Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

February 14, 2020

Ed Orris, P.E., New Source Review Chief
Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222

RE: Shell Chemical Appalachia LLC
Shell Polymers Monaca Site
Potter and Center Townships, Beaver County
Plan Approval Application – Design Updates

Dear Mr. Orris:

Shell Chemical Appalachia LLC ("Shell") is pleased to submit this application to Pennsylvania Department of Environmental Protection (PADEP) for review and approval. This application would incorporate "as-built" changes in design and construction associated with the Shell Polymers Monaca Site.

Due to the confidential nature of the information provided, Shell is submitting an original application that contains trade secret and confidential proprietary information as defined by the Pennsylvania Right to Know Law. Three additional copies with redacted confidential information are also provided, including an electronic redacted copy on CD.

This application contains the following information.

- Section 1.0 Introduction
- Section 2.0 Project Description
- Section 3.0 Air Regulatory Requirements
- Section 4.0 Control Technology Analysis (new class or category)
- Section 5.0 PADEP-Requested Air Quality Impacts Analysis (updated)
- Section 6.0 PADEP-Requested Inhalation Risk Assessment (updated)
- Appendix A – Application Forms (Process/Combustion)
- Appendix B – Emissions Estimates
- Appendix C – Air Dispersion Modeling Analysis Details
- Appendix D – Inhalation Risk Assessment Details
- Appendix E – Forms and Notifications (General Information Form, Compliance Review Form, Municipal Notifications and Receipts, Power of Attorney)
- A check made payable to PADEP in the amount of $29,700 for the total processing fee in accordance with 25 Pa Code §127.702(f)(3).

The following people have received Municipal Notifications.

Mr. Daniel C. Camp III
Chairman, Beaver County Commissioners
Beaver County Courthouse
810 Third St.
Beaver, PA 15009
dcamp@beavercountypa.gov

Mr. Bill DiCioccio, Jr.
Chairman, Center Township Board of Supervisors
224 Center Grange Rd.
Aliquippa, PA 15001
bdiciocciojr@ctbos.com

Ms. Rebecca Matsco
Chairwoman, Potter Township Board of Supervisors
300 Mowry Rd.
Monaco, PA 15061

Shell requests that PADEP approve a Plan Approval to address "as-built" changes in design for Shell Polymers Monaca Site. Please contact me at 724-709-2411 or jim.sewell@shell.com or Kim Kaal at 724-709-2467 or kimberly.kaal@shell.com if you have any questions or need additional information.

Sincerely,

H. James Sewell
CSU Environmental Manager, Attorney-in-Fact

Air Quality Plan Approval Application

Shell Polymers Monaca Design Updates
Shell Chemical Appalachia LLC
Beaver County, Pennsylvania

February 2020

Prepared for Submittal to:

Pennsylvania Department of Environmental Protection
Bureau of Air Quality Southwest Regional Office
400 Waterfront Drive
Pittsburgh, PA 15222-4745

Prepared by:

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1.0 Introduction

Prior to commencing construction on the Shell Polymers Monaca Site ("Facility"), Shell Chemical Appalachia LLC ("Shell") submitted an original plan approval application in May 2014, and a revised application in February 2015. The revised application was deemed complete and a final plan approval ("PA-04-00740A") was issued by PADEP on June 18, 2015. Construction of the new major stationary source was initiated following issuance of PA-04-00740A.

Shell has reviewed the construction to determine if there were any differences between the "as-built" facility and the application and plan approval. "As built" changes in design and construction are common and expected in large scale construction projects such as the Shell facility. The changes identified by Shell's review include minor equipment additions, removal and downsizing of equipment permitted, and increases and decreases in the unit capacities of some equipment. Shell is applying for a plan approval to address these changes to the facility.

In accordance with this objective, this plan approval application is organized as follows:

- Introduction
- Project Description
- Regulatory Analysis
- Control Technology Analysis
- Air Quality Impacts Analysis
- Inhalation Risk Assessment

At the request of the Pennsylvania Department of Environmental Protection (PaDEP), the following content is included with this application:

- A control technology analysis for equipment additions that are in a previously not evaluated class or category,
- An update to the air quality impacts analysis developed in support of the 2015 application for plan approval, that incorporates the proposed changes, and
- An update of inhalation risk assessment developed in support of the 2015 application for plan approval that incorporates the proposed changes to the facilities.

2.0 Project Description

A summary of the proposed changes covered by this application for plan approval is presented in Table 2-1.[1] As shown, the changes fall into the following categories: equipment additions, equipment changes (*i.e.,* removed or downsized), or increased equipment capacities. As shown, the changes that are categorized as changes and increases in capacity are self-explanatory.

2.1 Equipment Additions

2.1.1 Emergency Engines

Six additional engines not included in the original design will be incorporated into the Facility as source of minor significance. The six engines will be in the following emergency backup services:

- One diesel fuel engine (103 BHP/77 kW) used to drive an emergency generator that will provide electricity to the parking garage elevator/lighting during electrical outages;
- One diesel fuel engine (67 BHP/ 50 kW) used to drive an emergency generator that will provide electricity to the telecom hut and tower during electrical outages;
- One natural gas fired spark ignited engine (158 BHP/211 kW) that will be used to drive the intermediate lift station sanitary water pump during electrical outages;
- One natural gas fired spark ignited engine (50 BHP/67 kW) that will be used to drive the Lift Station A sanitary water pump during electrical outages;
- One natural gas fired spark ignited engine (113 BHP/151 kW) that will be used to drive an emergency generator that will provide electricity to the PGT Shell office building during electrical power outages; and
- One natural gas fired spark ignited engine (210 BHP/281 kW) that will be used to drive an emergency generator that will provide electricity to the PGT BGTC during electrical power outages.

2.1.2 Additional Diesel Storage

Two emergency engine diesel storage tanks will be installed to provide storage for the diesel fuel used by the parking garage and telecom hut emergency generators. Each of the tanks will have a design capacity of ~500 gallons. Two additional diesel fuel storage tanks will be installed to provide fuel for the permanent on-site fleet of vehicles, temporary and portable diesel-fueled equipment, and mobile refueling. Each of these tanks will have a design capacity of ~18,000

[1] On December 18, 2019, Shell Chemical Appalachia submitted a plan approval application to incorporate Best Available Control Technology (BACT) requirements for regulation of Greenhouse Gas (GHG) emissions from the SF_6-Insulated High Voltage Equipment associated with the cogen area. As a result, this equipment is not included in Table 2-1.

gallons. Each of these diesel storage tanks is a source of minor significance and will be equipped with a carbon canister.

2.1.3 Talc Transport via Railcar

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.

2.1.4 Polyethylene Unit 3 Intermittent Particulate Vents

Additional intermittent particulate matter vents associated in Polyethylene Unit No. 3 (*i.e.,* vacuum cleaning system and flexible intermediate bulk container (FIBC) compactor) were not included as part of the 2015 plan approval application. 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. With this action, the vents on the vacuum system and FIBC compactor are being included.

2.1.5 LPG Loading

Emissions associated with the loading of LPG materials other than C3+ were not included as part of the 2015 plan approval application. In addition, upon further review with respect to the final design of this system, the calculations estimating the emissions from the loading of C3+ and other LPG materials were overestimated in the 2015 plan approval application. The emissions factor used assumed emissions from bleeder valves which are not present in Shell's loading configuration. 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. With this action, the corrected emissions from these activities are being included.

Table 2-1. Summary of Updates to the Shell Polymers Monaca Site Design[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	0.00	0.00	0.00	0.06	0.20	0.00	0.76	43.39
Two additional diesel-fired emergency engines	105	0.00	0.00	0.00	0.00	0.05	0.00	0.05	9.73
Two additional emergency engine diesel storage tanks	406				0.00				
Two additional vehicle fuel diesel storage tanks	406				0.00				
Transport of talc to site by railcar instead of truck[2]	202	0.00	0.00	0.00					
Methanol storage vessels and associated components[3]	201				0.00				
LPG loading	304				1.99				
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	(0.33)	(0.32)	(0.30)	(5.63)	(4.56)	(0.01)	(5.76)	(1151.6)
Removed four emergency generator diesel storage tanks	406	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Removed one firewater pump engine	106	(0.01)	(0.01)	(0.01)	(0.09)	(0.14)	(0.00)	(0.20)	(40.09)
Removed one firewater pump engine diesel storage tank	405	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Decreased rating of remaining firewater pump engines (700 to 488 bhp)	106	(0.02)	(0.02)	(0.02)	(0.14)	(0.23)	(0.00)	(0.32)	(64.0)
Spent caustic vent thermal incinerator from 8 to 2.5 tonnes/hr (Heat input unchanged)	206	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Decrease process cooling water tower rate from 305 to 295.9 MMgal/min	203	(0.20)	(0.13)	(0.00)	(1.20)				
Decrease in blending silo emissions (0.01 to 0.005 gr/dscf)	301	(2.79)	0.12	0.12					
Deduster vent removal (Elutriator wash air)	301	(1.91)	(0.02)	(0.02)					
Decrease in light gasoline loading rate	403				(0.13)				
Decrease in C3+ emissions	304				(14.64)				
Decrease in PE3 activated catalyst vent emissions	202	(0.02)	(0.02)	(0.02)					

Description of Change	Source ID	PM	PM_{10}	$PM_{2.5}$	VOC	NO_X	SO_2	CO	CO_2e
Increased Equipment Capacities									
Combustion turbine heat input (475 to 481.4 MMBtu/hr, each) (3x)	101 102 103	0.16	0.56	0.56	0.30	0.63	0.12	0.30	9,847
Duct burner heat input (189 to 234 MMBtu/hr, each)		1.10	3.90	3.90	2.08	4.42	0.87	2.70	69,240
Recovered oil & flow equalization & removal tank capacity	401				<0.01				
Increase in railcar handling and storage PE rates	301	(0.23)	0.47	0.47					
Increase in truck handling and storage PE rates	301	1.38	0.58	0.58					
Increase in railcar loading PE rates	301	0.00	0.00	0.00					
Increase in truck loading PE rates	301	0.01	0.01	0.01					
Increase in pyrolysis fuel oil loading	303				(0.01)				
Increase in Cogen cooling water tower circ. rate	104	0.00	0.00	0.00					
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	0.01	0.06	0.06	0.04	0.54	0.01	2.94	929.9
Low pressure thermal incinerator (LPTI)	204	(1.09)	(1.09)	(1.09)	0.95	(9.93)	0.00	(12.03)	(21,322)
High pressure elevated flare (HPEF)	205	(0.41)	(1.65)	(1.65)	(1.19)	(15.07)	(0.33)	(81.99)	(25,947)
Proposed Project's Emissions Increase[4]		(1.93)	4.17	4.32	(6.41)	(11.62)	0.98	(28.22)	60,107
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.

[3] 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.

[4] For a new project at an existing major stationary source that comprises new emission units, the source must estimate 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.

2.2 Source and Group Changes Cogeneration Units Group Limitations

With this application Shell is requesting that the Cogeneration Units Group ID G02 emissions restrictions and capacity contained in PA-04-00740A be updated in accordance with the changes in potential to emit summarized in Table 2-1 and Appendix A Combustion Turbines with Duct Burners form. The updated values for the Cogeneration Units Group ID 02 are presented in Table 2-22. Shell is requesting that Section C. Condition #030 of PA-04-00740A and source descriptions be superseded with the updated capacities.

Table 2-2. Summary Changes to Cogeneration Units Group ID G02 Emission Restrictions

Air Pollutant	Existing Emission Restriction (tons in any consecutive 12-month period)	Updated Emission Restriction (tons in any consecutive 12-month period)
NO_X	65.4	70.5
CO	42.0	45.0
CO_2e	340,558 (per unit)	1,100,762 (total for all units)

2.2.1 Furnace Operation Limitations

With this application Shell is requesting that Ethane Cracking Furnaces Group ID G01 operation limitation contained in PA-04-00740A be updated in accordance with the updated air dispersion modeling included in Appendix C of this application. Specifically, Shell is requesting that Section E. Group Name G01 Condition #009 be superseded to allow for up to two furnaces to operate in decoking mode at any time. Air dispersion modeling has been updated to demonstrate that the proposed Project will not cause or contribute to air pollution in violation of a National Ambient Air Quality Standard ("NAAQS") or PSD increment. This modeling update includes two furnaces operating in decoking mode simultaneously with the higher originally permitted CO mass emission rate, and also maintains (consistent with the original model) two furnaces with higher short-term NO_x emissions due to process fluctuations.

2.2.2 Cogen Cooling Tower Operation Limitations

With this application Shell is requesting that Process Cooling Tower Source ID 104 operation limitation contained in PA-04-00740A be updated in accordance with the water circulation rate in Appendix A Cogen Cooling Tower form. Specifically, Shell is requesting that Section D. Source ID 104 Condition #003 be superseded to reflect the changed hourly flow rate.

2.2.3 Process Cooling Tower Operation Limitations

With this application Shell is requesting that Process Cooling Tower Source ID 203 operation limitation contained in PA-04-00740A be updated in accordance with the water circulation rate in Appendix A Cooling Tower form. Specifically, Shell is requesting that Section D. Source ID 203 Condition #003 be superseded to reflect the changed hourly flow rate.

2.2.4 LPG Liquid Loadout Operation Limitations

With this application Shell is requesting that Liquid Loadout (C3+) Source ID 304 contained in PA-04-00740A be updated to account for C3+ refrigerant, butene, isopentane, and isobutane loading. A description of this update is included earlier in Section 2. Specifically, Shell is requesting that Section D. Source ID 304 Condition #001 be superseded to reflect all LPG loading. These LPG materials are otherwise already included in Section D. Source ID 405 Condition #001 of PA-04-00740A and no update is request to this condition.

2.2.5 Polyethylene Manufacturing Line Catalyst Activation Vent Limitations

With this application Shell is requesting that Polyethylene Manufacturing Lines Source ID 202 contained in PA-04-00740A be updated to account for higher level control of the catalyst activation vents than other particulate vents that are part of this Source ID. Catalyst activation vents will be controlled by an internal cartridge filter, followed by knockout pot, and finally an external HEPA filter. Specifically, Shell is requesting that a new condition be added limiting PM (filterable) emissions from catalyst activation vents to not exceed 0.002 gr/dscf.

2.3 Site Level Emissions Restrictions

With this application Shell is requesting that the site level emissions restrictions and Cogeneration Units Group ID G02 emissions restrictions contained in PA-04-00740A be updated in accordance with the changes in potential to emit summarized in Table 2-1. The updated values for the site level emissions restrictions are presented in Table 2-3 and the updates values for the Cogeneration Units Group ID 02 are presented in Table 2-2.

Table 2-3. Summary Changes to Site Level Emission Restrictions[1]

Air Pollutant	Existing Emission Restriction (tons in any consecutive 12-month period)	Updated Emission Restriction (tons in any consecutive 12-month period)[2]
NO_X	348	336
CO	1,012	984
PM (filterable)	71	69
PM_{10}	164	168
$PM_{2.5}$	159	163
SO_2	21	22
VOC	522	516
HAP	30.5	32.0
Ammonia	152	154
CO_2e	2,248,293	2,308,400

[1] This is the representation of site-wide PTE

[2] Vales derived by applying the Table 2-1 values to the existing emissions restrictions.

3.0 Air Regulatory Requirements

This section addresses the applicability of Pennsylvania and Federal air quality regulations to the proposed changes to the facility. A complete review was performed of the Pennsylvania regulations and Federal regulations, including New Source Review (NSR),[2] New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAP), and other federal rules. The results of this review are documented herein identifying the State and Federal regulations applicable to the Project. A full and complete listing of affected emission units and citations for the requirements of compliance and recordkeeping and reporting is provided in Appendix D.[3]

3.1 Pennsylvania Air Pollution Control Regulations

The Commonwealth of Pennsylvania has promulgated ambient air quality standards and pollution control regulations under Title 25 of the Pennsylvania Code.[4] The proposed Project is subject to the Title 25 Code Pennsylvania Chapters 121 through 145. The specific applicability of each of these regulations in Chapters 121 through 145, and how Shell will address these requirements is presented below. The applicable requirements that will be discussed in this section are summarized in Table 3-1.

3.1.1 25 Pa. Code Ch. 121. General Provisions

This chapter provides for the control and prevention of air pollution anywhere in the Commonwealth of Pennsylvania. Included in this chapter are definitions, purpose, applicability, organization of the Department of Environmental Quality (Department), the prohibition of air pollution, responsibility to comply with other provisions of Title 25, and prohibiting the circumvention of Article III rules through the use of a device (e.g., stack height) which would otherwise be in violation of Article III rules. The proposed Project will comply with these provisions by obtaining all applicable permits and complying with the requirements of these permits.

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[2] New Source Review includes the Prevention of Significant Deterioration (PSD) review for attainment pollutants, non-attainment (NA) review for non-attainment pollutants, and minor source review for pollutants that are less than the applicable threshold values for PSD and NA review.

[3] A number of the unit designations in this table constitute trade secret and/or confidential proprietary information as defined under the Pennsylvania Right to Know Law, and hence the full table is being provided in Appendix D.

[4] The *Pennsylvania Code* is an official publication of the Commonwealth of Pennsylvania. Title 25. Environmental Protection; Subpart C. Protection of Natural Resources; Article III. Air Resources; Chapters 121 – 145.

Table 3-1. Summary of Regulatory Applicability

Applicable Regulation	Regulatory Applicability	Project Subject Unit & Pollutants
Chapter 121. General provisions 25 Pa. Code §121.1-121.10	Provides for the control and prevention of air pollution anywhere in this Commonwealth, except as expressly excluded in the act or otherwise noted in this article.	Entire Facility
Chapter 122. National Standards of Performance for New Stationary Sources 25 Pa. Code §122.1-122.3	Adopts NSPS regulations at 40 CFR Part 60 promulgated by the United States Environmental Protection Agency under the Clean Air Act (42 U.S.C.A. § § 7401—7642), regulating the construction or modification of stationary sources.	See Table 3-3 for discussion of applicable 40 CFR 60 – New Source Performance Standards
Chapter 123. Standards for Contaminants 25 Pa. Code §§123.1, 123.2, 123.11-123.12, 123.21-123.22, 123.31, 123.41, 123.46, 123.51	This chapter contains standards for sources of particulate matter, sulfur compounds, odors, visible emissions, and nitrogen compounds. Additionally, this chapter contains NOx allowance requirements.	See Table 3-2 below for detailed description of Ch. 123 requirements and applicable sources.
Chapter 124. National Emissions Standards for Hazardous Air Pollutants 25 Pa. Code §§124.1-124.3	Adopts National Emission Standards for Hazardous Air Pollutants promulgated by the United States Environmental Protection Agency under the Federal Clean Air Act (42 U.S.C.A. § 7412).	No new equipment subject to Part 61
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter A. General 25 Pa. Code §127.1-127.3	General declaration of purposes. Designed to insure that new sources conform to the applicable standards of this article and that they do not result in producing ambient air contaminant concentrations in excess of those specified in Chapter 131 (relating to ambient air quality standards). New sources shall control the emission of air pollutants to the maximum extent, consistent with the best available technology as determined by the Department as of the date of issuance of the plan approval for the new source.	Entire Facility - applies to Criteria and Hazardous Air Pollutants
25 Pa. Code §127.3	Provides for operational flexibility, with cross-reference to other provisions	Entire facility

Applicable Regulation	Regulatory Applicability	Project Subject Unit & Pollutants
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter B. Plan Approval Requirements 25 Pa. Code §127.11-127.52	Requires Department approval of the construction or modification of an air contamination source, the reactivation of an air contamination source after the source has been out of operation or production for 1 year or more, or the installation of an air cleaning device on an air contamination source, unless the construction, modification, reactivation or installation has been approved by the Department.	Entire Facility
25 Pa. Code §127.12(a)	Show that source to be equipped with reasonable and adequate facilities to monitor and record emissions of air contaminants Emissions from new source must be minimum attainable through use of the best available technology (PaBAT) Show source will comply with applicable EPA requirements Show that source and air cleaning devises will be operated and maintained in accordance with good air pollution control practices	All emission sources at facility
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter B. Plan Approval Requirements 25 Pa. Code §127.35	Incorporates by reference performance or emission standards promulgated under section 112 of the Clean Air Act (42 U.S.C.A. § 7412) at 40 CFR Part 63 (relating to National Emission Standards for Hazardous Air Pollutants for Source Categories). If the Administrator of the EPA has not promulgated a standard to control the emissions of HAPs for a category or subcategory of major stationary sources Clean Air Act §112(c), the Department will establish a performance or emission standard on a case-by-case basis for individual sources or a category of sources for those major stationary sources. The Department has the authority to require, in the plan approval, reasonable monitoring, recordkeeping and reporting requirements for sources which emit hazardous air pollutants.	See Table 3-3 for discussion of applicable 40 CFR 63 – National Emission Standards for Hazardous Air Pollutants Combustion Turbines - HAP, Part 63, Subpart YYYY
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter D. Prevention of Significant Deterioration of Air Quality 25 Pa. Code §§127.81-127.83	Adopts by cross-reference Prevention of Significant Deterioration (PSD) requirements promulgated by the USEPA under the Clean Air Act.	Entire Facility - CO, PM, PM_{10}, and GHGs

Applicable Regulation	Regulatory Applicability	Project Subject Unit & Pollutants
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter E. New Source Review 25 Pa. Code §§127.201-218	Provides for regulation of construction or modification of an air contamination facility in a nonattainment area or have an impact on a nonattainment area, imposing LAER and offset requirements	Entire Facility - NOx, VOC
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter F. Operating Permit Requirements 25 Pa. Code §§127.401-127.464	Operating permit requirements applicable to all sources required to obtain and operating permit under the Air Pollution Control Act	Entire Facility - All regulated pollutants
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter G. Title V Operating Permit Requirements 25 Pa. Code §127.502(a)	Operating permit requirements for major sources (Title V facilities), requiring that applicable requirements for stationary air contamination sources in the Title V facility be included in the operating permit.	Entire Facility - All regulated pollutants
Chapter 127. Construction, Modification, Reactivation and Operation of Sources Subchapter J. General Conformity 25 Pa. Code §§127.801-127.802	Adopts the general conformity rule promulgated by the United States Environmental Protection Agency under section 176(c) of the Clean Air Act (42 U.S.C.A. § 7506(c)) and the regulations codified at 40 CFR Part 93, Subpart B (relating to determining uniformity of general Federal actions to state or Federal implementation plans), with respect to the conformity of general Federal actions to the Commonwealth's State Implementation Plan.	Entire Facility - All regulated pollutants
Chapter 129. Standards for Sources 25 Pa. Code §§129.51, 129.56, 129.57, 129.71, 129.91-129.95	This chapter contains emission standards for VOCs and NOx for numerous emission sources including storage tanks, ethylene production, SOCMI manufacturing, and combustion units.	VOCs and NOx from: Storage tanks, ethylene production, SOCMI manufacturing, and combustion units

Applicable Regulation	Regulatory Applicability	Project Subject Unit & Pollutants
Chapter 129. Standards for Sources 25 Pa. Code §129.56. Storage tanks greater than 40,000 gallons capacity containing VOCs.	No person may permit the placing, storing or holding in a stationary tank, reservoir or other container with a capacity greater than 40,000 gallons of volatile organic compounds with a vapor pressure greater than 1.5 psia (10.5 kilopascals) under actual storage conditions unless the tank, reservoir or other container is a pressure tank capable of maintaining working pressures sufficient at all times to prevent vapor or gas loss to the atmosphere or is designed and equipped with an appropriate device.	Facility Storage Tanks storing VOCs
Chapter 129. Standards for Sources 25 Pa. Code §129.57. Storage tanks less than or equal to 40,000 gallons capacity containing VOCs.	Applies to above ground stationary storage tanks with a capacity equal to or greater than 2,000 gallons that contain volatile organic compounds with vapor pressure greater than 1.5 psia (10.5 kilopascals) under actual storage conditions. Petroleum liquid storage vessels that are used to store produced crude oil and condensate prior to lease custody transfer are exempt from the requirements.	Facility Storage Tanks storing VOCs
Chapter 129. Standards for Sources 25 Pa. Code §129.71. Synthetic organic chemical and polymer manufacturing—fugitive sources	Requires certain design, equipment and leak detection program requirements, applicable to surface active agent manufacturing facilities subject to § 129.72 and to a facility with design capability to manufacture 1,000 tons per year or more of one or a combination of the following: (1) Synthetic organic chemicals listed in 40 CFR 60.489 (relating to list of chemicals provided by affected facilities). (2) Methyl tert-butyl ether. (3) Polyethylene. (4) Polypropylene. (5) Polystyrene.	VOCs from Ethylene (and polyethylene) manufacturing including associated methanol system
Chapter 129. Standards for Sources 25 Pa. Code §§129. 91-129.95. Stationary Sources of NOx & VOCs	Establishes reasonably available control technology (RACT) requirements for major NOx emitting facilities or major VOC emitting facilities for which no RACT requirement has been established.	NOx & VOC emissions from combustion sources, equipment leaks, wastewater treating plant, transfer operations, and process vents.
Chapter 131. Ambient Air Quality Standards 25 Pa. Code §§ 131.1 - 131.3	Establishes the maximum ambient air concentrations of air contaminants. Adopts by cross-reference National Ambient Air Quality Standards. Adopts additional ambient standards for settled particulate, beryllium, fluorides, and hydrogen sulfide.	Entire Facility - CO, SO_2, NO_2, PM, PM_{10}, $PM_{2.5}$, Ozone, lead, beryllium, fluorides, and hydrogen sulfide
Chapter 135. Reporting of Sources 25 Pa. Code §§ 135.1-135.5	Provides for recordkeeping and submission of emission statements from most stationary sources.	Entire Facility - all regulated pollutants

Applicable Regulation	Regulatory Applicability	Project Subject Unit & Pollutants
Chapter 137. Air Pollution Episodes 25 Pa. Code §137.1-137.14	Provides for Department determination of air pollution episodes and requires preparation and submission of standby plans for certain industries including chemical and allied products industries, located in counties designated by PaDEP.	Entire Facility - CO, SO_2, NO_2, PM_{10} and Ozone
Chapter 139. Sampling & Testing 25 Pa. Code §§139.1-139.101	Establishes the sampling and testing methods and procedures, monitoring duties for certain sources, and requirements for source monitoring for stationary sources.	Entire Facility - all regulated pollutants
Chapter 145. Interstate Pollution Transport Reduction 25 Pa. Code §145.8	Establishes provisions for the NOx Budget Trading Program as a means of mitigating the interstate transport of ozone and nitrogen oxides, an ozone precursor. § 145.8 transitions the state program over to CAIR as of 2010.	NOx: Cogen Units
Chapter 145. CAIR NOx and SO_2 Trading Programs 25 Pa. Code § 145.201	Incorporates by reference the CAIR NOx Annual Trading Program and CAIR NOx Ozone Season Trading Program. The subchapter also establishes general provisions and the applicability, allowance and supplemental monitoring, recordkeeping and reporting provisions.	SO_2: Cogen Units NOx: Cogen Units

3.1.2 25 Pa. Code Ch. 122 National Standards of Performance for New Stationary Sources

This chapter adopts NSPS (40 CFR Part) promulgated by the United States Environmental Protection Agency under the Clean Air Act (42 U.S.C.A. § § 7401-7642), regulating the construction or modification of stationary sources. The standards are adopted to make them independently enforceable by the Department implementing the delegation of Federal authority under section 111(c) of the Federal Clean Air Act (42 U.S.C.A. § 7411). The applicability of these standards is addressed in Section 3.2.1.

3.1.3 25 Pa. Code Ch. 123. Standards for Contaminants

This chapter contains standards for sources of particulate matter, sulfur compounds, odors, visible emissions, nitrogen compounds, and NOx monitoring and allowance requirements. As presented in Table 3-2, sources that are specifically affected include: fugitive particulate matter sources, combustion units, and processes vents. The proposed Project's additional equipment emissions that are affected by this chapter include the process vents and loading emissions. As shown in Table 3-2, Plan Approval No. 04-00740A includes the Ch. 123 requirements. As presented in Table 3-2, the proposed additional equipment covered by this action will comply with the provisions in this chapter.

3.1.4 25 Pa. Code Ch. 127. Construction, Modification, Reactivation and Operation of Sources

This chapter contains the regulations applicable to construction, modification, reactivation, and operation of applicable sources.

3.1.4.1 25 Pa. Code §§ 127.1 and 127.12 Best Available Technology

In stating the purpose of the Ch. 127 rules, Section 127.1 states the objective of maintaining at existing levels in areas where the existing ambient air quality is better than the applicable ambient air quality standards and improving to achieve the applicable ambient air quality standards in areas where the existing air quality is worse than the applicable ambient air quality standards. The Ch. 127 rules require new sources to conform to the applicable standards and not result in producing ambient air contaminant concentrations in excess of those specified in Ch. 131 (relating to ambient air quality standards). These requirements are substantially addressed via the PSD requirements.

Sections 127.1 and 127.12(a)(5) require that new sources control the emission of air pollutants to the maximum extent, consistent with the best available technology as determined by the Department as of the date of issuance of the plan approval for the new source. New emissions sources included by the proposed Project will comply with the best available technology requirements where applicable for all pollutants.

Table 3-2. Summary of Compliance with the Standards of Containment at 25 Pa. Code Ch. 123

Standards for Contaminants	Affected Source(s)	Regulatory Requirement	Compliance
25 Pa Code § 123.1 Prohibition of certain fugitive emissions	Fugitive sources of air contaminants other than those allowed in § 123.1 (*i.e.,* construction activities, grading, clearing of land, et. al).	• Fugitive air emissions prohibited except for certain listed sources and emissions determined to be of minor significance after appropriate controls. • Emissions do not prevent or interfere with attainment or maintenance of ambient air quality standard.	Best management practices to be followed for construction, demolition, grading, paving and maintenance of roads, and other activities. Fugitive VOCs and particulate from processes are subject to control and are of minor significance after controls. Fugitives are included in the potential to emit determination. Therefore, the impacts of fugitives with respect to air pollution are considered Plan Approval No. 04-00740A Section C #002
25 Pa Code § 123.2 Fugitive particulate matter	All fugitive PM sources	No fugitive particulate emissions visible outside the property boundary	Current best management practices followed will prevent particulate matter visible emissions outside of the Facility property Plan Approval No. 04-00740A Section C #003

Standards for Contaminants	Affected Source(s)	Regulatory Requirement	Compliance
25 Pa Code § 123.11 PM - Combustion units	Combustion Units	Emission limits on PM for various sized units	Current limitations on affected equipment will meet this requirement. Plan Approval No. 04-00740A Section E Group Name G02 #004, Group Name G03 #004
25 Pa Code § 123.13 PM – Processes	Processes except combustion units	Emission limit on PM by formula or 0.02 grains/dscf whichever is greater	Current limitations on affected equipment will meet this requirement. Plan Approval No. 04-00740A Section D Source ID 202 #003, Section D Source ID 301 #003
25 Pa Code § 123.21 Sulfur Compound - General	Combustion Units	500 ppmvd effluent gas limit	Current site level conditions will meet this requirement. Plan Approval No. 04-00740A Section C #008 and #014
25 Pa Code § 123.22(d) Sulfur Compound – Combustion Units	Combustion Units	Specific fuel dependent Lower Beaver Valley air basin limit on SO_2	Current site level conditions will meet this requirement. Plan Approval No. 04-00740A Section C #008 and #014
25 Pa Code § 123.31 Odor Emissions	Combustion Units, Process Vents, Fugitives	No malodors detectable outside the property boundary	Plan Approval No. 04-00740A Section C #004

Standards for Contaminants	Affected Source(s)	Regulatory Requirement	Compliance
25 Pa Code § 123.41 Visible Emissions	Combustion Units, Fugitive Sources of PM	Visible emissions/opacity limitations	Current site level conditions and limitations on affected equipment will meet this requirement. Plan Approval No. 04-00740A Section C #011, #014, and #029; Section D Source ID 202 #001, Source ID 301 #001; Section E Group Name G02 #007
25 Pa Code § 123.51 Nitrogen Compound Emissions	Combustion Units	Monitor NO_x emissions	Current limitations on affected equipment will meet this requirement. Plan Approval No. 04-00740A Section E Group Name G02 #015

3.1.4.2 25 Pa. Code § 127.35 Maximum Achievable Control Technology Standards for Hazardous Air Pollutants (HAP)

Section 127.35 establishes the process that the Department will follow in establishing maximum achievable control technology (MACT) standards in plan approvals. Regulations promulgated under section 112 of the Clean Air Act (42 U.S.C.A. § 7412) at 40 CFR Part 63 are incorporated by reference into the plan approval program. These standards regulate specific categories of stationary sources that emit or have the potential to emit 10 tons per year of any HAP or 25 tons per year of any combination of HAP. The HAP emissions from the facility exceed a combined 25 tons per year, rendering the facility a major source for HAP. NESHAP standards applicable to the proposed Project's affected sources are presented in Table 2-1.

25 Pa. Code § 127.35(c) states that if the EPA has not promulgated a standard to control emissions of hazardous air pollutants (HAP) from a category or subcategory of major stationary sources under CAA Section 112 pursuant to the schedule established under CAA Section 112(c), the Department will establish standards on a case-by-case basis as required by section 112(g) of the CAA. These standards are to be incorporated into the plan approval of each source within the category for which a MACT requirement has been established. In essence, 25 Pa. Code §127.35(d) implements the Clean Air Act Section 112(g) case-by-case MACT rule. All of the HAP emitting additional equipment included in the proposed Project are covered by a promulgated standard. As a result, the provisions of Ch. 127.35 are not applicable to this action.

3.1.4.3 25 Pa. Code § 127.83 Prevention of Significant Deterioration

Section 127.83 of the Pennsylvania air quality regulations adopts by reference the Prevention of Significant Deterioration (PSD) requirements promulgated in 40 CFR 52 by the Administrator of the EPA under section 161 of the Clean Air Act (42 U.S.C.A. § 7471) in their entirety. In accordance with the PSD requirements, the proposed Project is at a facility that belongs to a listed source category (chemical processing plant) and has potential emissions of greater than 100 tons per year of a PSD regulated pollutant; thus, the existing facility is an existing major stationary source. For a project at an existing major stationary source that is comprised of new emission units, the source must estimate the change in the potential to emit of the NSR pollutants (CO, NO_2, H_2SO_4, PM/PM_{10}/ $PM_{2.5}$, and Pb).[5,6] If the change in potential to emit 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, which includes applying Best Available Control Technology (BACT), demonstrating compliance with air quality standards, assessing secondary impacts, and undergoing public participation for each pollutant for which there is a significant increase. As shown in Table 2-1, the proposed Project's change in PTE is less than the applicable PSD significant level for each of

[5] The proposed Project will not emit quantities of the other NSR pollutants, which include hydrogen sulfide, total reduced sulfur compounds, fluorides, and beryllium.

[6] See 40 CFR 52.21(a)(2)(iv)(d), 40 CFR 52.21(b)(48)(iii), and 40 CFR 52.21(b)(7)(i).

the PSD pollutants. As a result, the proposed Project is not subject to the PSD preconstruction permitting requirements.

3.1.4.4 25 Pa. Code § 127.201 New Source Review

Ch. 127, Subchapter E, (25 Pa. Code §§127.201-127.218) contains the nonattainment NSR regulations incorporated into the Pennsylvania air quality regulations in accordance with the federal requirements at 40 CFR §51.165. Nonattainment NSR applies to new major sources or major modifications at existing major stationary sources for pollutants where the area the source is located in is not in attainment with the National Ambient Air Quality Standards (NAAQS). All nonattainment NSR programs must require (1) the installation of the lowest achievable emission rate (LAER), (2) emission offsets, (3) alternative site evaluation, and (4) opportunity for public involvement.

Currently, Potter and Center Townships in Beaver County, Pennsylvania are designated as areas of nonattainment for 8-hour (2008) ozone and Pb (2008); and Potter Township in Beaver County, Pennsylvania is designated as an area of nonattainment for SO_2 (2010). Ozone has defined precursors of VOC and NOx. As shown Table 2-1, the change in PTE of the proposed project is less than the pollutant specific significant level for NOx, VOC, and SO_2. As a result, the proposed action is not subject to the Nonattainment NSR preconstruction permitting requirements.

3.1.5 25 Pa. Code Ch.129. Standards for Sources

Chapter 129 contains regulations for specific sources and emissions units which emit NOx and VOCs. The proposed Project will comply with the provisions in this chapter by obtaining all applicable permits and complying with the requirements of these permits.

3.1.5.1 25 Pa. Code § 129.14 Open burning operations

The proposed Project will be located in an area of Beaver County designated in § 121.1 as an air basin, which pursuant to 25 Pa. Code § 129.14, has a restriction on open burning. Open burning is defined in 25 Pa. Code § 121.1 as a fire, the air contaminants from which are emitted directly into the outdoor atmosphere and not directed thereto through a flue. The additional combustion equipment included in the proposed Project will be exhausted through a stack, so the requirements of Ch 129.14 are not applicable. [7]

[7] Open burning operations limitations are included in PA-04-00740A Section C Condition #007

3.1.5.2 25 Pa. Code § 129.56. Storage tanks greater than 40,000 gallons capacity containing VOCs.

Section 129.56 requires that any stationary tank, reservoir, or other container with a capacity greater than 40,000 gallons used to store volatile organic compounds with a vapor pressure greater than 1.5 psia (10.5 kilopascals) under actual storage conditions be a pressure tank capable of maintaining working pressures sufficient at all times to prevent vapor or gas loss to the atmosphere or be designed and equipped with an appropriate device:

An external or *an internal floating roof.* This control equipment is not permitted if the volatile organic compounds have a vapor pressure of 11 psia (76 kilopascals) or greater under actual storage conditions.

Vapor recovery system. A vapor recovery system, consisting of a vapor gathering system capable of collecting the volatile organic compound vapors and gases discharged and a vapor disposal system capable of processing such volatile organic vapors and gases so as to prevent their emission to the atmosphere. Tank gauging and sampling devices shall be gas-tight except when gauging or sampling is taking place. The vapor recovery system shall be maintained in good working order and recover at least 80% of the vapors emitted by such tank.

The proposed Project includes a methanol storage vessel that will contain volatile organic compounds with a vapor pressure greater than 1.5 psia that will be subject to the requirements of this rule. This vessel will be a pressurized vessel capable of maintaining working pressures to prevent vapor loss to the atmosphere and also relief to the high pressure system. As a result, it is equipped with controls that will, at a minimum, meet the requirements of this section.

3.1.5.3 25 Pa. Code § 129.57. Storage tanks less than or equal to 40,000 gallons capacity containing VOCs.

The provisions of this section apply to above-ground stationary storage tanks with a capacity equal to or greater than 2,000 gallons but less than 40,000 gallons, that contain volatile organic compounds with a vapor pressure greater than 1.5 psia (10.5 kilopascals) under actual storage conditions. Storage tanks subject to this section must have pressure relief valves which are maintained in good operating condition and which are set to release at no less than 0.7 psig (4.8 kilopascals) of pressure or 0.3 psig (2.1 kilopascals) of vacuum or the highest possible pressure and vacuum in accordance with state or local fire codes or the National Fire Prevention Association guidelines or other national consensus standards acceptable to the Department. Section 129.56(g) requirements also apply to these smaller tanks. The proposed Project includes methanol storage vessels which will be subject to the requirements of this rule. These vessels will be pressurized vessels capable of maintaining working pressures to prevent vapor loss to the atmosphere and also relief to the high pressure system that will, at a minimum, meet the requirements of this section.

3.1.5.4 25 Pa. Code § 129.71. Synthetic organic chemical and polymer manufacturing—fugitive sources

This section applies to the manufacture of polyethylene and synthetic organic chemicals listed in 40 CFR 60.489, which includes ethylene. As such, the proposed Project's equipment to which this rule applies will:

- Install a second valve, blind flange, plug, cap or other equivalent sealing system on open ended lines, except for safety pressure relief valves.
- Develop and initiate a leak detection program including liquid leaks for pumps, valves, compressors, vessels, and safety pressure relief valves and a repair program for these components that cause a hydrocarbon detection instrument reading equal to or greater than 10,000 ppm.

The proposed Project will comply with the above requirements and will have a more stringent leak detection program as part of the LAER requirements.

3.1.5.5 25 Pa. Code § § 129.91-95. Stationary Sources of NOx and VOCs

This section requires the owner and operator of a major NOx or VOC emitting facility apply Reasonably Available Control Technology (RACT).[8] This section applies to facilities for which no RACT requirement has been established in § § 129.51, 129.52, 129.54 - 129.72, 129.81 and 129.82. The proposed project does include NOx and/or VOC-emitting sources with no existing RACT requirements. However, these sources (e.g., combustion sources, equipment leaks, organic liquid transfer operations, process vents and storage vessels) are subject to NOx and VOC requirements as follows, and therefore, in accordance with the presumptive RACT emission limitations set forth in 25 Pa Code § 129.93(c), a case-by-case RACT analysis is not required.

- The six new emergency engines are emergency standby engines operating less than 500 hours in a consecutive 12-month period.
- There is no applicable RACT requirement for emergency engine diesel storage tanks at 25 Pa. Code § 129.
- There is no applicable RACT requirement for the vehicle fuel diesel storage tanks at 25 Pa. Code § 129.

3.1.6 25 Pa. Code Ch. 131. Ambient Air Quality Standards

This chapter establishes ambient air quality standards by incorporating by reference the National Ambient Air Quality Standards (NAAQS), and by setting State Ambient Air Quality Standards for settled particulate, beryllium, fluorides and hydrogen sulfide. The NAAQS are applicable to

[8] RACT is lowest emission limit for VOCs or NOx that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility per 25 Pa. Code § 121.1

the entire facility for the emissions of CO, SO_2, NO_2, PM, PM_{10}, $PM_{2.5}$, ozone, and lead. As noted in Section 3.1.4.3, the proposed Project is not subject to the PSD preconstruction permitting regulations. However, at the Department's request, an update to the air quality impacts analysis performed in support of the 2015 application for plan approval was performed for CO, NO_2, and PM_{10}. The results of this analysis, which demonstrate compliance with the NAAQS, are included in Section 6.0.

Based on previous conversations with PaDEP, only significant sources of beryllium, fluorides, and hydrogen sulfide, such as coal-fired emission sources, need to conduct an analysis against the state standards. This Project is not expected to be a significant source of beryllium, fluorides, or hydrogen sulfide based on the fuel to be combusted at the plant (i.e., tailgas, natural gas, and ultra-low sulfur diesel). As a result, these pollutants are not included in the ambient impacts analysis. Ambient impacts of settled particulate was included in the updated air quality analysis discussed above.

3.1.7 25 Pa. Code Ch. 135. Reporting of Sources

Ch. 135 provides a means of obtaining data required to evaluate the effectiveness of regulations, identify available or potential emission offsets, and maintain an accurate inventory of air contaminant emissions for air quality assessment and planning activities. It requires most stationary sources to submit annual emission inventories. Shell will comply with the requirements of this chapter initially by providing emission factors and emissions calculations as part of this application, and thereafter, Shell will submit by March 1 of each year a source emissions inventory report for the preceding calendar year. The report shall include information for all previously reported sources, new sources that were first operated during the preceding calendar year, and sources modified during the same period which were not previously reported. Shell will provide to the Department source reports that contain sufficient information to enable the Department to complete its emission inventory. Shell will provide the report information in the format specified by the Department. As part of this report, Shell will provide the Department with a statement showing the actual emissions of NOx and VOCs from that source for each reporting period, a description of the method used to calculate the emissions, and the time period over which the calculation is based. The statement will contain a certification by a company officer or the plant manager that the information contained in the statement is accurate.

Shell will maintain and make available upon request by the Department records, including computerized records that may be necessary to comply with reporting and emission statements. These may include records of production, fuel usage, maintenance of production or pollution control equipment, or other information determined by the Department to be necessary for identification and quantification of potential and actual air contaminant emissions. If direct recordkeeping is not possible or practical, sufficient records will be kept to provide the needed information by indirect means.

3.1.8 25 Pa. Code Ch. 137. Air Pollution Episodes

Chapter. 137 provides for the Department to declare air pollution episodes to prevent the excessive buildup of air pollutants during an episode. The Ch. 137 rules require that particular industries, including chemical industry facilities in designated counties, prepare standby plans for implementation in such episodes. Shell has developed a standby plan and will implement plans when requested by the Department.

3.1.9 25 Pa. Code Ch. 139. Sampling and Testing

This chapter contains provisions for:

- Subchapter A. Sampling and Testing Methods and Procedures,
- Subchapter B. Monitoring Duties of Certain Sources, and
- Subchapter C. Requirements for Source Monitoring for Stationary Sources.

Shell will follow the methods and procedures contained in this chapter as laid out in the Project's plan approval, and as directed by the Department.

3.1.10 25 Pa. Code Ch. 145. Interstate Pollution Transport Reduction

Ch. 145 establishes a NOx Budget Trading Program as a means to mitigate the interstate transport of ozone and nitrogen oxides, an ozone precursor. Subchapter 145.8 transitions the NOx Budget Trading Program to the CAIR NOx and SO_2 Trading Program (40 CFR 97) on May 1, 2010, and for each control period thereafter.[9] Subchapter 145.201 incorporates by reference the CAIR NOx Annual Trading Program and CAIR NOx Ozone Season Trading Program as a means to mitigate the interstate transport of fine particulates and NOx, and the CAIR SO_2 Trading Program as a means to mitigate the interstate transport of fine particulates and SO_2.

The proposed Cogen units will each serve a generator with nameplate capacity of more than 25 MWe supplying in any calendar year more than one-third of the unit's potential electric output capacity or 219,000 MWh, whichever is greater, to a utility power distribution system for sale. As such, Shell will obtain NOx and SO_2 budget allowances for the Cogen Units as required for interstate pollution transport reduction.

[9] It should be noted that the CAIR Program is currently being transitioned to the Cross-State Air Pollution Rule (CSAPR). In accordance with a court decision CSAPR Phase 1 implementation is scheduled for 2015, with Phase 2 beginning in 2017. Until the Pennsylvania State Implementation Plan (SIP) is updated and approved by EPA with the CSAPR requirements included CAIR will remain in effect.

3.2 Federal Regulations

The applicability of Federal regulations to the Project is presented by federal rule citation below. Table 3-3 presents a summary of the applicable Federal regulations, and the following subsections provide additional detail.

3.2.1 40 CFR Part: New Source Performance Standards

The New Source Performance Standards (NSPS) are codified at 40 CFR 60, and adopted by reference under Chapter 122 of the Commonwealth of Pennsylvania.

3.2.1.1 Part 60, Subpart A, General Provisions

The NSPS general provisions in Subpart A are applicable to facilities subject to any standard promulgated under Part 60. The proposed Project's new facilities will be subject to NSPS subparts IIII and JJJJ. Therefore, some of the provisions of subpart A are applicable to the proposed Project. In general, subpart A provisions specify performance test, performance evaluation (monitoring systems), notification, recordkeeping, reporting, and control device requirements for affected facilities.

3.2.1.2 Subpart IIII - Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

The provisions of this subpart are applicable to owners and operators of stationary compression ignition (CI) internal combustion engines (ICE), that commenced construction, modification, or reconstruction on or after July 11, 2005. For the purposes of this subpart, the date that construction commences is the date the engine is ordered by the owner or operator. There are different emission standards and requirements depending on the use of the CI ICE (*i.e.,* non-emergency, emergency, and fire pump engines), model year, and size. Per 40 CFR 60.4205, which references to 40 CFR 60.4202, the CI ICE engines included in the proposed Project will be subject to the emissions standards in Table 1 of 40 CFR 89.112.

Accordingly, Shell will comply with the subpart IIII emission standards, fuel, certification, testing, monitoring, recordkeeping and reporting requirements for these engines.

Table 3-3. Summary of Federal Regulatory Applicability

Applicable Regulation	Regulatory Applicability	Project Subject Unit & Pollutants
40 CFR Part 60 – New Source Performance Standards		
Subpart A: General Provisions	Facilities subject to subsequent subparts of Part 60	Subpart IIII - Compression Ignition Internal Combustion Engines Subpart JJJJ - Spark Ignition Internal Combustion Engines
Subpart IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines	Standards of Performance for emissions of NOx, VOC, CO, and PM from Stationary Compression Ignition Internal Combustion Engines (ICE) that commenced construction, after July 11, 2005.	Emergency diesel-electric generators.
Subpart JJJJ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines	Standards of Performance for emissions of NOx, CO, and VOC from Stationary Spark Ignited (SI) ICE that commenced construction, after July 1, 2008	Emergency natural gas-fired SI ICE that will be used to pump or drive emergency generators.
Subpart TTTT: Standards of Performance for Greenhouse Gas Emissions for Electric Generating Units	Standards of Performance for emissions of GHG from Electric Utility Generating Units with a base load rating >250 MMBtu/hr, combusting natural gas, serving generators capable of selling greater than 25 MW of electricity to a utility, supplying more than one-third of its potential electric output and more than 219,000 MWh net-electrical output to a utility, and that commenced construction after January 8, 2014	Cogen Units (stationary combustion turbine with duct burners)
40 CFR Part 63 - National Emission Standards for Hazardous Air Pollutants for Source Categories		
Subpart A – General Provisions	Facilities subject to subsequent subparts of 40 CFR Part 63	Control of HAP emissions from: • Organic Liquid Distribution: NESHAP subpart EEEE • Turbines – NESHAP subpart YYYY • Engines – NESHAP subpart ZZZZ
Subpart EEEE: National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (OLD)(Non-Gasoline)	OLD operation affected sources not subject to another part 63 standard and containing 5 percent by weight or greater of an organic HAP listed in Table 1 to subpart EEEE	Methanol system including storage vessels, transfer racks, equipment leak components, and transfer vehicles in ethylene manufacturing line
Subpart ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines	Stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions	Fire pump and emergency generator engines

3.2.1.3 Subpart JJJJ - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

The provisions of this subpart are applicable to owners and operators of stationary spark ignition (SI) ICE, that commenced construction, modification, or reconstruction on or after July 1, 2008. For the purposes of this subpart, the date that construction commences is the date the engine is ordered by the owner or operator.

Subpart JJJJ establishes NO_X, CO, and VOC emission standards for stationary SI ICE, depending on the use of the engine (*i.e.,* emergency or non-emergency), fuel, manufacture date, and the maximum engine power. The applicable emissions standards are summarized in Table 1 of NSPS subpart JJJJ. Requirements for performance testing for demonstration of compliance are captured in Table 2 to subpart JJJJ of part 60.

The proposed Project includes a total of four spark ignition emergency use engines. Three of the proposed engines are affected facilities per 40 CFR §60.4230(a)(5) and (6). The fourth engine, PGT BGTC backup emergency engine, rated 201 BHP, was manufactured prior to December 2005, therefore, this engine is not a subpart JJJJ affected facility. Shell will comply with the emissions standards, testing, monitoring, recordkeeping and reporting requirements of subpart JJJJ for the affected engines.

3.2.1.4 Subpart TTTT - Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

The provisions of this subpart are applicable to owners and operators of fossil fuel-fired electric generating units (EGUs) that commenced construction after January 8, 2014. For the purposes of this subpart, the date that construction commences is the date the EGU is ordered by the owner or operator.

Subpart TTTT establishes CO_2 emission standards for EGUs, depending on the use and size of the EGU. The applicable emissions standard of Table 2 to subpart TTTT of part 60 is 1,000 lb CO2/MWh of gross energy output.

The proposed Project includes a design change to three cogen units including combustion turbines with duct burners. These are affected facilities per 40 CFR §60.5509(a)(1) and (2). Shell will comply with the emissions standards, monitoring, recordkeeping and reporting requirements of subpart TTTT for the affected EGUs.

3.2.2 40 CFR Part 63: National Emissions Standards for Hazardous Air Pollutants for Source Categories (NESHAP)

40 CFR Part 63 contains the National Emission Standards for Hazardous Air Pollutants (NESHAP) established pursuant to section 112 of the Act as amended November 15, 1990.

These standards regulate specific categories of stationary sources that emit (or have the potential to emit) one or more hazardous air pollutants listed in this part pursuant to section 112(b) of the Act.

3.2.2.1 40 CFR Part 63, Subpart A - General Provisions

The general provisions in 40 CFR 63 Subpart A are applicable to stationary and area sources with facilities subject to any standard promulgated under 40 CFR Part 63. The following sources that are a part of the proposed Project are subject to relevant subparts of 40 CFR Part 63:

- Organic Liquid Distribution (non-gasoline) - Subpart EEEE
- Reciprocating Internal Combustion Engines - Subpart ZZZZ.

In general, Subpart A contains requirements related to notification, recordkeeping, monitoring, and performance testing.

3.2.2.2 40 C.F.R. Part 63, Subpart EEEE - National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline)

40 CFR 63 subpart EEEE, the organic liquid distribution (OLD) MACT establishes emission limitations, operating limits, and work practice standards for hazardous air pollutants (HAP) emitted from organic liquids distribution (OLD) (non-gasoline) operations at major sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations, operating limits, and work practice standards. Subpart EEEE is applicable to OLD operation affected sources that were constructed, reconstructed, or existing after February 3, 2004.

The OLD operations that are subject to the subpart EEEE requirements are as follows:

- Storage tanks storing organic liquids.
- Transfer racks at which organic liquids are loaded into or unloaded out of transport vehicles and/or containers.
- Equipment leak components in organic liquids service that are associated with:
    - Storage tanks storing organic liquids;
    - Transfer racks loading or unloading organic liquids;
    - Pipelines that transfer organic liquids directly between two storage tanks that are subject to this subpart;
    - Pipelines that transfer organic liquids directly between a storage tank subject to this subpart and a transfer rack subject to this subpart; and
- Pipelines that transfer organic liquids directly between two transfer racks that are subject to this subpart.
- Transport vehicles while they are loading or unloading organic liquids at transfer racks subject to this subpart.
- All containers while they are loading or unloading organic liquids at transfer racks subject to this subpart.

All of the proposed Project's operations, which are not already subject to the requirements of any other part 63 standard, that are in organic liquid service (*i.e.,* contain 5 percent by weight or greater of an organic HAP listed in Table 1 to subpart EEEE) will be subject to and comply with the applicable requirements of subpart EEEE.

3.2.2.3 40 C.F.R. Part 63, Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

40 CFR 63 subpart ZZZZ establishes emission limitations and operating limitations for HAPs emitted from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations.

As part of the proposed Project, Shell is proposing the addition of two emergency CI RICE, and four additional emergency SI RICE. All but one of the additional engines are subject to either NSPS subparts IIII and JJJJ. Per 40 CFR §63.6590(c), Shell will comply with the requirements of subparts IIII and JJJJ to meet the requirements of subpart ZZZZ.

As noted in Section 3.2.1.3, the PGT BGTC backup emergency engine, which is rated at 210 BHP is not subject to NSPS subpart JJJJ. Therefore, Shell will comply with the provision of subpart ZZZZ by complying with the requirements for equipment design/operation, testing, recordkeeping and reporting.

4.0 Control Technology Analysis

Based on discussions with PaDEP, the following control technology analyses are provided for the equipment additions that are not in a previously evaluated class or category.

4.1 Small Diesel Engines

As part of the proposed Project, two additional emergency diesel-fired engines will be installed. The rated output of the proposed engines will be 103 BHP/77 kW and 67 BHP/50 kW. Both engines will be CI ICE with a per cylinder volume displacement less than 10 liters. As noted in Section 3.2.1, emissions for this type of CI ICE are subject to NSPS subpart IIII standards for NOx, non-methane hydrocarbons (NMHC), CO, and PM emissions. The applicable emissions standards for these engine categories are presented Table 4-1. As shown, the NSPS standards for NOx and VOC are in the form of a combined standard, NOx+NMHC.

Table 4-1. NSPS Emissions Standards Applicable to the Diesel Engines[10]

Pollutant	Parking Garage Elevator/Lighting (77 kW)		Telecom Hut & Tower (50 kW)	
	(g/kw-hr)	(g/hp-hr)	(g/kw-hr)	(g/hp-hr)
NOx+NMHC	4.0	3.0	4.7	3.5
CO	5.0	3.7	5.0	3.7
PM	0.30	0.22	0.40	0.30

The following subsections present the NO_X+NMHC (VOC), CO, and PM emissions control technology analyses for the proposed emergency diesel-fired engines rated at 77 kW and 50 kW.

4.1.1 Small Diesel Engines NO_X and VOC LAER Analysis

The proposed Project will be at an existing major stationary source located in an area that is designated as nonattainment for ozone. nitrogen oxides (NO_X) and Volatile organic compounds (VOC) are defined as precursor to the formation of ozone. A LAER analysis is provided for NO_X+VOC emissions from the proposed diesel-fired engines. The area is designated as attainment/unclassified for nitrogen dioxide (NO_2). Therefore, a BACT analysis is provided for NO_2 emissions from the proposed engines. For purposes of these analyses, the more stringent LAER methodology is followed to meet the criteria for both the LAER and BACT analysis.

[10] By reference in NSPS subpart IIII, the Tier 3 emission standards at 40 CFR §89.112 apply to these emergency diesel-fired engines.

4.1.1.1 Step 1: Identity Small Diesel Engines NOx & VOC Controls

Control options for small diesel engines were identified by reviewing information contained in the following sources:

- 40 CFR 60, subpart IIII requirements.
- Technologies applied to the same class or category of source as determined by a search of RBLC database for process #17.210 "Small (<500 HP) fuel oil-fired (ASTM #1,2, includes kerosene, aviation, diesel fuel) ICE."
- Technologies that could reasonably be applied to this source type via technology transfer.

LAER/BACT permit limits must be at least as stringent as the applicable NSPS standards. As noted in Section 3.2.1.2, CI ICE that commenced construction, modification, or reconstruction on or after July 11, 2005 are subject to the NSPS subpart IIII standards:

- For engines rated 37 kW or higher but less than 75 kW (the 50 kW engine under review)
  - 3.5 g/hp-hr of NOx + NMHC
- For engines rated 75 kW or higher but less than 130 kW (the 77 kW engine under review)
  - 3.0 g/hp-hr of NOx + NMHC

These standards constitute the basis for this analysis. Table 4-2 presents a summary of the most recent permit determinations listed in the RBLC database. As shown, the technologies and emission limits identified by the RBLC search are consistent with NSPS subpart IIII. For this category of engine, the use of certified engines, good design (turbocharger and an intercooler/aftercooler), good combustion, operation, and maintenance practices; and compliance with NSPS subpart IIII are used to meet BACT/LAER requirements.

Lastly, additional controls that are applied to the control of NOx and CO from other types of combustion sources (e.g. larger engines, boilers, turbines) were evaluated. Selective Catalytic Reduction (SCR) for the control of NO_X emissions, and oxidation catalyst for the control of VOC are the top ranked technology to reduce emissions of NO_X and VOC used in larger engines.

4.1.1.2 Step 2: Eliminate Technically Infeasible NO_X and VOC Control Option

All NO_X and VOC control options identified in the RBLC search are considered technically feasible. The use of SCR and oxidation catalyst are considered to be technically feasible for engines that operate continuously but are not considered to be technically feasible for engines in emergency service due to their limited operation. Emergency engines are on standby and are not continuously running. To ensure engines are kept in good working order, they are operated for short and infrequent periods of time (less than one hour/week). The short duration of the engine's operation does not provide adequate time for an SCR or oxidation catalyst to reach their required operating temperature where a practical level of emissions reductions can be achieved. Thus, these technologies are not considered to be viable options and removed from further consideration.

Table 4-2. RBLC Summary of NO_X and VOC Precedents for Fuel Oil[1] Emergency Compression Ignition Engines < 500 HP

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	NO_X Limit	VOC Limit	Basis
TX-0846	Motor Vehicle Assembly Plant	9/23/2018	Fire Pump Diesel Engine	214 kW	Meets EPA Tier 4 requirements	0.4 g/kW-hr (0.3 g/hp-hr)	0.19 g/kW-hr (0.14 g/hp-hr)	BACT-PSD
OH-0376	Ironunits LLC – Toledo HBI	2/9/2018	Emergency Diesel-Fueled Fire Pump	250 HP	Compliance with 40 CFR Part 60, Subpart IIII	4.0 g/kW-hr NO_X+NMHC (3.0 g/hp-hr)		BACT-PSD
CA-1217	BEA San Diego Ship Repair	8/23/2012	Internal Combustion Engine	450 BHP	Not specified. SCR determined not feasible due to too low exhaust temperature	1.8 g/kW-hr (~1.3 g/hp-hr)	-	Other Case by Case
OH-0377	Harrison Power	4/19/2018	Emergency Fire Pump	320 HP	Good combustion practices (ULSD) and compliance with 40 CFR Part 60, Subpart IIII	4.0 g/kW-hr NO_X+NMHC (3.0 g/hp-hr)		BACT-PSD
LA-0308	Morgan City Power Plant	9/26/2013	Firewater Pump Engine	380 HP	Good combustion and maintenance practices, and compliance with NSPS 40 CFR 60 Subpart IIII	2.92 lb/hr (2.2 g/bhp-hr)	-	BACT-PSD
NY-0103	Cricket Valley Energy Center	2/6/2016	Emergency Fire Pump	460 HP	Vendor emission certification and adherence to vendor-specified maintenance recommendations.	2.6 g/bhp-hr	0.1 g/bhp-hr	LAER
PA-0278	Moxie Liberty LLC, Asylum Power PLT	10/10/2012	Fire Pump Engine	460 HP	Not specified	2.6 g/bhp-hr	0.1 g/bhp-hr	Other Case by Case
PA-0286	Moxie Energy LLC Patriot Generation PLT	1/31/2013	Fire Pump Engine	460 HP	Not specified	2.6 g/bhp-hr	0.1 g/bhp-hr	Other Case by Case
PR-0009	Energy Answers Arecibo Puerto Rico Renewable Energy Project	4/10/2014	Emergency Diesel Fire Pump	335 BHP	Not specified	2.85 g/bhp-hr	0.15 g/bhp-hr	BACT-PSD
IN-0179	Ohio Valley Resources, LLC	8/12/2014	Diesel-fired emergency water pump	481 BHP	Good combustion practices	2.86 g/bhp-hr	0.141 g/bhp-hr	BACT-PSD

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	NO_X Limit	VOC Limit	Basis
MD-0041	CPV St. Charles	4/23/2014	Emergency Diesel Engine for Fire Water Pump	300 HP	Exclusive use of ULSD fuel, good combustion practices, and limiting the hours of operation	3.0 g/hp-hr	-	LAER
PA-0310	CPV Fairview Energy Center	9/2/2016	Emergency Fire Pump Engine		Not specified	3.0 g/hp-hr	-	LAER
IN-0158	St. Joseph Energy Centre, LLC	12/3/2012	Firewater Pump Engines	371 HP (each)	Combustion design controls and usage limits	3.0 g/hp-hr	0.16 lb/hr	BACT-PSD
CA-1192	Avenal Energy Project	6/21/2011	Emergency Fire Pump Engine	288 HP	Equipped w/ a turbocharger and an intercooler/aftercooler	3.4 g/hp-hr	-	BACT-PSD
IL-0114	Cronus Chemical, LLC	9/5/2014	Firewater Pump Engine	373 HP	Tier IV standards for non-road engines at 40 CFR 1039.102, Table 7.	3.5 g/kW-hr	0.4 g/kW-hr	BACT-PSD
OH-0352	Oregon Clean Energy Center	6/18/2013	Emergency Fire Pump Engine	300 HP	Purchased certified to the standards in NSPS Subpart IIII	3.5 g/kW-hr	0.5 g/kWh-hr	BACT-PSD
IN-0234	Grain Processing Corporation	12/8/2015	Emergency Fire Pump Engine	425 HP	Good combustion practices	9.5 g/hp-hr	0.05 g/hp-hr	BACT-PSD

[1] ASTM #1,2, includes kerosene, aviation, diesel fuel.

This conclusion is consistent with the results of the RBLC database information summarized in Table 4-2.

4.1.1.3 Step 3: Establish Small Diesel Engines NO_X and VOC LAER

For any of the emergency diesel engines (*i.e.,* electric generating), the top-ranked control option for NOx and VOC emissions comprises use of combustion control techniques. For the proposed emergency generator diesel engines, the most stringent level of control achieved in practice is the Tier 2 emission standard for non-road, compression-ignition engines, as codified at 40 CFR § 89.112. This level of control will result in total NOx + VOC emissions of 0.05 tons per year from the two proposed emergency diesel engines with each engine operating 100 hours per year.

As LAER for the proposed emergency diesel engines, the following limits are proposed for NOx+VOC:

- Parking Garage Elevator/Lighting Emergency Generator (77kW): 2.37 g/bhp-hr
- Telecom Hut & Tower Emergency Generator (50kW): 2.83 g/bhp-hr

The higher emissions rate achievable for the smaller, 50 kW Telecom Hut & Tower Generator is consistent with the different NSPS standard for small engines. Compliance with these limits will be based on the purchase of certified engines and following the manufacturer's operation/maintenance procedures.

As shown in Table 4-2, there is one permit precedent for an emergency generator with NOx+VOC emissions limits more stringent than the proposed limits of 2.37 g/hp-hr for the Parking Garage Elevator/Lighting Emergency Generator, the TX-0846 precedent. Based on a review of the permit files for this project, it was determined that the facility withdrew the permit for this project and these emergency engines were never installed. As a result, because this precedent has not been achieved in practice it is removed from consideration.

As shown in Table 4-2, there are three additional precedents for emergency engines with NOx+VOC emissions limits that are more stringent than the proposed limit of 2.83 g/hp-hr for the Telecom Hut & Tower Emergency Generator, NY-103, PA-0278, and PA-0286. These precedents, which each have NOx+VOC emissions limits of 2.7 g/hp-hr are for engines that are much larger (*i.e.,* 460 bhp) versus the proposed Telecom Hut & Tower Emergency Generator's engine, 67 bhp. As noted above, the NSPS standards provide for a higher emission standard for smaller engines such as the Telecom Hut & Tower Emergency Generator's engine. As a result, the three more stringent precedents are considered to be in a different class of category than the proposed Project's engines. As a result, these precedents are removed from consideration.

The proposed emission limits for the small emergency diesel engines must meet two criteria to be considered LAER. The first criterion requires that the LAER limit be the most stringent

emission limitation that is contained in the implementation plan of a state (SIP). The second criterion requires that the LAER limit be achievable in practice.

To meet the first criterion, a review of states and agencies that would be most likely to have stringent emission limits contained in their SIP was performed. A summary of the results from this review is presented in Table 4-3. As shown, the South Coast Air Quality Management District (AQMD) and California Air Resource Board (CARB) require achievement of NOx+VOC emission standards that are less stringent than the proposed LAER. Based on the above discussion, the second criterion is met because no site with a more stringent limit was identified which was in the same class or category and has been operated in compliance.

In accordance with 25 Pa. Code §127.205(7), the proposed NOx and VOC LAER limit is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

The proposed LAER limits will result in a total of 0.05 tons per year of NO_X emissions and < 0.01 tons per year of VOC emissions for the two additional small diesel engines with each engine operating 100 hours per year. Compliance with these limits will be based on the use of certified engines, good design (turbocharger and an intercooler/aftercooler), good combustion, operation, and maintenance practices; and compliance with NSPS subpart IIII.

4.1.2 Small Diesel Engines PM/PM_{10}/$PM_{2.5}$ BACT/LAER Analysis

Emissions of particulate from diesel engines result from the inert solids contained in the combustion air and unburned fuel hydrocarbons resulting from incomplete combustion, which agglomerate to form particles and condensable organic and inorganic compounds (e.g., sulfuric acid mist). For PM and PM_{10} a BACT analysis is presented in accordance with the five-step BACT methodology. For PM2.5 a LAER analysis is presented. Because the first two steps in both the LAER and BACT methodologies are similar (*i.e.,* identify potentially applicable controls and then eliminate technically infeasible controls), a combined analysis is presented for the first two steps.

4.1.2.1 Step 1: Identify Small Diesel Engines PM/PM_{10}/$PM_{2.5}$ Controls

Control options for small diesel engines were identified by reviewing information from the following sources:

- 40 CFR 60, subpart IIII requirements.
- Technologies applied to the same class or category of source as determined by a search of RBLC database for process #17.210 “Small (<500 HP) fuel oil-fired (ASTM #1,2, includes kerosene, aviation, diesel fuel) ICE.”
- Technologies that could reasonably be applied to this source type via technology transfer.

Table 4-3. Regulatory Agencies with NO_X and VOC Guidelines/Requirements for Emergency Compression Ignition ICE

Regulatory Agency	Description	Emission Limit	Reference
South Coast Air Quality Management District	Compression Ignition, Other (non-fire water pump)	50 ≤ HP < 100 4.7 g/kW-hr (3.5 g/bhp-hr) NO_X + NMHC	Compliance with SCAQMD Rule 1470
		100 ≤ HP < 750 4.0 g/kW-hr (3.0 g/bhp-hr) NO_X + NMHC	
California Air Resource Board (CARB)	Heavy-Duty Off-Road Diesel Cycle Engines	50 ≤ HP < 100 4.7 g/kW-hr (3.5 g/bhp-hr) NO_X + NMHC	CCR 2423
		100 ≤ HP < 450 4.0 g/kW-hr (3.0 g/bhp-hr) NO_X + NMHC	
New Jersey Department of Environment Protection	Liquid Fuel (No. 2, Diesel or Kerosene)	SOTA for an emergency generator application meeting the definition found at N.J.A.C. 7:27-19.1, "emergency generator," is no auxiliary air pollution control.	State of the Art (SOTA) Manual for Reciprocating Internal Combustion Engines (2003)[1]

1. https://www.state.nj.us/dep/aqpp/sota.html

LAER/BACT permit limits must be at least as stringent as applicable NSPS limits. As noted in Section 3.2.1.2, CI ICE that commenced construction, modification or reconstruction on or after July 11, 2005 are subject to NSPS subpart IIII standards:

- For engines rated 37 kW or higher but less than 75 kW
  - 0.30 g/hp-hr of PM
- For engines rated 75 kW or higher but less than 130 kW:
  - 0.22 g/hp-hr of PM

Subpart IIII does not include emissions standards for PM_{10} or $PM_{2.5}$.

Table 4-4 summarizes the most recent permit determinations listed in the RBLC database. As shown, for this engine category, the use of certified engines, good design (turbocharger and an intercooler/aftercooler), good combustion, operation, and maintenance practices; use of low sulfur fuels (e.g., ultra-low sulfur diesel), and compliance with NSPS subpart IIII are used to meet BACT/LAER requirements.

Lastly, the review of additional controls that are applied to the control of $PM/PM_{10}/PM_{2.5}$ from other types of combustion sources (e.g., larger engines, boilers, turbines) resulted in no feasible technology.

4.1.2.2 Step 2: Eliminate Technically Infeasible $PM/PM_{10}/PM_{2.5}$ Control Option

All of the $PM/PM_{10}/PM_{2.5}$ control options identified through a review of the RBLC database are considered technically feasible.

4.1.2.3 Step 3: Establish Small Diesel Engines $PM_{2.5}$ LAER

As LAER for the proposed emergency diesel engines, the following limits are proposed for $PM_{2.5}$:

- Parking Garage Elevator/Lighting Emergency Generator (77kW): 0.06 g/bhp-hr
- Telecom Hut & Tower Emergency Generator (50kW): 0.22 g/bhp-hr

The higher emissions rate achievable for the smaller, 50 kW Telecom Hut & Tower Generator is consistent with the different NSPS standard for small engines. Compliance with these limits will be based on the purchase of certified engines and following the manufacturer's operation/maintenance procedures.

The proposed emission limits for the small emergency diesel engines must meet two criteria to be considered LAER. The first criterion requires that the LAER limit be the most stringent emission limitation that is contained in a SIP. The second criterion requires that the LAER limit be achievable in practice.

To meet the first criterion, a review of the states and agencies most likely to have the most stringent emissions limits contained in their SIP was completed. Table 4-5 presents a summary of the results from this review. As shown, no SIP requirements related to PM2.5 emissions from small diesel engines were identified. And the most stringent SIP requirement identified for PM was an emissions requirement of 0.15 g/bhp-hr for PM (filterable). As a result, it is assumed that the first criterion is met.

To meet the second criterion, that the LAER be achievable in practice, a review of RBLC database was used. Based on this review, the use of certified engines, good design (turbocharger and an intercooler/aftercooler), and good combustion, operation, and maintenance practices are the top-ranked control option for $PM_{2.5}$ emissions. As shown in Table 4-4, there is one precedent that is more stringent than the proposed LAER for the Parking Garage Elevator/Lighting Emergency Generator, TX-0846. As previously noted in Section 4.1.1.3, this facility was never constructed, so this precedent is eliminated from consideration.

As shown in Table 4-4, there are additional precedents for emergency engines with $PM_{2.5}$ emissions limits that are more stringent than the proposed limit of 0.22 g/hp-hr for the Telecom Hut & Tower Emergency Generator. However, all of these precedents are for engines which are much larger than the Telecom Hut & Tower Emergency Generator engine which is only 50 BHP. As noted above, the NSPS standards provide for a higher emission standard for smaller engines such as the Telecom Hut & Tower Emergency Generator's engine. As a result, the more stringent precedents are considered to be in a different class or category than the proposed Project's engines and these precedents are removed from consideration.

With this proposal, the first criterion necessary for LAER demonstration is met, because no more stringent $PM_{2.5}$ limit was identified in a SIP. The second criterion is met because the proposed limits are the most stringent limits that have been achieved in practice.

In accordance with 25 Pa. Code §127.205(7), the proposed $PM_{2.5}$ LAER is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.1.2.4 Step 3: Ranking of Technically Feasible PM/PM_{10} BACT Control Technologies

For all identified small emergency diesel engines, the top-ranked feasible and applicable control options for PM and PM_{10} emissions comprises the use of certified engines, good design (turbocharger and an intercooler/aftercooler), good combustion, operation, and maintenance practices; and compliance with NSPS subpart IIII.

With this application, Shell is proposing to use ultra-low sulfur diesel as the only fuel for the two CI ICE included in the proposed Project and use of good combustion, operation and maintenance practices.

