/yr	= (Potential Heat Input [HHV]) x (SO2 EF) x (Annual Hours) / (2000 lb/T)
CO Emissions	=	50.5 T/yr	= (Potential Heat Input [HHV]) x (CO EF) x (Annual Hours) / (2000 lb/T)
CO2 Emissions	=	89,170 T/yr	= (Potential Heat Input [HHV]) x (CO2 EF) x (Annual Hours) / (2000 lb/T)
N2O Emissions	=	0.81 T/yr	= (Potential Heat Input [HHV]) x (N2O EF) x (Annual Hours) / (2000 lb/T)
CH4 Emissions	=	4.06 T/yr	= (Potential Heat Input [HHV]) x (CH4 EF) x (Annual Hours) / (2000 lb/T)
H2SO4 Emissions	=	0.00 T/yr	= (Potential Heat Input [HHV]) x (H2SO4 EF) x (Annual Hours) / (2000 lb/T)
HAP Emissions	=	1.14 T/yr	= (Potential Heat Input [HHV]) x (HAP EF) x (Annual Hours) / (2000 lb/T)
CO2e Emissions	=	89,513 T/yr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.
Short-Term Emissions Calculations			
PM Emissions	=	1.05 lb/hr	= (Potential Heat Input [HHV]) x (PM EF)
PM10 Emissions	=	1.04 lb/hr	= (Potential Heat Input [HHV]) x (PM10 EF)
PM2.5 Emissions	=	1.04 lb/hr	= (Potential Heat Input [HHV]) x (PM2.5 EF)
VOC Emissions	=	3.75 lb/hr	= (Potential Heat Input [HHV]) x (VOC EF)
NOx Emissions	=	9.52 lb/hr	= (Potential Heat Input [HHV]) x (NOx EF)
SO2 Emissions	=	0.00 lb/hr	= (Potential Heat Input [HHV]) x (SO2 EF)
CO Emissions	=	11.53 lb/hr	= (Potential Heat Input [HHV]) x (CO EF)
CO2e Emissions	=	20,358 lb/hr	= (Potential Heat Input [HHV]) x (CO2 EF)
N2O Emissions	=	0.19 lb/hr	= (Potential Heat Input [HHV]) x (N2O EF)
CH4 Emissions	=	0.93 lb/hr	= (Potential Heat Input [HHV]) x (CH4 EF)
H2SO4 Emissions	=	0.00 lb/hr	= (Potential Heat Input [HHV]) x (H2SO4 EF)
HAP Emissions	=	0.26 lb/hr	= (Potential Heat Input [HHV]) x (HAP EF)
CO2e Emissions	=	20,437 lb/hr	= Sum of CO2, N2O and CH4 emissions adjusted for NO2 and CH4 GWPs of 298 and 25.

Summary of Results

		Potential Emissions (tons per year)										
		PM	**PM10**	**PM2.5**	**VOC**	**NOx**	**SO2**	**CO**	**GHGm**	**CO2e**	**H2SO4**	**HAP**
LP TI PTE	=	4.60	4.57	4.57	16.42	41.70	0.00	50.50	89,174	89,513	0.00	1.14
2015 PaDEP Review LP TI PTE*	=	1.14	4.57	4.57	15.46	41.70	0.00	50.50	89,244	89,582	0.00	1.14

* Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 8.

Table B-38. VOC Control System Low Pressure Thermal Incinerator HAP Emissions Estimates

