Attachment A

- Table 2-1. Summary of Updates to the Shell Polymers Monaca Site Design
- Table B-1. Summary of Emergency Engine Emissions Estimates
- Table B-8. Firewater Pump Engines Emissions Estimates

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	0	0	0.03	0.14	0	0.41	24.84
Two additional diesel-fired emergency engines	105	0	0	0	0	0.05	0	0.05	9.7
Two additional emergency engine diesel storage tanks	406				0				
Two additional vehicle fuel diesel storage tanks	406				0				
Transport of talc to site by railcar instead of truck[2]	202	0	0	0					
Methanol storage vessels and associated components[3]	201				0				
LPG loading	304				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	(0.41)	(0.40)	(0.37)	(0.65)	(12.1)	0	(7.24)	(1152)
Removed four emergency generator diesel storage tanks	406	0	0	0	0	0	0	0	0
Removed one firewater pump engine	106	(0.01)	(0.01)	(0.01)	(0.02)	(0.27)	0	(0.25)	(40.0)
Removed one firewater pump engine diesel storage tank	405	0	0	0	0	0	0	0	0
Decreased rating of remaining firewater pump engines (700 to 488 bhp)	106	(0.01)	(0.01)	(0.01)	0.08	(0.33)	0	(0.22)	(24.1)
Spent caustic vent thermal incinerator from 8 to 2.5 tonnes/hr (Heat input unchanged)	206	0	0	0	0	0	0	0	0
Decrease process cooling water tower rate from 305 to 295.9 MMgal/min	203	(0.2)	(0.13)	0	(1.2)				

Description of Change	Source ID	PM	PM_{10}	$PM_{2.5}$	VOC	NO_X	SO_2	CO	CO_2e
Decrease in blending silo PE rate (increase in exhaust rate)	301	0.36	0.66	0.66					
Deduster vent removal (Elutriator wash air)	301	(0.96)	(0.02)	(0.02)					
Decrease in light gasoline loading rate	403				(0.13)				
Decrease in C3+ emissions	304				(14.6)				
Decrease in PE3 activated catalyst vent emissions	202	(0.02)	(0.02)	(0.02)					
Road length updated from 0.97 to 0.49 miles		(0.29)	(0.06)	(0.01)					
Increased Equipment Capacities									
Combustion turbine heat input (475 to 481.4 MMBtu/hr, each) (3x)	101 102 103	0.16	0.56	0.56	0.3	0.63	0.12	0.3	9,847
Duct burner heat input (189 to 234 MMBtu/hr, each)		1.1	3.9	3.9	2.08	4.42	0.87	2.7	69,240
Recovered oil & flow equalization & removal tank capacity	401				<0.01				
Increase in railcar handling and storage PE rates	301	1.23	0.69	0.69					
Increase in truck handling and storage PE rates	301	1.62	0.61	0.61					
Increase in railcar loading PE rates	301	0.02	0.02	0.02					
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	0	0					
Flare gas comp. changes & sweep gas rate decreases									
High pressure ground flare (HPGF)	205	0.33	1.32	1.32	11.11	12.01	0.26	65.33	23,300
Multipoint ground flare (MPGF)	204	0.01	0.06	0.06	0.04	0.54	0.01	2.94	929.9
Low pressure thermal incinerator (LPTI)	204	(0.25)	(1.09)	(1.09)	0.95	(9.93)	0	(12.0)	(21,322

Description of Change	Source ID	PM	PM_{10}	$PM_{2.5}$	VOC	NO_X	SO_2	CO	CO_2e
High pressure elevated flare (HPEF)	205	(0.41)	(1.65)	(1.65)	(1.19)	(15.1)	(0.3)	(82)	(25,947)
Proposed Project's Emissions Increase[3]		2.82	4.14	4.34	(5.96)	(19.67)	0.927	(28.68)	55,336
NSR Significance Threshold		25	15	10	40	40	40	100	
Subject to PSD or NSR Review		No	No	No	No	No	No	No	

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

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

[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

Table B-1. Summary of Emergency Engine Emissions Estimates

Summary Emergency Engine Emissions Calculations

Input Parameters - Emission Factors

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

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

Input Parameters - Emission Factors

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

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

Output Calculations

Engine		Units	PM	PM10	PM2.5	VOC	NOx	SO2	CO	CO2	CH4	N2O	CO2e	H2SO4
			Emissions											
Cummins QSB5-G3		lb/hr-max	1.36E-02	1.31E-02	1.23E-02	9.08E-03	5.29E-01	1.12E-03	5.90E-01	1.18E+02	4.77E-03	9.54E-04	1.18E+02	4.50E-05
Kohler KDI 3404 TM		lb/hr-max	3.31E-02	3.17E-02	2.98E-02	1.21E-02	4.06E-01	7.29E-04	3.84E-01	7.65E+01	3.10E-03	6.20E-04	7.67E+01	2.93E-05
GM Vortec 5.7L V-8		lb/hr-max	1.35E-02	2.75E-02	2.75E-02	4.46E-01	8.92E-01	8.33E-04	3.16E-01	2.71E+02	3.26E-01	3.12E-04	2.79E+02	3.34E-05
GM Vortec 3.0L I-4		lb/hr-max	2.88E-05	3.69E-03	3.69E-03	4.41E-02	5.90E-01	2.20E-04	2.87E+00	7.80E+01	4.67E-01	8.23E-05	7.36E+01	8.81E-06
GM 5.7L V-8		lb/hr-max	5.64E-05	7.23E-03	7.23E-03	8.63E-02	1.24E+00	4.30E-04	5.09E+00	8.04E+01	9.14E-01	1.61E-04	1.44E+02	1.73E-05
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
		Total	3.01E-03	4.16E-03	4.02E-03	2.99E-02	1.83E-01	1.67E-04	4.62E-01	3.12E+01	8.57E-02	1.06E-04	3.46E+01	6.69E-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

Table B-8. Firewater Pump Engines Emissions Estimate

Emission Unit(s) ID =	FWP1/2		Fire Pump IC Engines
Parameter	**Value**	**Units**	**Source / Basis**
Calculation Inputs			
Rated Horsepower, each engine =	488	bhp	C18 ACERT™ Fire Pump
No. of Engines =	2		Design basis of project
Rated Horespower, Total =	976	bhp	= (Rated Horsepower, each engine) x (No. of Engines)
PM EF =	3.31E-04	lb/bhp-hr	NSPS Subpart IIII limit.
PM10 EF =	3.17E-04	lb/bhp-hr	PM10 = 96% of PM from AP-42, Table B.2-2, Category 1.
PM2.5 EF	2.98E-04	lb/bhp-hr	PM2.5 = 90% of PM from AP-42, Table B.2-2, Category 1.
VOC EF =	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	0.000	
2015 Plan Approval (3 units @ 700 bhp) =	0.035	0.033	0.031	0.26	0.43	0.001	0.60		120	0.00	
Updated per 2015 PaDEP Review* =	0.04	0.04	0.04	0.07	0.80	0.001	0.75		120		
Net Change in Emissions =	-0.02	-0.02	-0.03	0.05	-0.60	0.00	-0.47		-64.11	0.00	

Attachment B

- Transport Truck Road Particulate Matter Emissions (Hourly Rate)
- Talc Transport Truck Road Particulate Matter Emissions (Hourly Rate)
- Talc Transport Truck Road Particulate Matter Emissions (Annual Rate)

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	0.000	
2015 Plan Approval (3 units @ 700 bhp) =	0.035	0.033	0.031	0.26	0.43	0.001	0.60		120	0.00	
Updated per 2015 PaDEP Review* =	0.04	0.04	0.04	0.07	0.80	0.001	0.75		120		
Net Change in Emissions =	-0.02	-0.02	-0.03	0.05	-0.60	0.00	-0.47		-64.11	0.00	

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

TRANSPORT TRUCK ROAD PARTICULATE MATTER EMISSIONS (Hourly Rate)		
Parameter	**Value**	**Reference & Calculation Basis**
Calculation based based on paved Road Equation from AP-42 section 13.2.1 for hourly emissions		
k for PM	0.011 lb/VMT	AP-42, Table 13.2.1-1
k for PM10	0.0022 lb/VMT	AP-42, Table 13.2.1-1
k for PM2.5	0.00054 lb/VMT	AP-42, Table 13.2.1-1
sL	0.20 g/m2	Estimated value based on application of LAER controls.
W	25 tons	average weight (tons) of the vehicles traveling the road.
P	0 hours	Number of hours with rain fall greater than 0.01 inch.
N	24 hours	Number of hours in the averaging period.
EF for PM	0.068 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(N))
EF for PM10	0.0136 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(N))
EF for PM2.5	0.00333 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(N))
Vehicles per day	44 vehicles/day	Design estimate (1).
Hours per day of vehicle traffic	8 hrs/day	Assumes 8 hours per day of traffic as worst-case for short-term rate.
Road Length	0.49 miles	Round trip distance from current plot plan.
VMT hourly =	2.7 VMT/hr	= (Vehicles per day) / (Hours per day of vehicle traffic) x (Road Length)
PM Emissions [hourly]	0.183 lb/hr	= (VMT hourly =) x (EF for PM)
PM10 Emissions [hourly]	0.037 lb/hr	= (VMT hourly =) x (EF for PM10)
PM2.5 Emissions [hourly]	0.009 lb/hr	= (VMT hourly =) x (EF for PM2.5)
PM Emissions [annual]	0.800 tpy	= (PM Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM10 Emissions [annual]	0.160 tpy	= (PM10 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM2.5 Emissions [annual]	0.039 tpy	= (PM2.5 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)

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

TALC TRANSPORT TRUCK ROAD PARTICULATE MATTER EMISSIONS (Hourly Rate)		
Parameter	**Value**	**Reference & Calculation Basis**
Calculation based based on paved Road Equation from AP-42 section 13.2.1 for hourly emissions		
k for PM	0.011 lb/VMT	AP-42, Table 13.2.1-1
k for PM10	0.0022 lb/VMT	AP-42, Table 13.2.1-1
k for PM2.5	0.00054 lb/VMT	AP-42, Table 13.2.1-1
sL	0.20 g/m2	Estimated value based on application of LAER controls.
W	25 tons	average weight (tons) of the vehicles traveling the road.
P	0 hours	Number of hours with rain fall greater than 0.01 inch.
N	24 hours	Number of hours in the averaging period.
EF for PM	0.068 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(N))
EF for PM10	0.0136 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(N))
EF for PM2.5	0.00333 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 –1.2 P/(N))
Vehicles per day	4 vehicles/day	Design estimate (1).
Hours per day of vehicle traffic	1 hrs/day	Assumes 1 hour per day of traffic as worst-case for short-term rate.
Road Length	0.40 miles	Round trip distance from current plot plan.
VMT hourly =	1.6 VMT/hr	= (Vehicles per day) / (Hours per day of vehicle traffic) x (Road Length)
PM Emissions [hourly]	0.108 lb/hr	= (VMT hourly =) x (EF for PM)
PM10 Emissions [hourly]	0.022 lb/hr	= (VMT hourly =) x (EF for PM10)
PM2.5 Emissions [hourly]	0.005 lb/hr	= (VMT hourly =) x (EF for PM2.5)
PM Emissions [annual]	0.475 tpy	= (PM Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM10 Emissions [annual]	0.095 tpy	= (PM10 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM2.5 Emissions [annual]	0.023 tpy	= (PM2.5 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)

Note: (1) Four truckloads per railcar

TALC TRANSPORT TRUCK ROAD PARTICULATE MATTER EMISSIONS (Annual Rate)		
Parameter	**Value**	**Reference & Calculation Basis**
Calculation based based on paved Road Equation from AP-42 section 13.2.1 for hourly emissions		
k for PM	0.011 lb/VMT	AP-42, Table 13.2.1-1
k for PM10	0.0022 lb/VMT	AP-42, Table 13.2.1-1
k for PM2.5	0.00054 lb/VMT	AP-42, Table 13.2.1-1
sL	0.20 g/m2	Estimated value based on application of LAER controls.
W	25 tons	average weight (tons) of the vehicles traveling the road.
P	150 days	Number of days with rain fall greater than 0.01 inch
N	365 days	Number of days in the averaging period.
EF for PM	0.061 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
EF for PM10	0.0122 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
EF for PM2.5	0.00299 lb/VMT	EF = k (sL)0.91 (W)1.02 (1 – P/(4*N))
Vehicles per day	4 vehicles/day	Design estimate (1).
Hours per day of vehicle traffic	24.00 hr/day	Annual average value.
Road Length	0.40 miles	Round trip distance from current plot plan.
VMT hourly =	0.1 VMT/hr	= (Vehicles per day) / (Hours per day of vehicle traffic) x (Road Length)
PM Emissions [hourly]	0.00406 lb/hr	= (VMT hourly =) x (EF for PM)
PM10 Emissions [hourly]	0.001 lb/hr	= (VMT hourly =) x (EF for PM10)
PM2.5 Emissions [hourly]	0.0002 lb/hr	= (VMT hourly =) x (EF for PM2.5)
PM Emissions [annual]	0.018 tpy	= (PM Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM10 Emissions [annual]	0.004 tpy	= (PM10 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)
PM2.5 Emissions [annual]	0.001 tpy	= (PM2.5 Emissions [hourly]) x (8,760 hr/yr) / (2,000 lb/T)

Note: (1) Four truckloads per railcar

Attachment C

Air Dispersion Modeling and Class II Visibility Analysis for the Shell Polymers Monaca Site in Beaver County Pennsylvania
(Submittal Update No. 5 September 2020)

APPENDIX C

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

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Initial Submittal April 2014
Submittal Update No. 1 October 2014
Submittal Update No. 2 February 2015
Submittal Update No. 3 February 2020
Submittal Update No. 4 May 2020
Submittal Update No. 5 September 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, off-site source information, and modeling procedures. A complete list of the changes made to the model since the last update is provided below. This updated 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”). A comparison of the modeled impacts of the permitted facility design and the most recent facility design is also presented. 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 impacts 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 16%, with the new design impacts generally 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]

1.1 Model Revisions

- Included BEEST equivalency demonstration;
- Included ethane cracking furnace mode runs;
- Updated emission rates for the two fire water pumps and pellet dryer vent;
- Included original 2015 Class I SIL runs with comparison of results to results of revised 2020 Class I SIL runs;
- Lowered CO emission rates for ethane cracking furnaces #3 through #7;
- Eliminated the No. 6 emergency generator;
- Corrected cooling tower stack diameters and flows;
- Corrected NOx emission rates for the firewater pumps and generators;
- Jewel Acquisition Meltshop – removed from CO & PM-10 NAAQS analyses because it ceased operation;
- BASF Thermal Oxidation Unit – corrected stack location, stack height, stack temperature, stack velocity, stack diameter, and added downwash parameters;
- BASF – location, emission, and downwash data added for Cleaver Brooks Boiler #1 and Cleaver Brooks Boiler #2;
- Anchor Hocking Melt Tank – corrected stack location, stack height, stack temperature, stack velocity, stack diameter, and downwash parameters;
- Anchor Hocking Carton Mfg and Batch Plant – corrected stack locations;

- First Energy Bruce Mansfield (Unit #1&2) – corrected stack location, stack temperature, stack diameter, and downwash parameters;
- First Energy Bruce Mansfield (Unit #3) – corrected stack location, stack diameter, and downwash parameters;
- First Energy Bruce Mansfield – Modeled Units 1&2 from a single stack instead of separate flues. Also modeled Unit 3 from a single stack instead of separate flues;
- IPSCO Koppel Melt Shop – corrected stack location and downwash parameters;
- Nova Chemical sources – corrected in-stack ratio from 0.2 to 0.5;
- First Energy Bruce Mansfield Auxiliary Boiler – corrected in-stack ratio from 0.05 to 0.2;
- Corrected Lawrenceville CO 8-hour background from 1.1 to 1.2 ppm;
- Updated Beaver Falls NO2 1-hour & annual background data from 2015-2017 to 2016-2018;
- Corrected Beaver Falls NO2 1-hour temporally varying background concentrations;
- Updated Beaver Falls PM-10 24-hour background from 2015-2017 to 2016-2018;
- Revised 3DEP terrain data resolution in AERMAP from 1 arc-sec to 1/3 arc-sec (except in Class I SIL runs); and,
- Eliminated off-site sources located in excess of 20km from the Shell site based upon Appendix W and EPA policy.

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.