Table 4-4. RBLC Summary of $PM/PM_{10}/PM_{2.5}$ Precedents for Fuel Oil[1] Emergency Compression Ignition Engines < 500 HP

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	$PM_{2.5}$ Limit	PM_{10} Limit	PM Limit	Basis
OH-0379	Petmin USA Incorporated	2/6/19	Black Start Generator	158 HP	Tier IV engine. Tier IV NSPS standards certified by engine manufacturer.	0.015 g/bhp-hr PM (PM_{10} + $PM_{2.5}$)			BACT-PSD
TX-0846	Motor Vehicle Assembly Plant	9/23/18	Fire Pump Diesel Engine	214 kW	Meets EPA Tier 4 requirements	0.02 g/kW-hr (~0.015 g/bhp-hr)	0.02 g/kW-hr (~0.015 g/bhp-hr)	-	BACT-PSD
NY-0103	Cricket Valley Energy Center	2/6/16	Emergency Fire Pump	460 HP	Vendor emission certification and adherence to vendor-specified maintenance recommendations.	-	-	0.087 g/bhp-hr	BACT-PSD
PA-0278	Moxie Liberty LLC, Asylum Power PLT	10/10/12	Fire Pump Engine	460 HP	Not specified	0.09 g/bhp-hr	0.09 g/bhp-hr	-	Other Case by Case
PA-0286	Moxie Energy LLC Patriot Generation PLT	1/31/13	Fire Pump Engine	460 HP	Not specified	0.09 g/bhp-hr	0.09 g/bhp-hr	-	Other Case by Case
IN-0158	St. Joseph Energy Centre, LLC	12/3/12	Firewater Pump Engines	371 HP (each)	Combustion design controls and usage limits	0.09 g/bhp-hr	0.15 g/bhp-hr	-	BACT-PSD
IL-0114	Cronus Chemical, LLC	9/5/14	Firewater Pump Engine	373 HP	Tier IV standards for non-road engines at 40 CFR 1039.102, Table 7.	0.1 g/kW-hr (~0.07 g/hp-hr)	0.1 g/kW-hr (~0.07 g/hp-hr)	-	BACT-PSD
PA-0310	CPV Fairview Energy Center	9/2/16	Emergency Fire Pump Engine		Not specified	-	-	0.15 g/bhp-hr	LAER
PR-0009	Energy Answers Arecibo Puerto Rico Renewable Energy Project	4/10/14	Emergency Diesel Fire Pump	335 BHP	Not specified	0.15 g/bhp-hr	0.15 g/bhp-hr	0.15 g/bhp-hr	BACT-PSD

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	$PM_{2.5}$ Limit	PM_{10} Limit	PM Limit	Basis
LA-0308	Morgan City Power Plant	9/26/13	Firewater Pump Engine	380 HP	Good combustion and maintenance practices, and compliance with NSPS 40 CFR 60 Subpart IIII	0.15 lb/hr (~0.18 g/hp-hr)	0.15 lb/hr (~0.18 g/hp-hr)	-	BACT-PSD
IN-0179	Ohio Valley Resources, LLC	8/12/14	Diesel-fired emergency water pump	481 BHP	Good combustion practices	0.15 g/bhp-hr	0.15 g/bhp-hr	0.15 g/bhp-hr	BACT-PSD
MD-0041	CPV St. Charles	4/23/14	Emergency Diesel Engine for Fire Water Pump	300 HP	Exclusive use of ULSD fuel, good combustion practices, and limiting the hours of operation	-	0.15 g/bhp-hr	0.15 g/bhp-hr	BACT-PSD
IN-0234	Grain Processing Corporation	12/8/15	Emergency Fire Pump Engine	425 HP	Good combustion practices	-	0.16 g/bhp-hr	0.16 g/bhp-hr	BACT-PSD
OH-0376	Ironunits LLC – Toledo HBI	2/9/18	Emergency Diesel-Fueled Fire Pump	250 HP	Compliance with 40 CFR Part 60, Subpart IIII	0.18 g/bhp-hr	0.18 g/bhp-hr	-	BACT-PSD
OH-0377	Harrison Power	4/19/18	Emergency Fire Pump (P004)	320 HP	Good combustion practices (ULSD) and compliance with 40 CFR Part 60, Subpart IIII	0.20 g/kW-hr (0.15 g/bhp-hr)			BACT-PSD
OH-0352	Oregon Clean Energy Center	6/18/13	Emergency Fire Pump Engine	300 HP	Purchased certified to the standards in NSPS Subpart IIII	0.20 g/kW-hr (0.15 g/bhp-hr)			BACT-PSD

[1] ASTM #1,2, includes kerosene, aviation, diesel fuel.

Table 4-5. Regulatory Agencies with $PM_{2.5}$ Guidelines/Requirements for Emergency Compression Ignition ICE

Regulatory Agency	Description	Emission Limit	Reference
South Coast Air Quality Management District	Compression Ignition, Other (non-fire water pump)	50 < HP < 175 Compliance with SCAQMD Rule 1470 0.15 g/bhp-hr) PM (filterable only)	SCAQMD Rule 1470 Table 1
		175 ≤ HP < 750 (0.01 g/bhp-hr) PM (filterable only)	
		> 750 0.02 g/bhp-hr PM (filterable only)	
California Air Resources Board	Heavy-Duty Off-Road Diesel Cycle Engines	50 ≤ HP < 175 0.15 g/bhp-hr PM (filterable only)	CC Regulations: section 93115
New Jersey Department of Environment Protection	Liquid Fuel (No. 2, Diesel or Kerosene)	SOTA for an emergency generator application meeting the definition found at N.J.A.C. 7:27-19.1, "emergency generator," is no auxiliary air pollution control.	State of the Art (SOTA) Manual for Reciprocating Internal Combustion Engines (2003)1

1. https://www.state.nj.us/dep/aqpp/sota.html

4.1.2.5 Step 4: Evaluate PM/PM_{10} Control Options

Step 4 of the BACT analysis documents the energy, environmental, and economic impacts associate with applying the selected control technology. Shell is proposing the use of the top control options; therefore, these analyses are not necessary.

4.1.2.6 Step 5: Propose Small Diesel Engines PM/PM_{10} BACT Limit

Shell is proposing the use of ultra-low sulfur diesel and good combustion practices to achieve the following BACT limits:

- Parking Garage Elevator/Lighting Emergency Generator (77kW): 0.06 g/bhp-hr
- Telecom Hut & Tower Emergency Generator (50kW): 0.22 g/bhp-hr

Compliance with these limits will be based on the purchase of certified engines and following the manufacturer's operation/maintenance procedures.

In accordance with 25 Pa. Code §127.205(7), the proposed PM/PM_{10} BACT is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.1.3 Small Diesel Engine Carbon Monoxide BACT Analysis

Carbon monoxide (CO) is a product of incomplete combustion. The formation of this pollutant is limited by ensuring complete and efficient combustion of the fuel in the engine. High combustion temperatures, adequate excess air and good air/fuel mixing during combustion minimize CO emissions. Measures taken to minimize the formation of NO_X during combustion may inhibit complete combustion, which could increase CO emissions. For CO, the analysis is presented in accordance with the five-step BACT methodology.

4.1.3.1 Step 1: Identify Small Diesel Engines CO Controls

Control options for small diesel engines were identified by reviewing information from the following sources:

- 40 CFR 60, subpart IIII requirements.
- Technologies applied to similar type sources in practice as determined by a search of the RBLC database for process #17.210 "Small (<500 HP) fuel oil-fired (ASTM #1,2, includes kerosene, aviation, diesel fuel) ICE."
- Technologies that could reasonably be applied to this source type via technology transfer.

BACT permit limits must be at least as stringent as an applicable NSPS limits. As noted in Sections 3.2.1.2, CI ICE that commenced construction, modification or reconstruction on or after July 11, 2005 are subject to NSPS subpart IIII standards:

- For engines rated 37 kW or higher but less than 75 kW
  - 3.7 g/hp-hr of CO
- For engines rated 75 kW or higher but less than 130 kW:
  - 3.7 g/hp-hr of CO

These standards constitute the basis for this analysis. Technologies and emission limits identified through a search of the RBLC database are consistent with NSPS subpart IIII. A summary of the most recent permit determinations listed in the RBLC database is presented in Table 4-6. As shown, for this engine category, the use of certified engines, good design (turbocharger and an intercooler/aftercooler), good combustion, operation, and maintenance practices; and compliance with NSPS subpart IIII are used to comply with the identified BACT precedents.

Additional controls that are applied to the control of CO from other types of combustion sources (e.g. larger engines, boilers, turbines) were also evaluated. Oxidation catalyst is the top ranked technology to reduce emissions of CO used in larger engines that operate continuously.

4.1.3.2 Step 2: Eliminate Technically Infeasible

All CO control precedents identified in the RBLC search are technically feasible. The use of oxidation catalyst is considered to be technically feasible for engines that operate continuously but is not considered to be technically feasible for engines in emergency service due to their limited operation. Emergency engines are on standby and not continuously running. To ensure engines are kept in good working order, they are operated for short and infrequent periods of time (less than one hour/week). The short duration of the engine's operation does not provide adequate time for an oxidation catalyst to reach the required operating temperature where a practical level of emissions reductions can be achieved. Thus, this control is eliminated from further consideration. This conclusion is consistent with the findings in the RBLC database review summarized in Table 4-6. As a result, the use of oxidation catalyst is not considered feasible for the Project's emergency engines and eliminated from consideration.

4.1.3.3 Step 3: Ranking of Technically Feasible CO Control Technologies

For all of the identified small emergency diesel engine precedents, the top-ranked feasible and applicable control options for CO emissions was the use of certified engines, good design (turbocharger and an intercooler/aftercooler), good combustion, operation, and maintenance practices; and compliance with NSPS subpart IIII.

4.1.3.4 Step 4: Evaluate CO Control Options

Step 4 of the BACT analysis documents the energy, environmental, and economic impacts associate with applying the selected control technology. Shell is proposing the use of the top control options; therefore, these analyses are not necessary.

Table 4-6. RBLC Summary of CO Precedents for Fuel Oil* Emergency Compression Ignition Engines < 500 HP

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	CO Limit	Basis
CA-1192	Avenal Energy Project	6/21/2011	Emergency Fire Pump Engine	288 HP	Equipped w/ a turbocharger and an intercooler/aftercooler	0.447 g/bhp-hr	BACT-PSD
PA-0278	Moxie Liberty LLC, Asylum Power PLT	10/10/2012	Fire Pump Engine	460HP	Not specified	0.5 g/bhp-hr	Other Case by Case
PA-0286	Moxie Energy LLC Patriot Generation PLT	1/31/2013	Fire Pump Engine	460 HP	Not specified	0.5 g/bhp-hr	Other Case by Case
NY-0103	Cricket Valley Energy Center	2/6/2016	Emergency Fire Pump	460 HP	Vendor emission certification and adherence to vendor-specified maintenance recommendations.	0.53 g/bhp-hr	BACT-PSD
IN-0234	Grain Processing Corporation	12/8/2015	Emergency Fire Pump Engine	425 HP	Good combustion practices	2.01 g/hp-hr	BACT-PSD
OH-0376	Ironunits LLC – Toledo HBI	2/9/2018	Emergency Diesel-Fueled Fire Pump	250 HP	Compliance with 40 CFR Part 60, Subpart IIII	3.5 g/kW-hr (2.6 g/hp-hr)	BACT-PSD
OH-0377	Harrison Power	4/19/2018	Emergency Fire Pump	320 HP	Good combustion practices (ULSD) and compliance with 40 CFR Part 60, Subpart IIII	3.5 g/kW-hr (2.6 g/hp-hr)	BACT-PSD
PR-0009	Energy Answers Arecibo Puerto Rico Renewable Energy Project	4/10/2014	Emergency Diesel Fire Pump	335 BHP	Not specified	2.6 g/bhp-hr	BACT-PSD
IN-0179	Ohio Valley Resources, LLC	8/12/2014	Diesel-fired emergency water pump	481 BHP	Good combustion practices	2.6 g/bhp-hr	BACT-PSD
MD-0041	CPV St. Charles	4/23/2014	Emergency Diesel Engine for Fire Water Pump	300 HP	Use of ULSD fuel, good combustion practices	2.6 g/bhp-hr	BACT-PSD

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	CO Limit	Basis
PA-0310	CPV Fairview Energy Center	9/2/2016	Emergency Fire Pump Engine		Not specified	2.61 g/bhp-hr	LAER
IN-0158	St. Joseph Energy Centre, LLC	12/3/2012	Firewater Pump Engines	371 HP (each)	Combustion design controls and usage limits	2.6 g/bhp-hr	BACT-PSD
IL-0114	Cronus Chemical, LLC	9/5/2014	Firewater Pump Engine	373 HP	Tier IV standards for non-road engines at 40 CFR 1039.102, Table 7.	3.5 g/kW-hr (~2.6 g/hp-hr)	BACT-PSD
OH-0352	Oregon Clean Energy Center	6/18/2013	Emergency Fire Pump Engine	300 HP	Purchased certified to the standards in NSPS Subpart IIII	3.5 g/kW-hr (~2.6 g/hp-hr)	BACT-PSD
TX-0846	Motor Vehicle Assembly Plant	9/23/2018	Fire Pump Diesel Engine	214 kW	Meets EPA Tier 4 requirements	3.58 g/kW-hr (~2.67 g/hp-hr)	BACT-PSD
OH-0379	Petmin USA Incorporated	2/6/2019	Black Start Generator (P007)	158 HP	Tier 4 NSPS standards certified by engine manufacturer.	3.7 g/bhp-hr	-

4.1.3.5 Step 5: Propose Small Diesel Engine CO BACT Limit

The Project's small diesel engines will be certified by the equipment manufacturer to meet the Tier 3 emission standards for nonroad, compression ignition engines (3.7 g/bhp-hr), as codified at Subpart IIII of 40 CFR part 60 and 40 CFR § 89.112. Due to the very low annual emissions from these sources, the fact that they will operate as non-emergency engines only intermittently, the availability of engines that are certified to achieve this emission level, and the nature of the certification test procedure for the nonroad engine emission standards, Shell is proposing the use of good combustion, operation and maintenance practices to achieve BACT limits as follows:

- Parking Garage Elevator/Lighting Emergency Generator (77kW): 0.5 g/bhp-hr
- Telecom Hut & Tower Emergency Generator (50kW): 0.67 g/bhp-hr

In accordance with 25 Pa. Code §127.205(7), the proposed CO BACT is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.1.4 Small Diesel Engine GHG BACT Analysis

GHGs emitted by the diesel engines are the same as emitted by other fossil fuel combustion sources: CO_2, CH_4, and N_2O, although the emission factors vary by combustion fuel and combustor type (reciprocating engine versus a combustion turbine or furnace). As is the case for all fossil fuel-fired sources, CO_2 emissions are the dominant contributor to the CO_2e emissions rate. No applicable GHG standards have been promulgated for emergency engines under 40 CFR parts 60 and 61.

4.1.4.1 Steps 1-4: Identify Technically Feasible Controls

The available control techniques for control of GHGs from the diesel engines include:

- Use of low GHG emitting fuels,
- Energy efficiency,
- Good combustion practices (meeting diesel engine NSPS requirements), and
- Carbon capture and sequestration (CCS).

Energy efficiency options for reducing GHG emissions outside of good combustion practices are considered to be technically infeasible because emergency engines typically only operate one hour a month for periodic maintenance and testing to ensure operability. As a result, the engines never reach steady state operation long enough for a heat recovery system to warm up and operate.

Meeting the NSPS Part 60, Subpart IIII emission standards requires the use of good combustion control, thereby minimizing the emissions of methane (CH_4). As is the case for CO and VOC emissions, oxidation catalyst is a potential control option for reducing CH_4 emissions. However, given the much lower emission rate for CH_4 (0.003 kg/mmBtu) relative to CO_2

(73.96 kg/mmBtu), the use of oxidation catalyst would not be cost effective. The use of oxidation catalyst is rejected as BACT based on the previously identified technical feasibility issues and due to its adverse energy impacts, the control system pressure drop, economic impacts, and minimal environmental benefit.

The application of CCS technology to small emergency diesel engines is considered technically impractical. As is the case with a heat recovery system, the small emergency diesel engines do not operate long enough at steady state conditions to effectively capture CO_2 emissions. As such, the use of CCS is rejected as a BACT option for the control of CO_2 for such engines.

4.1.4.2 Step 5: Propose Small Diesel Engine CO_2e/GHG BACT Limits

The small diesel-fired, CI ICE will meet emission standards as codified at Subpart IIII of 40 CFR 60. Due to the very low emissions from these sources, the fact that they will operate only intermittently, the following GHG BACT limits are proposed:

- Small Emergency Diesel Engines: combined emissions of CO_2e from the two small emergency generator engines shall not exceed 10 tons per year on a 12-month rolling average basis.
- Compliance shall be demonstrated using applicable 40 CFR 98 Subpart C factors.

As previously stated, no applicable GHG standards have been promulgated for emergency engines under 40 CFR parts 60 and 61.

In accordance with 25 Pa. Code §127.205(7), the proposed GHG BACT limit is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.2 Small Natural Gas Engines

The proposed Project includes the addition of four natural gas-fired spark ignited emergency engines. The rated output of the four engines ranges between 50 BHP and 210 BHP. As noted in Section 3.2.1.3, the NO_X, CO and VOC emissions from this type of SI ICE are regulated under NSPS subpart JJJJ. Per 40 CFR §60.4233(d) and (e), the emission standards applicable to this engine category are those listed in Table 1 to subpart JJJJ as presented in Table 4-7.

The following subsections present the NOx, CO, VOC, and PM emission control technology analyses for the proposed four additional emergency natural gas-fired engines. For purposes of defining the class or category of each small natural gas engine covered by this control technology analysis, the NSPS size categories presented in Table 4-7 are used (*i.e.,* 25<HP<130 and $\geq$ 130 HP).

Table 4-7. NSPS Subpart JJJJ Standards Applicable to the Proposed SI Engines

Pollutant	Maximum Engine Power 25<HP<130[1]	Maximum Engine Power ≥130 HP	
	(g/hp-hr)	(g/hp-hr)	ppmvd @ 15%O_2
NOx	10[1]	2.0	160
CO	387	4.0	540
VOC	-	1.0	86

[1] Size range have been combined because the emissions standards are the same for 25<HP<100 and 100≤HP<130.
[2] The emission standards applicable to emergency engines between 25 HP and 130 HP are in terms of NO_X + HC.

4.2.1 Small Natural Gas Engine NO_X and VOC LAER Analysis

The proposed Project will be at an existing major stationary source located in an area that is designated as nonattainment for ozone. VOC and NO_X are defined precursors to the formation of ozone. A LAER analysis is provided for VOC and NO_X emissions from the proposed natural gas-fired engines. The area is designated as attainment/unclassified for nitrogen dioxide (NO_2). Therefore, a BACT analysis is provided for NO_2 emissions from the proposed engines. For purposes of these analyses, the more stringent LAER methodology is followed to meet the criteria for both the LAER and BACT analysis.

4.2.1.1 Step 1: Identity Small Natural Gas Engines NOx & VOC Controls

Control options for small natural gas engines were identified by reviewing information from the following sources:

- 40 CFR 60, subpart JJJJ requirements.
- Technologies applied to similar type sources in practice as determined by a search of the RBLC database for process #17.230 "Small (<500 HP) natural gas-fired (includes propane & liquified petroleum gas) ICE."
- Technologies that could reasonably be applied to this source category via technology transfer.

LAER/BACT permit limits must be at least as stringent as an applicable NSPS limits. As noted in Section 3.2.1.3, SI ICE that commenced construction, modification or reconstruction on or after July 1, 2008 are subject to NSPS subpart JJJJ standards:

- For engines rated 25 BHP or higher but less than 130 BHP
  - 10 g/hp-hr of NOx + HC
- For engines rated 130 BHP or higher:
  - 2.0 g/hp-hr of NOx
  - 1.0 g/hp-hr of VOC

These standards constitute the basis for this analysis. Technologies and emission limits identified in the RBLC search are consistent with NSPS subpart JJJJ. **Error! Reference source not found.**A summary of the most recent permit determinations identified in the RBLC database is presented in Table 4-8. As shown, for engines in this category, the use of low carbon/clean fuel (natural gas/propane), good combustion, and operation and maintenance practices, and compliance with NSPS subpart JJJJ are used to comply with the applicable BACT/LAER limits.

Additional controls applied to the control of NOx and CO from other types of combustion sources (e.g., larger engines, boilers, turbines) were identified via technology transfer. Selective Catalytic Reduction (SCR) for the control of NO_X emissions, and oxidation catalyst for the control of VOC are the top ranked technology to reduce emissions of NO_X and VOC from larger engines.

4.2.1.2 Step 2: Eliminate Technically Infeasible NO_X and VOC Control Option

All of the NO_X and VOC control options identified in the RBLC search are considered technically feasible. The use of SCR and oxidation catalyst are considered to be technically feasible for engines that operate continuously. However, SCR and oxidation catalyst are not considered technically feasible for engines in emergency service due to their limited operation. Emergency engines are on standby and not continuously running. To ensure these engines are kept in good working order, they are operated for short and infrequent periods of time (less than one hour/week). The short duration of the engine's operation would not provide adequate time for an SCR or oxidation catalyst to reach their required operating temperatures where a practical level of emissions reductions could be achieved. Thus, these technologies are not considered viable. This conclusion is consistent with the findings in the RBLC database review summarized in Table 4-8. As a result, the use of SCR and oxidation catalyst is not considered feasible and eliminated from further consideration.

4.2.1.3 Step 3: Establish Small Natural Gas Engines NO_X and VOC LAER

For any of the small natural gas engines (*i.e.,* electric generating or pumping), the top-ranked control option for NOx and VOC emissions comprises use of combustion control techniques.

The proposed emission limits for the small emergency natural gas engines must meet two criteria to be considered LAER. The first criterion requires that the LAER meets the most stringent emission limitation that is contained in the implementation plan of a state or agency (SIP). The second criterion requires that the LAER be achievable in practice.

Table 4-8. RBLC Summary of NO_X and VOC Precedents for Natural Gas Emergency Spark Ignition Engines < 500 HP

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	NO_X Limit	VOC Limit	Basis
IN-0167	Magnetation LLC	4/16/2013	Fire water Pump	300 HP	Use of natural gas and good combustion practices	0.5 g/hp-hr	-	BACT-PSD
IN-0288	Waupaca Foundry Inc. Plant 5	6/25/2018	Emergency Generator (1.12 mmBtu/hr)	100 kW	Natural gas	-	0.36 lb/mmBtu (1.4 g/hp-hr)	Waupaca Foundry Inc. Plant 5
LA-0276	Baton Rouge Junction Facility	12/15/2016	Emergency Generators	150 kW	Comply with standards of NSPS Subpart JJJJ	2.0 g/hp-hr	1.0 g/hp-hr	BACT PSD
				65 kW		10 g/hp-hr		
WI-0267/ WI-0292	Green Bay Packaging, Inc. Mill Division	9/6/2018	Emergency Generator	50 kW	Meet 40 CFR 60, Subpart JJJJ, limit operation to no more than 200 hr/yr	10 g/hp-hr (NOx + HC)		BACT PSD
CA-1225	Sierra Pacific Industries - Anderson Division	4/25/2014	Emergency Engine	256 HP	Operation limited for maintenance and testing purposes	0.78 lb/hr	-	BACT-PSD
IA-0102	Davenport Works, Alcoa Inc.	2/1/2012	Emergency Generator	225 kW	Good combustion practices	-	0.66 lb/hr (1.0 g/hp-hr)	BACT-PSD
SC-0182	Fiber Industries LLC	10/31/2017	Emergency Generator		Use of low carbon/clean fuel (propane), good combustion, operation, and maintenance practices; compliance with NSPS subpart JJJJ	0.004 lb/hp-hr (2.0 g/hp-hr)	0.002 lb/hp-hr (1.0 g/hp-hr)	BACT-PSD
VA-0325	Greensville Power Station	6/17/2016	Propane-fired Emergency Generator	201 HP	Good combustion practices/maintenance	2.0 g/hp-hr	1.0 g/hp-hr	BACT-PSD

To meet the first criterion, a review of the states and agencies most likely to have the most stringent emission limits contained in the SIP was completed. A summary of the results from this review is presented in Table 4-9. As shown, in the South Coast AQMD and Bay Area AQMD engines in emergency service, such as the proposed Project's engines are exempted from the SIP requirement for small natural gas engines. New Jersey requires recordkeeping to ensure that an engine is in emergency generator service.

To meet the second criterion, that the proposed LAER be achievable in practice, a review of RBLC database was performed. As shown in Table 4-8, the most stringent NOx precedent (0.5 g/hp-hr) identified was for a natural gas engine driving a fire water pump in a 2013 permit issued to Magnetation LLC (IN-0167) by the Indiana Department of Environmental Management (IDEM. In 2018, IDEM issued a PSD-TV renewal permit to the facility's new owner, ERP Iron Ore, LLC. In this permit EU18 is a backup jockey fire water pump driven by a 300 HP diesel engine. Based on the later permit action, it is unclear whether the engine is SI or CI. More recent documentation indicates that the facility was shut down and the Title V permit was revoked on June 28, 2019.[11] As such, it is unknown if the authorized NO_X pre-construction limit was achieved in practice, and this precedent is eliminated from consideration.

The next most stringent NOx precedents are equal to the NSPS subpart JJJJ standard, 2.0 g/bhp-hr. Notably, all three precedents are for engines that are in the >130 HP category, while the most stringent precedents identified for the 25<HP<130 HP category have combined NO_X+VOC limits of 10 g/bhp-hr.

As shown in Table 4-8, the most stringent VOC precedent is 1.0 g/bhp-hr for LA-0276, IA-0102, SC-0182, and VA-0325. As noted above all three of these precedents are for >130 HP category engines.

Based on the above analysis, Shell proposes the following NO_X and VOC LAER limits for the proposed small natural gas engines:

>130 HP Engines:

- NO_X: 2.0 g/hp-hr
- VOC: 1.0 g/bhp-hr

25<HP<130 HP Engines

- Lift Station A Sanitary Water Pump (50 BHP)
  - NO_X+VOC: 5.39 g/bhp-hr
- PGT Shell Office Building (113 BHP)
  - NO_X+VOC: 5.76 g/hp-hr

[11] https://www.in.gov/apps/idem/caats/sourceDetail.xhtml?sourceId=181-00054

Table 4-9. Regulatory Agencies with NO_X and VOC Guidelines/Requirements for Emergency Spark Ignition ICE

Regulatory Agency	Description	Emission Limit	Reference
South Coast Air Quality Management District	Spark Ignition	Emergency standby engines exempted from the provisions of subdivision (d) (Requirements). Limited to 200 hours/year non-emergency operation	Rule 1110.2: Emissions from Gaseous- and Liquid-Fueled Engines
Bay Area Air Quality Management District	Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines	Emergency engines exempt from emissions limits. Limited to 100 hours/year non-emergency operation	Reg. 9 Rule 8
New Jersey Department of Environment Protection	Emergency Generators	Recordkeeping required to ensure only emergency use.	Title 7, Chapter 27, Subchapter 19 7:27-19.11 Emergency Generator - recordkeeping

Compliance with these limits will be based on the purchase of certified engines, following the manufacturer's operation/maintenance procedures use of natural gas as fuel, and good combustion, operation.

With the proposed emission limits, the first criterion necessary for LAER demonstration is met, because the proposed emissions limits meet the requirement of LAER that the most stringent emission limitation that is contained in the implementation plan of a state be met. The second criterion is addressed by proposing emission limits as stringent or more than the most stringent limits achieved in practice identified in the RBLC search.

In accordance with 25 Pa. Code §127.205(7), the proposed NOx and VOC LAER limit is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

This level of control will result in a total of 0.18 tons per year of NO_X emissions and 0.05 tons per year of VOC emissions for the four small emergency natural gas engines with each engine operating 100 hours per year.

4.2.2 Small Natural Gas Engines PM/PM_{10}/$PM_{2.5}$ BACT/LAER Analysis

Emissions of particulate from small natural gas engines include trace amounts of metals, non-combustible inorganic material, and condensable, semi-volatile organics which result from volatilized lubricating oil, engine wear, or from products of incomplete combustion. Formation of sulfuric acid mist is expected to be minimal due to the low sulfur content in natural gas.

A PM and PM_{10} BACT analysis is presented in accordance with the five-step BACT methodology. A $PM_{2.5}$ LAER analysis is also presented. Because the first two steps in both the LAER and BACT methodologies are the same (*i.e.,* 1) identify potentially applicable controls and 2) eliminate technically infeasible controls), a combined analysis is presented for the first two steps.

4.2.2.1 Step 1: Identify Small Natural Gas Engines PM/PM_{10}/$PM_{2.5}$ Controls

Control options for small natural gas engines were identified by reviewing information from the following sources:

- 40 CFR 60, subpart JJJJ requirements.
- Technologies applied to similar type sources in practice as determined by the RBLC database search of process #17.230 "Small (<500 HP) natural gas-fired (includes propane & liquified petroleum gas) ICE."
- Technologies that could reasonably be applied to this source type via technology transfer.

LAER/BACT permit limits must be at least as stringent as an applicable NSPS limits. However, 40 CFR 60, subpart JJJJ does not establish emission standards for $PM/PM_{10}/PM_{2.5}$.

A summary of the most recent permit determinations listed in the RBLC database is presented in Table 4-10. As shown, for this engine category, the use of low carbon/clean fuel (natural gas/propane); good combustion, operation, and maintenance practices; and compliance with NSPS subpart JJJJ are used to meet BACT/LAER requirements.

In addition, a review performed to identified other potential control could be applied to the control of $PM/PM_{10}/PM_{2.5}$ from other types of combustion sources (e.g., larger engines, boilers, turbines) did not identify and other feasible technologies.

4.2.2.2 Step 2: Eliminate Technically Infeasible $PM/PM_{10}/PM_{2.5}$ Control Option

All $PM/PM_{10}/PM_{2.5}$ control options identified in the RBLC search were determined to be technically feasible.

4.2.2.3 Step 3: Establish Small Natural Gas Engines $PM_{2.5}$ LAER

As previously discussed, the proposed emission limits for the small emergency natural gas engines must meet two criteria to be considered LAER. The first criterion requires that the LAER limit be the most stringent emission limitation that is contained in a SIP. The second criterion requires that the LAER limit be achievable in practice.

To meet the first criterion, a review of states and agencies most likely to have the most stringent emissions limits contained in the SIP was completed. Based on this review, none of the SIPs that were reviewed included a $PM_{2.5}$ emissions requirement for small natural gas engines in emergency service.

To meet the second criterion that the LAER limit must be achievable in practice, a review of the information contained in the RBLC database was performed. Based on this review, the use of low carbon/clean fuel, and good combustion, operation, and maintenance practices were identified as the top-ranked control options for $PM_{2.5}$ emissions.

Table 4-10. RBLC Summary of PM/PM_{10}/$PM_{2.5}$ Precedents for Natural Gas* Emergency Spark Ignition Engines < 500 HP

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	$PM_{2.5}$ Limit	PM_{10} Limit	PM Limit	Basis
VA-0325	Greensville Power Station	6/17/2016	Propane-fired Emergency Generator	201 HP	Good combustion practices/maintenance	0.019 g/hp-hr			-
CA-1225	Sierra Pacific Industries – Anderson Division	4/25/2014	Emergency Engine	256 HP	Operation limited for maintenance and testing purposes	0.0216 lb/hr (0.04 g/hp-hr)			BACT-PSD
IN-0167	Magnetation LLC	4/16/2013	Fire water Pump	300 HP	Use of natural gas and good combustion practices	0.2 g/kW-hr (0.15 g/hp-hr)			BACT-PSD
SC-0182	g/hp-hr)	10/31/2017	Emergency Generator		Use of low carbon/clean fuel (propane), good combustion, operation, and maintenance practices; compliance with NSPS subpart JJJJ	0.0007 lb/hp-hr (0.4 g/hp-hr)			BACT-PSD

As shown in Table 4-10, four air permit $PM_{2.5}$ precedents for small natural gas engines were identified with limits ranging from 0.019 g/hp-hr to 0.4 g/hp-hr. The results from a further review of these precedents are as follows:

Greensville Power Station, Virginia. The Greensville PSD Permit (registration No. 52525) was issued on June 17, 2016 limits $PM_{2.5}$ emissions from the facility's propane-fired emergency generators to 0.019 g/hp-hr. The permit does not require testing to ensure compliance with this limit, and no assessment or justification of $PM_{2.5}$ emissions from the engines is included the Virginia Department of Environmental Quality (DEQ) final engineering analysis.[12] Thus, it is not possible to determine if this this precedent has been achieved in practice. As a result, this precedent is eliminated from further consideration.

Sierra Pacific Industries, California. The Sierra Pacific Industries PSD Permit issued on April 25, 2014 limits $PM_{2.5}$ emissions from the natural gas-fired emergency engine to 0.0216 lb/hr. The permit requires testing to ensure compliance with the permits NO_X and CO emissions limits but does not require testing for $PM_{2.5}$. Thus, it is not possible to determine if the $PM_{2.5}$ limit for this precedent has been achieved in practice. As a result, this precedent was eliminated from further consideration.

Magnetation, Indiana. As previously discussed in Section 4.2.1.3 , it is unclear if the engine at the former Magnetation facility is an SI or a CI ICE and whether the engine was tested because the source is now shut down. As a result, this precedent was eliminated from further consideration.

Fiber Industries. The Fiber Industries permit was issued on October 31, 2017. It is for a propane fired emergency generator. Because the heat content differs greatly between propane and natural gas (*i.e.,* 2,570 Btu/ft^3 for propane versus 1020 Btu/ft^3 for natural gas) the amount of unburn hydrocarbon produced under combustion conditions is expected to be less for the propane fired engine. As a result, this precedent was eliminated from further consideration.

Based on these findings, because the engine manufacturers for the proposed engines do not provide guaranteed $PM_{2.5}$ rates the AP-42 was used as the basis for the proposed LAER rates presented in Table 4-11. Compliance will be based on the use of natural gas as fuel, and good combustion, operation, and maintenance practices.

With this proposal, the first criterion necessary for LAER demonstration is met, because no $PM_{2.5}$ limit was found to be included in a SIP. The second criterion is addressed by proposing the

[12] https://www.deq.virginia.gov/Programs/Air/PermittingCompliance/Permitting/PowerPlants/DominionGreensville.aspx

Table 4-11. Proposed $PM_{2.5}$ LAER Limits for Small Natural Gas Engines

Engine Description	Proposed $PM_{2.5}$ LAER Limit (lb/MMBtu)
Intermediate lift station sanitary water pump	0.0194
Lift Station A sanitary water pump	0.0194
PGT Shell office building	0.0194
PGT BGTC	0.0194

use of clean fuel and good combustion and operation and maintenance practices, similarly to findings in the RBLC search.

In accordance with 25 Pa. Code §127.205(7), the proposed $PM_{2.5}$ LAER is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.2.2.4 Step 3: Ranking of Technically Feasible PM/PM_{10} BACT Control Technologies

For all identified small emergency natural gas engines, the top-ranked feasible and applicable control options for PM and PM_{10} emissions comprises use of low carbon/clean fuel, and good combustion, operation, and maintenance practices.

With this application, Shell is proposing to use natural gas as the only fuel for the proposed Project's SI ICEs and use of good combustion, operation and maintenance practices.

4.2.2.5 Step 4: Evaluate PM/PM_{10} Control Options

Step 4 of the BACT analysis documents the energy, environmental, and economic impacts associate with applying the selected control technology. Shell is proposing the use of the top control options; therefore, these analyses are not necessary.

4.2.2.6 Step 5: Propose Small Natural Gas Engines PM/PM_{10} BACT Limit

Shell is proposing the use of natural gas and good combustion practices as BACT for the four small emergency natural gas engines.

No applicable PM/PM_{10} standard has been promulgated for the natural gas-fired emergency engines under 40 CFR Parts 60 and 61. As shown in Table 4-10, four permit precedents were identified through a search of the RBLC database. As noted in Section 4.2.2.3, based on further analysis of each of the precedents were eliminated from consideration. As a result, the guaranteed PM and PM_{10} rates presented in Table 4-11 are proposed as BACT. Compliance will be based on the use of natural gas as fuel, and good combustion, operation, and maintenance practice along with the manufacturers guarantee sheet.

In accordance with 25 Pa. Code §127.205(7), the proposed PM/PM_{10} BACT is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.2.3 Small Natural Gas Engines Carbon Monoxide BACT Analysis

Carbon monoxide (CO) is a product of incomplete combustion. The formation of this pollutant is limited by ensuring complete and efficient combustion of the fuel in the engine. High combustion temperatures, adequate excess air and good air/fuel mixing during combustion minimize CO emissions. Measures taken to minimize the formation of NO_X during combustion may inhibit complete combustion, which could increase CO emissions. For CO, the analysis is presented in accordance with the five-step BACT methodology.

4.2.3.1 Step 1: Identify Small Natural Gas Engines CO Controls

Control options for small natural gas engines were identified by reviewing information from the following sources:

- 40 CFR 60, subpart JJJJ requirements
- Technologies applied to similar type sources in practice (as determined by the RBLC database search of process #17.230 small (<500 HP) natural gas-fired (includes propane & liquified petroleum gas) ICE
- Technologies that could reasonably be applied to this source type via technology transfer.

BACT permit limits must be at least as stringent as an applicable NSPS limits. As noted in Section 3.2.1.3, SI ICE that commenced construction, modification or reconstruction on or after July 1, 2008 are subject to NSPS subpart JJJJ standards:

- For engines rated 25 BHP or higher but less than 130 BHP:
  - 387 g/hp-hr of CO
- For engines rated 130 BHP or higher:
  - 4.0 g/hp-hr of CO

These standards constitute the basis for this analysis. Technologies and emission limits identified in the RBLC search are consistent with subpart JJJJ standards. A summary of the most recent permit precedents identified by a review of the information contain in the RBLC database is presented in Table 4-12. As shown, for this category of engines, the use of low carbon/clean fuel (natural gas/propane); good combustion, operation, and maintenance practices; and compliance with subpart JJJJ are used to comply with BACT requirements.

Additional controls that are applied to the control of CO emissions from other types of combustion sources (e.g., larger engines, boilers, turbines) were evaluated. Oxidation catalyst is

the top ranked technology to reduce emissions of CO used in larger engines that operate continuously.

4.2.3.2 Step 2: Eliminate Technically Infeasible

All CO control options identified in the RBLC search are considered technically feasible. The use of oxidation catalyst is considered to be technically feasible for engines that operate continuously but is not considered to be technically feasible for engines in emergency service due to their limited operation. Emergency engines are on standby and not continuously running. To ensure engines are kept in good working order, they are operated for short and infrequent periods of time (less than one hour/week). The short duration of the engine's operation does not provide adequate time for an oxidation catalyst to reach the required operating temperature where a practical level of emissions reductions can be achieved. Thus, the use of oxidation catalyst is eliminated as viable option. This conclusion is consistent with the findings in the RBLC database review summarized in Table 4-12. As a result, the use of oxidation catalyst is not considered feasible for the proposed Project's emergency engines and is eliminated from consideration.

4.2.3.3 Step 3: Ranking of Technically Feasible CO Control Technologies

For all of the identified small emergency natural gas engines, the top-ranked feasible and applicable control options for CO emissions comprises use of low carbon/clean fuel, and good combustion, operation, and maintenance practices. As a result, with this application, Shell is proposing to use natural gas as the only fuel for the four additional SI ICE and good combustion, operation and maintenance practices.

4.2.3.4 Step 4: Evaluate CO Control Options

Step 4 of the BACT analysis documents the energy, environmental, and economic impacts associate with applying the selected control technology. Shell is proposing the use of the top control options; therefore, these analyses are not necessary.

4.2.3.5 Step 5: Propose Small Natural Gas Engines CO BACT Limit

For the proposed Project's SI ICE Shell is proposing to use natural gas as the only fuel and use of good combustion, operation and maintenance practices to achieve the following NSPS subpart JJJJ standards as BACT:

- For engines rated 25 BHP or higher but less than 130 BHP:
  - 387 g/hp-hr of CO
- For engines rated 130 BHP or higher:
  - 4.0 g/hp-hr of CO

Table 4-12. RBLC Summary of CO Precedents for Natural Gas* Emergency Spark Ignition Engines < 500 HP

RBLC ID No.	Facility Name	Permit Issuance Date	Process Description	Capacity	Control Description	CO Limit	Basis
CA-1225	Sierra Pacific Industries - Anderson Division	4/25/2014	Emergency Engine	256 HP	Not specified	4.0 g/hp-hr	BACT-PSD
IN-0288	Waupaca Foundry Inc. Plant 5	6/25/2018	Emergency Generator (1.12 mmBtu/hr)	100 kW	Natural gas	0.317 lb/mmBtu (1.2 g/hp-hr)	BACT-PSD
SC-0182	Fiber Industries LLC	10/31/2017	Emergency Generator		Use of low carbon/clean fuel (propane), good combustion, operation, and maintenance practices; compliance with NSPS subpart JJJJ	0.01 lb/hp-hr (4.5 g/hp-hr)	BACT-PSD
LA-0311	Donaldsonville Nitrogen Complex	7/15/2013	Emergency Generators	300 HP	Good combustion practices; proper equipment design consistent with 40 CFR 60 Subpart JJJJ	3.31 lb/hr (5.0 g/hp-hr)	BACT-PSD
VA-0321	Brunswick County Power Station	3/2/2013	Emergency Generator	100 kW	Good combustion practices/maintenance	4.0 g/hp-hr	BACT-PSD
VA-0325	Greensville Power Station	6/17/2016	Propane-fired Emergency Generator	201 HP	Good combustion practices/maintenance	4.0 g/hp-hr	-
FL-0356	Okeechobee Clean Energy Center	3/9/2016	Propane Emergency Generators	25 kW	Compliance with NSPS subpart JJJJ	387 g/hp-hr	BACT-PSD
MI-0413	A K Steel	5/2/2014	Four <500 hp Natural Gas fired SI ICE	< 500 HP	Good combustion practices and hours of operation limitations	N/A	BACT-PSD

There is one precedent listed in Table 4-12 for an emergency generator engine that has a a CO emission limit which is more stringent than the proposed subpart JJJJ standards. The precedent was authorized by the IDEM in 2018 to Waupaca Foundry Inc. A review of the permit to construct for this facility[13] indicates that the engine is not required to perform compliance testing. Therefore, it is not known if the CO limit of 0.317 lb/mmBtu (approximately 1.2 g/hp-hr) has been achieved in practice, and this precedent is eliminated from consideration.

In accordance with 25 Pa. Code §127.205(7), the proposed CO BACT is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.2.4 Small Natural Gas Engines GHG BACT Analysis

GHGs emitted by the proposed small natural gas engines are the same as emitted by other fossil fuel combustion sources: CO_2, CH_4, and N_2O, although the emission factors vary by combustion fuel and combustor type (reciprocating engine versus a combustion turbine or furnace). As is the case for all fossil fuel-fired sources, CO_2 emissions are the dominant contributor to the CO_2e emission rate. No applicable GHG standards have been promulgated for emergency engines under 40 CFR parts 60 and 61.

4.2.4.1 Steps 1-4: Identify Technically Feasible Controls

The available control techniques for control of GHGs from the small natural gas engines include:

- Use of low GHG emitting fuels,
- Energy efficiency,
- Good combustion practices (meeting diesel engine NSPS requirements), and
- Carbon capture and sequestration (CCS).

Natural gas is considered a low carbon fuel. Energy efficiency options for reducing GHG emissions outside of good combustion practices are considered to be technically infeasible because emergency engines typically only operate one hour a month for periodic maintenance and testing to ensure operability. As a result, the engines never reach steady state operation long enough for a heat recovery system to warm up and operate.

Meeting the NSPS Part 60, Subpart JJJJ emission standards requires the use of good combustion control, thereby minimizing the emissions of methane (CH_4). As is the case for CO and VOC emissions, oxidation catalyst is a potential control option for reducing CH_4 emissions. However, given the much lower emission rate for CH_4 (0.001 kg/mmBtu) relative to CO_2 (53.06 kg/mmBtu), the use of oxidation catalyst would not be cost effective. The use of oxidation

[13] PSD/Significant Source Modification Permit No. 123-39589-00019.

catalyst is rejected as BACT due to its adverse energy impacts, the control system pressure drop, economic impacts, and minimal environmental benefit.

In the 2015 application plan approval, Shell discussed the potential applicability of CCS to the entire facility. It is noted here that the application of CCS technology to small emergency natural gas engines would be technically impractical. As is the case with a heat recovery system, the small emergency natural gas engines do not operate long enough at steady state conditions to effectively capture CO_2 emissions. As a result, in addition to the analysis presented the 2015 application, the use of CCS is rejected as a BACT option for the control of CO_2 for the proposed engines.

4.2.4.2 Step 5: Propose Small Natural Gas Engine CO_2e/GHG BACT Limits

The proposed natural gas-fired, spark ignition internal combustion engines will meet emission standards as codified at Subpart JJJJ of 40 CFR 60. Due to the very low emissions from these sources, the fact that they will operate only intermittently, the following GHG BACT limits are proposed:

- Small Emergency Natural Gas Engines: combined emissions of CO_2e from the four small emergency generator engines shall not exceed 43.4 tons per year on a 12-month rolling average basis.
- Compliance shall be demonstrated using applicable 40 CFR 98 Subpart C factors.

As previously stated, no applicable GHG standards have been promulgated for emergency engines under 40 CFR parts 60 and 61. In accordance with 25 Pa. Code §127.205(7), the proposed GHG BACT limit is equivalent to and satisfies the PaBAT requirements of 25 Pa. Code §127.12(a)(5).

4.3 Other Additional Equipment – Proposed PaBAT

In accordance with Pa. Code §127.205(7) and consistent with the currently required PaBAT levels applicable to similar equipment, the following PaBAT limits are proposed for the other additional equipment not covered by the above control technology analyses:

Additional Diesel Storage Tanks: Consistent with PA-04-00740A Section D Source ID: 406 Condition #001, Shell proposes the diesel fuel storage tank vents shall be controlled by carbon canisters designed to reduce VOC emissions by a minimum of 95%.

Transfer Talc via Railcar: Shell proposes that the particulate matter from this pneumatic transfer operation's vents be equipped with and controlled by fabric, sintered metal, or HEPA filters and that the filters be designed to achieve a particulate loading of 0.005 gr/dscf at the outlet.

Polyethylene Unit 3 Intermittent Particulate Vents: Consistent with PA-04-00740A Section D Source ID: 202 Condition #003, Shell proposes that the particulate matter from these intermittent vents be equipped with and controlled by fabric, sintered metal, or

HEPA filters and that the filters be designed to achieve a particulate loading of 0.005 gr/dscf at the outlet.

LPG Loading: Consistent with PA-04-00740A Section C Condition #031, Shell proposes that VOC emissions be controlled by the use of pressurized transfer with vapor balance and low leak couplings

Methanol System: As previously noted, the methanol vessels will be maintained under positive pressure with no emissions. The equipment components associated with this system will have components with the potential for fugitive VOC emissions. Consistent with PA-04-00740A Section C Conditions #026, Shell proposes to follow the sitewide Leak Detection and Repair (LDAR) work practice requirements to minimize VOC emissions.

5.0 Air Quality Impacts Analysis

An updated air quality dispersion modeling analysis was conducted for the Shell facility at the request of PADEP. The initial modeling analysis was submitted in April of 2014. Subsequent revisions to this analysis have been necessitated by changes to facility configuration and emissions as well as updates to the EPA-approved dispersion models and supporting software. Details of the updated air dispersion modeling analysis are presented in Appendix C. The analysis evaluated emissions of all criteria pollutants evaluated in the initial modeling demonstration. The analysis was conducted to ensure that the proposed Project will not cause or contribute to air pollution in violation of a National Ambient Air Quality Standard ("NAAQS") or PSD increment.

To determine if the Project would significantly impact local air quality, only the emissions from the proposed Project were initially evaluated. The resultant modeled concentrations were compared to the ambient Significant Impact Levels ("SILs") for Class I and Class II areas. The results of this significant impacts analysis demonstrate that the proposed Project will result in ambient impacts in excess of the Class II SILs for NO_2, PM10 and CO. Therefore, a refined air quality analysis to calculate concentrations for comparison to the NAAQS and increments was required.

The results of the refined analyses indicate compliance with the NAAQS standards. Modeled 1-hour NO_2 NAAQS exceedances were calculated in the vicinity of the Shell site. These modeled exceedances are attributable to existing sources in the vicinity of the Shell site. Shell is shown not to cause or contribute to an existing modeled NAAQS exceedance.

Class II visibility impacts were also evaluated at the Raccoon Creek State Park and determined to be acceptable.

The analysis conforms with the modeling procedures outlined in the Environmental Protection Agency's Guideline on Air Quality Models and associated EPA modeling policy and guidance. It also conforms with the initial modeling protocol submitted to and approved by the PADEP on February 19, 2014 as well as the more recent document describing the changes to the initial protocol submitted to the PADEP on December 20, 2019.

6.0 Inhalation Risk Assessment

In support of the 2015 plan approval application, at the request of Pennsylvania Department of Environmental Protection (PaDEP), Shell Chemical Appalachia LLC (Shell) conducted an inhalation risk assessment for the proposed Shell Petrochemicals Complex to be constructed in Beaver County, Pennsylvania. At PaDEP's request and update to 2015 assessment, which incorporates the modifications associated with the proposed Project was performed. This updated assessment was conducted in accordance with the Inhalation Risk Assessment Protocol submitted to and approved by PaDEP and is based on current risk indices.[1,2]

The results of this updated assessment, which are summarized in Table 6-1, show that the levels of risk posed by both chronic and acute exposure to the emissions of compounds of potential concern (COPC) from the proposed project do not exceed PaDEP's inhalation risk assessment benchmarks.

Table 6-1. Summary of Inhalation Risk Assessment

Inhalation Risk	PaDEP Inhalation Risk Assessment Benchmark	Shell Inhalation Risk Assessment Result
Excess Lifetime Cancer Risk	1 in 100,000	8 in 1,000,000
Chronic Non Cancer Risk	HI<0.25	HI=0.06
Acute Non Cancer Risk	HQ<1	Highest HQ=0.54

The analysis evaluated chronic risks posed by the emissions from the proposed facility operating at maximum conditions as well as acute exposure scenarios posed by short term emissions. Details of the analysis are included in Appendix D. Attachment A of Appendix D contains the emissions information for the proposed project, including the identification of the COPCs and the emissions rate estimates used for the chronic and acute scenarios that are considered by the assessment. Attachment B of Appendix D provides a discussion of the dispersion modeling analysis and the resulting maximum one-hour and five-year annual average exposure concentrations used in the assessment. Attachment C of Appendix D provides the methodology for determining the inhalation risk posed by the emissions from the proposed facility and detailed results of the risk assessment.

2700-PM-AQ0007 Rev. 7/2004

Submit in Triplicate

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR QUALITY

PROCESSES

Application for Plan Approval to Construct, Modify or Reactivate an Air Contamination Source and/or Install an Air Cleaning Device

This application must be submitted with the General Information Form (GIF).

Before completing this form, read the instructions provided for the form.

Section A - Facility Name, Checklist And Certification

Organization Name or Registered Fictitious Name/Facility Name: Shell Polymers Monaca Site

DEP Client ID# (if known): 311950

Type of Review required and Fees:

- ☐ Source, which is not subject to NSPS, NESHAPs, MACT, NSR and PSD:.....$_____
- ☒ Source requiring approval under NSPS or NESHAPS or both: $1,700
- ☒ Source requiring approval under NSR regulations:.....$5,300
- ☐ Source requiring the establishment of a MACT limitation: .....$_____
- ☒ Source requiring approval under PSD: $22,700

Applicant's Checklist

Check the following list to make sure that all the required documents are included.

- ☒ **General Information Form (GIF)**
- ☒ **Processes Plan Approval Application**
- ☒ **Compliance Review Form** or provide reference of most recently submitted compliance review form for facilities submitting on a periodic basis: _____
- ☒ **Copy and Proof of County and Municipal Notifications**
- ☒ **Permit Fees**
- ☐ **Addendum A:** Source Applicable Requirements (only applicable to existing Title V facility)

Certification of Truth, Accuracy and Completeness by a Responsible Official

I, _____, certify under penalty of law in 18 Pa. C. S. A. §4904, and 35 P.S. §4009(b) (2) that based on information and belief formed after reasonable inquiry, the statements and information in this application are true, accurate and complete.

(Signature): _____ Date: 2/13/2025

Name (Print): H. James Sewell Title: CSU Environmental Manager, Attorney-in-Fact

OFFICIAL USE ONLY

Application No. _____ Unit ID _____ Site ID _____

DEP Client ID #: _____ APS. ID _____ AUTH. ID _____

Date Received _____ Date Assigned _____ Reviewed By _____

Date of 1st Technical Deficiency _____ Date of 2nd Technical Deficiency _____

Comments: _____

Section B - Processes Information (Polyethylene Plants 1 & 2)

1. Source Information:

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

This section covers the Polyethylene Plants 1&2 manufacturing lines. Included for purposes of this application are the following changes described in the Support Document: transport of talc to the facility by railcar and increases in the railcar and truck handling and railcar and truck loading rates.

Manufacturer(s) To be determined	Model No.	Number of Sources
Source Designation See Table D-2 of the Plan Approval Application	Maximum Capacity:	Rated Capacity (Design capacities) Polyethylene: 1200 metric tons/yr

Type of Material Processed: Ethylene polymerized with comonomer to produce various grades of polyethylene (PE).

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
			1200 metric tons/yr PE, total

Operating Schedule

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

Seasonal variations (Months) From to

If variations exist, describe them

N/A

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 * _____					
_____					
_____					

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

Section B – Processes Information (Polyethylene Plants 1 & 2) (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.

Process flow diagrams for the overall facility are unchanged as covered by PA-04-00740A. This action covers the equipment that will allow transport of talc to the facility by railcar and increases in the railcar and truck handling and railcar and truck loading rates.

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 facility's fugitive 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 shutdown 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 (Particulate Control - PE 1 & 2 Manufacturing and Pellet Handling)

1. Precontrol Emissions* (Refer to Appendix B for emissions calculations)

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.

Describe the system in detail.

A grain loading of 0.005 gr/dscf is required by PA-04-00740A for all particulate containing vents, the pellet dryer.

Section C - Air Cleaning Device (PE 1& 2 Manufacturing and Pellet Handling) (Continued)

5. Fabric Collector: Particulate filters be designed to achieve PM limits as presented in Section 5.0 of the Plan Approval Application.

Equipment Specifications Refer to Appendix D for PM Sources. Specifications TBD

Manufacturer To be determined	Model No.	☐ Pressurized Design ☐ Suction Design
Number of Compartments	Number of Filters Per Compartment	Is Baghouse Insulated? ☐ Yes ☐ No

Can each compartment be isolated for repairs and/or filter replacement? ☐ Yes ☐ No

Are temperature controls provided? (Describe in detail) ☐ Yes ☐ No

Dew point at maximum moisture _____°F | Design inlet volume _____ SCFM

Type of Fabric

Material _____ ☐ Felted ☐ Membrane

Weight _____ oz/sq. yd. ☐ Woven ☐ Others: List: _____

Thickness _____in ☐ Felted-Woven

Fabric permeability (clean) @ ½" water-Δ P _____ CFM/sq. ft.

Filter dimensions Length _____ Diameter/Width _____

Effective area per filter _____ | Maximum operating temperature (°F) _____

Effective air to cloth ratio Minimum _____ Maximum _____

Drawing of Fabric Filter

A sketch of the fabric filter showing all access doors, catwalks, ladders and exhaust ductwork, location of each pressure and temperature indicator should be attached.

Operation and Cleaning

Volume of gases handled

_____ ACFM @ _____°F

Pressure drop across collector (in. of water).
Describe the equipment to be used to monitor the pressure drop.

Type of filter cleaning

☐ Manual Cleaning ☐ Bag Collapse ☐ Reverse Air Jets

☐ Mechanical Shakers ☐ Sonic Cleaning ☐ Other: _____

☐ Pneumatic Shakers ☐ Reverse Air Flow

Describe the equipment provided if dry oil free air is required for collector operation

Cleaning Initiated By

☐ Timer Frequency if timer actuated _____

☐ Expected pressure drop range _____ in. of water ☐ Other Specify _____

Does air cleaning device employ hopper heaters, hopper vibrators or hopper level detectors? If yes, describe.

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

Emissions Data: Refer to Appendix B of the Plan Approval Application for Emissions Estimates

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section B - Processes Information (Polyethylene Plant 3)

1. Source Information

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

This section covers the Polyethylene Plant 3 manufacturing line. Included for purposes of this application are the following changes described in the Support Document: a decrease in PE3 activated catalyst vent emissions, inclusion of a vacuum cleaning system and a flexible intermediate bulk container (FIBC) compactor vent, and increases in the railcar and truck handling and railcar and truck loading rates.

Manufacturer(s)	Model No.	Number of Sources
Various		
Source Designation	**Maximum Capacity**	**Rated Capacity**
		Polyethylene: 500 metric tons/yr

Type of Material Processed

Ethylene polymerized with comonomer to produce various grades of polyethylene (PE)

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
			500 metric tons/yr

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	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 * _____					
_____					
_____					

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

Section B - Processes Information (Polyethylene Plant 3) (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.

Process flow diagrams for the overall facility are unchanged as covered by PA-04-00740A. This action covers the inclusion of the vacuum cleaning system and FIBC compactor vents, which will be controlled by fabric filters achieving 0.005 gr/dscf and decrease in the activated catalyst vent emissions rate.

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 facility's fugitive 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 shutdown are included in PA-04-00740A (No changes requested by this design update)

Anticipated Milestones:

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

Section C - Air Cleaning Device (Particulate Control - PE 3 Manufacturing and Pellet Handling)

1. Precontrol Emissions* See 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.

Describe the system in detail.

A grain loading of 0.005 gr/dscf is required by PA-04-00740A for all particulate containing vents, the pellet dryer.

Section C - Air Cleaning Device (PE 3 Manufacturing and Pellet Handling) (Continued)

5. Fabric Collector: Particulate filters be designed to achieve total PM of less than 0.005 gr/DSCF outlet

Equipment Specifications Refer to Appendix D for Filter Specifications

Manufacturer	Model No.	☐ Pressurized Design ☐ Suction Design
Number of Compartments	Number of Filters Per Compartment	Is Baghouse Insulated? ☐ Yes ☐ No

Can each compartment be isolated for repairs and/or filter replacement? ☐ Yes ☐ No

Are temperature controls provided? (Describe in detail) ☐ Yes ☐ No

Dew point at maximum moisture _____°F | Design inlet volume _____ SCFM

Type of Fabric

Material _____ ☐ Felted ☐ Membrane

Weight _____ oz/sq.yd ☐ Woven ☐ Others: List: _____

Thickness _____in ☐ Felted-Woven

Fabric permeability (clean) @ ½" water-Δ P _____ CFM/sq.ft.

Filter dimensions Length _____ Diameter/Width _____

Effective area per filter _____ | Maximum operating temperature (°F) _____

Effective air to cloth ratio Minimum _____ Maximum _____

Drawing of Fabric Filter

A sketch of the fabric filter showing all access doors, catwalks, ladders and exhaust ductwork, location of each pressure and temperature indicator should be attached.

Operation and Cleaning

Volume of gases handled

_____ ACFM @ _____°F

Pressure drop across collector (in. of water).
Describe the equipment to be used to monitor the pressure drop.

Type of filter cleaning

☐ Manual Cleaning ☐ Bag Collapse ☐ Reverse Air Jets

☐ Mechanical Shakers ☐ Sonic Cleaning ☐ Other: _____

☐ Pneumatic Shakers ☐ Reverse Air Flow

Describe the equipment provided if dry oil free air is required for collector operation

Cleaning Initiated By

☐ Timer Frequency if timer actuated _____

☐ Expected pressure drop range _____ in. of water ☐ Other Specify _____

Does air cleaning device employ hopper heaters, hopper vibrators or hopper level detectors? If yes, describe.

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

Emissions Data: Refer to Appendix B of the Plan Approval Application for Emissions Estimates

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section B - Processes Information (Utilities and General Facility)

1. Source Information

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

This section covers units outside the battery limits (OSBL) of the ethylene and polyethylene manufacturing lines. Included for purposes of this application are the following changes described in the Support Document: emergency engine and vehicular diesel storage tanks, LPG loading, spent caustic incinerator, light gasoline loading, recovered oil and flow equalization & removal tank, pyrolysis fuel oil loading, high pressure ground flare, multipoint ground flare, low pressure thermal incinerator, and high pressure elevated flare.

Manufacturer(s) Various	Model No.	Number of Sources
Source Designation	Maximum Capacity	Rated Capacity

Type of Material Processed

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	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 * _____					
_____					
_____					

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

Section B - Processes Information (Utilities and General Facility) (Continued)

3. Burner

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

4. Process Storage Vessels

A. For Liquids: Refer to Table 2-1 in the Supporting Document

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 (Utilities and General Facility) (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.

Please refer to the attached Support Document. A description of the planned actions covered by this application is provided in Section 2.0. Process flow diagrams for the overall facility are unchanged and were included in Section 3.0 of the 2015 plan approval application. The Project's emissions estimates are included as Appendix B to the Support Document.

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.

Compliance monitoring equipment and recordkeeping procedures will be implemented to ensure that all of the proposed projects sources are operated in compliance with the proposed permit limits. Compliance monitoring and testing requirements are included as part of each of the proposed limits in Section 4.0 of the Support Document. All other monitoring required at the facility not included in Section 4.0 of the Support Document is contained in PA-04-00740A is unchanged.

Describe each proposed modification to an existing source.

A description of the proposed changes to the existing facility is included as Section 2.0 of the Support Document.

Identify and describe all fugitive emission points, all relief and emergency valves and any by-pass stacks.

Fugitive emissions will result from equipment leaks, tanks, silos, paved roads and parking areas, and cooling towers. Additional information related to the control and monitoring of emissions from the new emissions sources covered by this action are provided in Section 4.0.

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

The facility will install BACT and LAER controls as proposed in Section 4.0 of the support document. Limits covering startup and shutdown 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 (Carbon Canisters) (Utilities and General Facility)

1. Precontrol Emissions* See 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.

Carbon canisters will be used to control tank emissions associated with the proposed emergency diesel generators (2x) and vehicle fuel diesel storage (2x) tanks. Emissions associated with these carbon canister-controlled tanks are included in Appendix B of the Support Document.

Section C - Air Cleaning Device (Carbon Canisters) (Utilities and General Facility)

8. Adsorption Equipment

Equipment Specifications

Manufacturer	Type	Model No.

Design Inlet Volume (SCFM)	Adsorbent charge per adsorber vessel and number of adsorber vessels

Length of Mass Transfer Zone (MTZ), supplied by the manufacturer based upon laboratory data.

Adsorber diameter (ft.) and area ft^2.)	Adsorption bed depth (ft.)

Adsorbent information

Adsorbent type and physical properties.

Working capacity of adsorbent (%)	Heel percent or unrecoverable solvent weight % in the adsorbent after regeneration.

Operating Parameters

Inlet volume of gases handled _____ (ACFM) @ _____ °F

Adsorption time per adsorption bed	Breakthrough capacity: Lbs. of solvent / 100 lbs. of adsorbent = _____
Vapor pressure of solvents at the inlet temperature	Available steam in pounds to regenerate carbon adsorber (if applicable)

Percent relative saturation of each solvent at the inlet temperature

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

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

Emissions Data: See Appendix B of the Support Document

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (VOC Control System – LP System Thermal Incinerator) (Utilities and General Facility)

1. Precontrol Emissions* See 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.

Continuous and intermittent VOC containing vents from the pyrolysis fuel oil, light gasoline, and hexene tanks and loading of butene, isobutane, and isopentane are routed to the VOC Control System's LP header (LP system). With this action the pyrolysis fuel oil loading rate is increasing and light gasoline loading rate is decreasing. The LP System consists of an LP Thermal Incinerator and a Multipoint (MP) Ground Flare. The rated capacity of the Thermal Incinerator is 10 metric tons/hr. Emissions associated with the VOC Control System are included in Appendix B of the Support Document. As part of the proposed action, the emissions rate from the Thermal Incinerator is being updated to account for changes in gas composition of the flared gas and the sweep gas rate.

Section C - Air Cleaning Device (VOC Control System – LP System Thermal Incinerator) (Utilities and General Facility) (Continue)

11. Oxidizer/Afterburners

Equipment Specifications

Manufacturer To be determined	Type ☒ Thermal ☐ Catalytic	Model No.
Design Inlet Volume (SCFM)	Combustion chamber dimensions (length, cross-sectional area, effective chamber volume, etc.)	

Describe design features, which will ensure mixing in combustion chamber.

Describe method of preheating incoming gases (if applicable).	Describe heat exchanger system used for heat recovery (if applicable).

Catalyst used	Life of catalyst	Expected temperature rise across catalyst (°F)	Dimensions of bed (in inches). Height: _____ Diameter or Width: _____ Depth: _____

Are temperature sensing devices being provided to measure the temperature rise across the catalyst? ☐ Yes ☐ No
If yes, describe.

Describe any temperature sensing and/or recording devices (including specific location of temperature probe in a drawing or sketch.

Burner Information

Burner Manufacturer	Model No.	Fuel Used
Number and capacity of burners	Rated capacity (each)	Maximum capacity (each)

Describe the operation of the burner	Attach dimensioned diagram of afterburner

Operating Parameters

Inlet flow rate (ACFM) _____ @ _____°F	Outlet flow rate (ACFM) _____@ _____°F
State pressure drop range across catalytic bed (in. of water).	Describe the method adopted for regeneration or disposal of the used catalyst.

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

Emissions Data: See Table 2-1 and Appendix B of the Support Document

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (LP Flare System – MP Ground Flare) (Utilities and General Facility)

1. Precontrol Emissions* See 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.

Emissions associated with the VOC Control System are included in Appendix B of the Support Document. The Multipoint (MP) Ground Flare is sized with three independent headers, capacities of 45 metric tons/hr, 22 metric tons/hr, and 7 metric tons/hr to handle upsets from the product purge bins at PE Plants 1 & 2, the deinertization of the refrigerated ethylene storage tank, and malfunction relief from the LP Thermal Incinerator, respectively. As part of the proposed action, the emissions rate from the MP Ground Flare is being updated to account for changes in the composition of the flared gas and the sweep gas rate.

Section C - Air Cleaning Device (LP Flare System – MP Ground Flare) (Utilities and General Facility) (Continued)

12. Flares

Equipment Specifications

Manufacturer To be determined	Type ☐ Elevated flare ☒ Ground flare ☐ Other _____ Describe	Model No.
Design Volume (SCFM)	Dimensions of stack (ft.) Diameter 34 Height 75	
Residence time (sec.) and outlet temperature (°F) 1832	Turn down ratio	Burner details

Describe the flare design (air/steam-assisted or nonassisted), essential auxiliaries including pilot flame monitor of proposed flare with a sketch.

Describe the operation of the flare's ignition system.

Describe the provisions to introduce auxiliary fuel to the flare.

Operation Parameters

Detailed composition of the waste gas	Heat content 1 MMBtu/hr (Pilot)	Exit velocity
Maximum and average gas flow burned (ACFM)	Operating temperature (°F)	

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

Emissions Data See Table 2-1 and Appendix B of the Support Document

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (HP Flare System – Ground Flares (2x)) (Utilities and General Facility)

1. Precontrol Emissions* See 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.

The HP Header System consists of one elevated flare with a relieving capacity of 1,350 metric tons/hr and two totally enclosed ground flares, each rated for 150 metric tons/hr. The C3+ and C3 refrigerant storage systems are relieved to this system. The HP Elevated Flare is only used to control emissions during upsets. The two HP Ground Flares are used to control VOC emission associated with startup, shutdown, and maintenance of the ethylene manufacturing plant and PE Units. Emissions associated with the two HP Ground and Elevated Flares are included in Appendix B of the Support Document. As part of the proposed action, the emissions rate from the HP flare system is being updated to account for changes in the composition of the flared gas and the sweep gas rate.

Section C - Air Cleaning Device (HP Flare System – Ground Flares (2x)) (Continued)

12. Flares

Equipment Specifications

Manufacturer To be determined	Type ☐ Elevated flare ☒ Ground flare ☐ Other _____ Describe	Model No.
Design Volume (SCFM)	Dimensions of stack (ft.) Diameter 55 Height 110	
Residence time (sec.) and outlet temperature (°F) 1832	Turn down ratio	Burner details

Describe the flare design (air/steam-assisted or nonassisted), essential auxiliaries including pilot flame monitor of proposed flare with a sketch.

Describe the operation of the flare's ignition system.

Describe the provisions to introduce auxiliary fuel to the flare.

Operation Parameters

Detailed composition of the waste gas	Heat content	Exit velocity
Maximum and average gas flow burned (ACFM)	Operating temperature (°F)	

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

Emissions Data See Table 2-1 and Appendix B of the Support Document

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (HP Flare System – Elevated Flare) (Utilities and General Facility)

1. Precontrol Emissions* See 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.

The HP Header System consists of one elevated flare with a relieving capacity of 1,350 metric tons/hr and two totally enclosed ground flares, each rated for 150 metric tons/hr. The HP Elevated Flare will only be used to control emissions during upsets. The two HP Ground Flares will be used to control VOC emission associated with startup, shutdown, and maintenance of the ethylene manufacturing plant and PE Units. Emissions associated with the two HP Ground and Elevated Flares are included in Appendix B of the Support Document. As part of the proposed action, the emissions rate from the HP flare system is being updated to account for changes in the composition of the flared gas and the sweep gas rate.

Section C - Air Cleaning Device (HP Flare System – Elevated Flare) (Utilities and General Facility) (Continued)

12. FLARES

Equipment Specifications

Manufacturer	Type ☒ Elevated flare ☐ Ground flare ☐ Other _____ Describe	Model No.
Design Volume (SCFM)	Dimensions of stack (ft.) Diameter 5 _____ Height _____	
Residence time (sec.) and outlet temperature (°F) 1832	Turn down ratio	Burner details

Describe the flare design (air/steam-assisted or nonassisted), essential auxiliaries including pilot flame monitor of proposed flare with a sketch.

Steam assisted. Refer to supporting documentation for full flare description.

Describe the operation of the flare's ignition system.

Describe the provisions to introduce auxiliary fuel to the flare.

Operation Parameters

Detailed composition of the waste gas	Heat content 1 MMBtu/hr (Pilot)	Exit velocity
Maximum and average gas flow burned (ACFM)	Operating temperature (°F)	

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

Emissions Data See Table 2-1 and Appendix B of the Support Document

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Spent Caustic Vent Thermal Incinerator) (Utilities and General Facility)

1. Precontrol Emissions* See 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.

The spent caustic thermal incinerator will have a design heat input of 10.7 MMBtu/hr. It is designed to control VOC emissions from the spent caustic oxidizer stripper, and tank emissions from the spent caustic, flow equalization, and recovered oil tanks. With this action the capacity of the Spent Caustic Vent Thermal Incinerator is being updated as 2.5 metric tons/hr.

Section C - Air Cleaning Device (Spent Caustic Vent Thermal Incinerator) (Utilities and General Facility) (Continued)

11. Oxidizer/Afterburners

Equipment Specifications

Manufacturer To be determined	Type ☒ Thermal ☐ Catalytic	Model No.
Design Inlet Volume (SCFM)	Combustion chamber dimensions (length, cross-sectional area, effective chamber volume, etc.)	

Describe design features, which will ensure mixing in combustion chamber.

Describe method of preheating incoming gases (if applicable).	Describe heat exchanger system used for heat recovery (if applicable).

Catalyst used	Life of catalyst	Expected temperature rise across catalyst (°F)	Dimensions of bed (in inches). Height: _____ Diameter or Width: _____ Depth: _____

Are temperature sensing devices being provided to measure the temperature rise across the catalyst? ☐ Yes ☐ No
If yes, describe.

Describe any temperature sensing and/or recording devices (including specific location of temperature probe in a drawing or sketch.

Burner Information

Burner Manufacturer	Model No.	Fuel Used
Number and capacity of burners	Rated capacity (each)	Maximum capacity (each)

Describe the operation of the burner	Attach dimensioned diagram of afterburner

Operating Parameters

Inlet flow rate (ACFM) _____ @ _____°F	Outlet flow rate (ACFM) _____@ _____°F
State pressure drop range across catalytic bed (in. of water).	Describe the method adopted for regeneration or disposal of the used catalyst.

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

Emissions Data: See Table 2-1 and Appendix B of the Support Document

Pollutant	Inlet	Outlet	Removal Efficiency (%)

Section C - Air Cleaning Device (Wastewater Treatment Plant (WWTP))

1. Precontrol Emissions*

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.

Describe the system in detail.

As part of this action, the capacity of the Recovered Oil and Flow Equalization and Oil Removal Tanks is being increased. No other changes to the WWTP are requested as part of this action.

Section E - Compliance Demonstration

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: VOC Control System – Waste gas minimization and operation to achieve good destruction removal efficiency. Flares are designed to meet limitations on maximum exit velocity, as set forth in the general provisions at 40 CFR 60.18 and 63.11. Flare are operated to meet minimum net heating value requirements for gas streams combusted in flares as set forth in 40 CFR 60.18. VOC Control System compliance methods are included in PA-04-00740A. The Spent Caustic Vent Thermal Incinerator is designed and will be operated to ensure 99% DRE. The LP Thermal Incinerator is designed and will be operated to ensure 99.9% DRE.

Section F - Flue and Air Contaminant Emission (Spent Caustic Incinerator)

1. Estimated Atmospheric Emissions* See Table 2-1 and Appendix B of the Support Document

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.

2. Stack and Exhauster

Stack Designation/Number

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

% of flow exhausted to stack: 100

Stack height above grade (ft.) 200
Grade elevation (ft.) 714

Stack diameter (ft) or Outlet duct area (sq. ft.)
2.0

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

Stack exhaust
Volume 8476 ACFM Temperature 1600 °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 - Combustion Unit Information (Combustion Turbines/Duct Burners (3x))

1. Combustion Units: ☐ Coal ☐ Oil ☒ Natural Gas Other:_____

Description: Combustion turbines (CTs) with duct burners (DB) (3 Combined Cycle Units)

Manufacturer	Model No.	Number of units
GE	GE Frame 6B	3

Maximum heat input (Btu/hr)	Rated heat input (Btu/hr)	Typical heat input (Btu/hr)	Furnace Volume
	CT/DB:715.4 MMBtu/hr		

Grate Area (if applicable)	Method of firing
	Direct

Indicate how combustion air is supplied to boiler

Indicate the Steam Usage:

Mark and describe soot Cleaning Method:

i. Air Blown
ii. Steam Blown
iii. Brushed and Vacuumed
iv. Other _____
v. Frequency of Cleaning _____

Maximum Operating schedule

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

Operational restrictions taken or requested, if any (e.g., bottlenecks or voluntary restrictions to limit potential to emit)

Capacity (specify units)

Per hour	Per day	Per week	Per year

Typical Operating schedule

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

Seasonal variations (Months): If variations exist, describe them.