LPTI HAP EMISSIONS CALCULATIONS*										
Potential Heat Input (HHV)		140	MMBtu/hr Proposed design basis							
Max Short Term Heat Input (HHV)		250	MM Btu/hr based on 10tph capacity at 22,000 Btu/lb							
Annual Hours @ 100% Load =		8,760	hr/yr							
DRE =		99.9	%							
Hourly Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)									
Annual Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/T)									
					Combustion Product		**Process Gas**		**Total**	
Pollutant	**EF (lb/MMSCF)**	**EF Source (AP-42 7/98 Table #)**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Ave. (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**
1,3-Butadiene	N/A			YES			3.34E-05	1.46E-04	3.34E-05	1.46E-04
2-Methylnaphthalene	2.40E-05	1.4-3	2.35E-08	YES	5.88E-06	1.44E-05			5.88E-06	1.44E-05
3-Methylchloranthrene	<1.8E-06	1.4-3	<1.76E-09	YES	4.41E-07	1.08E-06			4.41E-07	1.08E-06
7,12Dimethylbenz(a)anthracene	<1.6E-05	1.4-3	<1.57E-08	YES	3.92E-06	9.63E-06			3.92E-06	9.63E-06
Acenaphthene	<1.8E-06	1.4-3	<1.76E-09	YES	4.41E-07	1.08E-06			4.41E-07	1.08E-06
Anthracene	<2.4E-06	1.4-3	<2.35E-09	YES	5.88E-07	1.44E-06			5.88E-07	1.44E-06
Benzo(a)anthracene	<1.8E-06	1.4-3	<1.76E-09	YES	4.41E-07	1.08E-06			4.41E-07	1.08E-06
Benzene	2.10E-03	1.4-3	2.06E-06	YES	5.15E-04	1.26E-03	1.76E-03	7.71E-03	2.27E-03	8.97E-03
Benzo(a)pyrene	<1.2E-06	1.4-3	<1.18E-09	YES	2.94E-07	7.22E-07			2.94E-07	7.22E-07
Benzo(b)fluoranthene	<1.8E-06	1.4-3	<1.76E-09	YES	4.41E-07	1.08E-06			4.41E-07	1.08E-06
Benzo(g,h,i)perylene	<1.2E-06	1.4-3	<1.18E-09	YES	2.94E-07	7.22E-07			2.94E-07	7.22E-07
Benzo(k)fluoranthene	<1.8E-06	1.4-3	<1.76E-09	YES	4.41E-07	1.08E-06			4.41E-07	1.08E-06
Butane	2.10E+00	1.4-3	2.06E-03	NO	5.15E-01	1.26E+00			5.15E-01	1.26E+00
Chrysene	<1.8E-06	1.4-3	<1.76E-09	YES	4.41E-07	1.08E-06			4.41E-07	1.08E-06
Dibenzo(a,h)anthracene	<1.2E-06	1.4-3	<1.18E-09	YES	2.94E-07	7.22E-07			2.94E-07	7.22E-07
Dichlorobenzene	1.20E-03	1.4-3	1.18E-06	YES	2.94E-04	7.22E-04			2.94E-04	7.22E-04
Ethane	3.10E+00	1.4-3	3.04E-03	NO	7.60E-01	1.87E+00	2.78E-06	1.22E-05	7.60E-01	1.87E+00
Ethylbenzene	N/A			YES			7.72E-05	3.38E-04	7.72E-05	3.38E-04