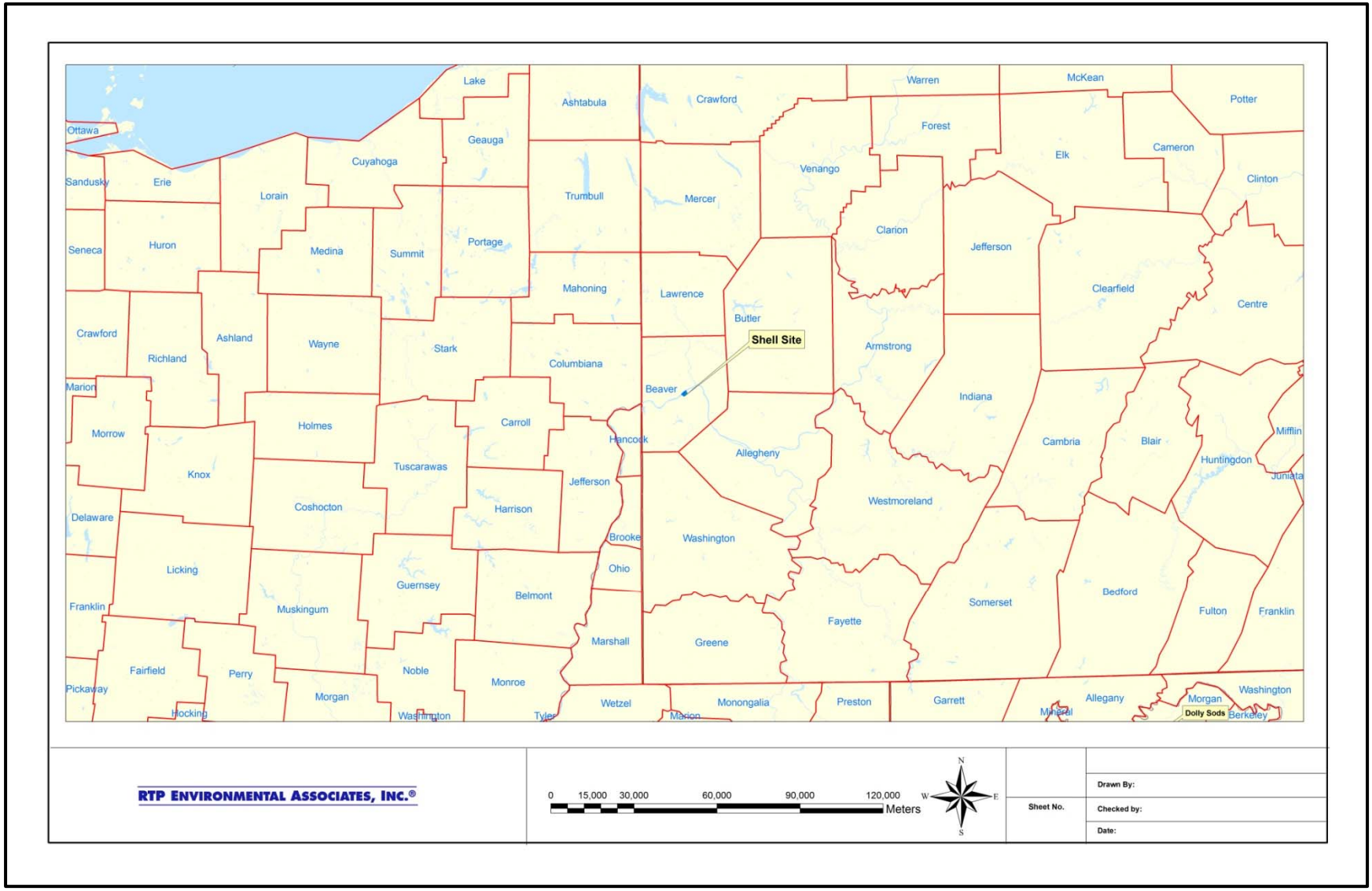


Figure 1. General Location of the Shell Facility

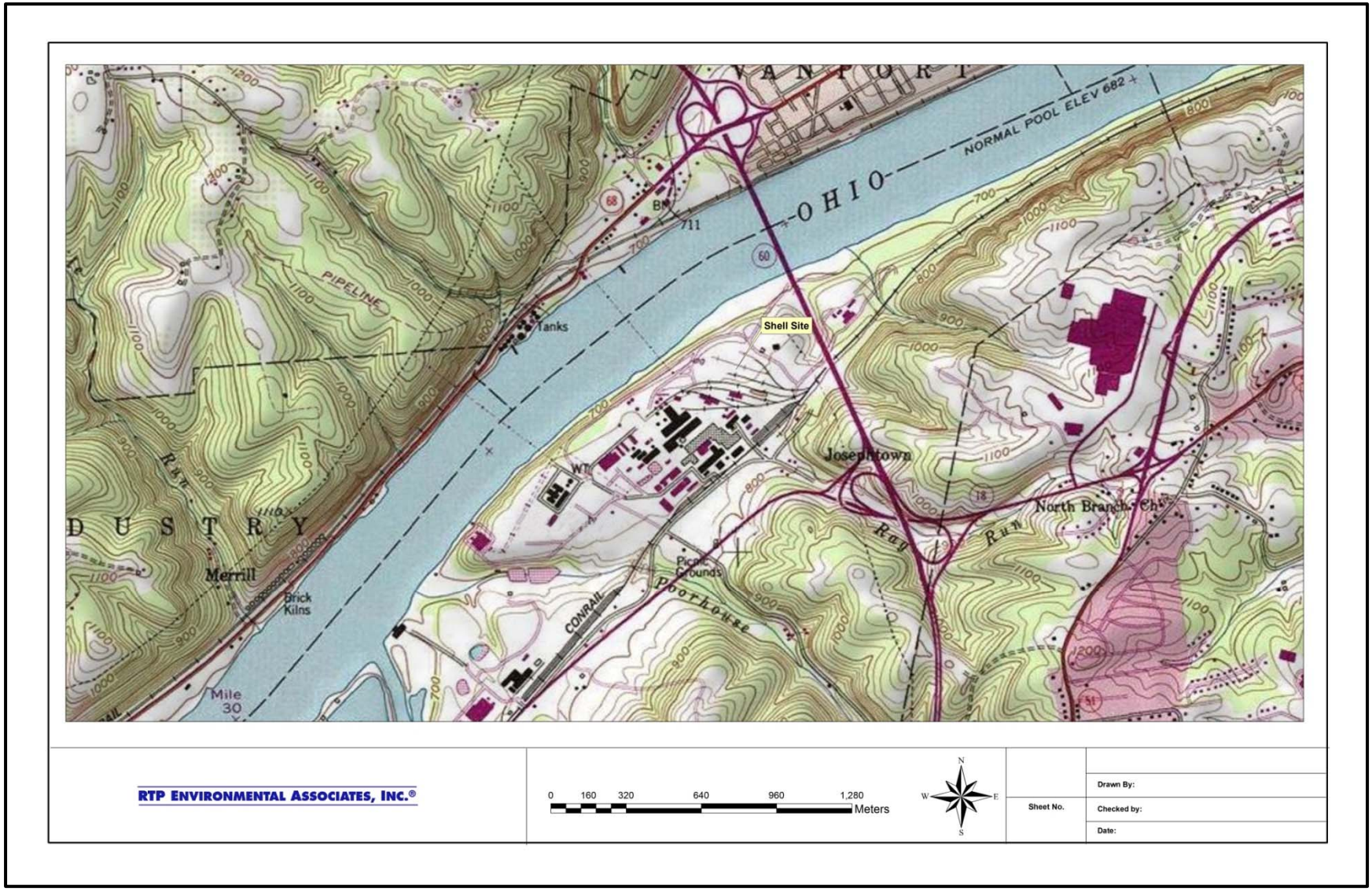


Figure 2. Specific Location of the Shell Facility

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 previously used an altered version of the AERMOD code to allow for flexibility in the file naming convention. While the dispersion algorithms of AERMOD were not altered, US EPA requested that a model equivalency evaluation be submitted pursuant to Section 3.1 of 40 CFR 51, Appendix W as part of the initial modeling demonstration. The current version of the GUI uses the unaltered EPA version of AERMOD. Therefore, an updated equivalency demonstration is not needed.

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.

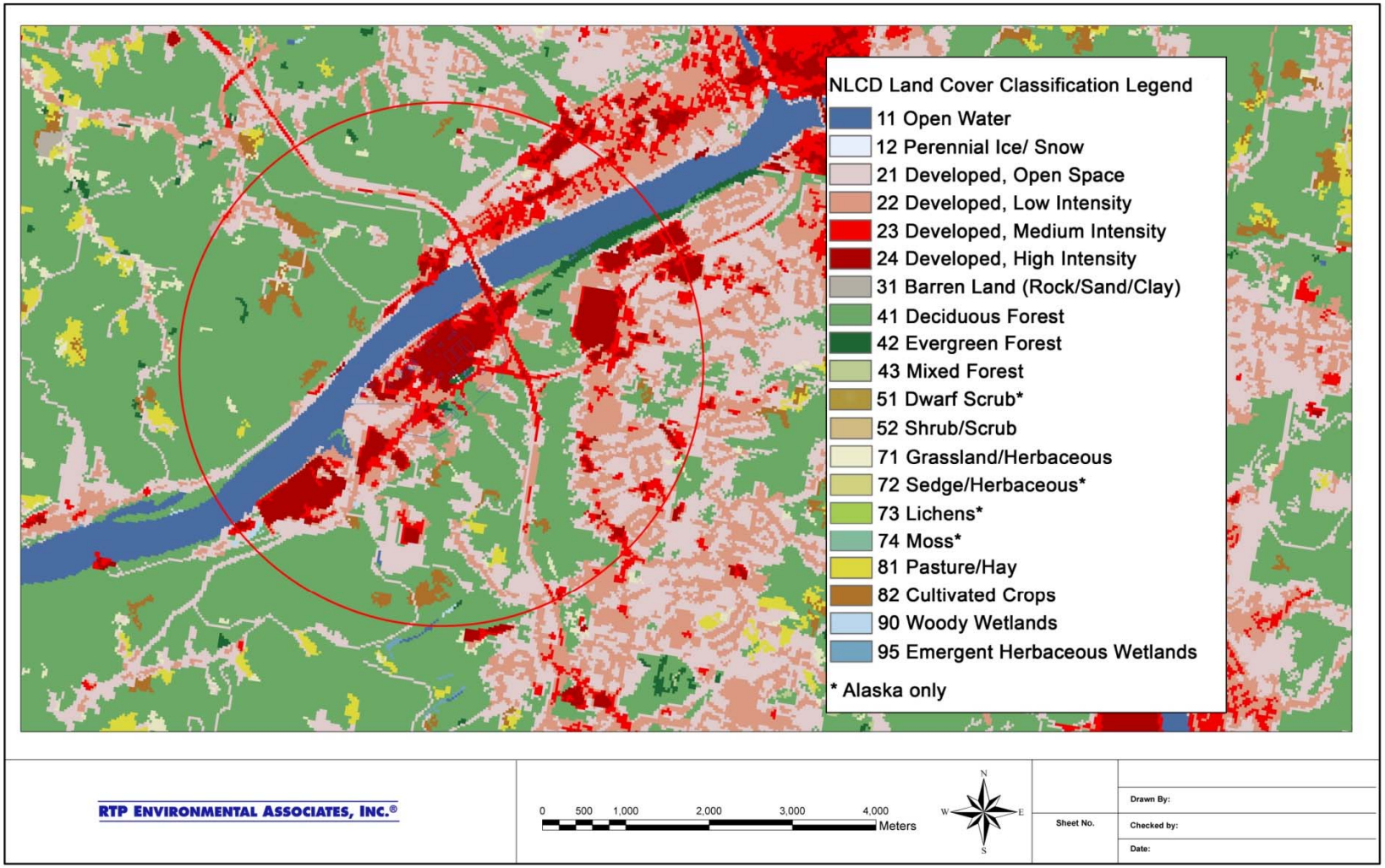


Figure 3. Land Use within Three Kilometers

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

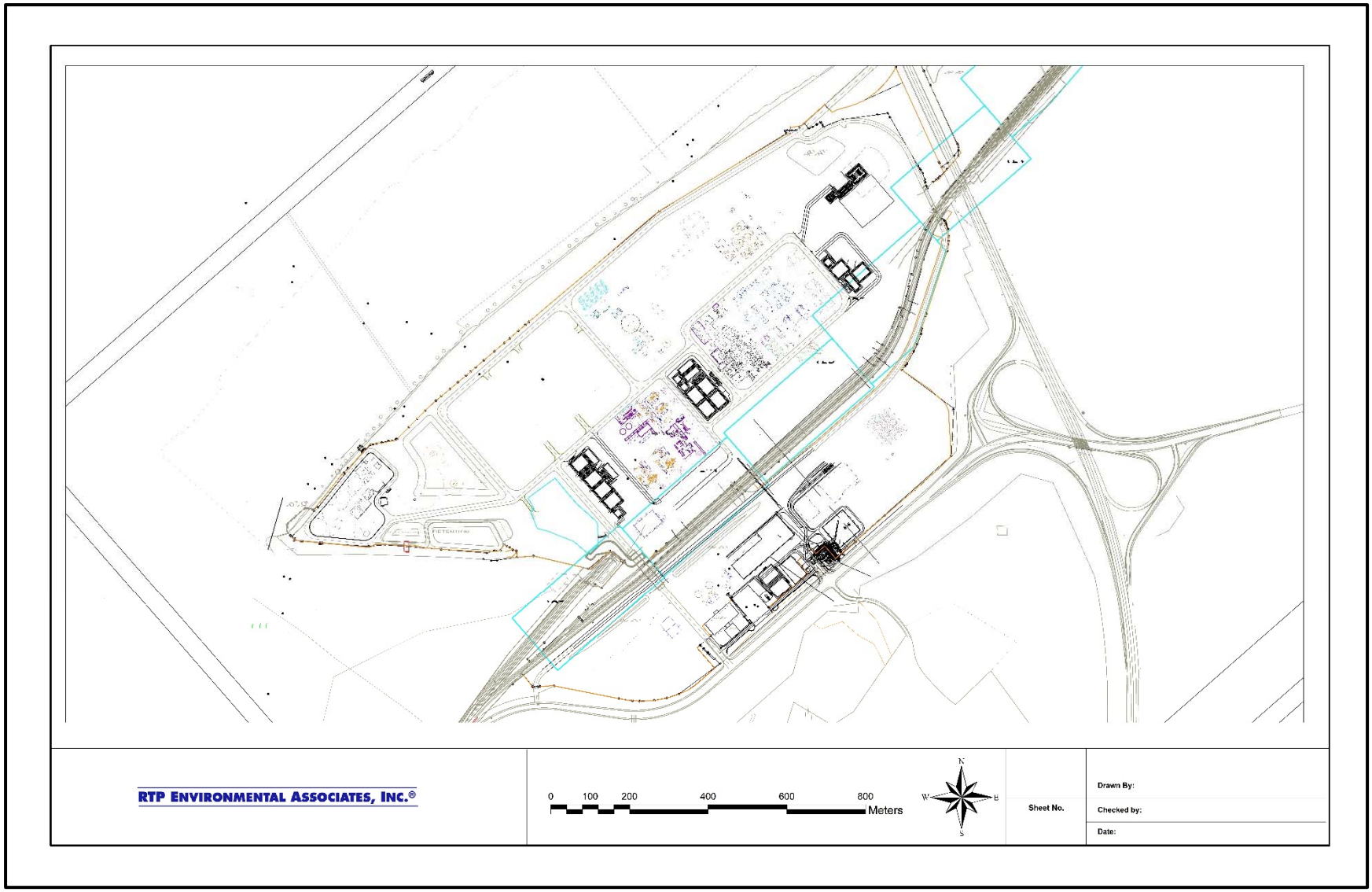


Figure 4. Shell Facility Plot Plan

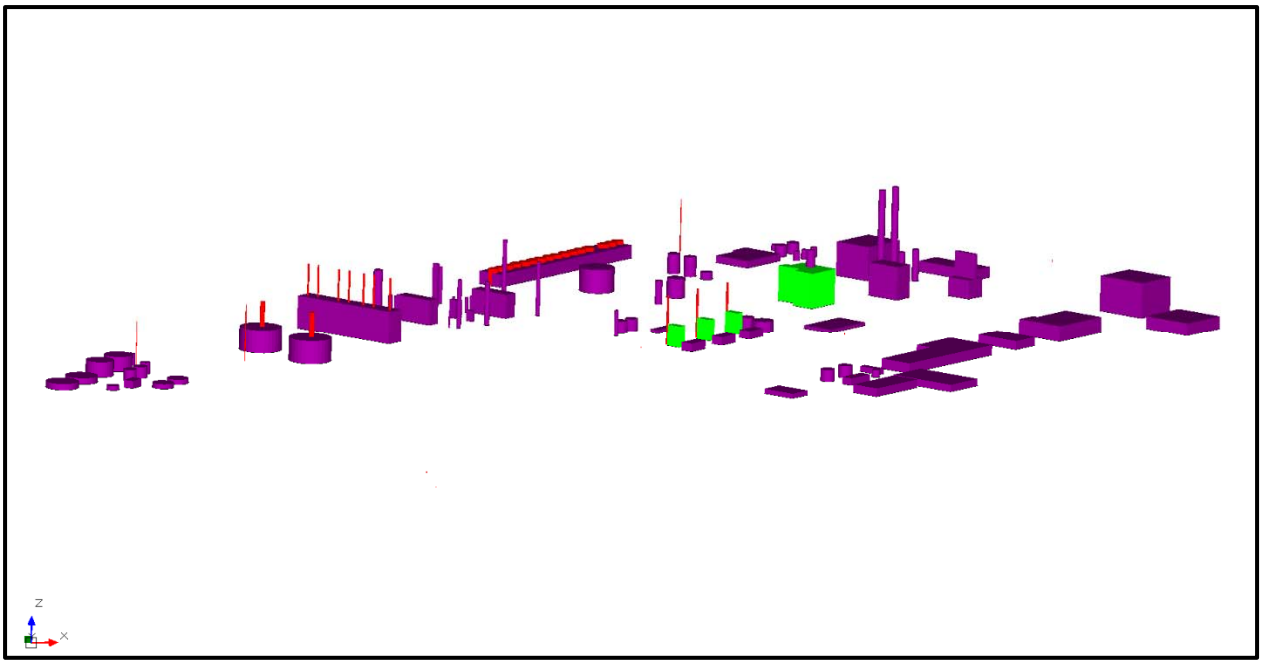


Figure 5. Shell Three Dimensional Plot Plan (View from SW)

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. 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 (2016-2018) from the Beaver Falls monitor to establish representative background NO_2 and

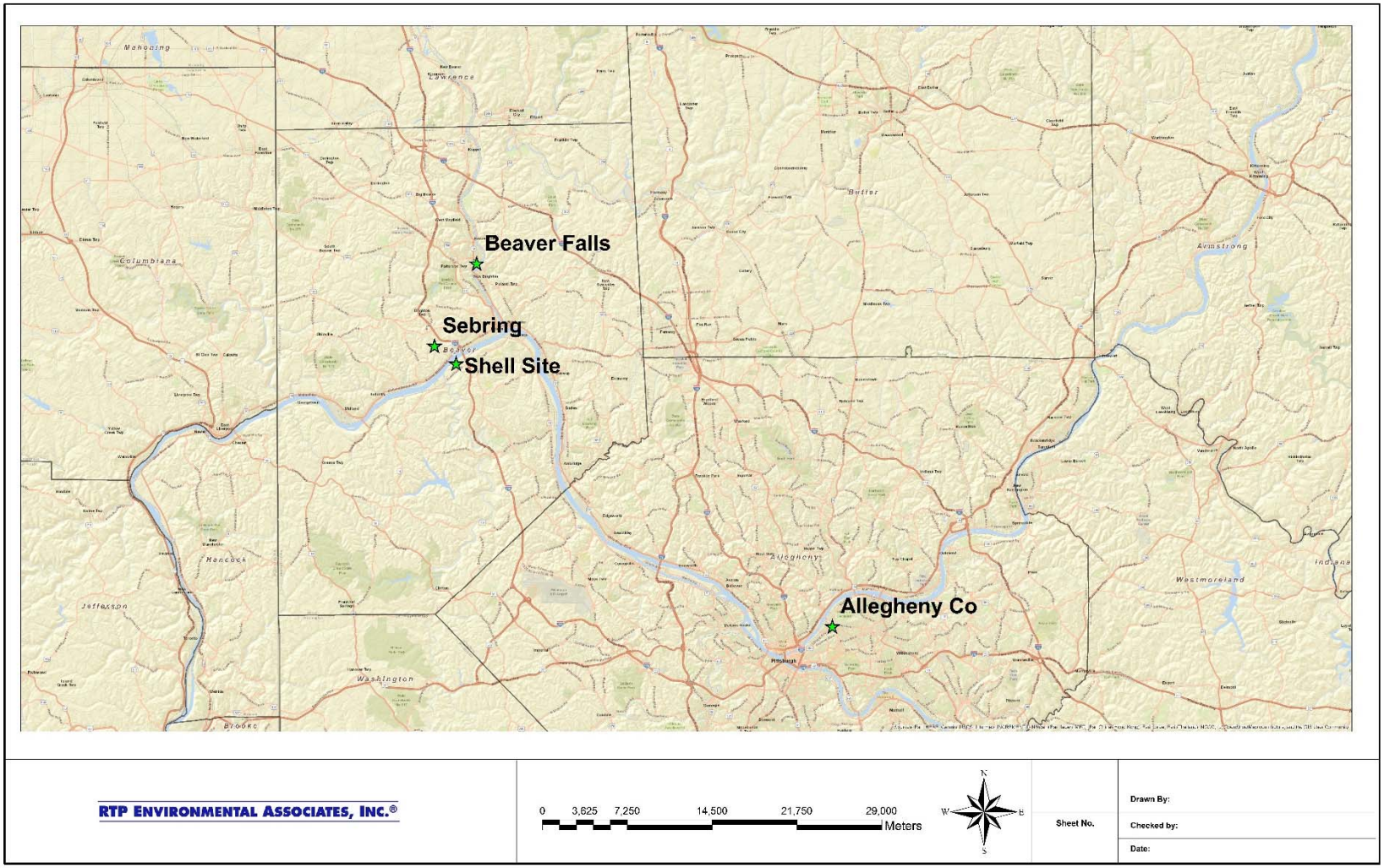


Figure 6. Ambient Air Quality Monitors in the Vicinity of the Shell Site

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	107	Beaver Falls (2016-18)
NO_2	Annual	8.93 ppb, 16.9 µg/m^3	
CO	1-hour	2.2 ppm, 2515 µg/m^3	Allegheny County (2016-18)
	8-hour	1.2 ppm, 1372 µg/m^3	

Table 2. Beaver Falls 98% Hourly NO_2 (ppb) By Season and Hour of Day (2016-18)

Model Ending Hour	Winter	Spring	Summer	Fall
01	32.7	26.7	18.7	24.0
02	32.3	27.2	18.2	25.3
03	33.3	27.0	20.7	26.3
04	33.7	30.0	19.7	22.7
05	33.3	31.3	19.7	21.7
06	33.7	31.7	17.7	22.0
07	33.3	31.0	18.7	23.7
08	33.0	32.0	17.7	24.3
09	34.0	30.0	16.7	25.0
10	36.0	28.0	15.3	24.7
11	34.0	19.7	11.7	25.3
12	33.3	15.0	8.0	22.7
13	29.7	11.0	7.0	18.0
14	28.3	10.0	7.7	19.0
15	28.7	9.3	5.3	17.3
16	32.0	9.0	6.7	16.0
17	32.3	9.7	6.7	20.3
18	32.3	12.3	7.3	24.0
19	31.0	16.0	9.7	26.0
20	31.0	19.7	14.3	24.3
21	32.7	22.0	15.3	23.7
22	35.3	23.7	16.0	24.3
23	33.0	26.0	17.3	24.3
24	33.3	28.3	18.3	24.7

Note: Maximum 1-hr NO_2 value is 36 ppb or 68 $\mu g/m^3$.