Operating using primary fuel: _____ From _____ to _____
Operating using secondary fuel: _____ Form _____ to _____
Non-operating: From _____ to _____

2. Specify the primary, secondary and startup fuel. Furnish the details in item 3.
Single fuel, 40 CFR Part 72 pipeline natural gas.

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

3. 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
Oil Number	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Natural Gas	CT/DB 701 MSCFH	X 10^6 Gal	0.5 gr/100 SCF		1020 Btu/SCF
Gas (other)	SCFH	X 10^6 Gal	gr/100 SCF		Btu/SCF
Coal					
Other*					

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

4. Burner

Manufacturer	Model Number	Type of Atomization (Steam, air, press, mech., rotary cup)

Number of Burners	Maximum fuel firing rate (all burners)	Normal fuel firing rate

If oil, temperature and viscosity.

Maximum theoretical air requirement

Percent excess air 100% rating

Turndown ratio

Combustion modulation control (on/off, low-high fire, full automatic, manual). Describe.

Main burner flame ignition method (electric spark, auto gas pilot, hand-held torch, other). Describe.

5. Nitrogen Oxides (NO_x) control Options

Mark and describe the NO_x control options adopted

	Low excess air (LEA)		Flue gas recirculation	Other: Lean Premix Dry Low NOx Combustor
	Over fire air (OFA)		Burner out of service	
x	Low-NO_x burner		Reburning	
	Low NO_x burners with over fire air	x	Flue gas treatment (SCR / SNCR)	

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

6. Miscellaneous Information

Describe fly ash reinjection operation

Describe, in detail, the equipment provided to monitor and to record the source(s) operating conditions, which may affect emissions of air contaminants. Show that they are reasonable and adequate.

Describe each proposed modification to an existing source.

Describe how emissions will be minimized especially during start up, shut down, combustion upsets and/or disruptions. Provide emission estimates for start up, shut down and upset conditions. Provide duration of start up and shut down.

Limits covering startup and shutdown are included in PA-04-00740A (No changes requested by this design update)

Describe in detail with a schematic diagram of the control options adopted for SO_2 (if applicable).

Anticipated milestones:

Expected commencement date of construction/reconstruction: 2015
Expected completion date of construction/reconstruction: 2020
Anticipated date(s) 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

Emission Rate

Pollutant	Maximum Emission Rate				Calculation/ Estimation Method
	Specify Units	Pounds/Hour	Hours/Year	Tons/Year	
PM					
PM_{10}					
SOx					
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 Conditioning NA

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

Outlet volume
_____ ACFM@ _____ °F _____ % Moisture

Describe the system in detail.

Three gas turbines with direct-fired duct burners and heat recovery steam generation capable of producing steam. The baseload rating is 41.5 MW for the GE unit. NOx LAER/BACT limits and BACT CO limits is achieved using selective catalytic reduction and CO oxidation catalyst, respectively. Two steam turbines each rated at 75.6 MW are used to generate electricity using the steam produced by the HRSGs and any excess steam from the ethane cracking unit.

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

8. ☒ **SELECTIVE CATALYTIC REDUCTION (SCR)**

☐ **SELECTIVE NON-CATALYTIC REDUCTION (SNCR)**

☐ **NON-SELECTIVE CATALYTIC REDUCTION (NSCR)**

Equipment specifications

Manufacturer	Type	Model No
General Electric (GE)		

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, urea slip).

Operating parameters

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

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

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

State expected range of usage rate and concentration.

Service life of catalyst	Ammonia slip (ppm)
	5 ppmvd @ 15% O_2

Describe fully with a sketch giving locations of equipment, controls system, 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% O_2. 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)

9. Other Control Equipment: CO Oxidation

Equipment specifications

Manufacturer	Type	Model No
To be Determined (TBD)		

Design inlet 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 data including auxiliary equipment and operation details to thoroughly evaluate the control equipment.

Operating parameters

Volume of gas handled

_____ @ _____ °F _____ % Moisture

Describe, in detail, 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 (Combustion Turbines/Duct Burners (3x)) (Continued)

10. Costs

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

Device	Direct Cost	Indirect Cost	Total Cost	Operating Cost

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

Note: Complete this section if the facility 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 (stack test, CEM etc.): NOx, CO, and CO_2 CEMs; Stack test VOC and $PM/PM_{10}/PM_{2.5}$

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 CO_2 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 the parameters that will be recorded and the recording frequency:

Records kept for continuous measurement of NOx, CO, and CO_2 concentration and volumetric flow rate, 5 year performance test for PM and VOC

Reporting:

a. Describe the type of information to be reported and the reporting frequency:

b. Reporting start date:

Work Practice Standard: Describe each

Good combustion design and operation for $PM/PM_{10}/PM_{2.5}$ control. Use of natural gas and energy efficient design for CO_2e/GHG control.

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

1. Estimated Maximum Emissions*Presented here for one of three identical SCR/CO Ox units

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: 100

Stack height above grade (ft.) 213
Grade elevation (ft.) 795

Stack diameter (ft) or Outlet duct area (sq. ft.)
10 ft

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
Combustion Turbine/Duct Burner #1	40	40	3.0144	-80	20	17.16
Combustion Turbine/Duct Burner #2	40	40	4.3068	-80	20	15.191
Combustion Turbine/Duct Burner #3	40	40	5.5704	-80	20	13207

Stack Exhaust

Volume 372,090 ACFM Temperature 311 °F Moisture _____%

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

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

Section B - Combustion Unit Information (Natural Gas Engines (4x))

1. Combustion Units: ☐ Coal ☐ Oil ☒ Natural Gas Other:

Description: Four 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 units
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

Maximum heat input (Btu/hr)	Rated heat input (Btu/hr)	Typical heat input (Btu/hr)	Furnace Volume

Grate Area (if applicable)	Method of firing
	Direct

Indicate how combustion air is supplied to boiler

Indicate the Steam Usage:

Mark and describe soot Cleaning Method:

i. Air Blown
ii. Steam Blown
iii. Brushed and Vacuumed
iv. Other _____
v. Frequency of Cleaning _____

Maximum Operating schedule

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

Operational restrictions taken or requested, if any (e.g., bottlenecks or voluntary restrictions to limit potential to emit)

Capacity (specify units)

Per hour	Per day	Per week	Per year

Typical Operating schedule

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

Seasonal variations (Months): If variations exist, describe them.

Operating using primary fuel: _____ From _____ to _____
Operating using secondary fuel: _____ Form _____ to _____
Non-operating: From _____ to _____

2. Specify the primary, secondary and startup fuel. Furnish the details in item 3.
Single fuel, 40 CFR Part 72 pipeline natural gas.

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

3. 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
Oil Number	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Natural Gas	SCFH	X 10^6 Gal	gr/100 SCF		Btu/SCF
Gas (other)	SCFH	X 10^6 Gal	gr/100 SCF		Btu/SCF
Coal					
Other*					

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

4. Burner

Manufacturer	Model Number	Type of Atomization (Steam, air, press, mech., rotary cup)

Number of Burners	Maximum fuel firing rate (all burners)	Normal fuel firing rate

If oil, temperature and viscosity.

Maximum theoretical air requirement

Percent excess air 100% rating

Turndown ratio

Combustion modulation control (on/off, low-high fire, full automatic, manual). Describe.

Main burner flame ignition method (electric spark, auto gas pilot, hand-held torch, other). Describe.

5. Nitrogen Oxides (NO_x) control Options

Mark and describe the NO_x control options adopted

Low excess air (LEA)	Flue gas recirculation	Other._____
Over fire air (OFA)	Burner out of service	
Low-NO_x burner	Reburning	
Low NO_x burners with over fire air	Flue gas treatment (SCR / SNCR)	

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

6. Miscellaneous Information

Describe fly ash reinjection operation

Describe, in detail, the equipment provided to monitor and to record the source(s) operating conditions, which may affect emissions of air contaminants. Show that they are reasonable and adequate.

Describe each proposed modification to an existing source.

Describe how emissions will be minimized especially during start up, shut down, combustion upsets and/or disruptions. Provide emission estimates for start up, shut down and upset conditions. Provide duration of start up and shut down.

Describe in detail with a schematic diagram of the control options adopted for SO_2 (if applicable).

Anticipated milestones:

Expected commencement date of construction/reconstruction: _____

Expected completion date of construction/reconstruction: _____

Anticipated date(s) of start-up: _____

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

1. Precontrol Emissions*Work Practice

Emission Rate

Pollutant	Maximum Emission Rate				Calculation/ Estimation Method
	Specify Units	Pounds/Hour	Hours/Year	Tons/Year	
PM					
PM_{10}					
SOx					
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 Conditioning N/A

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

Outlet volume
_____ ACFM@ _____ °F _____ % Moisture

Describe the system in detail.

Combustion control techniques and use of pipeline natural gas.

Attach efficiency curve and/ or other efficiency information.

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

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

10. Costs

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

Device	Direct Cost	Indirect Cost	Total Cost	Operating Cost

11 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 E - Compliance Demonstration (Natural Gas Engines (4x))

Note: Complete this section if the facility is not a-Title V facility. Title V facilities must complete Addendum A.
Refer to Section 4.0 of the Support Document for more details.
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 (stack test, CEM etc.): Operational hours run meter

b. Monitoring device location: Onboard electronic controls/display

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

Testing:

a. Reference Test Method Citation:

b. Reference Test Method Description:

Recordkeeping:

Describe the parameters that will be recorded and the recording frequency:

Record hours of operation on monthly basis

Reporting:

a. Describe the type of information to be reported and the reporting frequency:

b. Reporting start date:

Work Practice Standard: Describe each

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

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

1. Estimated Maximum 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: 100

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

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 and Appendix C 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	6.900
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 _____%

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

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

Section B - Combustion Unit Information (Diesel Engines (2x))

1. Combustion Units: ☐ Coal ☐ Oil ☐ Natural Gas Other: Diesel fuel

Description: 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 units
Cummins & Kohler	QSB5-G3 4.5L, Inline 4; KDI 3404TM, Inline 4, 4-Cycle Turbo	2

Maximum heat input (Btu/hr)	Rated heat input (Btu/hr)	Typical heat input (Btu/hr)	Furnace Volume

Grate Area (if applicable)	Method of firing
	Direct

Indicate how combustion air is supplied to boiler

Indicate the Steam Usage:

Mark and describe soot Cleaning Method:

i. Air Blown
ii. Steam Blown
iii. Brushed and Vacuumed
iv. Other _____
v. Frequency of Cleaning _____

Maximum Operating schedule

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

Operational restrictions taken or requested, if any (e.g., bottlenecks or voluntary restrictions to limit potential to emit)

Capacity (specify units)

Per hour	Per day	Per week	Per year

Typical Operating schedule

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

Seasonal variations (Months): If variations exist, describe them.

Operating using primary fuel: _____ From _____ to _____
Operating using secondary fuel: _____ Form _____ to _____
Non-operating: From _____ to _____

2. Specify the primary, secondary and startup fuel. Furnish the details in item 3.
Ultra-low sulfur diesel fuel

Section B - Combustion Unit Information (Diesel Engines (2x))

3. 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
Oil Number	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Natural Gas	SCFH	X 10^6 Gal	gr/100 SCF		Btu/SCF
Gas (other)	SCFH	X 10^6 Gal	gr/100 SCF		Btu/SCF
Coal					
Other*					

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

4. Burner

Manufacturer	Model Number	Type of Atomization (Steam, air, press, mech., rotary cup)

Number of Burners	Maximum fuel firing rate (all burners)	Normal fuel firing rate

If oil, temperature and viscosity.

Maximum theoretical air requirement

Percent excess air 100% rating

Turndown ratio

Combustion modulation control (on/off, low-high fire, full automatic, manual). Describe.

Main burner flame ignition method (electric spark, auto gas pilot, hand-held torch, other). Describe.

5. Nitrogen Oxides (NO_x) control Options

Mark and describe the NO_x control options adopted

Low excess air (LEA)	Flue gas recirculation	Other._____
Over fire air (OFA)	Burner out of service	
Low-NO_x burner	Reburning	
Low NO_x burners with over fire air	Flue gas treatment (SCR / SNCR)	

Section B - Combustion Unit Information (Diesel Engines (2x)) (Continued)

6. Miscellaneous Information

Describe fly ash reinjection operation

Describe, in detail, the equipment provided to monitor and to record the source(s) operating conditions, which may affect emissions of air contaminants. Show that they are reasonable and adequate.

Describe each proposed modification to an existing source.

Describe how emissions will be minimized especially during start up, shut down, combustion upsets and/or disruptions. Provide emission estimates for start up, shut down and upset conditions. Provide duration of start up and shut down.

Describe in detail with a schematic diagram of the control options adopted for SO_2 (if applicable).

Anticipated milestones:

Expected commencement date of construction/reconstruction: _____

Expected completion date of construction/reconstruction: _____

Anticipated date(s) of start-up: _____

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

1. Precontrol Emissions*Work Practice

Emission Rate

Pollutant	Maximum Emission Rate				Calculation/ Estimation Method
	Specify Units	Pounds/Hour	Hours/Year	Tons/Year	
PM					
PM_{10}					
SOx					
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 Conditioning N/A

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

Outlet volume
_____ ACFM@ _____ °F _____ % Moisture

Describe the system in detail.

Combustion control techniques and use of ultra-low sulfur fuel.

Attach efficiency curve and/ or other efficiency information.

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

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

10. Costs Refer to Section 4.0 of the Support Document

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

Device	Direct Cost	Indirect Cost	Total Cost	Operating Cost

11 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 E - Compliance Demonstration (Diesel Engines (2x))

Note: Complete this section if the facility is not a-Title V facility. Title V facilities must complete Addendum A.
Refer to Section 4.0 of the Support Document for more details.
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 (stack test, CEM etc.): Operational hours run meter

b. Monitoring device location: Onboard electronic controls/display

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

Testing:

a. Reference Test Method Citation:

b. Reference Test Method Description:

Recordkeeping:

Describe the parameters that will be recorded and the recording frequency:

Record hours of operation on monthly basis

Reporting:

a. Describe the type of information to be reported and the reporting frequency:

b. Reporting start date:

Work Practice Standard: Describe each

Compliance with proposed limits for NOx, VOC, $PM/PM_{10}/PM_{2.5}$. and CO met with purchase of certified engine.

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

1. Estimated Maximum 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: 100

Stack height above grade (ft.) 5 & 6 Grade elevation (ft.) 850	Stack diameter (ft) or Outlet duct area (sq. ft.) 0.3 & 0.2 ft	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 and Appendix C of the Support Document

Location of Stack** Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Generator 1	40	39	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 _____%

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

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

Section B - Combustion Unit Information (Firewater Pump Engines (2x))

1. Combustion Units: ☐ Coal ☐ Oil ☐ Natural Gas Other: Diesel fuel

Description: Two diesel-fired reciprocating internal combustion engines, each rated at 488 BHP/0.36 MW, will be used to drive emergency firewater pumps.

Manufacturer	Model No.	Number of units
Cummins	CFP15E-F10, Inline 6 Turbo	2

Maximum heat input (Btu/hr)	Rated heat input (Btu/hr)	Typical heat input (Btu/hr)	Furnace Volume

Grate Area (if applicable)	Method of firing
	Direct

Indicate how combustion air is supplied to boiler

Indicate the Steam Usage:

Mark and describe soot Cleaning Method:

i. Air Blown
ii. Steam Blown
iii. Brushed and Vacuumed
iv. Other _____
v. Frequency of Cleaning _____

Maximum Operating schedule

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

Operational restrictions taken or requested, if any (e.g., bottlenecks or voluntary restrictions to limit potential to emit)

Capacity (specify units)

Per hour	Per day	Per week	Per year

Typical Operating schedule

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

Seasonal variations (Months): If variations exist, describe them.

Operating using primary fuel: _____ From _____ to _____
Operating using secondary fuel: _____ Form _____ to _____
Non-operating: From _____ to _____

2. Specify the primary, secondary and startup fuel. Furnish the details in item 3.
Ultra-low sulfur diesel fuel

Section B - Combustion Unit Information (Firewater Pump Engines (2x))

3. 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
Oil Number	GPH @ 60°F	X 10^3 Gal	% by wt		Btu/Gal. & Lbs./Gal. @ 60 °F
Natural Gas	SCFH	X 10^6 Gal	gr/100 SCF		Btu/SCF
Gas (other)	SCFH	X 10^6 Gal	gr/100 SCF		Btu/SCF
Coal					
Other*					

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

4. Burner

Manufacturer	Model Number	Type of Atomization (Steam, air, press, mech., rotary cup)

Number of Burners	Maximum fuel firing rate (all burners)	Normal fuel firing rate

If oil, temperature and viscosity.

Maximum theoretical air requirement

Percent excess air 100% rating

Turndown ratio

Combustion modulation control (on/off, low-high fire, full automatic, manual). Describe.

Main burner flame ignition method (electric spark, auto gas pilot, hand-held torch, other). Describe.

5. Nitrogen Oxides (NO_x) control Options

Mark and describe the NO_x control options adopted

Low excess air (LEA)	Flue gas recirculation	Other._____
Over fire air (OFA)	Burner out of service	
Low-NO_x burner	Reburning	
Low NO_x burners with over fire air	Flue gas treatment (SCR / SNCR)	

Section B - Combustion Unit Information (Firewater Pump Engines (2x))

6. Miscellaneous Information

Describe fly ash reinjection operation

Describe, in detail, the equipment provided to monitor and to record the source(s) operating conditions, which may affect emissions of air contaminants. Show that they are reasonable and adequate.

Describe each proposed modification to an existing source.

Describe how emissions will be minimized especially during start up, shut down, combustion upsets and/or disruptions. Provide emission estimates for start up, shut down and upset conditions. Provide duration of start up and shut down.

Describe in detail with a schematic diagram of the control options adopted for SO_2 (if applicable).

Anticipated milestones:

Expected commencement date of construction/reconstruction: _____

Expected completion date of construction/reconstruction: _____

Anticipated date(s) of start-up: _____

Section C - Air Cleaning Device(Firewater Pump Engines (2x))

1. Precontrol Emissions*Work Practice

Emission Rate

Pollutant	Maximum Emission Rate				Calculation/ Estimation Method
	Specify Units	Pounds/Hour	Hours/Year	Tons/Year	
PM					
PM_{10}					
SOx					
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 Conditioning N/A

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

Outlet volume
_____ ACFM@ _____ °F _____ % Moisture

Describe the system in detail.

Combustion control techniques and use of ultra-low sulfur fuel.

Attach efficiency curve and/ or other efficiency information.

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

Section C - Air Cleaning Device (Continued)

10. Costs

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

Device	Direct Cost	Indirect Cost	Total Cost	Operating Cost

11 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 E - Compliance Demonstration (Firewater Pump Engines (3x))

Note: Complete this section if the facility is not a-Title V facility. Title V facilities must complete Addendum A.
Refer to Section 4.0 of the Support Document for more details.
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 (stack test, CEM etc.): Operational hours run meter

b. Monitoring device location: Onboard electronic controls/display

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

Testing:

a. Reference Test Method Citation:

b. Reference Test Method Description:

Recordkeeping:

Describe the parameters that will be recorded and the recording frequency:

Record hours of operation on monthly basis

Reporting:

a. Describe the type of information to be reported and the reporting frequency:

b. Reporting start date:

Work Practice Standard: Describe each

Compliance with proposed limits for NOx, VOC, $PM/PM_{10}/PM_{2.5}$. and CO met with purchase of certified engine.

Section F - Flue and Air Contaminant Emission (Firewater Pump Engines (3x))

1. Estimated Maximum 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: 100

Stack height above grade (ft.) 5 & 6
Grade elevation (ft.) 850

Stack diameter (ft) or Outlet duct area (sq. ft.)
1.0 ft

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 6.0 and Appendix C of the Support Document

Location of Stack** Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Firewater Pump 1	40	39	51.7788	-80	20	9.586
Firewater Pump 2	40	39	51.5592	-80	20	9.928

Stack Exhaust

Volume 5699 ACFM Temperature 787 °F Moisture _____%

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

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

Section B - Processes Information (Cogen Cooling Tower)

1. Source Information

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

Cogen Cooling Tower – 6 cell counter-flow mechanical draft cooling tower to supply water to cogeneration units

Manufacturer	Model No.	Number of Sources 1
Source Designation	Maximum Capacity 74,056 gal/min	Rated Capacity

Type of Material Processed

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
18,934 tons			

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	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 * _____					
_____					
_____					

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

Section B - Processes Information (Cogen Cooling Tower) (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.

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.
N/A

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 E Compliance Demonstration (Cogen Cooling Tower)

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:
Monitoring and reporting in compliance with requirements in PA-04-00740A.

b. Reporting start date: _____

Work Practice Standard:

Describe each: High efficiency drift eliminators with a manufacturer's specification of no more than 0.0005% drift loss will be installed.

Section F - Flue and Air Contaminant Emission (Cogen Cooling Tower)

1. Estimated Atmospheric Emissions* See Table 2-1 and Appendix B of the Support Document

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.

2. Stack and Exhauster

Stack Designation/Number CogenCWT

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

Stack height above grade (ft.) 71 Grade elevation (ft.) 795	Stack diameter (ft) or Outlet duct area (sq. ft.) 52	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)?

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 and Appendix C of the Support Document

Location of stack** Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

Stack exhaust
Volume _____ ACFM Temperature 71 °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 (Cooling Tower)

1. Source Information

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

Process Cooling Tower - 26 cell counter-flow mechanical draft cooling tower to supply cooling water to process units and the cogeneration plant.

Manufacturer	Model No.	Number of Sources 1
Source Designation	Maximum Capacity 295,900 gal/min	Rated Capacity

Type of Material Processed

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
73,934 tons			

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	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 * _____					
_____					
_____					

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

Section B - Processes Information (Cooling Tower) (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.

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.
N/A

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: _____
ii. Expected completion date of construction/reconstruction/installation: _____
iii. Anticipated date of start-up: _____

Section E Compliance Demonstration (Cooling Tower)

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:
Monitoring and reporting in compliance with requirements in PA-04-00740A.

b. Reporting start date: _____

Work Practice Standard:

Describe each: High efficiency drift eliminators with a manufacturer's specification of no more than 0.0005% drift loss will be installed.

Section F - Flue and Air Contaminant Emission (Cooling Tower)

1. Estimated Atmospheric Emissions* See Section 2.0 and Appendix B of the Support Document

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.

2. Stack and Exhauster

Stack Designation/Number CogenPWT

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

Stack height above grade (ft.) 71 Grade elevation (ft.) 795	Stack diameter (ft) or Outlet duct area (sq. ft.) 52	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 and Appendix C of the Support Document

Location of stack** Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds

Stack exhaust
Volume _____ ACFM Temperature 71 °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 D - Additional Information

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.

Yes, the proposed Project will result in increases in emissions. The emissions increases will be less than the respective pollutant specific significance thresholds. A summary of the emissions increases is presented in Table 2-1 of the support document. Detailed emission increases are included in Appendix B of the Support Document.

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

The Support Document contains all of the materials required for a complete minor modification preconstruction permit application covering the design update. Based on discussions with the Pennsylvania Department of Environmental Protection (PaDEP) the Support Document BACT/LAER analyses for the emergency engines included with this project are included. At PaDEP's request an update to the air quality impacts analysis and inhalation risk assessment performed in support of the 2015 plan approval application is included as Section 5.0 and 6.0 of the Support Document. Appendices C and D include the detailed air quality modeling report and inhalation risk assessment reports.

a. Prevention of Significant Deterioration permit (PSD), 40 CFR 52? (NO_2, CO, PM, & PM_{10}) ☐ YES ☒ NO

b. New Source Review (NSR), 25 Pa. Code Chapter 127, Subchapter E? (NOx, VOC, & $PM_{2.5}$) ☐ YES ☒ NO

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

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) EEEE and ZZZZ

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

See the control technology reviews included in Section 4.0 of the Support Document.

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 (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.

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). See the LAER subsections in Section 4.0 of the Support Document.

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). See Section 1.0 and Appendix E.2 of the 2015 plan approval application.

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 there under 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. See the Support Document for this information.

Appendix B

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

Appendix B-1

Emissions Estimates

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
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	(Emission Factor/Proposed Limit) x (Capacity/Flowrate) x (Op. Hours)	B-7

EU Description	Project Description	Methodology	Calculation Location in Appendix B-2
	activated catalyst vent emissions		
Fire Water Pump Engine	Decrease rating from 700 to 488 bhp	(Emission Factor/Proposed Limit) x (Capacity) x (Op. Hours)	B-8
Caustic and LP TI	Decrease loading from 8 to 2.5 tonnes/hr	(Emission Factor) x (Capacity)	B-9, B-19
Cooling Tower PM	Decrease process cooling water tower rate from 305 to 295.9 Mgal/min	AP-42 Methodology; PSD from Reisman & Frisbie	B-10, B-11, B-16, B-17
Cooling Tower VOC	Decrease process cooling water tower rate from 305 to 295.9 Mgal/min	(Proposed Limit) x (Circulation Rate)	B-10, B-11
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
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 a study of LPG loading conducted by the South Coast Air Quality Management District (SCAQMD) in

California.[1] An emissions factor was derived from the SCAQMD study and applied to the maximum expected volume of C3+ that will be shipped from the proposed plant. 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. 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 1.22 lb VOC per railcar loaded. Additional factors were developed to estimate other LPG materials. 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 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.

1.8 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.

1.9 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

[1] 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)

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.

1.10 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.[2]

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 circulation rates for both cooling towers. See Tables B-10 through B-11 and Tables B-16 through B-17 for documentation of the calculation methodology used to estimate emissions from the Process and Cogen Cooling Towers.

1.11 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.

1.12 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

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[2] 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.

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 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.

1.13 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.

1.14 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.

1.15 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.

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

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

Emission Factor (lb/bhp-hr)

Engine		Size (bhp)	PM	PM10	PM2.5	VOC	NOx	SO2	CO	CO2	CH4	N2O	CO2e	H2SO4	Comment
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

Emission Factor (lb/MMBtu)

Engine	Size (bhp)	Fuel Required (cfh)	PM	PM10	PM2.5	VOC	NOx	SO2	CO	CO2	CH4	N2O	CO2e	H2SO4	Comment
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

Emissions

Engine		Units	PM	PM10	PM2.5	VOC	NOx	SO2	CO	CO2	CH4	N2O	CO2e	H2SO4
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
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 =	C3LOAD		Propane Railcars Loading/Unloading Emissions
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
C3 Loaded and/or Unloaded =	297,840	m3/yr	Design basis of Franklin plant.
Volume of 1 Railcar =	115	m3	Standard railcar volume
Annual Railcars Loaded and/or Unloaded =	2,590	event/yr	Annual Railcars Loaded and/or Unload = (C3 Loaded and/or Unloaded) / (Volume of 1 Railcar)
VOC EF -g/event =	554	g/event	SCAQMD Emission Factor for LPG railcar loading/unloading events, LPG
VOC EF - lb/event =	1 22	lb/event	= (VOC EF -g/event) / (453.6 g/lb)
Annual Emissions Calculations			
VOC PTE =	1 58	tpy	= (VOC EF - lb/event) x (Annual Railcars Loaded and/or Unloaded - #/yr) / (2,000 lb/ton)

NOTES:
- Propane liquids contain no OHAP.
- EF source: Final Staff Report Proposed Rule 1177 – Liquefied Petroleum Gas Transfer and Dispensing (June 2012).
  Appendix B - Emissions Inventory Calculations "Summary of California LPG Transfer and Dispensing VOC Emissions and Reduction Estimates".
  Tower liquid line and tower vapor line disconnects

Emission Unit(s) ID =	C4LOAD		Butane Railcars Loading/Unloading Emissions
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
C4 Loaded and/or Unloaded =	297,840	m3/yr	Design basis of Franklin plant.
Volume of 1 Railcar =	115	m3	Standard railcar volume
Annual Railcars Loaded and/or Unloaded =	2,590	event/yr	Annual Railcars Loaded and/or Unload = (C4 Loaded and/or Unloaded) / (Volume of 1 Railcar)
VOC EF -g/event =	554	g/event	SCAQMD Emission Factor for LPG railcar loading/unloading events, LPG
C4 to C3 =	0.96	lb_{C4}/lb_{C3}	Ratio of Butane HHV/Propane HHV
VOC EF - lb/event =	1.18	lb/event	= (VOC EF -g/event) / (453.6 g/lb) * lbC4/lbC3
Annual Emissions Calculations			
VOC PTE =	1 52	tpy	= (VOC EF - lb/event) x (Annual Railcars Loaded and/or Unloaded - #/yr) / (2,000 lb/ton)

NOTES:
- Butane liquids contain no OHAP.
- EF source: Final Staff Report Proposed Rule 1177 – Liquefied Petroleum Gas Transfer and Dispensing (June 2012).
  Appendix B - Emissions Inventory Calculations "Summary of California LPG Transfer and Dispensing VOC Emissions and Reduction Estimates".
  Tower liquid line and tower vapor line disconnects
- C4 to C3 based on the ratio of butane to propane heat of combustion. See Constants table.

Emission Unit(s) ID =	C6LOAD		Hexene Railcars Loading/Unloading Emissions
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
C6 Loaded and/or Unloaded =	297,840	m3/yr	Design basis of Franklin plant.
Volume of 1 Railcar =	115	m3	Standard railcar volume
Annual Railcars Loaded and/or Unloaded =	2,590	event/yr	Annual Railcars Loaded and/or Unload = (C6 Loaded and/or Unloaded) / (Volume of 1 Railcar)
VOC EF -g/event =	554	g/event	SCAQMD Emission Factor for LPG railcar loading/unloading events, LPG
C6 to C3 =	0.95	lb_{C6}/lb_{C3}	Ratio of Hexene HHV/Propane HHV
VOC EF - lb/event =	1.15	lb/event	= (VOC EF -g/event) / (453.6 g/lb) * lbC6/lbC3
Annual Emissions Calculations			
VOC PTE =	1.49	tpy	= (VOC EF - lb/event) x (Annual Railcars Loaded and/or Unloaded - #/yr) / (2,000 lb/ton)

Total VOC PTE =	4.60	tpy	=C3LOAD+C4LOAD+C6LOAD
2015 Plan Approval C3+ VOC PTE =	17 21	tpy	Erroneously based on bleeder valve emission factor and only loadout operations.
Net Change in Emissions =	-12.61	tpy	

NOTES:
- Hexene liquids contain no OHAP.
- EF source: Final Staff Report Proposed Rule 1177 – Liquefied Petroleum Gas Transfer and Dispensing (June 2012).
  Appendix B - Emissions Inventory Calculations "Summary of California LPG Transfer and Dispensing VOC Emissions and Reduction Estimates".
  Tower liquid line and tower vapor line disconnects
- C6 to C3 based on the ratio of butane to propane heat of combustion. See Constants table.

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]	0.005	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 exhaust rates provided by vendor at normal conditions (i.e. 0°C) and permitted grain loading for filterable particulate at standard conditions (i.e., 20°C).

Table B-8. Fire Water Pump Engines Emissions Estimates

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 =	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 =	0.161	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 =	1.227	lb/hr	= (Rated Horsepower, each engine) x (VOC EF)
NOx Hourly Max =	2.001	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 =	0.123	tpy	= (VOC Hourly Max) x (No. of Engines) x (Annual Operating Hours) / (2000 lb/ton)
NOx PTE =	0.200	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	0.123	0.200	0.001	0.280	56	56	0.000
2015 Plan Approval (3 units @ 700 bhp) =	0.03	0.03	0.03	0.26	0.43	0.00	0.60	120	120	0.00
Net Change in Emissions =	-0.02	-0.02	-0.02	-0.14	-0 23	0.00	-0.32	-64	-64	0.00

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. Polyethylene Pellet Transport, Storage, Blending and Loading Operations Emissions Estimates

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	1,680,000	720,000		1,680,000	720,000	Based on 1.7 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	5,600	2,400		5,600	2,400	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	0.23	0.16		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	2.97	2.05		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	1.01	0.70		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 and Net Change in Emissions								
Annual PM PTE	T/yr	6.32	3.20	0.67	1.91	0.04	0.01	
Annual PM10/2.5 PTE	T/yr	1.07	0.54	0.11	0.02	0.04	0.01	
Net Change in PM PTE	T/yr	-2.79	-0.23	1.38	-1.91	0.00	0.01	
Net Change in PM10/PM2.5 PTE	T/yr	0.12	0.47	0.58	-0.02	0.00	0.01	
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							
***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							

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 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 lo 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 RNSRP 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 million gal/day	Emission Factor	Short Term Max Emissions	Annualized Emissions			Calculation/ Estimation Method	Emission Factor Reference
Pollutant		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 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. Low Temperature Thermal Incinerator Emissions Estimates

Emission Unit(s) ID	=	LPINCINERATOR	LP Thermal Incinerator
Parameter		**Value**	**Source / Basis**
Calcuation 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	=	0.0075 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	=	0.0351 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	=	3.48 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	=	0.80 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	=	3.48	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	=	4.57	4.57	4.57	15.46	41.73	0.00	50.54	89,244	89,582	0.00	1.14
Net Emissions Change	=	-1.09	-1.09	-1.09	0.95	-9.93	0.00	-12.03	-21,241	-21,322	0.00	-0.27

APPENDIX C

AIR DISPERSION MODELING AND CLASS II VISIBILITY ANALYSIS FOR THE SHELL POLYMERS MONACA SITE IN BEAVER COUNTY PENNSYLVANIA

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Submittal Update No. 3 February 2020

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1.0 INTRODUCTION AND SUMMARY OF RESULTS

This document presents the results of an updated air quality dispersion modeling analysis conducted for the Shell Polymers Monaca Site ("Shell") under construction in Beaver County Pennsylvania. An initial analysis was submitted to the Pennsylvania Department of Environmental Protection ("PADEP") in April of 2014. Subsequent revisions to the analysis have been necessitated by changes to facility configuration and emissions as well as updates to the EPA-approved dispersion models, supporting software, and modeling procedures. At the PADEP's request, an update to the air quality impacts analysis was conducted for emissions of carbon monoxide ("CO"), nitrogen dioxide ("NO_2"), and particulate matter with an aerodynamic diameter of less than 10 microns ("PM10"). In addition, the PADEP requested a comparison of the modeled impacts of the permitted facility design and the most recent facility design. The analysis was conducted to ensure that the Shell facility in conjunction with the updated dispersion models will not cause or contribute to air pollution in violation of a National Ambient Air Quality Standard ("NAAQS") or PSD increments.

Only the emissions from the Shell facility were initially evaluated to determine if the project would significantly impact local air quality. The resultant modeled concentrations were compared to the ambient Significant Impact Levels ("SILs") for Class I and Class II areas. The results of this significant impacts analysis demonstrate that the facility will result in ambient impacts in excess of the Class II SILs for NO_2, PM10 and CO. Therefore, a refined air quality analysis to calculate concentrations for comparison to the NAAQS and increments was required.

The results of the analyses indicate compliance with all NAAQS and increment standards except the 1-hr NO_2 NAAQS. Modeled 1-hr NO_2 NAAQS violations were calculated in the vicinity of the Shell site. These modeled violations are attributable to existing sources in the vicinity of the Shell site. The Shell project is shown not to cause or contribute to an existing modeled exceedance.

The model also demonstrates that the air quality impactts attributable to the original plant design and new plant design are comparable. The largest difference in modeled impacts between the original and new design is 17%, with the new design impacts being lower.

Class I Air Quality Related Values (AQRVs) were also evaluated using the Federal Land Managers Q/d screening and determined to be acceptable. In addition, impacts were evaluated at the nearby Racoon Creek State Park and determined to be acceptable.

The analysis conforms with the modeling procedures outlined in the Environmental Protection Agency's Guideline on Air Quality Models[1] ("Guideline") and associated EPA modeling policy and guidance. It also conforms with the initial modeling protocol submitted to and approved by the PADEP on February 19, 2014 as well as the more recent document describing the changes to the initial protocol submitted to the PADEP on December 20, 2019.[2]

2.0 FACILITY DESCRIPTION

The Shell facility will produce approximately 1,500,000 metric tons per year of ethylene and 1,600,000 metric tons per year of polyethylene. From an air emissions modeling perspective, the facility will consist seven ethane cracking furnaces, a number of natural gas-fired and diesel-fired engines to provide emergency power and to power fire water pumps, flares, cooling towers, catalyst activation vent, fugitive emissions from equipment leaks and liquid storage tanks, combustion turbines with heat recovery systems to provide steam and electric power to the facility and electric power for sale.

3.0 SITE DESCRIPTION

The Shell facility occupies approximately 400 acres on the site formerly owned by the Horsehead Corporation. The site is located adjacent to the Ohio River in the Borough of Monaca, Pennsylvania in Beaver County. The approximate Universal Transverse Mercator ("UTM") coordinates of the facility are 556,129 meters east and 4,502,450 meters north (UTM Zone 17, NAD 83). Figure 1 shows the general location of the facility. Figure 2 shows the specific facility location on a 7.5-minute U.S. Geological Survey ("USGS") topographic map.

The facility is classified under the regulations governing PSD (40 CFR 52.21) and Title V (40 CFR 70.2) as a major source of air pollution.

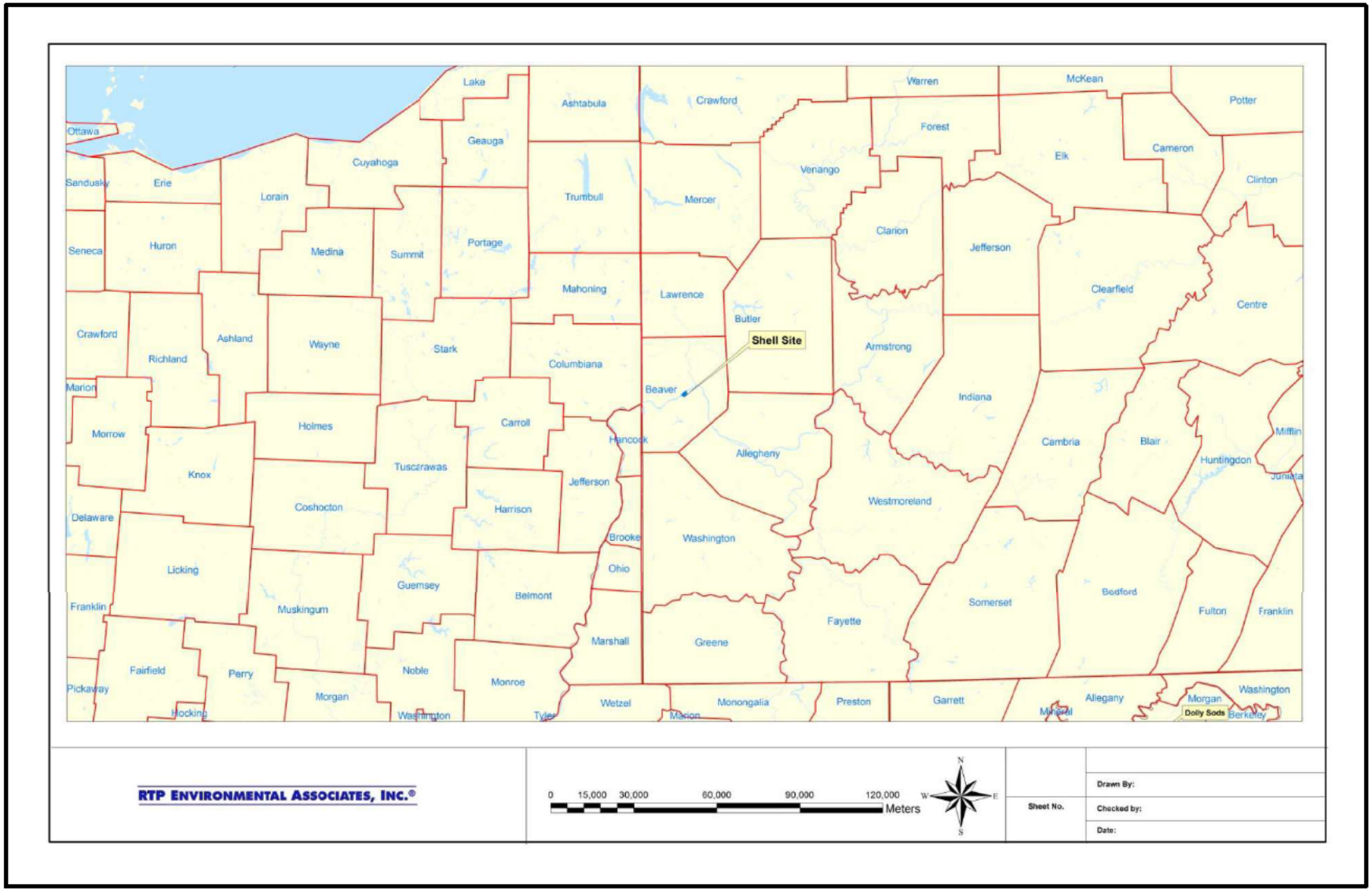


Figure 1. General Location of the Shell Facility

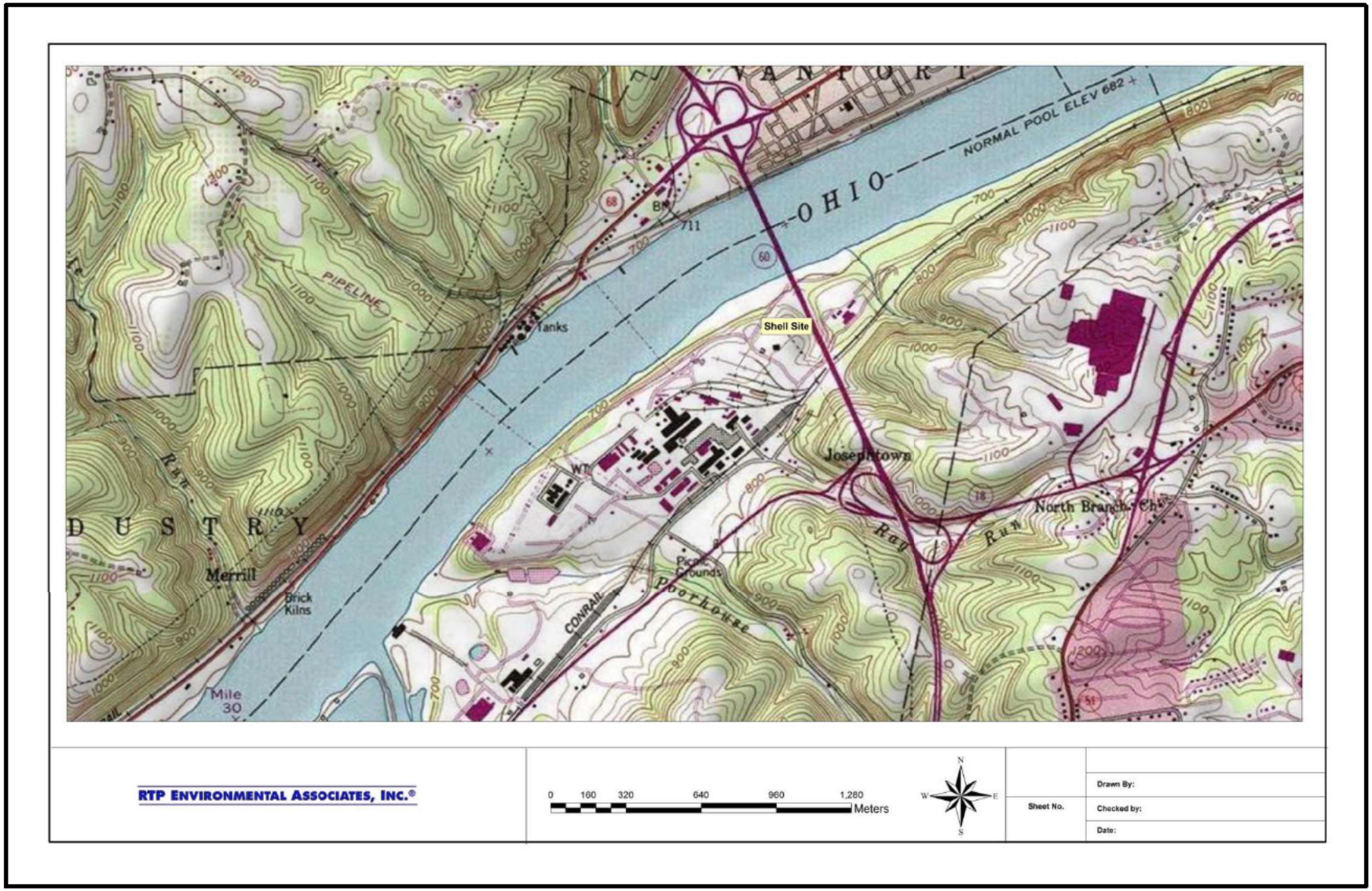


Figure 2. Specific Location of the Shell Facility

4.0 MODEL SELECTION AND MODEL INPUT

4.1 Model Selection

The latest version of the AMS/EPA Regulatory Model (AERMOD, Version 19191) was used to conduct the dispersion modeling analysis. AERMOD is a Gaussian plume dispersion model that is based on planetary boundary layer principals for characterizing atmospheric stability. The model evaluates the non-Gaussian vertical behavior of plumes during convective conditions with the probability density function and the superposition of several Gaussian plumes. AERMOD is a modeling system with three components: AERMAP is the terrain preprocessor program, AERMET is the meteorological data preprocessor and AERMOD includes the dispersion modeling algorithms.

AERMOD is the most appropriate model for calculating ambient concentrations near the Shell facility based on the model's ability to incorporate multiple sources and source types. The model can also account for convective updrafts and downdrafts and meteorological data throughout the plume depth. The model also provides parameters required for use with up to date planetary boundary layer parameterization. The model also has the ability to incorporate building wake effects and to calculate concentrations within the cavity recirculation zone. All model options were selected as recommended in the EPA Guideline on Air Quality Models.

Providence's BEEST Graphical User Interface ("GUI") was used to run AERMOD. The GUI uses an altered version of the AERMOD code to allow for flexibility in the file naming convention. The dispersion algorithms of AERMOD were not altered. A model equivalency evaluation was conducted pursuant to Section 3.1 of 40 CFR 51, Appendix W and submitted to the PADEP as part of the initial modeling demonstration.

4.2 Model Control Options and Land Use

AERMOD was run in the regulatory default mode for all pollutants except NO_2. The NO_2 modeling included the Plume Volume Molar Ratio Method ("PVMRM") in the

NAAQS analysis. This option is discussed in more detail in Section 5.5.

The default rural dispersion coefficients in the model were used. This rural classification is supported by the Land Use Procedure consistent with subsection 7.2.3(c) of the Guideline and Section 5.1 of the AERMOD Implementation Guide. The USGS 2006 National Land Cover Data (NLCD) within 3km of the site were converted to Auer 1978 land use types, using recommendations from the PADEP, and evaluated.[3] It was determined that the land use in the vicinity of Shell is predominantly rural (less than 15% of the area is classified as urban - Figure 3). Based upon this rural determination, the potential for urban heat island affects, which are regional in character, should not be of concern.

4.3 Source Data

Modeled source input data, emissions, and other supporting calculations and documentation are included in Attachment A of this report.

Source Characterization

Point Sources

Most emission sources at the Shell site will vent to stacks with a well defined opening. These sources were modeled as point sources in AERMOD. Several other sources were modeled as fugitive sources (e.g., rail and truck loading operations, haul roads, and a multi point, open top, ground flare also required evaluation).

Fugitive Emissions (Including Multi Point Ground Flare)

Fugitive emissions were modeled as volume sources. The initial dispersion coefficients (sigma y and sigma z) were calculated based upon the dimensions of the area of release and the equations contained in Table 3-1 of the AERMOD User's Guide.

Haul roads were modeled pursuant to procedures adopted by the EPA Haul Road

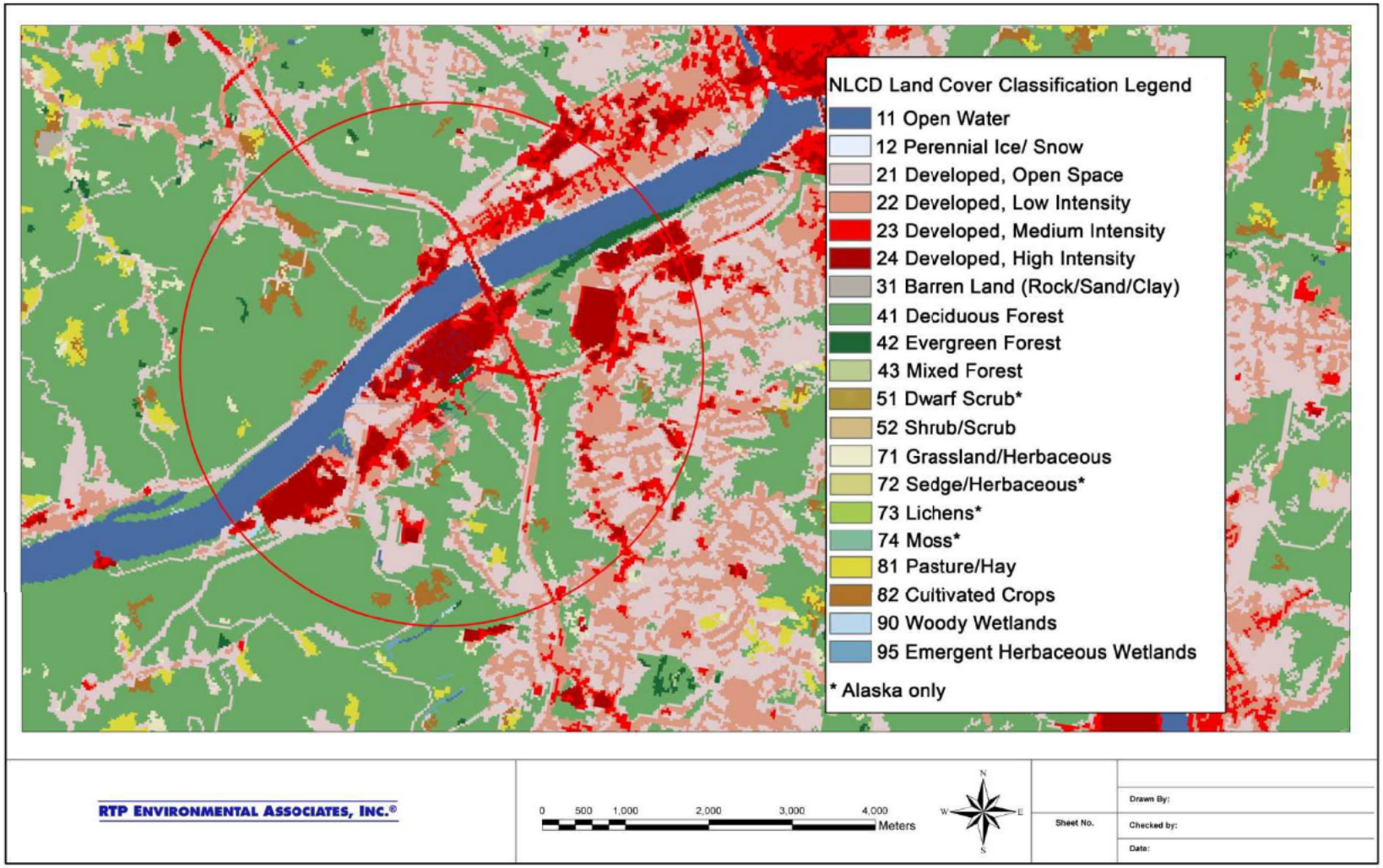


Figure 3. Land Use within Three Kilometers

Workgroup[4] as outlined in the six steps below:

Step 1: The adjusted width of the "road" was calculated as the actual road width plus 6 meters. The additional width represents turbulence caused by the vehicle as it moves along the road.

Step 2: The number of volume sources was calculated by dividing the length of the road by the adjusted width. This was the maximum number of volume sources modeled.

Step 3: The height of the volume was set to 1.7 times the height of the vehicle generating the emissions.

Step 4: The initial horizontal sigma for each volume was calculated by dividing the adjusted width by 2.15.

Step 5: The initial vertical sigma was calculated by dividing the height of the volume determined in Step 2 by 2.15.

Step 6: The release point height was calculated as the height of the volume divided by two. This point is in the center of the volume.

Flares

There will also be flares at the facility: enclosed ground flares and elevated, candlestick flares. The enclosed ground flares are different from the multi point ground flare discussed below. The enclosed ground flares have the flame at the base of the flare structure but vent to a well defined stack. The multi point ground flare is an open air area enclosed on four sides by a wind fence but without a well defined stack.

Several of the flares will only be operated during periods of malfunction. Malfunction emissions are not required to be modeled per 40 CFR Part 51 Appendix W. Therefore, only the emissions associated with the pilot lights were modeled for the flares that are used for malfunction. However, flares used for startup or shutdown (i.e., non-emergency flaring) and other foreseeable operations were modeled using the SCREEN3 proceedures developed by the EPA as described by the Ohio EPA[5]. The effective stack height (H, in meters) was computed as a function of heat release rate according to the following equation, where Q is the heat release rate of the flare in MMBtu/hr:

$$H_{equivalent} = H_{actual} + 0.944(Q)^{0.478}$$

The effective flare diameter (d, in meters) was computed as a function of heat release rate according to the following equation, where Q is the heat release rate of the flare in MMBty/hr:

$$d_{equivalent} = 0.1755(Q)^{0.5}$$

The following heat release rates and actual flare heights were used in calculating the effective flare heights and diameters: 1343.5 MMBtu/hr and 110 ft for the ground flares (GFLARE1&2), and 51.7 MMBtu/hr and 335 ft for the elevated, high pressure flare (HPFLARE). See Attachment A for the calculated stack heights and diameters modeled for the flares. An exit temperature of 1273K and velocity of 20 m/sec was assumed.

Multipoint Ground Flare

There will also be a multipoint ground flare surrounded by a 60 ft tall wind screen/fence at the facility. The multipoint ground flare was modeled as volume source. The release height was calculated as the effective stack height. The effective stack height was calculated as the top of the wind fence (60') plus the plume rise of the multipoint ground flare (calculated as a function of the flare heat release based upon the SCREEN3 proceedures described above). The initial dispersion coefficients sigma y and sigma z were calculated based upon the dimensions of the area of release and the equations contained in Table 3-1 of the AERMOD User's Guide.

All source locations were based upon a NAD83, UTM Zone 17 projection. The source elevations for all Shell sources were determined from facility survey data, not from AERMAP.

Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height evaluation was conducted to determine appropriate building dimensions to include in the model and to calculate the GEP formula stack height used to justify stack height credit for stacks to be constructed

in excess of 65m. Procedures used were in accordance with those described in the EPA Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations-Revised).[6] GEP formula stack height, as defined in 40 CFR 51, is expressed as GEP = H_b + 1.5L, where H_b is the building height and L is the lesser of the building height or maximum projected width. Building/structure locations were determined from a facility plot plan. The structure locations and heights were input to the EPA's Building Profile Input Program (BPIP-PRIME) computer program to calculate the direction-specific building dimensions needed for AERMOD. The Shell facility plot plan is shown in Figure 4. A three dimensional rendering of the facility is shown in Figure 5.

4.4 Ambient Monitoring and Monitored Background Data

Pursuant to 40 CFR 52.21(i)(5), as adopted at 25 Pa. Code Chapter 127, Subchapter D, requirements for ambient monitoring data may be waived by the permitting authority if projected increases in ambient concentrations due to the project are less than the Significant Monitoring Concentrations. As shown in Section 6, Table 7 herein, the Shell project would qualify for such a waiver with respect to all listed pollutants, except for the 8-hr CO impact, because the maximum modeled impacts are less than the Class II SILs and/or also less than the Significant Monitoring Concentrations ("SMC") (please note there is no SMC for NO_2 for the 1-hour average). However, in light of the decision of the D.C. Circuit Court of Appeals *Sierra Club v. EPA* last year,[7] Shell has elected not to request such a waiver. Shell has elected to use existing ambient data in lieu of preconstruction monitoring data.

The EPA's Ambient Monitoring Guidelines , other EPA interpretive guidance, and EPA administrative decisions clarify that representative, existing air quality monitoring data may be used to fulfill the PSD pre-construction monitoring requirements and establish the background concentrations needed for assessing NAAQS compliance, in lieu of monitoring data from the area in the vicinity of the proposed source or modification.

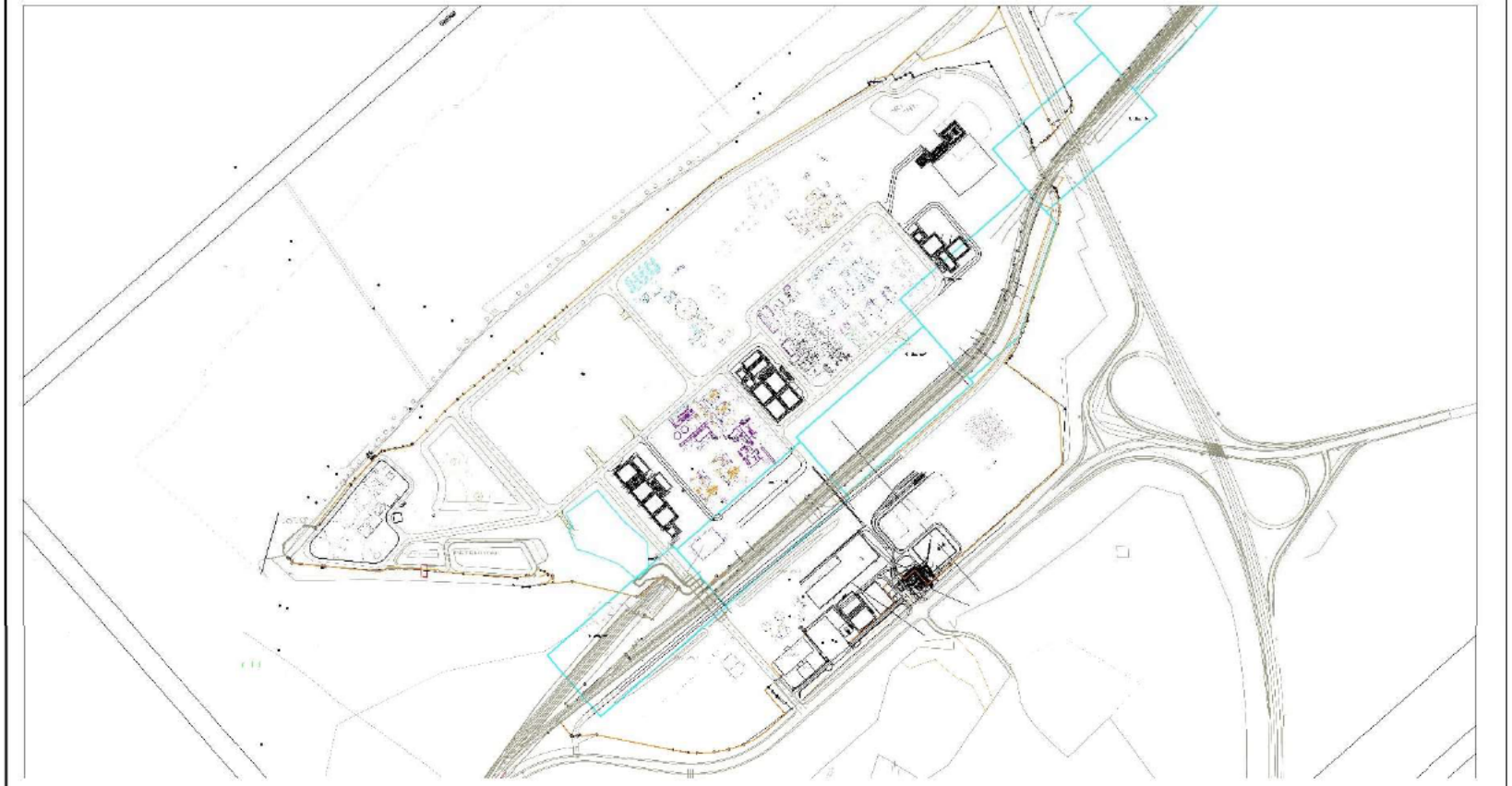


Figure 4. Shell Facility Plot Plan

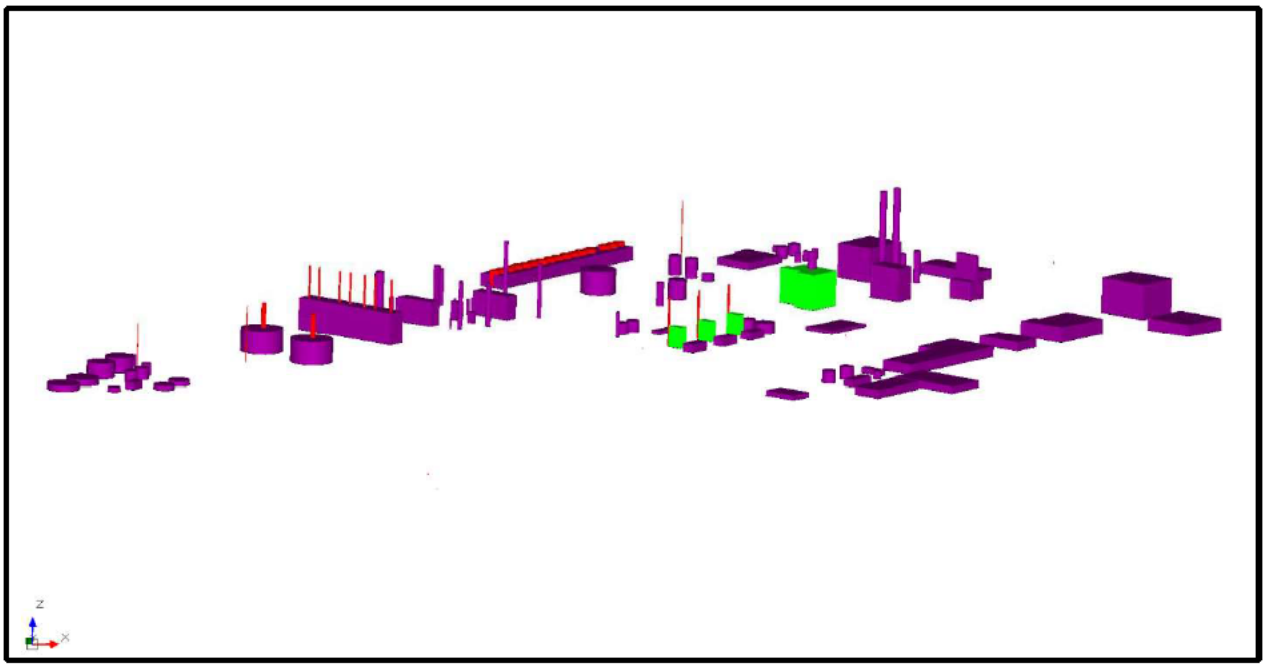


Figure 5. Shell Three Dimensional Plot Plan (View from SW)

EPA's Monitoring Guidelines suggest specific criteria to determine representativeness of off-site data: quality of the data, currentness of the data, and monitor location.

There are two ambient monitors in close vicinity (within 10km) of the Shell site (Figure 6). The Brighton Township monitor, on Sebring Road (AQS #42-007-0005), is located just across the river from the site to the north. However, only SO_2 and O_3 are monitored at this location. The second monitor is located in Beaver Falls (AQS #42-007-0014). PM10, PM2.5, NO_2, O_3, and SO_2 are monitored at this location. This monitor was inactivated in March of 2018. There are no CO monitors in Beaver Co. (Note that CO was monitored at the Beaver Falls site. However, the CO monitor was inactivated in 2008). The nearest CO monitor is the Pittsburgh monitor in Allegheny County (AQS# 42-003-0008). This monitor is located in an urban area and the concentrations are a conservative representation of the CO concentrations at the Shell site.

RTP has used the most recent available, quality assured NO_2 and PM10 data (2015-2017) from the Beaver Falls monitor to establish representative background NO_2 and

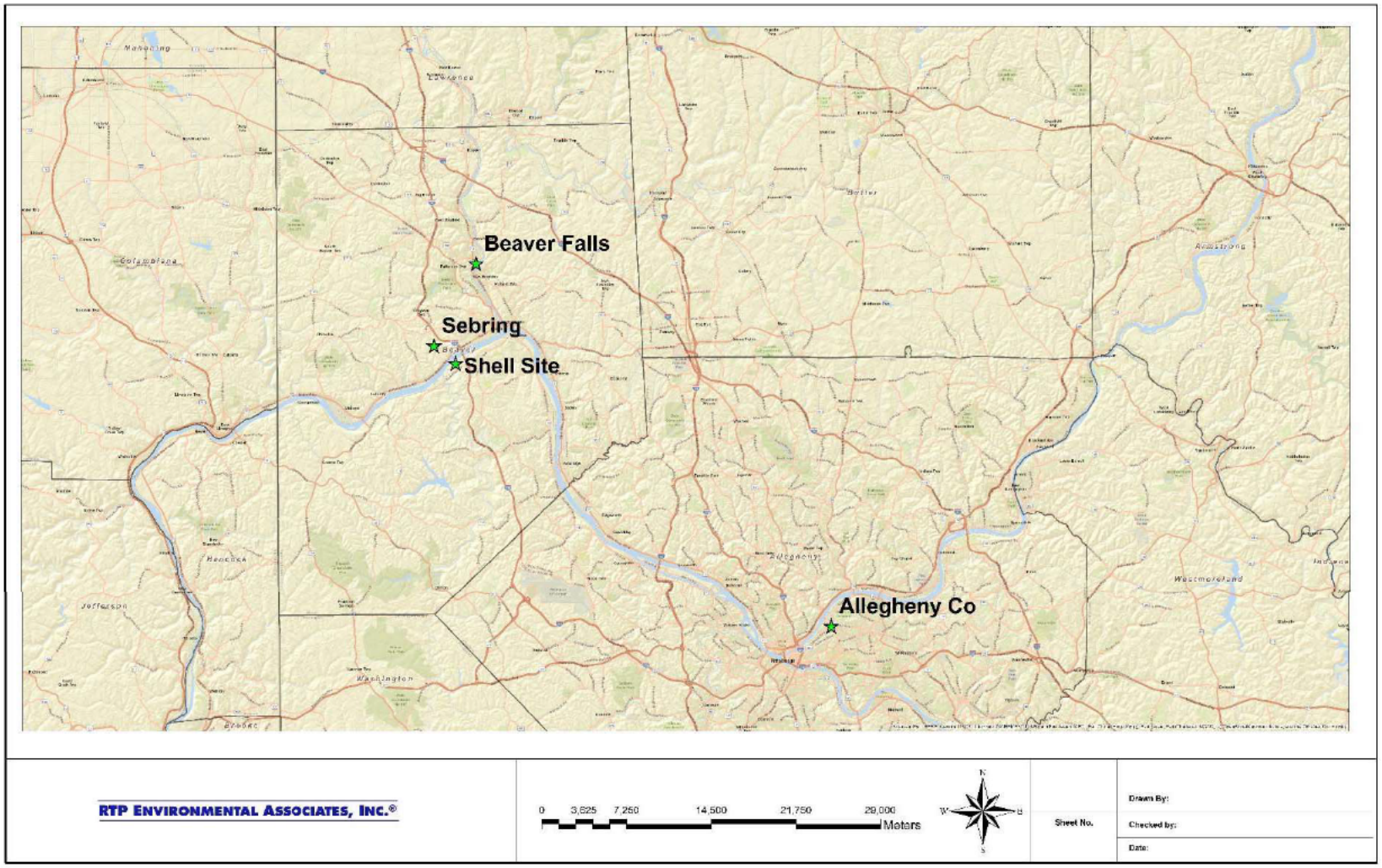


Figure 6. Ambient Air Quality Monitors in the Vicinity of the Shell Site

PM10 concentrations. This monitor best represents background concentrations as it is the closest monitor with data for the pollutants of concern and is in the vicinity of the site. It is also not likely significantly influenced by the localized source impacts of the First Energy facilities. The CO data from 2016-2018 from the monitor in Allegheny County was used. Ozone data from Sebring, commensurate with the modeled years of meteorology, were used in the NO_2 PVMRM analysis. The background data are presented in Tables 1 and 2.

Table 1. Background Concentrations

Pollutant	Averaging Time	Maximum Monitored Value (µg/m^3)	Monitor Site Location (Years Used)
PM10	24-hour	69	Beaver Falls (2015-17)
NO_2	Annual	9.5 ppb, 17.9 µg/m^3	
CO	1-hour	1.6 ppm, 2515 µg/m^3	Allegheny County (2016-18)
	8-hour	1.1 ppm, 1269 µg/m^3	

Table 2. Beaver Falls 98% Hourly NO_2 (ppb) By Season and Hour of Day (2015-17)

Model Ending Hour	Winter	Spring	Summer	Fall
01	36.7	33.3	22.3	28.7
02	38.0	34.7	21.3	24.0
03	38.3	32.3	21.7	29.3
04	36.7	35.3	22.7	28.3
05	33.7	36.0	20.7	26.7
06	35.7	36.7	20.0	27.3
07	34.0	36.7	20.0	27.7
08	36.7	35.3	19.3	29.3
09	37.3	34.0	18.3	27.7
10	40.0	36.0	18.3	30.0
11	37.3	28.0	15.3	30.0
12	34.7	27.3	10.0	27.7
13	32.7	23.0	8.0	21.7
14	28.3	14.7	8.7	21.3
15	35.3	18.3	8.3	19.0
16	35.7	21.3	8.0	19.7
17	37.7	21.0	7.0	26.7
18	38.3	22.0	8.0	26.7
19	35.0	23.7	12.0	28.7
20	35.7	28.7	17.0	26.7
21	36.0	30.0	18.3	27.0
22	36.7	30.0	20.7	28.0
23	38.0	31.0	18.0	27.0
24	39.0	31.0	21.0	27.3

Note: Maximum 1-hr NO_2 value is 58 ppb or 110 $\mu g/m^3$.

A range of monitored background NO_2 values that consider seasonal and diurnal variation was used to assess compliance with the 1-hr NAAQS. These seasonal values reflect the three year average (2015-2017) of the 98th percentile value by hour of day and by season. These seasonal NO_2 values were added to the modeled value within AERMOD.

The existing monitoring data satisfy the criteria provided in the Ambient Monitoring Guidelines as being representative of the Shell site.

Monitor Location

The Beaver Falls monitor is located less than 9 kilometers from the Shell facility. It is also located in an adjacent river valley, absent the influence of any major, localized industry. While the CO monitor is more distant at 36km, measurements from this site provide an adequate representation of the air quality in the vicinity of the Shell site.

Data Quality

The existing ambient monitors were established and air quality data were collected as part of EPA's ambient air quality monitoring network. Federal regulations at 40 CFR Part 58, Appendix A, require that these data meet quality assurance ("QA") requirements. The existing ambient air quality data also meet the data quality requirements of Section 2.4.2 of the Monitoring Guidelines. The QA requirements for monitoring criteria pollutants at PSD sites are very similar to the QA requirements for monitoring sites for NAAQS compliance. The data presented in Section 5.3 meet the data quality criterion.

Currentness of Data

The Monitoring Guidelines suggest that air quality monitoring data used to meet PSD data requirements should be “collected in the 3-year period preceding the permit application.”[8] The data presented herein are current and meet this criterion.

4.5 Receptor Data

Modeled receptors were placed in all areas considered as "ambient air" pursuant to 40 CFR 50.1(e). Ambient air is defined as that portion of the atmosphere, external to buildings, to which the general public has access. Approximately 25,500 receptors were used in the AERMOD significant impacts analysis. The receptor grid consists of four Cartesian grids and receptors spaced at 25m intervals along the facility fenceline and the railroad that transects the facility. The first Cartesian grid extended to approximately 1km from the fence in all directions. Receptors in this region were

spaced at 50m intervals. The second grid extended to 3km. Receptor spacing in this region was 100m. The third grid extended to 10km with a spacing of 500m.

The fourth grid extended to 50km with a receptor spacing of 1,000m. Receptors with flagpole elevations were also placed along the Highway 376 (Vanport) bridge east of the facility. The flagpole receptor calculations are provided in Attachment A. The receptor grid was designed such that maximum facility impacts fall within the 50m spacing of receptors. Such an expansive grid will be used as significant 1-hr NO_2 concentrations extended to a distance of 43km from the facility.

The receptor grid spacing is presented in Table 3.

Table 3. Receptor Grid Spacing

Receptor Spacing (m)	Distance from Facility Fence (m)
50	1,000
100	3,000
500	10,000
1,000	50,000

The Shell facility is located in western Pennsylvania. Terrain within 10km of the site is gently rolling; however, there is terrain in excess of stack top elevation. Receptor elevations and hill height scale factors were calculated with AERMAP (18081). The elevation data was obtained from the USGS 1 arc second National Elevation Data (NED) obtained from the USGS. Locations were based upon a NAD83, UTM Zone 17 projection. The near-field receptor grid is presented in Figure 7.