Fluoranthene	3.00E-06	1.4-3	2.94E-09	YES	7.35E-07	1.80E-06			7.35E-07	1.80E-06
Fluorene	2.80E-06	1.4-3	2.75E-09	YES	6.86E-07	1.68E-06			6.86E-07	1.68E-06
Formaldehyde	7.50E-02	1.4-3	7.35E-05	YES	1.84E-02	4.51E-02			1.84E-02	4.51E-02
Hexane	1.80E+00	1.4-3	1.76E-03	YES	4.41E-01	1.08E+00			4.41E-01	1.08E+00
Indeno(1,2,3-cd)pyrene	<1.8E-06	1.4-3	<1.76E-09	YES	4.41E-07	1.08E-06			4.41E-07	1.08E-06
Naphthalene	6.10E-04	1.4-3	5.98E-07	YES	1.50E-04	3.67E-04	1.60E-03	7.02E-03	1.75E-03	7.39E-03
Pentane	2.60E+00	1.4-3	2.55E-03	NO	6.37E-01	1.56E+00			6.37E-01	1.56E+00
Phenanthrene	1.70E-05	1.4-3	1.67E-08	YES	4.17E-06	1.02E-05			4.17E-06	1.02E-05
Propane	1.60E+00	1.4-3	1.57E-03	NO	3.92E-01	9.63E-01			3.92E-01	9.63E-01
Pyrene	5.00E-06	1.4-3	4.90E-09	YES	1.23E-06	3.01E-06			1.23E-06	3.01E-06
Styrene	N/A			YES			4.39E-04	1.92E-03	4.39E-04	1.92E-03
Toluene	3.40E-03	1.4-3	3.33E-06	YES	8.33E-04	2.05E-03	9.10E-04	3.99E-03	1.74E-03	6.03E-03
Xylenes	N/A			YES			2.92E-05	1.28E-04	2.92E-05	1.28E-04
Arsenic	2.00E-04	1.4-4	1.96E-07	YES	4.90E-05	1.20E-04			4.90E-05	1.20E-04
Barium	4.40E-03	1.4-4	4.31E-06	NO	1.08E-03	2.65E-03			1.08E-03	2.65E-03
Beryllium	<1.2E-05	1.4-4	<1.18E-08	YES	2.94E-06	7.22E-06			2.94E-06	7.22E-06
Cadmium	1.10E-03	1.4-4	1.08E-06	YES	2.70E-04	6.62E-04			2.70E-04	6.62E-04
Chromium	1.40E-03	1.4-4	1.37E-06	YES	3.43E-04	8.42E-04			3.43E-04	8.42E-04
Cobalt	8.40E-05	1.4-4	8.24E-08	YES	2.06E-05	5.05E-05			2.06E-05	5.05E-05
Copper	8.50E-04	1.4-4	8.33E-07	NO	2.08E-04	5.11E-04			2.08E-04	5.11E-04
Lead	5.00E-04	1.4-4	4.90E-07	YES	1.23E-04	3.01E-04			1.23E-04	3.01E-04
Manganese	3.80E-04	1.4-4	3.73E-07	YES	9.31E-05	2.29E-04			9.31E-05	2.29E-04
Mercury	2.60E-04	1.4-4	2.55E-07	YES	6.37E-05	1.56E-04			6.37E-05	1.56E-04
Molybdenum	1.10E-03	1.4-4	1.08E-06	NO	2.70E-04	6.62E-04			2.70E-04	6.62E-04
Nickel	2.10E-03	1.4-4	2.06E-06	YES	5.15E-04	1.26E-03			5.15E-04	1.26E-03
Selenium	<2.4E-05	1.4-4	<2.35E-08	YES	5.88E-06	1.44E-05			5.88E-06	1.44E-05
Vanadium	2.30E-03	1.4-4	2.25E-06	NO	5.64E-04	1.38E-03			5.64E-04	1.38E-03
Zinc	2.90E-02	1.4-4	2.84E-05	NO	7.11E-03	1.74E-02			7.11E-03	1.74E-02
Total §112 HAPs					**<4.63E-01**	**<1.14E+00**	**<4.85E-03**	**<2.12E-02**	**<4.68E-01**	**<1.16E+00**