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 (2016-2018) 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 1/3 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

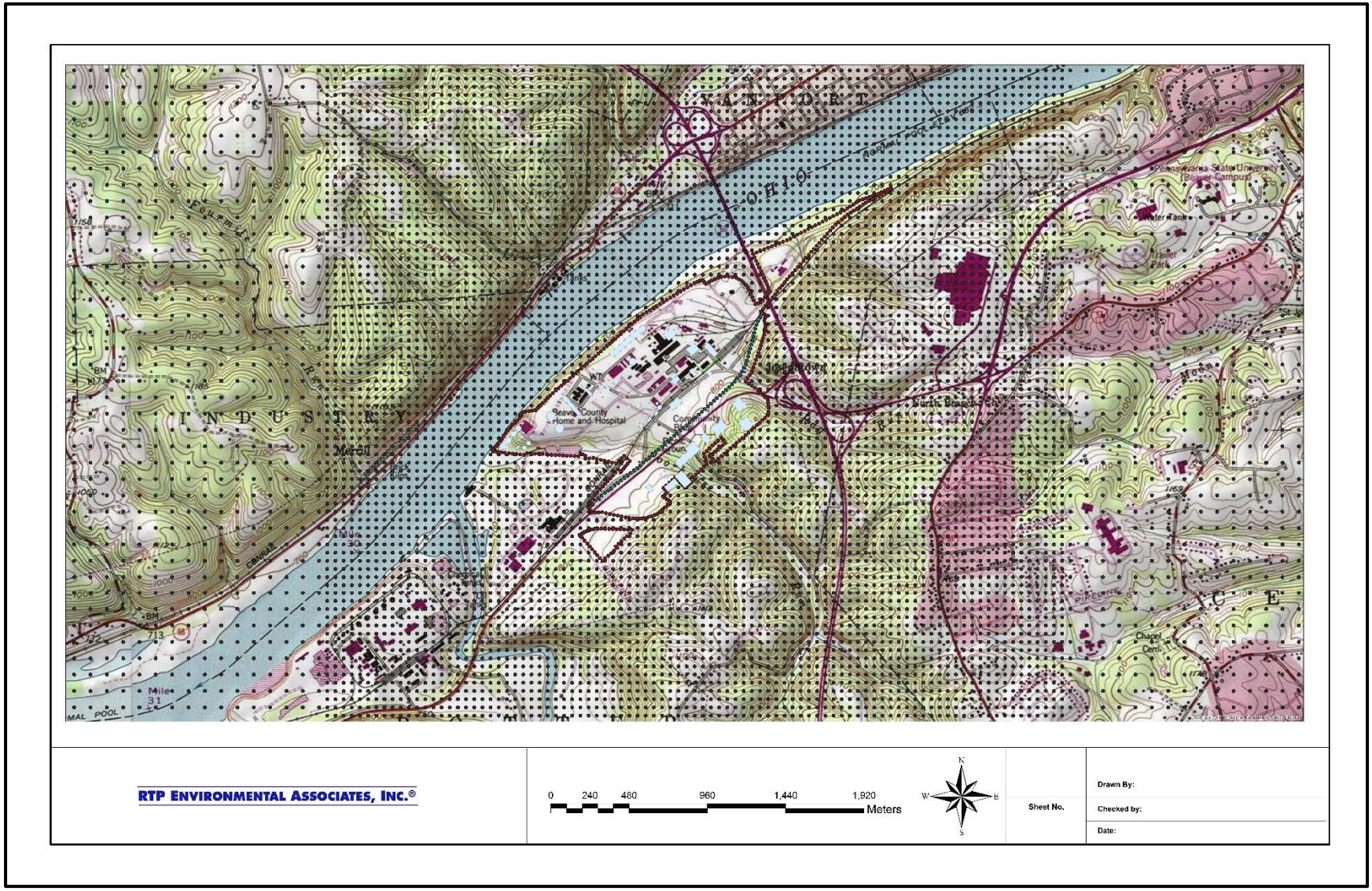


Figure 7. Shell Near-field Receptor Grid

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.

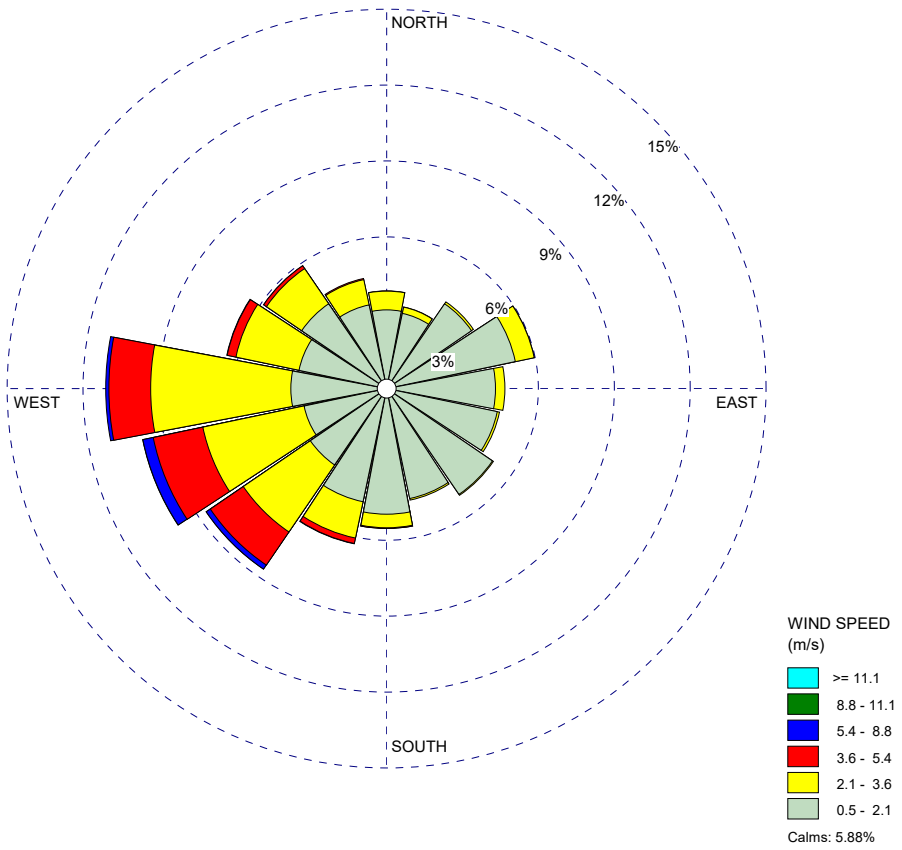
The First Energy station is located approximately 8km downstream of the Shell facility, also on the Ohio River. The Beaver Valley meteorological station and the Shell facility also share a similar orientation in relation to the Ohio River. As can be seen in Figure 8, the river flows from the northeast 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

WIND ROSE PLOT:

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME: RTP Environmental	
Reference Level Winds (10.7m) Only	**Start Date: 1/1/2006 - 00:00** **End Date: 12/31/2010 - 23:00**		RTP ENVIRONMENTAL ASSOCIATES, INC.®
	CALM WINDS: **5.88%**	TOTAL COUNT: **43688 hrs.**	
	AVG. WIND SPEED: **1.62 m/s**	DATE: **1/26/2015**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 9. Beaver Valley Windrose 2006-2010

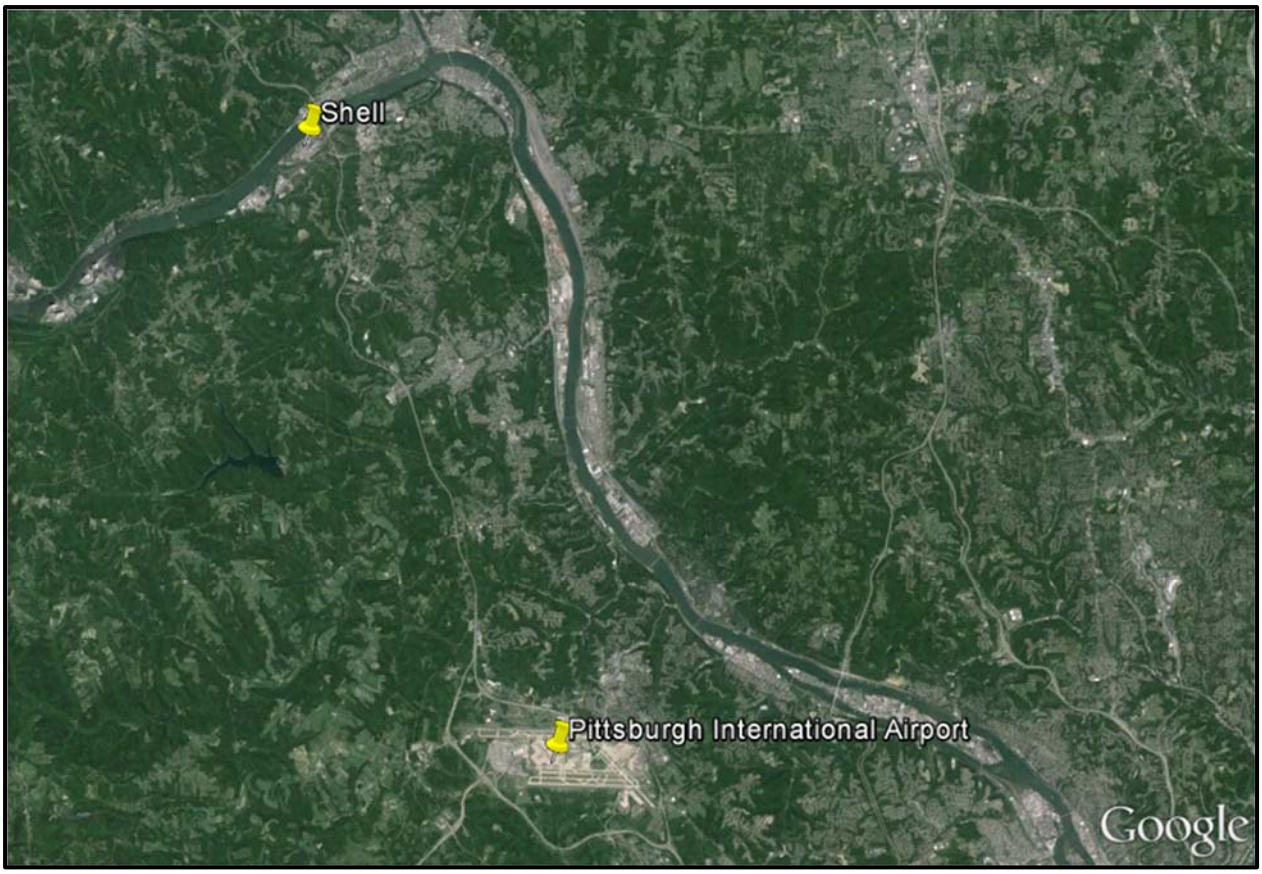


Figure 10. Pittsburgh International Airport Location Relative to Shell

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.

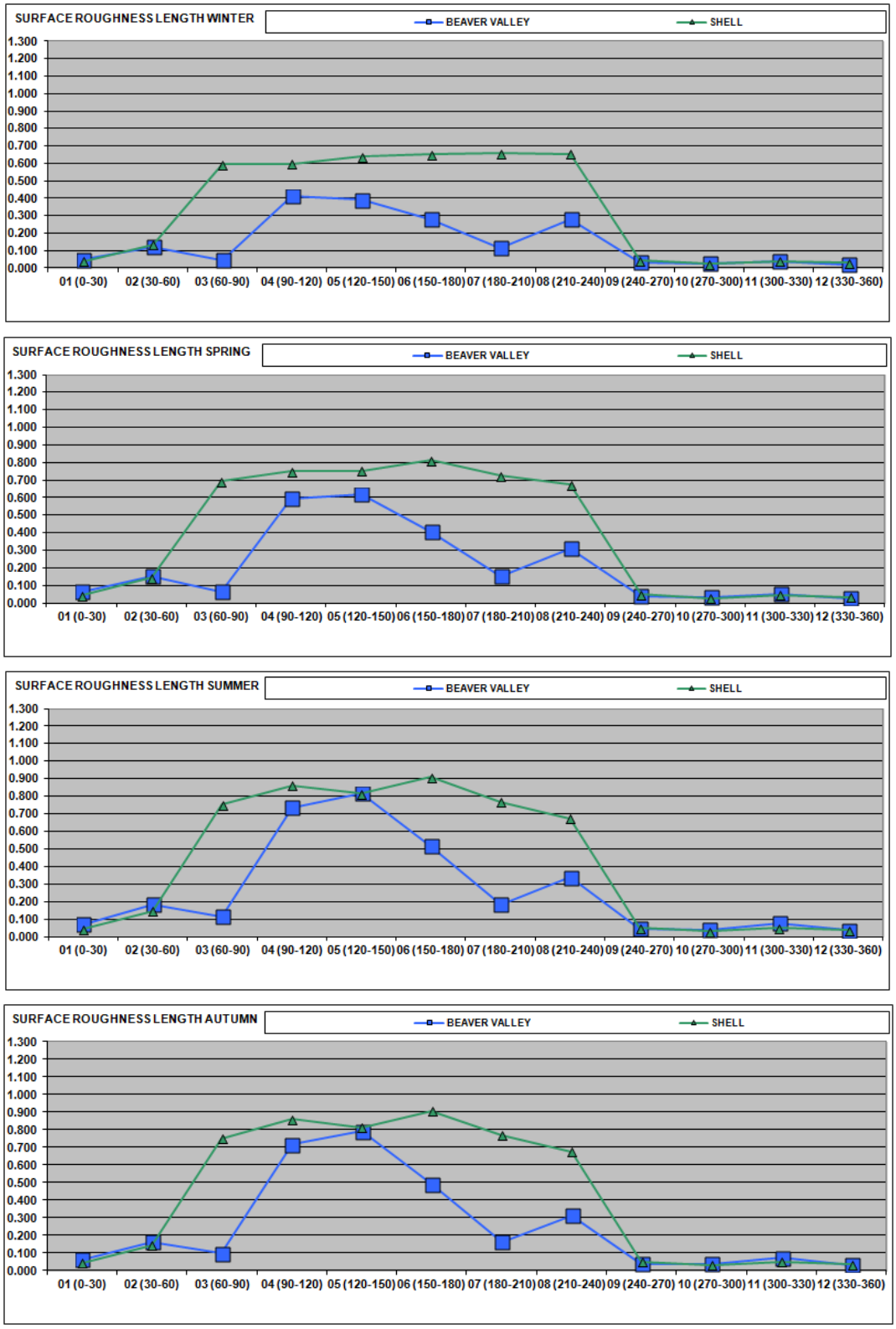


Figure 11. Meteorological Data Representativeness Analysis Results

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 Modes and Worst Case Operating Conditions

The furnaces will also have different modes of operation. All modes of operation, except for the normal modes, will occur infrequently and only for short durations. The modes of operation include: maximum normal, minimum normal, decoking, feed in/feed out, hot standby, and startup/shutdown. Normal furnace operation ranges from 100% of the furnace feed rate to 70% of the furnace feed rate. Both the maximum and minimum of the range of normal operation were evaluated. Furnace emissions are highest during normal operation for all pollutants except CO. Hourly NO_2 emissions during normal operation will be limited to 6.2 lb/hr, except two of the furnaces will be allowed to operate simultaneously at 9.3 lb/hr to allow for variation in control device performance. Since the exhaust gas temperatures and velocities vary by mode, it was necessary to determine the mode of operation that resulted in worst-case impacts. All furnace modes were modeled with anticipated emissions and gas release characteristics. The mode of operation with the worst case modeled impacts was then used in the remainder of the analysis.

CO emissions are significantly higher during decoking. In addition, as stated, two of the furnaces will be allowed to operate simultaneously at an elevated NO_2 emission rate. It was therefore also necessary to identify furnaces with worst case short-term impacts during decoking and elevated NO_2 emissions. 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 analysis, Shell has conservatively modeled the higher, non-coking PM10 emission rate for all furnaces. Both normal and decoking modes of furnace operation were modeled for the Class I SIL analysis and the highest 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 Allegheny Energy facility was included even though it is located approximately 60km from Shell as it is a large source of NO_2. The inventory of offsite sources was provided by PADEP and through review of facility permits.[10] In addition, model inputs for the nearby BASF facility were updated based upon more current information obtained from the facility. 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 3km 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 except the 75% load case for turbine number 3 resulted in an 8-hr impact that is slightly (0.006 μg/m^3) higher than the 100% load case. Since turbine startups generally last less than an hour, the 100% load condition was considered worst case. The 100% load case was therefore used in the remainder of the modeling analysis.