4.6 Meteorological Data

Data Selection and Representativeness

The 2006-2010, 5-year sequential hourly surface meteorological data collected at the First Energy Beaver Valley Nuclear Generating Station (Beaver Valley) and surface and

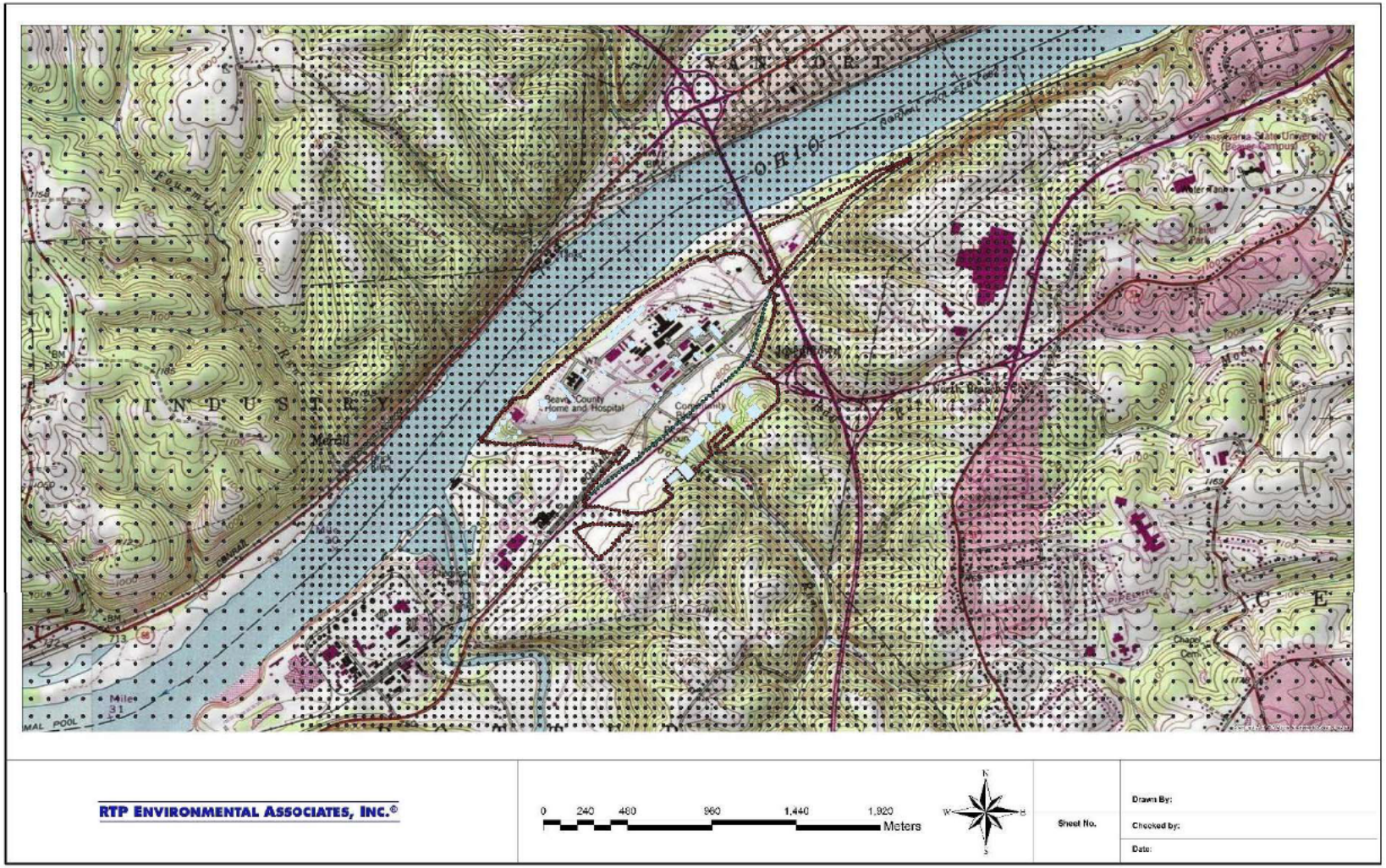


Figure 7. Shell Near-field Receptor Grid

upper air data from the Pittsburgh International Airport (KPIT, WBAN 94823) were used in the analysis. The First Energy surface data were collected as part of a continuous data collection program required by the U.S. Nuclear Regulatory Commission (NRC). The meteorological data adequately represent atmospheric boundary layer conditions within the Shell analysis domain for AERMOD to properly characterize the transport and dispersion of the Shell emissions plumes. A profile base elevation of 228.6m was employed which corresponds to the base elevation of the Beaver Valley tower.

The First Energy station is located approximately 8km downstream of the Shell facility, also on the Ohio River. The Beaver Valley meteorological station and the Shell facility also share a similar orientation in relation to the Ohio River. As can be seen in Figure 8, the river flows from the northeast to southwest relative to both the Shell facility and the Beaver Valley meteorological station. The topography is also similar at each location. The wind patterns are therefore likely similar at each location (see the wind rose Figure 9). Wind speed, direction and standard deviation of the horizontal wind direction are measured at three levels at the Beaver Valley station (10.7m, 45.7m, and 152.4m). Temperature is also measured at the 10.7m level. These three levels provide adequate representation of plume behavior at the various release heights to be seen at the Shell facility.

The Pittsburgh International Airport is located approximately 21km southeast of the facility (Figure 10). Station pressure, cloud cover, and twice daily sounding data from Pittsburgh were used. These meteorological parameters are of synoptic scale and are adequately representative of the Beaver Valley area.

Figure 8. First Energy Meteorological Tower Location Relative to Shell

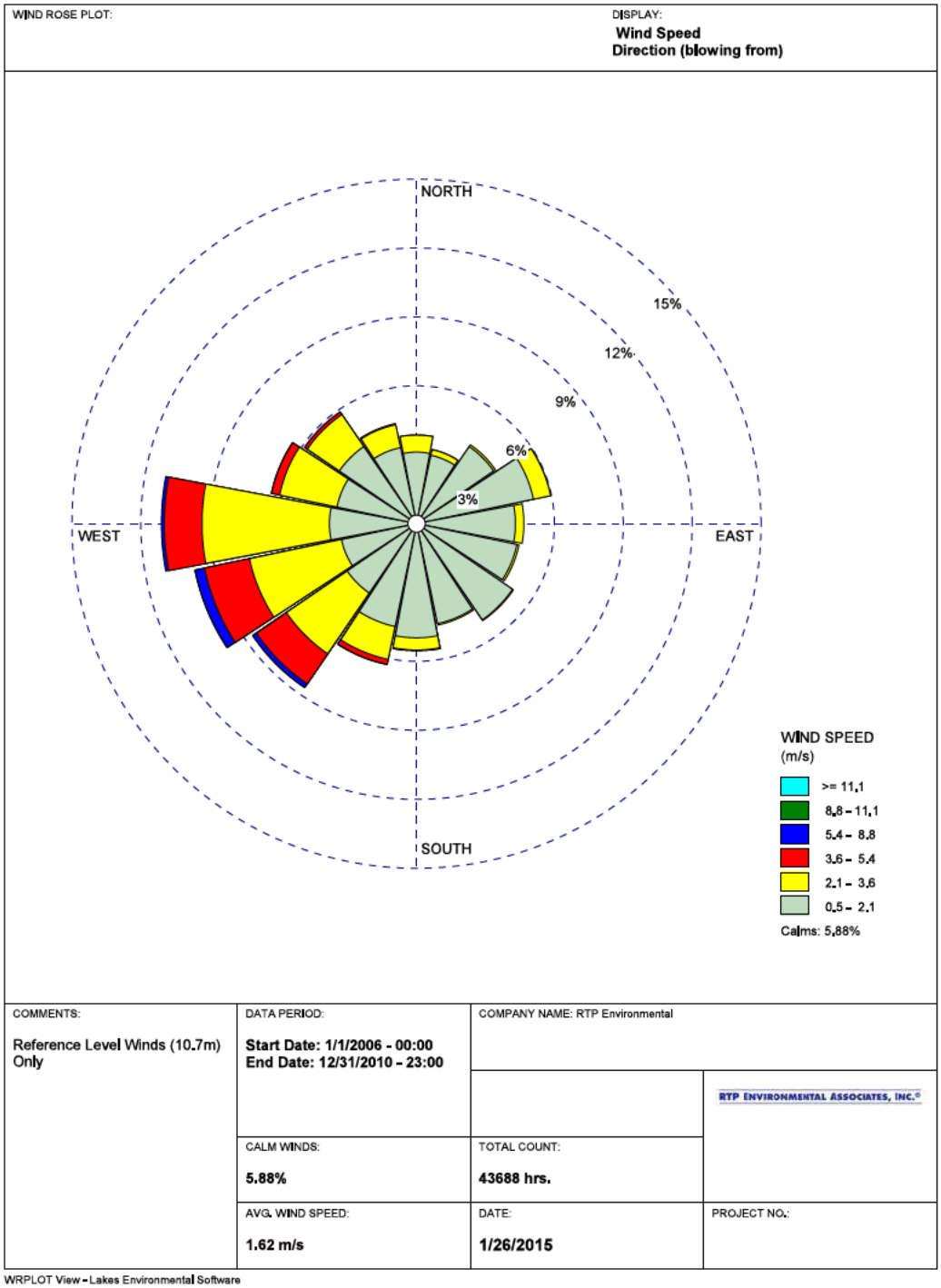


Figure 9. Beaver Valley Windrose 2006-2010

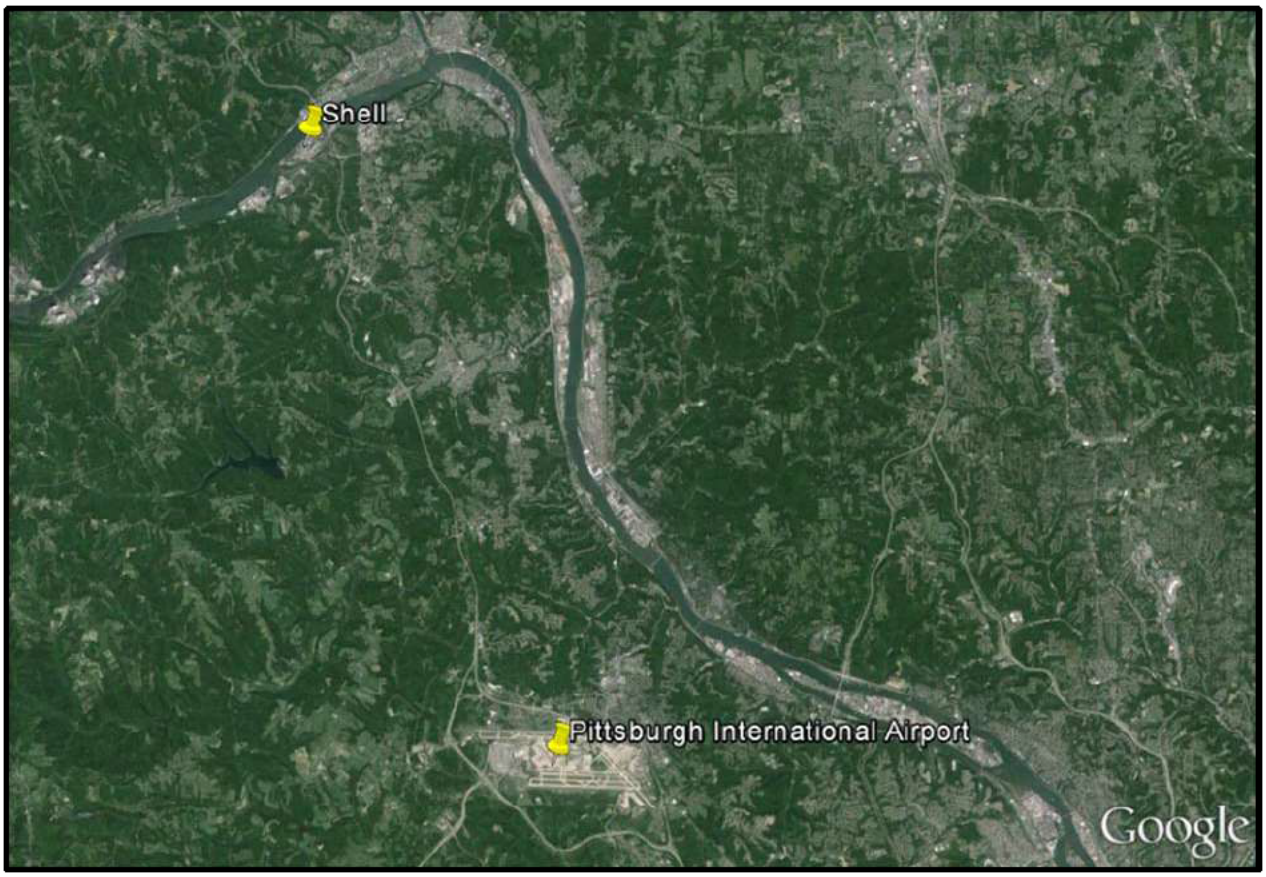


Figure 10. Pittsburgh International Airport Location Relative to Shell

According to the EPA's AERMOD Implementation Guide[9], the surface characteristics should be similar for the meteorological station and the study site. RTP compared the surface characteristics at the First Energy station and the Shell site. The AERSURFACE program was run to determine the characteristics for comparison. The results of the surface roughness comparison, by season, are shown in Figure 11. As can be seen, the surface characterisitics values for the two sites, when compared on a seasonal and sector basis, are similar.

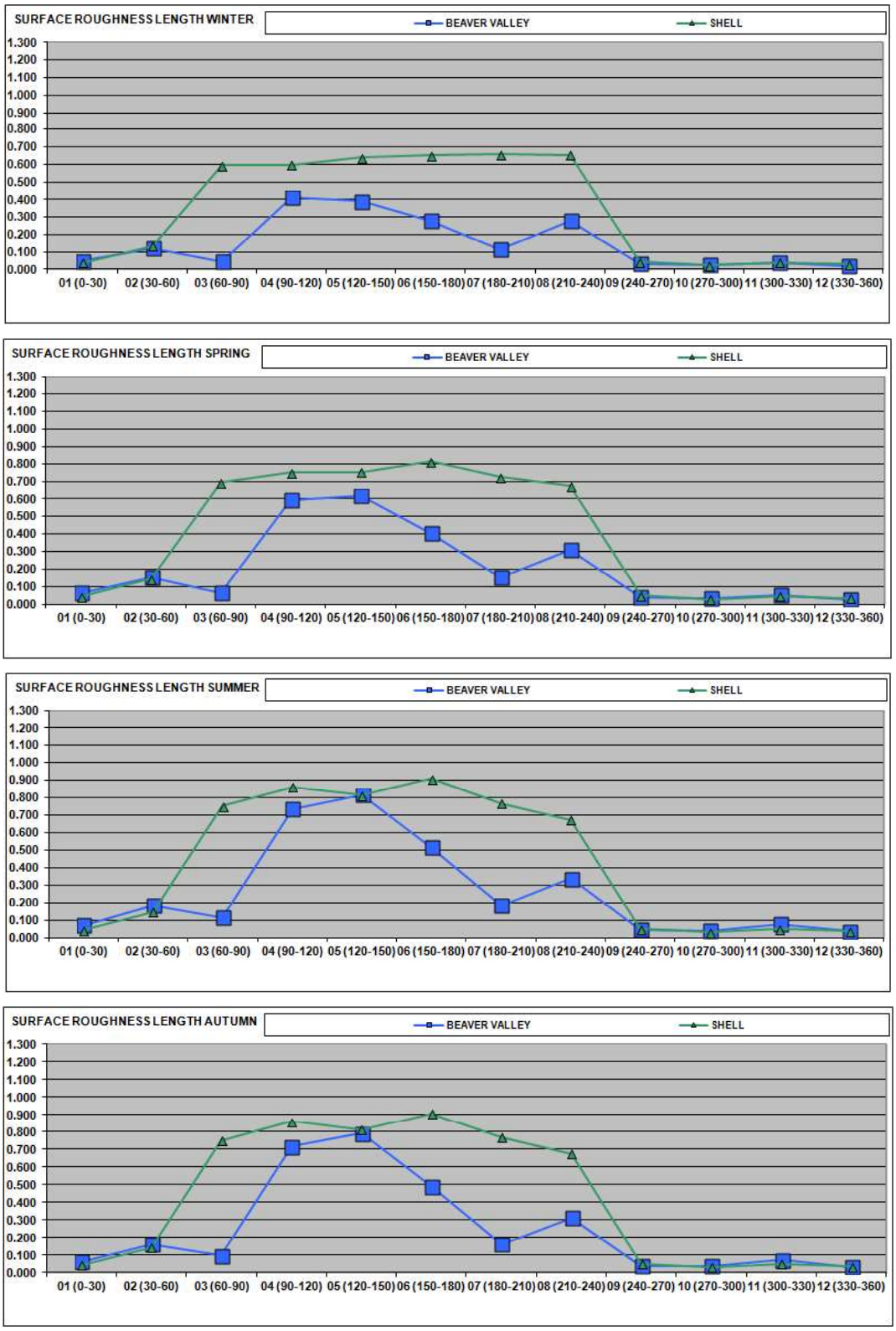


Figure 11. Meteorological Data Representativeness Analysis Results

Data Processing

The processed meteorological data were provided to RTP Environmental by the PADEP. The PADEP processed the Beaver Valley surface data, Pittsburgh International Airport (KPIT) surface data and KPIT upper air data using the meteorological preprocessor AERMET (Ver. 19191). In AERMET Stage 1, KPIT surface meteorological data in the Integrated Surface Data (ISD) format were extracted. KPIT upper air meteorological data in the Forecast Systems Laboratory (FSL) format were also extracted.

Also, the MODIFY keyword was entered to fill missing temperatures in the upper air data with interpolated values. In AERMET Stage 3, values of the surface characteristics (noon-time albedo, Bowen ratio, and surface roughness length) representative of the Beaver Valley surface meteorological site, were entered. RTP Environmental employed the PADEP meteorological dataset that employed the adjust u* method for the turbulence calculations in the Stage 3 processing.

These surface characteristics values were calculated by AERSURFACE 13016 using USGS National Land Cover Data ("NLCD") for 1992. The following options were selected in AERSURFACE: default 1-km radius and default twelve 30-degree sectors for surface roughness length, seasonal temporal resolution, non-airport site and non-arid region. AERSURFACE was executed for each surface moisture condition (average, dry, and wet), assuming both no continuous snow cover and continuous snow cover during the winter (i.e., AERSURFACE was executed six times). AERMET Stage 3 was then executed for each set of surface characteristics to produce six (6) surface (.sfc) files. The final AERMET surface file was assembled by season based on estimates of surface moisture condition and snow cover during the meteorological data period. Estimates of surface moisture condition were based on precipitation data for Pennsylvania Climate Division 9. Snow cover was based on National Climatic Data Center (NCDC) Local Climatological Data from KPIT.

5.0 MODELING METHODOLOGY

5.1 Pollutants Modeled

An update to the air quality impacts analysis performed in support of the 2015 application for plan approval was performed for CO, NO_2, and PM10.

5.2 Turbine Load/Operating Conditions

The combustion turbines will occasionally operate at a reduced load. Therefore, a range of load conditions and operating modes representing potential unit operation were evaluated to identify the condition which results in the worst-case impact for each averaging period of concern. Three load conditions were evaluated for each turbine: 100%, 75%, and 45%. A unit (i.e., 1 lb/hr) emission rate was assumed to represent the 100% load condition for each turbine and the emissions and flows for the other loads and operating modes scaled from the 100% load condition. The condition resulting in the worst-case impacts was carried forward for the remainder of the analysis.

5.3 Furnace Operating Conditions

The furnaces will also have a different mode of operation (decoking) for short durations. The short term NO_2 and CO emission rates will be higher, the exhaust gas temperature higher, and the exhaust gas exit velocity lower during decoking.

Only two furnaces will be in decoking mode at any point in time. It was therefore necessary to identify furnaces with worst case short-term impacts during decoking. Each furnace was modeled with a unit emission rate. The two furnaces that generated the worst case impacts were assigned this operating mode. The PM10 emission rate will also be lower during decoking; however, to simplify all analyses except the Class I SIL abalysis, Shell has conservatively modeled the higher, no-coking PM10 emission rate for all furnaces. Both modes of furnace operation were modeled for the Class I SIL analysis and the higest impact from either mode was compared to the SIL.

5.4 Significant Impact Analysis

The criteria pollutant air quality analysis was conducted in two phases: an initial or significant impact analysis, and a refined phase including an increment analysis and a NAAQS analysis. In the significant impacts analysis, the calculated maximum impacts were determined for each pollutant. These impacts determine the net change in air quality resulting from the facility. Maximum modeled concentrations were compared to the SILs for all pollutants and averaging times except for the 1-hr NO_2 impact. The five year average of the maximum impact at each receptor was used to assess significance for the 1-hr NO_2 average.

Two SIL analyses were conducted at PADEP's request. One SIL analysis was conducted for the original facility design. The second SIL analysis was conducted for the revised facility design. Each SIL analysis was conducted using current EPA models and the original 2006-2010 meteorological dataset. The PADEP requested this analysis to assess the change in air quality concentrations due to the change in facility design.

Pollutants with impacts that exceed the ambient air significance levels, as defined in 40 CFR 51.165, were included in both the NAAQS and increment analyses. In these latter analyses, impacts from the Shell facility were added to concentrations calculated from other nearby sources, plus a regional background concentration. The resultant total concentration was compared to the NAAQS to determine compliance. No background concentration was considered to assess compliance with the increments. The PSD Class II Significant Impact Levels are listed in Table 4.

Five years of meteorological data were used in the significant impact analysis. The maximum distance to significant impact was determined for each pollutant and averaging period. The maximum concentration was used to determine significance.

5.5 NAAQS and Increment Analyses

Following the determination of significant impacts, a refined air quality analysis to determine compliance with the NAAQS and PSD increments was conducted. A refined analysis was conducted to determine compliance with the NAAQS and increments for all pollutants and averaging times except for the 1-hr CO NAAQS as the 1-hr CO impacts were determined to be less than significant.

Table 4. PSD Class II Significant Impact Levels

Pollutant	Averaging Time	PSD Class II Significant Impact Levels ($\mu g/m^3$) [1]
PM10	24-hour	5.0
	Annual	1.0
NO_2	1-hour	7.5 [2]
	Annual	1.0
CO	1-hour	2000
	8-hour	500

1. Note that on January 22, 2013, the US Court of Appeals for the District of Columbia Circuit Court granted a request from the EPA to vacate and remand the $PM_{2.5}$ SILs. EPA has stated that as long as the difference between the background monitored $PM_{2.5}$ value and the NAAQS is greater than the SIL, the SIL can still be used in evaluating significance (see the May 2014, "Guidance for PM2.5 Permit Modeling"). The PADEP is following this guidance for PM2.5 as well as other pollutants. The difference between Beaver Falls and New Castle background values and the NAAQS were evaluated and determined to be greater than the SILs (see Tables 1 & 2).
2. Also note that there is no 1-hr NO_2 SIL promulgated at 40 CFR 51.165. Consistent with to the June 28, 2010 EPA Policy Memorandum from Anna Marie Wood to the Regional Air Directors, an interim 1-hr NO_2 SIL of 4 ppb ($7.5\mu g/m^3$) has been adopted by the PADEP (see the December 1, 2010 Memorandum from Andrew Fleck to the Regional Air Program Managers).

The receptors modeled in the NAAQS and increment analyses were limited to those showing a significant impact. Each source's potential emission rate was modeled with five years of meteorological data.

Nearby Source Inventory

Off-site sources were included in the NAAQS and increment analyses. Pursuant to the March 1, 2011 Clarification Memorandum (see page 16 of reference no. 8) and the current (January 2017) 40 CFR 51 Appendix W, only sources located within 20km of the Shell facility were included in the modeling evaluation. The inventory of offsite sources was provided by PADEP and through review of facility permits.[10] All sources with the exception of First Energy Bruce Mansfield Units #1&2 were conservatively assumed to consume increment at the potential emission rates used in the NAAQS analysis. Bruce Mansfield Units #1&2 were constructed prior to the PM10 major source baseline date of January 6, 1975. Therefore, only changes in actual emissions after the minor source baseline date of August 1992 consume increment. The changes in actual emissions at these units was calculated as the difference between the emissions from the average of the 1990-1991 annual emissions inventory and the 2011-2013 annual emissions inventory. Since the actual emissions at the Bruce Mansfield Units #1&2 declined over this period, these units do not consume PM10 increment. Bruce Mansfield Unit #3 was constructed after the major source baseline date. This unit was conservatively modeled at its potential to emit in the increment analysis. The increment emission calculations for these units are provided in Attachment A. The increment evaluation conservatively did not consider the PM10 emission reductions that occurred when the Horsehead Lead Smelter and AES Beaver Valley ceased operation.

NAAQS and Increment Compliance Assessment

Appropriate ambient background concentrations (as discussed in more detail in Section 4.3) were then added to the modeled concentrations to assess NAAQS compliance. The five year average of the 98th percentile maximum daily 1-hr NO_2 modeled value was added to the three year average of the 98th percentile NO_2 monitor value by season and hour of day within AERMOD. The resultant concentration was compared to the 1-hr NO_2 NAAQS. The methodology for combining NO_2 background concentrations in the 1-hour cumulative analysis is based upon the methodology outlined in the March 1, 2011 Additional Clarification memorandum.[11] The maximum highest-second-high value from the five year meteorological dataset was added to the appropriate

background concentration in assessing compliance with the CO NAAQS standards. The maximum sixth-high from the five years of meteorology was added to the added to the appropriate background concentration to assess compliance with the PM10 NAAQS. The maximum highest, second-high value was used to assess compliance with the 24-hr PM10 increment. The maximum concentration from the 5 years of meteorology was used to assess compliance with the annual PM10 increment.

As discussed below, modeled exceedances of the 1-hr NO_2 NAAQS were identified. These modeled exceedances are attributable to existing sources in the vicinity of the Shell site. Shell employed the EPA's post-processor "MAXDCONT" to demonstrate that the project does not significantly contribute to an existing modeled 1-hr NO_2 exceedance. The post-processor demonstrations are receptor and averaging time specific.

5.6 NO_2 Analyses

Following recent USEPA guidance, the NO_2 modeling analyses used the recommended three tier screening approach. Initially, Tier 1 was employed with the conservative assumption that 100% of the available NOx converts to NO_2. The NO_2 impacts under this assumption exceeded the SILs. The Tier 2 (Ambient Ratio Method, or ARM2) was therefore employed with the EPA recommended minimum and maximum ambient NO_2/NOx ratios of 0.5 and 0.9, respectively. Tier 3 was employed to assess the 1-hr NO_2 NAAQS. Tier 3 accounts for the chemical reactions that convert NOx to NO_2 in the presence of ozone. 100% NOx to NO_2 conversion was conservatively assumed in assessing compliance with the annual NAAQS and increment.

Tier 3 Option

There are two Tier 3 methods currently available in AERMOD for simulating the conversion of NOx to NO_2: the Ozone Limiting Method (OLM) and the Plume Volume Molar Ratio Method (PVMRM). Shell has employed PVMRM. While not currently required as PVMRM is no longer a non-guideline technique, a formal request was submitted to PADEP that addresses the five criteria of Section 3.2.2(e) of 40 CFR 51

Appendix W. PADEP also requested formal approval from EPA Region 3. Approval was received on April 21, 2014. These letters are included in Attachment A.

The EPA's more conservative, default NO_2/NOx in stack ratio of 0.50 has been employed for all sources located within 1km of the Shell site. An in-stack ratio of 0.2 was employed for more distant sources. A NO_2/NOx in stack ratio of 0.05 was employed for the uncontrolled emissions from the First Energy coal boilers. This value was used based upon footnote "c" of Table 1.1-3 in AP-42, which states that 95% or more of NOx present in combustion exhaust will be in the form of NO, the rest is NO_2. Justification for this in stack ratio is provided in Attachment A. In addition, a NO_2/NOx equilibrium ratio of 0.90 was employed.

Hourly ozone concentrations from the Sebring (Brighton Township) monitor, concurrent with the 2006-2010 meteorological data period, were employed. Missing data were filled with data from the Tomlinson Road (Beaver Falls) O_3 monitor in southwestern Beaver County. The month of March is missing for several years for both the Sebring and Tomlinson Road monitors. These data, as well as any other times when observations missing from both monitors, were filled with data from the Harrison and Lawrenceville O_3 monitors in Pittsburgh.

Intermittent Emissions

Emissions from sources that emit intermittently (i.e., emergency generators, firewater pumps, flares, and certain furnace operating scenarios, and startups and shutdowns) were modeled in the 1-hr NO_2 analysis pursuant to the March 1, 2011 EPA guidance. Pursuant to this guidance, any source with emissions that do not have the potential to contribute significantly to the annual distribution of the daily maximum concentrations will either be excluded from the analysis or the emissions will be based on an average hourly rate, rather than the maximum hourly rate. Sources that are not likely to contribute include those with emission duration of less than 24-hours and with operational frequency of less than seven occurrences per year.

6.0 RESULTS

Attachment B to this report provides the model summary output. AERMOD input and output files, including the BPIP-PRIME files, are included on the enclosed CD.

6.1 Turbine Load Analysis Results

The results of the load analysis are presented in Table 5. As shown, the 100% load scenario for each turbine was found to generate the highest impacts. The 100% load case was therefore used in the remainder of the modeling analysis.

6.2 Furnaces Operating Condition Results

The results of the worst-case furnace analysis are presented in Table 6. As shown, the Furnace Nos. 1&2 were found to generate the highest short-term impacts. These two furnaces were therefore assigned the elevated CO and NOx emissions associated with the short-term furnace operating modes.

6.3 Significant Impact Analysis Results

The project is expected to result in significant impacts for all pollutants and averaging periods except the 1-hr CO average. There is only a single receptor that shows a significant 8-hr CO impact. This receptor is adjacent to the PGT BGTC emergency generator, located outside of the Shell fenceline. The Class II significant impact analysis results are presented in Table 7. The table shows the impacts attributable to the original plant design (using current models and methodologies) as well as the impacts due to the current plant design. As show, the impacts between the two designs are very similar. The impacts are all within 10% except for the 24-hr PM10 impacts. The new plant design PM10 24-hr impacts are approximately 15% lower than the original plant design impacts.

Based upon the results of the significant impacts analysis for the current plant design, a cumulative analysis was conducted for the 1-hour NO2, the 24-hour PM10, and the 1 and 8-hour CO NAAQS. A cumulative analysis was also conducted for PM10 increment. Note there is no CO or 1-hour NO_2 increment.

Table 5. Load Analysis Results

Averaging Period	Source Name	Modeled Concentration (µg/m³)	Source Description
1-hr	CT1_100	**1.29**	Turbine 1, 100% load
	CT1_75	1.14	Turbine 1, 75% load
	CT1_45	0.76	Turbine 1, 45% load
	CT2_100	**1.27**	Turbine 2, 100% load
	CT2_75	1.12	Turbine 2, 75% load
	CT2_45	0.78	Turbine 2, 45% load
	CT3_100	**1.26**	Turbine 3, 100% load
	CT3_75	1.10	Turbine 3, 75% load
	CT3_45	0.79	Turbine 3, 45% load
24-hr	CT1_100	**0.27**	Turbine 1, 100% load
	CT1_75	0.25	Turbine 1, 75% load
	CT1_45	0.19	Turbine 1, 45% load
	CT2_100	**0.24**	Turbine 2, 100% load
	CT2_75	0.23	Turbine 2, 75% load
	CT2_45	0.17	Turbine 2, 45% load
	CT3_100	**0.21**	Turbine 3, 100% load
	CT3_75	0.20	Turbine 3, 75% load
	CT3_45	0.15	Turbine 3, 45% load
8-hr	CT1_100	**0.53**	Turbine 1, 100% load
	CT1_75	0.49	Turbine 1, 75% load
	CT1_45	0.36	Turbine 1, 45% load
	CT2_100	**0.56**	Turbine 2, 100% load
	CT2_75	0.48	Turbine 2, 75% load
	CT2_45	0.40	Turbine 2, 45% load
	CT3_100	**0.57**	Turbine 3, 100% load
	CT3_75	0.57	Turbine 3, 75% load
	CT3_45	0.45	Turbine 3, 45% load
Annual	CT1_100	**0.02**	Turbine 1, 100% load
	CT1_75	0.02	Turbine 1, 75% load
	CT1_45	0.01	Turbine 1, 45% load
	CT2_100	**0.02**	Turbine 2, 100% load
	CT2_75	0.02	Turbine 2, 75% load
	CT2_45	0.01	Turbine 2, 45% load
	CT3_100	**0.02**	Turbine 3, 100% load
	CT3_75	0.02	Turbine 3, 75% load
	CT3_45	0.01	Turbine 3, 45% load

Table 6. Worst Case Furnace Analysis Results

Averaging Period	Source Name	Modeled Concentration ($\mu g/m^3$)	Source Description
1-hr	EC#1	**1.51**	Ethane Cracking Furnace #1
	EC#2	**1.49**	Ethane Cracking Furnace #2
	EC#3	1.46	Ethane Cracking Furnace #3
	EC#4	1.44	Ethane Cracking Furnace #4
	EC#5	1.41	Ethane Cracking Furnace #5
	EC#6	1.38	Ethane Cracking Furnace #6
	EC#7	1.33	Ethane Cracking Furnace #7
24-hr	EC#1	**0.78**	Ethane Cracking Furnace #1
	EC#2	**0.76**	Ethane Cracking Furnace #2
	EC#3	0.75	Ethane Cracking Furnace #3
	EC#4	0.72	Ethane Cracking Furnace #4
	EC#5	0.68	Ethane Cracking Furnace #5
	EC#6	0.66	Ethane Cracking Furnace #6
	EC#7	0.62	Ethane Cracking Furnace #7
8-hr	EC#1	**1.51**	Ethane Cracking Furnace #1
	EC#2	**1.49**	Ethane Cracking Furnace #2
	EC#3	1.46	Ethane Cracking Furnace #3
	EC#4	1.44	Ethane Cracking Furnace #4
	EC#5	1.41	Ethane Cracking Furnace #5
	EC#6	1.38	Ethane Cracking Furnace #6
	EC#7	1.33	Ethane Cracking Furnace #7

Table 7. Class II Significant Impact Analysis Results

Pollutant	Avg Period	Maximum Modeled Impact - Original Plant Design ($\mu g/m^3$)	Maximum Modeled Impact - Current Plant Design ($\mu g/m^3$)	PSD Significant Class II Impact Level ($\mu g/m^3$)	Significant Monitoring Concentration ($\mu g/m^3$)	Maximum Distance to a Significant Impact – Current Plant Design (km)
PM10	24-hr	11.2	9.33	5.0	10	3.4
	Annual	2.60	2.84	1.0	N/A	1.7
NO_2[a]	1-hr	58.21	59.17	1.0	14	31.4
	Annual	1.26	1.29	1.0	NA	2.4
CO	1-hr	2035	1757	2000	N/A	NA
	8-hr	920	917	500	575	1.0

[a]NO_2 impacts include ARM2 with minimum and maximum ambient ratios of 0.5 and 0.9, respectively.
N/A – Not applicable, impacts calculated to be insignificant.

6.4 NAAQS Analysis Results

Following the determination of significant impacts, an analysis was conducted to assess compliance with the PM10, CO, and NO_2 NAAQS. All major and minor sources located within 10km of the Shell facility were modeled in conjunction with the Shell facility in assessing compliance. Background concentrations were added to the model results to assess compliance. Evaluation of compliance with the 1-hour NO_2 NAAQS was based on the five-year average of the 98th percentile of the annual distribution of daily maximum 1-hour concentrations. Compliance with the CO short term standards was based upon the maximum of the highest-second-highest values from the five year meteorological dataset. Compliance with the PM10 short term standard was based upon the sixth highest value as modeled over the full five year meteorological dataset.

The results of the NAAQS analysis are presented in Table 8. As can be seen, the model demonstrates compliance for all pollutants and averaging periods except for the 1-hr NO_2 standard. However, the modeled 1-hr NO2 exceedences are attributable to existing sources that were modeled as part of the off-site inventory and not the Shell facility. The Shell contribution to each modeled concentration 1-hr NO_2 in excess of the NAAQS was determined using the "MAXDCONT" processor in AERMOD. This option

Table 8. NAAQS Analysis Results

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	Standard ($\mu g/m^3$)	Comment
NO_2	1-hour	664[a]	NA	664	188	Maximum concentration due to off-site sources. Shell project impact is insignificant at 4.75 $\mu g/m^3$ (72nd High) as paired in time and space.
	Annual	9.0	17.9	26.9	100	Compliant
CO	1-hour	1,687	2,515	4,202	40,000	Compliant
	8-hour	793	1,269	2,062	10,000	Compliant
PM10	24-hour	19.5	69	88.5	150	Compliant

[a]Based on the 98th percentile of the annual distribution of maximum daily 1-hour concentrations, averaged across the 5 years of meteorological data modeled. PVMRM was employed for the 1-hr calculations.

NA- Not applicable. Background NO_2 concentration added within AERMOD run and therefore is included in the modeled concentration.

allows for the calculation of the impact due to Shell consistent in both time and space with each modeled concentration in excess of the standard. The maximum contribution of the Shell facility to an existing modeled 1-hr NO_2 exceedence is 4.75 µg/m^3. The 1-hr NO2 interim SIL is 7.5 µg/m^3. Since the concentrations from the Shell project are insignificant, the project will not contribute to any existing modeled 1-hr NO_2 NAAQS violation.

6.5 Increment Analysis Results

Evaluation of compliance with the short-term increments was based upon the highest-second-high value from the five years of meteorology. The maximum annual concentrations were used to assess compliance with the annual increments. All sources, with the exception of Bruce Mansfield Units 1&2 identified in the inventory were conservatively assumed to consume increment at their potential to emit rates. The results of the increment analysis are presented in Table 9. As shown, the model demonstrates compliance for all pollutants and averaging periods.

6.6 Model Input and Output Files

The modeling input and output files are provided on the attached CD. Model summary results are presented in Attachment B to this report. The summary results list the model file names associated with each phase of the analysis.[a]

[a] As a general rule, the AERMOD input files have a "dta" extension. The AERMOD output files have a "lst" extension.

Table 9. PSD Increment Analysis Results

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)[a]	Standard ($\mu g/m^3$)	Comment
PM10	24-hour	22.6	30	Compliant
	Annual	5.28	17	Compliant
NO_2	Annual	9.00	25	Compliant

[a]Based on the maximum highest second high value from the five years of meteorology.

7.0 CLASS II VISIBILITY ANALYSIS

The CAA Amendments of 1977 require evaluation of new and modified emission sources to determine potential impacts on visibility. The total hourly particulate matter and NO_X emissions from the Shell facility were used as input parameters in the visibility analysis. Emissions were evaluated as described in the EPA Workbook for Plume Visual Impact Screening and Analysis[12] to determine potential contribution to atmospheric discoloration and visual range reduction.

Generally, atmospheric discoloration occurs when NO emissions from combustion sources react in the presence of atmospheric oxygen to form NO_2, a reddish-brown gas. Another form of atmospheric discoloration may be caused by particulate emissions and secondary aerosols formed by gaseous precursor emissions. The visual range reduction (increased haze) is caused primarily by particulate emissions and secondary aerosols such as sulfates and nitrates.[13] Both secondary sulfate and primary particulate emissions are accounted for in the analysis. Emission of other pollutants do not materially affect visibility.

U.S. EPA visibility impairment analysis guidelines were followed in conducting the analysis. The analysis was performed for the Raccoon Creek State Park, located a minimum of 16km and a maximum of 23km southwest of the Shell site.

This analysis requires inputs of emission rates (PM and NO_X), regional visual range, distance between the source and the object of study, and worst-case dispersion parameters (i.e., wind speed and stability). Outputs from the model include:

- Plume contrast against the sky and terrain; and,
- Perceptibility of the plume (Delta E criteria).

Emission rates for PM and NOx for the analyses were set to 63 and 118 lb/hr, respectively. These emissions are from the initial permit application and are slightly higher than the current emission estimates for PM and NOx of 62 and 114 lb/hr, respectively. The background visual range was set to 20km, which was determined from Figure 9 of the VISCREEN manual. The VISCREEN default screening values for

Delta E (2.0) and contrast (0.05) were assumed.

As shown in Table 10, exceedances of the default delta E and green contrast parameters were calculated using the conservative meteorological conditions (F stability and 1 m/sec wind speed) and Level-1 procedures. Therefore, a more refined Level-2 VISCREEN analysis was performed based upon the procedures outlined in the visibility Workbook.

The Raccoon Creek State Park is located in a 185-225 degree wind sector (wind blowing towards) relative to the Shell facility (Figure 12). The frequency of occurrence of all meteorological conditions in these wind sectors were evaluated for a five year meteorological dataset using the Iowa Department of Natural Resources "VISCREEN Screening Tool". The screening tool was developed using the guidance, equations, and constants from the visibility Workbook. As the VISCREEN procedures and screening tool requires a meteorological database with both wind speed and stability categories in the older Industrial Source Complex (ISC) model format, a five year ISC meteorological dataset (1987-1991) was developed for the Pittsburgh airport.

The results of this wind sector analysis are provided in Figure 13. Based upon the results of this wind sector analysis, a wind speed of 2 m/sec and F stability class was employed in the Level-2 VISCREEN analysis. This is the next worst stability class and wind speed combination to the combination employed in the Level-1 analysis.

The results of the Level-2 VISCREEN analysis are shown in Table 11. As shown, there are no exceedances of the visibility screening criteria using the 2 m/sec and F stability meteorological conditions. The total number of hours with meteorology conducive to the visibility exceedances occur approximately 2.1% of the time and only in the early morning hours. Given the infrequency of these occurrences and the fact that most of the adverse meteorological conditions occur when it is dark, when visibility is of less concern, Shell believes the potential for visibility impact is negligible. The VISCREEN model files are provided on the enclosed CD.

Table 10. Level-1 Class II Visibility Analysis Results for Raccoon Creek State Park

Viewing Background	Theta (degrees)	Azimuth (degrees)	Distance (km)	Alpha (degrees)	Delta E		Green Contrast	
					Criterion	Plume	Criterion	Plume
SKY	10	115	18	54	2.0	2.793*	0.05	0.018
SKY	140	115	18	54	2.0	0.81	0.05	-0.017
TERRAIN	10	84	16	84	2.0	2.042*	0.05	0.025
TERRAIN	140	84	16	84	2.0	0.372	0.05	0.016

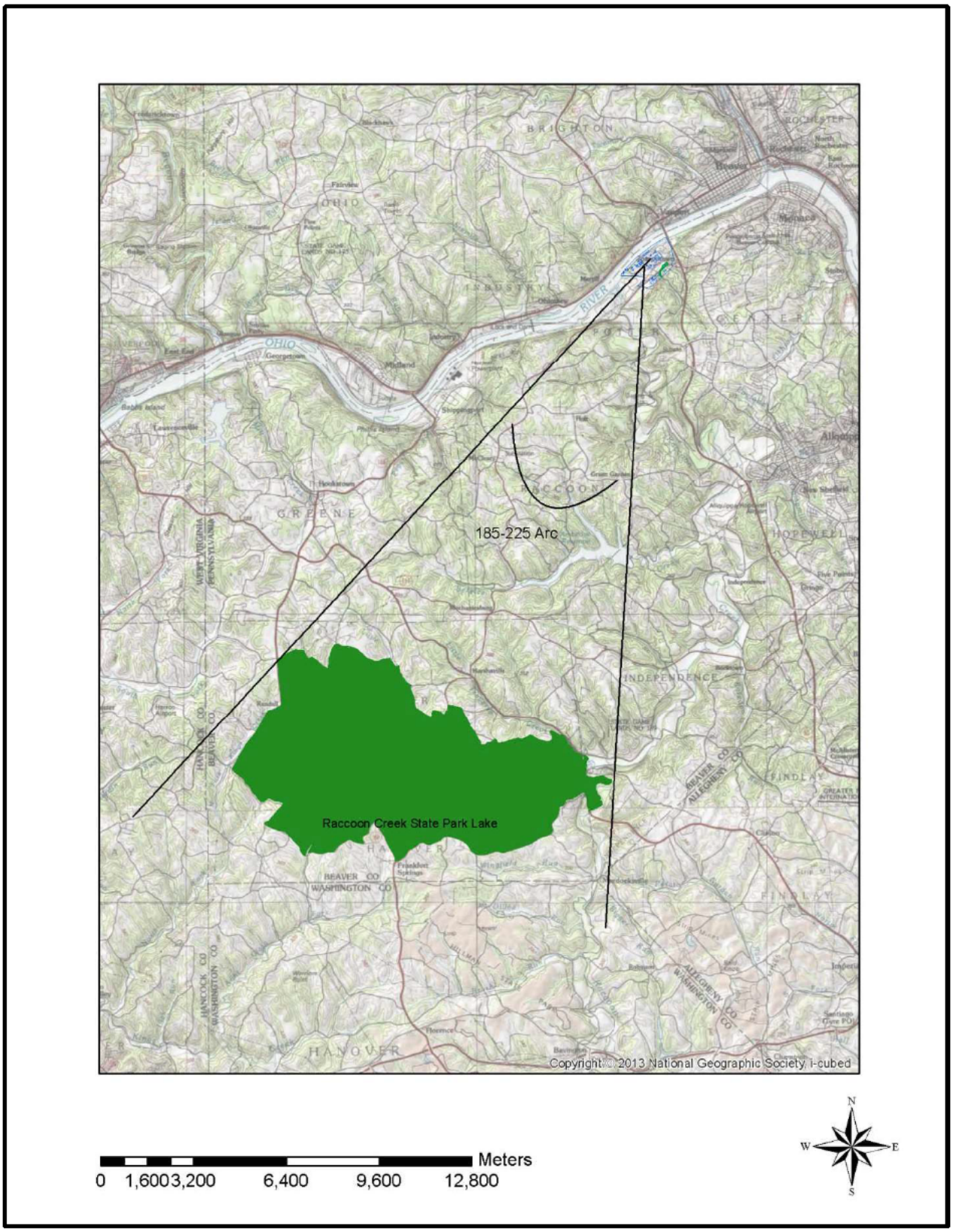
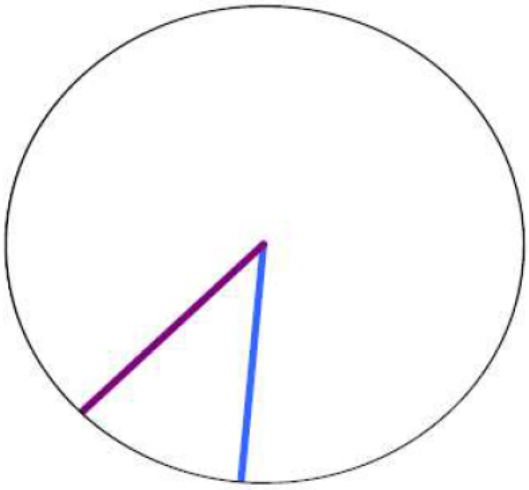


Figure 12. Location of Raccoon Creek State Park Relative to the Shell Site

Iowa DNR Level-2 Visibility Screening Tool

Facility:	Shell
Sensitive Area Being Evaluated:	Racoon Creek State Park
Project Number:	
Minimum Source-Site Angle:	185
Maximum Source-Site Angle:	225
Source-Observer Distance (km):	16
Meteorological Data Set:	Unknown
Time Period Being Evaluated:	1/1/87 - 12/31/91



Worst-Case Meteorological Conditions Summary

Dispersion Condition (stability, wind speed)	σyσzu (m^3/s)	Transport Time (hours)	Frequency (f) and Cumulative Frequency (cf) of occurrence of given dispersion condition associated with source-site wind directions for given time of day (%)							
			1 - 6		7 - 12		13 - 18		19 - 24	
			f	cf	f	cf	f	cf	f	cf
F,1	2.31E+04	8.9	2.13	**2.13**	0.09	0.09	0.00	0.00	0.91	0.91
F,2	4.61E+04	3.0	0.43	2.56	0.02	0.11	0.00	0.00	0.16	**1.07**
E,1	6.08E+04	8.9	0.14	2.70	0.15	0.26	0.00	0.00	0.03	1.10
F,3	6.92E+04	1.8	1.10	3.80	0.07	0.33	0.00	0.00	1.01	2.11
E,2	1.22E+05	3.0	0.03	3.83	0.05	0.38	0.00	0.00	0.04	2.15
D,1	1.45E+05	8.9	0.08	3.91	0.24	0.62	0.03	0.03	0.06	2.21
E,3	1.82E+05	1.8	0.55	4.46	0.13	0.75	0.03	0.06	0.42	2.63
E,4	2.43E+05	1.3	0.71	5.17	0.07	0.82	0.05	0.11	0.78	3.41
D,2	2.90E+05	3.0	0.06	5.23	0.10	0.92	0.01	0.12	0.02	3.43
E,5	3.04E+05	1.0	0.29	5.52	0.04	0.96	0.02	0.14	0.80	4.23
D,3	4.36E+05	1.8	0.40	5.92	0.50	**1.46**	0.49	0.63	0.27	4.50
D,4	5.81E+05	1.3	0.81	6.73	0.78	2.24	0.68	**1.31**	0.94	5.44
D,5	7.26E+05	1.0	0.69	7.42	0.68	2.92	0.59	1.90	0.87	6.31
D,6	8.71E+05	0.8	0.24	7.66	0.54	3.46	0.65	2.55	0.44	6.75
D,7	1.02E+06	0.7	0.13	7.79	0.28	3.74	0.31	2.86	0.16	6.91
D,8	1.16E+06	0.6	0.05	7.84	0.02	3.76	0.09	2.95	0.06	6.97

Figure 13. Level-2 Wind Sector Analysis Results

Table 11. Level-2 Class II Visibility Analysis Results for Raccoon Creek State Park

Viewing Background	Theta (degrees)	Azimuth (degrees)	Distance (km)	Alpha (degrees)	Delta E		Green Contrast	
					Criterion	Plume	Criterion	Plume
SKY	10	120	18.4	49	2.0	1.436	0.05	0.009
SKY	140	120	18.4	49	2.0	0.411	0.05	-0.009
TERRAIN	10	84	16	84	2.0	1.055	0.05	0.013
TERRAIN	140	84	16	84	2.0	0.189	0.05	0.008

8.0 CLASS I AREA IMPACTS

8.1 Class I AQRV Analysis

There are three Class I areas located within 300km of the Shell facility.[b] Each Class I area is located in excess of 50km from the Shell facility. The FLM's Q/D (maximum daily emissions of SO_2, NOx, PM, and H_2SO_4 in tons per year over distance in kilometers) method was used to determine the potential for adverse Air Quality Related Values ("AQRV") impacts for each Class I area. AQRVs include impacts to Class I area soils, vegetation, and visibility. The maximum Q/D value was calculated to be 4.2 (Q= 792 tpy, D = 189 km for Otter Creek). The Q/D evaluation was presented to the FLMs for the 2015 plan approval application which had an emissions increase of 816 tpy and a resultant, higher Q/D of 4.3. The FLMs reviewed the Q/D evaluation and stated that no Class I Air Quality Related Values (AQRV) evaluation was required for the Shell facility.[14] The Q/D for each Class I area and correspondence with the FLMs is provided in Attachment A.

8.2 Class I Significant Impacts Analysis

The air quality impacts at each Class I area within 300km was determined using AERMOD. An arc of receptors spaced at 1 degree, located in the direction of the Class I areas, was placed at 50km from the Shell site (Figure 14). The model results were compared to the proposed Class I significant impact levels (Table 12) [c]. As shown, the impacts are less than the Class I SILs. The Shell facility will not therefore threaten a Class I increment. The model summary output is provided in Attachment B. The modeling files are on the enclosed CD.

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[b] Class I areas are pristine areas (e.g., National Parks and Wilderness Areas) that have been designated by Congress and are afforded a greater degree of air quality protection. All other areas are designated as Class II areas.

[c] See 61 FR 38249 (July 23, 1996) for the proposed Class I SILs.

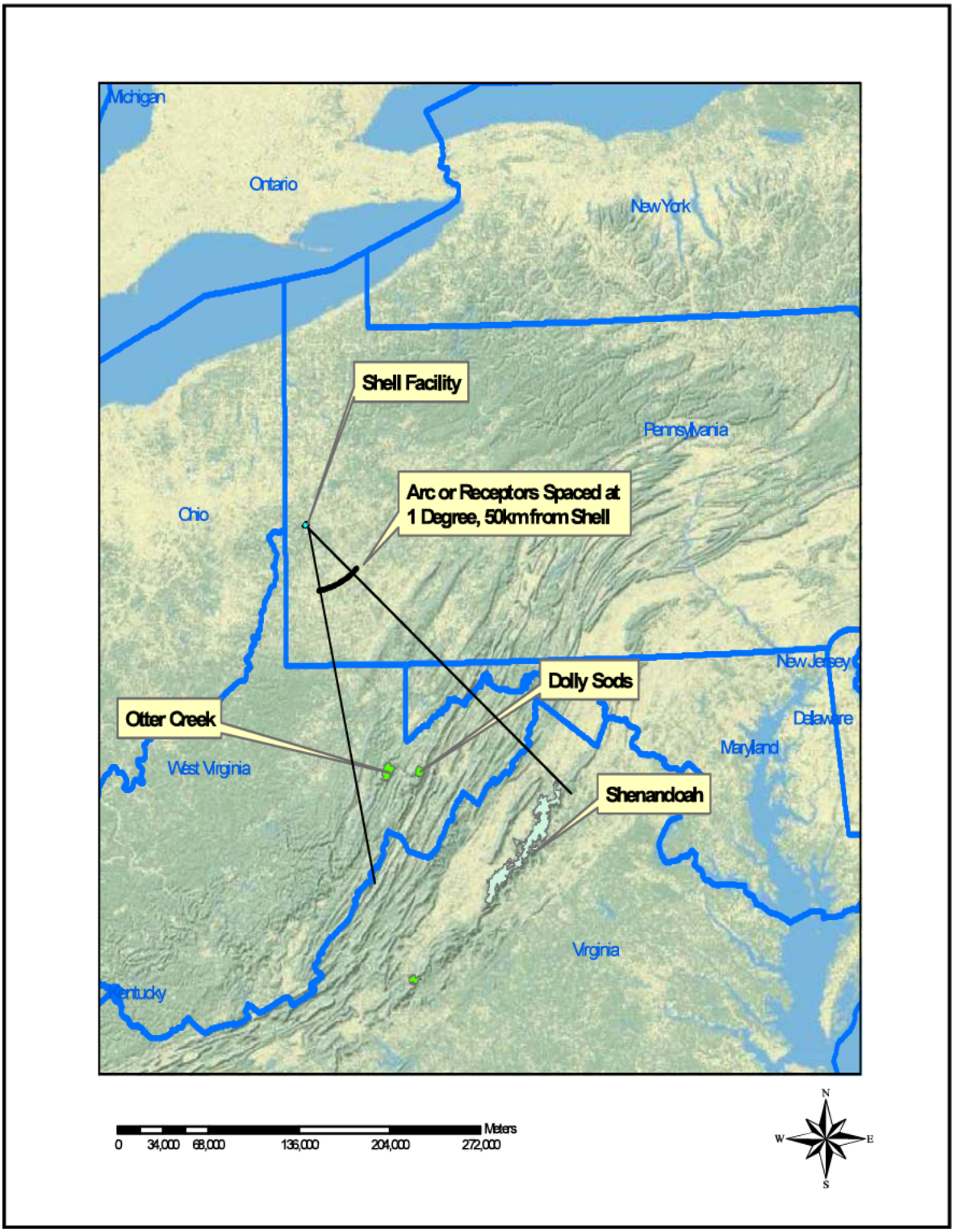

Figure 14. Class I Areas Located within Three Hundred Kilometers of Shell and Modeled Receptors

Table 12. Class I Significant Impact Analysis Results

Pollutant	Averaging Period	Maximum Modeled Impact ($\mu g/m^3$)	Proposed Class I Significant Impact Level ($\mu g/m^3$)	% Class I SIL
PM10	24-hr	0.297	0.30	99%
	Annual	0.020	0.20	10%
NO_2	Annual	0.028	0.10	28%

REFERENCES

1. Guidelines on Air Quality Models, Appendix W of 40 CFR Part 51, U.S. Environmental Protection Agency, January 2017.

2. February 19, 2014 letter from Andrew Fleck, PADEP, to David Keen, RTP Environmental. December 20, 2019 letter from David Keen, RTP Environmental, to Andrew Fleck, PADEP.

3. Auer, Jr., A.H. "Correlation of Land Use and Cover with Meteorological Anomalies." Journal of Applied Meteorology, 17:636-643, 1978.

4. Haul Road Workgroup Final Report, EPA Region 5, December 6, 2011.

5. Engineering Guide #69, Air Dispersion Modeling Guidance. Ohio EPA, Division of Air Pollution Control, 2003.

6. Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for Stack Height Regulations (Revised). EPA-450/4-80-023R, U.S. Environmental Protection Agency, June 1985.

7. *Sierra Club v. EPA*, No. 10-1413, 2013 WL 216018 (Jan. 22, 2013).

8. Ambient Monitoring Guidelines for Prevention of Significant Deterioration, EPA-450/4-87-007, USEPA, May 1987.

9. Monitoring Guidelines at p. 9.

10. AERMOD Implementation Guide, EPA, September 27, 2005.

11 . February 6, 2014 email from Alan Binder, PADEP, to Irene Kuo, RTP Environmental.

12. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO2 National Ambient Air Quality Standard, Memo from Tyler Fox, US EPA, to Regional Air Division Directors, March 1, 2011.

13. Workbook for Plume Visual Impact Screening and Analysis. US EPA, EPA Pub. No. 450/4-88-015. RTP, NC. September 1988.

14. Workbook for Estimating Visibility Impairment. US EPA, EPA Pub. No. 450/4-80-031. RTP, NC. November 1980.

15. February 11, 2014 email from Melanie Pitrolo, US Forest Service, to David Keen, RTP Environmental. February 12, 2014 email from Don Shepard, National Parks Service, to David Keen, RTP Environmental. February 13, 2014 email from Claire O'Dea, US Forest Service, to David Keen, RTP Environmental.

ATTACHMENT A
MODELED SOURCE INPUT DATA

Shell Franklin Model Input Data (NAD83, Zone 17)
Point Source (updated 1/24/20)

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)	NO2 (lb/hr)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)
EC#1	Ethane Cracking Furnace #1	555502.11	4502199.00	795.0	275.0	348.8	29.9	8.5	9.300	5.913	52.200	3.100
EC#2	Ethane Cracking Furnace #2	555512.76	4502186.65	795.0	275.0	348.8	29.9	8.5	9.300	5.913	52.200	3.100
EC#3	Ethane Cracking Furnace #3	555534.48	4502160.24	795.0	275.0	253.6	40.2	8.5	6.200	5.913	25.085	3.100
EC#4	Ethane Cracking Furnace #4	555545.98	4502148.32	795.0	275.0	253.6	40.2	8.5	6.200	5.913	25.085	3.100
EC#5	Ethane Cracking Furnace #5	555561.73	4502131.29	795.0	275.0	253.6	40.2	8.5	6.200	5.913	25.085	3.100
EC#6	Ethane Cracking Furnace #6	555572.81	4502118.51	795.0	275.0	253.6	40.2	8.5	6.200	5.913	25.085	3.100
EC#7	Ethane Cracking Furnace #7	555590.27	4502098.92	795.0	275.0	253.6	40.2	8.5	6.200	5.913	25.085	3.100
CT1	Combustion Turbine 1	555945.76	4502058.51	795.0	213.0	311.0	79.0	10.0	5.354	5.354	276.000	4.722
CT2	Combustion Turbine 2	555991.73	4502098.68	795.0	213.0	311.0	79.0	10.0	5.354	5.354	3.207	4.722
CT3	Combustion Turbine 3	556038.01	4502138.02	795.0	213.0	311.0	79.0	10.0	5.354	5.354	3.207	4.722
GFLARE1	Ground Flare 1	555472.50	4502011.25	780.0	206.9	1832.0	65.62	21.10	18.524	4.462	503.968	10.149
GFLARE2	Ground Flare 2	555421.71	4502085.72	780.0	206.9	1832.0	65.62	21.10	18.524	4.462	503.968	10.149
HPFLARE	HP Elevated Flare	555385.33	4502007.13	780.0	246.0	1832.0	65.62	4.14	0.076	0.076	0.413	0.008
INCIN	LP Incinerator	556066.31	4502619.14	795.0	250.0	1600.0	186.2	4.5	8.868	7.256	16.122	1.459
COI	Caustic Oxidizer	555256.39	4502075.62	714.0	200.0	1600.0	45.0	2.0	0.729	0.729	0.884	0.080
TALC	Rail to Truck Talc Transfer	556541.50	4502557.60	795.0	12.0	-460.0	0.03	0.6	0.000	0.000	0.000	0.014
COOLTWR1	Cooling Tower 1	555792.73	4502459.17	795.0	71.0	71.0	20.0	45.0	0.000	0.000	0.000	0.078
COOLTWR2	Cooling Tower 2	555804.58	4502468.80	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.078
COOLTWR3	Cooling Tower 3	555815.69	4502481.38	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.078
COOLTWR4	Cooling Tower 4	555828.28	4502492.49	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COOLTWR5	Cooling Tower 5	555841.61	4502502.12	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COOLTWR6	Cooling Tower 6	555853.33	4502512.89	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COOLTWR7	Cooling Tower 7	555866.07	4502523.70	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COOLTWR8	Cooling Tower 8	555878.57	4502535.24	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COOLTWR9	Cooling Tower 9	555891.07	4502545.57	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COLTWR10	Cooling Tower 10	555903.80	4502556.38	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COLTWR11	Cooling Tower 11	555916.06	4502567.20	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COLTWR12	Cooling Tower 12	555927.83	4502578.01	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COLTWR13	Cooling Tower 13	555940.57	4502588.83	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COLTWR14	Cooling Tower 14	555964.12	4502609.50	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COLTWR15	Cooling Tower 15	555975.66	4502619.59	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
COLTWR16	Cooling Tower 16	555986.47	4502629.68	795.0	71.0	71.0	20.0	52.0	0.000	0.000	0.000	0.072
FWP1	Fire Water Pump 1	556126.22	4501713.44	850.0	32.7	787.0	121.0	1.0	0.023	0.023	2.797	0.052
FWP2	Fire Water Pump 2	556118.30	4501706.53	850.0	32.7	787.0	121.0	1.0	0.023	0.023	2.797	0.052
GEN1	Emerg Gen - Parking Garage	556228.46	4501766.08	850.0	5.0	778.0	225.8	0.3	0.006	0.006	0.590	0.013
GEN2	Emerg Gen - Telecom Hut	556275.53	4501732.18	850.0	6.0	914.0	139.8	0.2	0.005	0.005	0.384	0.032
GEN3	Emerg Gen - Lift Station	556186.33	4502105.90	795.0	6.0	1250.0	297.4	0.3	0.003	0.003	0.316	0.027
GEN4	Emerg Gen - Lift Station	555907.33	4502035.53	795.0	6.0	1270.0	122.2	0.2	0.010	0.010	2.866	0.004
GEN5	Emerg Gen - PGT Visitor	555485.98	4501269.42	784.0	6.0	1300.0	199.9	0.3	0.017	0.017	5.086	0.007
GEN6	Emerg Gen - PGT BGTC	555476.79	4501156.43	795.0	4.0	1300.0	249.9	0.3	0.048	0.048	7.005	0.037
CAH1	Catalyst Heater 1	556294.39	4502493.32	795.0	150.0	392.0	35.0	1.3	0.000	0.000	0.000	0.009
CAH2	Catalyst Heater 2	556289.38	4502488.95	795.0	150.0	392.0	35.0	1.3	0.000	0.000	0.000	0.009

Shell Franklin Model Input Data (NAD83, Zone 17)
Point Source (updated 1/24/20)

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)	NO2 (lb/hr)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)
CAA	Catalyst Activator A Filter (External)	556151.35	4502347.38	795.0	78.3	392.0	23.6	0.7	0.000	0.000	0.000	0.013
CAB	Catalyst Activator B Filter (External)	556158.56	4502339.12	795.0	78.3	392.0	23.6	0.7	0.000	0.000	0.000	0.013
AUSA	Additive Unloading Station A	556183.65	4502329.83	795.0	115.0	59.0	36.9	0.5	0.000	0.000	0.000	0.019
AUSB	Additive Unloading Station B	556183.42	4502329.63	795.0	115.0	59.0	36.9	0.5	0.000	0.000	0.000	0.019
AUSC	Additive Unloading Station C	556183.24	4502329.47	795.0	115.0	59.0	36.9	0.5	0.000	0.000	0.000	0.019
AUSD	Additive Unloading Station D	556183.01	4502329.27	795.0	115.0	59.0	36.9	0.5	0.000	0.000	0.000	0.019
FIBC	FIBC Compactor	556182.66	4502308.22	795.0	117.5	59.0	105.5	0.5	0.000	0.000	0.000	0.054
AFEEDA	Additive Feeder A	556192.58	4502325.85	795.0	57.5	59.0	4.0	0.5	0.000	0.000	0.000	0.002
AFEEDB	Additive Feeder B	556192.40	4502326.06	795.0	57.5	59.0	4.0	0.5	0.000	0.000	0.000	0.002
AFEEDC	Additive Feeder C	556192.24	4502326.25	795.0	57.5	59.0	4.0	0.5	0.000	0.000	0.000	0.002
AFEEDD	Additive Feeder D	556192.06	4502326.45	795.0	57.5	59.0	4.0	0.5	0.000	0.000	0.000	0.002
EXTRUD	Extruder Vent	556194.85	4502323.26	795.0	84.0	59.0	109.2	0.3	0.000	0.000	0.000	0.025
PELTDRY	Pellet Dryer Vent	556189.76	4502305.88	795.0	140.0	176.0	63.9	2.5	0.000	0.000	0.000	0.156
VACLEAN	Vacuum Cleaning System	556210.64	4502312.58	795.0	78.0	59.0	80.4	0.3	0.000	0.000	0.000	0.018

Volume Sources

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elevation (ft)	Release Height (ft)	Horizontal Dimension (ft)	Vertical Dimension (ft)	NO2 (lb/hr)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)
PEBLD	PE Blending Silos	556290.17	4502354.40	795.0	141.0	25.6	65.6	0.000	0.000	0.000	0.299
PERC	PE Rail Loading Silos	556389.00	4502348.93	795.0	187.0	22.9	87.0	0.000	0.000	0.000	0.375
PETK	PE Truck Loading Silos	556573.49	4502153.59	850.0	151.0	47.6	70.2	0.000	0.000	0.000	0.596
PEU1	LDPE Vents	556400.47	4502491.96	795.0	45.0	40.8	20.9	0.000	0.000	0.000	0.245
PEU2	LDPE Vents	556287.18	4502495.70	795.0	45.0	40.8	20.9	0.000	0.000	0.000	0.245
MPFLARE	Multipoint Ground Flare	556083.87	4502666.73	795.0	87.7	45.0	16.9	1.503	0.397	38.235	0.770
PERD_1	PE Haul Road	556500.85	4501934.99	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_2	PE Haul Road	556524.52	4501954.21	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_3	PE Haul Road	556548.18	4501973.42	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_4	PE Haul Road	556555.98	4502001.64	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_5	PE Haul Road	556560.36	4502031.81	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_6	PE Haul Road	556564.74	4502061.97	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_7	PE Haul Road	556585.70	4502082.99	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_8	PE Haul Road	556608.87	4502102.79	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_9	PE Haul Road	556632.04	4502122.60	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_10	PE Haul Road	556654.19	4502142.96	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_11	PE Haul Road	556656.29	4502172.98	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_12	PE Haul Road	556642.86	4502199.61	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_13	PE Haul Road	556621.84	4502221.36	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_14	PE Haul Road	556594.67	4502227.32	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_15	PE Haul Road	556569.50	4502211.37	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_16	PE Haul Road	556546.44	4502191.45	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_17	PE Haul Road	556526.09	4502169.05	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_18	PE Haul Road	556517.50	4502141.09	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_19	PE Haul Road	556522.55	4502111.96	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_20	PE Haul Road	556535.88	4502084.55	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_21	PE Haul Road	556543.41	4502055.97	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_22	PE Haul Road	556541.82	4502025.53	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_23	PE Haul Road	556540.24	4501995.09	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_24	PE Haul Road	556527.44	4501970.10	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_25	PE Haul Road	556504.47	4501950.06	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
PERD_26	PE Haul Road	556490.48	4501940.46	850.0	12.8	20.9	11.9	0.000	0.000	0.000	1.41E-03
TLCRD_1	Talc Haul Road	556521.21	4502553.10	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_2	Talc Haul Road	556492.72	4502561.08	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_3	Talc Haul Road	556467.64	4502546.01	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_4	Talc Haul Road	556444.27	4502527.20	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_5	Talc Haul Road	556452.84	4502502.08	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_6	Talc Haul Road	556470.01	4502477.80	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03

Volume Sources

Source ID	Source Description	Easting (X)	Northing (Y)	Base Elevation (ft)	Release Height (ft)	Horizontal Dimension (ft)	Vertical Dimension (ft)	NO2 (lb/hr)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)
TLCRD_7	Talc Haul Road	556456.25	4502452.49	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_8	Talc Haul Road	556433.83	4502432.57	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_9	Talc Haul Road	556411.40	4502412.64	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_10	Talc Haul Road	556388.97	4502392.72	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_11	Talc Haul Road	556366.54	4502372.79	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_12	Talc Haul Road	556341.02	4502363.86	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
TLCRD_13	Talc Haul Road	556320.87	4502386.02	795.0	12.8	20.9	11.9	0.000	0.000	0.000	1.67E-03
							Road Total (lb/hr)	0.000	0.000	0.000	0.058
							Overall Total (lb/hr)	114.02	74.97	1597.67	62.09

Combustion Turbine Individual Stack Load Analysis Input

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)	Unit (lb/hr)
CT1_100	Combustion Turbine 100% Load	555945.76	4502058.51	795.0	213.0	311	79.0	10.00	1.00
CT1_75	Combustion Turbine 75% Load	555945.76	4502058.51	795.0	213.0	311	63.2	10.00	0.75
CT1_45	Combustion Turbine 45% Load	555945.76	4502058.51	795.0	213.0	311	47.4	10.00	0.45
CT2_100	Combustion Turbine 100% Load	555991.73	4502098.68	795.0	213.0	311	79.0	10.00	1.00
CT2_75	Combustion Turbine 75% Load	555991.73	4502098.68	795.0	213.0	311	63.2	10.00	0.75
CT2_45	Combustion Turbine 45% Load	555991.73	4502098.68	795.0	213.0	311	47.4	10.00	0.45
CT3_100	Combustion Turbine 100% Load	556038.01	4502138.02	795.0	213.0	311	79.0	10.00	1.00
CT3_75	Combustion Turbine 75% Load	556038.01	4502138.02	795.0	213.0	311	63.2	10.00	0.75
CT3_45	Combustion Turbine 45% Load	556038.01	4502138.02	795.0	213.0	311	47.4	10.00	0.45

Note: Emissions are approximately linear with load. Flow (and velocity) are not.