* Emissions from the combustion of process gases based on natural gas combustion emission factors and heat input values consistent with those presented in the April 2014 Plan Approval Application and September 2014 Technical Supplement.

Table B-38. VOC Control System Flares Emissions Estimates

FLARE EMISSIONS CALCULATIONS																
VOC to Flare	Basis			NSR POLLUTANT EMISSION FACTORS (lb/MMBtu)												
	MMBtu/hr	VOC to Flare	VOC DRE	NOx	SO2	PM2.5	VOC	CO2	CH4	N2O	CO2e	CO	PM	PM10	H2SO4	Pb
HP Ground Flares / Short-Term Max	2,687	31 MT/hr		0.068								0.37		0.0075		
HP Ground Flares / Annual Average	91.40	1.17 MT/hr	98.0% DRE	0.068	0.0015	0.0075	0.5646	131.4	0.0066	0.0013	132.0	0.37	0.0019	0.0075	0.00006	4.9E-07
HP Elevated Flare / Normal Ops	51.7	NG only		0.068	0.0015	0.0075	0.0054	117.0	0.0022	0.0002	117.1	0.37	0.0019	0.0075	0.00006	4.9E-07
MP Ground Flare / Normal Ops	2.3	0 MT/hr		0.068	0.0015	0.0075	0.0054	117.0	0.0022	0.0002	117.1	0.37	0.0019	0.0075	0.00006	4.9E-07
MP Ground Flare / Short-Term Max	100	0 MT/hr		0.068								0.37		0.0075		
MP Ground Flare/PE Normal Ops	1.0	NG Only	98.0% DRE	0.068	0.0015	0.0075	0.0000	131.4	0.0066	0.0013	132.0	0.37	0.0019	0.0075	0.00006	4.9E-07
FLARE / FLARING MODE		Basis		NSR POLLUTANT RATES USED IN AMBIENT IMPACT MODELING (lb/hr)												
		MMBtu/hr	NOTES	NOx								CO		PM10		
HP Ground Flares / Short-Term Max		2,687	[A]	36.5								994		20.0		
HP Ground Flares / Annual Average		91	[B]	6.2										0.68		
HP Elevated Flare / Normal Ops		51.7	[C]	3.5								19.1		0.39		
MP Ground Flare / Normal Ops		2.3	[D]	0.2								0.8		0.02		
MP Ground Flare / Short-Term Max		100	[E]	1.4								36.9		0.74		
MP Ground Flare/PE Normal Ops		1.0	[F]	0.1								0.4		0.01		
FLARE / FLARING MODE		Basis		NSR POLLUTANT PTE (T/yr)												
		Hours/yr	MMBtu/yr	NOx	SO2	PM2.5	VOC	CO2	CH4	N2O	CO2e	CO	PM	PM10	H2SO4	Pb
HP Ground Flares / Annual Average		8,760	800,635	27.2	0.59	2.98	226.0	52,600	2.65	0.53	52,824	148.1	0.75	2.98	0.02	2.0E-04
HP Elevated Flare / Normal Ops		8,760	452,947	15.40	0.33	1.69	1.22	26,492	0.50	0.05	26,520	83.80	0.42	1.69	0.01	1.1E-04
MP Ground Flare / Normal Ops		8,760	19,871	0.68	0.01	0.07	0.05	1,162	0.02	0.00	1,163	3.68	0.02	0.07	0.00	4.9E-06
MP Ground Flare/PE Normal Ops		8,760	8,760	0.30	0.01	0.03	0.00	576	0.03	0.01	578	1.62	0.01	0.03	0.00	2.1E-06