6.2 Furnace Mode and Worst Case Operating Condition Results

The results of the worst-case furnace mode analysis are presented in Tables 6 and 7. As shown, decoking mode results in the worst case furnace impacts for CO. The maximum normal mode of operation results in the worst case impacts for all other pollutants. This normal mode of furnace operation was therefore used to model all but two of the furnaces. The other two furnaces were modeled with the elevated CO and NOx emissions to represent decoking and the reduced NOx control efficiency. Table 7 demonstrates that 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.

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 8. 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 and 1-hr CO

Table 5. Turbine Load Analysis Results

Averaging Period	Source Name	Modeled Concentration ($\mu g/m^3$)	Source Description
1-hr	CT1_100	**1.295**	Turbine 1, 100% load
	CT1_75	1.138	Turbine 1, 75% load
	CT1_45	0.758	Turbine 1, 45% load
	CT2_100	**1.270**	Turbine 2, 100% load
	CT2_75	1.121	Turbine 2, 75% load
	CT2_45	0.781	Turbine 2, 45% load
	CT3_100	**1.264**	Turbine 3, 100% load
	CT3_75	1.098	Turbine 3, 75% load
	CT3_45	0.791	Turbine 3, 45% load
24-hr	CT1_100	**0.272**	Turbine 1, 100% load
	CT1_75	0.249	Turbine 1, 75% load
	CT1_45	0.187	Turbine 1, 45% load
	CT2_100	**0.242**	Turbine 2, 100% load
	CT2_75	0.227	Turbine 2, 75% load
	CT2_45	0.171	Turbine 2, 45% load
	CT3_100	**0.216**	Turbine 3, 100% load
	CT3_75	0.205	Turbine 3, 75% load
	CT3_45	0.156	Turbine 3, 45% load
8-hr	CT1_100	**0.530**	Turbine 1, 100% load
	CT1_75	0.488	Turbine 1, 75% load
	CT1_45	0.363	Turbine 1, 45% load
	CT2_100	**0.557**	Turbine 2, 100% load
	CT2_75	0.482	Turbine 2, 75% load
	CT2_45	0.388	Turbine 2, 45% load
	CT3_100	0.569	Turbine 3, 100% load
	CT3_75	**0.575**	Turbine 3, 75% load
	CT3_45	0.454	Turbine 3, 45% load
Annual	CT1_100	**0.019**	Turbine 1, 100% load
	CT1_75	0.017	Turbine 1, 75% load
	CT1_45	0.013	Turbine 1, 45% load
	CT2_100	**0.019**	Turbine 2, 100% load
	CT2_75	0.017	Turbine 2, 75% load
	CT2_45	0.013	Turbine 2, 45% load
	CT3_100	**0.018**	Turbine 3, 100% load
	CT3_75	0.017	Turbine 3, 75% load
	CT3_45	0.013	Turbine 3, 45% load

Table 6. Worst Case Furnace Mode Analysis Results

Pollutant	Average	Mode	Modeled Concentration (µg/m3)
CO	1-HR	Normal (Max Rate)	32.67
		Normal (Min Rate)	28.09
		Decoke	**79.04**
		Feed in/out	15.55
		Hot Standby	10.57
		Start up/Shut down	51.74
	8-HR	Normal (Max Rate)	16.62
		Normal (Min Rate)	13.12
		Decoke	**40.47**
		Feed in/out	7.68
		Hot Standby	5.18
		Start up/Shut down	23.75
NO_2	1ST-HIGHEST MAX DAILY 1-HR	Normal (Max Rate)	**11.74**
		Normal (Min Rate)	8.70
		Decoke	3.40
		Feed in/out	5.46
		Hot Standby	6.04
		Start up/Shut down	NA
	ANNUAL	Normal (Max Rate)	**0.15**
		Normal (Min Rate)	0.14
		Decoke	0.00
		Feed in/out	0.00
		Hot Standby	0.01
		Start up/Shut down	0.00
PM10	24-HR	Normal (Max Rate)	**1.18**
		Normal (Min Rate)	0.88
		Decoke	0.71
		Feed in/out	0.55
		Hot Standby	0.37
		Start up/Shut down	0.21
	ANNUAL	Normal (Max Rate)	**0.08**
		Normal (Min Rate)	0.06
		Decoke	0.05
		Feed in/out	0.04
		Hot Standby	0.03
		Start up/Shut down	0.02

NA – Not applicable. Start-up/Shut-down mode not modeled for the 1-hr NO_2 average as this mode is considered intermittent and will not contribute to an exceedance of the 1-hr standard.

Table 7. Worst Case Furnace Analysis Results

Averaging Period	Source Name	Modeled Concentration (µg/m³)	Source Description
1-hr	EC#1	**1.519**	Ethane Cracking Furnace #1
	EC#2	**1.495**	Ethane Cracking Furnace #2
	EC#3	1.473	Ethane Cracking Furnace #3
	EC#4	1.451	Ethane Cracking Furnace #4
	EC#5	1.418	Ethane Cracking Furnace #5
	EC#6	1.392	Ethane Cracking Furnace #6
	EC#7	1.336	Ethane Cracking Furnace #7
24-hr	EC#1	**0.776**	Ethane Cracking Furnace #1
	EC#2	**0.768**	Ethane Cracking Furnace #2
	EC#3	0.753	Ethane Cracking Furnace #3
	EC#4	0.731	Ethane Cracking Furnace #4
	EC#5	0.692	Ethane Cracking Furnace #5
	EC#6	0.670	Ethane Cracking Furnace #6
	EC#7	0.623	Ethane Cracking Furnace #7
8-hr	EC#1	**0.385**	Ethane Cracking Furnace #1
	EC#2	**0.384**	Ethane Cracking Furnace #2
	EC#3	0.367	Ethane Cracking Furnace #3
	EC#4	0.353	Ethane Cracking Furnace #4
	EC#5	0.344	Ethane Cracking Furnace #5
	EC#6	0.412	Ethane Cracking Furnace #6
	EC#7	0.381	Ethane Cracking Furnace #7

Table 8. Class II Significant Impact Analysis Results

Pollutant	Avg Period	Maximum Modeled Impact - Original Plant Design (µg/m³)	Maximum Modeled Impact - Current Plant Design (µg/m³)	PSD Significant Class II Impact Level (µg/m³)	Significant Monitoring Concentration (µg/m³)	Maximum Distance to a Significant Impact – Current Plant Design (km)
PM10	24-hr	11.2	9.60	5.0	10	3.4
	Annual	2.60	2.80	1.0	N/A	2.5
NO_2[a]	1-hr	64.2	59.49	1.0	14	31.4
	Annual	1.26	1.29	1.0	NA	2.4
CO	1-hr	2035	1776	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.

impacts. The new plant design PM10 24-hr and CO 1-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 NO_2, 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.

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 20km of the Shell facility and the Allegheny Energy facility, located at 60km, were conservatively modeled in conjunction with the Shell facility in assessing compliance with the PM10 and CO NAAQS. Consistent with the January 17, 2018 Appendix W regulation, only sources located within 10km of Shell were considered in the 1-hr NO2 NAAQS analysis. 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 9. 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 NO_2 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 9. 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	272[a]	NA	272	188	Maximum concentration due to off-site sources. Shell project impact is insignificant at 0.44 $\mu g/m^3$ (32nd High) as paired in time and space.
	Annual	8.16	16.9	25.0	100	Compliant
CO	1-hour	1,697	2,515	4,212	40,000	Compliant
	8-hour	804	1,372	2,176	10,000	Compliant
PM10	24-hour	19.0	107	126	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 0.44 µg/m^3. The 1-hr NO_2 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 10. 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 10. PSD Increment Analysis Results

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)[a]	Standard ($\mu g/m^3$)	Comment
PM10	24-hour	22.5	30	Compliant
	Annual	5.22	17	Compliant
NO_2	Annual	8.16	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 conservatively 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 61.4 and 112 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 11, 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 12. 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 11. 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

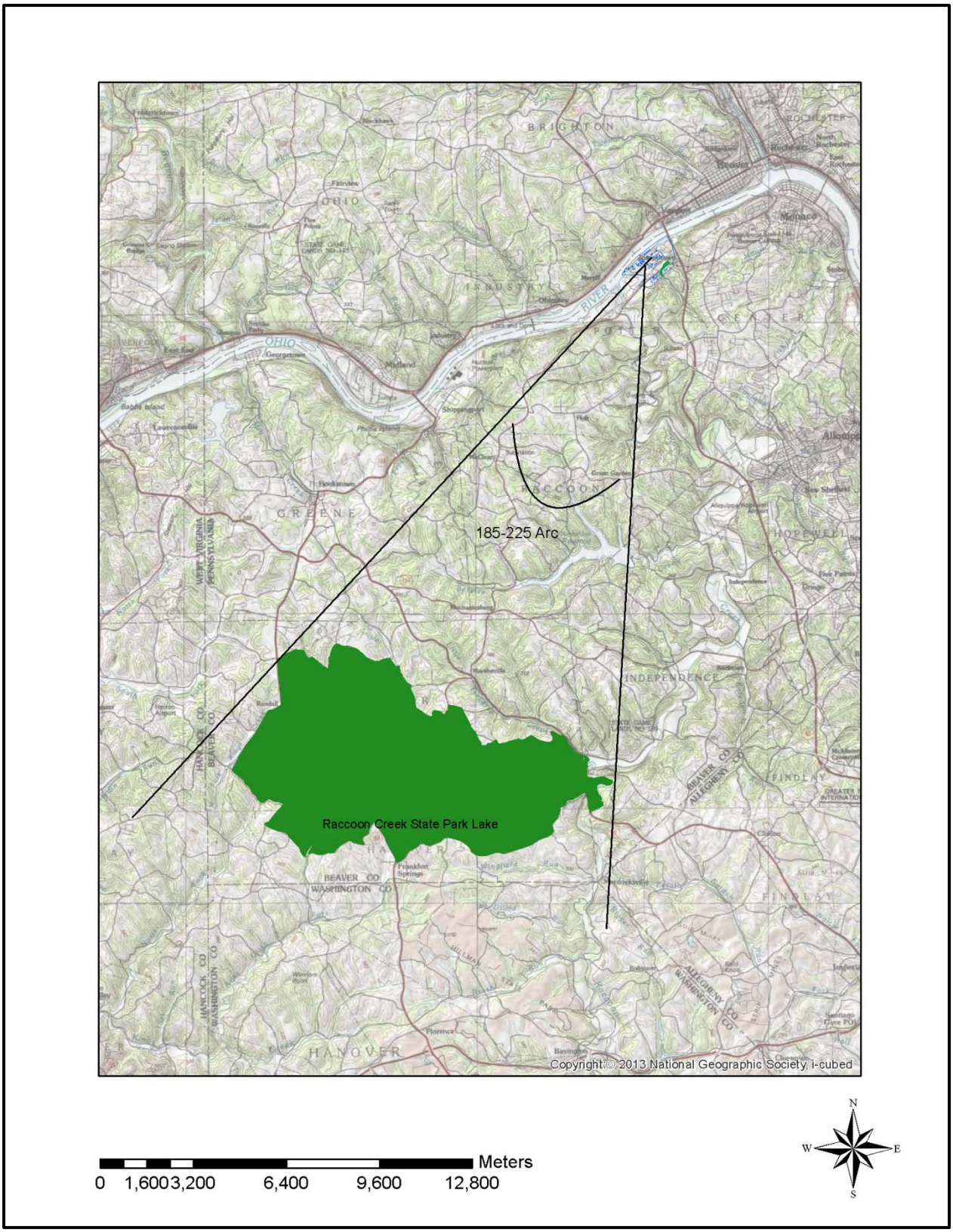
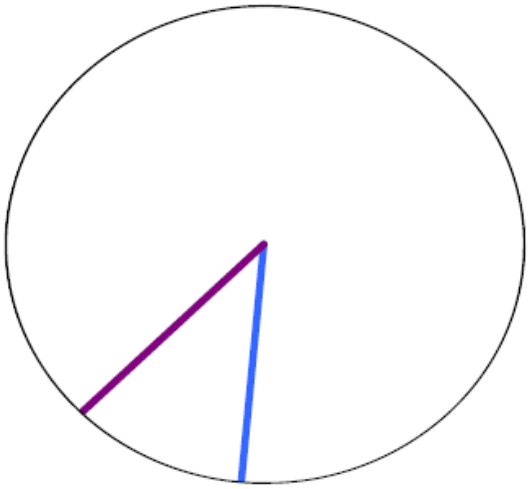


Figure 12. Location of Raccoon Creek State Park Relative to the Shell Site

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 12. 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 4.1 (Q= 783 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 revised Q/D for each Class I area is provided below and the correspondence with the FLMs is provided in Attachment A.

Class I Area Q/D Calculations

Class I Area	Distance (km)	Q (tpy)	Q/D
Otter Creek (USFS)	189	782.8	4.15
Dolly Sods (USFS)	200	782.8	3.92
Shenandoah (NPS)	269	782.8	2.91
James River Face (USFS)	347	782.8	2.26

Pollutant	Q (TPY)
NOx	492.19
PM10	268.84
SO2	21.00
H2SO4	0.80
Total	782.84

Q is calculated as maximum daily rate x 365.
The maximum daily rate for NO2 was conservatively assumed to equal the max hourly rate x 24.

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). To account for the variation

[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.

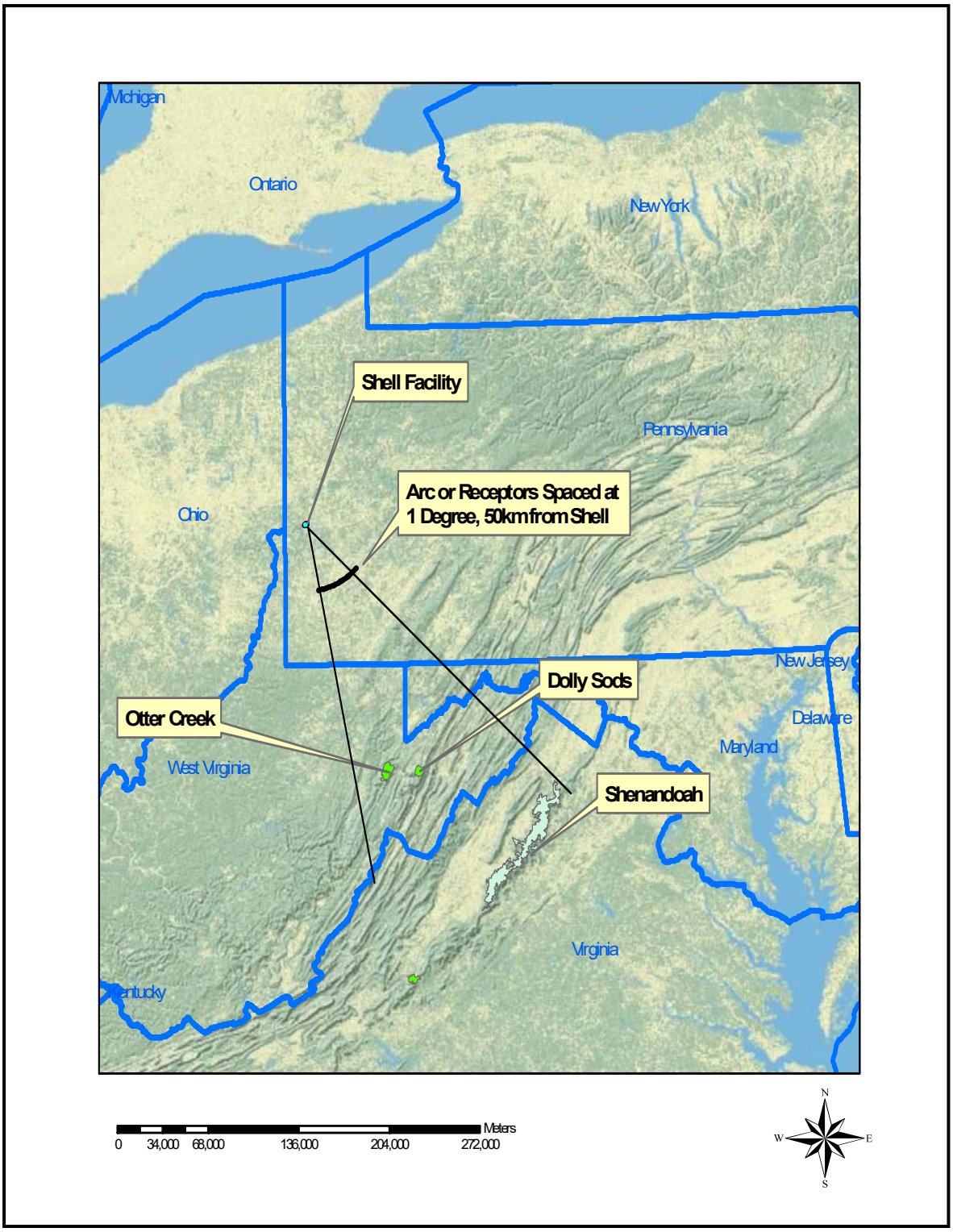


Figure 14. Class I Areas Located within Three Hundred Kilometers of Shell and Modeled Receptors

in receptor elevations within each Class I area, flagpole heights were modeled at each receptor. The flagpole heights were calculated by subtracting the actual elevation from the minimum, maximum and average NPS elevation for each Class I area. The model results were compared to the proposed Class I significant impact levels (Table 13) [c]. 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. 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.

Table 13. Class I Significant Impact Analysis Results

Pollutant	Averaging Period	Maximum Modeled Impact - Original Plant Design (µg/m3)	Maximum Modeled Impact - Current Plant Design (µg/m3)	Proposed Class I Significant Impact Level (µg/m^3)	% Class I SIL
PM10	24-hr	0.269	0.295	0.30	98%
	Annual	0.019	0.020	0.20	10%
NO_2	Annual	0.027	0.028	0.10	27%

[c] See 61 FR 38249 (July 23, 1996) for the proposed Class I SILs.

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. Monitoring Guidelines at p. 9.

9. AERMOD Implementation Guide, EPA, September 27, 2005.

10 . February 6, 2014 email from Alan Binder, PADEP, to Irene Kuo, RTP Environmental.

11. 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.