Shell Franklin Off-Site Source Model Input Data (All Sources within 60km of Shell Site) (NAD83, Zone 17)

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)	NO2 (lb/hr)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)
BASF_S02	BASF Thermal Oxidation Unit	555298.00	4501272.00	743.44	40.0	70	4.72	0.3	7.50	7.50	2.35	0.21
AES_S02	AES Beaver Valley (No. 2 Boiler)	554594.21	4500893.80	754.99	220.0	135	53.20	7.5	0.00	0.00	0.00	0.00
AES_S03	AES Beaver Valley (No. 3 Boiler)	554602.06	4500892.25	755.02	220.0	135	52.30	7.5	0.00	0.00	0.00	0.00
AES_S04	AES Beaver Valley (No. 4 Boiler)	554615.70	4500891.49	755.15	220.0	135	58.60	7.5	0.00	0.00	0.00	0.00
AES_S05	AES Beaver Valley (No. 5 Boiler)	554625.50	4500888.92	755.28	220.0	135	79.60	6.0	0.00	0.00	0.00	0.00
AES_Z12	AES Beaver Valley (Fugitives)	554628.00	4500888.92	755.28	10.0	70	0.03	1.0	0.00	0.00	0.00	0.00
NOVA_S01	Nova Chem Beaver Valley D3 D4 EPS	554033.50	4500593.40	755.22	40.0	460	71.90	4.8	4.40	4.40	12.50	0.23
NOVA_S03	Nova Chem Dylene Process	554033.50	4500593.40	755.22	99.0	1800	9.94	2.0		0.00	0.00	0.23
NOVA_Z07	Nova Chem Beaver Valley Gen Plant Equip	554033.50	4500593.40	755.22	15.0	70	63.70	2.0	0.38	0.38	0.08	0.05
NOVA_NGB	Nova Chem NG Package Boilers (16 total)	554033.50	4500593.40	755.22	33.0	230	5.81	3.2	2.73	2.73	6.90	1.39
EATONS01	Eaton Boilers	557399.00	4504911.00	766.11	49.0	550	28.00	4.7	0.00	0.00	0.00	0.00
ANCH_S01	Anchor Hocking Misc NG	560718.00	4504581.00	739.27	10.0	200	0.03	1.0	1.61	1.61	1.36	0.03
ANCH_S02	Anchor Hocking Melt Tank	560718.00	4504581.00	739.27	100.0	800	4.33	5.0	17.20	17.20	2.24	5.94
ANCH_S08	Anchor Hocking Carton Mfg	560718.00	4504581.00	739.27	30.0	70	95.51	2.0		0.00		1.62
ANCHS108	Anchor Hocking Batch Plant	560718.00	4504581.00	739.27	10.0	70	0.03	1.0		0.00		0.13
ANCHS115	Anchor Hocking Dec LEHR	560718.00	4504581.00	739.27	10.0	70	0.03	1.0	0.23	0.23	0.19	0.00
ANCH_Z01	Anchor Hocking Quench LEHR	560718.00	4504581.00	739.27	40.0	68	0.03	1.0	0.37	0.37	0.31	0.01
ANCH_Z02	Anchor Hocking Anneal LEHR	560718.00	4504581.00	739.27	40.0	68	0.03	1.0	2.33	2.33	2.01	0.05
ANCHZ107	Anchor Hocking Glass Form Lub	560718.00	4504581.00	739.27	10.0	600	0.03	1.0	0.08	0.08	0.03	0.00
FEBV_S01	First Energy Nuclear Beaver Valley Aux Boil A	548011.90	4497013.10	734.48	122.0	601	17.10	7.0	6.74	6.74	1.69	0.67
FEBV_S02	First Energy Nuclear Beaver Valley Aux Boil B	548011.90	4497013.10	734.48	122.0	601	17.10	7.0	6.74	6.74	1.69	0.67
FEBVS101	First Energy Nuclear Beaver Valley Emg Dies Eng	548011.90	4497013.10	734.48	20.0	635	0.03	1.0	0.00	4.82	33.63	10.97
FEBVS102	First Energy Nuclear Beaver Valley Emg Dies Eng	548011.90	4497013.10	734.48	20.0	635	0.03	1.0	0.00	4.82	33.63	10.97
FEBVS103	First Energy Nuclear Beaver Valley Emg Dies Eng	548011.90	4497013.10	734.48	20.0	900	0.03	1.0	0.00	5.37	37.34	12.18
FEBVS104	First Energy Nuclear Beaver Valley Emg Dies Eng	548011.90	4497013.10	734.48	20.0	900	0.03	1.0	0.00	5.37	37.34	12.18
FEBVS105	First Energy Nuclear Beaver Valley Emg Res Gen	548011.90	4497013.10	734.48	10.0	1000	0.03	1.0	0.00	4.82	33.63	10.97
FEBVS106	First Energy Nuclear Beaver Valley Shot Blast	548011.90	4497013.10	734.48	10.0	70	0.03	1.0		0.00		6.11
FEBVZ109	First Energy Nuclear Beaver Valley Misc	548011.90	4497013.10	734.48	10.0	70	0.03	1.0	37.67	37.67	82.00	26.75
FEBMS02a	First Energy Bruce Mansfield (Unit #1)	549490.00	4498355.00	720.00	950	126	75.11	19.2	1979.50	1979.50	76.09	395.70
FEBMS02b	First Energy Bruce Mansfield (Unit #1)	549490.00	4498355.00	720.00	950	126	75.11	19.2	1979.50	1979.50	76.09	395.70
FEBMS03a	First Energy Bruce Mansfield (Unit #2)	549490.00	4498355.00	720.00	950	126	75.11	19.2	1979.50	1979.50	76.09	395.70
FEBMS03b	First Energy Bruce Mansfield (Unit #2)	549490.00	4498355.00	720.00	950	126	75.11	19.2	1979.50	1979.50	76.09	395.70
FEBMS06a	First Energy Bruce Mansfield (Unit #3)	549352.00	4498169.00	720.00	600	126	75.11	19.2	1979.50	1979.50	76.09	395.70

Shell Franklin Off-Site Source Model Input Data (All Sources within 60km of Shell Site) (NAD83, Zone 17)

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)	NO2 (lb/hr)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)
FEBMS06b	First Energy Bruce Mansfield (Unit #3)	549352.00	4498169.00	720.00	600	126	75.11	19.2	1979.50	1979.50	76.09	395.70
FEBM_S07	First Energy Bruce Mansfield (Aux Boils)	549490.50	4498345.90	720.00	136	585	6.89	12.0	129.02	129.02	26.88	121.87
FEBM_Z01	First Energy Fugitives	549490.50	4498345.90	729.59	10.0	70	0.03	1.0		0.00		3.30
NGC_S09	NGC Ind Shippingport Board Dryer	548962.00	4497373.00	772.08	10.0	250	0.03	1.0	20.50	20.50	10.70	2.87
NGC_S100	NGC Ind Shippingport IMP Mill	548962.00	4497373.00	772.08	30.0	350	53.10	2.0	15.20	15.20	4.40	15.20
NGC_S11	NGC Ind Shippingport Cage Mill	548962.00	4497373.00	772.08	20.0	200	61.40	5.7	12.10	12.10	2.17	5.01
NGC_S201	NGC Ind Shippingport Board Trim	548962.00	4497373.00	772.08	59.0	70	38.94	1.7		0.00		1.31
NGC_S202	NGC Ind Shippingport Riser Maker	548962.00	4497373.00	772.08	59.0	70	12.99	1.7		0.00		0.22
NGC_S203	NGC Ind Shippingport Catenary	548962.00	4497373.00	772.08	59.0	70	46.23	1.5		0.00		0.22
NGC_S204	NGC Ind Shippingport Board Plant	548962.00	4497373.00	772.08	45.0	70	62.24	1.5		0.00		0.29
NGC_S205	NGC Ind Shippingport Starch Storage	548962.00	4497373.00	772.08	60.0	70	16.96	1.0		0.00		0.03
NGC_SZ01	NGC Ind Shippingport Raw Material Storage	548962.00	4497373.00	772.08	10.0	75	0.03	1.0		0.00		1.90
NGC_SZ10	NGC Ind Shippingport Roads	548962.00	4497373.00	772.08	10.0	70	0.03	1.0		0.00		3.13
NGCSZ206	NGC Ind Shippingport Mat Hand Fugitives	548962.00	4497373.00	772.08	1.0	70	0.03	1.0		0.00		2.02
USGYP_S1	US Gypsum S1	564090.67	4497863.46	740.72	54.0	203	50.20	8.5	7.46	7.46	41.78	5.13
USGYP_S2	US Gypsum #1 Kettle	564090.67	4497863.46	740.72	97.0	600	139.00	1.4	4.21	4.21	2.16	0.80
USGYPS20	US Gypsum End Saw	564090.67	4497863.46	740.72	68.0	70	94.32	1.5		0.00		3.43
USGYS200	US Gypsum #1 DC Balance	564090.67	4497863.46	740.72	99.0	140	0.03	2.0		0.00		9.57
USGYPS21	US Gypsum #1 Dunnage	564090.67	4497863.46	740.72	68.0	70	94.32	1.5		0.00		3.43
USGYP_S3	US Gypsum #2 Kettle	564090.67	4497863.46	740.72	98.0	600	139.00	1.4	4.21	4.21	2.16	0.80
USGYP_S4	US Gypsum #1 Dryer Mill	564090.67	4497863.46	740.72	100.0	220	51.60	5.1	2.50	2.50	2.56	5.51
USGYP_S5	US Gypsum #2 Dryer Mill	564090.67	4497863.46	740.72	100.0	220	51.60	5.1	2.50	2.50	2.56	5.51
USGYP_S6	US Gypsum Gauging Water Heater	564090.67	4497863.46	740.72	25.0	600	52.40	0.9	0.49	0.49	0.41	2.00
USGYP_Z01	US Gypsum Paved Road Fug Emissions	564090.67	4497863.46	740.70	10.0	70	0.03	1.0				0.10
JEWLS41A	Jewel Acquisition Boilers	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		0.93	0.78	0.07
JEWLS41B	Jewel Acquisition Boilers	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		0.93	0.78	0.07
JEWLS106	Jewel Acquisition Meltshop	545579.00	4498791.00	775.00	50.0	350	127.33	10.0		0.00	205.48	34.30
JEWLS181	Jewel Acquisition Caster	545579.00	4498791.00	775.00	60.0	75	0.03	1.0				1.53
JEWLS202	Jewel Acquisition Shot Blaster	545579.00	4498791.00	775.00	10.0	75	0.03	1.0				0.12
JEWLS205	Jewel Acquisition Cold Reduction	545579.00	4498791.00	775.00	10.0	200	0.03	1.0				2.10
JEWLS206	Jewel Acquisition Annealing	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		5.10	5.76	1.10
JEWLS208	Jewel Acquisition Pickle	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		4.30		
JEWLS209	Jewel Acquisition Boiler 1	545579.00	4498791.00	775.00	10.0	350	0.03	1.0		2.87	2.41	0.22

Shell Franklin Off-Site Source Model Input Data (All Sources within 60km of Shell Site) (NAD83, Zone 17)

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)	NO2 (lb/hr)	NOx (lb/hr)	CO (lb/hr)	PM10 (lb/hr)
JEWLS210	Jewel Acquisition Boiler 2	545579.00	4498791.00	775.00	10.0	99	0.03	1.0		3.28	2.75	0.25
JEWLZ050	Jewel Acquisition Heaters	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		1.96	1.65	0.15
JEWLZ182	Jewel Acquisition Roads	545579.00	4498791.00	775.00	10.0	68	0.03	1.0				5.07
DOM_S01	Dominion Trans Eng 1	558671.00	4518753.00	1224.70	52.0	700	0.03	3.0		14.10	18.30	1.14
DOM_S02	Dominion Trans Eng 2	558671.00	4518753.00	1224.70	52.0	700	0.03	3.0		14.10	18.30	1.14
DOM_S03	Dominion Trans Eng 3	558671.00	4518753.00	1224.70	52.0	700	0.03	3.0		14.10	18.30	1.14
DOM_S04	Dominion Trans Eng 4	558671.00	4518753.00	1224.70	52.0	700	0.03	3.0		14.10	18.30	1.14
DOM_S06	Dominion Trans Boiler 1	558671.00	4518753.00	1224.70	31.0	450	0.03	2.0		1.50	0.13	0.06
IPSC_S02	IPSCO Koppel Aus Furnace	557468.00	4520732.00	887.93	54.0	900	10.17	4.0		1.95	0.10	12.00
IPSC_S03	IPSCO Koppel Var Heaters	557468.00	4520732.00	887.93	54.0	900	14.07	4.0		2.55	2.14	0.20
IPSC_S04	IPSCO Koppel Temper Furnace	557468.00	4520732.00	887.93	54.0	900	14.07	4.0		0.77	0.22	6.80
IPSC_S05	IPSCO Koppel Melt Shop	557468.00	4520732.00	887.93	100.0	150	57.19	10.0		60.00	500.00	17.17
IPSC_S01	IPSCO Koppel Rot Hearth	557458.00	4520772.00	887.20	125.0	800	0.56	10.8		31.51	15.12	1.37
IPSCS02a	IPSCO Koppel Quench	557458.00	4520772.00	887.20	54.0	900	0.13	4.0		3.72	3.13	0.28
IPSCS03a	IPSCO Koppel Temper Furnace	557458.00	4520772.00	887.20	10.0	900	0.03	1.0		4.11	3.46	0.31
IPSCS04a	IPSCO Koppel Reheat	557458.00	4520772.00	887.20	10.0	1195	0.03	1.0		2.94	2.47	0.22
IPSCS05a	IPSCO Koppel Upsetter	557458.00	4520772.00	887.20	10.0	500	0.03	1.0		0.78	0.66	0.06
IPSC_S09	IPSCO Koppel Misc Htrs	557458.00	4520772.00	887.20	10.0	500	0.03	1.0		4.51	3.79	0.34
IPSCS09a	IPSCO Koppel Upsetter	557458.00	4520772.00	887.20	10.0	500	0.03	1.0		1.05	0.88	0.08
IPSCS09b	IPSCO Koppel Mill Piercing	557458.00	4520772.00	887.20	10.0	500	0.03	1.0				19.62
ALLGS01a	Allegheny Energy B&W Oil Unit	587738.00	4452830.00	752.82	193.0	375	25.98	14.0		168.20	30.50	10.06
ALLGS01b	Allegheny Energy B&W Oil Unit	587738.00	4452830.00	752.82	193.0	375	25.98	14.0		168.20	30.50	10.06
ALLGS01c	Allegheny Energy B&W Oil Unit	587738.00	4452830.00	752.82	193.0	375	25.98	14.0		168.20	30.50	10.06
ALLGS04	Allegheny Energy Boiler 33	587738.00	4452830.00	752.82	375.0	117	62.99	20.0		2182.05	65.00	271.91
ALLGS05a	Allegheny Energy Boiler 1	587738.00	4452830.00	752.82	150.0	385	22.90	3.5		3.70	0.93	10.80
ALLGS05b	Allegheny Energy Boiler 2	587738.00	4452830.00	752.82	150.0	385	22.90	3.5		3.70	0.93	10.80
ALLGZ02	Allegheny Energy Fugitives	587738.00	4452830.00	752.82	10.0	68	0.03	1.0				19.75

Truck Roadway Volume Source Parameter Calculation

Step 1: Adjusted Width of Road			
	Two Lane Road Width (ft) of	25 + 20 ft (6 m) =	45 ft
Step 2: Height of Volume			
	Vehicle height (ft) of	15 X 1.7 =	25.5 ft
Step 3: Initial Sigma Y (Horizontal Dimension)			
	Adjusted road width (ft) of	45 / 2.15 =	20.93 ft
Step 4: Initial Sigma Z (Vertical Dimension)			
	Height of volume (ft) of	25.5 / 2.15 =	11.86 ft
Step 5: Height of Release			
	Height of volume (ft) of	25.5 / 2 =	13 ft

Shell Franklin Non-Road Volume Source Parameter Calculation

		Source Dimensions					Initial Dispersion Coefficients		
Model ID	Source Description	Length (ft)	Width (ft)	Square Root of Area (ft)	Structure Height/Vertical Dimension (ft)	Release Height (ft)	Initial Horizontal Dimension s_Y (ft)	Initial Vertical Dimension s_Z (ft)	Reference
PEBLD	PE Blending Silos	147.6	82.0	110.0	141.0	141.0	25.58	65.6	Note 1, 2, and 3
PERC	PE Rail Loading Silos	98.4	98.4	98.4	187.0	187.0	22.88	87.0	Note 1, 2, and 3
PETK	PE Truck Loading Silos	213.2	196.8	204.8	151.0	151.0	47.64	70.2	Note 1, 2, and 3
PEU1	LDPE Vents	313.2	98.4	175.6	45.0	45.0	40.83	20.9	Note 1, 2, and 3
PEU2	LDPE Vents	213.2	164.0	187.0	145.0	145.0	43.49	67.4	Note 1, 2, and 3
PEU3	HDPE Vents	213.2	164.0	187.0	150.0	150.0	43.49	69.8	Note 1, 2, and 3
MPFLARE	Multi Point Ground Flare	250.0	150.0	193.6	60.0	87.71	45.03	16.91	Note 2, 4 and 5
ECFUG1	Ethane Cracking	492.0	78.7	196.8	140.0	70.0	45.77	65.12	Note 2, 6 and 7
ECFUG2	Fuel Gas and Regeneration System	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG3	Wash Water System	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG4	Cracked Gas Compression	425.0	425.0	425.0	82.0	41.0	98.84	38.14	Note 2, 6 and 7
ECFUG5	Caustic Wash	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG6	Gas Redistillation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG7	C2/C3 Separation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG8	C2 Hydrogenation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG9	C1/C2 Separation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG10	Spent Caustic Treatment	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG11	Flare Condensate	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
OSBLFUG1	Recovered Oil and Truck Loadout	300.0	300.0	300.0	48.0	24.0	69.77	22.33	Note 2, 6 and 7
OSBLFUG2	Rail for C3+	300.0	300.0	300.0	52.0	26.0	69.77	24.19	Note 2, 6 and 7
OSBLFUG3	Diesel Tanks	300.0	300.0	300.0	52.0	26.0	69.77	24.19	Note 2, 6 and 7
OSBLFUG4	C3+	164.0	98.4	127.0	83.0	41.5	29.54	38.60	Note 2, 6 and 7
WWTP	Waste Water Treatment Fugitives	225.0	225.0	225.0	30.0	15.0	52.33	13.95	Note 2, 6 and 7

Note 1: Release height equal to top of structure as process is aspirated and emissions will occur at the top of the structure.

Note 2: Sigma Y value calculated as the square root of the area divided by 4.3 (Table 3-1 of AERMOD Manual for single volume source).

Note 3: Sigma Z values for elevated sources on or adjacent to a building calculated as the building height divided by 2.15 (Table 3-1 of AERMOD Manual for Elevated Source on or Adjacent to Building).

Note 4. Release height of ground flare calculated based upon Ohio EPA Guidance for deriving plume rise for a flare (0.944*(98)^0.478)*3.28). The modeled height was set to the height of the wind fence of 60' plus the plum rise. The plume rise was calculated to be 27.7'. The heat release rate of flare is 98 MMBtu/hr.

Note 5. Sigma Z value for ground flare assumed equal to effective stack height (vertical dimension) divided by 4.3. Effective height calculated based upon Ohio EPA Guidance and heat release rate of 98 MMBtu/hr [60+((0.944*(98)^0.478)*3.28)].

Note 6: Sigma Z values for surface based source calculated as the vertical dimension of source divided by 2.15 (Table 3-1 of AERMOD Manual for Surface Based Source).

Flare Effective Release Height and Diameter Calculation

Flare	Total Heat Release Rate (MMBtu/hr)	Effective Diameter (ft)	Actual Height (ft)	Effective Height (ft)
Ground Flare 1	1343.5	21.1	110.0	206.9
Ground Flare 2	1343.5	21.1	110.0	206.9
HP Elevated Flare	51.7	4.14	335.0	355.4

Effective diameter (ft) = (0.1755 x (heat release (MMBtu/hr)^.5)*3.28
Effective height (ft) = actual height + (0.944 x (heat release (MMBtu/hr))^0.478)*3.28
Based upon calculations consistent with SCREEN3 as presented in the 2003 Ohio EPA Engineering Guide #69.
GEP height of 246 ft concervatively modeled for the HP Elevated Flare.

11-14 Vanport Bridge Receptors

	x (m)	y (m)	elev (m)	terr max (m)	flagpole (m)	flagpole height above pool (ft)
1	556613.057	4503089.098	227.75	342.68	5.60	83
2	556592.472	4503134.664	212 00	354.30	21 35	
3	556571.886	4503180.230	208.13	354.30	25 22	
4	556551.301	4503225.796	208 05	354.30	25 30	
5	556530.716	4503271.362	208 05	355.09	25 30	
6	556510.130	4503316.927	208 05	355.56	25 30	
7	556489.545	4503362.493	208 05	355.56	25 30	
8	556468.959	4503408.059	208 05	355.56	25 30	
9	556448.374	4503453.625	208 05	355.56	25 30	
10	556427.789	4503499.191	208.12	355 56	25 23	
11	556407.203	4503544.756	215.15	355 56	18 20	
12	556386.618	4503590.322	232 83	354 30	0.52	

Vanport Bridge Clearance Height above pool elevation of 208ft or 63.43m

Light List corrected through LNM week: 09/14

(1) No.	(2) Name and Location	(3) Mile	(4) Bank	(5) Characteristic	(6) Structure / Dayboard Up	Down	(7) Remarks
				OHIO RIVER			
	OHIO RIVER						
23045	Vanport Bridge	28.0					CLEARANCES: Horizontal, 700.0 feet; vertical, 88.0 feet above pool for center 640.0 feet of span.

From: US Coast Guard - Light List: Mississippi River System of the United States, 2014

Bridge Deck is at least 15' from the lowest clearance heigh of 68ft, so total height of flagpole is 68+15 or 83ft above pool elevation.

Flagpole receptor locations in model (every 50m along span)

David Keen

From: Phil May [may@rtpenv.com]
Sent: Thursday, October 30, 2014 10:43 AM
To: Binder, Alan; Andrew Fleck
Cc: David Keen; Shari Keller
Subject: Basis for In-Stack Ratios - First Energy and AES
Attachments: 8-NO2-Measurements- M Carpenter.pdf

This email is in response to questions raised by the Department in regards to the in-stack NO2/Nox ratios used for purposes of modeling the emissions from First Energy and Bruce Mansfield. The basis for these ratios is briefly discussed on Page 5-6 of Appendix C in the application for plan approval. The following provides some additional perspective to that discussion and the basis for the in-stack ratios.

The coal fired boilers located at First Energy's Bruce Mansfield Station have a permitted NOx emissions rates of 0.5 lb/MMBtu (RACT). Each of these units is equipped with an SCR that is used to reduce NOx emissions in accordance with the CAIR program. Because the SCR systems is not required to operate year round, the starting point for the total amount of NOx that was modeled from these units was 0.5 lb/MMBtu and the permitted heat input for the three units of 7914 MMBtu/hr (each). The molar ratio of NO2 to total NOx in the stack was determined based upon information included in AP-42 Table 1.1-3 for coal fired boilers. Footnote "c" which is located on the NOx column header states the following:

> Expressed as NO2. Generally, 95 volume % or more of NOx present in combustion exhaust will be in the form of NO, the rest NO2 (Reference 6). To express factors as NO, multiply factors by 0.66. All factors represent emissions at baseline operation (i. e., 60 to 110% load and no NOx control measures).

This ratio is further supported by the information contained in the attached on page 13.

Using this basis a 0.05 ratio was derived.

The coal fired boilers located at AES Beaver Valley Plant have a permitted NOx emissions rates of 0..7 lb/MMBtu (Units 032, 033, and 034) and 0.77 lb/MMBtu (Unit 035). Compliance with the limit is achieved through the use of a selective non catalytic reduction system (SNCR). SNCR systems inject ammonia (a selective reactant) into the exhaust gas path where the exhaust temperature is around 2100F. The injected ammonia selectively reacts with the NOx in the exhaust gas. A review of the reaction mechanisms associated with SNCR indicates that the predominant reaction pathway involves the reaction of NH3 with NO, not NO2. A well operated SNCR system is able to achieve a total NOx reduction of 40%. To determine the in-stack ratio if uncontrolled exhaust concentration of NOx is 100 parts NOx, then using the AP-42 reference identified above the concentration of Nox species in the exhaust is 5 parts NO2 and 95 parts NO. If the SNCR achieves a 40% reduction by reacting with NO then the exit gas concentration of NOx in the exhaust when the SNCR is operating is 5 parts NO2 and 55 parts NO (i.e., only NO is reduced via the selective reaction with ammonia). The in-stack ratio of NO2/NOx is 5/60 = 0.08. For purposes of the modeling performed in support of the Shell Project a ratio of 0.17 was conservatively assumed.

Phillip May
RTP Environmental Associates
304-A West Millbrook Road

Calculation of PM10 Increment Consumption for AES Beaver Valley and First Energy Bruce Mansfield

		PM10 Actual Emissions from Annual Reports (TPY)					Max 2012/2013 - Min 1990/1991
Source	**Unit**	**1990**	**1991**	**2011**	**2012**	**2013**	**Change**
AES Beaver Valley	S02	35.7	34.2	70.2	90.1	*9.7*	55.9
	S03	32.0	35.1	86.2	109.0	*1.3*	77.0
	S04	34.3	34.2	73.7	149.9	*17.2*	115.7
	S05	0.0	17.6	28.8	52.9	*0.1*	52.9
	Z12	0.0	0.0	3.0	3.2	*1.5*	3.2
First Energy Bruce Mansfield	S01	122.3	124.6		102.7	104.0	-18.3
	S02	122.3	124.6		102.7	104.0	-18.3
	S03	154.4	113.0		110.1	86.7	-2.9
	S04	154.4	113.0		110.1	86.7	-2.9
	S05	43.3	50.7		140.7	132.5	97.4
	S06	43.3	50.7		140.7	132.5	97.4
	Z01	0.0	0.0		11.3	11.3	11.3

Note: 2013 Emissions from AES Beaver Valley were suspect and not used. 2011 emissions were used instead.

David Keen

From: Shepherd, Don [don_shepherd@nps.gov]
Sent: Wednesday, February 12, 2014 2:39 PM
To: David Keen
Cc: Rick Graw (rgraw@fs.fed.us); Melanie Pitrolo (mpitrolo@fs.fed.us); David Keen (keen@rtpenv.com); James Schaberl; Jalyn Cummings; Holly Salazer
Subject: Re: FW: Request for Applicability of Class I Area Modeling Analysis

David,

Please note that, when calculating Q, you should annualize the maximum hourly emission rate. Nevertheless, based upon the information provided in the attachment, NPS does not request an AQRV analysis. However, please keep us in the loop by providing electronic copies of the complete application, public notice, draft permit, and PA staff analysis.

thanks.

On Tue, Feb 11, 2014 at 3:14 PM, David Keen <keen@rtpenv-nc.com> wrote:

Rick and Don,

We are preparing a PSD permit application for Shell for an ethane cracking facility to be located in Beaver County, PA. I sent the attached notification to Melanie Pitrolo last week, but seem to recall that she may be on leave. I wanted to make sure that you guys were aware of this project, so am resending the notification to you. Please let me know if you have any questions or need additional information.

Thanks,

David Keen

From: David Keen [mailto:keen@rtpenv-nc.com]
Sent: Thursday, February 06, 2014 2:42 PM
To: Melanie Pitrolo (mpitrolo@fs.fed.us)
Cc: Andrew Fleck; Phillip May; Shari Keller (shari.keller@shell.com); David Keen (keen@rtpenv.com)
Subject: Request for Applicability of Class I Area Modeling Analysis

Melanie,

Shell Chemical Appalachia, LLC ("Shell") is proposing to construct a ethylene and polyethylene production facility in Beaver County Pennsylvania on the site of the zinc smelter currently owned by the Horsehead Corporation. Please find attached our "Request for Applicability of Class I Area Modeling". Should you have any questions about our request or need additional information, please do not hesitate to contact me at (919) 845-1422 x41. Please let me know when you have successfully received this request.

Thanks very much,

David Keen

David Keen

RTP Environmental

keen@rtpenv.com

(919) 845-1422 x41

(919) 845-1424 fax

(919) 906-6016 mobile

Note: This message originates from RTP Environmental Associates Inc. It contains information that may be confidential or privileged and is intended only for the individual or entity named above. It is proh bited for anyone else to disclose, copy, distr bute, or use the contents of this message. All personal messages express views solely of the sender, which are not to be attributed to RTP Environmental, and may not be copied or distributed without this disclaimer. If you received this message in error, please notify me immediately at: keen@rtpenv.com or 919-845-1422 x41.

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Don Shepherd
National Park Service
Air Resources Division
12795 W. Alameda Pkwy.
Lakewood, CO 80228
Phone: 303-969-2075
Fax: 303-969-2822
E-Mail: don_shepherd@nps.gov
"the man who really counts in the world is the doer, not the mere critic" TR 1891

David Keen

From: Pitrolo, Melanie -FS [mpitrolo@fs.fed.us]
Sent: Tuesday, February 11, 2014 6:19 PM
To: David Keen
Subject: RE: Request for Applicability of Class I Area Modeling Analysis

Hi David. Thanks for sending this again to me.

Based on the information contained in your email, we do not anticipate that emissions from the proposed facility will cause an adverse impact to any of the air quality related values at Forest Service Class I Areas. Therefore, we are not requesting that an AQRV modeling analysis be included in the application. Should emissions from the project increase, please let me know so that I can re-evaluate the proposed facility.

Thanks again for keeping the USDA Forest Service informed about PSD applications that may potentially impact Class I Areas managed by us. Should you have any questions about this determination, please feel free to call or email me.

Melanie

Melanie Pitrolo, Air Quality Specialist
USDA Forest Service
160 Zillicoa Street
Asheville, NC 28801
(828) 257-4213
mpitrolo@fs.fed.us

From: David Keen [mailto:keen@rtpenv-nc.com]
Sent: Tuesday, February 11, 2014 5:14 PM
To: Graw, Rick -FS; Don Shepherd (Don_Shepherd@nps.gov)
Cc: Pitrolo, Melanie -FS; David Keen (keen@rtpenv.com)
Subject: FW: Request for Applicability of Class I Area Modeling Analysis

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Thanks,
David Keen

From: David Keen [mailto:keen@rtpenv-nc.com]
Sent: Thursday, February 06, 2014 2:42 PM
To: Melanie Pitrolo (mpitrolo@fs.fed.us)
Cc: Andrew Fleck; Phillip May; Shari Keller (shari.keller@shell.com); David Keen (keen@rtpenv.com)
Subject: Request for Applicability of Class I Area Modeling Analysis

Melanie,

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Thanks very much,

David Keen

_____

David Keen
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(919) 845-1424 fax
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David Keen

From: O'Dea, Claire B -FS [cbodea@fs.fed.us]
Sent: Thursday, February 13, 2014 9:44 AM
To: David Keen
Cc: Don Shepherd (don_shepherd@nps.gov); Salazer, Holly (holly_salazer@nps.gov); Pitrolo, Melanie -FS; Perron, Ralph -FS; keen@rtpenv.com; jim_schaberl@nps.gov; jalyn_cummings@nps.gov; Phillip May; David Keen (keen@rtpenv.com)
Subject: RE: FW: Request for Applicability of Class I Area Modeling Analysis

Hi David,

Thank you for your reply. Melanie just informed me that she had already responded to your request, so I will just echo her response that the Forest Service does not anticipate that any air quality related values (AQRVs) at Forest Service Class I Areas will be adversely impacted by the proposed project, based on the information submitted. We will therefore not be requesting that an AQRV modeling analysis be completed. Please do keep us both posted when electronic copies of the complete application, public notice, etc. are available.

Thank you,

Claire O'Dea, Ph.D.
Air Quality Specialist, USDA Forest Service Eastern Region
1400 Independence Ave., SW, Mailstop: 1121
Washington, DC 20250
(202) 205-1686
(919) 368-6879 (c)
cbodea@fs.fed.us

From: David Keen [mailto:keen@rtpenv-nc.com]
Sent: Wednesday, February 12, 2014 7:16 PM
To: O'Dea, Claire B -FS
Cc: Don Shepherd (don_shepherd@nps.gov); Salazer, Holly (holly_salazer@nps.gov); Pitrolo, Melanie -FS; Perron, Ralph -FS; keen@rtpenv.com; jim_schaberl@nps.gov; jalyn_cummings@nps.gov; Phillip May; David Keen (keen@rtpenv.com)
Subject: RE: FW: Request for Applicability of Class I Area Modeling Analysis

Thank you Claire. We will keep you informed of any changes to the proposed emissions. The facility will use natural gas with very low sulfur as its primary feedstock. In addition, the facility will be located in a SO2 non-attainment area. So there should be little to no sulfuric acid mist emitted from the facility.

Again, thank you and please let me know if you have any other questions or need additional information.

David

From: O'Dea, Claire B -FS [mailto:cbodea@fs.fed.us]
Sent: Wednesday, February 12, 2014 3:58 PM
To: David Keen
Cc: Don Shepherd (don_shepherd@nps.gov); Salazer, Holly (holly_salazer@nps.gov); Pitrolo, Melanie -FS; Perron, Ralph -FS; keen@rtpenv.com; jim_schaberl@nps.gov; jalyn_cummings@nps.gov
Subject: RE: FW: Request for Applicability of Class I Area Modeling Analysis

Hi David,

Thank you for sending out this "Request for Applicability of Class I Area Modeling" form. Please include me in future correspondence with the US Forest Service regarding Dolly Sods and Otter Creek Class I Areas.

With respect to this proposed facility and the completed form that you sent out, I wanted to verify whether there will be any sulfuric acid mist emissions. This row of the table was left empty and I wanted to make sure that was intentional, and not that the row was overlooked due to being pushed onto the next page. I also wanted to agree with Don that annualized maximum hourly emissions should be used to calculate Q for Q/D analysis.

Once I hear from you regarding confirmation of sulfuric acid mist emissions I will respond with the FS determination.

Thank you for keeping us in the loop and for using this Request for Determination form.

Best,

Claire O'Dea, Ph.D.
Air Quality Specialist, USDA Forest Service Eastern Region
1400 Independence Ave., SW, Mailstop: 1121
Washington, DC 20250
(202) 205-1686
(919) 368-6879 (c)
cbodea@fs.fed.us

---------- Forwarded message ----------
From: **Shepherd, Don** <don_shepherd@nps.gov>
Date: Wed, Feb 12, 2014 at 2:39 PM
Subject: Re: FW: Request for Applicability of Class I Area Modeling Analysis
To: David Keen <keen@rtpenv-nc.com>
Cc: "Rick Graw (rgraw@fs.fed.us)" <rgraw@fs.fed.us>, "Melanie Pitrolo (mpitrolo@fs.fed.us)" <mpitrolo@fs.fed.us>, "David Keen (keen@rtpenv.com)" <keen@rtpenv.com>, James Schaberl <jim_schaberl@nps.gov>, Jalyn Cummings <jalyn_cummings@nps.gov>, Holly Salazer <holly_salazer@nps.gov>

David,

Please note that, when calculating Q, you should annualize the maximum hourly emission rate. Nevertheless, based upon the information provided in the attachment, NPS does not request an AQRV analysis. However, please keep us in the loop by providing electronic copies of the complete application, public notice, draft permit, and PA staff analysis.

thanks.

On Tue, Feb 11, 2014 at 3:14 PM, David Keen <keen@rtpenv-nc.com> wrote:

Rick and Don,

We are preparing a PSD permit application for Shell for an ethane cracking facility to be located in Beaver County, PA. I sent the attached notification to Melanie Pitrolo last week, but seem to recall that she may be on leave. I wanted to make sure that you guys were aware of this project, so am resending the notification to you. Please let me know if you have any questions or need additional information.

Thanks,

David Keen

From: David Keen [mailto:keen@rtpenv-nc.com]
Sent: Thursday, February 06, 2014 2:42 PM
To: Melanie Pitrolo (mpitrolo@fs.fed.us)
Cc: Andrew Fleck; Phillip May; Shari Keller (shari.keller@shell.com); David Keen (keen@rtpenv.com)
Subject: Request for Applicability of Class I Area Modeling Analysis

Melanie,

Shell Chemical Appalachia, LLC ("Shell") is proposing to construct a ethylene and polyethylene production facility in Beaver County Pennsylvania on the site of the zinc smelter currently owned by the Horsehead Corporation. Please find attached our "Request for Applicability of Class I Area Modeling". Should you have any questions about our request or need additional information, please do not hesitate to contact me at (919) 845-1422 x41. Please let me know when you have successfully received this request.

Thanks very much,

David Keen

_____

David Keen

RTP Environmental

keen@rtpenv.com

(919) 845-1422 x41

(919) 845-1424 fax

(919) 906-6016 mobile

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--
Don Shepherd
National Park Service
Air Resources Division
12795 W. Alameda Pkwy.
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Phone: 303-969-2075
Fax: 303-969-2822
E-Mail: don_shepherd@nps.gov
"the man who really counts in the world is the doer, not the mere critic" TR 1891

--

Holly Sharpless Salazer
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Natural Resources Program
National Park Service - Northeast Region

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Class I Area Q/D Calculations

Class I Area	Distance (km)	Q (tpy)	Q/D
Otter Creek (USFS)	189	815.8	4.32
Dolly Sods (USFS)	200	815.8	4.08
Shenandoah (NPS)	269	815.8	3.04
James River Face (USFS)	347	815.8	2.35

Pollutant	Q (TPY)
NOx	518.66
PM10	275.36
SO2	21.00
H2SO4	0.80
Total	815.82

Q is calculated as maximum daily rate x 365.

RTP ENVIRONMENTAL ASSOCIATES, INC.®

February 4, 2014

Mr. Andrew Fleck
Environmental Group Manager
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street | Harrisburg PA 17101

Subject: Justification for Use of the Plume Volume Molar Ratio Method in Calculation of Ambient Impacts for the Proposed Ethane Cracker and Polyethylene Plant, Shell Chemical Appalachia, LLC in Beaver County

Dear Mr. Fleck,

Shell Chemical Appalachia, LLC ("Shell") has proposed to construct an Ethane Cracking/Polyethylene Manufacturing and energy production facility near Monaca, Pennsylvania. The proposed project will result in a significant increase in emissions of nitrogen oxides ("NOx") as well as other pollutants which will require evaluation under the Prevention of Significant Deterioration ("PSD") regulations of 40 CFR § 52.21. The PSD regulations are incorporated in their entirety in 25 Pa. Code § 127.83 and the Commonwealth's State Implementation Plan codified at 40 CFR § 52.2020. Shell submitted a modeling protocol to the Pennsylvania Department of Environmental Protection (DEP) in January of 2014 . The modeling protocol outlined Shell's plans to employ either the Plume Volume Molar Ratio Method ("PVMRM") or Ozone Limiting Method ("OLM") in modeling of NOx emissions to account for the conversion of NOx to NO_2. The PVMRM and OLM methods are currently implemented through a non-regulatory default option in AERMOD. As a result, AERMOD is not considered a "preferred" model and its use must be justified and approved on a case-by-case basis. On behalf of Shell, RTP Environmental requests approval of the PVMRM method described below for the NO_2 modeling analysis.

The NO_X emissions will be subject to the source impact analysis requirements of 40 CFR 52.21(k). As required by IDAPA 58.01.01,202.02, estimates of ambient NO_2 concentrations needed to assess compliance with these requirements will be based on the applicable air quality models, databases, and other requirements specified in Appendix W of 40 CFR Part 51. When EPA finalized the ambient standard for NO_2, the agency did not include a revision to Appendix W for the required analysis. Consequently, a non-regulatory application of the model will need to be employed to accomplish the required review. Shell therefore plans to employ AERMOD in the non-

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Raleigh, North Carolina 27609
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regulatory mode using the PVMRM in modeling of NO_X emissions to account for the conversion of NO_X to NO_2.

Use of PVMRM is considered a non-regulatory application of AERMOD and use of the method changes the status of the model. As stated in Section 3.1.2(c) of 40 CFR Part 51, Appendix W,

> *A preferred model should be operated with the options listed in Appendix A as "Recommendations for Regulatory Use." If other options are exercised, the model is no longer "preferred." Any other modification to a preferred model that would result in a change in the concentration estimates likewise alters its status as a preferred model. Use of the model must then be justified on a case-by-case basis.*

If non-regulatory options are to be used for regulatory purposes, justification must be made pursuant to five criteria presented at Section 3.2.2(e) of 40 CFR 51 Appendix W. The five Section 3.2.2(e) criteria are:

i. The model has received a scientific peer review;
ii. The model can be demonstrated to be applicable to the problem on a theoretical basis;
iii. The data bases which are necessary to perform the analysis are available and adequate;
iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and
v. A protocol on methods and procedures to be followed has been established.

The use of PVMRM meets these five criteria as discussed below:[1]

3.2.2(e)(i), "The model has received a scientific peer review"

As noted in the memorandum from Tyler Fox on June 28, 2010;[2] "Since AERMOD is the preferred model for dispersion for a wide range of applications, the focus of the alternative model demonstration for use of the OLM/PVMRM options within AERMOD is on the treatment of NOx chemistry within the model, and does not need to address basic dispersion algorithms within AERMOD." Therefore, the following will address the basic chemistry of the non-regulatory option.

---

[1] The justification is adapted from a document prepared by the San Joaquin Valley Air Pollution Control District document, "Assessment of Non-Regulatory Options in AERMOD Specifically OLM and PVMRM", September 16, 2010.
[2] "Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard", June 28, 2010.

Basic PVMRM Chemistry:
The PVMRM determines the conversion rate for NO_x to NO_2 based on a calculation of the NO_x moles emitted into the plume, and the amount of O_3 moles contained within the volume of the plume between the source and receptor. The dispersion algorithms in AERMOD and other steadystate plume models are based on the use of total dispersion coefficients, which are formulated to represent the time-averaged spread of the plume. A more appropriate definition of the volume of the plume for purposes of determining the ozone moles available for conversion of NOx is based on the instantaneous volume of the plume, which is represented by the use of relative dispersion coefficients, (Cole and Summerhays, 1979; Bange, 1991). The implementation of PVMRM in AERMOD is based on the use of relative dispersion coefficients to calculate the plume volume. Weil (1996 and 1998) has defined formulas for relative dispersion that are consistent with the AERMOD treatment of dispersion, and which can be calculated using meteorological parameters available within AERMOD.

The chemistry for PVMRM has been peer-reviewed as noted by the documents posted on EPA's Support Center for Regulatory Air Modeling (SCRAM) web site:

Cole, H.S. and J.E. Summerhays, 1979. A Review of Techniques Available for Estimation of Short-Term NO_2 Concentrations, *Journal of the Air Pollution Control Association*, 29(8):812-817.

Hanrahan, P.L., 1999a. The Plume Volume Molar Ratio Method for Determining NO_2/NOx Ratios in Modeling - Part I: Methodology. *Journal of the Air & Waste Management Association*, 49, 1324-1331.

Hanrahan, P.L., 1999b. The Plume Volume Molar Ratio Method for Determining NO_2/NOx Ratios in Modeling - Part II: Evaluation Studies. *Journal of the Air & Waste Management Association*, 49, 1332-1338.

MACTEC, 2005. Evaluation of Bias in AERMOD-PVMRM. Final Report, Alaska DEC Contract No. 18-9010-12. MACTEC Federal Programs, Inc., RTP, NC.

These documents demonstrate that the models have received appropriate scientific peer review.

3.2.2(e)(ii), "The model can be demonstrated to be applicable to the problem on a theoretical basis"

The EPA's June 28, 2010 memorandum states that satisfaction of this criterion is "a case-by-case determination based on an assessment of the adequacy of the ozone titration mechanism utilized by these options [OLM and PVMRM] to account for NOx chemistry within the AERMOD model based on the 'chemical environment into which the source's plume is to be emitted (Appendix W, Section 5.1.j)." PVMRM is based on the same simple chemical mechanism of titration to account for the conversion of NO

emissions to NO_2. The EPA notes that both the OLM and PVMRM methods will suffer from the same limitations for application in which other mechanisms, such as photosynthesis, contribute significantly to the overall process of chemical transformation. Sources located in areas with high levels of VOC emissions may be subject to such limitations. However, since titration is generally a much faster mechanism for converting NOx to NO_2 than photosynthesis, it is likely to be appropriate for characterizing peak 1-hour NO_2 impacts in many cases. The location of the Shell site is not subject to elevated levels of VOC emissions. In fact, out of the 67 counties in Pennsylvania, Beaver County ranks 56 with a total VOC emission rate of 7,748 tons per year. Allegheny County ranks number one with a total VOC emission rate of 30,349 tons per year (2011 National Emissions Inventory from the EPA's Technology Transfer Network). RTP therefore believes that the titration method employed by PVMRM is appropriate for the Shell NO_2 analysis.

As noted in the document entitled “Sensitivity Analysis of PVMRM and OLM in AERMOD”, “This report presents results of a sensitivity analysis of the PVMRM and OLM options for NO_x to NO_2 conversion in the AERMOD dispersion model. Several single source scenarios were examined as well as a multiple-source scenario. The average conversion ratios of NO_2/NO_x for the PVMRM option tend to be lower than for the OLM option and for the Tier 2 option or the Ambient Ratio Method which has a default value of 0.75 for the annual average. The sensitivity of the PVMRM and OLM options to emission rate, source parameters and modeling options appear to be reasonable and are as expected based on the formulations of the two methods. For a given NO_x emission rate and ambient ozone concentration, the NO_2/NO_x conversion ratio for PVMRM is primarily controlled by the volume of the plume, whereas the conversion ratio for OLM is primarily controlled by the ground-level NO_x concentration. Overall the PVMRM option appears to provide a more realistic treatment of the conversion of NO_x to NO_2 as a function of distance downwind from the source than OLM or the other NO_2 screening options (Hanrahan, 1999a; Hanrahan, 1999b). No anomalous behavior of the PVMRM or OLM options was identified as a result of these sensitivity tests.” Based on this report, both PVMRM and OLM methods are applicable to the problem of NO_2 formation and as noted by the author and provide a better estimation of the NO_2 impacts compared to other screening options.

3.2.2(e)(iii), "The data bases which are necessary to perform the analysis are available and adequate"

The data needed to conduct an PVMRM run are 1) hourly meteorological data, 2) hourly ozone data, and 3) in-stack NO_2/NO_x ratio. Shell proposes to use the 2006-2010, 5-year sequential hourly surface meteorological data collected at the First Energy Beaver Valley Nuclear Generating Station (Beaver Valley) and upper air data from the Pittsburgh International Airport (KPIT, WBAN 94823). The First Energy surface data were collected as part of a continuous data collection program required by the U.S. Nuclear Regulatory Commission (NRC). The First Energy station is located approximately 8km downstream of the proposed Shell site, also on the Ohio River. Shell proposes to use representative hourly ozone data for 2006-2010 from the DEP's

Brighton Township monitor, on Sebring Road (AQS #42-007-0005), which is located just across the river from the site 2km to the north. Missing data values will be substituted from data collected at the Beaver Falls monitor (AQS #42-007-0014), located 9km from the site, as well as the Harrison and Lawrenceville monitors in Pittsburgh (AQS #s 42-007-002 and 42-003-0008, respectively). Shell proposes to use the default NO_2/NOx value of 0.5 for all sources in the absence of source-specific information. This default value is recommended in the EPA's March 1, 2011 memorandum.[3] If source-specific information becomes available, Shell will use these more appropriate in-stack ratios. Shell also proposes to use the default NO_2/NOx ambient equilibrium ratio of 0.9. Shell believes the meteorological, ozone, in-stack and equilibrium ratio values are available and adequate.

3.2.2(e)(iv), "Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates"

As noted in the document entitled “Evaluation Of Bias In AERMOD-PVMRM” prepared by Roger W. Brode, “This report presents results of an analysis of evaluation results to determine whether the AERMOD-PVMRM algorithm produces biased or unbiased estimates of the NO_2/NO_x ratio. Evaluation results from two aircraft studies and two long-term field studies were examined, as well as comparisons between AERMOD-PVMRM and other refined chemically reactive plume models. Comparisons between predicted and observed NO_2/NO_x ratios were based on results paired in time and space, providing a more rigorous assessment than is commonly used in evaluating the performance of air dispersion models. While there does not appear to be a clear and objective criterion established by EPA for determining whether a model is biased or unbiased, a general “rule of thumb” that is commonly used as a benchmark in judging the performance of air dispersion models is agreement with observations within a factor of two. In all cases, the average ratio between predicted and observed NO_2/NO_x ratios showed agreement within a factor of two, and in most cases within about a factor of 1.5. Based on all of the data available, the AERMOD-PVMRM algorithm is judged to provide unbiased estimates of the NO_2/NO_x ratio based on criteria that are comparable to, or more rigorous than, evaluations performed for other dispersion models that are judged to be refined, implying unbiased performance.” As noted in the above report, it has been determined that PVMRM has been judged to provide unbiased estimates based on criteria that are comparable to, or more rigorous than, evaluations performed for other dispersion models.

3.2.2 (e)(v), "A protocol on methods and procedures to be followed has been established"

Shell has prepared and submitted a modeling protocol that will be followed in conducting the analysis.

[3] "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard", March 01, 2011.

Conclusion:

Based on the information provided above, Shell believes the method for determining hourly NO_2 concentrations using AERMOD in conjunction with the non-regulatory PVMRM option is acceptable based on the requirements in 40 CFR Part 51, Appendix W, Section 3.2.2(e). We request PADEP concurrence with our determination.

Should you have any questions or require additional information in assessing our request, please do not hesitate to contact me at (919) 845-1422 x41.

Sincerely,

David Keen

David Keen
RTP Environmental

cc: Shari Keller, Shell
Phil May, RTP

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

SECRETARY

March 31, 2014

Mr. Shawn M. Garvin
Regional Administrator
U.S. Environmental Protection Agency Region III
Mail Code: 3RA00
1650 Arch Street
Philadelphia, PA 19103-2029

Re: Request to Use the Plume Volume Molar Ratio Method in AERMOD Air Quality Analysis for Shell Chemical Appalachia, LLC, Proposed Ethane Cracker and Polyethylene Manufacturing Facility in Potter Township, Beaver County

Dear Mr. Garvin:

I am writing to request your approval of the use of the Plume Volume Molar Ratio Method (PVMRM) in the Shell Chemical Appalachia, LLC, (Shell) air quality analysis to support a Plan Approval Application for the construction of an ethane cracker and polyethylene manufacturing facility near Monaca in Potter Township, Beaver County. The proposed project will be subject to the federal Prevention of Significant Deterioration (PSD) rule promulgated in 40 CFR § 52.21. These PSD provisions are adopted and incorporated by reference in the Pennsylvania Code.

As required under the federal PSD rule, Shell must conduct a "source impact analysis" for nitrogen dioxide (NO_2) that meets the requirements of 40 CFR § 52.21(k). To this end, Shell proposes to use the PVMRM in the American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD) in accordance with the "Guideline on Air Quality Models," codified in 40 CFR § 51, Appendix W. My staff has indicated that the use of the PVMRM in AERMOD for determining the air quality impact of NO_2 from the proposed Shell facility is adequately justified in the enclosure to this letter.

I am requesting your expedited approval of the PVMRM. If you have questions or need additional information, please contact Joyce E. Epps, Director of the Bureau of Air Quality, by e-mail at jeepps@pa.gov or by telephone at 717.787.9702.

Sincerely,

E. Christopher Abruzzo
Secretary

Enclosure

cc: Randy Armstrong, Shell
Hayley Book, DEP Policy Office
Kathleen Cox, EPA Region III
Diana Esher, EPA Region III
Timothy Leon Guerrero, EPA Region III
David Keen, RTP Environmental
Shari Keller, Shell

bcc: Vincent Brisini, WARR Deputy Secretary
Joyce Epps, BAQ Director
Krishnan Ramamurthy, BAQ Division of Permits
Mark Wayner, Southwest Region AQ Program
AQ Modeling Correspondence File

Request to Use the Plume Volume Molar Ratio Method in AERMOD Air Quality Analysis for Shell Chemical Appalachia LLC Proposed Ethane Cracker and Polyethylene Manufacturing Facility in Potter Township, Beaver County

On February 4, 2014, the Pennsylvania Department of Environmental Protection (DEP) received a request from RTP Environmental Associates, Inc., on behalf of Shell Chemical Appalachia LLC (Shell), to use the Plume Volume Molar Ratio Method (PVMRM) in an air quality analysis to support an anticipated Plan Approval Application for the construction of an ethane cracker and polyethylene manufacturing facility near Monaca in Potter Township, Beaver County. The proposed project will be subject to the federal Prevention of Significant Deterioration (PSD) rule promulgated in 40 CFR § 52.21. These PSD provisions are adopted and incorporated by reference in their entirety in 25 *Pa. Code* § 127.83 and the Commonwealth's State Implementation Plan codified at 40 CFR § 52.2020.

The PVMRM is currently implemented as a non-regulatory default option in the American Meteorological Society / Environmental Protection Agency Regulatory Model (AERMOD). The PVMRM is mentioned in Subsection 5.1(j) of the U.S. Environmental Protection Agency's (EPA) "Guideline on Air Quality Models" (Guideline), codified in 40 CFR § 51, Appendix W, as a possible approach for determining the impact of an individual source on ambient nitrogen dioxide (NO_2) which depends, in part, on the chemical environment into which the source's plume is to be emitted. Air quality modeling for NO_2 requires special consideration since emissions that affect ambient NO_2 concentrations are predominantly in the form of nitrogen oxide (NO) which, in the presence of ozone (O_3), converts in the atmosphere to form NO_2 and oxygen (O_2), following a basic chemical mechanism known as titration. According to the 1-hour NO_2 National Ambient Air Quality Standard (NAAQS) implementation memoranda issued by the EPA on June 29, 2010[1], and March 1, 2011[2], the PVMRM is considered a "Tier 3" detailed screening method under Subsection 5.2.4(d) of the Guideline which must be considered on a case-by-case basis for NO_2 analyses.

Appendix A, Subsection A.1(a)(2) of the Guideline provides recommendations for the regulatory use of AERMOD, the "preferred" near-field dispersion model for the Shell Chemical Appalachia LLC (Shell) "source impact analysis." Specifically, for regulatory applications of AERMOD, the regulatory default option should be set. Subsection 3.1.2(c) of the Guideline provides that a "preferred" model should be operated with the options listed in Appendix A. If other options are exercised, the model is no longer ''preferred'' and the use of the model must then be justified on a case-by-case basis. Pursuant to condition (2) of Subsection 3.2.2(a) of the Guideline, the PVMRM is a more appropriate analytical procedure that is applicable to the required NO_2 "source impact analysis" for the proposed Shell facility. Subsection 3.2.2(b) of the Guideline provides that "[a]n alternative model should be evaluated from both a theoretical and performance perspective before it is selected for use." Several conditions exist under which

[1] "Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program." From: Stephen D. Page, Director, Office of Air Quality Planning and Standards; To: Regional Air Division Directors. June 29, 2010.

[2] "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard." From: Tyler Fox, Leader, Air Quality Modeling Group; To: Regional Air Division Directors. March 1, 2011.

alternative models will normally be approved. Condition (3) of Subsection 3.2.2(b) provides that an alternative model may be approved if the "preferred" model is less appropriate for the specific application. Subsection 3.2.2(e) states that an alternative model may be used for condition (3) of Subsection 3.2.2(b) provided that the following five criteria are satisfied:

i. The model has received a scientific peer review;
ii. The model can be demonstrated to be applicable to the problem on a theoretical basis;
iii. The data bases which are necessary to perform the analysis are available and adequate;
iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and
v. A protocol on methods and procedures to be followed has been established.

In accordance with the EPA's June 29, 2010 memorandum, since AERMOD is the "preferred" dispersion model, the focus of the alternative model demonstration for the use of the PVMRM in AERMOD is on the treatment of nitrogen oxides (NO_X) chemistry within the model, and does not need to address basic algorithms within AERMOD. The DEP believes each criterion is satisfied, as described in the following paragraphs:

i. The model has received a scientific peer review:

The PVMRM was developed over a decade ago and was the subject of peer-reviewed papers referenced in the EPA's June 29, 2010 memorandum, including the following papers:

Cole, H.S. and J.E. Summerhays, 1979. A Review of Techniques Available for Estimation of Short-Term NO_2 Concentrations. *Journal of the Air Pollution Control Association*, 29(8): 812-817.

Hanrahan, P.L., 1999a. The Plume Volume Molar Ratio Method for Determining NO_2/NO_X Ratios in Modeling – Part I: Methodology. *Journal of the Air & Waste Management Association*, 49, 1324-1331.

Hanrahan, P.L., 1999b. The Plume Volume Molar Ratio Method for Determining NO_2/NO_X Ratios in Modeling – Part II: Evaluation Studies. *Journal of the Air & Waste Management Association*, 49, 1332-1338.

MACTEC, 2005. Evaluation of Bias in AERMOD-PVMRM. Final Report, Alaska DEC Contract No. 18-9010-12. MACTEC Federal Programs, Inc., Research Triangle Park, NC.

The DEP believes the PVMRM has been subject to sufficient scientific peer review to satisfy this criterion.

ii. The model can be demonstrated to be applicable to the problem on a theoretical basis:

The EPA's June 29, 2010, memorandum states that satisfaction of this criterion is "a case-by-case determination based on an assessment of the adequacy of the ozone titration mechanism utilized by these options [including the PVMRM] to account for NO_X chemistry within the AERMOD model based on 'the chemical environment into which the source's plume is to be emitted' (Appendix W, Section 5.1.j)." The EPA has indicated that while the titration mechanism may capture the most important aspects of NO-to-NO_2 conversion in many applications, there may be limitations for applications in which other mechanisms, such as photosynthesis, contribute significantly to the overall process of chemical transformation. Sources located in areas with high levels of volatile organic compound (VOC) emissions may be subject to these limitations. Titration is generally a much faster mechanism for converting NO to NO_2 than photosynthesis, and as such is likely to be appropriate for characterizing peak 1-hour NO_2 impacts in many cases. Evaluations of the PVMRM with a variety of data bases from different chemical environments were published in Hanrahan, 1999b and MACTEC, 2005 and demonstrate that the PVMRM consistently predicts the NO-to-NO_2 conversion well. Furthermore, the chemical environment of Shell's proposed site is not subject to high levels of VOC emissions from either stationary or mobile sources. Therefore, the DEP believes it is clear that the ozone titration mechanism in the PVMRM is appropriate for the Shell NO_2 analysis and thus, satisfies this criterion.

iii. The data bases which are necessary to perform the analysis are available and adequate:

The data necessary for implementing the PVMRM in AERMOD include representative meteorological data, hourly background ozone data concurrent with the meteorological data, NO_2/NO_X in-stack ratios for all modeled emission sources, and an NO_2/NO_X ambient equilibrium ratio.

Shell proposes to use a representative 5-year (2006 – 2010) meteorological dataset derived from surface data measured at the First Energy Beaver Valley Nuclear Power Station, located approximately 8.9 kilometers (km) west-southwest of Shell's proposed site, and upper air data measured at Pittsburgh International Airport.

Shell proposes to use representative hourly ozone data for 2006 – 2010 from the DEP's Brighton Township monitor (Site ID: 42-007-0005), located approximately 2.5 km west-northwest of Shell's proposed site. For periods of missing ozone data from the Brighton Township monitor, Shell proposes to substitute data from either the DEP's Beaver Falls monitor (Site ID: 42-007-0014), the Allegheny County Health Department's (ACHD) Harrison monitor (Site ID: 42-007-0002), or the ACHD's Lawrenceville monitor (Site ID: 42-003-0008).

In regard to the NO_2/NO_X in-stack ratio, Shell proposes to use the default value of 0.5 for all emission sources, in the absence of source-specific information. This default value is recommended in the EPA's March 1, 2011, memorandum. If source-specific information becomes available, Shell proposes to use a more appropriate in-stack ratio.

In regard to the NO_2/NO_X ambient equilibrium ratio, Shell proposes to use the default value of 0.90 incorporated into the PVMRM.

The DEP has reviewed the representativeness of the meteorological data and ozone data, and believes these data, used in conjunction with appropriate in-stack ratios and the default ambient equilibrium ratio, satisfy this criterion.

iv. Appropriate performance evaluations of the model have shown that the model is not biased toward underestimates:

Evaluations of the PVMRM, published in Hanrahan, 1999b and MACTEC, 2005, demonstrate that the PVMRM has unbiased performance. Supplemental evaluations described in Attachment A of the EPA's March 1, 2011, memorandum were performed to evaluate 1-hour NO_2 concentrations with the current AERMOD. The memorandum stated that the supplemental evaluations "lend further credence to the use of these Tier 3 options [including the PVMRM] in AERMOD for estimating hourly NO_2 concentrations." The DEP believes these evaluations satisfy this criterion.

v. A protocol on methods and procedures to be followed has been established:

A modeling protocol, describing the methods and procedures to be followed for the use of the PVMRM in AERMOD, and for the use of AERMOD in general, was prepared by Shell. The DEP formally approved the protocol on February 19, 2014. The DEP believes the established protocol satisfies this criterion.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

APR 2 1 2014

The Honorable E. Christopher Abruzzo
Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 2063
Harrisburg, Pennsylvania 17105-2063

Dear ~~Secretary~~ Chris Abruzzo:

Thank you for your letter dated March 31, 2014 regarding the Prevention of Significant Deterioration (PSD) plan approval application for Shell Chemical Appalachia, LLC, (Shell) to construct an ethane cracker and polyethylene manufacturing facility. This proposed facility will be located near Monaca in Potter Township, Beaver County, Pennsylvania.

As you described in your letter, Shell is planning to conduct an air quality analysis for NO_2 in accordance with 40 CFR § 52.21 (k). Shell intends to use a nonguideline option, the Plume Volume Molar Ratio Method (PVMRM), in the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) dispersion model to show compliance with the NO_2 National Ambient Air Quality Standard or NAAQS. The use of PVMRM in AERMOD requires an approval from the Regional Administrator under Section 3.2.2 (a) of Appendix W of 40 Code of Federal Regulations (CFR) Part 51 - Guideline on Air Quality Models.

Approval of the use of PVMRM is contingent on meeting the five conditions outlined in Section 3.2.2 (e) of 40 CFR Part 51, Appendix W. These include:

i. the model has received a scientific peer review;
ii. the model can be demonstrated to be applicable to the problem on a theoretical basis;
iii. the data bases which are necessary to perform the analysis are available and adequate;
iv. appropriate performance evaluations of the model have shown that the model is not biased toward underestimates; and
v. a protocol on methods and procedures to be followed has been established.

We have reviewed your responses to these items outlined in the attachment to your March 31, 2014 letter and have reviewed the modeling protocol provided by Mr. Andrew Fleck, of your staff. As a result, we have determined that the applicant meets the requirements outlined in Section 3.2.2 (e) of Appendix W, Guideline on Air Quality Models and therefore formally approve the use of PVMRM in the AERMOD analysis for the Shell project.

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If you have any questions regarding this matter please do not hesitate to contact me or have your staff contact Ms. Kinshasa Brown-Perry, EPA's Pennsylvania Liaison, at (215) 814-5404. For questions regarding this approval action, your staff may contact Ms. Diana Esher, Director, Air Protection Division, at (215) 814-2706 or Mr. Tim Leon Guerrero of the Air Protection Division at (215) 814-2192.

Sincerely,

Shawn M. Garvin
Regional Administrator

cc: Ms. Joyce E. Epps, PADEP

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Customer Service Hotline: 1-800-438-2474

David Keen

From: David Keen [keen@rtpenv-nc.com]
Sent: Thursday, March 20, 2014 4:03 PM
To: Andrew Fleck; leon-guerrero.tim@epa.gov
Cc: Phillip May; Shari Keller (shari.keller@shell.com); James Red (jred@oris-solutions.com); Dmitriy Shnayder (dshnayder@oris-solutions.com); David Keen (keen@rtpenv.com)
Subject: BEEST Software
Attachments: Comparisons.xlsx

Andrew,

As discussed, I spoke with James Red of Oris Solutions regarding the changes they make to AERMOD. The following is from an email he sent to me describing the changes, " What we do with AERMOD (and other components like BPIP-Prime, AERMAP, etc) is change the input and output file naming convention to give the user flexibility. That is, the input file name is not limited to something like "AERMOD.INP". We do not in any way, shape or form alter or modify the core code of any of these programs. As a general rule, when we compile the model/processor code for inclusion with BEEST, we use the compiler that EPA uses."

Oris also sent me the results of a model equivalency analysis they performed to demonstrate that the modified version of AERMOD generates results that are within 2% (the criterion in Section 3.2.2.c of Appendix W) of the EPA version of AERMOD. Oris ran all of the EPA AERMOD test cases from SCRAM and the results for all cases are well below the 2% difference criterion. The maximum difference they found was 0.00024%. The attached spreadsheet summarizes their results. I also obtained all of the input and output files from the test case runs. You can download these files from our ftp server. You can access the site via Windows Explorer at the following address "XXXX" The user name is "ftpuser" and the password is XXXXXXXXXX . The filesare located inthe "XXXXX".

Please let me know if you have any questions or require additional information.

Thanks very much,
Dave

_____
David Keen
RTP Environmental
keen@rtpenv.com
(919) 845-1422 x41
(919) 845-1424 fax
(919) 906-6016 mobile

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RTP ENVIRONMENTAL ASSOCIATES, INC.®

December 20, 2019

Mr. Andrew Fleck
Environmental Group Manager
Department of Environmental Protection
Rachel Carson State Office Building
400 Market Street | Harrisburg PA 17101

Subject: Modeling Protocol Update for the Ethane Cracker and Polyethylene Plant, Shell Chemical Appalachia LLC in Beaver County

Dear Mr. Fleck,

Shell Chemical Appalachia LLC ("Shell") is in the process of preparing a plan approval application for several design changes to its Ethane Cracking/Polyethylene Manufacturing and energy production facility near Monaca in Potter and Center Townships, Beaver County Pennsylvania. The Pennsylvania Department of Environmental Protection ("PADEP") has requested that a revised modeling analysis demonstrating compliance with all applicable air quality standards be included as a part of plan approval application. The PADEP also requested that Shell submit documentation outlining any changes to the modeling protocol approved as part of the original plan approval. These changes are presented in the attached table.

PADEP also requested the Shell provide a comparison of the modeled concentrations from the original plant design to the concentrations calculated from the revised plant design. To make this comparison, the latest model versions will be run for both the original and the revised plant design. The original meteorological data years (2006-2010) will be employed. This comparison will be made only for the significant impacts analysis.

Should you have any questions or require additional information, please do not hesitate to contact me at (919) 845-1422 x41.

Sincerely,

David Keen

David Keen
RTP Environmental

304-A West Millbrook Road,
Raleigh, North Carolina 27609
Tel: (919) 845-1422 x41 Fax: (919) 845-1424

cc: Jim Sewell, Shell
Phil May, RTP Environmental

Shell Model Protocol Updates

Model Input	February 2015 Model Submittal	2019 Model Update	Basis for Change
Model Versions	AERMET (Ver. 14134), AERMOD (Ver. 14134), AERMAP (Ver. 11103) and AERSURFACE (Ver. 13016)	AERMET (Ver. 19191), AERMOD (Ver. 19191), AERMAP (Ver. 18081) and AERSURFACE (Ver. 13016)	Newer model versions
Meteorological Data	Processed without Adjust U* option	Processed with Adjust U* option	Refinements to turbulence calculations within AERMET
Ambient Data	NO2 (2010-2012) from Beaver Falls (AQS # 42-007-0014), CO and PM10 (2010-2012) from New Castle (AQS #42-073-0015), hourly ozone (2006-2010) from Sebring (AQS #42-007-0005)	NO2 and PM10 (2015-2017) from Beaver Falls (AQS # 42-007-0014) monitor inactivated 3/18, CO (2016-2018) from Allegheny County (AQS #42-003-0008), hourly ozone (2006-2015) from Sebring (AQS #42-007-0005)	Update to more current ambient conditions
Nearby Source Inventory	Based on data received from PADEP and file reviews conducted in 2014	Based on data received from PADEP and file reviews conducted in 2019. Notable changes: 1) AES Beaver Valley and Eaton Industries removed as no longer in operation 2) radius for assessing sources to include in inventory limited to 20km	Update to address source changes and newer EPA policy regarding nearby sources
Nearby Source NO2/NOx in-stack ratio	0.5 for all sources except First Energy boilers. 0.05 employed for First Energy boilers.	0.2 for sources located in excess of 1km from Shell, 0.5 for sources located within 1km of Shell, and 0.05 for First Energy boilers	Update to address newer EPA policy regarding nearby sources
NO2 model methodology	Ambient Ratio Method (ARM) of 0.8 for 1-hr and 0.75 for annual used for significant impacts analysis	ARM2 with minimum and maximum NO2/NOx ratios of 0.5 and 0.9, respectively, used for significant impacts analysis	Update to address newer EPA NO2 calculation methodology

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ATTACHMENT B
MODEL SUMMARY RESULTS

Turbine Load Analysis Results - New Plant Configurations (1/21/20)

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.29197	557800	4501500	371.88	371.88	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.22226	557800	4501500	371.88	371.88	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.15664	557800	4501500	371.88	371.88	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.15365	557800	4501500	371.88	371.88	0	6091902	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.05334	557800	4501500	371.88	371.88	0	8102924	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.75796	557750	4501500	364.08	372.11	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.73413	557750	4501550	364.35	371.92	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.72492	557700	4501600	363.69	363.69	0	6050604	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.71851	557750	4501550	364.35	371.92	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.6875	557750	4501600	363.96	363.96	0	8121722	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.13689	557800	4501500	371.88	371.88	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.05891	557850	4501500	370.83	371.72	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.04013	557850	4501500	370.83	371.72	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.02892	557800	4501500	371.88	371.88	0	6082006	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	0.95614	557800	4501500	371.88	371.88	0	8102924	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.26903	557800	4501500	371.88	371.88	0	10011903	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.22494	557800	4501550	368.75	371.12	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.19252	557800	4501500	371.88	371.88	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.1499	557800	4501500	371.88	371.88	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.10891	557800	4501500	371.88	371.88	0	6082001	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.78085	557800	4501550	368.75	371.12	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.76673	557700	4501600	363.69	363.69	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.74865	557700	4501600	363.69	363.69	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.73968	557700	4501600	363.69	363.69	0	6091902	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.71935	557800	4501500	371.88	371.88	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.11848	557800	4501550	368.75	371.12	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.0753	557800	4501500	371.88	371.88	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.04457	557800	4501500	371.88	371.88	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.03886	557800	4501500	371.88	371.88	0	10011903	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.00843	557800	4501500	371.88	371.88	0	6040121	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.26222	557800	4501500	371.88	371.88	0	10022705	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.17428	557800	4501500	371.88	371.88	0	6082001	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.15631	557800	4501500	371.88	371.88	0	7110319	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.14405	557800	4501500	371.88	371.88	0	8103002	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.12779	557800	4501550	368.75	371.12	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.78727	557750	4501600	363.96	363.96	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.75456	557700	4501600	363.69	363.69	0	10011903	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.73438	557800	4501550	368.75	371.12	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.72546	557800	4501550	368.75	371.12	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.71462	557700	4501650	360.73	360.73	0	6091902	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.0971	557800	4501500	371.88	371.88	0	10022705	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.05554	557800	4501550	368.75	371.12	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.03983	557800	4501500	371.88	371.88	0	6082001	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.03298	557750	4501600	363.96	363.96	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.0213	557800	4501500	371.88	371.88	0	8061801	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.26938	557750	4501600	363.96	363.96	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.22372	557800	4501500	371.88	371.88	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.21751	557800	4501500	371.88	371.88	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.16214	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.1564	557800	4501500	371.88	371.88	0	8120724	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.18618	557700	4501650	360.73	360.73	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.14105	557800	4501500	371.88	371.88	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.13862	557800	4501550	368.75	371.12	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.11079	557750	4501650	360.42	363.17	0	8081124	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.10514	557700	4501450	361.28	371.48	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.24688	557750	4501600	363.96	363.96	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.20266	557800	4501500	371.88	371.88	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.19391	557800	4501500	371.88	371.88	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.1423	557800	4501450	365.51	372.11	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.14107	557800	4501500	371.88	371.88	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.24071	557750	4501650	360.42	363.17	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.20959	557800	4501550	368.75	371.12	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.2053	557800	4501550	368.75	371.12	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.19158	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.17503	557800	4501500	371.88	371.88	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.17064	557750	4501650	360.42	363.17	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.14281	557800	4501500	371.88	371.88	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.1389	557700	4501600	363.69	363.69	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480

Turbine Load Analysis Results - New Plant Configurations (1/21/20)

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.11206	557800	4501450	365.51	372.11	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.11139	557800	4501500	371.88	371.88	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.22649	557750	4501650	360.42	363.17	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.19688	557800	4501500	371.88	371.88	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.18811	557800	4501550	368.75	371.12	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.16344	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.16002	557800	4501500	371.88	371.88	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.20867	557800	4501550	368.75	371.12	0	10011924	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.19893	557800	4501500	371.88	371.88	0	7012224	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.1974	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.19279	557800	4501550	368.75	371.12	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.17226	557800	4501500	371.88	371.88	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.15388	557700	4501700	356.71	358.97	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.14157	557800	4501550	368.75	371.12	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.13294	557700	4501650	360.73	360.73	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.11745	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.11221	557700	4501600	363.69	363.69	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.19912	557700	4501450	361.28	371.48	0	10012924	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.18702	557800	4501550	368.75	371.12	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.17863	557800	4501550	368.75	371.12	0	7031824	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.17538	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.15532	557800	4501550	368.75	371.12	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.52847	557800	4501500	371.88	371.88	0	10060708	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.51287	557800	4501500	371.88	371.88	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.47041	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.41848	557800	4501500	371.88	371.88	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.41813	557800	4501500	371.88	371.88	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.35986	557700	4501400	360.6	360.6	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.32529	557750	4501500	364.08	372.11	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.31642	557700	4501700	356.71	358.97	0	8081108	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.30457	557700	4501450	361.28	371.48	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.25579	557800	4501500	371.88	371.88	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.48727	557800	4501500	371.88	371.88	0	10060708	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.45401	557800	4501500	371.88	371.88	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.41241	557800	4501450	365.51	372.11	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.41083	557800	4501500	371.88	371.88	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.37461	557800	4501500	371.88	371.88	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.55635	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.54505	557800	4501500	371.88	371.88	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.51353	557800	4501500	371.88	371.88	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.50869	557800	4501500	371.88	371.88	0	10011908	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.38901	557800	4501550	368.75	371.12	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.4018	557800	4501450	365.51	372.11	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.33621	557750	4501550	364.35	371.92	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.32524	557800	4501500	371.88	371.88	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.32371	557800	4501450	365.51	372.11	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.26537	557700	4501400	360.6	360.6	0	6031608	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.48155	557800	4501500	371.88	371.88	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.47476	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.47245	557800	4501550	368.75	371.12	0	10060708	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.46907	557800	4501500	371.88	371.88	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.35952	557800	4501550	368.75	371.12	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.56827	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.54507	557800	4501500	371.88	371.88	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.52361	557800	4501550	368.75	371.12	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.50522	557800	4501500	371.88	371.88	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.41746	557800	4501500	371.88	371.88	0	6092508	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.45402	557800	4501500	371.88	371.88	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.35382	557700	4501600	363.69	363.69	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.33816	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.32718	557700	4501600	363.69	363.69	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.27881	557700	4501450	361.28	371.48	0	6031608	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.57389	557800	4501500	371.88	371.88	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.50573	557800	4501500	371.88	371.88	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.47661	557800	4501550	368.75	371.12	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.45495	557800	4501550	368.75	371.12	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.37757	557800	4501500	371.88	371.88	0	6092508	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01917	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480

Turbine Load Analysis Results - New Plant Configurations (1/21/20)

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01357	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01277	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01253	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01118	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.01275	557800	4501550	368.75	371.12	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00965	557800	4501550	368.75	371.12	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00901	557800	4501550	368.75	371.12	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00861	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00797	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01743	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01267	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01169	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01154	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01042	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01856	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01321	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01274	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01272	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01201	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.01264	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.00941	557800	4501550	368.75	371.12	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.0088	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.00878	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.0085	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01704	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01213	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01176	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01164	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01111	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01808	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01314	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01299	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01291	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01282	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.01256	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00911	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00906	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00903	557800	4501550	368.75	371.12	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00882	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01676	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01217	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01197	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01188	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01163	557800	4501500	371.88	371.88	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	9	9	25480

Turbine Load Analysis Results - New Plant Configurations (1/21/20)

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors

Turbine Load Analysis Results - New Plant Configurations (1/21/20)

Pollutant	Average	Group	Rank	Conc.
UNIT	1-HR	CT1_100	1ST	**1.29**
UNIT	1-HR	CT1_75	1ST	1.14
UNIT	1-HR	CT1_45	1ST	0.76
UNIT	1-HR	CT2_100	1ST	**1.27**
UNIT	1-HR	CT2_75	1ST	1.12
UNIT	1-HR	CT2_45	1ST	0.78
UNIT	1-HR	CT3_100	1ST	**1.26**
UNIT	1-HR	CT3_75	1ST	1.10
UNIT	1-HR	CT3_45	1ST	0.79
UNIT	24-HR	CT1_100	1ST	**0.27**
UNIT	24-HR	CT1_75	1ST	0.25
UNIT	24-HR	CT1_45	1ST	0.19
UNIT	24-HR	CT2_100	1ST	**0.24**
UNIT	24-HR	CT2_75	1ST	0.23
UNIT	24-HR	CT2_45	1ST	0.17
UNIT	24-HR	CT3_100	1ST	**0.21**
UNIT	24-HR	CT3_75	1ST	0.20
UNIT	24-HR	CT3_45	1ST	0.15
UNIT	8-HR	CT1_100	1ST	**0.53**
UNIT	8-HR	CT1_75	1ST	0.49
UNIT	8-HR	CT1_45	1ST	0.36
UNIT	8-HR	CT2_100	1ST	**0.56**
UNIT	8-HR	CT2_75	1ST	0.48
UNIT	8-HR	CT2_45	1ST	0.40
UNIT	8-HR	CT3_100	1ST	**0.57**
UNIT	8-HR	CT3_75	1ST	0.57
UNIT	8-HR	CT3_45	1ST	0.45
UNIT	Annual	CT1_100	1ST	**0.02**
UNIT	Annual	CT1_75	1ST	0.02
UNIT	Annual	CT1_45	1ST	0.01
UNIT	Annual	CT2_100	1ST	**0.02**
UNIT	Annual	CT2_75	1ST	0.02
UNIT	Annual	CT2_45	1ST	0.01
UNIT	Annual	CT3_100	1ST	**0.02**
UNIT	Annual	CT3_75	1ST	0.02
UNIT	Annual	CT3_45	1ST	0.01

100% CT load produces the highest impact for all averaging periods.