Table B-39. VOC Control System Flares Emissions Estimates Notes

FLARE EMISSIONS CALCULATIONS NOTES:
General:
• VOC mass flaring rates are based on preliminary vendor data associated with various potential scenarios (e.g., a cold-startup).
• Short-term VOC mass flaring rates represent maximum expected short-term rates excluding emergency flaring.
• Annual average VOC mass flaring rates represent annual average anticipated flaring rates excluding emergency flaring.
• Where applicable, flare destruction efficiencies represent LAER or beyond-LAER control levels.
Calculation Methodology:
• Hourly Emissions = (Heat Input - MMBtu/hr) x (Emissions Factor - lb/MMBtu)
• Annual Emissions = (Heat Input - MMBtu/hr) x (Annual Hours) x (Emissions Factor - lb/MMBtu) x (1 ton/2,000 lb)
Basis for Emissions Factors:
• NOx/NO2 and CO = AP-42, Table 13.5-1.
• SO2 = Natural gas SO2 emissions factor (see "Constants" sheet); Factor applied to pilot flame only; Flared process gases do not contain sulfur.
• PM10/2.5 = Natural gas external combustion emissions factor (see "Constants" sheet); Smokeless flares have zero filterable PM (see AP-43, Table 13.5-1).
• VOC from HP Ground Flares: based on 98.00% DRE of incoming VOC;
• VOC from Refrigerated Tank Flares: flared gases contain no VOC.
• VOC emissions factor for emergency-only flares pilot fuel = AP-42, Table 1.4-2.
• CO2 from pilot fuel is based on natural gas firing = weighted U.S. average NG CO2 emissions factor from 40 CFR 98, Table C-1.
• CO2 from VOC flaring is assumed to result from ethane flaring = ethane CO2 emissions factor from 40 CFR 98, Table C-1.
• CH4 and N2O from pilot fuel is based on natural gas firing = NG emissions factors from 40 CFR 98, Table C-1.
• CH4 and N2O from VOC flaring is assumed to result from fuel gas flaring = fuel gas emissions factors from 40 CFR 98, Table C-2.
• CO2e = sum of CO2, CH4 and N2O emissions adjusted for global warming potentials; see "Constants" table for details.
• PM = AP-42, Table 1.4-2; Natural gas filterable emissions factor used as conservative estimate since flares are smokeless.
• H2SO4 = AP-42, Table 1.3-1; estimated based on SO3-to-SO2 emissions ratio for distillate oil.
• Little HAP-containing gas will be flared; HAP emissions estimated based on the total of all AP-42 HAP emissions factors for external combustion of natural gas.
[A] - HP Ground Flares Short-Term Maximum Emissions Rates:
• Short-term max heat input based on flaring 52 MT/hr which is maximum anticipated rate from various SU/SD modes.
• Heat input also includes 1.0 MMBtu/hr of pilot gas at all times.
• The 1-hr maximum NOx rate used for short-term NO2 modeling is divided by 5 because SU/SD events expected to occur less than once every five years.
[B] - HP Ground Flares Annual Average Emissions Rates:
• Annual average heat input based on assuming 1 startup and 1 shutdown occur in a year.
• Annual average heat input also includes flaring events associated with reasonably anticipated maintenance events at a rate of 1 of each event/year/furnace.
• Annual average heat input also includes anticipated PE unit releases and 1.0 MMBtu/hr of pilot gas at all times.
[C] - HP Elevated Flare Annual Average Emissions Rates:
• Heat input based on 1.0 MMBtu/hr of pilot gas plus 1.0 MT/hr of natural gas as sweep gas.
[D] - MP Ground Flare Annual Average Emissions Rates:
• Heat input based on 1.0 MMBtu/hr of pilot gas and flaring of refrigerated tank emissions (see notes D1 and D2). • All other flaring is emergency-use only.
[D1] - Refrigerated Tank Flare Short-Term Maximum Emissions Rates:
• Short-term max heat input based on flaring 1.4 MT/hr of ethane which is maximum anticipated rate from various SU/SD modes.
• Heat input also includes 1.0 MMBtu/hr of pilot gas at all times.
• The 1-hr maximum NOx rate is divided by 5 because SU/SD events expected to occur at most once every five years.
[D2] - Refrigerated Tank Flare Annual Average Emissions Rates:
• Annual average heat input based on assuming 1 startup and 1 shutdown occur in a year with anticipated flaring of 225 MT of ethane/event in this flare.
• Annual average heat input also includes 1.0 MMBtu/hr of pilot gas at all times.