12. Workbook for Plume Visual Impact Screening and Analysis. US EPA, EPA Pub. No. 450/4-88-015. RTP, NC. September 1988.

13. Workbook for Estimating Visibility Impairment. US EPA, EPA Pub. No. 450/4-80-031. RTP, NC. November 1980.

14. 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

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)	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	21.700	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	21.700	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	21.700	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	21.700	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	21.700	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	18.527	4.478	504.056	10.151
GFLARE2	Ground Flare 2	555421.71	4502085.72	780.0	206.9	1832.0	65.62	21.10	18.527	4.478	504.056	10.151
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	7.260	7.260	8.792	0.795
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	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR2	Cooling Tower 2	555804.58	4502468.80	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR3	Cooling Tower 3	555815.69	4502481.38	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR4	Cooling Tower 4	555828.28	4502492.49	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR5	Cooling Tower 5	555841.61	4502502.12	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR6	Cooling Tower 6	555853.33	4502512.89	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR7	Cooling Tower 7	555866.07	4502523.70	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR8	Cooling Tower 8	555878.57	4502535.24	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COOLTWR9	Cooling Tower 9	555891.07	4502545.57	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COLTWR10	Cooling Tower 10	555903.80	4502556.38	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COLTWR11	Cooling Tower 11	555916.06	4502567.20	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COLTWR12	Cooling Tower 12	555927.83	4502578.01	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COLTWR13	Cooling Tower 13	555940.57	4502588.83	795.0	71.0	71.0	25.9	36.7	0.000	0.000	0.000	0.072
COLTWR14	Cooling Tower 14	555964.12	4502609.50	795.0	71.0	71.0	22.5	36.7	0.000	0.000	0.000	0.078
COLTWR15	Cooling Tower 15	555975.66	4502619.59	795.0	71.0	71.0	22.5	36.7	0.000	0.000	0.000	0.078
COLTWR16	Cooling Tower 16	555986.47	4502629.68	795.0	71.0	71.0	22.5	36.7	0.000	0.000	0.000	0.078
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	0.010	0.010	0.316	0.027
GEN4	Emerg Gen - Lift Station	555907.33	4502035.53	795.0	6.0	1270.0	122.2	0.2	0.007	0.007	2.866	0.004
GEN5	Emerg Gen - PGT Visitor	555485.98	4501269.42	784.0	6.0	1300.0	199.9	0.3	0.014	0.014	5.086	0.007
GEN6	Emerg Gen - PGT BGTC	555476.79	4501156.43	795.0	4.0	1300.0	249.9	0.3	0.000	0.000	0.000	0.000
CAH1	Catalyst Vent Filter 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 Vent Filter 2	556289.38	4502488.95	795.0	150.0	392.0	35.0	1.3	0.000	0.000	0.000	0.009

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)	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	0.005
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	0.005
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	1.505	0.401	38.255	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

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.

Furnace Modes

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)	Event Duration (hr/event)	Frequency (#/yr)
Max_norm	Furnace Normal Mode (Max Ops)	555502.11	4502199.00	795.00	275.0	253.6	40.2	8.50	9.30	5.91	21.70	3.10		
Min_norm	Furnace Normal Mode (Min Ops)	555502.11	4502199.00	795.0	275.0	230.0	21.5	8.50	5.16	3.55	13.58	1.65		
Decoke	Furnace Decoking Mode	555502.11	4502199.00	795.0	275.0	350.6	29.9	8.50	2.70	0.13	52.20	1.86	36	12
Fedinout	Furnace Feed in Feed out Mode	555502.11	4502199.00	795.0	275.0	292.1	32.2	8.50	4.16	0.01	9.70	1.39	2	12
HotStnby	Furnace Hot Steam Standby	555502.11	4502199.00	795.0	275.0	330.8	24.6	8.50	4.33	0.36	6.06	0.87	60	12
SUSD	Furnace Startup Shutdown	555502.11	4502199.00	795.0	275.0	165.4	32.4	8.50	0.00	0.04	25.10	0.43	24	1

Location of Furnace #1 assumed.

Startup and shutdowns will only occur once per year and will normally last 24hrs. This mode not evaluated for the 1-hr NO2 given frequency and duration.

The pollutant "NO2" represents worst-case short-term emissions. The pollutant "NOx" represents annual emissions.

Worst Case Furnace 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)
EC#1	DEFAULT	Ethane Cracking Furnace #1	555502.11	4502199.00	795.0	275.0	348.8	29.9	8.50	1.00
EC#2	DEFAULT	Ethane Cracking Furnace #2	555512.76	4502186.65	795.0	275.0	348.8	29.9	8.50	1.00
EC#3	DEFAULT	Ethane Cracking Furnace #3	555534.48	4502160.24	795.0	275.0	348.8	29.9	8.50	1.00
EC#4	DEFAULT	Ethane Cracking Furnace #4	555545.98	4502148.32	795.0	275.0	348.8	29.9	8.50	1.00
EC#5	DEFAULT	Ethane Cracking Furnace #5	555561.73	4502131.29	795.0	275.0	348.8	29.9	8.50	1.00
EC#6	DEFAULT	Ethane Cracking Furnace #6	555572.81	4502118.51	795.0	275.0	348.8	29.9	8.50	1.00
EC#7	DEFAULT	Ethane Cracking Furnace #7	555590.27	4502098.92	795.0	275.0	348.8	29.9	8.50	1.00

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_S01	DEFAULT	BASF Thermal Oxidation Unit	555260.00	4501187.00	743.44	75.0	1257	15.45	4.8	7.50	7.50	2.35	0.21
BASF_S031	DEFAULT	BASF Cleaver Brooks Boiler #1	555230.83	4501184.04	743.44	15.0	463	56.48	2.0	1.01	1.01	1.16	0.41
BASF_S032	DEFAULT	BASF Cleaver Brooks Boiler #2	555223.82	4501190.03	743.44	15.0	463	56.48	2.0	1.01	1.01	1.16	0.41
AES_S02	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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_S103	DEFAULT	Anchor Hocking Melt Tank	560668.90	4504652.40	738.39	50.0	496	54.40	3.7	17.20	17.20	2.24	5.94
ANCH_S08	DEFAULT	Anchor Hocking Carton Mfg	560668.90	4504652.40	739.27	30.0	70	95.51	2.0		0.00		1.62
ANCHS108	DEFAULT	Anchor Hocking Batch Plant	560668.90	4504652.40	739.27	10.0	70	0.03	1.0		0.00		0.13
ANCHS115	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	First Energy Bruce Mansfield (Unit #1&2)	549516.10	4498374.00	720.00	950	150	75.11	38.4	7918.00	7918.00	304.37	1582.80
FEBMS06a	DEFAULT	First Energy Bruce Mansfield (Unit #3)	549384.60	4498178.00	720.00	600	126	75.11	27.1	3959.00	3959.00	152.19	791.40
FEBM_S07	DEFAULT	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	DEFAULT	First Energy Fugitives	549490.50	4498345.90	729.59	10.0	70	0.03	1.0		0.00		3.30

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)
NGC_S09	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	NGC Ind Shippingport Board Trim	548962.00	4497373.00	772.08	59.0	70	38.94	1.7		0.00		1.31
NGC_S202	DEFAULT	NGC Ind Shippingport Riser Maker	548962.00	4497373.00	772.08	59.0	70	12.99	1.7		0.00		0.22
NGC_S203	DEFAULT	NGC Ind Shippingport Catenary	548962.00	4497373.00	772.08	59.0	70	46.23	1.5		0.00		0.22
NGC_S204	DEFAULT	NGC Ind Shippingport Board Plant	548962.00	4497373.00	772.08	45.0	70	62.24	1.5		0.00		0.29
NGC_S205	DEFAULT	NGC Ind Shippingport Starch Storage	548962.00	4497373.00	772.08	60.0	70	16.96	1.0		0.00		0.03
NGC_SZ01	DEFAULT	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	DEFAULT	NGC Ind Shippingport Roads	548962.00	4497373.00	772.08	10.0	70	0.03	1.0		0.00		3.13
NGCSZ206	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	US Gypsum End Saw	564090.67	4497863.46	740.72	68.0	70	94.32	1.5		0.00		3.43
USGYS200	DEFAULT	US Gypsum #1 DC Balance	564090.67	4497863.46	740.72	99.0	140	0.03	2.0		0.00		9.57
USGYPS21	DEFAULT	US Gypsum #1 Dunnage	564090.67	4497863.46	740.72	68.0	70	94.32	1.5		0.00		3.43
USGYP_S3	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	US Gypsum Paved Road Fug Emissions	564090.67	4497863.46	740.70	10.0	70	0.03	1.0				0.10
JEWLS41A	DEFAULT	Jewel Acquisition Boilers	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		0.93	0.78	0.07
JEWLS41B	DEFAULT	Jewel Acquisition Boilers	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		0.93	0.78	0.07
JEWLS106	DEFAULT	Jewel Acquisition Meltshop	545579.00	4498791.00	775.00	50.0	350	127.33	10.0		0.00	0.00	0.00
JEWLS181	DEFAULT	Jewel Acquisition Caster	545579.00	4498791.00	775.00	60.0	75	0.03	1.0				1.53
JEWLS202	DEFAULT	Jewel Acquisition Shot Blaster	545579.00	4498791.00	775.00	10.0	75	0.03	1.0				0.12
JEWLS205	DEFAULT	Jewel Acquisition Cold Reduction	545579.00	4498791.00	775.00	10.0	200	0.03	1.0				2.10
JEWLS206	DEFAULT	Jewel Acquisition Annealing	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		5.10	5.76	1.10
JEWLS208	DEFAULT	Jewel Acquisition Pickle	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		4.30		
JEWLS209	DEFAULT	Jewel Acquisition Boiler 1	545579.00	4498791.00	775.00	10.0	350	0.03	1.0		2.87	2.41	0.22
JEWLS210	DEFAULT	Jewel Acquisition Boiler 2	545579.00	4498791.00	775.00	10.0	99	0.03	1.0		3.28	2.75	0.25
JEWLZ050	DEFAULT	Jewel Acquisition Heaters	545579.00	4498791.00	775.00	10.0	300	0.03	1.0		1.96	1.65	0.15
JEWLZ182	DEFAULT	Jewel Acquisition Roads	545579.00	4498791.00	775.00	10.0	68	0.03	1.0				5.07
DOM_S01	DEFAULT	Dominion Trans Eng 1	558671.00	4518753.00	1224.70	52.0	700	0.03	3.0		14.10	18.30	1.14

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)
DOM_S02	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	IPSCO Koppel Temper Furnace	557468.00	4520732.00	887.93	54.0	900	14.07	4.0		0.77	0.22	6.80
IPSC_S05a	POINTCAP	IPSCO Koppel Melt Shop	557297.50	4520629.10	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05b	POINTCAP	IPSCO Koppel Melt Shop	557303.60	4520629.42	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05c	POINTCAP	IPSCO Koppel Melt Shop	557309.70	4520629.74	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05d	POINTCAP	IPSCO Koppel Melt Shop	557315.80	4520630.07	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05e	POINTCAP	IPSCO Koppel Melt Shop	557321.90	4520630.39	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05f	POINTCAP	IPSCO Koppel Melt Shop	557328.00	4520630.71	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05g	POINTCAP	IPSCO Koppel Melt Shop	557334.10	4520631.03	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05h	POINTCAP	IPSCO Koppel Melt Shop	557340.20	4520631.36	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05i	POINTCAP	IPSCO Koppel Melt Shop	557346.30	4520631.68	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S05j	POINTCAP	IPSCO Koppel Melt Shop	557352.40	4520632.00	889.40	100.0	150	57.19	10.0		6.00	50.00	1.72
IPSC_S01	DEFAULT	IPSCO Koppel Rot Hearth	557458.00	4520772.00	887.20	125.0	800	0.56	10.8		31.51	15.12	1.37
IPSCS02a	DEFAULT	IPSCO Koppel Quench	557458.00	4520772.00	887.20	54.0	900	0.13	4.0		3.72	3.13	0.28
IPSCS03a	DEFAULT	IPSCO Koppel Temper Furnace	557458.00	4520772.00	887.20	10.0	900	0.03	1.0		4.11	3.46	0.31
IPSCS04a	DEFAULT	IPSCO Koppel Reheat	557458.00	4520772.00	887.20	10.0	1195	0.03	1.0		2.94	2.47	0.22
IPSCS05a	DEFAULT	IPSCO Koppel Upsetter	557458.00	4520772.00	887.20	10.0	500	0.03	1.0		0.78	0.66	0.06
IPSC_S09	DEFAULT	IPSCO Koppel Misc Htrs	557458.00	4520772.00	887.20	10.0	500	0.03	1.0		4.51	3.79	0.34
IPSCS09a	DEFAULT	IPSCO Koppel Upsetter	557458.00	4520772.00	887.20	10.0	500	0.03	1.0		1.05	0.88	0.08
IPSCS09b	DEFAULT	IPSCO Koppel Mill Piercing	557458.00	4520772.00	887.20	10.0	500	0.03	1.0				19.62
ALLGS01a	DEFAULT	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	DEFAULT	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	DEFAULT	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	DEFAULT	Allegheny Energy Boiler 33	587738.00	4452830.00	752.82	375.0	117	62.99	20.0		2182.05	65.00	271.91
ALLGS05a	DEFAULT	Allegheny Energy Boiler 1	587738.00	4452830.00	752.82	150.0	385	22.90	3.5		3.70	0.93	10.80
ALLGS05b	DEFAULT	Allegheny Energy Boiler 2	587738.00	4452830.00	752.82	150.0	385	22.90	3.5		3.70	0.93	10.80
ALLGZ02	DEFAULT	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, 68.0 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

Source	Unit	PM10 Actual Emissions from Annual Reports (TPY)					Max 2012/2013 - Min 1990/1991
		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

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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

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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

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Thanks very much,

David Keen

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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>

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Subject: Request for Applicability of Class I Area Modeling Analysis

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--
Don Shepherd
National Park Service
Air Resources Division
12795 W. Alameda Pkwy.
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--
Holly Sharpless Salazer
Air Resources Coordinator
Natural Resources Program
National Park Service - Northeast Region

Phone: (814) 865-3100
Fax: (814) 863-7217
Cell: (814) 321-3309

Mailing Address:
National Park Service
207 Buckhout Lab
University Park, PA 16802

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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
Tel: (919) 845-1422 x41 Fax: (919) 845-1424

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 21 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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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 (4/21/20)

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	1.29454	557800	4501500	371.98	371.98	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.22434	557850	4501500	371.26	371.26	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.16416	557850	4501500	371.26	371.26	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.16157	557850	4501500	371.26	371.26	0	6091902	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT1_100	1ST	1.05579	557800	4501500	371.98	371.98	0	8102924	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.75788	557750	4501500	364.06	373.81	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.74527	557700	4501550	363.14	372.05	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.72592	557700	4501550	363.14	372.05	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.72548	557700	4501600	363.75	363.75	0	6050604	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT1_45	1ST	0.69054	557750	4501600	364.25	364.25	0	8121722	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.13788	557800	4501500	371.98	371.98	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.06208	557850	4501500	371.26	371.26	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.04543	557850	4501500	371.26	371.26	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	1.0301	557800	4501500	371.98	371.98	0	6082006	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT1_75	1ST	0.95742	557800	4501500	371.98	371.98	0	8102924	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.26987	557800	4501500	371.98	371.98	0	10011903	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.22898	557800	4501550	368.87	372.27	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.19477	557800	4501500	371.98	371.98	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.1526	557800	4501500	371.98	371.98	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT2_100	1ST	1.11058	557800	4501500	371.98	371.98	0	6082001	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.78103	557800	4501550	368.87	372.27	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.76731	557700	4501600	363.75	363.75	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.74946	557700	4501600	363.75	363.75	0	9070120	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.74033	557700	4501600	363.75	363.75	0	6091902	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT2_45	1ST	0.71915	557800	4501500	371.98	371.98	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.12083	557800	4501550	368.87	372.27	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.07616	557800	4501500	371.98	371.98	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.04593	557800	4501500	371.98	371.98	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.04316	557850	4501550	368.08	368.08	0	10032419	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT2_75	1ST	1.00976	557800	4501500	371.98	371.98	0	6040121	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.26434	557800	4501500	371.98	371.98	0	10022705	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.17606	557800	4501500	371.98	371.98	0	6082001	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.15742	557800	4501500	371.98	371.98	0	7110319	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.1454	557800	4501500	371.98	371.98	0	8103002	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT3_100	1ST	1.1314	557800	4501550	368.87	372.27	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.79084	557750	4501600	364.25	364.25	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.75462	557700	4501600	363.75	363.75	0	10011903	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.73476	557800	4501550	368.87	372.27	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.72607	557800	4501550	368.87	372.27	0	8021324	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT3_45	1ST	0.72179	557700	4501550	363.14	372.05	0	6082001	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.0979	557800	4501500	371.98	371.98	0	10022705	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.05796	557800	4501550	368.87	372.27	0	9120518	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.04168	557750	4501600	364.25	364.25	0	7012209	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.04024	557800	4501500	371.98	371.98	0	6082001	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	1-HR	CT3_75	1ST	1.02279	557800	4501500	371.98	371.98	0	8061801	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.27201	557750	4501600	364.25	364.25	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.22429	557800	4501500	371.98	371.98	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.21796	557800	4501500	371.98	371.98	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.16243	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT1_100	1ST	0.15674	557800	4501500	371.98	371.98	0	8120724	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.18656	557700	4501650	360.82	360.82	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.1411	557800	4501500	371.98	371.98	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.13871	557800	4501550	368.87	372.27	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.11113	557750	4501650	360.54	363.17	0	8081124	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT1_45	1ST	0.10753	557700	4501450	362.31	373.81	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.24871	557750	4501600	364.25	364.25	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.203	557800	4501500	371.98	371.98	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.19413	557800	4501500	371.98	371.98	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.14447	557700	4501450	362.31	373.81	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT1_75	1ST	0.14127	557800	4501500	371.98	371.98	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.2419	557750	4501650	360.54	363.17	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.21037	557800	4501550	368.87	372.27	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.20597	557800	4501550	368.87	372.27	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.19193	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT2_100	1ST	0.17543	557800	4501500	371.98	371.98	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.17111	557750	4501650	360.54	363.17	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.14287	557800	4501500	371.98	371.98	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.13906	557700	4501600	363.75	363.75	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.1114	557800	4501500	371.98	371.98	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT2_45	1ST	0.10969	557800	4501450	363.97	373.81	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480

Turbine Load Analysis Results - New Plant Configurations (4/21/20)