Worst Case Furnace Analysis Results - New Plant Configuration (1/21/20)

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.51474	555050	4502900	340.54	341.78	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.49132	555000	4502800	338.75	339.77	0	6011303	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.49114	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.4859	555000	4502900	343.75	343.75	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.4034	555000	4502800	338.75	339.77	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.48696	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.4842	555050	4502900	340.54	341.78	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.46917	555000	4502800	338.75	339.77	0	6011303	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.45248	555000	4502900	343.75	343.75	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.36823	555000	4502800	338.75	339.77	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.46458	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.41954	555000	4502800	338.75	339.77	0	6011303	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.41161	555050	4502900	340.54	341.78	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.39076	555000	4502900	343.75	343.75	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.30247	555000	4502800	338.75	339.77	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.44326	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.40062	555000	4502900	343.75	343.75	0	6030921	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.36236	555050	4502900	340.54	341.78	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.36095	555000	4502900	343.75	343.75	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.28358	555000	4502800	338.75	339.77	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.41058	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.37106	555000	4502900	343.75	343.75	0	6030921	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.31771	555000	4502900	343.75	343.75	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.29434	555050	4502900	340.54	341.78	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.25457	555000	4502800	338.75	339.77	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.38467	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.34753	555000	4502900	343.75	343.75	0	6030921	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.28848	555000	4502900	343.75	343.75	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.25402	554850	4503000	344.74	344.74	0	10060901	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.23086	555000	4502800	338.75	339.77	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.32852	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.29507	555000	4502900	343.75	343.75	0	6030921	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.23495	555000	4502900	343.75	343.75	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.21504	554850	4503000	344.74	344.74	0	10060901	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.19089	555000	4502800	338.75	339.77	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.77631	554650	4502500	337.14	341.31	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.68853	554700	4502450	333.7	333.7	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.65887	554500	4502150	327.73	336.42	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.64798	554500	4502200	336.18	336.18	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.63482	554600	4502300	335.36	335.36	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.76334	554700	4502450	333.7	333.7	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.68775	554700	4502450	333.7	333.7	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.66116	554500	4502150	327.73	336.42	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.64768	554600	4502300	335.36	335.36	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.64056	554500	4502200	336.18	336.18	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.74674	554700	4502450	333.7	333.7	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.63655	554600	4502300	335.36	335.36	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.62504	554450	4502150	334.13	334.13	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.60821	554700	4502450	333.7	333.7	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.59486	554500	4502200	336.18	336.18	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.72422	554700	4502450	333.7	333.7	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.61276	554600	4502300	335.36	335.36	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.59222	554450	4502150	334.13	334.13	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.58071	554650	4502450	334.4	336.33	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.5791	554450	4502150	334.13	334.13	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.68477	554700	4502450	333.7	333.7	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.57722	554500	4502200	336.18	336.18	0	8021708	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.5713	554550	4502250	336.22	336.22	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.56487	554450	4502150	334.13	334.13	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.54609	554650	4502450	334.4	336.33	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.66284	554650	4502450	334.4	336.33	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.57918	554550	4502250	336.22	336.22	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.56401	554500	4502200	336.18	336.18	0	8021708	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.54704	554450	4502150	334.13	334.13	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480

Worst Case Furnace Analysis Results - New Plant Configuration (1/21/20)

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.52996	556681.8	4502030.1	298.98	328.26	0	10121508	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.61698	554550	4502450	336.96	336.96	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.5655	554550	4502250	336.22	336.22	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.53532	554550	4502250	336.22	336.22	0	8011708	BEAVER_VALLEY_2008_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.51933	556665.3	4502015.2	297.55	328.26	0	10121508	BEAVER_VALLEY_2010_ADJUSTAR.SFC	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.50025	554450	4502150	334.13	334.13	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	7	7	25480

Worst Case Furnace Analysis Results - New Plant Configuration (1/21/20)

Pollutant	Average	Group	Rank	Conc.
UNIT	1-HR	EC#1	1ST	**1.51**
UNIT	1-HR	EC#2	1ST	**1.49**
UNIT	1-HR	EC#3	1ST	1.46
UNIT	1-HR	EC#4	1ST	1.44
UNIT	1-HR	EC#5	1ST	1.41
UNIT	1-HR	EC#6	1ST	1.38
UNIT	1-HR	EC#7	1ST	1.33
UNIT	8-HR	EC#1	1ST	**0.78**
UNIT	8-HR	EC#2	1ST	**0.76**
UNIT	8-HR	EC#3	1ST	0.75
UNIT	8-HR	EC#4	1ST	0.72
UNIT	8-HR	EC#5	1ST	0.68
UNIT	8-HR	EC#6	1ST	0.66
UNIT	8-HR	EC#7	1ST	0.62

Furnaces 1 and 2 generate worst-case short term impacts.

Only short term emissions (i.e., 1 and 8-hour averages) are higher during decoking.

1/27/20 - Shell Franklin Class II SIL Model Results - New Plant Configuration

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin Significance_2006_CO.SUM	CO	1-HR	ALL	1ST	1756.52615	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2007_CO.SUM	CO	1-HR	ALL	1ST	1746.48459	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2007_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2009_CO.SUM	CO	1-HR	ALL	1ST	1586.39216	556443.2	4501936.5	268.15	334.28	0	9041607	BEAVER_VALLEY_2009_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2008_CO.SUM	CO	1-HR	ALL	1ST	1556.1206	556474.4	4501936.9	269.22	334.62	0	8022009	BEAVER_VALLEY_2008_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2010_CO.SUM	CO	1-HR	ALL	1ST	1420.41571	555500	4501150	247.16	344.1	0	10012811	BEAVER_VALLEY_2010_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2010_CO.SUM	CO	8-HR	ALL	1ST	916.56048	555500	4501150	247.16	344.1	0	10010216	BEAVER_VALLEY_2010_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2007_CO.SUM	CO	8-HR	ALL	1ST	831.64323	555500	4501150	247.16	344.1	0	7112216	BEAVER_VALLEY_2007_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2008_CO.SUM	CO	8-HR	ALL	1ST	820.29058	555500	4501150	247.16	344.1	0	8021024	BEAVER_VALLEY_2008_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2009_CO.SUM	CO	8-HR	ALL	1ST	652.70642	555500	4501150	247.16	344.1	0	9022016	BEAVER_VALLEY_2009_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2006_CO.SUM	CO	8-HR	ALL	1ST	510.00355	555500	4501150	247.16	344.1	0	6120808	BEAVER_VALLEY_2006_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_5yrs_NO2.SUM	NO2	1ST-HIGHEST MA	ALL	1ST	59.17288	555000	4502800	338.75	339.77	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2010_NO2.SUM	NO2	ANNUAL	ALL	1ST	1.28536	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2007_NO2.SUM	NO2	ANNUAL	ALL	1ST	1.01575	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2008_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.9246	556681.8	4502030.1	298.98	328.26	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2009_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.91393	554450	4502150	334.13	334.13	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2006_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.90396	556750	4501950	314.42	327.75	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	24	1	25480
AERMOD 19191	Shell Franklin Significance_2010_PM10.SUM	PM10	24-HR	ALL	1ST	9.32987	556634.34	4502473.98	250.66	343.02	0	10022724	BEAVER_VALLEY_2010_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2006_PM10.SUM	PM10	24-HR	ALL	1ST	8.68013	554600	4502300	335.36	335.36	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2007_PM10.SUM	PM10	24-HR	ALL	1ST	7.6577	554400	4502550	350.78	350.78	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2008_PM10.SUM	PM10	24-HR	ALL	1ST	7.18916	556578.18	4502335.71	243.6	343.02	0	8111824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2009_PM10.SUM	PM10	24-HR	ALL	1ST	6.98501	556658.66	4502570.98	240.61	343.02	0	9100424	BEAVER_VALLEY_2009_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2010_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.84304	556652.58	4502546.73	242.24	343.02	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2006_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.73001	556601.9	4502379.7	242.94	343.02	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2007_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.58072	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2009_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.54112	556652.58	4502546.73	242.24	343.02	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	101	1	25480
AERMOD 19191	Shell Franklin Significance_2008_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.50306	556601.9	4502379.7	242.94	343.02	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	101	1	25480

1/27/20 - Shell Franklin Class II SIL Model Results - New Plant Configuration

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard	to Significant Impact
PM10	24-HR	ALL	1ST	9.33	NA	9.3	5	187%	3.4
PM10	ANNUAL	ALL	1ST	2.84	NA	2.84	1	284%	1.7
NO2	ANNUAL	ALL	1ST	1.29	NA	1.3	1	129%	2.4
NO2	1ST-HIGHEST MA	ALL	1ST	59.17	NA	59.2	7.5	789%	31.4
CO	1-HR	ALL	1ST	1756.53	NA	1756.5	2000	88%	NA
CO	8-HR	ALL	1ST	916.56	NA	916.6	500	183%	1.0

Notes:

1) NO2 impacts include ARM2 with minimum and maximum ratios of 0.5 and 0.8, respectively.

1/23/20 - Shell Franklin Class II SIL Model Results - Original Plant Configuration

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin Significance-Original_2009_CO.SUM	CO	1-HR	ALL	1ST	2034.85419	555950	4502850	207.97	355.56	0	9110720	BEAVER_VALLEY_2009_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2006_CO.SUM	CO	1-HR	ALL	1ST	2017.30371	555350	4503200	286.28	354.3	0	6061721	BEAVER_VALLEY_2006_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2007_CO.SUM	CO	1-HR	ALL	1ST	2010.62371	556342.05	4502136.67	244.22	334.92	0	7110320	BEAVER_VALLEY_2007_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2008_CO.SUM	CO	1-HR	ALL	1ST	1931.29048	556042.4	4502798.4	211.54	355.56	0	8060105	BEAVER_VALLEY_2008_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2010_CO.SUM	CO	1-HR	ALL	1ST	1918.60525	556395.23	4502189.56	246.57	337.02	0	10062021	BEAVER_VALLEY_2010_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2010_CO.SUM	CO	8-HR	ALL	1ST	920.15555	556023.5	4502784.7	209.87	355.56	0	10101808	BEAVER_VALLEY_2010_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2006_CO.SUM	CO	8-HR	ALL	1ST	918.41313	556042.4	4502798.4	211.54	355.56	0	6112308	BEAVER_VALLEY_2006_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2007_CO.SUM	CO	8-HR	ALL	1ST	896.85295	556023.5	4502784.7	209.87	355.56	0	7061108	BEAVER_VALLEY_2007_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2009_CO.SUM	CO	8-HR	ALL	1ST	871.015	555650	4501700	232.37	340.28	0	9060708	BEAVER_VALLEY_2009_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2008_CO.SUM	CO	8-HR	ALL	1ST	836.43618	555433	4501787.4	218.92	352.4	0	8092408	BEAVER_VALLEY_2008_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_5yrs_NO2.SUM	NO2	1ST-HIGHEST MA	ALL	1ST	58.2146	554200	4503950	369.64	369.64	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2010_NO2.SUM	NO2	ANNUAL	ALL	1ST	1.25574	557700	4501900	352.7	353.04	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2007_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.86368	557700	4501900	352.7	353.04	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2008_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.83855	557700	4501900	352.7	353.04	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2006_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.83206	557700	4501650	360.73	360.73	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2009_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.82456	557250	4502350	336.13	336.13	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	23	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2007_PM10.SUM	PM10	24-HR	ALL	1ST	11.24025	555947.9	4502730.1	213.09	355.56	0	7110224	BEAVER_VALLEY_2007_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2008_PM10.SUM	PM10	24-HR	ALL	1ST	10.42725	555966.8	4502743.7	212.4	355.56	0	8101924	BEAVER_VALLEY_2008_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2010_PM10.SUM	PM10	24-HR	ALL	1ST	10.29522	555966.8	4502743.7	212.4	355.56	0	10111224	BEAVER_VALLEY_2010_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2009_PM10.SUM	PM10	24-HR	ALL	1ST	10.04987	556023.5	4502784.7	209.87	355.56	0	9090424	BEAVER_VALLEY_2009_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2006_PM10.SUM	PM10	24-HR	ALL	1ST	9.47523	556004.6	4502771	212.31	355.56	0	6082224	BEAVER_VALLEY_2006_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2007_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.60015	555947.9	4502730.1	213.09	355.56	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2008_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.53768	555947.9	4502730.1	213.09	355.56	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2009_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.52539	555947.9	4502730.1	213.09	355.56	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2010_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.37397	555947.9	4502730.1	213.09	355.56	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	86	1	22593
AERMOD 19191	Shell Franklin Significance-Original_2006_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.13083	556061.3	4502812	210.28	355.56	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	86	1	22593

1/23/20 - Shell Franklin Class II SIL Model Results - Original Plant Configuration

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard	to Significant Impact
PM10	24-HR	ALL	1ST	11.24	NA	11.2	5	225%	3.3
PM10	ANNUAL	ALL	1ST	2.60	NA	2.60	1	260%	1.2
NO2	ANNUAL	ALL	1ST	1.26	NA	1.3	1	126%	2.3
NO2	1ST-HIGHEST MA	ALL	1ST	58.21	NA	58.2	7.5	776%	30.1
CO	1-HR	ALL	1ST	2034.85	NA	2034.9	2000	102%	0.6
CO	8-HR	ALL	1ST	920.16	NA	920.2	500	184%	1.2

Notes:

1) NO2 impacts include ARM2 with minimum and maximum ratios of 0.5 and 0.8, resprectively.

1/27/20 - Shell Franklin Class II SIL Model Results

Comparison Between Origninal Plant Configuration and Revised (Current Models)

Pollutant	Average	Group	Rank	New Plant Conc. (ug/m3)	New Plant Max Distance to Sign Impact (km)	Original Plant Conc. (ug/m3)	Original Plant Max Distance to Sign Impact (km)	SIL (ug/m3)
PM10	24-HR	ALL	1ST	9.33	3.4	11.24	3.3	5
PM10	ANNUAL	ALL	1ST	2.84	1.7	2.60	1.2	1
NO2	ANNUAL	ALL	1ST	1.29	2.4	1.26	2.3	1
NO2	1ST-HIGHEST MA	ALL	1ST	59.17	31.4	58.21	30.1	7.5
CO	1-HR	ALL	1ST	1757	NA	2035	NA	2000
CO	8-HR	ALL	1ST	917	1.0	920	1.2	500

Notes:

1) NO2 impacts include ARM2 with minimum and maximum ambient ratios of 0.5 and 0.9, resprectively.
2) NA - Not applicable. Impact below SIL.

9/27/20 - Shell Franklin Class I SIL Model Results

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin Class I Significance_2010_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02764	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02699	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02599	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02254	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02208	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02756	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02694	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02589	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02249	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02203	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	26	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.27932	588800.58	4464383.42	375.2	375.2	0	7111024	BEAVER_VALLEY_2007_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.26035	591352.97	4466763.56	365.9	375.2	0	10122424	BEAVER_VALLEY_2010_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.25033	588800.58	4464383.42	375.2	375.2	0	8092824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.21182	588800.58	4464383.42	375.2	375.2	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.20744	579471.21	4457971.52	367.7	367.7	0	9021524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.29678	588800.58	4464383.42	375.2	375.2	0	7111024	BEAVER_VALLEY_2007_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.27863	569779.5	4454055.81	373	434.2	0	10122524	BEAVER_VALLEY_2010_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.27068	588800.58	4464383.42	375.2	375.2	0	8092824	BEAVER_VALLEY_2008_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.23054	588800.58	4464383.42	375.2	375.2	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.22353	579471.21	4457971.52	367.7	367.7	0	9021524	BEAVER_VALLEY_2009_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01897	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01868	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01843	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01582	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01545	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.02022	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01993	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01958	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01682	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	103	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01644	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	103	2	360

9/27/20 - Shell Franklin Class I SIL Model Results

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard
NO2	ANNUAL	DECOKE	1ST	0.028	NA	0.03	0.1	28%
NO2	ANNUAL	NORMAL	1ST	0.028	NA	0.03	0.1	28%
PM10	ANNUAL	DECOKE	1ST	0.019	NA	0.02	0.2	9%
PM10	ANNUAL	NORMAL	1ST	0.020	NA	0.02	0.2	10%
PM10	24-HR	DECOKE	1ST	0.279	NA	0.28	0.3	93%
PM10	24-HR	NORMAL	1ST	0.297	NA	0.30	0.3	99%

Notes:

1) NO2 impacts include ARM2 with minimum and maximum ratios of 0.5 and 0.9, respectively.
2) PM10 emission rates and stack gas velocities are lower during decoking. Stack gas temperature however is higher. Two scenarios were therefore modeled to assess which mode of operation is worst case. In all other analyses, the higher PM10 emission rate was conservatively modeled during decoking.

1/27/20 - Shell NAAQS Analysis Results

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin NAAQS_2007_CO.SUM	CO	1-HR	ALL	2ND	1687.13835	555500	4501150	247.16	344.1	0	7020417	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	1-HR	ALL	2ND	1474.40646	555500	4501150	247.16	344.1	0	8021022	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	1-HR	ALL	2ND	1283.19182	555500	4501150	247.16	344.1	0	10122715	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	1-HR	ALL	2ND	1266.07841	555500	4501150	247.16	344.1	0	6112509	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	1-HR	ALL	2ND	1249.97392	555500	4501150	247.16	344.1	0	9011316	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2007_CO.SUM	CO	1-HR	SHELL	2ND	1686.76579	555500	4501150	247.16	344.1	0	7020417	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	1-HR	SHELL	2ND	1474.16244	555500	4501150	247.16	344.1	0	8021022	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	1-HR	SHELL	2ND	1281.06376	555500	4501150	247.16	344.1	0	10122715	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	1-HR	SHELL	2ND	1249.84126	555500	4501150	247.16	344.1	0	9011316	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	1-HR	SHELL	2ND	1085.11555	555500	4501150	247.16	344.1	0	6012513	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	8-HR	ALL	2ND	793.44418	555500	4501150	247.16	344.1	0	8021016	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	8-HR	ALL	2ND	776.89595	555500	4501150	247.16	344.1	0	10012816	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2007_CO.SUM	CO	8-HR	ALL	2ND	647.19278	555500	4501150	247.16	344.1	0	7020424	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	8-HR	ALL	2ND	573.61341	555500	4501150	247.16	344.1	0	9021916	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	8-HR	ALL	2ND	512.71311	555500	4501150	247.16	344.1	0	6021716	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	8-HR	SHELL	2ND	790.89652	555500	4501150	247.16	344.1	0	8021016	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	8-HR	SHELL	2ND	767.7922	555500	4501150	247.16	344.1	0	10012816	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2007_CO.SUM	CO	8-HR	SHELL	2ND	643.85287	555500	4501150	247.16	344.1	0	7020424	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	8-HR	SHELL	2ND	571.10793	555500	4501150	247.16	344.1	0	9021916	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	8-HR	SHELL	2ND	507.2351	555500	4501150	247.16	344.1	0	6021716	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	2	1
AERMOD 19191	Shell Franklin NAAQS_5yrs_NO2.SUM	NO2	8TH-HIGHEST MA	ALL	1ST	663.97	555450	4501200	238.82	345.62	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	53	3	14372
AERMOD 19191	Shell Franklin NAAQS_5yrs_NO2.SUM	NO2	8TH-HIGHEST MA	BACKGRND	1ST	75.20211	556368.9	4502893.9	231.26	339.23	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	53	3	14372
AERMOD 19191	Shell Franklin NAAQS_5yrs_NO2.SUM	NO2	8TH-HIGHEST MA	SHELL	1ST	43.32793	554550	4502600	347.25	347.25	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	53	3	14372
AERMOD 19191	Shell Franklin NAAQS_2010_NOX.SUM	NOX	ANNUAL	ALL	1ST	9.00088	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2006_NOX.SUM	NOX	ANNUAL	ALL	1ST	8.64313	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2009_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.67006	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2008_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.54266	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2007_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.35657	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2010_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.42817	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2007_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.12861	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2008_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.02733	556681.8	4502030.1	298.98	328.26	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2006_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.0044	556750	4501950	314.42	327.75	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_2009_NOX.SUM	NOX	ANNUAL	SHELL	1ST	0.95617	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	2	74
AERMOD 19191	Shell Franklin NAAQS_5yrs_PM10.SUM	PM10	24-HR	ALL	6TH	19.50733	554500	4502300	323.49	352.4	0	8110624	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	185	2	832
AERMOD 19191	Shell Franklin NAAQS_5yrs_PM10.SUM	PM10	24-HR	SHELL	6TH	7.13637	556652.58	4502546.73	242.24	343.02	0	10021624	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	185	2	832

1/27/20 - Shell NAAQS Analysis Results

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard	Comment
NO2	8TH-HIGHEST MA	ALL	1ST	663.97	Note 1	664.0	188	353%	Shell not significant at 4.75 (7.5 is SIL) 72nd high.
NOx	ANNUAL	ALL	1ST	9.00	17.9	26.9	100	27%	
CO	1-HR	ALL	2ND	1687.14	2515.0	4202.1	40000	11%	
CO	8-HR	ALL	2ND	793.44	1269.0	2062.4	10000	21%	
PM10	24-HR	ALL	6TH	19.51	69.0	88.5	150	59%	

Notes:

1) NO2 background (2015-17) from Beaver Falls (AQS No. 42-007-0014). Season by hour background added to AERMOD results within the model.
2) PM10 background (2015-17) also from Beaver Falls.
3) CO background (2016-18) concentrations from Allegheny Co. (AQS No. 42-003-0008).
4) NO2 annual impacts conservatively assumes 100% conversion of NOx to NO2.
5) NO2 1-hr impacts include PVMRM with 0.9 equilibrium ratio.

9/27/19 - Shell Increment Analysis Results

Model	File	Pollutant	Average	Group	Rank	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Shell Franklin Increment_2010_NOX.SUM	NOX	ANNUAL	ALL	1ST	9.00088	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2006_NOX.SUM	NOX	ANNUAL	ALL	1ST	8.64313	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2009_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.67006	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2008_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.54266	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2007_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.35657	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2010_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	6.53574	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2006_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	6.31313	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2009_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	5.80454	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2007_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	5.6356	556593	4501952.2	290.15	334.03	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2008_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	5.49011	556731.5	4502074.9	289.92	334.23	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2010_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.42817	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2007_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.12861	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2008_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.02733	556681.8	4502030.1	298.98	328.26	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2006_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.0044	556750	4501950	314.42	327.75	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2009_NOX.SUM	NOX	ANNUAL	SHELL	1ST	0.95617	556750	4502000	309.27	327.75	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	87	3	74
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	24-HR	ALL	2ND	22.66532	556163.4	4501695.2	253.75	340.28	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	24-HR	ALL	2ND	21.80728	554300	4502400	329.87	352.64	0	10053024	BEAVER_VALLEY_2010_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	24-HR	ALL	2ND	19.15131	556634.34	4502473.98	250.66	343.02	0	9071124	BEAVER_VALLEY_2009_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	24-HR	ALL	2ND	18.95277	554200	4502400	322.45	353.77	0	8060924	BEAVER_VALLEY_2008_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	24-HR	ALL	2ND	18.85703	556361.7	4501834.4	259.45	340.28	0	7031324	BEAVER_VALLEY_2007_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	24-HR	INCREMNT	2ND	22.57967	556163.4	4501695.2	253.75	340.28	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	24-HR	INCREMNT	2ND	20.42017	554300	4502400	329.87	352.64	0	10053024	BEAVER_VALLEY_2010_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	24-HR	INCREMNT	2ND	17.8864	554500	4502300	323.49	352.4	0	9012624	BEAVER_VALLEY_2009_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	24-HR	INCREMNT	2ND	17.66823	556361.7	4501834.4	259.45	340.28	0	7031324	BEAVER_VALLEY_2007_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	24-HR	INCREMNT	2ND	17.64925	554250	4502600	334.57	353.88	0	8060224	BEAVER_VALLEY_2008_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	24-HR	SHELL	2ND	7.4906	556652.58	4502546.73	242.24	343.02	0	10100624	BEAVER_VALLEY_2010_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	24-HR	SHELL	2ND	6.90832	556658.66	4502570.98	240.61	343.02	0	9121024	BEAVER_VALLEY_2009_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	24-HR	SHELL	2ND	6.90446	556634.34	4502473.98	250.66	343.02	0	6013124	BEAVER_VALLEY_2006_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	24-HR	SHELL	2ND	6.55269	556652.58	4502546.73	242.24	343.02	0	7122724	BEAVER_VALLEY_2007_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	24-HR	SHELL	2ND	6.31194	556529.18	4502279.2	252.3	339.96	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	ANNUAL	ALL	1ST	5.75839	556611.65	4502402.72	242.23	343.02	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	ANNUAL	ALL	1ST	5.74424	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	ANNUAL	ALL	1ST	5.32263	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	ANNUAL	ALL	1ST	5.2186	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	ANNUAL	ALL	1ST	5.10365	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	5.28031	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	5.26985	556611.65	4502402.72	242.23	343.02	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	4.93465	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	4.86327	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	4.68512	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.84304	556652.58	4502546.73	242.24	343.02	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.73001	556601.9	4502379.7	242.94	343.02	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.58072	556578.18	4502335.71	243.6	343.02	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.54112	556652.58	4502546.73	242.24	343.02	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SFC	185	3	832
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.50306	556601.9	4502379.7	242.94	343.02	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SFC	185	3	832

9/27/19 - Shell Increment Analysis Results

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard	Comment
PM10	24-HR	INCREMNT	2ND	22.58	NA	22.6	30	75%	Conservatively assumes all sources consume increment at PTE.
PM10	ANNUAL	INCREMNT	1ST	5.28	NA	5.3	17	31%	
NOX	ANNUAL	ALL	1ST	9.00	NA	9.0	25	36%	

Notes:

1) All sources identified in the off-site inventory were conservatively assumed to consume PM10 increment with the exception of First Energy Bruce Mansfield Units #1&2.
These sources were constructed prior to the PM10 major source baseline date of January 6, 1975. Therefore, only changes in actual emissions after the minor source baseline date of August 1992 consume PM10 increment.
Changes in actual emissions were calculated as the difference between the emissions from the average of the 1990-1991 annual emissions inventory and the 2011-2013 annual emissions inventory.
Since Bruce Mansfield Units #1&2 emissions declined over this period, these units do not consume increment.
2) All sources identified in the off-site inventory were conservatively assumed to consume NOx increment.
3) NO2 annual impacts conservatively assumes 100% conversion of NOx to NO2.

Visual Effects Screening Analysis for
Source: Shell
Class I Area: Racoon Creek

*** Level-1 Screening ***

Input Emissions for

Particulates	62.87	LB /HR
NOx (as NO2)	118.42	LB /HR
Primary NO2	0.00	LB /HR
Soot	0.00	LB /HR
Primary SO4	0.00	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	20.00 km
Source-Observer Distance:	16.00 km
Min. Source-Class I Distance:	16.00 km
Max. Source-Class I Distance:	23.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast Plume
SKY	10.	115.	18.0	54.	2.00	2.793*	0.05	0.018
SKY	140.	115.	18.0	54.	2.00	0.810	0.05	-0.017
TERRAIN	10.	84.	16.0	84.	2.00	2.042*	0.05	0.025
TERRAIN	140.	84.	16.0	84.	2.00	0.372	0.05	0.016

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast Plume
SKY	10.	25.	11.4	144.	2.00	3.247*	0.05	0.021
SKY	140.	25.	11.4	144.	2.00	0.835	0.05	-0.020
TERRAIN	10.	1.	1.0	168.	2.00	3.127*	0.05	0.034
TERRAIN	140.	1.	1.0	168.	2.00	0.863	0.05	0.033

Visual Effects Screening Analysis for
Source: Shell
Class I Area: Racoon Creek

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	62.87	LB /HR
NOx (as NO2)	118.42	LB /HR
Primary NO2	0.00	LB /HR
Soot	0.00	LB /HR
Primary SO4	0.00	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04 ppm
Background Visual Range:	20.00 km
Source-Observer Distance:	16.00 km
Min. Source-Class I Distance:	16.00 km
Max. Source-Class I Distance:	23.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	6
Wind Speed:	2.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	120.	18.4	49.	2.00	1.436	0.05	0.009
SKY	140.	120.	18.4	49.	2.00	0.411	0.05	-0.009
TERRAIN	10.	84.	16.0	84.	2.00	1.055	0.05	0.013
TERRAIN	140.	84.	16.0	84.	2.00	0.189	0.05	0.008

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	20.	10.5	149.	2.00	1.698	0.05	0.011
SKY	140.	20.	10.5	149.	2.00	0.420	0.05	-0.011
TERRAIN	10.	1.	1.0	168.	2.00	2.030*	0.05	0.022
TERRAIN	140.	1.	1.0	168.	2.00	0.550	0.05	0.022

APPENDIX D

INHALATION RISK ASSESSMENT FOR SHELL POLYMERS MONACA SITE SHELL CHEMICAL APPALACHIA LLC BEAVER COUNTY, PENNSYLVANIA

ATTACHMENT A: EMISSION ESTIMATES
ATTACHMENT B: DISPERSION MODELING ANALYSIS
ATTACHMENT C: INHALATION RISK ASSESSMENT ANALYSIS

Prepared by:
RTP Environmental Associates
304A West Millbrook Road
Raleigh, North Carolina 27609

February 2020

ATTACHMENT A

EMISSION ESTIMATES FOR THE INHALATION RISK ASSESSMENT FOR SHELL POLYMERS MONACA SITE SHELL CHEMICAL APPALACHIA LLC BEAVER COUNTY, PENNSYLVANIA

Prepared by:
RTP Environmental Associates
304A West Millbrook Road
Raleigh, North Carolina 27609

February 2020

1.0 General Discussion

The methodologies used by this updates analysis to estimate emissions rates for the compounds of potential concern (COPC) are consistent with the methodologies previously used.[1] To identify the COPC from the project's combustion sources, EPA's compilation of Air Pollutant Emission Factors (*i.e.,* AP-42) was used. The COPC emissions for the remaining points of emission were determined based on process knowledge. A summary of the identified COPCs is presented in Table 1.

A summary of the one-hour emissions rate estimates used in the chronic and acute exposure analyses are presented in Table 2 and Table 3, respectively. The following subsections provide more specific discussion of the calculation methodologies used for each type of emissions unit. References to hazardous air pollutants (HAP) are for Plan Approval purposes and should be considered synonymous with COPC for this analysis.

1.1 Combustion Sources

As previously noted, COPC emission rates from the facilities combustion sources (*i.e.,* cracking furnaces, combustion turbines, emergency engines, flares, and incinerators) are based on the application of the appropriate AP-42 factor and the fuel firing rate of the unit. Emission rates for the combustion units are presented in Table 4 through Table 7.

1.2 Polyethylene Units

The COPCs emitted from the polyethylene manufacturing units are hexavalent chromium (CrVI) from the catalyst heaters and hexane from equipment leaks. Estimated hexane emission rates are provided in Section 1.7. Hexavalent chromium emissions result from the catalyst activation process. To activate the catalyst, hot air produced via electrical heaters is passed through the catalyst heater where it contacts with the catalyst. After passing through the heater, the air exhausts through a stack to the atmosphere. Catalyst particulate entrained in the hot exhaust contains trace amounts of CrVI. The CrVI emissions rate estimate is based on the licensor information presented in Table 8.

1.3 Storage Tanks

Uncontrolled COPC emission rates from certain fixed roof atmospheric storage tanks are presented in Table 9. These emission rates are estimated using the methodology outlined in AP-42, Chapter 7, Section 1. Total VOC emissions are determined using EPA's TANKS 4.09d software. The Hazardous Air Pollutant (HAP) Speciation methodology (AP-42, Section 7.1.4) is then used to determine the COPC emission rate.

[1] See the February 2015 Application for Plan Approval submitted to the Pennsylvania Department of Environmental Protection (PaDEP) and the September 23, 2014, Technical Supplement.

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 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 rates from the LP Thermal and Spent Caustic Vent Thermal Incinerators.

1.4 Process Cooling Water Tower

COPC emissions from the process cooling water tower are estimated by assuming 10 percent of the VOC emissions are hexane. The VOC emissions are based on the proposed VOC LAER limit and the design cooling water circulation rate. The process cooling water tower VOC emissions rate estimate is presented in Table 10.

1.5 Wastewater Treatment Plant

Uncontrolled emissions from the Wastewater Treatment Plant (WWTP) operations are estimated using EPA's WATER9 air emissions model. Controlled emissions are accounted for in the emissions rate estimates from the Spent Caustic Vent Thermal Incinerator. The WWTP emissions rate estimates are presented in Table 11.

1.6 Flares and Incinerators

COPC emissions from the flares and incinerators are based on a combination of the products of combustion and any COPC in the process gas that remains in the exhaust stream of the control device. Products of combustion are estimated using AP-42 emission factors for natural gas combustion as a surrogate for the combusted stream. Constituents in the controlled streams are estimated based on licensor information. The short term and annualized hourly emissions rates for the flares are presented in Table 12. The short term and annualized hourly emissions rates for the low pressure thermal incinerator and the spent caustic vent incinerator are presented in Table 13 and Table 14, respectively.

1.7 Fugitive Emissions from Equipment Leaks

EPA's 1995 Protocol for Equipment Leak Emission Estimates (EPA-453-R-95-017) is used to estimate emissions from equipment leaks for all components except connectors. Consistent with the approach used to estimate VOC emissions in support of the February 2015 application for Plan Approval, the average emission factor approach used for the synthetic organic chemical manufacturing industry (SOCMI) are used to estimate the fugitive emissions from the proposed facility. 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 TCEQ in "Emissions Factors for Equipment Leak Fugitive Components (Addendum to RG-360A, Jan. 2008)" are used. To determine the emissions rate for an individual COPC, process knowledge of the chemical composition of the lines is applied to the EPA/TCEQ based VOC emissions rate. To account for the level of control resulting from the implementation of the proposed LDAR program, control efficiencies developed by the Texas Commission on Environmental Quality (TCEQ) are applied to the uncontrolled SOCMI emissions factors for the various equipment components types. A summary of the ethylene manufacturing fugitive

emissions rates by process location is presented in Table 15. Table 16 provides a cross reference to the ethylene manufacturing fugitive locations. Table 17 and Table 18 provide the summary of the fugitive emissions rates from areas located outside the boundary limits (OSBL) and a cross reference to the specific OSBL areas, respectively. A summary of the fugitive hexane emission rates from the polyethylene manufacturing units is presented in Table 19.

Table 1. Identified Compounds of Potential Concern[1]

1,3-Butadiene	Dichlorobenzene
2-Methylnaphthalene	Ethylbenzene
3-Methylchloranthrene	Ethylene Oxide
7,12-Dimethylbenz(a)anthracene	Fluoranthene
Acenaphthene	Fluorene
Acenaphthylene	Formaldehyde
Acetaldehyde	Hexane
Acrolein	Indeno(1,2,3-cd)pyrene
Anthracene	Lead
Arsenic	Manganese
Barium	Mercury
Benzene	Methanol
Benzo(a)anthracene	Molybdenum
Benzo(a)pyrene	Naphthalene
Benzo(b)fluoranthene	Nickel
Benzo(g,h,i)perylene	Pentane
Benzo(g,h,l)perylene	Phenanthrene
Benzo(k)fluoranthene	Phenol
Beryllium	Propane
Biphenyl	Propylene Oxide
Cadmium	Pyrene
Chromium VI	Selenium
Chromium III[2]	Styrene
Chrysene	Toluene
Cobalt	Vanadium
Copper	Xylenes
Dibenzo(a,h)anthracene	Ammonia

[1] Compounds of Potential Concern were identified from EPA's Compilation of AP-42 Emission Factors for combustion of natural gas and from process knowledge.

[2] For purposes of this analysis, all chromium emissions were conservatively assumed to be in the form of Chromium VI.

Table 2. Maximum Annual Average COPC Emission Rates[1]

Pollutant	One Cracking Furnace	One Combined Cycle Unit	HPGF-1	HPGF-2	HPEF	LPTI	MPGF	Spent Caustic Incinerator	Tanks & Loadout	EC Fugitives	OSBL Fugitives	Emergency Engines	One Firewater Pump Engine	WWTP	Cooling Tower	PE 1&2	PE3	Total
1,3-Butadiene		3.08E-05				3.74E-05		1.50E-02		3.00E-02	2.96E-02	1.40E-05						7.48E-02
2-Methylnaphthalene	7.54E-06		1.55E-06	1.55E-06	2.63E-08	2.51E-06	9.60E-08	2.52E-07				1.67E-06						6.04E-05
3-Methylchloranthrene	5.65E-07		1.16E-07	1.16E-07	1.97E-09	1.88E-07	7.20E-09	1.89E-08										4.41E-06
7,12-Dimethylbenz(a)anthracene	5.02E-06		1.03E-06	1.03E-06	1.75E-08	1.67E-06	6.40E-08	1.68E-07										3.92E-05
Acenaphthene	5.65E-07		1.16E-07	1.16E-07	1.97E-09	1.88E-07	7.20E-09	1.89E-08				1.93E-08	1.82E-07					4.79E-06
Acenaphthylene												6.87E-08	3.60E-07					7.89E-07
Acetaldehyde		2.86E-03										4.31E-04	9.83E-07					9.02E-03
Acrolein		4.58E-04										2.60E-04	3.07E-07					1.63E-03
Anthracene	7.54E-07		1.55E-07	1.55E-07	2.63E-09	2.51E-07	9.60E-09	2.52E-08				2.54E-08	4.80E-08					5.99E-06
Arsenic	6.28E-05		1.29E-05	1.29E-05	2.19E-07	2.09E-05	8.00E-07	2.10E-06										4.89E-04
Benzene	6.59E-04	8.58E-04	1.36E-04	1.36E-04	2.30E-06	2.19E-03	8.40E-06	1.09E-01		7.42E-02	2.31E-02	3.48E-05	3.03E-05	9.64E-03				2.26E-01
Benzo(a)anthracene	5.65E-07		1.16E-07	1.16E-07	1.97E-09	1.88E-07	7.20E-09	1.89E-08				2.28E-08	2.43E-08					4.48E-06
Benzo(a)pyrene	3.77E-07		7.75E-08	7.75E-08	1.31E-09	1.26E-07	4.80E-09	1.26E-08				2.55E-09	1.00E-08					2.96E-06
Benzo(b)fluoranthene	5.65E-07		1.16E-07	1.16E-07	1.97E-09	1.88E-07	7.20E-09	1.89E-08				1.35E-09	4.33E-08					4.49E-06
Benzo(g,h,i)perylene	3.77E-07		7.75E-08	7.75E-08	1.31E-09	1.26E-07	4.80E-09	1.26E-08										2.94E-06
Benzo(g,h,l)perylene												6.64E-09	2.17E-08					5.00E-08
Benzo(k)fluoranthene	5.65E-07		1.16E-07	1.16E-07	1.97E-09	1.88E-07	7.20E-09	1.89E-08				2.11E-09	8.50E-09					4.42E-06
Beryllium	3.77E-06		7.75E-07	7.75E-07	1.31E-08	1.26E-06	4.80E-08	1.26E-07										2.94E-05
Biphenyl									2.03E-09		8.65E-06	1.07E-05						1.93E-05
Cadmium	3.45E-04		7.10E-05	7.10E-05	1.20E-06	1.15E-04	4.40E-06	1.16E-05										2.69E-03
Chromium	4.40E-04															1.64E-06	4.41E-05	3.12E-03
Chrysene	5.65E-07		1.16E-07	1.16E-07	1.97E-09	1.88E-07	7.20E-09	1.89E-08				4.80E-09	5.97E-08					4.53E-06
Cobalt	2.64E-05		5.42E-06	5.42E-06	9.19E-08	8.79E-06	3.36E-07	8.83E-07										2.06E-04
Dibenzo(a,h)anthracene	3.77E-07		7.75E-08	7.75E-08	1.31E-09	1.26E-07	4.80E-09	1.26E-08				7.92E-09	1.35E-08					2.97E-06
Dichlorobenzene	3.77E-04		7.75E-05	7.75E-05	1.31E-06	1.26E-04	4.80E-06	1.26E-05										2.94E-03
Ethylbenzene		2.29E-03				8.64E-05		0.00E+00	5.77E-05	2.95E-03	6.44E-04	2.00E-06						1.06E-02
Ethylene Oxide								0.00E+00										0.00E+00
Fluoranthene	9.42E-07		1.94E-07	1.94E-07	3.28E-09	3.14E-07	1.20E-08	3.15E-08				1.03E-07	1.57E-07					7.76E-06
Fluorene	8.79E-07		1.81E-07	1.81E-07	3.06E-09	2.93E-07	1.12E-08	2.94E-08				3.97E-07	4.99E-07					8.25E-06
Formaldehyde	2.35E-02	5.08E-02	4.84E-03	4.84E-03	8.20E-05	7.85E-03	3.00E-04	7.89E-04				2.67E-03	3.08E-06					3.39E-01
Hexane	5.65E-01		1.16E-01	1.16E-01	1.97E-03	1.88E-01	7.20E-03	1.89E-02			5.43E-01	5.58E-05			0.068			6.04E+00
Indeno(1,2,3-cd)pyrene	5.65E-07		1.16E-07	1.16E-07	1.97E-09	1.88E-07	7.20E-09	1.89E-08				5.09E-09	1.61E-08					4.44E-06
Lead	1.57E-04		3.23E-05	3.23E-05	5.47E-07	5.23E-05	2.00E-06											1.22E-03
Manganese	1.19E-04		2.45E-05	2.45E-05	4.16E-07	3.98E-05	1.52E-06	4.00E-06										9.30E-04
Mercury	8.16E-05		1.68E-05	1.68E-05	2.84E-07	2.72E-05	1.04E-06	2.73E-06										6.36E-04
Methanol										4.86E-02		1.26E-04						4.87E-02
Naphthalene	1.92E-04	9.30E-05	3.94E-05	3.94E-05	6.67E-07	1.81E-03	2.44E-06	6.41E-06	5.94E-08	5.87E-02	9.25E-03	4.89E-06	5.07E-06					7.14E-02

Pollutant	One Cracking Furnace	One Combined Cycle Unit	HPGF-1	HPGF-2	HPEF	LPTI	MPGF	Spent Caustic Incinerator	Tanks & Loadout	EC Fugitives	OSBL Fugitives	Emergency Engines	One Firewater Pump Engine	WWTP	Cooling Tower	PE 1&2	PE3	Total
Nickel	6.59E-04		1.36E-04	1.36E-04	2.30E-06	2.20E-04	8.40E-06	2.21E-05										5.14E-03
PAH[2]		1.57E-04										3.63E-06						4.76E-04
Phenanthrene	5.34E-06		1.10E-06	1.10E-06	1.86E-08	1.78E-06	6.80E-08	1.79E-07				3.99E-07	1.59E-06					4.52E-05
Phenol												1.21E-06		7.50E-07				1.96E-06
Propylene Oxide		2.07E-03																6.22E-03
Pyrene	1.57E-06		3.23E-07	3.23E-07	5.47E-09	5.23E-07	2.00E-08	5.26E-08				1.33E-07	1.45E-07					1.27E-05
Selenium	7.54E-06		1.55E-06	1.55E-06	2.63E-08	2.51E-06	9.60E-08	2.52E-07										5.87E-05
Styrene						4.91E-04		0.00E+00		1.68E-02	3.51E-03	1.19E-06						2.08E-02
Toluene	1.07E-03	9.30E-03	2.20E-04	2.20E-04	3.72E-06	1.37E-03	1.36E-05	3.58E-05	3.31E-05	3.48E-02	8.05E-03	2.61E-05	1.10E-05					8.02E-02
Xylenes		4.58E-03				3.27E-05		0.00E+00		1.12E-03	2.33E-04	1.31E-05	7.53E-06					1.51E-02

[1]All emission rates are provided in lb/hr

[2]AP-42 factors for stationary combustion turbines are not available for individual PAH compounds. For the purposes of the risk assessment, the PAH emissions were assumed to be that of the individual PAH COPC with the highest cancer and non-cancer impact.

Table 3. Maximum Hourly COPC Emission Rates[1]

Pollutant	One Cracking Furnace	One Combined Cycle Units	HPGF-1	HPGF-2	HPEF	LPTI	MPGF	Spent Caustic Incinerator	Tanks & Loadout	EC Fugitives Total	OSBL Fugitives Total	PE Fugitives Total	Emergency Engines Total	One Firewater Pump Engines	WWTP	Cooling Tower	PE1&2	PE3
1,3-Butadiene		3.08E-05				3.74E-05		1.50E-02		3.00E-02	2.96E-02		1.22E-03					
2-Methylnaphthalene	7.54E-06		3.21E-05	3.21E-05	2.63E-08	5.88E-06	2.39E-06	2.52E-07					1.46E-04					
3-Methylchloranthrene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08										
7,12-Dimethylbenz(a)anthracene	5.02E-06		2.14E-05	2.14E-05	1.75E-08	3.92E-06	1.59E-06	1.68E-07										
Acenaphthene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08					1.69E-06	1.60E-05				
Acenaphthylene													6.02E-06	3.15E-05				
Acetaldehyde		2.86E-03											3.77E-02	8.61E-05				
Acrolein		4.58E-04											2.27E-02	2.69E-05				
Anthracene	7.54E-07		3.21E-06	3.21E-06	2.63E-09	5.88E-07	2.39E-07	2.52E-08					2.23E-06	4.20E-06				
Arsenic	6.28E-05		2.67E-04	2.67E-04	2.19E-07	4.90E-05	1.99E-05	2.10E-06										
Benzene	6.59E-04	8.58E-04	2.80E-03	2.80E-03	2.30E-06	2.48E-03	2.09E-04	1.09E-01		7.42E-02	2.31E-02		3.05E-03	2.65E-03	4.77E-02			
Benzo(a)anthracene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08					2.00E-06	2.12E-06				
Benzo(a)pyrene	3.77E-07		1.60E-06	1.60E-06	1.31E-09	2.94E-07	1.20E-07	1.26E-08					2.24E-07	8.78E-07				
Benzo(b)fluoranthene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08					1.18E-07	3.79E-06				
Benzo(g,h,i)perylene	3.77E-07		1.60E-06	1.60E-06	1.31E-09	2.94E-07	1.20E-07	1.26E-08										
Benzo(g,h,l)perylene													5.82E-07	1.90E-06				
Benzo(k)fluoranthene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08					1.84E-07	7.45E-07				
Beryllium	3.77E-06		1.60E-05	1.60E-05	1.31E-08	2.94E-06	1.20E-06	1.26E-07										
Biphenyl									2.03E-09		8.65E-06		9.34E-04					
Cadmium	3.45E-04		1.47E-03	1.47E-03	1.20E-06	2.70E-04	1.10E-04	1.16E-05										
Chromium	4.40E-04																2.10E-04	1.07E-04
Chrysene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08					4.20E-07	5.23E-06				
Cobalt	2.64E-05		1.12E-04	1.12E-04	9.19E-08	2.06E-05	8.37E-06	8.83E-07										
Dibenzo(a,h)anthracene	3.77E-07		1.60E-06	1.60E-06	1.31E-09	2.94E-07	1.20E-07	1.26E-08					6.94E-07	1.18E-06				
Dichlorobenzene	3.77E-04		1.60E-03	1.60E-03	1.31E-06	2.94E-04	1.20E-04	1.26E-05										
Ethylbenzene		2.29E-03				8.64E-05		0.00E+00	5.77E-05	2.95E-03	6.44E-04		1.75E-04					
Ethylene Oxide								0.00E+00										
Fluoranthene	9.42E-07		4.01E-06	4.01E-06	3.28E-09	7.35E-07	2.99E-07	3.15E-08					9.06E-06	1.38E-05				
Fluorene	8.79E-07		3.74E-06	3.74E-06	3.06E-09	6.86E-07	2.79E-07	2.94E-08					3.47E-05	4.37E-05				
Formaldehyde	2.35E-02	5.08E-02	1.00E-01	1.00E-01	8.20E-05	1.84E-02	7.47E-03	7.89E-04					2.34E-01	2.70E-04				
Hexane	5.65E-01		2.40E+00	2.40E+00	1.97E-03	4.41E-01	1.79E-01	1.89E-02			5.43E-01		4.89E-03			0.068		
Indeno(1,2,3-cd)pyrene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08					4.46E-07	1.41E-06				
Lead	1.57E-04		6.68E-04	6.68E-04	5.47E-07	1.23E-04	4.98E-05											
Manganese	1.19E-04		5.08E-04	5.08E-04	4.16E-07	9.31E-05	3.78E-05	4.00E-06										
Mercury	8.16E-05		3.47E-04	3.47E-04	2.84E-07	6.37E-05	2.59E-05	2.73E-06										
Methanol										4.86E-02			1.10E-02					
Naphthalene	1.92E-04	9.30E-05	8.15E-04	8.15E-04	6.67E-07	1.89E-03	6.07E-05	6.41E-06	5.95E-08	5.87E-02	9.25E-03		4.29E-04	4.44E-04				

Pollutant	One Cracking Furnace	One Combined Cycle Units	HPGF-1	HPGF-2	HPEF	LPTI	MPGF	Spent Caustic Incinerator	Tanks & Loadout	EC Fugitives Total	OSBL Fugitives Total	PE Fugitives Total	Emergency Engines Total	One Firewater Pump Engines	WWTP	Cooling Tower	PE1&2	PE3
Nickel	6.59E-04		2.80E-03	2.80E-03	2.30E-06	5.15E-04	2.09E-04	2.21E-05										
PAH		1.57E-04											3.18E-04					
Phenanthrene	5.34E-06		2.27E-05	2.27E-05	1.86E-08	4.17E-06	1.69E-06	1.79E-07					3.50E-05	1.39E-04				
Phenol													1.06E-04		3.73E-06			
Propylene Oxide		2.07E-03																
Pyrene	1.57E-06		6.68E-06	6.68E-06	5.47E-09	1.23E-06	4.98E-07	5.26E-08					1.17E-05	1.27E-05				
Selenium	7.54E-06		3.21E-05	3.21E-05	2.63E-08	5.88E-06	2.39E-06	2.52E-07										
Styrene						4.91E-04		0.00E+00		1.68E-02	3.51E-03		1.04E-04					
Toluene	1.07E-03	9.30E-03	4.54E-03	4.54E-03	3.72E-06	1.85E-03	3.39E-04	3.58E-05	3.31E-05	3.48E-02	8.05E-03		2.28E-03	9.60E-04				
Xylenes		4.58E-03				3.27E-05		0.00E+00		1.12E-03	2.33E-04		1.15E-03	6.59E-04				

[1] All emission rates are provided in lb/hr

[2] AP-42 factors for stationary combustion turbines are not available for individual PAH compounds. For the purposes of the risk assessment, the PAH emissions were assumed to be that of the individual PAH COPC with the highest cancer and non-cancer impact.

[3]Cooling Tower emissions were modeled as 16 individual units. Values presented are per unit.

[4]Total emissions for each COPC are based on 7 cracking furnaces, 2 PE catalyst heaters, 3 combustion turbines, 4 emergency engines, 3 firewater pumps, and 16 modeled cooling water tower units.

Table 4. Speciated Emissions from Ethylene Cracking Furnaces

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	EF (lb/MMBtu)	§112 HAP?	PTE 1 Cracking Furnace (lb/hr)	PTE 1 Cracking Furnace (T/yr)
2-Methylnaphthalene	2.40E-05	AP42; Table 1.4-3; 7/98.	2.35E-08	YES	7.54E-06	3.30E-05
3-Methylchloranthrene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	<5.65E-07	<2.48E-06
7,12-Dimethylbenz(a)anthracene	<1.6E-05	AP42; Table 1.4-3; 7/98.	<1.57E-08	YES	<5.02E-06	<2.20E-05
Acenaphthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Anthracene	<2.4E-06	AP42; Table 1.4-3; 7/98.	<2.35E-09	YES	<7.54E-07	<3.30E-06
Benzo(a)anthracene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Benzene	2.10E-03	AP42; Table 1.4-3; 7/98.	2.06E-06	YES	6.59E-04	2.89E-03
Benzo(a)pyrene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	<3.77E-07	<1.65E-06
Benzo(b)fluoranthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Benzo(g,h,i)perylene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	<3.77E-07	<1.65E-06
Benzo(k)fluoranthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Butane	2.10E+00	AP42; Table 1.4-3; 7/98.	2.06E-03	NO	6.59E-01	2.89E+00
Chrysene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Dibenzo(a,h)anthracene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	<3.77E-07	<1.65E-06
Dichlorobenzene	1.20E-03	AP42; Table 1.4-3; 7/98.	1.18E-06	YES	3.77E-04	1.65E-03
Ethane	3.10E+00	AP42; Table 1.4-3; 7/98.	3.04E-03	NO	9.73E-01	4.26E+00
Fluoranthene	3.00E-06	AP42; Table 1.4-3; 7/98.	2.94E-09	YES	9.42E-07	4.13E-06
Fluorene	2.80E-06	AP42; Table 1.4-3; 7/98.	2.75E-09	YES	8.79E-07	3.85E-06
Formaldehyde	7.50E-02	AP42; Table 1.4-3; 7/98.	7.35E-05	YES	2.35E-02	1.03E-01
Hexane	1.80E+00	AP42; Table 1.4-3; 7/98.	1.76E-03	YES	5.65E-01	2.48E+00
Indeno(1,2,3-cd)pyrene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	<5.65E-07	<2.48E-06
Naphthalene	6.10E-04	AP42; Table 1.4-3; 7/98.	5.98E-07	YES	1.92E-04	8.39E-04
Pentane	2.60E+00	AP42; Table 1.4-3; 7/98.	2.55E-03	NO	8.16E-01	3.58E+00
Phenanthrene	1.70E-05	AP42; Table 1.4-3; 7/98.	1.67E-08	YES	5.34E-06	2.34E-05
Propane	1.60E+00	AP42; Table 1.4-3; 7/98.	1.57E-03	NO	5.02E-01	2.20E+00
Pyrene	5.00E-06	AP42; Table 1.4-3; 7/98.	4.90E-09	YES	1.57E-06	6.88E-06

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	EF (lb/MMBtu)	§112 HAP?	PTE 1 Cracking Furnace (lb/hr)	PTE 1 Cracking Furnace (T/yr)
Toluene	3.40E-03	AP42; Table 1.4-3; 7/98.	3.33E-06	YES	1.07E-03	4.68E-03
Arsenic	2.00E-04	AP42; Table 1.4-4; 7/98.	1.96E-07	YES	6.28E-05	2.75E-04
Barium	4.40E-03	AP42; Table 1.4-4; 7/98.	4.31E-06	NO	1.38E-03	6.05E-03
Beryllium	<1.2E-05	AP42; Table 1.4-4; 7/98.	<1.18E-08	YES	<3.77E-06	<1.65E-05
Cadmium	1.10E-03	AP42; Table 1.4-4; 7/98.	1.08E-06	YES	3.45E-04	1.51E-03
Chromium**	1.40E-03	AP42; Table 1.4-4; 7/98.	1.37E-06	YES	4.40E-04	1.93E-03
Cobalt	8.40E-05	AP42; Table 1.4-4; 7/98.	8.24E-08	YES	2.64E-05	1.16E-04
Copper	8.50E-04	AP42; Table 1.4-4; 7/98.	8.33E-07	NO	2.67E-04	1.17E-03
Lead	5.00E-04	AP-42; Table 1.4-4	4.90E-07	YES	1.57E-04	6.88E-04
Manganese	3.80E-04	AP42; Table 1.4-4; 7/98.	3.73E-07	YES	1.19E-04	5.23E-04
Mercury	2.60E-04	AP42; Table 1.4-4; 7/98.	2.55E-07	YES	8.16E-05	3.58E-04
Molybdenum	1.10E-03	AP42; Table 1.4-4; 7/98.	1.08E-06	NO	3.45E-04	1.51E-03
Nickel	2.10E-03	AP42; Table 1.4-4; 7/98.	2.06E-06	YES	6.59E-04	2.89E-03
Selenium	<2.4E-05	AP42; Table 1.4-4; 7/98.	<2.35E-08	YES	<7.54E-06	<3.30E-05
Vanadium	2.30E-03	AP42; Table 1.4-4; 7/98.	2.25E-06	NO	7.22E-04	3.16E-03
Zinc	2.90E-02	AP42; Table 1.4-4; 7/98.	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 5. Speciated Emissions from Combustion Turbines and Duct Burners

Emission Unit(s) ID =	CT1/2/3		Combustion Turbine & Duct Burner HAP PTE*		
Max CH4+NG Input:	715 (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	<3.08E-05	<1.35E-04
Acetaldehyde :	AP42; Table 3.1-3; 4/00.	4.00E-05	YES	2.86E-03	1.25E-02
Acrolein :	AP42; Table 3.1-3; 4/00.	6.40E-06	YES	4.58E-04	2.01E-03
Benzene :	AP42; Table 3.1-3; 4/00.	1.20E-05	YES	8.58E-04	3.76E-03
Ethylbenzene :	AP42; Table 3.1-3; 4/00.	3.20E-05	YES	2.29E-03	1.00E-02
Formaldehyde :	AP42; Table 3.1-3; 4/00.	7.10E-04	YES	5.08E-02	2.22E-01
Naphthalene :	AP42; Table 3.1-3; 4/00.	1.30E-06	YES	9.30E-05	4.07E-04
PAH :	AP42; Table 3.1-3; 4/00.	2.20E-06	YES	1.57E-04	6.89E-04
Propylene Oxide :	AP42; Table 3.1-3; 4/00.	<2.90E-05	YES	<2.07E-03	<9.09E-03
Toluene :	AP42; Table 3.1-3; 4/00.	1.30E-04	YES	9.30E-03	4.07E-02
Xylenes :	AP42; Table 3.1-3; 4/00.	6.40E-05	YES	4.58E-03	2.01E-02
Total §112 HAPs from 1 Cogen Unit =				**<7.35E-02**	**<3.22E-01**
Total §112 HAPs from 3 Cogen Units =				**<2.20E-01**	**<9.66E-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 6. Speciated Emissions from Emergency Generators

Emergency Engine HAP Emissions Calculations

Engine Information						
	Cummins QSB5-G3	Kohler KDI 3404 TM	GM Vortec 5.7L V-8	GM Vortec 3.0L I-4	GM 5.7L V-8	TBD
Size (bhp)	103	67	158	50	113	210
Fuel Fired	Diesel	Diesel	NG	NG	NG	NG
Heat Input (MMBtu/hr)	-	-	1.42	0.37	0.73	1.88
Hours of Operation (hrs/yr)	100	100	100	100	100	100

Pollutant	Emission Factor (lb/MMBtu)		Emission Factor (lb/hp-hr)	HAP Emissions by Engine (lb/hr - annualized)					
	Natural Gas[a]	Diesel[b]	Diesel[b]	Cummins QSB5-G3	Kohler KDI 3404 TM	GM Vortec 5.7L V-8	GM Vortec 3.0L I-4	GM 5.7L V-8	TBD
Benzene	4.40E-04	9.33E-04	6.53E-06	7.68E-06	5.00E-06	7.12E-06	1.88E-06	3.67E-06	9.46E-06
Toluene	4.08E-04	4.09E-04	2.86E-06	3.37E-06	2.19E-06	6.60E-06	1.74E-06	3.41E-06	8.77E-06
Xylenes	1.84E-04	2.85E-04	2.00E-06	2.35E-06	1.53E-06	2.98E-06	7.84E-07	1.54E-06	3.96E-06
Propylene		2.58E-03	1.81E-05	2.12E-05	1.38E-05				
1,3-Butadiene	2.67E-04	3.92E-05	2.74E-07	3.23E-07	2.10E-07	4.32E-06	1.14E-06	2.23E-06	5.74E-06
Formaldehyde	5.28E-02	1.18E-03	8.26E-06	9.71E-06	6.32E-06	8.54E-04	2.25E-04	4.41E-04	1.13E-03
Acetaldehyde	8.36E-03	7.67E-04	5.37E-06	6.31E-06	4.11E-06	1.35E-04	3.56E-05	6.98E-05	1.80E-04
Acrolein	5.14E-03	9.25E-05	6.48E-07	7.61E-07	4.95E-07	8.31E-05	2.19E-05	4.29E-05	1.10E-04
Naphthalene	7.44E-05	8.48E-05	5.94E-07	6.98E-07	4.54E-07	1.20E-06	3.17E-07	6.21E-07	1.60E-06
PAH	2.69E-05	1.68E-04	1.18E-06	1.38E-06	8.99E-07	4.35E-07	1.15E-07	2.25E-07	5.78E-07
Acenaphthylene		5.06E-06	3.54E-08	4.16E-08	2.71E-08				
Acenaphthene		1.42E-06	9.94E-09	1.17E-08	7.60E-09				
Anthracene		1.87E-06	1.31E-08	1.54E-08	1.00E-08				
Benzo(a)anthracene		1.68E-06	1.18E-08	1.38E-08	8.99E-09				
Benzo(b)fluoranthene		9.91E-08	6.94E-10	8.16E-10	5.31E-10				
Benzo(k)fluoranthene		1.55E-07	1.09E-09	1.28E-09	8.30E-10				
Benzo(a)pyrene		1.88E-07	1.32E-09	1.55E-09	1.01E-09				
Benzo(g,h,l)perylene		4.89E-07	3.42E-09	4.02E-09	2.62E-09				
Biphenyl	2.12E-04					3.43E-06	9.03E-07	1.77E-06	4.56E-06
Butyr/Isobutyraldehyde	1.01E-04					1.63E-06	4.30E-07	8.43E-07	2.17E-06
Carbon Tetrachloride	3.67E-05					5.94E-07	1.56E-07	3.06E-07	7.89E-07
Chlorobenzene	3.04E-05					4.92E-07	1.30E-07	2.54E-07	6.53E-07
Chloroethane	1.87E-06					3.02E-08	7.97E-09	1.56E-08	4.02E-08
Chloroform	2.85E-05					4.61E-07	1.21E-07	2.38E-07	6.13E-07
Chrysene		3.53E-07	2.47E-09	2.91E-09	1.89E-09				
Cyclopentane	2.27E-04					3.67E-06	9.67E-07	1.90E-06	4.88E-06
Dibenzo(a,h)anthracene		5.83E-07	4.08E-09	4.80E-09	3.12E-09				
Ethylbenzene	3.97E-05					6.42E-07	1.69E-07	3.31E-07	8.53E-07

Emergency Engine HAP Emissions Calculations

Engine Information						
	Cummins QSB5-G3	Kohler KDI 3404 TM	GM Vortec 5.7L V-8	GM Vortec 3.0L I-4	GM 5.7L V-8	TBD
Size (bhp)	103	67	158	50	113	210
Fuel Fired	Diesel	Diesel	NG	NG	NG	NG
Heat Input (MMBtu/hr)	-	-	1.42	0.37	0.73	1.88
Hours of Operation (hrs/yr)	100	100	100	100	100	100

Pollutant		Emission Factor (lb/MMBtu)		Emission Factor (lb/hp-hr)	HAP Emissions by Engine (lb/hr - annualized)					
		Natural Gas[a]	Diesel[b]	Diesel[b]	Cummins QSB5-G3	Kohler KDI 3404 TM	GM Vortec 5.7L V-8	GM Vortec 3.0L I-4	GM 5.7L V-8	TBD
Ethylene Dibromide		4.43E-05					7.16E-07	1.89E-07	3.70E-07	9.52E-07
Fluoranthene			7.61E-06	5.33E-08	6.26E-08	4.07E-08				
Fluorene			2.92E-05	2.04E-07	2.40E-07	1.56E-07				
Methanol		2.50E-03					4.04E-05	1.07E-05	2.09E-05	5.37E-05
Methylcyclohexane		1.23E-03					1.99E-05	5.24E-06	1.03E-05	2.64E-05
Methylene Chloride		2.00E-05					3.23E-07	8.52E-08	1.67E-07	4.30E-07
Hexane		1.11E-03					1.80E-05	4.73E-06	9.27E-06	2.39E-05
Indeno(1,2,3-cd)pyrene			3.75E-07	2.63E-09	3.09E-09	2.01E-09				
Phenanthrene			2.94E-05	2.06E-07	2.42E-07	1.57E-07				
Phenol		2.40E-05					3.88E-07	1.02E-07	2.00E-07	5.16E-07
Pyrene		1.36E-06	4.78E-06	3.35E-08	3.93E-08	2.56E-08	2.20E-08	5.80E-09	1.14E-08	2.92E-08
Styrene		2.36E-05					3.82E-07	1.01E-07	1.97E-07	5.07E-07
Tetrachloroethane		2.48E-06					4.01E-08	1.06E-08	2.07E-08	5.33E-08
Vinyl Chloride		1.49E-05					2.41E-07	6.35E-08	1.24E-07	3.20E-07
1,1,2,2-Tetrachloroethane		4.00E-05					6.47E-07	1.70E-07	3.34E-07	8.60E-07
1,1,2-Trichloroethane		3.18E-05					5.14E-07	1.36E-07	2.65E-07	6.84E-07
1,1-Dichloroethane		2.36E-05					3.82E-07	1.01E-07	1.97E-07	5.07E-07
1,2,3-Trimethylbenzene		2.30E-05					3.72E-07	9.80E-08	1.92E-07	4.94E-07
1,2,4-Trimethylbenzene		1.43E-05					2.31E-07	6.09E-08	1.19E-07	3.07E-07
1,2-Dichloroethane		2.36E-05					3.82E-07	1.01E-07	1.97E-07	5.07E-07
1,2-Dichloropropane		2.69E-05					4.35E-07	1.15E-07	2.25E-07	5.78E-07
1,3,5-Trimethylbenzene		3.38E-05					5.47E-07	1.44E-07	2.82E-07	7.27E-07
1,3-Dichloropropene		2.64E-05					4.27E-07	1.13E-07	2.20E-07	5.67E-07
2-Methylnaphthalene		3.32E-05					5.37E-07	1.41E-07	2.77E-07	7.14E-07
2,2,4-Trimethylpentane		2.50E-04					4.04E-06	1.07E-06	2.09E-06	5.37E-06

[a]Emission factors from AP-42 Section 3.2 Natural Gas-fired Reciprocating Engines, Table 3.2-2.
[b]Emission factors from AP-42 Section 3.3 Gasoline and Diesel Industrial Engines, Table 3.3-2. Average brake-specific fuel consumption of 7,000 Btu/hp-hr was used to convert from lb/MMBtu to lb/hr-hr.

Table 7. Speciated Emissions from Fire Water Pump Engines

Fire Pump ICE HAP PTE - FWP1/2 (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	1.72E-04	8.61E-06
Acrolein	7.88E-06	AP42; Table 3.4-3; 10/96.	YES	5.38E-05	2.69E-06
Benzene	7.76E-04	AP42; Table 3.4-3; 10/96.	YES	5.30E-03	2.65E-04
Formaldehyde	7.89E-05	AP42; Table 3.4-3; 10/96.	YES	5.39E-04	2.70E-05
Propylene	2.79E-03	AP42; Table 3.4-3; 10/96.	NO	1.91E-02	9.53E-04
Toluene	2.81E-04	AP42; Table 3.4-3; 10/96.	YES	1.92E-03	9.60E-05
Xylenes	1.93E-04	AP42; Table 3.4-3; 10/96.	YES	1.32E-03	6.59E-05
Naphthalene	1.30E-04	AP42; Table 3.4-4; 10/96.	YES	8.88E-04	4.44E-05
Acenaphthylene	9.23E-06	AP42; Table 3.4-4; 10/96.	YES	6.31E-05	3.15E-06
Acenaphthene	4.68E-06	AP42; Table 3.4-4; 10/96.	YES	3.20E-05	1.60E-06
Fluorene	1.28E-05	AP42; Table 3.4-4; 10/96.	YES	8.74E-05	4.37E-06
Phenanthrene	4.08E-05	AP42; Table 3.4-4; 10/96.	YES	2.79E-04	1.39E-05
Anthracene	1.23E-06	AP42; Table 3.4-4; 10/96.	YES	8.40E-06	4.20E-07
Fluoranthene	4.03E-06	AP42; Table 3.4-4; 10/96.	YES	2.75E-05	1.38E-06
Pyrene	3.71E-06	AP42; Table 3.4-4; 10/96.	YES	2.53E-05	1.27E-06
Benzo(a)anthracene	6.22E-07	AP42; Table 3.4-4; 10/96.	YES	4.25E-06	2.12E-07
Chrysene	1.53E-06	AP42; Table 3.4-4; 10/96.	YES	1.05E-05	5.23E-07
Benzo(b)fluoranthene	1.11E-06	AP42; Table 3.4-4; 10/96.	YES	7.58E-06	3.79E-07
Benzo(k)fluoranthene	<2.18E-07	AP42; Table 3.4-4; 10/96.	YES	1.49E-06	<7.45E-08
Benzo(a)pyrene	<2.57E-07	AP42; Table 3.4-4; 10/96.	YES	1.76E-06	<8.78E-08
Indeno(1,2,3-cd)pyrene	<4.14E-07	AP42; Table 3.4-4; 10/96.	YES	2.83E-06	<1.41E-07
Dibenzo(a,h)anthracene	<3.46E-07	AP42; Table 3.4-4; 10/96.	YES	2.36E-06	<1.18E-07
Benzo(g,h,l)perylene	<5.56E-07	AP42; Table 3.4-4; 10/96.	YES	3.80E-06	<1.90E-07
Total PAH	<1.68E-04	AP42; Table 3.4-4; 10/96.	NO	1.15E-03	<5.74E-05
			Total § 112 HAP =	<1.08E-02	<5.38E-04
Calculation Basis:	Hourly Emissions = EF x Max Heat In x No. of Engines				
	Annual Emissions = Hourly x 100 Hrs/yr / 2000.				