Table B-40. VOC Control System HAP Emissions Estimates

Flare	MMBtu/hr*	
HP Ground Flares / Short-Term Max	2,687	Maximum expected short-term rates based on proposed vendor data associated with various potential scenarios (e.g., a cold start-up). Includes 1.0 MM Btu/hr of pilot gas at all times.
HP Ground Flares / Annual Average	91	Represents reasonably anticipated maintenance events, 1 start up and 1 shutdown, and 1.0 MMBtu/hr pilot gas
HP Elevated Flare / Normal Ops	52	Represents 1.0 MMBtu/hr of pilot gas and 1.0MT/hr of natural gas as sweep gas
MP Grnd. Flare / Normal Ops	2	Based on 1 start up and 1 shutdown with anticipated flaring of 225 MT of ethane/event and includes 1.0 MM Btu/hr pilot gas
MP Grnd Flare / Short-Term Max	100	Based on flaring 2.0 MT/hr of ethane, which is maximum anticipate rate from various SU/SD modes and includes 1.0 MMBtu/hr pilot gas.

Annual Hours @ 100% Load =	8,760 hr/yr
Hourly Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)
Annual Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/T)

Pollutant	EF (lb/ MMSCF)	EF Source (AP-42 7/98 Table #)	EF (lb/MMBtu)	§112 HAP?	HP Ground Flares Short Term Max (lb/hr)	HP Ground Flares Annual Average (tpy)	HP Elevated Flare Short Term Max (lb/hr)	HP Elevated Flare Annual Average (tpy)	MP Ground Flares Short Term Max (lb/hr)	MP Ground Flares Annual Ave. (tpy)
2-Methylnaphthalene	2.40E-05	1.4-3	2.35E-08	YES	6.32E-05	9.42E-06	1.22E-06	5.33E-06	2.35E-06	2.34E-07
3-Methylchloranthrene	<1.8E-06	1.4-3	<1.76E-09	YES	4.74E-06	7.06E-07	9.12E-08	4.00E-07	1.76E-07	1.75E-08
7,12-Dimethylbenz(a)anthracene	<1.6E-05	1.4-3	<1.57E-08	YES	4.21E-05	6.28E-06	8.11E-07	3.55E-06	1.56E-06	1.56E-07
Acenaphthene	<1.8E-06	1.4-3	<1.76E-09	YES	4.74E-06	7.06E-07	9.12E-08	4.00E-07	1.76E-07	1.75E-08
Anthracene	<2.4E-06	1.4-3	<2.35E-09	YES	6.32E-06	9.42E-07	1.22E-07	5.33E-07	2.35E-07	2.34E-08
Benzo(a)anthracene	<1.8E-06	1.4-3	<1.76E-09	YES	4.74E-06	7.06E-07	9.12E-08	4.00E-07	1.76E-07	1.75E-08
Benzene	2.10E-03	1.4-3	2.06E-06	YES	5.53E-03	8.24E-04	1.06E-04	4.66E-04	2.05E-04	2.05E-05
Benzo(a)pyrene	<1.2E-06	1.4-3	<1.18E-09	YES	3.16E-06	4.71E-07	6.08E-08	2.66E-07	1.17E-07	1.17E-08
Benzo(b)fluoranthene	<1.8E-06	1.4-3	<1.76E-09	YES	4.74E-06	7.06E-07	9.12E-08	4.00E-07	1.76E-07	1.75E-08
Benzo(g,h,i)perylene	<1.2E-06	1.4-3	<1.18E-09	YES	3.16E-06	4.71E-07	6.08E-08	2.66E-07	1.17E-07	1.17E-08
Benzo(k)fluoranthene	<1.8E-06	1.4-3	<1.76E-09	YES	4.74E-06	7.06E-07	9.12E-08	4.00E-07	1.76E-07	1.75E-08
Butane	2.10E+00	1.4-3	2.06E-03	NO	5.53E+00	8.24E-01	1.06E-01	4.66E-01	2.05E-01	2.05E-02
Chrysene	<1.8E-06	1.4-3	<1.76E-09	YES	4.74E-06	7.06E-07	9.12E-08	4.00E-07	1.76E-07	1.75E-08
Dibenzo(a,h)anthracene	<1.2E-06	1.4-3	<1.18E-09	YES	3.16E-06	4.71E-07	6.08E-08	2.66E-07	1.17E-07	1.17E-08
Dichlorobenzene	1.20E-03	1.4-3	1.18E-06	YES	3.16E-03	4.71E-04	6.08E-05	2.66E-04	1.17E-04	1.17E-05
Ethane	3.10E+00	1.4-3	3.04E-03	NO	8.17E+00	1.22E+00	1.57E-01	6.88E-01	3.03E-01	3.02E-02
Fluoranthene	3.00E-06	1.4-3	2.94E-09	YES	7.90E-06	1.18E-06	1.52E-07	6.66E-07	2.93E-07	2.92E-08
Fluorene	2.80E-06	1.4-3	2.75E-09	YES	7.38E-06	1.10E-06	1.42E-07	6.22E-07	2.74E-07	2.73E-08
Formaldehyde	7.50E-02	1.4-3	7.35E-05	YES	1.98E-01	2.94E-02	3.80E-03	1.67E-02	7.34E-03	7.31E-04
Hexane	1.80E+00	1.4-3	1.76E-03	YES	4.74E+00	7.06E-01	9.12E-02	4.00E-01	1.76E-01	1.75E-02
Indeno(1,2,3-cd)pyrene	<1.8E-06	1.4-3	<1.76E-09	YES	4.74E-06	7.06E-07	9.12E-08	4.00E-07	1.76E-07	1.75E-08
Naphthalene	6.10E-04	1.4-3	5.98E-07	YES	1.61E-03	2.39E-04	3.09E-05	1.35E-04	5.97E-05	5.94E-06
Pentane	2.60E+00	1.4-3	2.55E-03	NO	6.85E+00	1.02E+00	1.32E-01	5.77E-01	2.54E-01	2.53E-02
Phenanthrene	1.70E-05	1.4-3	1.67E-08	YES	4.48E-05	6.67E-06	8.62E-07	3.77E-06	1.66E-06	1.66E-07
Propane	1.60E+00	1.4-3	1.57E-03	NO	4.21E+00	6.28E-01	8.11E-02	3.55E-01	1.56E-01	1.56E-02
Pyrene	5.00E-06	1.4-3	4.90E-09	YES	1.32E-05	1.96E-06	2.53E-07	1.11E-06	4.89E-07	4.87E-08
Toluene	3.40E-03	1.4-3	3.33E-06	YES	8.96E-03	1.33E-03	1.72E-04	7.55E-04	3.33E-04	3.31E-05
Arsenic	2.00E-04	1.4-4	1.96E-07	YES	5.27E-04	7.85E-05	1.01E-05	4.44E-05	1.96E-05	1.95E-06
Barium	4.40E-03	1.4-4	4.31E-06	NO	1.16E-02	1.73E-03	2.23E-04	9.77E-04	4.30E-04	4.29E-05
Beryllium	<1.2E-05	1.4-4	<1.18E-08	YES	3.16E-05	4.71E-06	6.08E-07	2.66E-06	1.17E-06	1.17E-07
Cadmium	1.10E-03	1.4-4	1.08E-06	YES	2.90E-03	4.32E-04	5.58E-05	2.44E-04	1.08E-04	1.07E-05