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_2010_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.22742	557750	4501650	360.54	363.17	0	10120324	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.19721	557800	4501500	371.98	371.98	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.18852	557800	4501550	368.87	372.27	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.16358	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT2_75	1ST	0.16025	557800	4501500	371.98	371.98	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.21571	557700	4501450	362.31	373.81	0	10012924	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.19934	557800	4501500	371.98	371.98	0	7012224	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.19779	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.19371	557850	4501550	368.08	368.08	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT3_100	1ST	0.17264	557800	4501500	371.98	371.98	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.15619	557650	4501450	360.3	360.47	0	10012924	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.14178	557800	4501550	368.87	372.27	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.13325	557700	4501650	360.82	360.82	0	7012524	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.11738	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT3_45	1ST	0.11236	557700	4501600	363.75	363.75	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.20522	557700	4501450	362.31	373.81	0	10012924	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.18756	557800	4501550	368.87	372.27	0	6102524	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.17892	557800	4501550	368.87	372.27	0	7031824	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.17556	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	24-HR	CT3_75	1ST	0.1557	557800	4501550	368.87	372.27	0	8102824	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.52966	557800	4501500	371.98	371.98	0	10060708	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.51365	557800	4501500	371.98	371.98	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.47125	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.41945	557800	4501500	371.98	371.98	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT1_100	1ST	0.41923	557800	4501500	371.98	371.98	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.36288	557700	4501450	362.31	373.81	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.32522	557750	4501500	364.06	373.81	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.31537	557700	4501700	356.62	359.68	0	8081108	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.31162	557700	4501450	362.31	373.81	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT1_45	1ST	0.25589	557800	4501500	371.98	371.98	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.48796	557800	4501500	371.98	371.98	0	10060708	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.45422	557800	4501500	371.98	371.98	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.4178	557700	4501450	362.31	373.81	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.41142	557800	4501500	371.98	371.98	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT1_75	1ST	0.37526	557800	4501500	371.98	371.98	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.55739	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.5459	557800	4501500	371.98	371.98	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.51472	557800	4501500	371.98	371.98	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.50921	557800	4501500	371.98	371.98	0	10011908	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT2_100	1ST	0.39053	557800	4501550	368.87	372.27	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.38808	557700	4501450	362.31	373.81	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.34229	557700	4501550	363.14	372.05	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.32527	557800	4501500	371.98	371.98	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.31687	557800	4501450	363.97	373.81	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT2_45	1ST	0.26455	557700	4501400	360.48	373.81	0	6031608	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.48181	557800	4501500	371.98	371.98	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.47515	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.47368	557800	4501550	368.87	372.27	0	10060708	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.46974	557800	4501500	371.98	371.98	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT2_75	1ST	0.36057	557800	4501550	368.87	372.27	0	6102508	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.5694	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.54661	557800	4501500	371.98	371.98	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.52503	557800	4501550	368.87	372.27	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.50637	557800	4501500	371.98	371.98	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT3_100	1ST	0.41862	557800	4501500	371.98	371.98	0	6092508	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.45429	557800	4501500	371.98	371.98	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.35412	557700	4501600	363.75	363.75	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.33799	557700	4501550	363.14	372.05	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.32759	557700	4501600	363.75	363.75	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT3_45	1ST	0.2873	557700	4501450	362.31	373.81	0	6031608	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.57502	557800	4501500	371.98	371.98	0	10030508	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.50621	557800	4501500	371.98	371.98	0	9120524	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.47739	557800	4501550	368.87	372.27	0	7031808	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.45609	557800	4501550	368.87	372.27	0	8102808	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	8-HR	CT3_75	1ST	0.3783	557800	4501500	371.98	371.98	0	6092508	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01922	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.0136	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.0128	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01257	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT1_100	1ST	0.01121	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480

Turbine Load Analysis Results - New Plant Configurations (4/21/20)

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_2010_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.01277	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00967	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00903	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00862	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT1_45	1ST	0.00798	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01745	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01269	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01171	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01157	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT1_75	1ST	0.01044	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.0186	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01324	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01277	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01275	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT2_100	1ST	0.01203	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.01265	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.00943	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.00881	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.00879	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT2_45	1ST	0.00851	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01707	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01215	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01178	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01166	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT2_75	1ST	0.01113	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01812	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01317	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01302	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01294	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT3_100	1ST	0.01285	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.01258	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00912	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00907	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00905	557800	4501550	368.87	372.27	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT3_45	1ST	0.00883	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2010_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01679	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2006_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01219	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2008_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01199	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2009_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.0119	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	9	9	25480
AERMOD 19191	Shell Franklin CT Load_2007_UNIT.SUM	UNIT	ANNUAL	CT3_75	1ST	0.01165	557800	4501500	371.98	371.98	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	9	9	25480

Turbine Load Analysis Results - New Plant Configurations (4/21/20)

Pollutant	Average	Group	Rank	Conc.
UNIT	1-HR	CT1_100	1ST	**1.295**
UNIT	1-HR	CT1_75	1ST	1.138
UNIT	1-HR	CT1_45	1ST	0.758
UNIT	1-HR	CT2_100	1ST	**1.270**
UNIT	1-HR	CT2_75	1ST	1.121
UNIT	1-HR	CT2_45	1ST	0.781
UNIT	1-HR	CT3_100	1ST	**1.264**
UNIT	1-HR	CT3_75	1ST	1.098
UNIT	1-HR	CT3_45	1ST	0.791
UNIT	24-HR	CT1_100	1ST	**0.272**
UNIT	24-HR	CT1_75	1ST	0.249
UNIT	24-HR	CT1_45	1ST	0.187
UNIT	24-HR	CT2_100	1ST	**0.242**
UNIT	24-HR	CT2_75	1ST	0.227
UNIT	24-HR	CT2_45	1ST	0.171
UNIT	24-HR	CT3_100	1ST	**0.216**
UNIT	24-HR	CT3_75	1ST	0.205
UNIT	24-HR	CT3_45	1ST	0.156
UNIT	8-HR	CT1_100	1ST	**0.530**
UNIT	8-HR	CT1_75	1ST	0.488
UNIT	8-HR	CT1_45	1ST	0.363
UNIT	8-HR	CT2_100	1ST	**0.557**
UNIT	8-HR	CT2_75	1ST	0.482
UNIT	8-HR	CT2_45	1ST	0.388
UNIT	8-HR	CT3_100	1ST	0.569
UNIT	8-HR	CT3_75	1ST	**0.575**
UNIT	8-HR	CT3_45	1ST	0.454
UNIT	Annual	CT1_100	1ST	**0.019**
UNIT	Annual	CT1_75	1ST	0.017
UNIT	Annual	CT1_45	1ST	0.013
UNIT	Annual	CT2_100	1ST	**0.019**
UNIT	Annual	CT2_75	1ST	0.017
UNIT	Annual	CT2_45	1ST	0.013
UNIT	Annual	CT3_100	1ST	**0.018**
UNIT	Annual	CT3_75	1ST	0.017
UNIT	Annual	CT3_45	1ST	0.013

100% CT load produces the highest impact for all averaging periods except the 8-hr 75% load is slightly higher.
Turbine startups, however, generally last less than an hour, so use of 100% load conditions is considered worst case.

Worst Case Furnace Mode Analysis Results (5/12/20)

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 Mode_2010_CO.SUM	CO	1-HR	DECOKE	1ST	79.04375	555050	4502900	340.64	342.58	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	1-HR	DECOKE	1ST	78.09019	554950	4502800	339.65	341.68	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	1-HR	DECOKE	1ST	77.93071	555000	4502800	338.93	340.75	0	6011303	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	1-HR	DECOKE	1ST	77.6781	555000	4502900	343.94	343.94	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	1-HR	DECOKE	1ST	73.45797	555000	4502800	338.93	340.75	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	1-HR	FEDINOUT	1ST	15.54512	555050	4502900	340.64	342.58	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	1-HR	FEDINOUT	1ST	15.3193	554950	4502800	339.65	341.68	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	1-HR	FEDINOUT	1ST	14.94991	555000	4502900	343.94	343.94	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	1-HR	FEDINOUT	1ST	14.74327	555000	4502800	338.93	340.75	0	6051022	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	1-HR	FEDINOUT	1ST	14.11724	554950	4502850	340.15	340.15	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	1-HR	HOTSTNBY	1ST	10.5681	555050	4502900	340.64	342.58	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	1-HR	HOTSTNBY	1ST	10.36816	554950	4502800	339.65	341.68	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	1-HR	HOTSTNBY	1ST	9.96069	555000	4502900	343.94	343.94	0	6040706	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	1-HR	HOTSTNBY	1ST	9.77388	555050	4502900	340.64	342.58	0	8111322	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	1-HR	HOTSTNBY	1ST	9.76629	555000	4502900	343.94	343.94	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	1-HR	MAX_NORM	1ST	32.67116	555050	4502900	340.64	342.58	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	1-HR	MAX_NORM	1ST	32.52688	554950	4502800	339.65	341.68	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	1-HR	MAX_NORM	1ST	32.47814	555000	4502900	343.94	343.94	0	7101823	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	1-HR	MAX_NORM	1ST	32.22294	555000	4502900	343.94	343.94	0	6062722	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	1-HR	MAX_NORM	1ST	30.70942	554950	4502850	340.15	340.15	0	8090423	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	1-HR	MIN_NORM	1ST	28.08671	555000	4502900	343.94	343.94	0	8122619	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	1-HR	MIN_NORM	1ST	27.64081	555000	4502750	337	341.73	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	1-HR	MIN_NORM	1ST	26.87779	555000	4502850	340.2	343.17	0	6040706	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	1-HR	MIN_NORM	1ST	25.87937	555050	4502900	340.64	342.58	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	1-HR	MIN_NORM	1ST	25.69368	554950	4502750	337.91	341.68	0	7010519	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	1-HR	SUSD	1ST	51.7427	555000	4502900	343.94	343.94	0	8122619	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	1-HR	SUSD	1ST	50.99594	555000	4502750	337	341.73	0	9120224	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	1-HR	SUSD	1ST	49.23102	555000	4502850	340.2	343.17	0	6040706	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	1-HR	SUSD	1ST	47.94958	555050	4502900	340.64	342.58	0	10112124	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	1-HR	SUSD	1ST	47.77534	554950	4502750	337.91	341.68	0	7010519	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	8-HR	DECOKE	1ST	40.46947	554650	4502500	337.18	341.86	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	8-HR	DECOKE	1ST	36.0038	554700	4502450	334.5	335.63	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	8-HR	DECOKE	1ST	34.53033	554550	4502200	327.56	336.69	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	8-HR	DECOKE	1ST	33.8103	554500	4502200	336.32	336.32	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	8-HR	DECOKE	1ST	33.42613	554650	4502300	326.87	336.69	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	8-HR	FEDINOUT	1ST	7.67911	554650	4502500	337.18	341.86	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	8-HR	FEDINOUT	1ST	6.76355	554700	4502450	334.5	335.63	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	8-HR	FEDINOUT	1ST	6.5882	554500	4502150	328.51	336.58	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	8-HR	FEDINOUT	1ST	6.52556	554500	4502200	336.32	336.32	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	8-HR	FEDINOUT	1ST	6.40136	554650	4502300	326.87	336.69	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	8-HR	HOTSTNBY	1ST	5.17826	554700	4502450	334.5	335.63	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	8-HR	HOTSTNBY	1ST	4.43206	554500	4502200	336.32	336.32	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	8-HR	HOTSTNBY	1ST	4.42868	554500	4502150	328.51	336.58	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	8-HR	HOTSTNBY	1ST	4.33753	554700	4502450	334.5	335.63	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	8-HR	HOTSTNBY	1ST	4.23753	554650	4502300	326.87	336.69	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	8-HR	MAX_NORM	1ST	16.61721	554650	4502500	337.18	341.86	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	8-HR	MAX_NORM	1ST	14.77097	554700	4502450	334.5	335.63	0	10012324	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	8-HR	MAX_NORM	1ST	14.09895	554500	4502200	336.32	336.32	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	8-HR	MAX_NORM	1ST	13.70107	554500	4502200	336.32	336.32	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	8-HR	MAX_NORM	1ST	13.60846	554600	4502300	335.87	335.87	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	8-HR	MIN_NORM	1ST	13.11884	554700	4502450	334.5	335.63	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	8-HR	MIN_NORM	1ST	11.2339	554550	4502150	303.92	352.88	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	8-HR	MIN_NORM	1ST	11.17566	554450	4502150	334.69	334.69	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	8-HR	MIN_NORM	1ST	10.71627	554600	4502300	335.87	335.87	0	6122208	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	8-HR	MIN_NORM	1ST	10.61344	555000	4502750	337	341.73	0	10090708	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_CO.SUM	CO	8-HR	SUSD	1ST	23.74999	554700	4502450	334.5	335.63	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_CO.SUM	CO	8-HR	SUSD	1ST	20.16644	554500	4502150	328.51	336.58	0	8082808	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_CO.SUM	CO	8-HR	SUSD	1ST	20.10107	554500	4502200	336.32	336.32	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_CO.SUM	CO	8-HR	SUSD	1ST	19.50716	554600	4502350	331.49	335.74	0	6122208	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_CO.SUM	CO	8-HR	SUSD	1ST	19.42276	555000	4502750	337	341.73	0	10090708	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_5yrs_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	DECOKE	1ST	3.40113	555000	4502800	338.93	340.75	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	5	5	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_5yrs_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	FEDINOUT	1ST	5.45714	555000	4502800	338.93	340.75	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	5	5	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_5yrs_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	HOTSTNBY	1ST	6.03602	555050	4502900	340.64	342.58	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	5	5	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_5yrs_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	MAX_NORM	1ST	11.73707	555000	4502800	338.93	340.75	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	5	5	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_5yrs_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	MIN_NORM	1ST	8.69966	555000	4502750	337	341.73	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	5	5	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_NOX.SUM	NOX	ANNUAL	DECOKE	1ST	0.00332	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_NOX.SUM	NOX	ANNUAL	DECOKE	1ST	0.00325	556850	4501900	327.35	327.35	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_NOX.SUM	NOX	ANNUAL	DECOKE	1ST	0.00298	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_NOX.SUM	NOX	ANNUAL	DECOKE	1ST	0.00268	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_NOX.SUM	NOX	ANNUAL	DECOKE	1ST	0.00241	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480

Worst Case Furnace Mode Analysis Results (5/12/20)

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 Mode_2009_NOX.SUM	NOX	ANNUAL	FEDINOUT	1ST	0.00027	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_NOX.SUM	NOX	ANNUAL	FEDINOUT	1ST	0.00026	556850	4501900	327.35	327.35	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_NOX.SUM	NOX	ANNUAL	FEDINOUT	1ST	0.00024	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_NOX.SUM	NOX	ANNUAL	FEDINOUT	1ST	0.00022	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_NOX.SUM	NOX	ANNUAL	FEDINOUT	1ST	0.0002	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_NOX.SUM	NOX	ANNUAL	HOTSTNBY	1ST	0.01081	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_NOX.SUM	NOX	ANNUAL	HOTSTNBY	1ST	0.0104	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_NOX.SUM	NOX	ANNUAL	HOTSTNBY	1ST	0.00982	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_NOX.SUM	NOX	ANNUAL	HOTSTNBY	1ST	0.00923	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_NOX.SUM	NOX	ANNUAL	HOTSTNBY	1ST	0.00826	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_NOX.SUM	NOX	ANNUAL	MAX_NORM	1ST	0.14752	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_NOX.SUM	NOX	ANNUAL	MAX_NORM	1ST	0.14525	556850	4501900	327.35	327.35	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_NOX.SUM	NOX	ANNUAL	MAX_NORM	1ST	0.13247	554550	4502250	336.31	336.31	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_NOX.SUM	NOX	ANNUAL	MAX_NORM	1ST	0.1197	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_NOX.SUM	NOX	ANNUAL	MAX_NORM	1ST	0.10694	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_NOX.SUM	NOX	ANNUAL	MIN_NORM	1ST	0.13872	554500	4502150	328.51	336.58	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_NOX.SUM	NOX	ANNUAL	MIN_NORM	1ST	0.12868	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_NOX.SUM	NOX	ANNUAL	MIN_NORM	1ST	0.12382	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_NOX.SUM	NOX	ANNUAL	MIN_NORM	1ST	0.12314	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_NOX.SUM	NOX	ANNUAL	MIN_NORM	1ST	0.11427	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_NOX.SUM	NOX	ANNUAL	SUSD	1ST	0.00151	554500	4502150	328.51	336.58	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_NOX.SUM	NOX	ANNUAL	SUSD	1ST	0.0014	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_NOX.SUM	NOX	ANNUAL	SUSD	1ST	0.00136	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_NOX.SUM	NOX	ANNUAL	SUSD	1ST	0.00135	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_NOX.SUM	NOX	ANNUAL	SUSD	1ST	0.00125	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.71466	554600	4502300	335.87	335.87	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.70769	554500	4502150	328.51	336.58	0	10051724	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.60837	554450	4502100	321.54	336.58	0	9111824	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.60274	554650	4502450	335.39	335.88	0	8051124	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.59107	554500	4502200	336.32	336.32	0	7022524	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	24-HR	FEDINOUT	1ST	0.54842	554600	4502300	335.87	335.87	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	24-HR	FEDINOUT	1ST	0.54008	554500	4502150	328.51	336.58	0	10051724	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	24-HR	FEDINOUT	1ST	0.46737	554450	4502100	321.54	336.58	0	9111824	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	24-HR	FEDINOUT	1ST	0.46659	554700	4502450	334.5	335.63	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	24-HR	FEDINOUT	1ST	0.46438	554700	4502400	324.09	347.43	0	8051124	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	24-HR	HOTSTNBY	1ST	0.3743	554600	4502300	335.87	335.87	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	24-HR	HOTSTNBY	1ST	0.35984	554550	4502150	303.92	352.88	0	10051724	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	24-HR	HOTSTNBY	1ST	0.31749	554700	4502450	334.5	335.63	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	24-HR	HOTSTNBY	1ST	0.31397	554700	4502400	324.09	347.43	0	8051124	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	24-HR	HOTSTNBY	1ST	0.3112	554450	4502100	321.54	336.58	0	9111824	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	24-HR	MAX_NORM	1ST	1.17758	554600	4502300	335.87	335.87	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	24-HR	MAX_NORM	1ST	1.1465	554500	4502150	328.51	336.58	0	10051724	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	24-HR	MAX_NORM	1ST	0.99588	554650	4502450	335.39	335.88	0	8051124	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	24-HR	MAX_NORM	1ST	0.97178	554450	4502100	321.54	336.58	0	9111824	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	24-HR	MAX_NORM	1ST	0.96693	554500	4502200	336.32	336.32	0	7022524	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	24-HR	MIN_NORM	1ST	0.88455	554650	4502300	326.87	336.69	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	24-HR	MIN_NORM	1ST	0.78297	554600	4502150	284.47	354.2	0	10051724	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	24-HR	MIN_NORM	1ST	0.75169	554600	4502350	331.49	335.74	0	8051124	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	24-HR	MIN_NORM	1ST	0.73965	554400	4502050	318.03	336.54	0	7102624	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	24-HR	MIN_NORM	1ST	0.71507	554500	4502150	328.51	336.58	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	24-HR	SUSD	1ST	0.21389	554650	4502300	326.87	336.69	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	24-HR	SUSD	1ST	0.19468	554550	4502150	303.92	352.88	0	10051724	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	24-HR	SUSD	1ST	0.19213	554600	4502350	331.49	335.74	0	8051124	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	24-HR	SUSD	1ST	0.1838	554400	4502050	318.03	336.54	0	7102624	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	24-HR	SUSD	1ST	0.18031	554450	4502150	334.69	334.69	0	9010624	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.04746	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.04653	556850	4501900	327.35	327.35	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.04266	554550	4502250	336.31	336.31	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.03834	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.03448	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	ANNUAL	FEDINOUT	1ST	0.03725	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	ANNUAL	FEDINOUT	1ST	0.03609	556850	4501900	327.35	327.35	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	ANNUAL	FEDINOUT	1ST	0.03355	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	ANNUAL	FEDINOUT	1ST	0.03097	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	ANNUAL	FEDINOUT	1ST	0.02755	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	ANNUAL	HOTSTNBY	1ST	0.02613	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	ANNUAL	HOTSTNBY	1ST	0.02513	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	ANNUAL	HOTSTNBY	1ST	0.02373	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	ANNUAL	HOTSTNBY	1ST	0.02231	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	ANNUAL	HOTSTNBY	1ST	0.01997	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480