Table 8. Particulate Chromium Emissions from Polyethylene Unit

Catalyst Activation Heater Cr VI Calc									
Calculation									
Unit Description	EU IDs	Operating Hours (hrs/yr)	Permit Limit (gr/dscf)	Short Term Max Exhaust Rate (Nm3/hr)	Normal Exhaust Rate (Nm3/hr)	CrVI (% by wt)	24-hr Avg CrVI Rate (lb/hr)	Annualized Avg CrVI Rate (lb/hr)	CrVI Emissions (T/yr)
[redacted]	[redacted]	100	0.005	323	221	1.2	1.05E-04	8.20E-07	4.10E-08
[redacted]	[redacted]	100	0.005	323	221	1.2	1.05E-04	8.20E-07	4.10E-08
[redacted]	[redacted]	8760	0.002	485	200	1	5.35E-05	2.20E-05	9.66E-05
[redacted]	[redacted]	8760	0.002	485	200	1	5.35E-05	2.20E-05	9.66E-05

Table 9. Speciated Emissions from Diesel Storage Tanks

Diesel Storage Tank Emissions Calculation				
	Pollutant			
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	1.1E-09	3.3E-08	1.9E-05	3.2E-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

Calculation is based on controlled VOC emissions per tank

Table 10. Process Cooling Tower Emissions

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])

Table 11. WWTP Emissions

WWTP Equipment (W-1001) - Emissions Summary								
	Maximum Rate	Emission Factor	Short Term Max Emissions	Annualized Emissions			Calculation/ Estimation Method	Emission Factor Reference
Pollutant	MMG /day	lb/MMG	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 12. Speciated Short Term and Annualized Hourly Flare Emission

FLARE HAP EMISSIONS CALCULATIONS*		
Flare	**MMBtu/hr****	
HP Ground Flares / Short-Term Max	2,725	Maximum expected short term rates based on preliminary vendor data assocated with various potential scenarios (e.g., a cold start-up). Includes 1.0 MM Btu/hr of pilot gas at all times and sweep gas.
HP Ground Flares / Annual Average	132	Represents reasonably anticipated maintenance events, 1 start up and 1 shutdown, sweep gas, and 1.0 MMBtu/hr pilot gas
HP Elevated Flare / Normal Ops	1	Represents 1.0 MMBtu/hr of pilot gas
MP Ground Flare / Normal Ops	4	Based on 1 start up and 1 shutdown with anticipated flaring of 225 MT of ethane/event and includes sweep gas and 1.0 MM Btu/hr pilot gas
MP Ground Flare / Short-Term Max	102	Based on flaring 2.0 MT/hr of ethane which is maximum anticipate rate from various SU/SD modes and includes sweep gas and 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	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 Average (tpy)
2-Methylnaphthalene	2.40E-05	AP42; Table 1.4-3; 7/98.	2.35E-08	YES	6.41E-05	1.36E-05	2.63E-08	1.15E-07	2.39E-06	4.21E-07
3-Methylchloranthrene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.81E-06	1.02E-06	1.97E-09	8.62E-09	1.79E-07	3.15E-08
7,12-Dimethylbenz(a)anthracene	<1.6E-05	AP42; Table 1.4-3; 7/98.	<1.57E-08	YES	4.27E-05	9.05E-06	1.75E-08	7.67E-08	1.59E-06	2.80E-07
Acenaphthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.81E-06	1.02E-06	1.97E-09	8.62E-09	1.79E-07	3.15E-08
Anthracene	<2.4E-06	AP42; Table 1.4-3; 7/98.	<2.35E-09	YES	6.41E-06	1.36E-06	2.63E-09	1.15E-08	2.39E-07	4.21E-08
Benzo(a)anthracene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.81E-06	1.02E-06	1.97E-09	8.62E-09	1.79E-07	3.15E-08
Benzene	2.10E-03	AP42; Table 1.4-3; 7/98.	2.06E-06	YES	5.61E-03	1.19E-03	2.30E-06	1.01E-05	2.09E-04	3.68E-05
Benzo(a)pyrene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	3.21E-06	6.79E-07	1.31E-09	5.75E-09	1.20E-07	2.10E-08
Benzo(b)fluoranthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.81E-06	1.02E-06	1.97E-09	8.62E-09	1.79E-07	3.15E-08
Benzo(g,h,i)perylene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	3.21E-06	6.79E-07	1.31E-09	5.75E-09	1.20E-07	2.10E-08
Benzo(k)fluoranthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.81E-06	1.02E-06	1.97E-09	8.62E-09	1.79E-07	3.15E-08
Butane	2.10E+00	AP42; Table 1.4-3; 7/98.	2.06E-03	NO	5.61E+00	1.19E+00	2.30E-03	1.01E-02	2.09E-01	3.68E-02

FLARE HAP EMISSIONS CALCULATIONS*		
Flare	**MMBtu/hr****	
HP Ground Flares / Short-Term Max	2,725	Maximum expected short term rates based on preliminary vendor data assocated with various potential scenarios (e.g., a cold start-up). Includes 1.0 MM Btu/hr of pilot gas at all times and sweep gas.
HP Ground Flares / Annual Average	132	Represents reasonably anticipated maintenance events, 1 start up and 1 shutdown, sweep gas, and 1.0 MMBtu/hr pilot gas
HP Elevated Flare / Normal Ops	1	Represents 1.0 MMBtu/hr of pilot gas
MP Ground Flare / Normal Ops	4	Based on 1 start up and 1 shutdown with anticipated flaring of 225 MT of ethane/event and includes sweep gas and 1.0 MM Btu/hr pilot gas
MP Ground Flare / Short-Term Max	102	Based on flaring 2.0 MT/hr of ethane which is maximum anticipate rate from various SU/SD modes and includes sweep gas and 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	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 Average (tpy)
Chrysene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.81E-06	1.02E-06	1.97E-09	8.62E-09	1.79E-07	3.15E-08
D benzo(a,h)anthracene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	3.21E-06	6.79E-07	1.31E-09	5.75E-09	1.20E-07	2.10E-08
Dichlorobenzene	1.20E-03	AP42; Table 1.4-3; 7/98.	1.18E-06	YES	3.21E-03	6.79E-04	1.31E-06	5.75E-06	1.20E-04	2.10E-05
Ethane	3.10E+00	AP42; Table 1.4-3; 7/98.	3.04E-03	NO	8.28E+00	1.75E+00	3.39E-03	1.49E-02	3.09E-01	5.43E-02
Fluoranthene	3.00E-06	AP42; Table 1.4-3; 7/98.	2.94E-09	YES	8.01E-06	1.70E-06	3.28E-09	1.44E-08	2.99E-07	5.26E-08
Fluorene	2.80E-06	AP42; Table 1.4-3; 7/98.	2.75E-09	YES	7.48E-06	1.58E-06	3.06E-09	1.34E-08	2.79E-07	4.91E-08
Formaldehyde	7.50E-02	AP42; Table 1.4-3; 7/98.	7.35E-05	YES	2.00E-01	4.24E-02	8.20E-05	3.59E-04	7.47E-03	1.31E-03
Hexane	1.80E+00	AP42; Table 1.4-3; 7/98.	1.76E-03	YES	4.81E+00	1.02E+00	1.97E-03	8.62E-03	1.79E-01	3.15E-02
Indeno(1,2,3-cd)pyrene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.81E-06	1.02E-06	1.97E-09	8.62E-09	1.79E-07	3.15E-08
Naphthalene	6.10E-04	AP42; Table 1.4-3; 7/98.	5.98E-07	YES	1.63E-03	3.45E-04	6.67E-07	2.92E-06	6.07E-05	1.07E-05
Pentane	2.60E+00	AP42; Table 1.4-3; 7/98.	2.55E-03	NO	6.95E+00	1.47E+00	2.84E-03	1.25E-02	2.59E-01	4.56E-02
Phenanthrene	1.70E-05	AP42; Table 1.4-3; 7/98.	1.67E-08	YES	4.54E-05	9.61E-06	1.86E-08	8.15E-08	1.69E-06	2.98E-07
Propane	1.60E+00	AP42; Table 1.4-3; 7/98.	1.57E-03	NO	4.27E+00	9.05E-01	1.75E-03	7.67E-03	1.59E-01	2.80E-02
Pyrene	5.00E-06	AP42; Table 1.4-3; 7/98.	4.90E-09	YES	1.34E-05	2.83E-06	5.47E-09	2.40E-08	4.98E-07	8.76E-08

FLARE HAP EMISSIONS CALCULATIONS*		
Flare	**MMBtu/hr****	
HP Ground Flares / Short-Term Max	2,725	Maximum expected short term rates based on preliminary vendor data assocated with various potential scenarios (e.g., a cold start-up). Includes 1.0 MM Btu/hr of pilot gas at all times and sweep gas.
HP Ground Flares / Annual Average	132	Represents reasonably anticipated maintenance events, 1 start up and 1 shutdown, sweep gas, and 1.0 MMBtu/hr pilot gas
HP Elevated Flare / Normal Ops	1	Represents 1.0 MMBtu/hr of pilot gas
MP Ground Flare / Normal Ops	4	Based on 1 start up and 1 shutdown with anticipated flaring of 225 MT of ethane/event and includes sweep gas and 1.0 MM Btu/hr pilot gas
MP Ground Flare / Short-Term Max	102	Based on flaring 2.0 MT/hr of ethane which is maximum anticipate rate from various SU/SD modes and includes sweep gas and 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	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 Average (tpy)
Toluene	3.40E-03	AP42; Table 1.4-3; 7/98.	3.33E-06	YES	9.08E-03	1.92E-03	3.72E-06	1.63E-05	3.39E-04	5.96E-05
Arsenic	2.00E-04	AP42; Table 1.4-4; 7/98.	1.96E-07	YES	5.34E-04	1.13E-04	2.19E-07	9.58E-07	1.99E-05	3.51E-06
Barium	4.40E-03	AP42; Table 1.4-4; 7/98.	4.31E-06	NO	1.18E-02	2.49E-03	4.81E-06	2.11E-05	4.38E-04	7.71E-05
Beryllium	<1.2E-05	AP42; Table 1.4-4; 7/98.	<1.18E-08	YES	3.21E-05	6.79E-06	1.31E-08	5.75E-08	1.20E-06	2.10E-07
Cadmium	1.10E-03	AP42; Table 1.4-4; 7/98.	1.08E-06	YES	2.94E-03	6.22E-04	1.20E-06	5.27E-06	1.10E-04	1.93E-05
Chromium	1.40E-03	AP42; Table 1.4-4; 7/98.	1.37E-06	YES	3.74E-03	7.92E-04	1.53E-06	6.71E-06	1.39E-04	2.45E-05
Cobalt	8.40E-05	AP42; Table 1.4-4; 7/98.	8.24E-08	YES	2.24E-04	4.75E-05	9.19E-08	4.02E-07	8.37E-06	1.47E-06
Copper	8.50E-04	AP42; Table 1.4-4; 7/98.	8.33E-07	NO	2.27E-03	4.81E-04	9.30E-07	4.07E-06	8.47E-05	1.49E-05
Lead	5.00E-04	AP-42; Table 1.4-2; 7/98	4.90E-07	YES	1.34E-03	2.83E-04	5.47E-07	2.40E-06	4.98E-05	8.76E-06
Manganese	3.80E-04	AP42; Table 1.4-4; 7/98.	3.73E-07	YES	1.02E-03	2.15E-04	4.16E-07	1.82E-06	3.78E-05	6.66E-06
Mercury	2.60E-04	AP42; Table 1.4-4; 7/98.	2.55E-07	YES	6.95E-04	1.47E-04	2.84E-07	1.25E-06	2.59E-05	4.56E-06
Molybdenum	1.10E-03	AP42; Table 1.4-4; 7/98.	1.08E-06	NO	2.94E-03	6.22E-04	1.20E-06	5.27E-06	1.10E-04	1.93E-05
Nickel	2.10E-03	AP42; Table 1.4-4; 7/98.	2.06E-06	YES	5.61E-03	1.19E-03	2.30E-06	1.01E-05	2.09E-04	3.68E-05
Selenium	<2.4E-05	AP42; Table 1.4-4; 7/98.	<2.35E-08	YES	6.41E-05	1.36E-05	2.63E-08	1.15E-07	2.39E-06	4.21E-07

FLARE HAP EMISSIONS CALCULATIONS*		
Flare	**MMBtu/hr****	
HP Ground Flares / Short-Term Max	2,725	Maximum expected short term rates based on preliminary vendor data assocated with various potential scenarios (e.g., a cold start-up). Includes 1.0 MM Btu/hr of pilot gas at all times and sweep gas.
HP Ground Flares / Annual Average	132	Represents reasonably anticipated maintenance events, 1 start up and 1 shutdown, sweep gas, and 1.0 MMBtu/hr pilot gas
HP Elevated Flare / Normal Ops	1	Represents 1.0 MMBtu/hr of pilot gas
MP Ground Flare / Normal Ops	4	Based on 1 start up and 1 shutdown with anticipated flaring of 225 MT of ethane/event and includes sweep gas and 1.0 MM Btu/hr pilot gas
MP Ground Flare / Short-Term Max	102	Based on flaring 2.0 MT/hr of ethane which is maximum anticipate rate from various SU/SD modes and includes sweep gas and 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	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 Average (tpy)
Vanadium	2.30E-03	AP42; Table 1.4-4; 7/98.	2.25E-06	NO	6.14E-03	1.30E-03	2.52E-06	1.10E-05	2.29E-04	4.03E-05
Zinc	2.90E-02	AP42; Table 1.4-4; 7/98.	2.84E-05	NO	7.75E-02	1.64E-02	3.17E-05	1.39E-04	2.89E-03	5.08E-04
Total §112 HAPs					**<5.04E+00**	**<1.07E+00**	**<2.07E-03**	**<9.05E-03**	**<1.88E-01**	**<3.31E-02**

* Emissions from the combustion of process gases based on natural gas combustion emission factors.

** Heat input includes contr bution from H2 for conservative estimate.

Table 13. Speciated Low Pressure Thermal Incinerator Emissions

LPTI HAP EMISSIONS CALCULATIONS*										
Potential Heat Input (HHV)		107	MMBtu/hr Preliminary design basis							
Max Short Term Heat Input (HHV)		250	MM Btu/hr based on 10tph capcity 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**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**
1,3-Butadiene	N/A			YES			3.74E-05	1.64E-04	3.74E-05	1.64E-04
2-Methylnaphthalene	2.40E-05	AP42; Table 1.4-3; 7/98.	2.35E-08	YES	5.88E-06	1.10E-05			5.88E-06	1.10E-05
3-Methylchloranthrene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.41E-07	8.25E-07			4.41E-07	8.25E-07
7,12-Dimethylbenz(a)anthracene	<1.6E-05	AP42; Table 1.4-3; 7/98.	<1.57E-08	YES	3.92E-06	7.33E-06			3.92E-06	7.33E-06
Acenaphthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.41E-07	8.25E-07			4.41E-07	8.25E-07
Anthracene	<2.4E-06	AP42; Table 1.4-3; 7/98.	<2.35E-09	YES	5.88E-07	1.10E-06			5.88E-07	1.10E-06
Benzo(a)anthracene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.41E-07	8.25E-07			4.41E-07	8.25E-07
Benzene	2.10E-03	AP42; Table 1.4-3; 7/98.	2.06E-06	YES	5.15E-04	9.62E-04	1.97E-03	8.63E-03	2.48E-03	9.59E-03
Benzo(a)pyrene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	2.94E-07	5.50E-07			2.94E-07	5.50E-07
Benzo(b)fluoranthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.41E-07	8.25E-07			4.41E-07	8.25E-07
Benzo(g,h,i)perylene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	2.94E-07	5.50E-07			2.94E-07	5.50E-07

LPTI HAP EMISSIONS CALCULATIONS*		
Potential Heat Input (HHV)	107	MMBtu/hr Preliminary design basis
Max Short Term Heat Input (HHV)	250	MM Btu/hr based on 10tph capcity 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**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**
Benzo(k)fluoranthene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.41E-07	8.25E-07			4.41E-07	8.25E-07
Butane	2.10E+00	AP42; Table 1.4-3; 7/98.	2.06E-03	NO	5.15E-01	9.62E-01			5.15E-01	9.62E-01
Chrysene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.41E-07	8.25E-07			4.41E-07	8.25E-07
Dibenzo(a,h)anthracene	<1.2E-06	AP42; Table 1.4-3; 7/98.	<1.18E-09	YES	2.94E-07	5.50E-07			2.94E-07	5.50E-07
Dichlorobenzene	1.20E-03	AP42; Table 1.4-3; 7/98.	1.18E-06	YES	2.94E-04	5.50E-04			2.94E-04	5.50E-04
Ethane	3.10E+00	AP42; Table 1.4-3; 7/98.	3.04E-03	NO	7.60E-01	1.42E+00	3.11E-06	1.36E-05	7.60E-01	1.42E+00
Ethylbenzene	N/A			YES			8.64E-05	3.78E-04	8.64E-05	3.78E-04
Fluoranthene	3.00E-06	AP42; Table 1.4-3; 7/98.	2.94E-09	YES	7.35E-07	1.37E-06			7.35E-07	1.37E-06
Fluorene	2.80E-06	AP42; Table 1.4-3; 7/98.	2.75E-09	YES	6.86E-07	1.28E-06			6.86E-07	1.28E-06
Formaldehyde	7.50E-02	AP42; Table 1.4-3; 7/98.	7.35E-05	YES	1.84E-02	3.44E-02			1.84E-02	3.44E-02
Hexane	1.80E+00	AP42; Table 1.4-3; 7/98.	1.76E-03	YES	4.41E-01	8.25E-01			4.41E-01	8.25E-01
Indeno(1,2,3-cd)pyrene	<1.8E-06	AP42; Table 1.4-3; 7/98.	<1.76E-09	YES	4.41E-07	8.25E-07			4.41E-07	8.25E-07

LPTI HAP EMISSIONS CALCULATIONS*		
Potential Heat Input (HHV)	107	MMBtu/hr Preliminary design basis
Max Short Term Heat Input (HHV)	250	MM Btu/hr based on 10tph capcity 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**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**
Naphthalene	6.10E-04	AP42; Table 1.4-3; 7/98.	5.98E-07	YES	1.50E-04	2.80E-04	1.74E-03	7.63E-03	1.89E-03	7.91E-03
Pentane	2.60E+00	AP42; Table 1.4-3; 7/98.	2.55E-03	NO	6.37E-01	1.19E+00			6.37E-01	1.19E+00
Phenanthrene	1.70E-05	AP42; Table 1.4-3; 7/98.	1.67E-08	YES	4.17E-06	7.79E-06			4.17E-06	7.79E-06
Propane	1.60E+00	AP42; Table 1.4-3; 7/98.	1.57E-03	NO	3.92E-01	7.33E-01			3.92E-01	7.33E-01
Pyrene	5.00E-06	AP42; Table 1.4-3; 7/98.	4.90E-09	YES	1.23E-06	2.29E-06			1.23E-06	2.29E-06
Styrene	N/A			YES			4.91E-04	2.15E-03	4.91E-04	2.15E-03
Toluene	3.40E-03	AP42; Table 1.4-3; 7/98.	3.33E-06	YES	8.33E-04	1.56E-03	1.02E-03	4.46E-03	1.85E-03	6.02E-03
Xylenes	N/A			YES			3.27E-05	1.43E-04	3.27E-05	1.43E-04
Arsenic	2.00E-04	AP42; Table 1.4-4; 7/98.	1.96E-07	YES	4.90E-05	9.16E-05			4.90E-05	9.16E-05
Barium	4.40E-03	AP42; Table 1.4-4; 7/98.	4.31E-06	NO	1.08E-03	2.02E-03			1.08E-03	2.02E-03
Beryllium	<1.2E-05	AP42; Table 1.4-4; 7/98.	<1.18E-08	YES	2.94E-06	5.50E-06			2.94E-06	5.50E-06
Cadmium	1.10E-03	AP42; Table 1.4-4; 7/98.	1.08E-06	YES	2.70E-04	5.04E-04			2.70E-04	5.04E-04

LPTI HAP EMISSIONS CALCULATIONS*		
Potential Heat Input (HHV)	107	MMBtu/hr Preliminary design basis
Max Short Term Heat Input (HHV)	250	MM Btu/hr based on 10tph capcity 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**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**
Chromium	1.40E-03	AP42; Table 1.4-4; 7/98.	1.37E-06	YES	3.43E-04	6.41E-04			3.43E-04	6.41E-04
Cobalt	8.40E-05	AP42; Table 1.4-4; 7/98.	8.24E-08	YES	2.06E-05	3.85E-05			2.06E-05	3.85E-05
Copper	8.50E-04	AP42; Table 1.4-4; 7/98.	8.33E-07	NO	2.08E-04	3.89E-04			2.08E-04	3.89E-04
Lead	5.00E-04	AP42; Table 1.4-2; 7/98	4.90E-07	YES	1.23E-04	2.29E-04			1.23E-04	2.29E-04
Manganese	3.80E-04	AP42; Table 1.4-4; 7/98.	3.73E-07	YES	9.31E-05	1.74E-04			9.31E-05	1.74E-04
Mercury	2.60E-04	AP42; Table 1.4-4; 7/98.	2.55E-07	YES	6.37E-05	1.19E-04			6.37E-05	1.19E-04
Molybdenum	1.10E-03	AP42; Table 1.4-4; 7/98.	1.08E-06	NO	2.70E-04	5.04E-04			2.70E-04	5.04E-04
Nickel	2.10E-03	AP42; Table 1.4-4; 7/98.	2.06E-06	YES	5.15E-04	9.62E-04			5.15E-04	9.62E-04
Selenium	<2.4E-05	AP42; Table 1.4-4; 7/98.	<2.35E-08	YES	5.88E-06	1.10E-05			5.88E-06	1.10E-05
Vanadium	2.30E-03	AP42; Table 1.4-4; 7/98.	2.25E-06	NO	5.64E-04	1.05E-03			5.64E-04	1.05E-03
Zinc	2.90E-02	AP42; Table 1.4-4; 7/98.	2.84E-05	NO	7.11E-03	1.33E-02			7.11E-03	1.33E-02
Total §112 HAPs					**<4.63E-01**	**<8.65E-01**	**<5.38E-03**	**<2.36E-02**	**<4.68E-01**	**<8.89E-01**

LPTI HAP EMISSIONS CALCULATIONS*										
Potential Heat Input (HHV)		107	MMBtu/hr Preliminary design basis							
Max Short Term Heat Input (HHV)		250	MM Btu/hr based on 10tph capcity 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**	**EF (lb/MMBtu)**	**§112 HAP?**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**	**Short Term Max (lb/hr)**	**Annual Average (tpy)**

* Emissions from the combustion of process gases based on natural gas combustion emission factors.
** Heat input includes contribution from H2 for conservative estimate.

Table 14. Speciated Spent Caustic Incinerator Emissions

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

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)**
Cobalt	8.40E-05	1.4-4	8.24E-08	YES	8.83E-07	8.83E-07			8.83E-07	8.83E-07
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 15. Speciated Equipment Leak Emissions Estimates

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

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	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
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

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	Naphthalene	67	16	0.004
6	Valves	Gas/Vapor	0.0132	97	Toluene	67	13.09	0.003
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

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	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
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

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	Toluene	2	13.09	0.001
11	Pumps	Light Liquid	0.0439	93	Styrene	2	6.31	0.000
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

Table 16. Key Code for Ethylene Cracking Unit Fugitive 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	[redacted]

Redacted information considered trade secret and/or confidential proprietary information as defined in the Pennsylvania Right to Know Law

Table 17. Speciated OSBL Fugitive Emissions by Location

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

OSBL Fugitives Area Designation	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equipment Count	Composition (wt %)	Emissions (lb/hr)
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
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	39	4.63E-04
2	Valves	Gas /Vapor	0.0132	97	Benzene	3	12	1.43E-04
2	Valves	Gas /Vapor	0.0132	97	Toluene	3	1	1.19E-05
2	Valves	Light Liquid	0.0089	97	1,3-Butadiene	27	39	2.81E-03
2	Valves	Light Liquid	0.0089	97	Benzene	27	12	8.65E-04
2	Valves	Light Liquid	0.0089	97	Toluene	27	1	7.21E-05
2	Connectors	Gas /Vapor	0.0039	97	1,3-Butadiene	9	39	4.11E-04
2	Connectors	Gas /Vapor	0.0039	97	Benzene	9	12	1.26E-04
2	Connectors	Gas /Vapor	0.0039	97	Toluene	9	1	1.05E-05
2	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	81	39	4.74E-04
2	Connectors	Light Liquid	0.0005	97	Benzene	81	12	1.46E-04
2	Connectors	Light Liquid	0.0005	97	Toluene	81	1	1.22E-05
2	Pumps	Light Liquid	0.0439	93	1,3-Butadiene	2	39	2.40E-03
2	Pumps	Light Liquid	0.0439	93	Benzene	2	12	7.38E-04
2	Pumps	Light Liquid	0.0439	93	Toluene	2	1	6.15E-05
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

OSBL Fugitives Area Designation	Equipment	Service	SOCMI Emission Factor (lb/hr/source)	LAER Control Efficiency (%)	Compound	Equipment Count	Composition (wt %)	Emissions (lb/hr)
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	4	0.138	1.70E-05
3	Pumps	Light Liquid	0.0439	93	Xylenes	4	0.138	1.70E-05
3	Pumps	Light Liquid	0.0439	93	Styrene	4	0.0753	9.26E-06
3	Pumps	Light Liquid	0.0439	93	Biphenyl	4	0.0437	5.37E-06
4	Valves	Gas /Vapor	0.0132	97	1,3-Butadiene	32	39	4.94E-03
4	Valves	Gas /Vapor	0.0132	97	Benzene	32	12	1.52E-03
4	Valves	Gas /Vapor	0.0132	97	Toluene	32	1	1.27E-04
4	Valves	Light Liquid	0.0089	97	1,3-Butadiene	18	39	1.87E-03
4	Valves	Light Liquid	0.0089	97	Benzene	18	12	5.77E-04
4	Valves	Light Liquid	0.0089	97	Toluene	18	1	4.81E-05
4	Connectors	Gas /Vapor	0.0039	97	1,3-Butadiene	108	39	4.93E-03
4	Connectors	Gas /Vapor	0.0039	97	Benzene	108	12	1.52E-03
4	Connectors	Gas /Vapor	0.0039	97	Toluene	108	1	1.26E-04
4	Connectors	Light Liquid	0.0005	97	1,3-Butadiene	54	39	3.16E-04
4	Connectors	Light Liquid	0.0005	97	Benzene	54	12	9.72E-05
4	Connectors	Light Liquid	0.0005	97	Toluene	54	1	8.10E-06

Table 18. Key Code for OSBL Fugitives Emission Locations

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

Table 19. COPC Fugitive Emissions from Polyethylene Manufacturing Units

POLYETHYLENE UNITS 1 & 2							
Equipment	**Service**	**SOCMI Average Emissions Factor lb/hr/src**	**LAER Control Efficiency %**	**Component Count**	**Hexane Composition[1] (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.

ATTACHMENT B

DISPERSION MODELING ANALYSIS FOR THE INHALATION RISK ASSESSMENT FOR THE SHELL POLYMERS MONACA SITE BEAVER COUNTY, PENNSYLVANIA

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Initial Submittal January 2015
Submittal Update February 2020

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1.0 INTRODUCTION

This document presents the procedures used in the dispersion modeling analysis conducted to calculate the ground level concentrations that were employed in the inhalation risk assessment for the Shell Polymers Monaca Site ("Shell") in Beaver County, Pennsylvania. An initial analysis was submitted to the Pennsylvania Department of Environmental Protection ("PADEP") in January of 2015. At PADEP's request, revisions to the 2015 analysis have been made to account for updates to the facility configuration and emissions as well as updates to the EPA-approved dispersion models, supporting software, and modeling procedures. The assessment evaluated the potential cancer and non- cancer inhalation risks from the compounds of potential concern ("COPC") emitted from the facility. The air quality dispersion modeling conforms with the modeling procedures outlined in the Environmental Protection Agency's Guideline on Air Quality Models[1] (Guideline) and associated EPA modeling policy and guidance.

2.0 PROJECT DESCRIPTION

The Shell facility is designed to produce approximately 1,500,000 metric tons per year of ethylene and 1,600,000 metric tons per year of polyethylene. From an air emissions modeling perspective, the facility comprises seven ethane cracking furnaces, a number of natural gas-fired and diesel-fired engines to provide emergency power and to power fire water pumps, flares, cooling towers, catalyst activation vent, fugitive emissions from equipment leaks and liquid storage tanks, combustion turbines with heat recovery systems to provide steam and electric power to the facility and electric power for sale.

3.0 SITE DESCRIPTION

The Shell facility occupies approximately 400 acres on the property previously owned by the Horsehead Corporation. The site is located adjacent to the Ohio River in the Borough of Monaca, Pennsylvania in Beaver County. The approximate Universal Transverse Mercator ("UTM") coordinates of the facility are 556,129 meters east and 4,502,450 meters north (UTM Zone 17, NAD 83). Figure 1 shows the general location of the facility. Figure 2 shows the specific facility location on a 7.5-minute U.S. Geological Survey (USGS) topographic map.

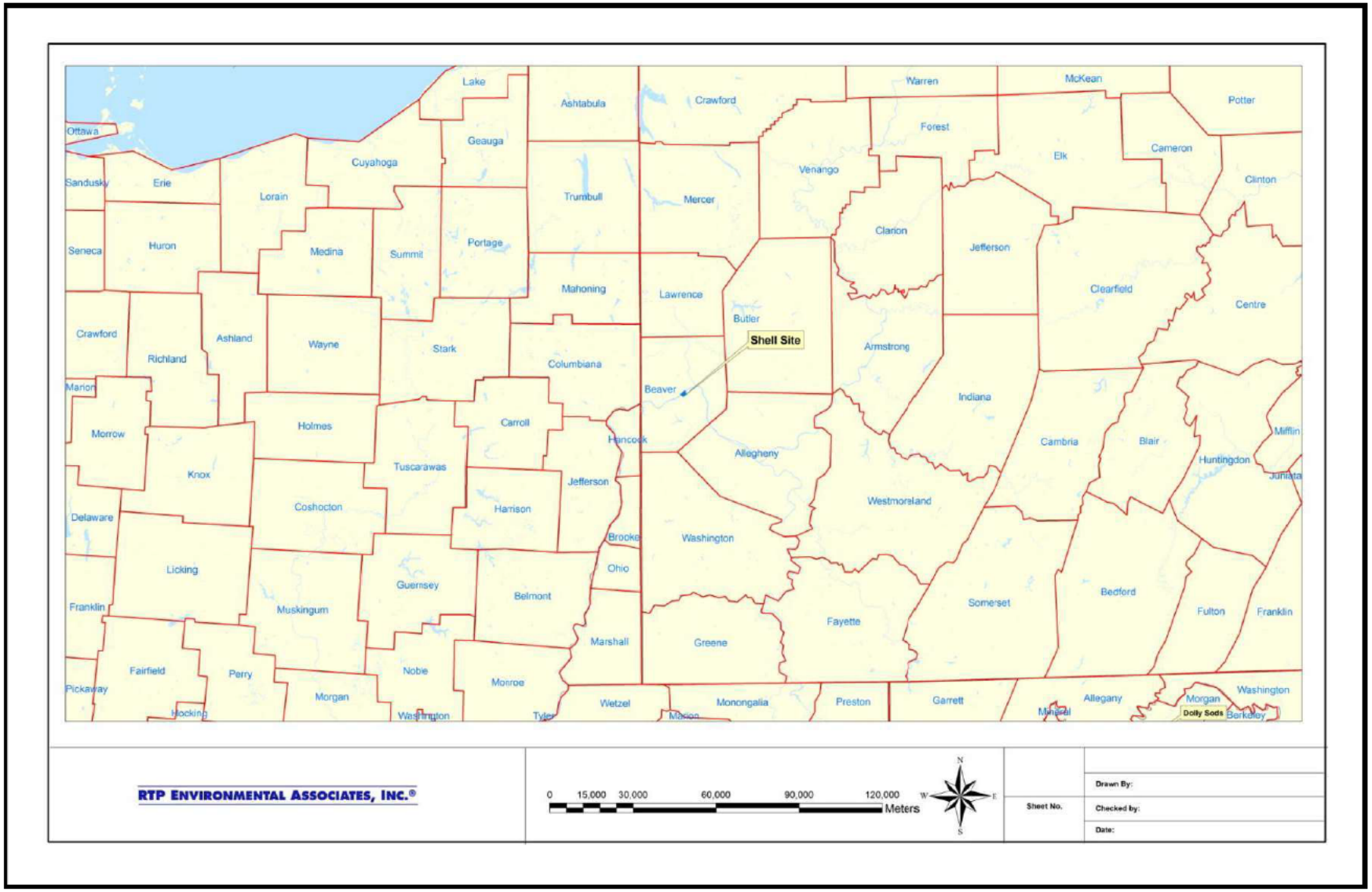

Figure 1. General Location of Shell Facility

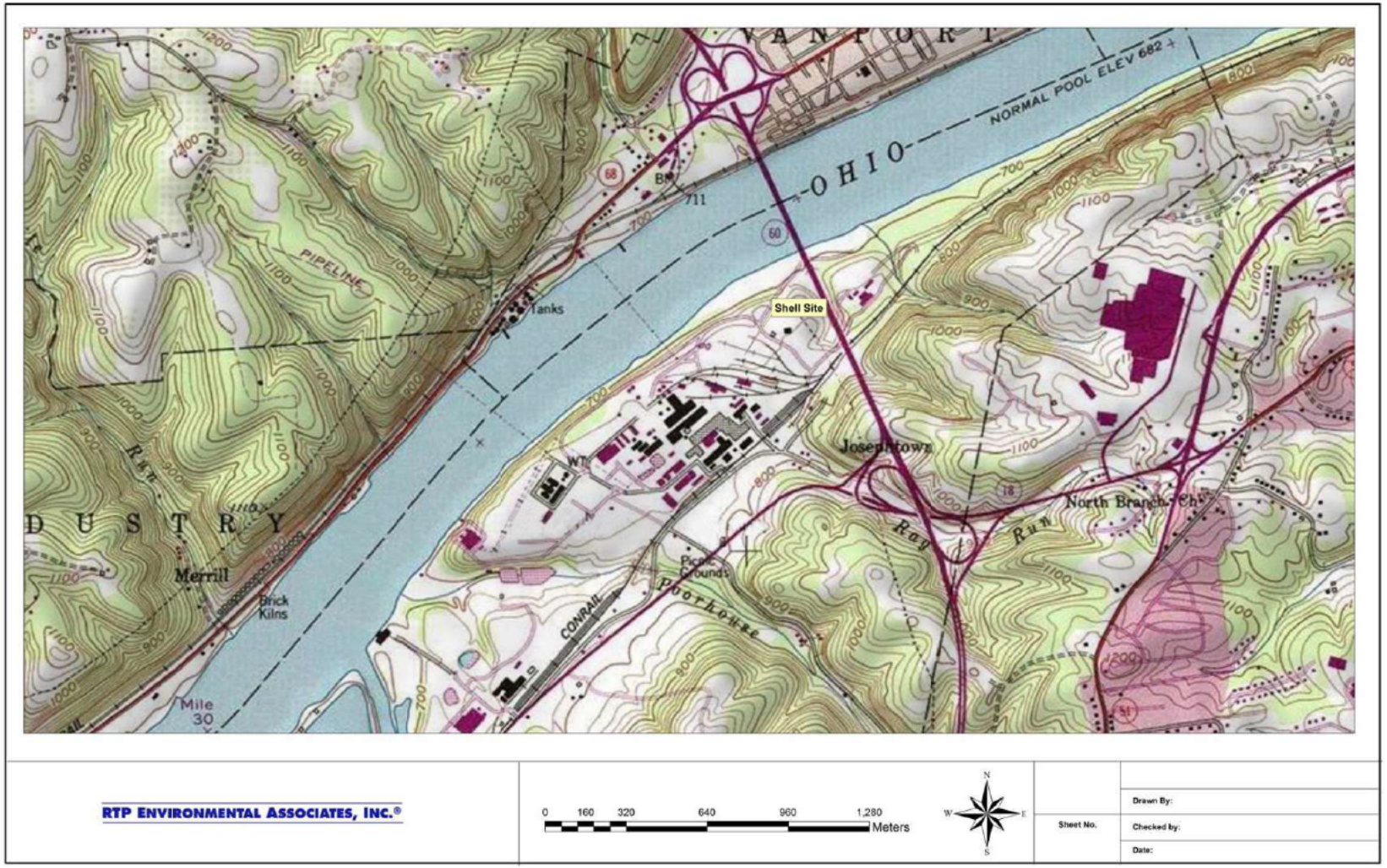

Figure 2. Specific Location of the Shell Facility

4.0 MODEL SELECTION AND MODEL INPUT

4.1 Model Selection

The latest version of the AMS/EPA Regulatory Model (AERMOD, Version 19191) was used to conduct the dispersion modeling analysis. AERMOD is a Gaussian plume dispersion model that is based on planetary boundary layer principals for characterizing atmospheric stability. The model evaluates the non-Gaussian vertical behavior of plumes during convective conditions with the probability density function and the superposition of several Gaussian plumes. AERMOD is a modeling system with three components: AERMAP is the terrain preprocessor program, AERMET is the meteorological data preprocessor and AERMOD includes the dispersion modeling algorithms.

AERMOD is the most appropriate model for calculating ambient concentrations near the Shell facility, based on the model's ability to incorporate multiple sources and source types. The model can also account for convective updrafts and downdrafts and meteorological data throughout the plume depth. The model also provides parameters required for use with up-to-date planetary boundary layer parameterization. The model also has the ability to incorporate building wake effects and to calculate concentrations within the cavity recirculation zone. All model options were selected as recommended in the EPA Guideline on Air Quality Models.

Providence's BEEST Graphical User Interface ("GUI") was used to run AERMOD. The GUI uses an altered version of the AERMOD code to allow for flexibility in the file naming convention. The dispersion algorithms of AERMOD were not altered. A model equivalency evaluation was conducted pursuant to Section 3.1 of 40 CFR 51, Appendix W and submitted to the PADEP as part of the initial modeling demonstration.

4.2 Model Control Options and Land Use

AERMOD was run in the regulatory default mode for all pollutants. The default rural dispersion coefficients in the model were used. This is supported by the Land Use Procedure consistent with subsection 7.2.3(c) of the Guideline and Section 5.1 of the AERMOD Implementation Guide.

The USGS 2006 National Land Cover Data ("NLCD") within 3km of the site were converted to Auer 1978 land use types, using recommendations from the PADEP, and evaluated.[2] It was determined that the land use in the vicinity of the Shell facility is predominantly rural (less than 15% of the area is classified as urban, Figure 3). The potential for urban heat island affects, which are regional in character, was considered and determined not to be of concern.

4.3 Source Data

Source Characterization

Point Sources

Most emission sources at the Shell site vent to stacks with a well defined opening. These sources were modeled as point sources in AERMOD. The model source characteristics for the point sources are presented in Table 1. The modeled emission rates for each source can be found in Table 2 of Attachment A. The location of each point source is shown in Figure 4.

Fugitive Emissions from Tanks and Equipment Leaks

Fugitive emissions from tanks and equipment leaks were modeled as volume sources. The emissions rate for a given COPC was determined by applying process area component speciation data to the VOC emissions rate associated with the equipment components contained within known process areas. The initial dispersion coefficients (sigma y and sigma z) were calculated based upon the dimensions of the area of release and the equations contained in Table 3-1 of the AERMOD User's Guide.

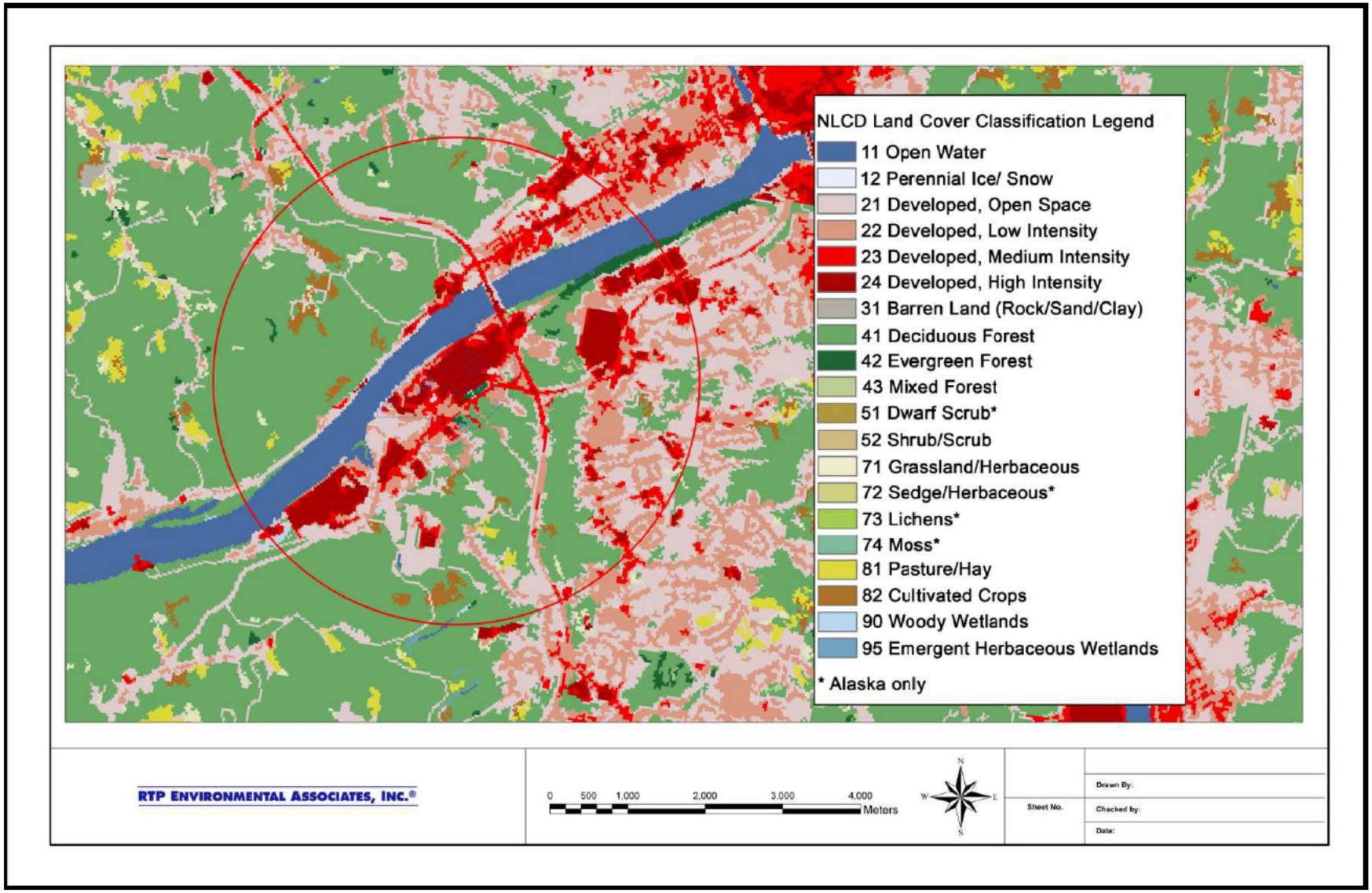

Figure 3. Land Use within Three Kilometers

Table 1. Point Source Input Parameters

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)
EC#1	Ethane Cracking Furnace #1	555502.11	4502199.00	795.0	275.0	348.8	29.9	8.5
EC#2	Ethane Cracking Furnace #2	555512.76	4502186.65	795.0	275.0	348.8	29.9	8.5
EC#3	Ethane Cracking Furnace #3	555534.48	4502160.24	795.0	275.0	253.6	40.2	8.5
EC#4	Ethane Cracking Furnace #4	555545.98	4502148.32	795.0	275.0	253.6	40.2	8.5
EC#5	Ethane Cracking Furnace #5	555561.73	4502131.29	795.0	275.0	253.6	40.2	8.5
EC#6	Ethane Cracking Furnace #6	555572.81	4502118.51	795.0	275.0	253.6	40.2	8.5
EC#7	Ethane Cracking Furnace #7	555590.27	4502098.92	795.0	275.0	253.6	40.2	8.5
CT1	Combustion Turbine 1	555945.76	4502058.51	795.0	213.0	311.0	79.0	10.0
CT2	Combustion Turbine 2	555991.73	4502098.68	795.0	213.0	311.0	79.0	10.0
CT3	Combustion Turbine 3	556038.01	4502138.02	795.0	213.0	311.0	79.0	10.0
GFLARE1	Ground Flare 1	555472.50	4502011.25	780.0	206.9	1832.0	65.62	21.10
GFLARE2	Ground Flare 2	555421.71	4502085.72	780.0	206.9	1832.0	65.62	21.10
HPFLARE	HP Elevated Flare	555385.33	4502007.13	780.0	246.0	1832.0	65.62	4.14
INCIN	LP Incinerator	556066.31	4502619.14	795.0	250.0	1600.0	186.2	4.5
COI	Caustic Oxidizer	555256.39	4502075.62	714.0	200.0	1600.0	45.0	2.0
TALC	Rail to Truck Talc Transfer	556541.50	4502557.60	795.0	12.0	-460.0	0.03	0.6
COOLTWR1	Cooling Tower 1	555792.73	4502459.17	795.0	71.0	71.0	20.0	45.0
COOLTWR2	Cooling Tower 2	555804.58	4502468.80	795.0	71.0	71.0	20.0	52.0
COOLTWR3	Cooling Tower 3	555815.69	4502481.38	795.0	71.0	71.0	20.0	52.0
COOLTWR4	Cooling Tower 4	555828.28	4502492.49	795.0	71.0	71.0	20.0	52.0
COOLTWR5	Cooling Tower 5	555841.61	4502502.12	795.0	71.0	71.0	20.0	52.0
COOLTWR6	Cooling Tower 6	555853.33	4502512.89	795.0	71.0	71.0	20.0	52.0
COOLTWR7	Cooling Tower 7	555866.07	4502523.70	795.0	71.0	71.0	20.0	52.0
COOLTWR8	Cooling Tower 8	555878.57	4502535.24	795.0	71.0	71.0	20.0	52.0
COOLTWR9	Cooling Tower 9	555891.07	4502545.57	795.0	71.0	71.0	20.0	52.0
COLTWR10	Cooling Tower 10	555903.80	4502556.38	795.0	71.0	71.0	20.0	52.0
COLTWR11	Cooling Tower 11	555916.06	4502567.20	795.0	71.0	71.0	20.0	52.0
COLTWR12	Cooling Tower 12	555927.83	4502578.01	795.0	71.0	71.0	20.0	52.0
COLTWR13	Cooling Tower 13	555940.57	4502588.83	795.0	71.0	71.0	20.0	52.0
COLTWR14	Cooling Tower 14	555964.12	4502609.50	795.0	71.0	71.0	20.0	52.0

Table 1. Point Source Input Parameters

Source ID	Source Description	Easting (X) (m)	Northing (Y) (m)	Base Elevation (ft)	Stack Height (ft)	Temperature (°F)	Exit Velocity (ft/sec)	Stack Diameter (ft)
COLTWR15	Cooling Tower 15	555975.66	4502619.59	795.0	71.0	71.0	20.0	52.0
COLTWR16	Cooling Tower 16	555986.47	4502629.68	795.0	71.0	71.0	20.0	52.0
FWP1	Fire Water Pump 1	556126.22	4501713.44	850.0	32.7	787.0	121.0	1.0
FWP2	Fire Water Pump 2	556118.30	4501706.53	850.0	32.7	787.0	121.0	1.0
GEN1	Emerg Gen - Parking Garage	556228.46	4501766.08	850.0	5.0	778.0	225.8	0.3
GEN2	Emerg Gen - Telecom Hut	556275.53	4501732.18	850.0	6.0	914.0	139.8	0.2
GEN3	Emerg Gen - Lift Station	556186.33	4502105.90	795.0	6.0	1250.0	297.4	0.3
GEN4	Emerg Gen - Lift Station	555907.33	4502035.53	795.0	6.0	1270.0	122.2	0.2
GEN5	Emerg Gen - PGT Visitor	555485.98	4501269.42	784.0	6.0	1300.0	199.9	0.3
GEN6	Emerg Gen - PGT BGTC	555476.79	4501156.43	795.0	4.0	1300.0	249.9	0.3
CAH1	Catalyst Heater 1	556294.39	4502493.32	795.0	150.0	392.0	35.0	1.3
CAH2	Catalyst Heater 2	556289.38	4502488.95	795.0	150.0	392.0	35.0	1.3
CAA	Catalyst Activator A Filter (External)	556151.35	4502347.38	795.0	78.3	392.0	23.6	0.7
CAB	Catalyst Activator B Filter (External)	556158.56	4502339.12	795.0	78.3	392.0	23.6	0.7
AUSA	Additive Unloading Station A	556183.65	4502329.83	795.0	115.0	59.0	36.9	0.5
AUSB	Additive Unloading Station B	556183.42	4502329.63	795.0	115.0	59.0	36.9	0.5
AUSC	Additive Unloading Station C	556183.24	4502329.47	795.0	115.0	59.0	36.9	0.5
AUSD	Additive Unloading Station D	556183.01	4502329.27	795.0	115.0	59.0	36.9	0.5
FIBC	FIBC Compactor	556182.66	4502308.22	795.0	117.5	59.0	105.5	0.5
AFEEDA	Additive Feeder A	556192.58	4502325.85	795.0	57.5	59.0	4.0	0.5
AFEEDB	Additive Feeder B	556192.40	4502326.06	795.0	57.5	59.0	4.0	0.5
AFEEDC	Additive Feeder C	556192.24	4502326.25	795.0	57.5	59.0	4.0	0.5
AFEEDD	Additive Feeder D	556192.06	4502326.45	795.0	57.5	59.0	4.0	0.5
EXTRUD	Extruder Vent	556194.85	4502323.26	795.0	84.0	59.0	109.2	0.3
PELTDRY	Pellet Dryer Vent	556189.76	4502305.88	795.0	140.0	176.0	63.9	2.5
VACLEAN	Vacuum Cleaning System	556210.64	4502312.58	795.0	78.0	59.0	80.4	0.3

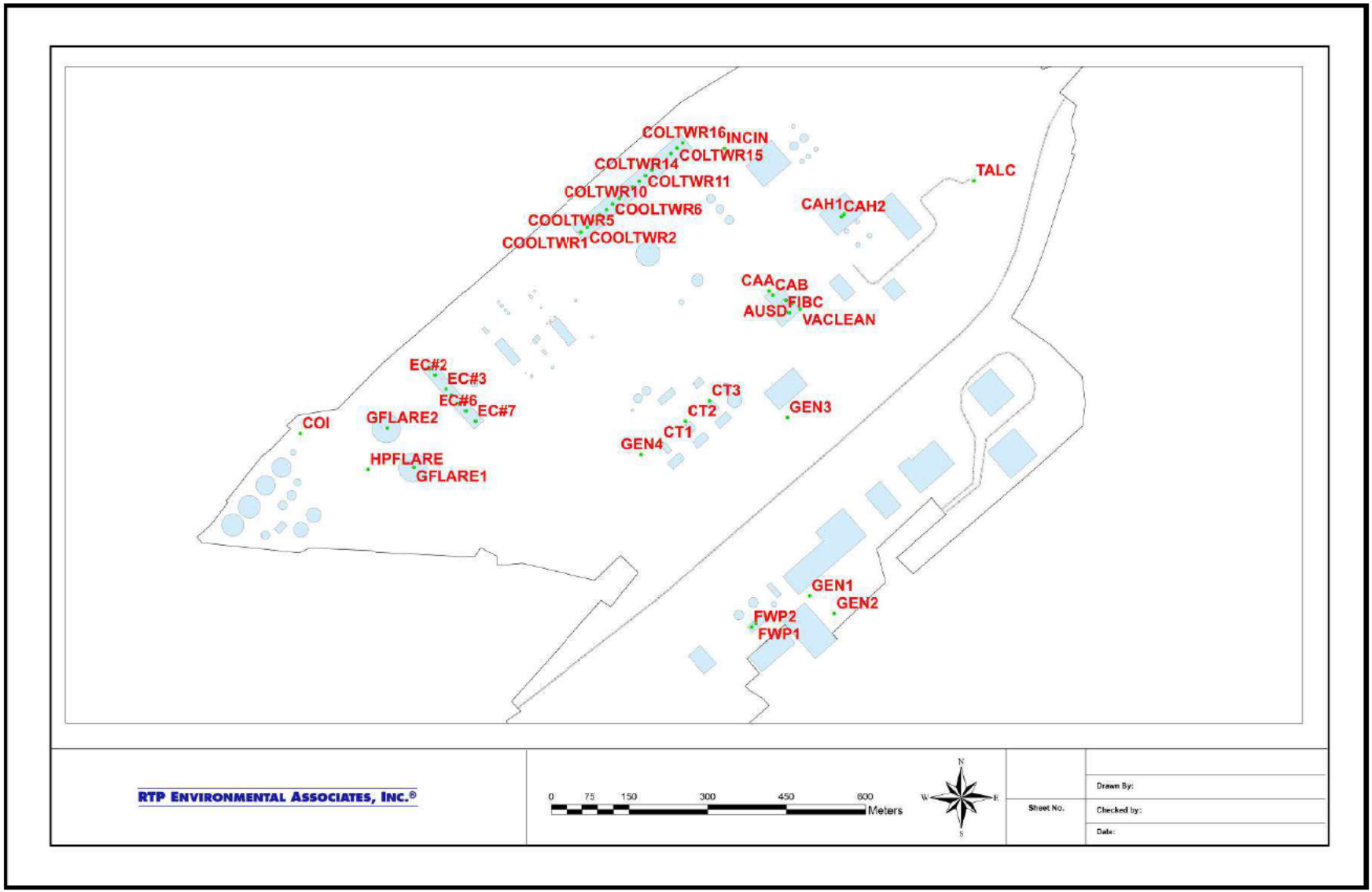

Figure 4. Modeled Point Source Locations

Flares

There is an elevated flare, ground flares and multipoint ground flare. The elevated flare is only operated during periods of malfunction. Only the emissions associated with the pilots were modeled for this flare. The ground flares are used for startup or shutdown (i.e., non-emergency flaring) and to control other VOC emissions and were modeled using the SCREEN3 procedures developed by the EPA, as described by the Ohio EPA[3]. The effective stack height (H, in meters) was computed as a function of heat release rate according to the following equation, where Q is the heat release rate of the flare in MMBtu/hr:

$$H_{equivalent} = H_{actual} + 0.944(Q)^{0.478}$$

The effective flare diameter (d, in meters) was computed as a function of heat release rate according to the following equation, where Q is the heat release rate of the flare in MMBtu/hr:

$$d_{equivalent} = 0.1755(Q)^{0.5}$$

An exit temperature of 1273 K and velocity of 20 m/sec was assumed.

Multipoint Ground Flare

There is also a multipoint ground flare surrounded by a 60 ft tall wind screen/fence at the facility. The multipoint ground flare was modeled as volume source. The release height was calculated as the effective stack height. The effective stack height was calculated as the top of the wind fence (60') plus the plume rise of the multipoint ground flare (calculated as a function of the flare heat release based upon the SCREEN3 proceedures described above). The initial dispersion coefficients sigma y and sigma z were calculated based upon the dimensions of the area of release and the equations contained in Table 3-1 of the AERMOD User's Guide.

The volume source parameter calculations can be found in Table 2. The modeled emission rates for each source are presented in Table 2 of Attachment A. The location of each modeled volume source is shown in Figure 5. All source locations were based upon a NAD83, UTM Zone 17 projection. Source elevations were determined from facility survey data, not from AERMAP.

Table 2. Shell Franklin Non-Road Volume Source Parameter Calculation

		Source Dimensions					Initial Dispersion Coefficients		
Model ID	Source Description	Length (ft)	Width (ft)	Square Root of Area (ft)	Structure Height/Vertical Dimension (ft)	Release Height (ft)	Initial Horizontal Dimension s_Y (ft)	Initial Vertical Dimension s_Z (ft)	Reference
PEBLD	PE Blending Silos	147.6	82.0	110.0	141.0	141.0	25.58	65.6	Note 1, 2, and 3
PERC	PE Rail Loading Silos	98.4	98.4	98.4	187.0	187.0	22.88	87.0	Note 1, 2, and 3
PETK	PE Truck Loading Silos	213.2	196.8	204.8	151.0	151.0	47.64	70.2	Note 1, 2, and 3
PEU1	LDPE Vents	313.2	98.4	175.6	45.0	45.0	40.83	20.9	Note 1, 2, and 3
PEU2	LDPE Vents	213.2	164.0	187.0	145.0	145.0	43.49	67.4	Note 1, 2, and 3
PEU3	HDPE Vents	213.2	164.0	187.0	150.0	150.0	43.49	69.8	Note 1, 2, and 3
MPFLARE	Multi Point Ground Flare	250.0	150.0	193.6	60.0	87.71	45.03	16.91	Note 2, 4 and 5
ECFUG1	Ethane Cracking	492.0	78.7	196.8	140.0	70.0	45.77	65.12	Note 2, 6 and 7
ECFUG2	Fuel Gas and Regeneration System	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG3	Wash Water System	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG4	Cracked Gas Compression	425.0	425.0	425.0	82.0	41.0	98.84	38.14	Note 2, 6 and 7
ECFUG5	Caustic Wash	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG6	Gas Redistillation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG7	C2/C3 Separation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG8	C2 Hydrogenation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG9	C1/C2 Separation	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG10	Spent Caustic Treatment	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
ECFUG11	Flare Condensate	300.0	300.0	300.0	82.0	41.0	69.77	38.14	Note 2, 6 and 7
OSBLFUG1	Recovered Oil and Truck Loadout	300.0	300.0	300.0	48.0	24.0	69.77	22.33	Note 2, 6 and 7
OSBLFUG2	Rail for C3+	300.0	300.0	300.0	52.0	26.0	69.77	24.19	Note 2, 6 and 7
OSBLFUG3	Diesel Tanks	300.0	300.0	300.0	52.0	26.0	69.77	24.19	Note 2, 6 and 7
OSBLFUG4	C3+	164.0	98.4	127.0	83.0	41.5	29.54	38.60	Note 2, 6 and 7
WWTP	Waste Water Treatment Fugitives	225.0	225.0	225.0	30.0	15.0	52.33	13.95	Note 2, 6 and 7

Note 1: Release height equal to top of structure as process is aspirated and emissions will occur at the top of the structure.

Note 2: Sigma Y value calculated as the square root of the area divided by 4.3 (Table 3-1 of AERMOD Manual for single volume source).

Note 3: Sigma Z values for elevated sources on or adjacent to a building calculated as the building height divided by 2.15 (Table 3-1 of AERMOD Manual for Elevated Source on or Adjacent to Building).

Note 4. Release height of ground flare calculated based upon Ohio EPA Guidance for deriving plume rise for a flare (0.944*(98)^0.478)*3.28). The modeled height was set to the height of the wind fence of 60' plus the plume rise. The plume rise was calculated to be 27.7'. The heat release rate of flare is 98 MMBtu/hr.

Note 5. Sigma Z value for ground flare assumed equal to effective stack height (vertical dimension) divided by 4.3. Effective height calculated based upon Ohio EPA Guidance and heat release rate of 98 MMBtu/hr [60+((0.944*(98)^0.478)*3.28)].

Note 6: Sigma Z values for surface based source calculated as the vertical dimension of source divided by 2.15 (Table 3-1 of AERMOD Manual for Surface Based Source).

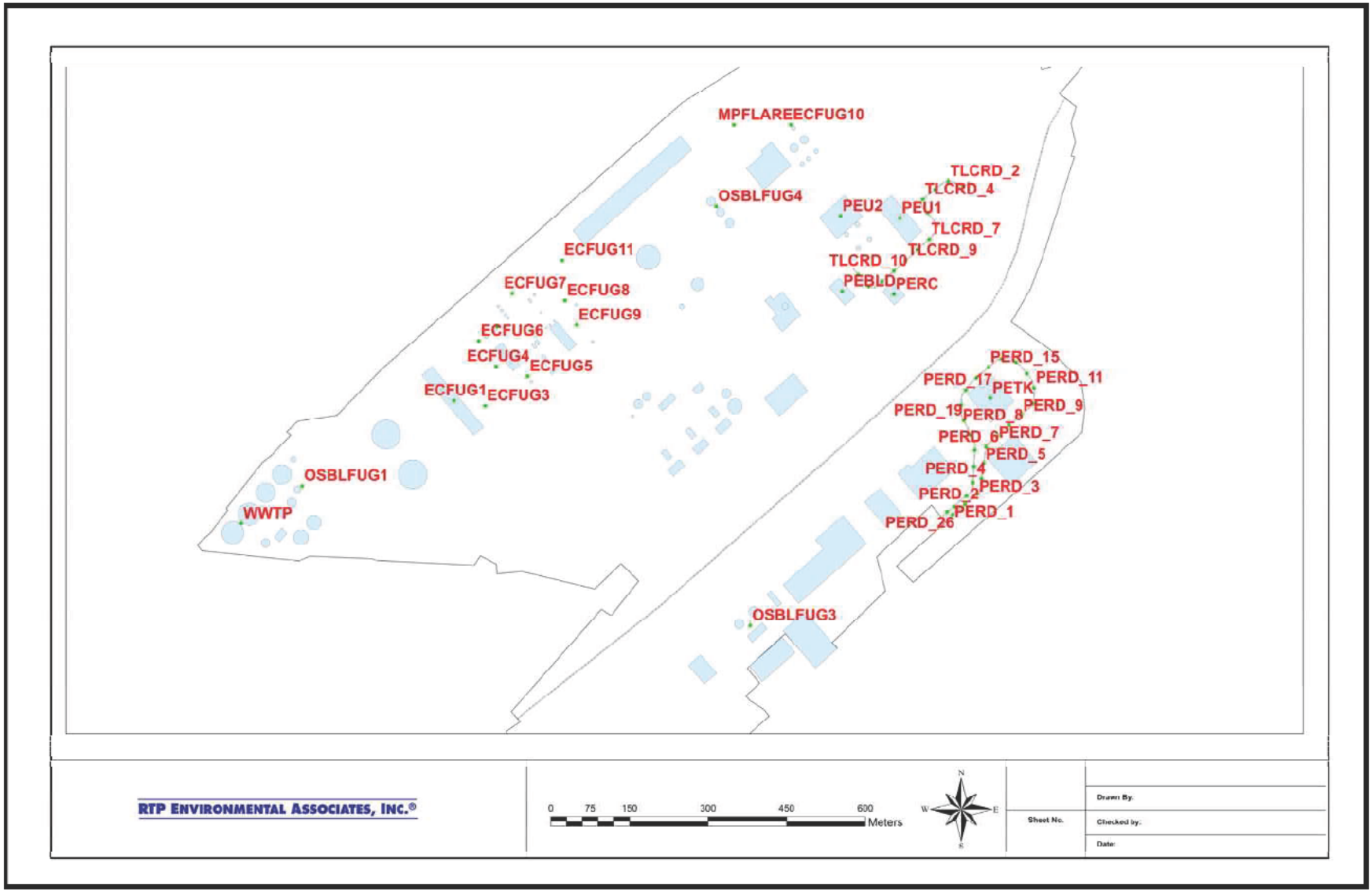

Figure 5. Modeled Volume Source Locations

Load/Operating Conditions

The combustion turbines may operate at a reduced load. Therefore, a range of load conditions was evaluated to identify the load condition which results in the worst-case impact for each averaging period of concern. Three load conditions were evaluated: 100%, 75%, and 50%. The emission rates and flow conditions associated with each load were modeled. The condition resulting in the worst-case impact was carried forward for the remainder of the analysis.

Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height evaluation was conducted to determine appropriate building dimensions to include in the model and to calculate the GEP formula stack height used to justify stack height credit for stacks to be constructed in excess of 65m. Procedures used were in accordance with those described in the EPA Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations-Revised)[4]. GEP formula stack height, as defined in 40 CFR 51, is expressed as GEP = H_b + 1.5L, where H_b is the building height and L is the lesser of the building height or maximum projected width. Building/structure locations were determined from a facility plot plan. The structure locations and heights were input to the EPA's Building Profile Input Program (BPIP-PRIME) computer program to calculate the direction-specific building dimensions needed for AERMOD. The Shell facility plot plan is shown in Figure 6. A three dimensional rendering of the facility is shown in Figure 7. All stacks were included in the AERMOD runs.

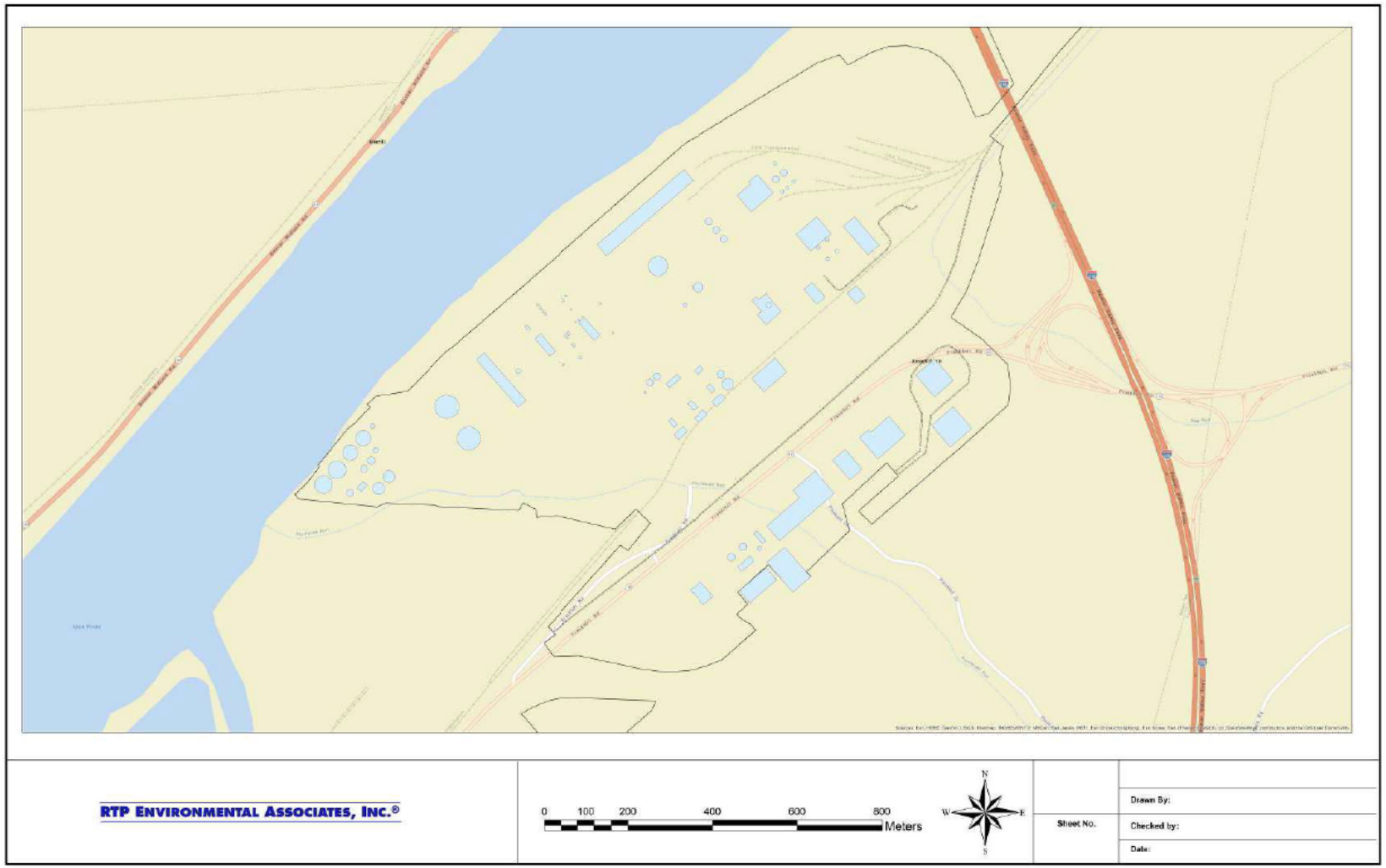

Figure 6. Shell Facility Plot Plan

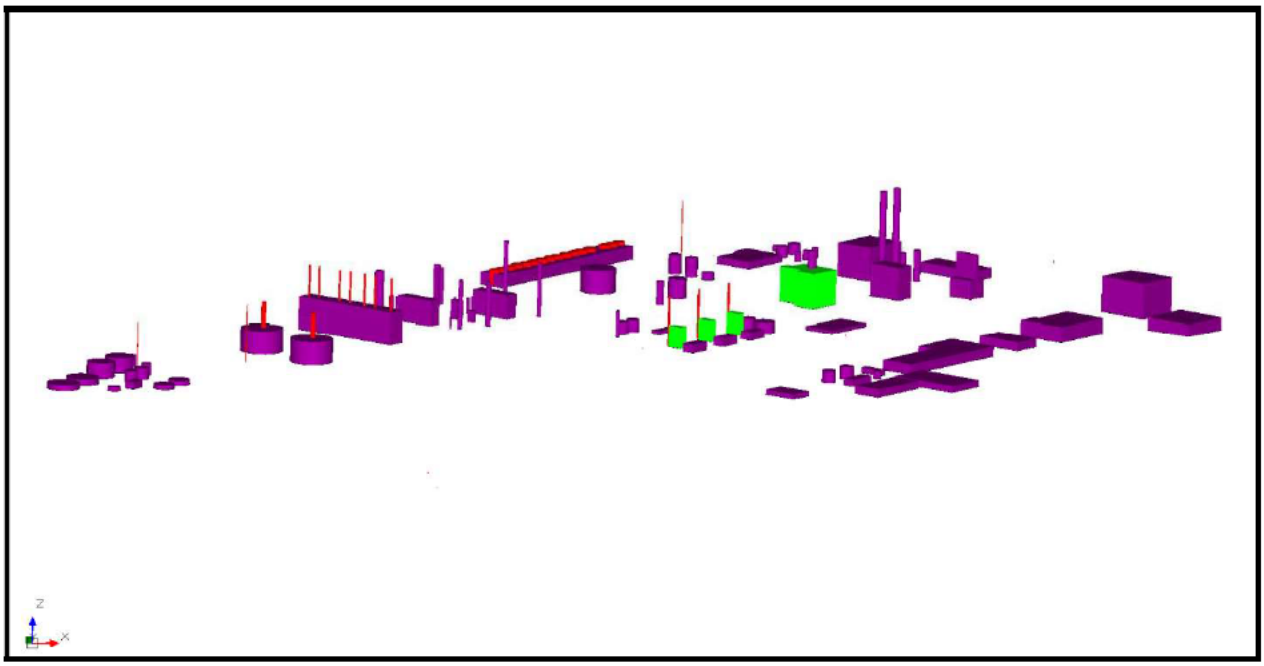

Figure 7. Preliminary Shell Three Dimensional Plot Plan (View from SW)

4.4 Receptor Data

Two receptor grids were developed for this analysis: one for assessing acute impacts and one for assessing chronic impacts. For the acute impacts assessment, modeled receptors were placed in all areas considered as "ambient air" pursuant to 40 CFR 50.1(e). Ambient air is defined as that portion of the atmosphere, external to buildings, to which the general public has access. The receptor grid consisted of three Cartesian grids and receptors spaced at 25m intervals along the facility fenceline and the railroad that transects the facility. The first cartesian grid extended to approximately 1km from the fence in all directions. Receptors in this region were spaced at 50m intervals. The second grid extended to 3km. Receptor spacing in this region was 100m. The third grid extended to approximately 10km with a spacing of 500m. Receptors with flagpole elevations were also placed along the Highway 376 bridge (Vanport Bridge) east of the facility. The receptor grid was designed such that maximum facility impacts fall within the 50m spacing of receptors. The receptor grid spacing is presented in Table 3.

Table 3. Receptor Grid Spacing

Receptor Spacing (m)	Distance from Facility Fence (m)
50	1,000
100	3,000
500	10,000

The second grid was used for assessment of chronic impacts. This grid did not include receptors located on the Ohio River, facility property adjacent to the river, the Vanport Bridge, or the railroad that transects the facility. These receptors were excluded from the assessment of chronic impacts as exposure in these areas is limited to the short term.

The Shell facility is located in western Pennsylvania. Terrain within 10km of the site is gently rolling; however, there is terrain in excess of stack top elevation. Receptor elevations and hill height scale factors were calculated with AERMAP (18081). The elevation data were obtained from the USGS 1 arc second National Elevation Data ("NED") obtained from the USGS. Locations were based upon a NAD83, UTM Zone 17 projection. The near-field receptor grids used in the acute and chronic assessments are shown in Figures 8 and 9, respectively.

RTP ENVIRONMENTAL ASSOCIATES, INC.®

0 150 300 600 900 1,200 Meters

N W E S

Sheet No.

Drawn By:

Checked by:

Date:

Figure 8. Shell Acute Analysis Receptor Grid

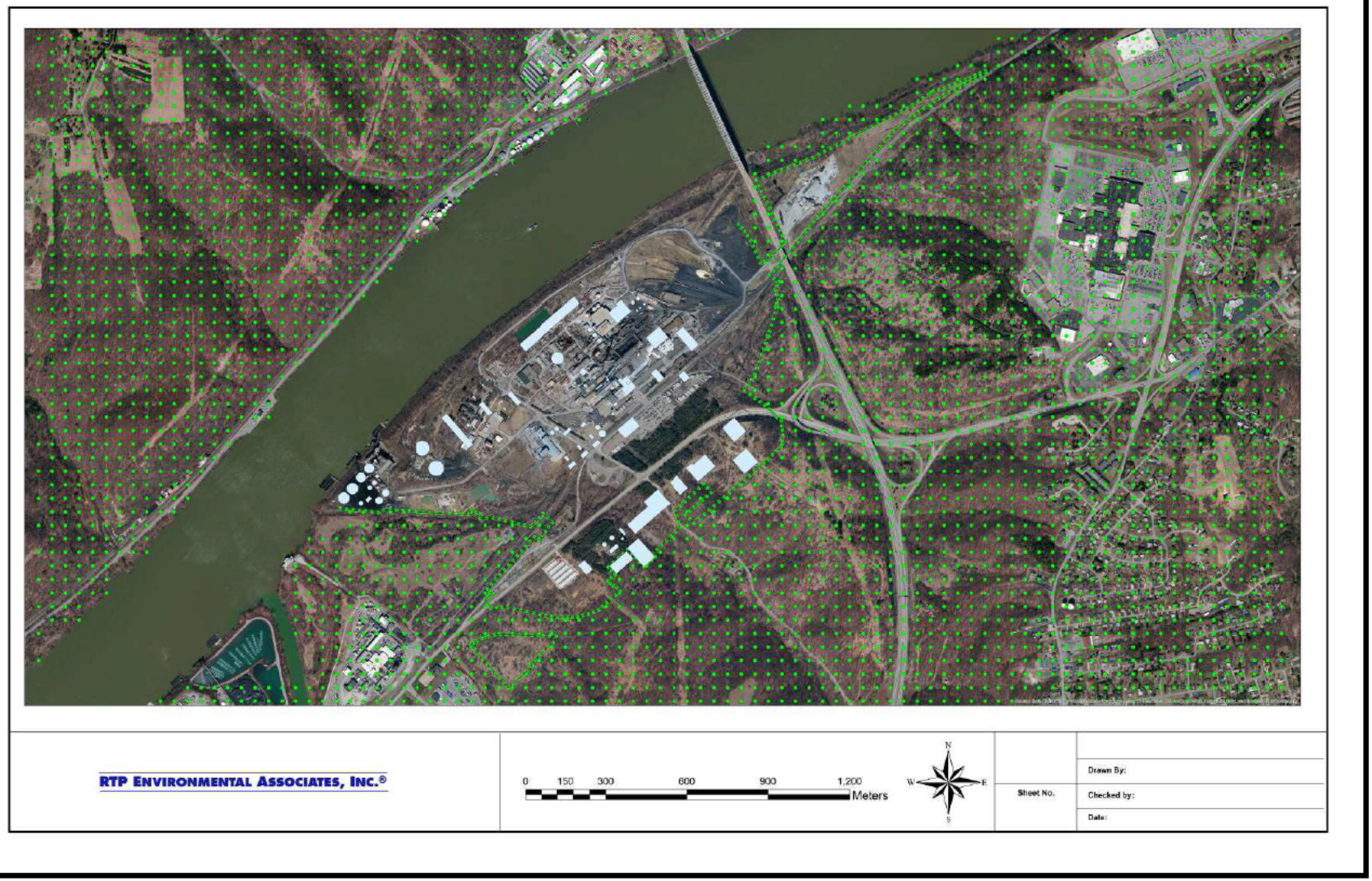

Figure 9. Shell Chronic Analysis Receptor Grid

4.5 Meteorological Data

Data Selection and Representativeness

The 2006-2010, 5-year sequential hourly surface meteorological data collected at the First Energy Beaver Valley Nuclear Generating Station (Beaver Valley) and secondary surface and upper air data from the Pittsburgh International Airport (KPIT, WBAN 94823) were used in the analysis. The First Energy surface data were collected as part of a continuous data collection program required by the U.S. Nuclear Regulatory Commission ("NRC"). For the reasons discussed below, RTP believes the meteorological data adequately represent atmospheric boundary layer conditions within the Shell analysis domain for AERMOD to properly characterize the transport and dispersion of the Shell emissions plumes. A profile base elevation of 228.6m was employed which corresponds to the base elevation of the Beaver Valley tower.

The First Energy station is located approximately 8km downstream of the Shell site, also on the Ohio River. The Beaver Valley meteorological station and Shell site also share a similar orientation in relation to the Ohio River. As can be seen in Figure 10, the river flows from the northeast to southwest relative to both the Shell site and the Beaver Valley meteorological station. The topography is also similar at each location. The wind patterns are therefore likely similar at each location (see the wind rose Figure 11). Wind speed, direction and standard deviation of the horizontal wind direction are measured at three levels at the Beaver Valley station (10.7m, 45.7m, and 152.4m). Temperature is also measured at the 10.7m level. These three levels provide adequate representation of plume behavior at the various release heights to be seen at the Shell site.