Flare	MMBtu/hr*	
HP Ground Flares / Short-Term Max	2,687	Maximum expected short-term rates based on proposed vendor data associated with various potential scenarios (e.g., a cold start-up). Includes 1.0 MM Btu/hr of pilot gas at all times.
HP Ground Flares / Annual Average	91	Represents reasonably anticipated maintenance events, 1 start up and 1 shutdown, and 1.0 MMBtu/hr pilot gas
HP Elevated Flare / Normal Ops	52	Represents 1.0 MMBtu/hr of pilot gas and 1.0MT/hr of natural gas as sweep gas
MP Grnd. Flare / Normal Ops	2	Based on 1 start up and 1 shutdown with anticipated flaring of 225 MT of ethane/event and includes 1.0 MM Btu/hr pilot gas
MP Grnd Flare / Short-Term Max	100	Based on flaring 2.0 MT/hr of ethane, which is maximum anticipate rate from various SU/SD modes and includes 1.0 MMBtu/hr pilot gas.

Annual Hours @ 100% Load =	8,760 hr/yr
Hourly Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF)
Annual Emissions =	(Max Heat Input - MMBtu/hr) x (1 SCF/1,020 Btu) x (EF - lb/MMSCF) x (Annual Operating Hours) / (2,000 lb/T)

Pollutant	EF (lb/ MMSCF)	EF Source (AP-42 7/98 Table #)	EF (lb/MMBtu)	§112 HAP?	HP Ground Flares Short Term Max (lb/hr)	HP Ground Flares Annual Average (tpy)	HP Elevated Flare Short Term Max (lb/hr)	HP Elevated Flare Annual Average (tpy)	MP Ground Flares Short Term Max (lb/hr)	MP Ground Flares Annual Ave. (tpy)
Chromium	1.40E-03	1.4-4	1.37E-06	YES	3.69E-03	5.49E-04	7.10E-05	3.11E-04	1.37E-04	1.36E-05
Cobalt	8.40E-05	1.4-4	8.24E-08	YES	2.21E-04	3.30E-05	4.26E-06	1.87E-05	8.22E-06	8.18E-07
Copper	8.50E-04	1.4-4	8.33E-07	NO	2.24E-03	3.34E-04	4.31E-05	1.89E-04	8.31E-05	8.28E-06
Lead	5.00E-04	1.4-4	4.90E-07	YES	1.32E-03	1.96E-04	2.53E-05	1.11E-04	4.89E-05	4.87E-06
Manganese	3.80E-04	1.4-4	3.73E-07	YES	1.00E-03	1.49E-04	1.93E-05	8.44E-05	3.72E-05	3.70E-06
Mercury	2.60E-04	1.4-4	2.55E-07	YES	6.85E-04	1.02E-04	1.32E-05	5.77E-05	2.54E-05	2.53E-06
Molybdenum	1.10E-03	1.4-4	1.08E-06	NO	2.90E-03	4.32E-04	5.58E-05	2.44E-04	1.08E-04	1.07E-05
Nickel	2.10E-03	1.4-4	2.06E-06	YES	5.53E-03	8.24E-04	1.06E-04	4.66E-04	2.05E-04	2.05E-05
Selenium	<2.4E-05	1.4-4	<2.35E-08	YES	6.32E-05	9.42E-06	1.22E-06	5.33E-06	2.35E-06	2.34E-07
Vanadium	2.30E-03	1.4-4	2.25E-06	NO	6.06E-03	9.03E-04	1.17E-04	5.11E-04	2.25E-04	2.24E-05
Zinc	2.90E-02	1.4-4	2.84E-05	NO	7.64E-02	1.14E-02	1.47E-03	6.44E-03	2.84E-03	2.82E-04
Total §112 HAPs					**<4.97E+00**	**<7.41E-01**	**<9.57E-02**	**<4.19E-01**	**<1.85E-01**	**<1.84E-02**

* Emissions from the combustion of process gases based on natural gas combustion emission factors and heat input values consistent with those presented in the April 2014 Plan Approval Application and September 2014 Technical Supplement.