Worst Case Furnace Mode Analysis Results (5/12/20)

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 Mode_2009_PM10.SUM	PM10	ANNUAL	MAX_NORM	1ST	0.07738	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	ANNUAL	MAX_NORM	1ST	0.07619	556850	4501900	327.35	327.35	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	ANNUAL	MAX_NORM	1ST	0.06949	554550	4502250	336.31	336.31	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	ANNUAL	MAX_NORM	1ST	0.06278	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	ANNUAL	MAX_NORM	1ST	0.0561	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	ANNUAL	MIN_NORM	1ST	0.06447	554500	4502150	328.51	336.58	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	ANNUAL	MIN_NORM	1ST	0.05981	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	ANNUAL	MIN_NORM	1ST	0.05755	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	ANNUAL	MIN_NORM	1ST	0.05723	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	ANNUAL	MIN_NORM	1ST	0.05311	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2009_PM10.SUM	PM10	ANNUAL	SUSD	1ST	0.01622	554500	4502150	328.51	336.58	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2010_PM10.SUM	PM10	ANNUAL	SUSD	1ST	0.01507	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2007_PM10.SUM	PM10	ANNUAL	SUSD	1ST	0.01463	554700	4502450	334.5	335.63	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2008_PM10.SUM	PM10	ANNUAL	SUSD	1ST	0.01453	554500	4502200	336.32	336.32	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	6	6	25480
AERMOD 19191	Shell Franklin Worst Case Furnace Mode_2006_PM10.SUM	PM10	ANNUAL	SUSD	1ST	0.01343	554600	4502300	335.87	335.87	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	6	6	25480

Worst Case Furnace Mode Analysis Results (5/12/20)

Pollutant	Average	Mode	Rank	Conc.
CO	1-HR	Max_Norm	1ST	32.67
CO	1-HR	Min_Norm	1ST	28.09
CO	**1-HR**	**Decoke**	**1ST**	**79.04**
CO	1-HR	Fedinout	1ST	15.55
CO	1-HR	HotStnby	1ST	10.57
CO	1-HR	SUSD	1ST	51.74
CO	8-HR	Max_Norm	1ST	16.62
CO	8-HR	Min_Norm	1ST	13.12
CO	**8-HR**	**Decoke**	**1ST**	**40.47**
CO	8-HR	Fedinout	1ST	7.68
CO	8-HR	HotStnby	1ST	5.18
CO	8-HR	SUSD	1ST	23.75
NO2	**1ST-HIGHEST MAX DAILY 1-HR**	**Max_Norm**	**1ST**	**11.74**
NO2	1ST-HIGHEST MAX DAILY 1-HR	Min_Norm	1ST	8.70
NO2	1ST-HIGHEST MAX DAILY 1-HR	Decoke	1ST	3.40
NO2	1ST-HIGHEST MAX DAILY 1-HR	Fedinout	1ST	5.46
NO2	1ST-HIGHEST MAX DAILY 1-HR	HotStnby	1ST	6.04
NOx	**ANNUAL**	**Max_Norm**	**1ST**	**0.15**
NOx	ANNUAL	Min_Norm	1ST	0.14
NOx	ANNUAL	Decoke	1ST	0.00
NOx	ANNUAL	Fedinout	1ST	0.00
NOx	ANNUAL	HotStnby	1ST	0.01
NOx	ANNUAL	SUSD	1ST	0.00
PM10	**24-HR**	**Max_Norm**	**1ST**	**1.18**
PM10	24-HR	Min_Norm	1ST	0.88
PM10	24-HR	Decoke	1ST	0.71
PM10	24-HR	Fedinout	1ST	0.55
PM10	24-HR	HotStnby	1ST	0.37
PM10	24-HR	SUSD	1ST	0.21
PM10	**ANNUAL**	**Max_Norm**	**1ST**	**0.08**
PM10	ANNUAL	Min_Norm	1ST	0.06
PM10	ANNUAL	Decoke	1ST	0.05
PM10	ANNUAL	Fedinout	1ST	0.04
PM10	ANNUAL	HotStnby	1ST	0.03
PM10	ANNUAL	SUSD	1ST	0.02

Worst Case Furnace During Decoking and Lower NOx Control Analysis Results - New Plant Configuration (4/21/20)

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	1.519	555050	4502900	340.64	342.58	0	10112124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.500	554950	4502800	339.65	341.68	0	9120224	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.495	555000	4502800	338.93	340.75	0	6011303	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.491	555000	4502900	343.94	343.94	0	7101823	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#1	1ST	1.410	555000	4502800	338.93	340.75	0	8090423	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.495	554950	4502800	339.65	341.68	0	9120224	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.488	555050	4502900	340.64	342.58	0	10112124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.473	555000	4502800	338.93	340.75	0	6011303	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.457	555000	4502900	343.94	343.94	0	7101823	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#2	1ST	1.374	555000	4502800	338.93	340.75	0	8090423	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.473	554950	4502800	339.65	341.68	0	9120224	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.424	555000	4502900	343.94	343.94	0	6030921	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.415	555050	4502900	340.64	342.58	0	10112124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.395	555000	4502900	343.94	343.94	0	7101823	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#3	1ST	1.309	554950	4502850	340.15	340.15	0	8090423	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.451	554950	4502800	339.65	341.68	0	9120224	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.406	555000	4502900	343.94	343.94	0	6030921	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.366	555050	4502900	340.64	342.58	0	10112124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.365	555000	4502900	343.94	343.94	0	7101823	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#4	1ST	1.289	555000	4502800	338.93	340.75	0	8090423	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.418	554950	4502800	339.65	341.68	0	9120224	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.376	555000	4502900	343.94	343.94	0	6030921	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.322	555000	4502900	343.94	343.94	0	7101823	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.297	555050	4502900	340.64	342.58	0	10112124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#5	1ST	1.260	555000	4502800	338.93	340.75	0	8090423	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.392	554950	4502800	339.65	341.68	0	9120224	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.353	555000	4502900	343.94	343.94	0	6030921	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.292	555000	4502900	343.94	343.94	0	7101823	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.262	554850	4503000	345	345	0	10060901	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#6	1ST	1.236	555000	4502800	338.93	340.75	0	8090423	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.336	554950	4502800	339.65	341.68	0	9120224	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.300	555000	4502900	343.94	343.94	0	6030921	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.239	555000	4502900	343.94	343.94	0	7101823	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.223	554850	4503000	345	345	0	10060901	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	1-HR	EC#7	1ST	1.196	555000	4502800	338.93	340.75	0	8090423	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	24-HR	EC#1	1ST	0.385	554600	4502300	335.87	335.87	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	24-HR	EC#1	1ST	0.380	554500	4502150	328.51	336.58	0	10051724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	24-HR	EC#1	1ST	0.328	554650	4502500	337.18	341.86	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	24-HR	EC#1	1ST	0.328	554450	4502100	321.54	336.58	0	9111824	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	24-HR	EC#1	1ST	0.324	554650	4502450	335.39	335.88	0	8051124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	24-HR	EC#2	1ST	0.384	554600	4502300	335.87	335.87	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	24-HR	EC#2	1ST	0.369	554500	4502150	328.51	336.58	0	10051724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	24-HR	EC#2	1ST	0.324	554700	4502400	324.09	347.43	0	8051124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	24-HR	EC#2	1ST	0.314	554700	4502450	334.5	335.63	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	24-HR	EC#2	1ST	0.308	554450	4502150	334.69	334.69	0	9031024	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	24-HR	EC#3	1ST	0.367	554600	4502300	335.87	335.87	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	24-HR	EC#3	1ST	0.337	554500	4502150	328.51	336.58	0	10051724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	24-HR	EC#3	1ST	0.300	554550	4502400	335.1	335.1	0	8051124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	24-HR	EC#3	1ST	0.300	554700	4502450	334.5	335.63	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	24-HR	EC#3	1ST	0.296	554450	4502150	334.69	334.69	0	9031024	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	24-HR	EC#4	1ST	0.353	554600	4502300	335.87	335.87	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	24-HR	EC#4	1ST	0.319	554450	4502100	321.54	336.58	0	10051724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	24-HR	EC#4	1ST	0.290	554700	4502450	334.5	335.63	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	24-HR	EC#4	1ST	0.285	554450	4502150	334.69	334.69	0	9031024	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	24-HR	EC#4	1ST	0.284	554550	4502400	335.1	335.1	0	8051124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	24-HR	EC#5	1ST	0.344	554550	4502250	336.31	336.31	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	24-HR	EC#5	1ST	0.332	556753.3	4502134.2	277.47	337.02	0	10021824	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	24-HR	EC#5	1ST	0.279	556648.7	4502000.3	297.19	329.48	0	8112024	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	24-HR	EC#5	1ST	0.277	554650	4502450	335.39	335.88	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	24-HR	EC#5	1ST	0.266	554450	4502150	334.69	334.69	0	9031024	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	24-HR	EC#6	1ST	0.412	556362.43	4502128.19	246.77	334.89	0	10021824	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	24-HR	EC#6	1ST	0.340	554550	4502250	336.31	336.31	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	24-HR	EC#6	1ST	0.319	556269.1	4502045.05	241.83	340.38	0	8112024	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	24-HR	EC#6	1ST	0.284	556460.7	4501952.7	266.98	334.89	0	7111624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	24-HR	EC#6	1ST	0.254	556343.84	4502111.48	248.3	334.89	0	9112724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	24-HR	EC#7	1ST	0.381	556800	4502100	299.66	329.48	0	10021824	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	24-HR	EC#7	1ST	0.325	554550	4502250	336.31	336.31	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	24-HR	EC#7	1ST	0.296	556611.6	4501968.2	294.44	329.48	0	8112024	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	24-HR	EC#7	1ST	0.285	556399.61	4502161.62	247.52	337.02	0	7040824	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	24-HR	EC#7	1ST	0.254	556473.98	4502228.47	252.97	337.02	0	9100724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480

Worst Case Furnace During Decoking and Lower NOx Control Analysis Results - New Plant Configuration (4/21/20)

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_2007_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.776	554650	4502500	337.18	341.86	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.690	554700	4502450	334.5	335.63	0	10012324	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.662	554550	4502200	327.56	336.69	0	8082808	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.649	554500	4502200	336.32	336.32	0	9010624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#1	1ST	0.641	554650	4502300	326.87	336.69	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.768	554700	4502450	334.5	335.63	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.689	554700	4502450	334.5	335.63	0	10012324	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.664	554500	4502150	328.51	336.58	0	8082808	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.649	554600	4502300	335.87	335.87	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#2	1ST	0.642	554500	4502200	336.32	336.32	0	9010624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.753	554700	4502450	334.5	335.63	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.639	554600	4502300	335.87	335.87	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.627	554450	4502150	334.69	334.69	0	8082808	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.613	554700	4502450	334.5	335.63	0	10012324	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#3	1ST	0.596	554500	4502200	336.32	336.32	0	9010624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.731	554700	4502450	334.5	335.63	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.615	554600	4502300	335.87	335.87	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.594	554450	4502150	334.69	334.69	0	8082808	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.586	554650	4502450	335.39	335.88	0	10012324	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#4	1ST	0.584	554450	4502150	334.69	334.69	0	9010624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.692	554700	4502450	334.5	335.63	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.578	554500	4502200	336.32	336.32	0	8021708	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.572	554550	4502250	336.31	336.31	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.569	554450	4502150	334.69	334.69	0	9010624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#5	1ST	0.551	554650	4502450	335.39	335.88	0	10012324	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.670	554650	4502450	335.39	335.88	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.580	554550	4502250	336.31	336.31	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.565	554500	4502200	336.32	336.32	0	8021708	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.551	554450	4502150	334.69	334.69	0	9010624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#6	1ST	0.529	556681.8	4502030.1	298.09	329.48	0	10121508	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2007_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.623	554650	4502450	335.39	335.88	0	7122124	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2006_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.566	554550	4502250	336.31	336.31	0	6102724	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2008_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.536	554550	4502250	336.31	336.31	0	8011708	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2010_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.520	556665.3	4502015.2	297.82	329.48	0	10121508	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480
AERMOD 19191	Shell Franklin Worst Case Furnace_2009_UNIT.SUM	UNIT	8-HR	EC#7	1ST	0.504	554450	4502150	334.69	334.69	0	9010624	F:\My Docs\RTPENV\Projects\Shell\F	7	7	25480

Worst Case Furnace During Decoking and Lower NOx Control Analysis Results - New Plant Configuration (4/21/20)

Pollutant	Average	Group	Rank	Conc.
UNIT	1-HR	EC#1	1ST	**1.519**
UNIT	1-HR	EC#2	1ST	**1.495**
UNIT	1-HR	EC#3	1ST	1.473
UNIT	1-HR	EC#4	1ST	1.451
UNIT	1-HR	EC#5	1ST	1.418
UNIT	1-HR	EC#6	1ST	1.392
UNIT	1-HR	EC#7	1ST	1.336
UNIT	8-HR	EC#1	1ST	**0.776**
UNIT	8-HR	EC#2	1ST	**0.768**
UNIT	8-HR	EC#3	1ST	0.753
UNIT	8-HR	EC#4	1ST	0.731
UNIT	8-HR	EC#5	1ST	0.692
UNIT	8-HR	EC#6	1ST	0.670
UNIT	8-HR	EC#7	1ST	0.623
UNIT	24-HR	EC#1	1ST	**0.385**
UNIT	24-HR	EC#2	1ST	**0.384**
UNIT	24-HR	EC#3	1ST	0.367
UNIT	24-HR	EC#4	1ST	0.353
UNIT	24-HR	EC#5	1ST	0.344
UNIT	24-HR	EC#6	1ST	0.412
UNIT	24-HR	EC#7	1ST	0.381

Furnaces 1 and 2 generate worst-case short term impacts.

Only short term emissions are higher during decoking. Annual impacts therefore were not evaluated.

8/18/20 - Shell Franklin Class II SIL Model Results - New Plant Configuration (8-20 PM10 and NOx Updates)

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	1775.59	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2007_CO.SUM	CO	1-HR	ALL	1ST	1746.48	555500	4501150	247.16	345.39	0	7020318	BEAVER_VALLEY_2007_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2008_CO.SUM	CO	1-HR	ALL	1ST	1539.75	555500	4501150	247.16	345.39	0	8102701	BEAVER_VALLEY_2008_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2009_CO.SUM	CO	1-HR	ALL	1ST	1518.80	556390.9	4501887.9	268.65	336.81	0	9041607	BEAVER_VALLEY_2009_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2010_CO.SUM	CO	1-HR	ALL	1ST	1420.42	555500	4501150	247.16	345.39	0	10012811	BEAVER_VALLEY_2010_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2010_CO.SUM	CO	8-HR	ALL	1ST	916.56	555500	4501150	247.16	345.39	0	10010216	BEAVER_VALLEY_2010_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2007_CO.SUM	CO	8-HR	ALL	1ST	831.64	555500	4501150	247.16	345.39	0	7112216	BEAVER_VALLEY_2007_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2008_CO.SUM	CO	8-HR	ALL	1ST	820.29	555500	4501150	247.16	345.39	0	8021024	BEAVER_VALLEY_2008_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2009_CO.SUM	CO	8-HR	ALL	1ST	652.70	555500	4501150	247.16	345.39	0	9022016	BEAVER_VALLEY_2009_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_2006_CO.SUM	CO	8-HR	ALL	1ST	510.00	555500	4501150	247.16	345.39	0	6120808	BEAVER_VALLEY_2006_ADJUSTAR.SF	24	1	25480
AERMOD 19191	Shell Franklin Significance_5yrs_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	ALL	1ST	59.49	555000	4502800	338.93	340.75	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	24	1	25480
AERMOD 19191	Shell Franklin Significance_2010_NO2.SUM	NO2	ANNUAL	ALL	1ST	1.29	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	23	1	25480
AERMOD 19191	Shell Franklin Significance_2007_NO2.SUM	NO2	ANNUAL	ALL	1ST	1.02	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	23	1	25480
AERMOD 19191	Shell Franklin Significance_2008_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.93	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	23	1	25480
AERMOD 19191	Shell Franklin Significance_2009_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.92	554450	4502150	334.69	334.69	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	23	1	25480
AERMOD 19191	Shell Franklin Significance_2006_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.91	556750	4501950	314.82	328.02	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	23	1	25480
AERMOD 19191	Shell Franklin Significance_2010_PM10.SUM	PM10	24-HR	ALL	1ST	9.60	556634.34	4502473.98	251.17	343.47	0	10022724	BEAVER_VALLEY_2010_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2006_PM10.SUM	PM10	24-HR	ALL	1ST	8.83	554600	4502300	335.87	335.87	0	6102724	BEAVER_VALLEY_2006_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2007_PM10.SUM	PM10	24-HR	ALL	1ST	7.73	554400	4502550	350.98	352.8	0	7122124	BEAVER_VALLEY_2007_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2008_PM10.SUM	PM10	24-HR	ALL	1ST	7.36	556578.18	4502335.71	243.22	343.47	0	8111824	BEAVER_VALLEY_2008_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2009_PM10.SUM	PM10	24-HR	ALL	1ST	6.99	556658.66	4502570.98	240.39	343.47	0	9100424	BEAVER_VALLEY_2009_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2010_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.80	556646.5	4502522.48	244.33	343.47	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2006_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.75	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2007_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.61	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2008_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.54	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	100	1	25480
AERMOD 19191	Shell Franklin Significance_2009_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.51	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	100	1	25480

8/18/20 - Shell Franklin Class II SIL Model Results - New Plant Configuration (8-20 PM10 and NOx Updates)

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard	Max Dist to Significant Impact (km)
PM10	24-HR	ALL	1ST	9.60	NA	9.60	5	192%	3.4
PM10	ANNUAL	ALL	1ST	2.80	NA	2.80	1	280%	2.5
NO2	ANNUAL	ALL	1ST	1.29	NA	1.29	1	129%	2.4
NO2	1ST-HIGHEST MAX DAILY 1-HR	ALL	1ST	59.49	NA	59.5	7.5	793%	31.4
CO	1-HR	ALL	1ST	1775.59	NA	1775.6	2000	89%	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, resprectively.