The Pittsburgh International Airport is located approximately 21km southeast of the facility (Figure 12). Station pressure, cloud cover, and twice daily sounding data from

Figure 10. First Energy Meteorological Tower Location Relative to Shell

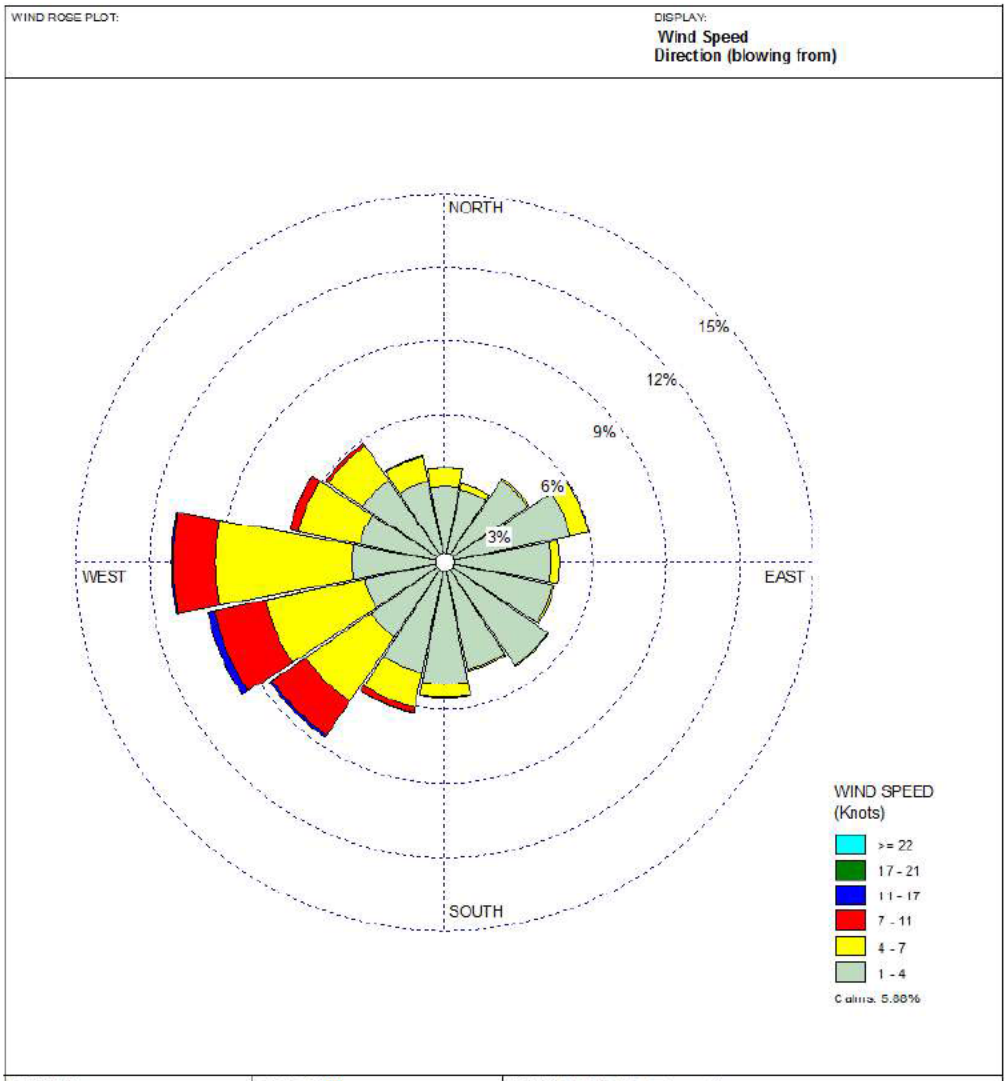

Figure 11. Beaver Valley Windrose 2006-2010

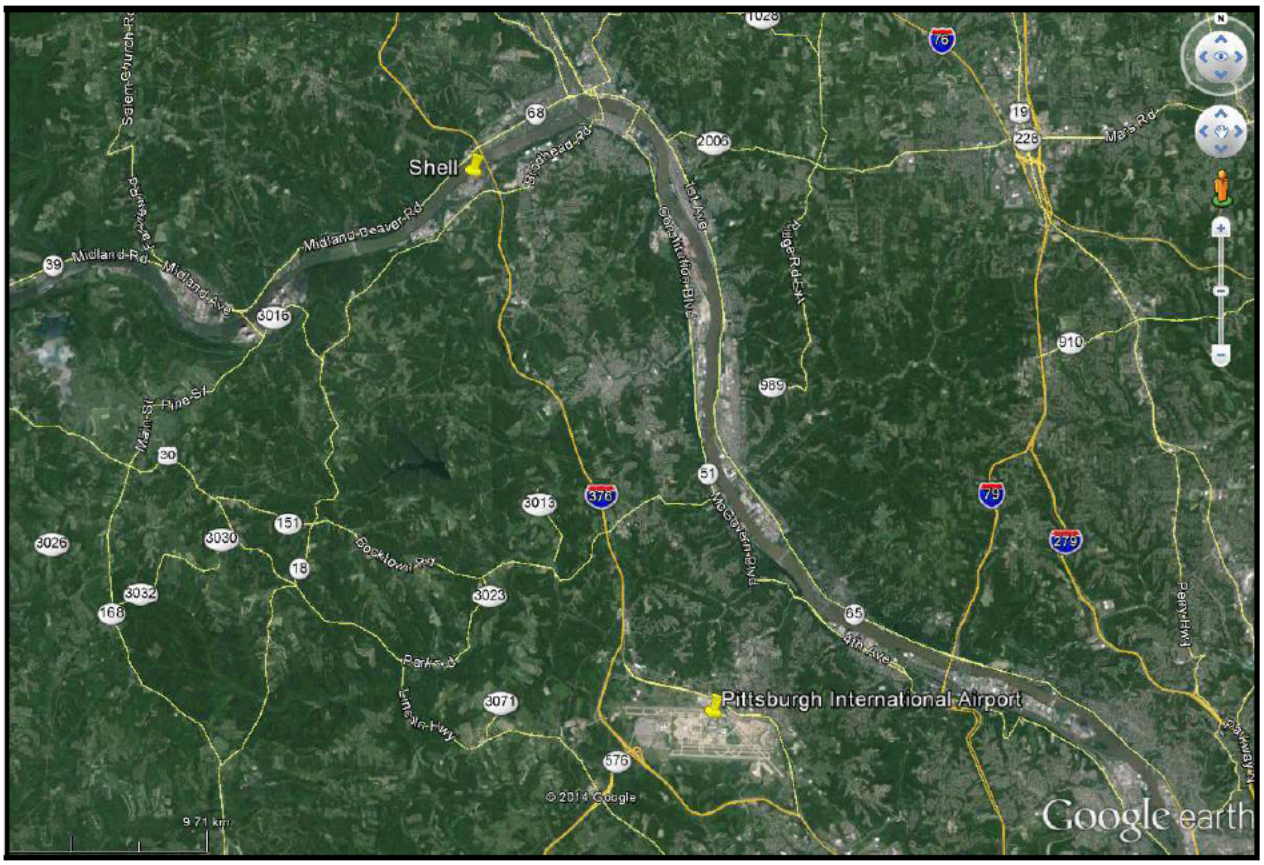

Figure 12. Pittsburgh International Airport Location Relative to Shell

Pittsburgh were used. These meteorological parameters are of synoptic scale and are adequately representative of the Beaver Valley area.

According to the EPA's AERMOD Implementation Guide[5], the surface characteristics should be similar for the meteorological station and the study site. RTP compared the surface characteristics at the First Energy station and the site. The AERSURFACE program was run to determine the characteristics for comparison. The results of the surface roughness comparison, by season, are shown in Figure 13. As can be seen, the surface characterisitics values for the two sites, when compared on a seasonal and sector basis, are similar.

Data Processing

The meteorological data were provided to RTP Environmental by the DEP. The DEP processed the Beaver Valley surface data, Pittsburgh International Airport (KPIT) surface data and KPIT upper air data using the meteorological preprocessor AERMET (Ver. 19191). In AERMET Stage 1, KPIT surface meteorological data in the Integrated Surface Data (ISD) format were extracted. KPIT upper air meteorological data in the Forecast Systems Laboratory (FSL) format were also extracted.

Also, the MODIFY keyword was entered to fill missing temperatures in the upper air data with interpolated values. In AERMET Stage 3, values of the surface characteristics (noon-time albedo, Bowen ratio, and surface roughness length) representative of the Beaver Valley surface meteorological site, were entered. RTP Environmental employed the PADEP meteorological dataset that employed the adjust u* method for the turbulence calculations in the Stage 3 processing.

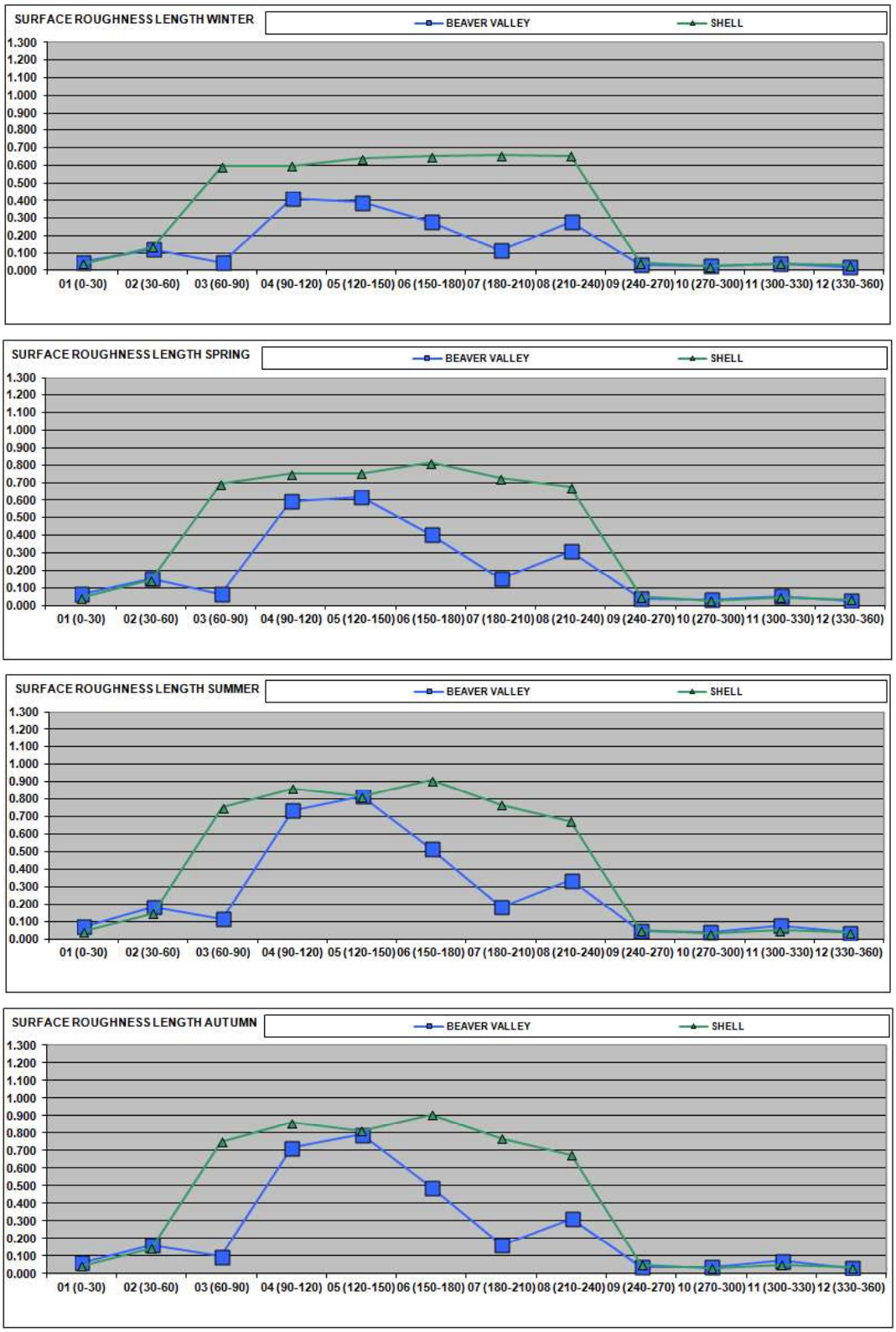

Figure 13. Meteorological Data Representativeness Analysis Results

These surface characteristics values were calculated by AERSURFACE 13016 using USGS National Land Cover Data (NLCD) for 1992. The following options were selected in AERSURFACE: default 1-km radius and default twelve 30-degree sectors for surface roughness length, seasonal temporal resolution, non-airport site and non-arid region. AERSURFACE was executed for each surface moisture condition (average, dry, and wet), assuming both no continuous snow cover and continuous snow cover during the winter (i.e., AERSURFACE was executed six times). AERMET Stage 3 was then executed for each set of surface characteristics to produce six surface (.sfc) files. The final AERMET surface file was assembled by season, based on actual estimates of surface moisture condition and snow cover during the meteorological data period. Estimates of surface moisture condition were based on precipitation data for Pennsylvania Climate Division 9. Snow cover was based on National Climatic Data Center (NCDC) Local Climatological Data from KPIT.

4.6 Output Options

The output options were specified to generate graph files of concentrations for each pollutant and averaging period. The chronic impacts for each pollutant were based upon the five year average. Acute impacts were calculated as the maximum 1-hour concentrations from the five years of meteorology. In assessing chronic cancer and non-cancer risks, the 5-year average impacts and subsequent risk for each pollutant were summed for each receptor and the receptor with the maximum total risk was used to assess the potential for a 1:100,000 risk.

5.0 RESULTS

5.1 Turbine Load Analysis Results

The results of the load analysis are presented in Table 4. As shown, the 100% load scenario for each turbine was found to generate the highest impacts. The 100% load case was therefore used in the remainder of the modeling analysis.

Table 4. Turbine Load Analysis Results

Averaging Period	Source Name	Modeled Concentration ($\mu g/m^3$)	Source Description
1-hr	CT1_100	**1.29**	Turbine 1, 100% load
	CT1_75	1.14	Turbine 1, 75% load
	CT1_45	0.76	Turbine 1, 45% load
	CT2_100	**1.27**	Turbine 2, 100% load
	CT2_75	1.12	Turbine 2, 75% load
	CT2_45	0.78	Turbine 2, 45% load
	CT3_100	**1.26**	Turbine 3, 100% load
	CT3_75	1.10	Turbine 3, 75% load
	CT3_45	0.79	Turbine 3, 45% load
Annual	CT1_100	**0.02**	Turbine 1, 100% load
	CT1_75	0.02	Turbine 1, 75% load
	CT1_45	0.01	Turbine 1, 45% load
	CT2_100	**0.02**	Turbine 2, 100% load
	CT2_75	0.02	Turbine 2, 75% load
	CT2_45	0.01	Turbine 2, 45% load
	CT3_100	**0.02**	Turbine 3, 100% load
	CT3_75	0.02	Turbine 3, 75% load
	CT3_45	0.01	Turbine 3, 45% load

5.2 Acute Pollutant Results

Table 5 presents the results of the acute COPC pollutant modeling. The maximum 1-hr impact from the five years of meteorology is presented for each pollutant. All model input and output files are provided on the attached CD.

Table 5. Acute Model Results – Maximum 1-hr Concentrations

COPC	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
13BUTA	1.87699	555623.1	4502391.6	235.62	347.43	0	6112609	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	24	1	13756
2METHY	0.01558	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
3METHY	0	556683.3	4502451.3	261.84	343.02	0	9041007	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
712DIMET	0.00003	556683.3	4502451.3	261.84	343.02	0	9041007	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
ACENAP	0.00159	556250	4501600	287.1	340.15	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
ACENAPL	0.00314	556250	4501600	287.1	340.15	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	4	1	13756
ACET	3.91376	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	11	1	13756
ACROL	2.41307	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	11	1	13756
ANTHRA	0.00041	556150	4501500	289.2	340.28	0	6022805	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AS	0.00091	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
BA	0.01381	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	7	1	13756
BE	0.00002	556683.3	4502451.3	261.84	343.02	0	9041007	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
BENSOAP	0.00001	556667.4	4502405.8	253.7	343.02	0	8031320	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
BENZOAA	0.00031	556250	4501600	287.1	340.15	0	6121404	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
BENZOB	0.00031	556150	4501500	289.2	340.28	0	8032421	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
BENZOG	0	556683.3	4502451.3	261.84	343.02	0	9041007	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
BENZOG2	0.00013	556425.4	4501866.1	284.43	327.75	0	8090820	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	4	1	13756
BENZOK	0.00001	556667.4	4502405.8	253.7	343.02	0	8031320	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
BIPH	0.09946	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	5	1	13756
BZ	15.43834	555096.6	4501916	215.21	353.88	0	10122201	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	36	1	13756
CD	0.00504	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
CHRYS	0.00052	556250	4501600	287.1	340.15	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
CO	0.00035	556443.2	4501936.5	268.15	334.28	0	9041607	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
CR	0.00742	556288.03	4502061.4	245.31	338.71	0	9110909	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	11	1	13756
CU	0.00267	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	7	1	13756
DIBENZ	0.0001	556394.1	4501838.6	271.22	337.73	0	8050305	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
DICHLB	0.0055	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
EB	0.12962	555571.1	4502346.3	235.67	347.88	0	7123002	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	16	1	13756
FL	0.00596	556250	4501600	287.1	340.15	0	6121404	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756

Table 5. Continued

COPC	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
FLUOR	0.00175	556250	4501600	287.1	340.15	0	6121404	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
FORM	24.77882	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	24	1	13756
HEX	24.82717	555726.9	4502482.3	234.77	345.01	0	10081422	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	34	1	13756
HG	0.00119	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
IDENO	0.0001	556425.4	4501866.1	284.43	327.75	0	8090820	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
MEOH	2.23169	555657.7	4502421.8	235.08	347.43	0	10010716	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	6	1	13756
MN	0.00173	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
MOLYB	0.00345	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	7	1	13756
NAPTH	2.83528	555571.1	4502346.3	235.67	347.88	0	10020722	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	32	1	13756
NH3	30.21765	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	10	1	13756
NICKEL	0.00957	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
PAH	0.02844	556361.7	4501834.4	259.45	340.28	0	9112422	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	9	1	13756
PB	0.00228	556067.3	4502759	228.88	354.3	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	12	1	13756
PENT	8.16437	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	7	1	13756
PHEN	0.01127	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	5	1	13756
PHENAN	0.01385	556250	4501600	287.1	340.15	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
PROP	0.00701	557800	4501500	371.88	371.88	0	10011903	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	3	1	13756
PROPANE	5.02269	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	7	1	13756
PYR	0.00146	556200	4501550	289.9	340.28	0	9040920	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	21	1	13756
SEL	0.0001	556443.2	4501936.5	268.15	334.28	0	9041607	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
STY	0.73802	555571.1	4502346.3	235.67	347.88	0	7123002	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	12	1	13756
TOL	1.53019	555571.1	4502346.3	235.67	347.88	0	7123002	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	34	1	13756
VAN	0.00722	554950	4502800	339.49	339.49	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	7	1	13756
XY	0.08626	555500	4501150	247.16	344.1	0	7020318	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	19	1	13756

5.3 Chronic Pollutant Results

To calculate the ambient concentrations used in the chronic cancer and non-cancer risks, a unit emission rate of 1 lb/hr was modeled for each source. An AERMOD concentration file (graph file) was generated containing the unit impacts by source and by receptor. The graph file "Shell Franklin HRA_5yrs_Unit.grf" is provided on the attached CD. The impacts for each pollutant were then calculated by multiplying the annual pollutant emission rate (in lb/hr) for each source by the concentration calculated for that source and receptor. To determine the total exposure concentration, the concentrations for all facility sources at each receptor for each COPC were then summed. An example of the calculation of the total concentration at each receptor for benzene is provide in the spreadsheet "benzene_annual_impact_xreceptor.xlsx" on the attached CD. A summary of the total concentation of all COPCs at each rectptor is provided in the spreadsheet "COPC_annual_impact_xreceptor.xlsx", also on the attached CD.

REFERENCES

1. Guidelines on Air Quality Models, Appendix W of 40 CFR Part 51, U.S. Environmental Protection Agency, January 2017.

2. Auer, Jr., A.H. "Correlation of Land Use and Cover with Meteorological Anomalies." Journal of Applied Meteorology, 17:636-643, 1978.

3. Engineering Guide #69, Air Dispersion Modeling Guidance. Ohio EPA, Division of Air Pollution Control, 2003.

4. Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for Stack Height Regulations (Revised). EPA-450/4-80-023R, U.S. Environmental Protection Agency, June 1985.

5. AERMOD Implementation Guide, EPA, September 27, 2005.

ATTACHMENT C

INHALATION RISK ASSESSMENT FOR SHELL POLYMERS MONACA SITE SHELL CHEMICAL APPALACHIA LLC BEAVER COUNTY, PENNSYLVANIA

Prepared by:
RTP Environmental Associates
304A West Millbrook Road
Raleigh, North Carolina 27609

February 2020

1.0 General Discussion

This inhalation risk assessment for the proposed Shell Chemical Appalachia LLC Petrochemicals Complex evaluated the potential cancer and non-cancer inhalation risks from the compounds of potential concern (COPC) emitted from the proposed facility. The approach used to conduct the assessment is based on guidance provided by the Pennsylvania Department of Environmental Protection (PaDEP) as outlined in the approved Inhalation Risk Assessment Protocol.[1]

1.1 Chronic Cancer and Non-cancer Risks

Chronic cancer and non-cancer impacts were estimated for each COPC at approximately 10,000 habitable points on a receptor grid surrounding the proposed facility. As detailed in Attachment B, exposure concentrations at each receptor were determined by modeling a unit emissions rate (*i.e.,* 1 lb/hr) from each emissions unit at the proposed facility. The resulting concentration was then scaled based on the estimated annual hourly average emissions rate for each COPC from each emissions unit. As referenced in Attachment B, a summary of the total concentration of all COPCs at each receptor is provided in the spreadsheet, COPC_annual_impact_xreceptor.xlsx on the attached CD. For the chronic excess lifetime cancer risk (ELCR), the exposure concentration of each pollutant at each receptor was multiplied by the compound specific unit risk factor. The compound specific unit risk factors used in the ELCR calculation are presented in Table 1. The risk factors have been updated from those used in the previous analysis based on the data provided in the Risk Assessment Information System (RAIS) database.[2] The aggregate ELCR was then determined for each receptor by summing the individual COPC ELCR. The ELCR for each COPC and the aggregate ELCR at each receptor is provided in the spreadsheet, COPC_ELCR_xreceptor.xlsx on the attached CD. As shown in Figure 1, the receptor with the highest ELCR is located northeast of the proposed facility's fence line. The location of the receptor with the maximum aggregate ELCR shifted from the southwest of the facility's fenceline in the previous analysis primarily due to the 7 fold increase in the risk factor for hexavalent chromium and the proximity of the catalyst activation heaters. The ELCR at this receptor is 0.76 in 100,000 (*i.e.,* 7.6E-6) which does not exceed PaDEP's inhalation risk management facility-wide target level of cancer risk of 1 in 100,000 (i.e., 1eE-5).

For the chronic non-cancer risk, the exposure concentration of each pollutant at each receptor was divided by the compound specific reference concentration (RfC) to determine the hazard quotient (HQ) for that COPC. The reference concentrations used for this analysis are presented in Table 1. As with the unit risk factors, the reference concentrations were updated using the RAIS database. The aggregate health index (HI) was determined for each receptor by summing the individual COPC HQ values. The HQ for each COPC and the aggregate HI at each receptor is provided in the spreadsheet, COPC_HQ_xreceptor.xlsx on the attached CD. As shown in Figure 1, the receptor with the highest HI is located north of the proposed facility's fence line. The location of the receptor with the maximum aggregate HI shifted from the southwest of the facility's fenceline in the previous analysis due to a

[1] Email from A. Binder, PaDEP to P. May, RTP Environmental Assoc., January 12, 2015
[2] http://rais.ornl.gov

combination of changes to the model. The facility HI at this receptor is 0.063, which does not exceed PaDEP's inhalation risk management facility-wide target level for non-cancer HI of 0.25.

1.2 Acute Non-cancer Risks

The acute health risks were determined for the one-hour average exposure to each COPC at all points in the receptor grid. For each pollutant, the highest modeled exposure concentration was divided by compound-specific RfC values derived from short term exposure levels to determine the HQ for each pollutant. The compound specific RfC values are presented in Table 1. As with the unit risk factors, the reference concentrations were updated using the RAIS database. Each HQ was then compared to the threshold of 1.0, the level at which no adverse effect would be expected from the exposure per PaDEP guidance. As presented in Table 2, no COPC has an HQ above 1. The pollutant with the highest HQ is benzene with an HQ of 0.5.

Table 1. Chronic and Acute Risk Factors for Inhalation Risk Assessment[1]

ANALYSIS	Chemical Abstracts Service (CAS) Number	Chronic Inhalation Reference Concentration (mg/m^3)	Chronic Inhalation Reference Concentration Reference	Acute Inhalation Reference Concentration (mg/m^3)	Acute Inhalation Reference Concentration Reference	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Inhalation Unit Risk Reference
Acenaphthene	83-32-9						
Acenaphthylene	208-96-8						
Acetaldehyde	75-07-0	0.009	IRIS	0.47	CALEPA	0.0000022	IRIS
Acrolein	107-02-8	0.00002	IRIS	0.006878528	ATSDR Final		
Ammonia	7664-41-7	0.5	IRIS	1.18408998	ATSDR Final		
Anthracene	120-12-7						
Arsenic (III)	22569-72-8						
Arsenic V	17428-41-0						
Arsenic, Inorganic	7440-38-2	0.000015	CALEPA	0.0002	CALEPA	0.0043	IRIS
Barium	7440-39-3	0.0005	HEAST Current				
Benz[a]anthracene	56-55-3					0.00006	EPA/RPF
Benzene	71-43-2	0.03	IRIS	0.028752147	ATSDR Final	0.0000078	IRIS
Benzo[a]pyrene	50-32-8	0.000002	IRIS			0.0006	IRIS
Benzo[b]fluoranthene	205-99-2					0.00006	EPA/RPF
Benzo[g,h,i]perylene	191-24-2						
Benzo[k]fluoranthene	207-08-9					0.000006	EPA/RPF
Beryllium and compounds	7440-41-7	0.00002	IRIS			0.0024	IRIS
Biphenyl, 1,1'-	92-52-4	0.0004	SCREEN Current				
Butadiene, 1,3-	106-99-0	0.002	IRIS	0.66	CALEPA	0.00003	IRIS
Cadmium (Diet)	7440-43-9	0.00001	ATSDR Final	0.00003	ATSDR Final	0.0018	IRIS
Chromium VI (chromic acid mists)	1333-82-0	0.000008	IRIS			0.084	SURROGATE. Based on Total Chromium -- use 1:6 ratio (x7)

ANALYSIS	Chemical Abstracts Service (CAS) Number	Chronic Inhalation Reference Concentration (mg/m^3)	Chronic Inhalation Reference Concentration Reference	Acute Inhalation Reference Concentration (mg/m^3)	Acute Inhalation Reference Concentration Reference	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Inhalation Unit Risk Reference
Chromium(III) (Soluble Particulates)	16065-83-1						
Chromium(III), Insoluble Salts	16065-83-1						
Chromium(VI)	18540-29-9	0.0001	IRIS			0.084	SURROGATE. Based on Total Chromium -- use 1:6 ratio (x7)
Chromium(VI), Aerosol Mists	7738-94-5	0.000005	ATSDR Final				
Chromium, Total	7440-47-3						
Chrysene	218-01-9					0.0000006	EPA/RPF
Cobalt	7440-48-4	0.000006	PPRTV Current			0.009	PPRTV Current
Copper	7440-50-8			0.1	CALEPA		
Dibenz[a,h]anthracene	53-70-3					0.0006	EPA/RPF
Dichlorobenzene	25321-22-6						
Dimethylbenz(a)anthracene, 7,12-	57-97-6					0.071	CALEPA
Ethylbenzene	100-41-4	1	IRIS	21.68	ATSDR Final	0.0000025	CALEPA
Ethylene Oxide	75-21-8	0.03	CALEPA			0.003	IRIS
Fluoranthene	206-44-0						
Fluorene	86-73-7						
Formaldehyde	50-00-0	0.009825767	ATSDR Final	0.049128834	ATSDR Final	0.000013	IRIS
Hexane, N-	110-54-3	0.7	IRIS				
Indeno[1,2,3-cd]pyrene	193-39-5					0.00006	EPA/RPF
Lead and Compounds	7439-92-1					0.000012	CALEPA
Manganese (Diet)	7439-96-5	0.00005	IRIS				

ANALYSIS	Chemical Abstracts Service (CAS) Number	Chronic Inhalation Reference Concentration (mg/m^3)	Chronic Inhalation Reference Concentration Reference	Acute Inhalation Reference Concentration (mg/m^3)	Acute Inhalation Reference Concentration Reference	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Inhalation Unit Risk Reference
Manganese (Non-diet)	7439-96-5	0.00005	IRIS				
Mercury (elemental)	7439-97-6	0.0003	IRIS	0.0006	CALEPA		
Methanol	67-56-1	20	IRIS	28	CALEPA		
Methylcholanthrene, 3-	56-49-5					0.0063	CALEPA
Methylnaphthalene, 2-	91-57-6						
Molybdenum	7439-98-7	0.0004	ATSDR Draft				
Naphthalenes, C1-	NA						
Naphthalenes, C2-	NA						
Naphthalenes, C3-	NA						
Naphthalenes, C4-	NA						
Nickel Refinery Dust	NA	0.000014	CALEPA	0.0002	CALEPA	0.00024	IRIS
Pentane, n-	109-66-0	1	PPRTV Current				
Phenanthrene	85-01-8						
Phenol	108-95-2	0.2	CALEPA	5.8	CALEPA		
Propylene Oxide	75-56-9	0.03	IRIS	3.1	CALEPA	0.0000037	IRIS
Pyrene	129-00-0						
Selenium	7782-49-2	0.02	CALEPA				
Styrene	100-42-5	1	IRIS	21.27	ATSDR Final		
Toluene	108-88-3	5	IRIS	7.6	ATSDR Final		
Vanadium	NA						
Xylenes	1330-20-7	0.1	IRIS	8.684662577	ATSDR Final		
Zinc and Compounds	7440-66-6						

[1]Source: The Risk Assessment Information located at http://rais.ornl.gov

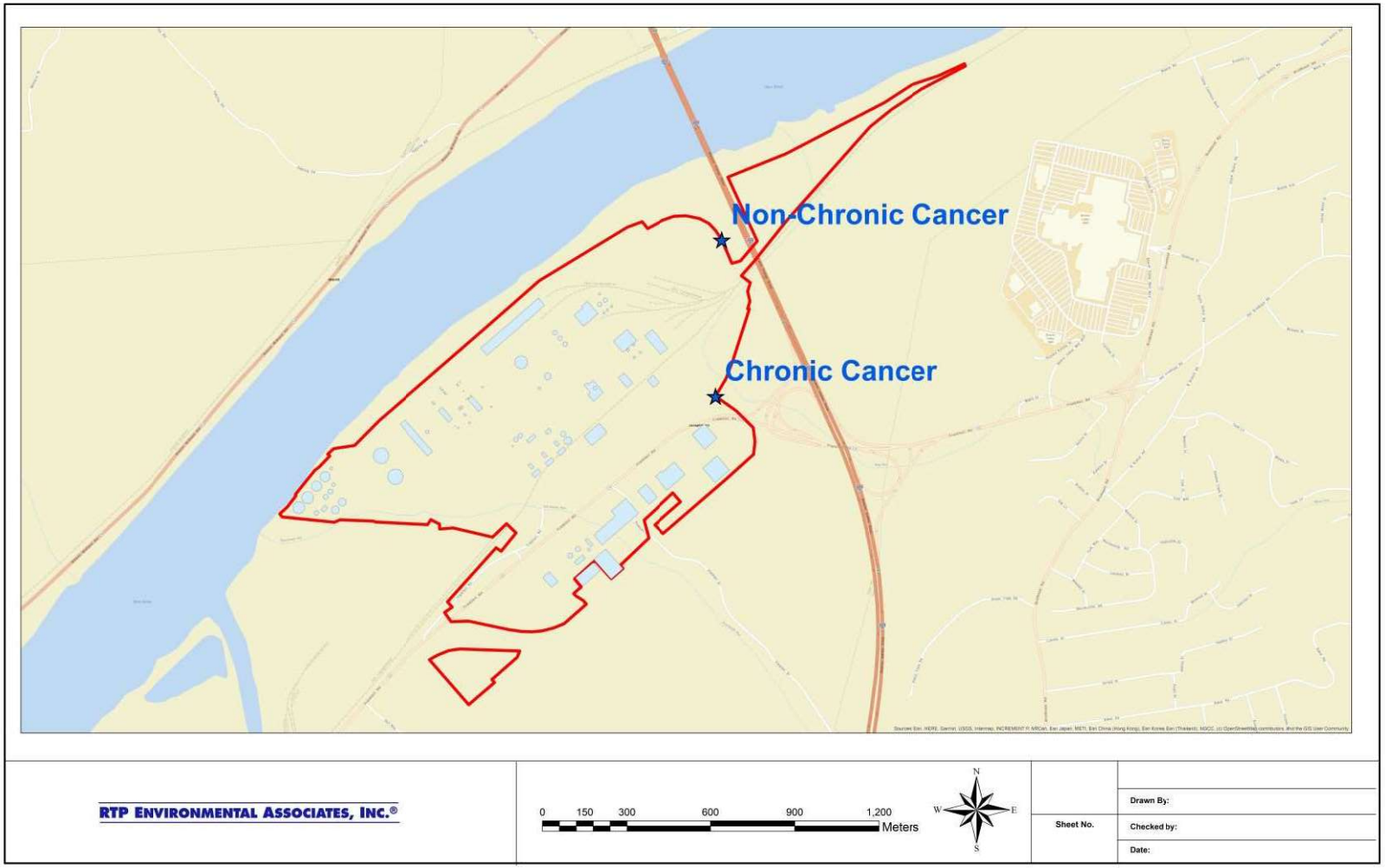

Figure 1. Location of Receptors with the Highest ELCR and Highest HI

Table 2. Risks from COPCs at Receptor with the Highest Aggregate Chronic Risk

Compound of Potential Concern	Excess Lifetime Cancer Risk	Chronic Non-cancer HQ
1,3-Butadiene	1.1E-06	4.8E-02
2-Methylnaphthalene		
3-Methylchloranthrene	4.1E-10	
7,12-Dimethylbenz(a)anthracene	4.1E-08	
Acenaphthene		
Acenaphthylene		
Acetaldehyde	3.1E-10	9.6E-06
Acrolein		2.2E-03
Anthracene		
Arsenic	3.1E-08	2.7E-04
Benzene	3.6E-07	1.7E-03
Benzo(a)anthracene	5.1E-12	
Benzo(a)pyrene	2.8E-11	
Benzo(b)fluoranthene	4.2E-12	
Benzo(g,h,i)perylene		
Benzo(g,h,l)perylene		
Benzo(k)fluoranthene	4.0E-13	
Beryllium	1.0E-09	1.2E-05
Biphenyl		1.2E-05
Cadmium	7.1E-08	2.2E-03
Chromium	5.6E-06	4.5E-03
Chrysene	4.5E-14	
Cobalt	2.7E-08	2.8E-04
Dibenzo(a,h)anthracene	3.1E-11	
Dichlorobenzene		
Ethylbenzene	3.7E-09	9.9E-07
Ethylene Oxide		
Fluoranthene		
Fluorene		
Formaldehyde	4.9E-08	2.2E-04
Hexane		6.4E-04
Indeno(1,2,3-cd)pyrene	4.2E-12	
Manganese		1.5E-04
Mercury		1.7E-05
Methanol		8.5E-07
Naphthalene		
Nickel	1.8E-08	3.0E-03

Compound of Potential Concern	Excess Lifetime Cancer Risk	Chronic Non-cancer HQ
PAH	2.3E-07	
Phenanthrene		
Phenol		1.4E-09
Propylene Oxide	5.0E-11	3.6E-07
Pyrene		
Selenium		2.4E-08
Styrene		5.4E-06
Toluene		2.7E-06
Xylenes		3.9E-06
Lead	2.1E-10	
Pentane		4.9E-05
Propane		
Barium		1.7E-04
Copper		
Molybdenum		
Vanadium		
Total Risk at Receptor with Highest Risk=	**7.6E-06**	**0.063**

[1]Emissions of chromium conservatively assumed to be in hexavalent form
[2]AP-42 factors for stationary combustion turbines are not available for individual PAH compounds. For this assessment, PAH emissions from CTs were conservatively assumed to be benzo(a)pyrene
- Denotes no available risk factor

Table 3. Acute Non Cancer Risk Assessment

Compound of Potential Concern	Modeled 1-hr Impact	Modeled 1-hr Impact	Acute Non-Cancer RfC[1]	HQ
	(µg/m3)	(mg/m3)	(mg/m3)	
1,3-Butadiene	1.88E+00	1.88E-03	6.60E-01	2.84E-03
2-Methylnaphthalene	1.56E-02	1.56E-05		
3-Methylchloranthrene	0.00E+00	0.00E+00		
7,12-Dimethylbenz(a)anthracene	3.00E-05	3.00E-08		
Acenaphthene	1.59E-03	1.59E-06		
Acenaphthylene	3.14E-03	3.14E-06		
Acetaldehyde	3.91E+00	3.91E-03	4.70E-01	8.33E-03
Acrolein	2.41E+00	2.41E-03	6.88E-03	3.51E-01
Ammonia	3.02E+01	3.02E-02	1.18E+00	2.55E-02
Anthracene	4.10E-04	4.10E-07		
Arsenic	9.10E-04	9.10E-07	2.00E-04	4.55E-03
Barium	1.38E-02	1.38E-05		
Beryllium	2.00E-05	2.00E-08		
Benzo(a)pyrene	1.00E-05	1.00E-08		
Benzo(a)anthracene	3.10E-04	3.10E-07		
Benzo(b)fluoranthene	3.10E-04	3.10E-07		
Benzo(g,h,I)perylene	1.30E-04	1.30E-07		
Benzo(k)fluoranthene	1.00E-05	1.00E-08		
Biphenyl	9.95E-02	9.95E-05		
Benzene	1.54E+01	1.54E-02	2.88E-02	5.37E-01
Cadmium	5.04E-03	5.04E-06	3.00E-05	1.68E-01
Chrysene	5.20E-04	5.20E-07		
Cobalt	3.50E-04	3.50E-07		
Chromium	7.42E-03	7.42E-06		
Copper	2.67E-03	2.67E-06	1.00E-01	2.67E-05
Dibenzo(a,h)anthracene	1.00E-04	1.00E-07		
Dichlorobenzene	5.50E-03	5.50E-06		
Ethylbenzene	1.30E-01	1.30E-04	2.17E+01	5.98E-06
Fluoranthene	1.75E-03	1.75E-06		
Fluorene	5.96E-03	5.96E-06		
Formaldehyde	2.48E+01	2.48E-02	4.91E-02	5.04E-01
Hexane	2.48E+01	2.48E-02		
Mercury	1.19E-03	1.19E-06	6.00E-04	1.98E-03
Indeno(1,2,3-cd)pyrene	1.00E-04	1.00E-07		
Methanol	2.23E+00	2.23E-03	2.80E+01	7.97E-05
Manganese	1.73E-03	1.73E-06		

Compound of Potential Concern	Modeled 1-hr Impact	Modeled 1-hr Impact	Acute Non-Cancer RfC[1]	HQ
Molybdenum	3.45E-03	3.45E-06		
Naphthalene	2.84E+00	2.84E-03		
Nickel	9.57E-03	9.57E-06	2.00E-04	4.79E-02
PAH	2.84E-02	2.84E-05	3.00E-02	9.48E-04
Lead	2.28E-03	2.28E-06		
Pentane	8.16E+00	8.16E-03		
Phenol	1.13E-02	1.13E-05	5.80E+00	1.94E-06
Phenanthrene	1.39E-02	1.39E-05		
Propane	7.01E-03	7.01E-06		
Pyrene	1.46E-03	1.46E-06		
Selenium	1.00E-04	1.00E-07		
Styrene	7.38E-01	7.38E-04	2.13E+01	3.47E-05
Toluene	1.53E+00	1.53E-03	7.60E+00	2.01E-04
Vanadium	7.22E-03	7.22E-06		
Xylenes	8.63E-02	8.63E-05	8.68E+00	9.93E-06

[1]Reference concentrations developed using short term exposure limits as per PaDEP guidance. Refer to Table 1 for more information.

[2]Emissions of chromium conservatively assumed to be in hexavalent form

[3]AP-42 factors for stationary combustion turbines are not available for individual PAH compounds. For this assessment, PAH emissions from CTs were conservatively assumed to be benzo(k)fluoranthene

"0" or ""Denotes no available risk factor

APPENDIX E

ADDITIONAL INFORMATION FOR SHELL POLYMERS MONACA SITE SHELL CHEMICAL APPALACHIA LLC BEAVER COUNTY, PENNSYLVANIA

CONTENTS:

1. Special Power of Attorney
2. General Information Form
3. Compliance Review Form
4. Municipal Notices and Receipt of Deliveries
5. Copy of Permit Fee Check

Prepared by:
RTP Environmental Associates
304A West Millbrook Road
Raleigh, North Carolina 27609

February 2020

SHELL CHEMICAL APPALACHIA LLC

SPECIAL POWER OF ATTORNEY

Shell Chemical Appalachia LLC, a Delaware limited liability company (the "Company"), with offices at 150 N. Dairy Ashford, Houston, Texas 77079, hereby appoints and authorizes H. James Sewell, who is managing environmental permitting and other regulatory affairs on behalf of the Company's efforts to construct a petrochemical facility in Beaver County, PA, as its true and lawful Attorney-in-Fact, in the name and on behalf of the Company in connection with Health, Safety, Security and Environment (HSS&E) related activities to:

1. Interface with government agencies;
2. Make binding representations to government agencies;
3. Sign permits, licenses and applications;
4. Sign discharge monitoring reports, routine compliance reports, routine compliance reports, fines, penalties, and other required HSS&E reports; and/or
5. Sign site access agreements not to exceed $10,000,000.00,

with full power and authority to do and perform every act and deed necessary and proper in the exercise of the forgoing powers as fully as the Company could do by any duly authorized officer, hereby ratifying and confirming all that the said Attorney-in-Fact shall lawfully do or cause to be done by virtue thereof.

This Special Power of Attorney is effective as of January 8, 2020, and shall continue in full force and effect until specifically revoked in writing. The authorities granted by this Special Power of Attorney may not be sub-delegated and shall be exercised only in the Company's country of tax residency.

IN WITNESS WHEREOF, the Company has caused this Special Power of Attorney to be signed by its duly authorized representative, sealed with its company seal and attested to by its Secretary.

ATTEST:

Lynn S. Borgmeier
Secretary

SHELL CHEMICAL APPALACHIA LLC

Hilary Mercer
President

WITNESS:

WITNESS:

STATE OF TEXAS §
§
COUNTY OF HARRIS §

This instrument was acknowledged before me on the 10th day of January, 2020 by Hilary Mercer, President of Shell Chemical Appalachia LLC, a Delaware limited liability company, on behalf of said company.

Linda L. Meagher
Notary Public in and for the State of Texas

NOTARY PUBLIC STATE OF TEXAS
LINDA L. MEAGHER
My Notary ID # 170102
Expires September 28, 2022

0210-PM-PIO0001 4/2018
Form

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

GENERAL INFORMATION FORM – AUTHORIZATION APPLICATION

Before completing this General Information Form (GIF), read the step-by-step instructions provided in this application package. This version of the General Information Form (GIF) must be completed and returned with any program-specific application being submitted to the Department.

Related ID#s (If Known)		DEP USE ONLY
Client ID#	**APS ID#**	Date Received & General Notes
Site ID#	**Auth ID#**	
Facility ID#		

CLIENT INFORMATION

DEP Client ID#	Client Type / Code
	LLC

Organization Name or Registered Fictitious Name	Employer ID# (EIN)	Dun & Bradstreet ID#
Shell Chemical Appalachia LLC	46-1624986-1	

Individual Last Name	First Name	MI	Suffix	SSN
Sewell	H	James		

Additional Individual Last Name	First Name	MI	Suffix	SSN

Mailing Address Line 1	Mailing Address Line 2
300 Frankfort Rd.	

Address Last Line – City	State	ZIP+4	Country
Monaca	PA	15061	

Client Contact Last Name	First Name	MI	Suffix
Sewell	H	James	

Client Contact Title	Phone	Ext
Environmental Manager	(724) 709-2411	

Email Address	FAX
jim.sewell@shell.com	

SITE INFORMATION

DEP Site ID#	Site Name
	Shell Chemical Appalachia LLC

EPA ID#	Estimated Number of Employees to be Present at Site	600

Description of Site
Ethylene and polyethylene manufacturing, and cogeneration power plant

County Name	Municipality	City	Boro	Twp	State
Beaver	Potter	☐	☐	☒	

County Name	Municipality	City	Boro	Twp	State
Beaver	Center	☐	☐	☒	

Site Location Line 1	Site Location Line 2
300 Frankfort Rd.	

Site Location Last Line – City	State	ZIP+4
Monaca	PA	15061

Detailed Written Directions to Site
Approximately 30 miles from Pittsburgh, PA on I-376, Exit 30 (PA 18) toward Monaca/Shippingport. Turn left on PA 18S, Frankfort Rd. Turn right on Old Route 18. Turn Left on Frankfort Rd. Site is on left.

Site Contact Last Name	First Name	MI	Suffix
Sewell	H	James	

Site Contact Title	Site Contact Firm
Environmental Manager	Shell Chemical Appalachia LLC

Mailing Address Line 1	Mailing Address Line 2
300 Frankfort Rd.	

Mailing Address Last Line – City	State	ZIP+4
Monaca	PA	15061

Phone	Ext	FAX	Email Address
(724) 709-2411			jim.sewell@shell.com

NAICS Codes (Two- & Three-Digit Codes – List All That Apply)	6-Digit Code (Optional)
32, 22	325110, 325211, 221112

Client to Site Relationship
Owner/Operator

FACILITY INFORMATION

Modification of Existing Facility

		Yes	No
1.	**Will this project modify an existing facility, system, or activity?**	☐	☒
2.	**Will this project involve an addition to an existing facility, system, or activity?**	☒	☐

If "Yes", check all relevant facility types and provide DEP facility identification numbers below.

	Facility Type	DEP Fac ID#		Facility Type	DEP Fac ID#
☒	Air Emission Plant	775836	☐	Industrial Minerals Mining Operation	
☐	Beneficial Use (water)		☐	Laboratory Location	
☐	Blasting Operation		☐	Land Recycling Cleanup Location	
☐	Captive Hazardous Waste Operation		☐	Mine DrainageTrmt/LandRecyProjLocation	
☐	Coal Ash Beneficial Use Operation		☐	Municipal Waste Operation	
☐	Coal Mining Operation		☐	Oil & Gas Encroachment Location	
☐	Coal Pillar Location		☐	Oil & Gas Location	
☐	Commercial Hazardous Waste Operation		☐	Oil & Gas Water Poll Control Facility	
☐	Dam Location		☐	Oil & Gas Wastewater Storage Impoundment	
☐	Deep Mine Safety Operation -Anthracite		☐	Public Water Supply System	
☐	Deep Mine Safety Operation -Bituminous		☐	Radiation Facility	
☐	Deep Mine Safety Operation -Ind Minerals		☐	Residual Waste Operation	
☐	Encroachment Location (water, wetland)		☐	Storage Tank Location	
☐	Erosion & Sediment Control Facility		☐	Water Pollution Control Facility	
☐	Explosive Storage Location		☐	Water Resource	
			☐	Other:	

Latitude/Longitude Point of Origin	Latitude			Longitude		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
CNTAR	40	40	**17**	80	20	**10**

Horizontal Accuracy Measure	Feet 18 --or-- Meters
Horizontal Reference Datum Code	☐ North American Datum of 1927 ☒ North American Datum of 1983 ☐ World Geodetic System of 1984
Horizontal Collection Method Code	GISDAR
Reference Point Code	CNTAR
Altitude	Feet 785.91 --or-- Meters
Altitude Datum Name	☐ The National Geodetic Vertical Datum of 1929 ☒ The North American Vertical Datum of 1988 (NAVD88)
Altitude (Vertical) Location Datum Collection Method Code	SRVEY
Geometric Type Code	POINT
Data Collection Date	5/26/2012
Source Map Scale Number	1 Inch(es) = 200 Feet
--or--	Centimeter(s) = Meters

PROJECT INFORMATION

Project Name
Shell Polymers Monaca Site

Project Description
Construction and operation of an ethane cracker and three polyethylene units. All the ethylene produced by thermally cracking ethane will be used to produce polyethylene. Additional facilities include utilities (natural gas-fired cogeneration plant, water treatment, cooling water), waste treatment systems (wastewater, flare, solid waste handling), storage and logistics (tanks, silos, rail yard, track racks, and dock facilities}, buildings (administration building, control room, maintenance facilities, catalyst storage}, and site infrastructure. The cogeneration plant will provide steam and electricity to the site and send electricity to the grid.

Project Consultant Last Name	First Name	MI	Suffix
May	Phil		

Project Consultant Title	Consulting Firm
Senior Project Manager	RTP Environmental Associates, Inc.

Mailing Address Line 1	Mailing Address Line 2
304-A West Millbrook Rd.	

Address Last Line – City	State	ZIP+4
Raleigh	NC	27609

Phone	Ext	FAX	Email Address
(919) 929-5551			

Time Schedules	Project Milestone (Optional)
	N/A

1.	**Have you informed the surrounding community and addressed any concerns prior to submitting the application to the Department?**	☒ Yes	☐ No
2.	**Is your project funded by state or federal grants?**	☐ Yes	☒ No

Note: If "Yes", specify what aspect of the project is related to the grant and provide the grant source, contact person and grant expiration date.
Aspect of Project Related to Grant
Grant Source: _____
Grant Contact Person: _____
Grant Expiration Date: _____

3.	**Is this application for an authorization on Appendix A of the Land Use Policy? (For referenced list, see Appendix A of the Land Use Policy attached to GIF instructions)**	☐ Yes	☒ No

Note: If "No" to Question 3, the application is not subject to the Land Use Policy.
If "Yes" to Question 3, the application is subject to this policy and the Applicant should answer the additional questions in the **Land Use Information** section.

LAND USE INFORMATION

Note: Applicants are encouraged to submit copies of local land use approvals or other evidence of compliance with local comprehensive plans and zoning ordinances.

1.	**Is there an adopted county or multi-county comprehensive plan?**	☐ Yes	☐ No
2.	**Is there an adopted municipal or multi-municipal comprehensive plan?**	☐ Yes	☐ No
3.	**Is there an adopted county-wide zoning ordinance, municipal zoning ordinance or joint municipal zoning ordinance?**	☐ Yes	☐ No

Note: If the Applicant answers "No" to either Questions 1, 2 or 3, the provisions of the PA MPC are not applicable and the Applicant does not need to respond to questions 4 and 5 below.
If the Applicant answers "Yes" to questions 1, 2 and 3, the Applicant should respond to questions 4 and 5 below.

4.	**Does the proposed project meet the provisions of the zoning ordinance or does the proposed project have zoning approval?** If zoning approval has been received, attach documentation.	☐ Yes	☐ No
5.	**Have you attached Municipal and County Land Use Letters for the project?**	☐ Yes	☐ No

COORDINATION INFORMATION

Note: The PA Historical and Museum Commission must be notified of proposed projects in accordance with DEP Technical Guidance Document 012-0700-001 and the accompanying Cultural Resource Notice Form.

If the activity will be a mining project (i.e., mining of coal or industrial minerals, coal refuse disposal and/or the operation of a coal or industrial minerals preparation/processing facility), respond to questions 1.0 through 2.5 below.

If the activity will not be a mining project, skip questions 1.0 through 2.5 and begin with question 3.0.

1.0	**Is this a coal mining project?** If "Yes", respond to 1.1-1.6. If "No", skip to Question 2.0.	☐	Yes	☑	No
1.1	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be equal to or greater than 200 tons/day?**	☐	Yes	☐	No
1.2	**Will this coal mining project involve coal preparation/ processing activities in which the total amount of coal prepared/processed will be greater than 50,000 tons/year?**	☐	Yes	☐	No
1.3	**Will this coal mining project involve coal preparation/ processing activities in which thermal coal dryers or pneumatic coal cleaners will be used?**	☐	Yes	☐	No
1.4	**For this coal mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
1.5	**Will this coal mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No
1.6	**Will this coal mining project involve underground coal mining to be conducted within 500 feet of an oil or gas well?**	☐	Yes	☐	No
2.0	**Is this a non-coal (industrial minerals) mining project?** If "Yes", respond to 2.1-2.6. If "No", skip to Question 3.0.	☐	Yes	☑	No
2.1	**Will this non-coal (industrial minerals) mining project involve the crushing and screening of non-coal minerals other than sand and gravel?**	☐	Yes	☐	No
2.2	**Will this non-coal (industrial minerals) mining project involve the crushing and/or screening of sand and gravel with the exception of wet sand and gravel operations (screening only) and dry sand and gravel operations with a capacity of less than 150 tons/hour of unconsolidated materials?**	☐	Yes	☐	No
2.3	**Will this non-coal (industrial minerals) mining project involve the construction, operation and/or modification of a portable non-metallic (i.e., non-coal) minerals processing plant under the authority of the General Permit for Portable Non-metallic Mineral Processing Plants (i.e., BAQ-PGPA/GP-3)?**	☐	Yes	☐	No
2.4	**For this non-coal (industrial minerals) mining project, will sewage treatment facilities be constructed and treated waste water discharged to surface waters?**	☐	Yes	☐	No
2.5	**Will this non-coal (industrial minerals) mining project involve the construction of a permanent impoundment meeting one or more of the following criteria: (1) a contributory drainage area exceeding 100 acres; (2) a depth of water measured by the upstream toe of the dam at maximum storage elevation exceeding 15 feet; (3) an impounding capacity at maximum storage elevation exceeding 50 acre-feet?**	☐	Yes	☐	No

3.0	**Will your project, activity, or authorization have anything to do with a well related to oil or gas production, have construction within 200 feet of, affect an oil or gas well, involve the waste from such a well, or string power lines above an oil or gas well?** If "Yes", respond to 3.1-3.3. If "No", skip to Question 4.0.	☐	Yes	☑	No
3.1	**Does the oil- or gas-related project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water (including wetlands)?**	☐	Yes	☐	No
3.2	**Will the oil- or gas-related project involve discharge of industrial wastewater or stormwater to a dry swale, surface water, ground water or an existing sanitary sewer system or storm water system?** If "Yes", discuss in *Project Description*.	☐	Yes	☐	No
3.3	**Will the oil- or gas-related project involve the construction and operation of industrial waste treatment facilities?**	☐	Yes	☐	No
4.0	**Will the project involve a construction activity that results in earth disturbance?** If "Yes", specify the total disturbed acreage. **4.0.1 Total Disturbed Acreage** No additional	☐	Yes	☑	No
5.0	**Does the project involve any of the following?** If "Yes", respond to 5.1-5.3. If "No", skip to Question 6.0. No additional	☐	Yes	☑	No
5.1	**Water Obstruction and Encroachment Projects – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a watercourse, floodway or body of water?**	☐	Yes	☐	No
5.2	**Wetland Impacts – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a wetland?**	☐	Yes	☐	No
5.3	**Floodplain Projects by the commonwealth, a Political Subdivision of the commonwealth or a Public Utility – Does the project involve any of the following: placement of fill, excavation within or placement of a structure, located in, along, across or projecting into a floodplain?**	☐	Yes	☐	No
6.0	**Will the project involve discharge of stormwater or wastewater from an industrial activity to a dry swale, surface water, ground water or an existing sanitary sewer system or separate storm water system?** No add.	☐	Yes	☑	No
7.0	**Will the project involve the construction and operation of industrial waste treatment facilities?** No additional	☐	Yes	☑	No
8.0	**Will the project involve construction of sewage treatment facilities, sanitary sewers, or sewage pumping stations?** If "Yes", indicate estimated proposed flow (gal/day). Also, discuss the sanitary sewer pipe sizes and the number of pumping stations/treatment facilities/name of downstream sewage facilities in the *Project Description*, where applicable. **8.0.1 Estimated Proposed Flow (gal/day)** No additional	☐	Yes	☑	No
9.0	**Will the project involve the subdivision of land, or the generation of 800 gpd or more of sewage on an existing parcel of land or the generation of an additional 400 gpd of sewage on an already-developed parcel, or the generation of 800 gpd or more of industrial wastewater that would be discharged to an existing sanitary sewer system?** No additional	☐	Yes	☑	No
	9.0.1 Was Act 537 sewage facilities planning submitted and approved by DEP? If "Yes" attach the approval letter. Approval required prior to 105/NPDES approval.	☐	Yes	☑	No
10.0	**Is this project for the beneficial use of biosolids for land application within Pennsylvania?** If "Yes" indicate how much (i.e. gallons or dry tons per year). **10.0.1 Gallons Per Year (residential septage)** _____ **10.0.2 Dry Tons Per Year (biosolids)**	☐	Yes	☑	No

11.0	**Does the project involve construction, modification or removal of a dam?** If "Yes", identify the dam. **11.0.1 Dam Name**	☐	Yes	☑	No
12.0	**Will the project interfere with the flow from, or otherwise impact, a dam?** If "Yes", identify the dam. **12.0.1 Dam Name**	☐	Yes	☑	No
13.0	**Will the project involve operations (excluding during the construction period) that produce air emissions (i.e., NOX, VOC, etc.)?** If "Yes", identify each type of emission followed by the amount of that emission. **13.0.1 Enter all types & amounts of emissions; separate each set with semicolons.** See Application Section 2 and Appendix B	☑	Yes	☐	No
14.0	**Does the project include the construction or modification of a drinking water supply to serve 15 or more connections or 25 or more people, at least 60 days out of the year?** If "Yes", check all proposed sub-facilities.	☐	Yes	☑	No
	14.0.1 Number of Persons Served No additional				
	14.0.2 Number of Employee/Guests				
	14.0.3 Number of Connections				
	14.0.4 Sub-Fac: Distribution System	☐	Yes	☐	No
	14.0.5 Sub-Fac: Water Treatment Plant	☐	Yes	☐	No
	14.0.6 Sub-Fac: Source	☐	Yes	☐	No
	14.0.7 Sub-Fac: Pump Station	☐	Yes	☐	No
	14.0.8 Sub Fac: Transmission Main	☐	Yes	☐	No
	14.0.9 Sub-Fac: Storage Facility	☐	Yes	☐	No
15.0	**Will your project include infiltration of storm water or waste water to ground water within one-half mile of a public water supply well, spring or infiltration gallery?**	☐	Yes	☑	No
16.0	**Is your project to be served by an existing public water supply?** If "Yes", indicate name of supplier and attach letter from supplier stating that it will serve the project. **16.0.1 Supplier's Name** Center Township Water Authority	☑	Yes	☐	No
	16.0.2 Letter of Approval from Supplier is Attached	☐	Yes	☑	No
17.0	**Will this project involve a new or increased drinking water withdrawal from a stream or other water body?** If "Yes", should reference both Water Supply and Watershed Management. **17.0.1 Stream Name**	☐	Yes	☑	No
18.0	**Will the construction or operation of this project involve treatment, storage, reuse, or disposal of waste?** If "Yes", indicate what type (i.e., hazardous, municipal (including infectious & chemotherapeutic), residual) and the amount to be treated, stored, re-used or disposed. No additional **18.0.1 Type & Amount**	☐	Yes	☑	No
19.0	**Will your project involve the removal of coal, minerals, etc. as part of any earth disturbance activities?**	☐	Yes	☑	No
20.0	**Does your project involve installation of a field constructed underground storage tank?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **20.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☑	No
21.0	**Does your project involve installation of an aboveground storage tank greater than 21,000 gallons capacity at an existing facility?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **21.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☑	No

22.0	**Does your project involve installation of a tank greater than 1,100 gallons which will contain a highly hazardous substance as defined in DEP's Regulated Substances List, 2570-BK-DEP2724?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. **22.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☑	No
23.0	**Does your project involve installation of a storage tank at a new facility with a total AST capacity greater than 21,000 gallons?** If "Yes", list each Substance & its Capacity. **Note:** Applicant may need a Storage Tank Site Specific Installation Permit. No additional **23.0.1 Enter all substances & capacity of each; separate each set with semicolons.**	☐	Yes	☑	No
24.0	**Will the intended activity involve the use of a radiation source?** No additional	☐	Yes	☑	No

CERTIFICATION

I certify that I have the authority to submit this application on behalf of the applicant named herein and that the information provided in this application is true and correct to the best of my knowledge and information.

Type or Print Name H. James Sewell

	Environmental Manager - Attorney-in-Fact	
Signature	**Title**	**Date**

2700-PM-AQ0005 Rev. 6/2006

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR QUALITY

AIR POLLUTION CONTROL ACT COMPLIANCE REVIEW SUPPLEMENTAL FORM

Fully and accurately provide the following information, as specified. Attach additional sheets as necessary.

Date of Submission of Original Compliance Review Form 05/01/2014

Type of Supplemental Compliance Review Form Submittal (check all that apply)

☐ Original Filing ☒ Amended Filing
☒ No Changes ☒ Date of Last Compliance Review Form Filing 12/18/2019

Type of Submittal

☒ New Plan Approval ☐ New Operating Permit ☐ Renewal of Operating Permit
☐ Extension of Plan Approval ☐ Change of Ownership ☐ Periodic Submission (every six months)
☐ Other _____

SECTION A. GENERAL APPLICANT INFORMATION

1. Name of Applicant/Permittee/("Applicant") (non-corporations attach documentation of legal name)
Shell Chemical Appalachia LLC

Address	300 Frankfort Road
	Monaca, PA 15601
Telephone	713-241-2067
Taxpayer ID#	46-1624986
Permit, Plan Approval or Application ID#	PA-04-00740A

2. Identify the form of management under which the applicant conducts its business.

☐ Individual ☐ Fictitious Name ☐ Association
☐ Municipality ☐ Partnership ☐ Syndicate
☐ Proprietorship ☐ Limited Partnership
☐ Public corporation ☐ Government Agency
☐ Private Corporation ☐ Joint Venture
☐ Municipal Authority ☒ Other Type of Business (specify) Limited Liability Company

3. Describe the type(s) of business activities performed.

* * * Supplemental * * *

List only those changes since the date of the last original submission.
No Changes

SECTION B. GENERAL INFORMATION REGARDING "APPLICANT"

If applicant is a corporation or a division or other unit of a corporation, provide the names, principal places of business, state of incorporation, and taxpayer ID numbers of all domestic and foreign parent corporations (including the ultimate parent corporation), and all domestic and foreign subsidiary corporations of the ultimate parent corporation with operations in Pennsylvania. Please include all corporate divisions or units, (whether incorporated or unincorporated) and privately held corporations. (A diagram of corporate relationships may be provided to illustrate corporate relationships.) Attach additional sheets as necessary.

* * * Supplemental * * *

List only those changes since the date of the last original submission.

Unit Name	Principal Places of Business	State of Incorporation	Taxpayer ID	Relationship to Applicant
No Changes				

SECTION C. INFORMATION REGARDING APPLICANT & ITS "RELATED PARTIES"

1. **Pennsylvania Facilities.** List the name and location (mailing address, municipality, county), telephone number, and relationship to applicant (parent, subsidiary or general partner) of all Related Parties' places of business, and facilities in Pennsylvania. Attach additional sheets as necessary.

* * * Supplemental * * *

List only those changes since the date of the last original submission.

Unit Name	Street Business	County and Municipality	Telephone No.	Relationship to Applicant
No Changes				

2. General Partners. Provide the names and business addresses of all general partners of the applicant and parent corporation, if any.

* * * Supplemental * * *

List only those changes since the date of the last original submission.

Name	Business Address
No Changes	

3. Management Responsibility. Provide the names and business of persons with overall management responsibility for the process being permitted (i.e., plant manager).

* * * Supplemental * * *

List only those changes since the date of the last original submission.

Name	Business Address
No changes	
	[

4. **Plan Approvals or Operating Permits.** List all plan approvals or operating permits issued by the Department or an approved local air pollution control agency under the APCA to the applicant or related parties that are currently in effect or have been in effect at any time five years prior to the date on which this form is notarized. This list shall include the plan approval and operating permit numbers, locations, issuance and expiration dates. Attach additional sheets as necessary.

* * * Supplemental * * *

List only those changes since the date of the last original submission.

Source	Plan Approval Operating Permit Number	Location	Issuance Date	Expiration Date
No Changes				

SECTION D. COMPLIANCE BACKGROUND

Note: Copies of specific documents, if applicable, must be made available to the Department upon its request.)

1. **Documented Conduct.** List all documented conduct of violations or enforcement actions identified by the Department pursuant to the APCA, regulations, terms and conditions of an operating permit or plan approval or order by applicant or any related party, using the following format grouped by source and location in reverse chronological order. Attach additional sheets as necessary. See the definition of "documented conduct" for further clarification. Unless specifically directed by the Department, deviations which have been previously reported to the Department in writing, relating to monitoring and reporting, need not be reported.

* * * Supplemental * * *

List only those changes since the date of the last original submission.

Date	Location	Plan Approval/ Operating Permit#	Nature of Documented Conduct	Type of Department Action	Status Litigation; Existing/Continuing; or corrected/Date	Dollar Amount Penalty
11/11/19	Shell Polymers Monaca	PA-04-00740A	Installation and operation of SF6-insulated switchgear without authorization	Consent Order and Agreement	Continuing	$10,000

CONTINUING OBLIGATION: Applicant is under a continuing obligation to update this form using the Compliance Review Supplemental Form if any additional documented conduct occurs or related parties develop between the date of submission and Department action on its application

2. Incidents of Deviation. List all incidents of deviations of the APCA, regulations, terms and conditions of an operating permit or plan approval or order by applicant or any related party, using the following format grouped by source and location in reverse chronological order. This list must include items both currently known and unknown to the Department. Attach additional sheets as necessary. See the definition of "deviations" for further clarification.

* * * Supplemental * * *

List only those changes since the date of the last original submission.

Date	Location	Plan Approval/ Operating Permit#	Nature of Deviation	Incident Status: Existing/Continuing; or Corrected Date
None				

CONTINUING OBLIGATION: Applicant is under a continuing obligation to update this form using the Compliance Review Supplemental Form if any additional documented conduct occur or related parties develop between the date of submission and Department action on its application

VERIFICATION STATEMENT

Subject to the penalties of Title 18 Pa.C.S. Section 4904 and 35 P.S. Section 4009(b)(2), I verify under penalty of law that I am authorized to make this verification on behalf of the Applicant/Permittee. I further verify that the information contained in this Compliance Review Supplemental Form is true and complete to the best of my belief formed after reasonable inquiry. I further verify that reasonable procedures are in place to ensure that "documented conduct" and "deviations" as defined in 25 Pa Code Section 121.1 are identified and included in the information set forth in this Compliance Review Supplemental Form.

Signature

Date

H. James Sewell

Name (Print or Type)

Environmental Manager, Attorney-in-Fact

Title

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

February 5, 2020

Daniel C. Camp III
Chairman, Beaver County Commissioners
Beaver County Courthouse
810 Third St.
Beaver, PA 15009

RE: Shell Chemical Appalachia LLC
Shell Polymers Monaca Site
Potter and Center Townships, Beaver County

Dear Mr. Camp,

The purpose of this notice is to inform you that at the request of Pennsylvania Department of Environmental (PADEP) Protection, Shell Chemical Appalachia LLC applied for a new Plan Approval to document design changes with PADEP. This application incorporates as built changes to design and construction associated with the Shell Polymers Monaca Site.

Plan Approval No.:	04-00740A
Project:	Petrochemicals Complex
Applicant Name:	Shell Chemical Appalachia LLC
Applicant Contact:	H. James Sewell Shell Chemical Appalachia LLC 300 Franklin Rd. Monaca, PA 15061 (724) 709-2411
Site Location:	300 Franklin Rd., Monaca, Beaver County, PA 15061
Municipality/County	Potter and Center Townships, Beaver County, PA

This letter is intended to satisfy the requirement of 25 PA Code Chapter 127, Subchapter B, Plan Approval Requirements §127.43a, Municipal Notifications. Each applicant for a plan approval, "shall notify the local municipality and county where the air pollution source is to be located that the applicant has applied for the plan approval as required by section 1905-A of the Administrative Code of 1929 (71 P.S. § 510.5)."

The design changes identified include minor equipment additions, removal and downsizing of permitted equipment, and increases and decreases in the unit capacities of some equipment. Shell is applying for a plan approval to address these changes in the facility. The application includes a Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) analysis for several emergency backup natural gas / diesel generator sets at the site. Other changes document increases / decreases in process equipment rates. The application also includes updated air dispersion modeling and inhalation risk assessment. All as built changes are found in the Plan Approval Application.

A 30-day comment period begins upon receipt of this notice by the municipality and county. If you have comments, you should address those comments to the PADEP, Southwest Regional Office.

Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Dr.
Pittsburgh, PA 15222-4745

If you have any questions, you can contact me at 724-709-2411 or by e-mail at jim.sewell@shell.com.

H. James Sewell
CSU Environmental Manager
Attorney-in-Fact

Proof of Delivery

Dear Customer,

This notice serves as proof of delivery for the shipment listed below.

Tracking Number
1Z58F3R72592681916

Weight
0.00 LBS

Service

UPS Next Day Air®

Shipped / Billed On
02/05/2020

Delivered On

02/07/2020 9:59 A.M.

Delivered To
BEAVER, PA, US
Received By

PIPCHOK

Left At
Office

Thank you for giving us this opportunity to serve you. Details are only available for shipments delivered within the last 120 days. Please print for your records if you require this information after 120 days.

Sincerely,

UPS

Tracking results provided by UPS: 02/10/2020 9:48 A.M. EST

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

February 5, 2020

Mr. Bill DiCioccio, Jr.
Chairman, Center Township Board of Supervisors
224 Center Grange Rd.
Aliquippa, PA 15001

RE: Shell Chemical Appalachia LLC
Shell Polymers Monaca Site
Potter and Center Townships, Beaver County

Dear Mr. DiCioccio,

The purpose of this notice is to inform you that at the request of Pennsylvania Department of Environmental (PADEP) Protection, Shell Chemical Appalachia LLC applied for a new Plan Approval to document design changes with PADEP. This application incorporates as built changes to design and construction associated with the Shell Polymers Monaca Site.

Plan Approval No.:	04-00740A
Project:	Petrochemicals Complex
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Applicant Contact:	H. James Sewell Shell Chemical Appalachia LLC 300 Franklin Rd. Monaca, PA 15061 (724) 709-2411
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Municipality/County	Potter and Center Townships, Beaver County, PA

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Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Dr.
Pittsburgh, PA 15222-4745

If you have any questions, you can contact me at 724-709-2411 or by e-mail at jim.sewell@shell.com.

H. James Sewell
CSU Environmental Manager
Attorney-in-Fact

Proof of Delivery

Dear Customer,

This notice serves as proof of delivery for the shipment listed below.

Tracking Number

1Z58F3R72592393102

Weight

0.00 LBS

Service

UPS Next Day Air®

Shipped / Billed On

02/05/2020

Delivered On

02/07/2020 9:11 A.M.

Delivered To

ALIQUIPPA, PA, US

Received By

DUGAN

Left At

Receiver

Thank you for giving us this opportunity to serve you. Details are only available for shipments delivered within the last 120 days. Please print for your records if you require this information after 120 days.

Sincerely,

UPS

Tracking results provided by UPS: 02/10/2020 9:39 A.M. EST

Shell Chemical Appalachia LLC
300 Frankfort Rd
Monaca, PA 15061

February 5, 2020

Ms. Rebecca Matsco
Chairwoman, Potter Township Board of Supervisors
300 Mowry Rd.
Monaca, PA 15061

RE: Shell Chemical Appalachia LLC
Shell Polymers Monaca Site
Potter and Center Townships, Beaver County

Dear Ms. Matsco,

The purpose of this notice is to inform you that at the request of Pennsylvania Department of Environmental (PADEP) Protection, Shell Chemical Appalachia LLC applied for a new Plan Approval to document design changes with PADEP. This application incorporates as built changes to design and construction associated with the Shell Polymers Monaca Site.

Plan Approval No.:	04-00740A
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Applicant Name:	Shell Chemical Appalachia LLC
Applicant Contact:	H. James Sewell Shell Chemical Appalachia LLC 300 Franklin Rd. Monaca, PA 15061 (724) 709-2411
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This letter is intended to satisfy the requirement of 25 PA Code Chapter 127, Subchapter B, Plan Approval Requirements §127.43a, Municipal Notifications. Each applicant for a plan approval, "shall notify the local municipality and county where the air pollution source is to be located that the applicant has applied for the plan approval as required by section 1905-A of the Administrative Code of 1929 (71 P.S. § 510.5)."

The design changes identified include minor equipment additions, removal and downsizing of permitted equipment, and increases and decreases in the unit capacities of some equipment. Shell is applying for a plan approval to

address these changes in the facility. The application includes a Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) analysis for several emergency backup natural gas / diesel generator sets at the site. Other changes document increases / decreases in process equipment rates. The application also includes updated air dispersion modeling and inhalation risk assessment. All as built changes are found in the Plan Approval Application.

A 30-day comment period begins upon receipt of this notice by the municipality and county. If you have comments, you should address those comments to the PADEP, Southwest Regional Office.

Pennsylvania Department of Environmental Protection
Southwest Regional Office
400 Waterfront Dr.
Pittsburgh, PA 15222-4745

If you have any questions, you can contact me at 724-709-2411 or by e-mail at jim.sewell@shell.com.

H. James Sewell
Environmental Manager
Attorney-in-Fact

Proof of Delivery

Dear Customer,

This notice serves as proof of delivery for the shipment listed below.

Tracking Number

1Z58F3R72591437923

Weight

0.00 LBS

Service

UPS Next Day Air®

Shipped / Billed On

02/05/2020

Delivered On

02/07/2020 9:10 A.M.

Delivered To

MONACA, PA, US

Received By

DRIVER RELEASE

Left At

Front Door

Thank you for giving us this opportunity to serve you. Details are only available for shipments delivered within the last 120 days. Please print for your records if you require this information after 120 days.

Sincerely,

UPS

Tracking results provided by UPS: 02/10/2020 9:51 A.M. EST

Shell Chemical Appalachia LLC
PO Box 4913
Houston, TX 77210

0114573 01 RE 0.436 **AUTO T2 0 6021 17105-283333 -P14587 C07

COMMONWEALTH OF PENNSYLVANIA
DEP ENVIRONMENTAL PROTECTION
P.O. Box 2833
HARRISBURG PA 17105-2833 17105-2833

CHECK NO.: 0005060164
COMPANY CODE: UST8
CHECK DATE: 01/31/2020
CLIENT NO.: 0000825382

INVOICE NO.	INV. DATE	REFERENCE	DESCRIPTION	DISC. AMOUNT	NET AMOUNT
20200128AIR	01/28/2020	1900001414		$0.00	$29,700.00
				TOTAL:	$29,700.00

RE0114573-0001_of_0001 6021-0014573 (F23S)

Direct all inquiries to:

APVENDORHELPDESK@SHELL.COM
We invite you to convert to electronic payments in the form of ACH.
Please contact us at the above address/phone number for further details.

DETACH AND RETAIN THIS STUB FOR YOUR RECORDS

Shell Chemical Appalachia LLC
PO Box 4913
Houston, TX 77210

62-20
311

Check No.: 0005060164

01/31/2020

PAY TO THE ORDER OF:
COMMONWEALTH OF PENNSYLVANIA
DEP ENVIRONMENTAL PROTECTION
P.O. Box 2833
HARRISBURG PA

*********$29,700.00

NOT VALID AFTER 180 DAYS

AUTHORIZED SIGNATURE

VOID

Twenty-nine Thousand Seven Hundred and 00/100 Dollars

CITIBANK, N.A.
ONE PENN'S WAY, NEW CASTLE, DE 19720

⑈0005060164⑈ ⑆031100209⑆ 3887215 4⑈