Table B-41. Transport Truck Road PM Annual Emissions Estimates

TRANSPORT TRUCK ROAD PARTICULATE MATTER EMISSIONS (Annual Rate)			
Parameter	**Value**		**Reference & Calculation Basis**
Calculation based on paved Road Equation from AP-42 section 13.2.1 for hourly emissions			
k for PM	0.011	lb/VMT	AP-42, Table 13.2.1-1
k for PM10	0.0022	lb/VMT	AP-42, Table 13.2.1-1
k for PM2.5	0.00054	lb/VMT	AP-42, Table 13.2.1-1
sL	0.20	g/m2	Estimated value based on application of LAER controls.
W	25	tons	Average weight (tons) of the vehicles traveling the road.
P	150	days	Number of days with rain fall greater than 0.01 inch
N	365	days	Number of days in the averaging period.
EF for PM	0.059	lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(4*N))
EF for PM10	0.0119	lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(4*N))
EF for PM2.5	0.00292	lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(4*N))
Vehicles per day	44	vehicles/day	Design estimate (1).
Hours per day of vehicle traffic	24	hr/day	Annual average value.
Road Length	0.97	miles	Round trip distance from current plot plan.
VMT hourly =	1.8	VMT/hr	= (Vehicles per day) / (Hours per day of vehicle traffic) x (Road Length)
PM Emissions [hourly]	0.105	lb/hr	= (VMT hourly =) x (EF for PM)
PM10 Emissions [hourly]	0.021	lb/hr	= (VMT hourly =) x (EF for PM10)
PM2.5 Emissions [hourly]	0.005	lb/hr	= (VMT hourly =) x (EF for PM2.5)
PM Emissions [annual]	0.461	tpy	= (PM Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM10 Emissions [annual]	0.092	tpy	= (PM10 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM2.5 Emissions [annual]	0.023	tpy	= (PM2.5 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)

Note: (1) Original logistics of 10% truck shipments updated to 20% per Volume X Version D.

Table B-42. Truck Transport Road PM Emissions Estimates

TRANSPORT TRUCK ROAD PARTICULATE MATTER EMISSIONS (Annual Rate)		
Parameter	**Value**	**Reference & Calculation Basis**
Calculation based based on paved Road	***Equation from AP-42 section 13.2.1 for hourly emissions***	
k for PM	0.011 lb/VMT	AP-42, Table 13.2.1-1
k for PM10	0.0022 lb/VMT	AP-42, Table 13.2.1-1
k for PM2.5	0.00054 lb/VMT	AP-42, Table 13.2.1-1
sL	0.20 g/m2	Estimated value based on application of LAER controls.
W	25 tons	average weight (tons) of the vehicles traveling the road.
P	150 days	Number of days with rain fall greater than 0.01 inch
N	365 days	Number of days in the averaging period.
EF for PM	0.059 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
EF for PM10	0.0119 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
EF for PM2.5	0.00292 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
Vehicles per day	44 vehicles/day	Design estimate (1).
Hours per day of vehicle traffic	24 hr/day	Annual average value.
Road Length	0.97 miles	Round trip distance from current plot plan.
VMT hourly =	1.8 VMT/hr	= (Vehicles per day) / (Hours per day of vehicle traffic) x (Road Length)
PM Emissions [hourly]	0.11 lb/hr	= (VMT hourly =) x (EF for PM)
PM10 Emissions [hourly]	0.02 lb/hr	= (VMT hourly =) x (EF for PM10)
PM2.5 Emissions [hourly]	0.01 lb/hr	= (VMT hourly =) x (EF for PM2.5)
PM Emissions [annual]	0.46 tpy	= (PM Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM10 Emissions [annual]	0.09 tpy	= (PM10 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM2.5 Emissions [annual]	0.02 tpy	= (PM2.5 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
Note: (1) Original logistics of 10% truck shipments updated to 20% per Volume X Version D.		
PaDEP Review PM Emissions [annual]*	0.52 tpy	Updated based on PaDEP Review
PaDEP Review PM10 Emissions [annual]*	0.10 tpy	Updated based on PaDEP Review
PaDEP Review PM2.5 Emissions [annual]*	0.03 tpy	Updated based on PaDEP Review

*Memorandum from A. Binder, Air Quality Engineering Specialist, Commonwealth of Pennsylvania, DEP Southwest Regional Office to Air Quality Permit File PA-04-00740A, April 1, 2015, Table 19.