5/4/20 - 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	Significance-Original_2009_CO.SUM	CO	1-HR	ALL	1ST	2034.85	555950	4502850	207.97	355.82	0	9110720	BEAVER_VALLEY_2009_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2006_CO.SUM	CO	1-HR	ALL	1ST	2020.24	555350	4503200	287.19	355.13	0	6061721	BEAVER_VALLEY_2006_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2007_CO.SUM	CO	1-HR	ALL	1ST	2010.28	556342.05	4502136.67	244.31	337.48	0	7110320	BEAVER_VALLEY_2007_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2008_CO.SUM	CO	1-HR	ALL	1ST	1927.63	556042.4	4502798.4	209.55	355.82	0	8060105	BEAVER_VALLEY_2008_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2010_CO.SUM	CO	1-HR	ALL	1ST	1919.93	556395.23	4502189.56	247.08	337.02	0	10062021	BEAVER_VALLEY_2010_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2010_CO.SUM	CO	8-HR	ALL	1ST	919.75	556023.5	4502784.7	209.23	355.82	0	10101808	BEAVER_VALLEY_2010_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2006_CO.SUM	CO	8-HR	ALL	1ST	918.08	556042.4	4502798.4	209.55	355.82	0	6112308	BEAVER_VALLEY_2006_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2007_CO.SUM	CO	8-HR	ALL	1ST	896.33	556023.5	4502784.7	209.23	355.82	0	7061108	BEAVER_VALLEY_2007_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2009_CO.SUM	CO	8-HR	ALL	1ST	870.92	555650	4501700	232.36	340.38	0	9060708	BEAVER_VALLEY_2009_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2008_CO.SUM	CO	8-HR	ALL	1ST	838.04	555433	4501787.4	219.34	352.88	0	8092408	BEAVER_VALLEY_2008_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2006_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	ALL	1ST	64.19	554400	4503900	364.45	364.45	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	23	1	38125
AERMOD 19191	Significance-Original_5yrs_NO2.SUM	NO2	1ST-HIGHEST MAX DAILY 1-HR	ALL	1ST	58.45	554200	4503950	369.89	369.89	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	23	1	38125
AERMOD 19191	Significance-Original_2010_NO2.SUM	NO2	ANNUAL	ALL	1ST	1.26	557700	4501900	352.83	353.04	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	23	1	22593
	2006 Missing															
AERMOD 19191	Significance-Original_2007_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.87	556850	4501900	327.35	327.35	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2008_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.84	557800	4501950	354.87	354.87	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2009_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.82	557250	4502350	336.01	336.01	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	23	1	22593
AERMOD 19191	Significance-Original_2007_PM10.SUM	PM10	24-HR	ALL	1ST	11.23	555947.9	4502730.1	211.27	355.82	0	7110224	BEAVER_VALLEY_2007_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2008_PM10.SUM	PM10	24-HR	ALL	1ST	10.42	555966.8	4502743.7	210.25	355.82	0	8101924	BEAVER_VALLEY_2008_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2010_PM10.SUM	PM10	24-HR	ALL	1ST	10.29	555966.8	4502743.7	210.25	355.82	0	10111224	BEAVER_VALLEY_2010_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2009_PM10.SUM	PM10	24-HR	ALL	1ST	10.05	556023.5	4502784.7	209.23	355.82	0	9090424	BEAVER_VALLEY_2009_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2006_PM10.SUM	PM10	24-HR	ALL	1ST	9.47	556004.6	4502771	210.19	355.82	0	6082224	BEAVER_VALLEY_2006_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2007_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.60	555947.9	4502730.1	211.27	355.82	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2008_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.53	555947.9	4502730.1	211.27	355.82	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2009_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.52	555947.9	4502730.1	211.27	355.82	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2010_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.37	555947.9	4502730.1	211.27	355.82	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	86	1	22593
AERMOD 19191	Significance-Original_2006_PM10.SUM	PM10	ANNUAL	ALL	1ST	2.13	556061.3	4502812	209.63	355.82	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	86	1	22593

5/4/20 - 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	Max Dist to Significant Impact (km)
PM10	24-HR	ALL	1ST	11.23	NA	11.2	5	225%	2.5
PM10	ANNUAL	ALL	1ST	2.60	NA	2.60	1	260%	1.0
NO2	ANNUAL	ALL	1ST	1.26	NA	1.3	1	126%	2.3
NO2	1ST-HIGHEST MAX DAILY 1-HR	ALL	1ST	64.19	NA	64.2	7.5	856%	30.1
CO	1-HR	ALL	1ST	2034.85	NA	2034.9	2000	102%	0.6
CO	8-HR	ALL	1ST	919.75	NA	919.7	500	184%	1.1

Notes:

1) NO2 impacts include ARM2 with minimum and maximum ratios of 0.5 and 0.8, respectively.

8/20/20 - Shell Franklin Class II SIL Model Results
Comparison Between Origninal Plant and Revised Plant Configuration (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	9.60	3.4	11.23	2.5	5
PM10	ANNUAL	ALL	1ST	2.80	2.5	2.60	1	1
NO2	ANNUAL	ALL	1ST	1.29	2.4	1.26	2.3	1
NO2	1ST-HIGHEST MAX DAILY 1-HR	ALL	1ST	59.49	31.4	64.19	30.1	7.5
CO	1-HR	ALL	1ST	1776	NA	2035	NA	2000
CO	8-HR	ALL	1ST	917	1.0	920	1.1	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.

8/19/20 - Shell Franklin Class I 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 Class I Significance_2010_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02763	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02698	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02597	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_NO2.SUM	NO2	ANNUAL	DECOKE	1ST	0.02253	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	25	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.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02754	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02692	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02588	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02248	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_NO2.SUM	NO2	ANNUAL	NORMAL	1ST	0.02202	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	25	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.27782	588800.58	4464383.42	375.2	375.2	0	7111024	BEAVER_VALLEY_2007_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.25717	591964.62	4467385.98	353.1	381.2	0	10122424	BEAVER_VALLEY_2010_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.24888	588800.58	4464383.42	375.2	375.2	0	8092824	BEAVER_VALLEY_2008_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.21264	588800.58	4464383.42	375.2	375.2	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	24-HR	DECOKE	1ST	0.20513	580997.63	4458817.63	368.6	368.6	0	9021524	BEAVER_VALLEY_2009_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.29529	588800.58	4464383.42	375.2	375.2	0	7111024	BEAVER_VALLEY_2007_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.27504	569779.5	4454055.81	373	434.2	0	10122524	BEAVER_VALLEY_2010_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.26923	588800.58	4464383.42	375.2	375.2	0	8092824	BEAVER_VALLEY_2008_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.23135	588800.58	4464383.42	375.2	375.2	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	24-HR	NORMAL	1ST	0.22045	579471.21	4457971.52	367.7	367.7	0	9021524	BEAVER_VALLEY_2009_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01873	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01847	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01825	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01568	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	ANNUAL	DECOKE	1ST	0.01528	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2010_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01998	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2007_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01972	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2006_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.0194	588800.58	4464383.42	375.2	375.2	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2009_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01667	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	102	2	360
AERMOD 19191	Shell Franklin Class I Significance_2008_PM10.SUM	PM10	ANNUAL	NORMAL	1ST	0.01628	568938.58	4453822.61	378.7	436.9	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	102	2	360

8/19/20 - Shell Franklin Class I SIL Model Results - New Plant Configuration

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard
NO2	ANNUAL	DECOKE	1ST	0.0276	NA	0.03	0.1	28%
NO2	ANNUAL	NORMAL	1ST	0.0275	NA	0.03	0.1	28%
PM10	ANNUAL	DECOKE	1ST	0.0187	NA	0.02	0.2	9%
PM10	ANNUAL	NORMAL	1ST	0.0200	NA	0.02	0.2	10%
PM10	24-HR	DECOKE	1ST	0.2778	NA	0.28	0.3	93%
PM10	24-HR	NORMAL	1ST	0.2953	NA	0.295	0.3	98%

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.

4/29/20 - Shell Franklin Class I 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 Class I Significance-Original_2010_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.02683	588800.58	4464383.42	375.2	375.2	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	23	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2007_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.02563	568938.58	4453822.61	378.7	436.9	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	23	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2006_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.02373	588800.58	4464383.42	375.2	375.2	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	23	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2009_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.02317	568938.58	4453822.61	378.7	436.9	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	23	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2008_NO2.SUM	NO2	ANNUAL	ALL	1ST	0.02115	568938.58	4453822.61	378.7	436.9	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	23	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2010_PM10.SUM	PM10	24-HR	ALL	1ST	0.269	569779.5	4454055.81	373	434.2	0	10122524	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2008_PM10.SUM	PM10	24-HR	ALL	1ST	0.21582	582493.59	4459716.50	353.2	402.2	0	8032824	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2006_PM10.SUM	PM10	24-HR	ALL	1ST	0.19609	591352.97	4466763.56	365.9	375.2	0	6011524	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2009_PM10.SUM	PM10	24-HR	ALL	1ST	0.19007	568938.58	4453822.61	378.7	436.9	0	9012624	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2007_PM10.SUM	PM10	24-HR	ALL	1ST	0.18138	568938.58	4453822.61	378.7	436.9	0	7081324	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2010_PM10.SUM	PM10	ANNUAL	ALL	1ST	0.01894	588800.58	4464383.42	375.2	375.2	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2007_PM10.SUM	PM10	ANNUAL	ALL	1ST	0.01835	568938.58	4453822.61	378.7	436.9	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2006_PM10.SUM	PM10	ANNUAL	ALL	1ST	0.01756	588800.58	4464383.42	375.2	375.2	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2009_PM10.SUM	PM10	ANNUAL	ALL	1ST	0.01649	568938.58	4453822.61	378.7	436.9	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360
AERMOD 19191	Shell Franklin Class I Significance-Original_2008_PM10.SUM	PM10	ANNUAL	ALL	1ST	0.01514	568938.58	4453822.61	378.7	436.9	0	1 YEARS	F:\My Docs\RTPENV\Projects\Shell\F	86	1	360

4/29/20 - Shell Franklin Class I SIL Model Results - Original Plant Configuration

Pollutant	Average	Group	Rank	Conc. (ug/m3)	Background (ug/m3)	Total (ug/m3)	Standard (ug/m3)	% Standard
NO2	ANNUAL	ALL	1ST	0.0268	NA	0.03	0.1	27%
PM10	ANNUAL	ALL	1ST	0.0189	NA	0.02	0.2	9%
PM10	24-HR	ALL	1ST	0.2690	NA	0.27	0.3	90%

Notes:

1) NO2 impacts include ARM2 with minimum and maximum ratios of 0.5 and 0.9, respectively.
2) Decoking mode was not part of the plant Class I modeling in the original permit application. Only the worst-case furnace operation was modeled.

8/20/20 - Shell Franklin Class I SIL Model Results
Comparison Between Origninal Plant and Revised Plant Configuration (Current Models)

Pollutant	Average	Group	Rank	New Plant Conc. (ug/m3)	Original Plant Conc. (ug/m3)	Standard (ug/m3)
NO2	ANNUAL	ALL	1ST	0.028	0.027	0.1
PM10	ANNUAL	ALL	1ST	0.020	0.019	0.2
PM10	24-HR	ALL	1ST	0.295	0.269	0.3

Notes:

1) NO2 impacts include ARM2 with minimum and maximum ambient ratios of 0.5 and 0.9, respectively.
2) Worst case impact from normal or decoking mode presented for revised plant configuration.

8/20/20 - 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	1696.99268	555500	4501150	247.16	345.39	0	7020417	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	1-HR	ALL	2ND	1489.86069	555500	4501150	247.16	345.39	0	8021022	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	1-HR	ALL	2ND	1298.64896	555500	4501150	247.16	345.39	0	10010213	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	1-HR	ALL	2ND	1272.28166	555500	4501150	247.16	345.39	0	9011316	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	1-HR	ALL	2ND	1263.23576	555500	4501150	247.16	345.39	0	6112509	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2007_CO.SUM	CO	1-HR	SHELL	2ND	1686.76579	555500	4501150	247.16	345.39	0	7020417	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	1-HR	SHELL	2ND	1474.16244	555500	4501150	247.16	345.39	0	8021022	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	1-HR	SHELL	2ND	1281.06376	555500	4501150	247.16	345.39	0	10122715	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	1-HR	SHELL	2ND	1249.84126	555500	4501150	247.16	345.39	0	9011316	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	1-HR	SHELL	2ND	1085.11546	555500	4501150	247.16	345.39	0	6012513	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	8-HR	ALL	2ND	804.10827	555500	4501150	247.16	345.39	0	8021016	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	8-HR	ALL	2ND	780.66785	555500	4501150	247.16	345.39	0	10012816	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2007_CO.SUM	CO	8-HR	ALL	2ND	652.96204	555500	4501150	247.16	345.39	0	7020424	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	8-HR	ALL	2ND	580.78466	555500	4501150	247.16	345.39	0	9021916	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	8-HR	ALL	2ND	514.52806	555500	4501150	247.16	345.39	0	6021716	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2008_CO.SUM	CO	8-HR	SHELL	2ND	790.89623	555500	4501150	247.16	345.39	0	8021016	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2010_CO.SUM	CO	8-HR	SHELL	2ND	767.79212	555500	4501150	247.16	345.39	0	10012816	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2007_CO.SUM	CO	8-HR	SHELL	2ND	643.85287	555500	4501150	247.16	345.39	0	7020424	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2009_CO.SUM	CO	8-HR	SHELL	2ND	571.10705	555500	4501150	247.16	345.39	0	9021916	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_2006_CO.SUM	CO	8-HR	SHELL	2ND	507.23337	555500	4501150	247.16	345.39	0	6021716	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	2	1
AERMOD 19191	Shell Franklin NAAQS_5yrs_NO2.SUM	NO2	8TH-HIGHEST MAX DAILY 1-HR	ALL	1ST	271.56381	560500	4504500	268.02	300.92	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	51	3	14377
AERMOD 19191	Shell Franklin NAAQS_5yrs_NO2.SUM	NO2	8TH-HIGHEST MAX DAILY 1-HR	BACKGRND	1ST	67.6819	556368.9	4502893.9	231.19	339.37	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	51	3	14377
AERMOD 19191	Shell Franklin NAAQS_5yrs_NO2.SUM	NO2	8TH-HIGHEST MAX DAILY 1-HR	SHELL	1ST	43.60451	554550	4502600	347.72	347.72	0	5 YEARS	BEAVER_VALLEY_2006-2010_ADJUST	51	3	14377
AERMOD 19191	Shell Franklin NAAQS_2010_NOX.SUM	NOX	ANNUAL	ALL	1ST	8.16411	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2006_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.53269	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2009_NOX.SUM	NOX	ANNUAL	ALL	1ST	6.81666	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2008_NOX.SUM	NOX	ANNUAL	ALL	1ST	6.65112	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2007_NOX.SUM	NOX	ANNUAL	ALL	1ST	6.50509	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2010_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.43568	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2007_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.13348	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2008_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.03139	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2006_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.00622	556750	4501950	314.82	328.02	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_2009_NOX.SUM	NOX	ANNUAL	SHELL	1ST	0.96109	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	2	73
AERMOD 19191	Shell Franklin NAAQS_5yrs_PM10.SUM	PM10	24-HR	ALL	6TH	18.94513	554500	4502350	327.63	352.88	0	10101124	BEAVER_VALLEY_2006-2010_ADJUST	190	2	836
AERMOD 19191	Shell Franklin NAAQS_5yrs_PM10.SUM	PM10	24-HR	SHELL	6TH	6.93058	556634.34	4502473.98	251.17	343.47	0	10121524	BEAVER_VALLEY_2006-2010_ADJUST	190	2	836

8/20/20 - 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 MAX DAILY 1-HR	ALL	1ST	271.56	Note 1	271.6	188	144%	Shell not significant at 0.44 (7.5 is SIL) 32nd high.
NOx	ANNUAL	ALL	1ST	8.16	16.9	25.0	100	25%	
CO	1-HR	ALL	2ND	1696.99	2514.6	4211.6	40000	11%	
CO	8-HR	ALL	2ND	804.11	1371.6	2175.7	10000	22%	
PM10	24-HR	ALL	6TH	18.95	107.0	125.9	150	84%	

Notes:

1) NO2 background (2016-18) from Beaver Falls (AQS No. 42-007-0014). Season by hour background added to AERMOD results within the model.
2) PM10 background (2016-18) 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.

8/20/20 - 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	8.15771	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2006_NOX.SUM	NOX	ANNUAL	ALL	1ST	7.52736	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2009_NOX.SUM	NOX	ANNUAL	ALL	1ST	6.80996	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2008_NOX.SUM	NOX	ANNUAL	ALL	1ST	6.64628	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2007_NOX.SUM	NOX	ANNUAL	ALL	1ST	6.49982	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2010_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	8.15771	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2006_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	7.52736	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2009_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	6.80996	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2008_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	6.64628	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2007_NOX.SUM	NOX	ANNUAL	INCREMNT	1ST	6.49982	556700	4502000	303.93	329.48	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2010_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.43568	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2007_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.13348	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2008_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.03139	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2006_NOX.SUM	NOX	ANNUAL	SHELL	1ST	1.00622	556750	4501950	314.82	328.02	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2009_NOX.SUM	NOX	ANNUAL	SHELL	1ST	0.96109	556750	4502000	309.94	329.48	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	93	3	73
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	24-HR	ALL	2ND	22.54161	556367.3	4501813.2	253.61	340.38	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	24-HR	ALL	2ND	20.21594	554300	4502400	330.01	353.11	0	10053024	BEAVER_VALLEY_2010_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	24-HR	ALL	2ND	17.40022	554250	4502400	328.78	353.11	0	7100724	BEAVER_VALLEY_2007_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	24-HR	ALL	2ND	17.38772	554500	4502300	322.64	352.88	0	9012624	BEAVER_VALLEY_2009_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	24-HR	ALL	2ND	17.33685	554250	4502600	335.03	354.2	0	8060224	BEAVER_VALLEY_2008_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	24-HR	INCREMNT	2ND	22.54161	556367.3	4501813.2	253.61	340.38	0	6062424	BEAVER_VALLEY_2006_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	24-HR	INCREMNT	2ND	20.21594	554300	4502400	330.01	353.11	0	10053024	BEAVER_VALLEY_2010_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	24-HR	INCREMNT	2ND	17.40022	554250	4502400	328.78	353.11	0	7100724	BEAVER_VALLEY_2007_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	24-HR	INCREMNT	2ND	17.38772	554500	4502300	322.64	352.88	0	9012624	BEAVER_VALLEY_2009_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	24-HR	INCREMNT	2ND	17.33685	554250	4502600	335.03	354.2	0	8060224	BEAVER_VALLEY_2008_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	24-HR	SHELL	2ND	7.48997	556646.5	4502522.48	244.33	343.47	0	10100624	BEAVER_VALLEY_2010_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	24-HR	SHELL	2ND	7.12613	556634.34	4502473.98	251.17	343.47	0	6091924	BEAVER_VALLEY_2006_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	24-HR	SHELL	2ND	6.91727	556658.66	4502570.98	240.39	343.47	0	9121024	BEAVER_VALLEY_2009_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	24-HR	SHELL	2ND	6.37206	556529.18	4502279.2	252.37	340.53	0	8092824	BEAVER_VALLEY_2008_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	24-HR	SHELL	2ND	6.31958	556652.58	4502546.73	241.05	343.47	0	7122724	BEAVER_VALLEY_2007_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	ANNUAL	ALL	1ST	5.22292	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	ANNUAL	ALL	1ST	5.1687	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	ANNUAL	ALL	1ST	4.87681	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	ANNUAL	ALL	1ST	4.81527	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	ANNUAL	ALL	1ST	4.63344	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	5.22292	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	5.1687	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	4.87681	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	4.81527	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	ANNUAL	INCREMNT	1ST	4.63344	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2010_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.80329	556646.5	4502522.48	244.33	343.47	0	1 YEARS	BEAVER_VALLEY_2010_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2006_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.75429	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2006_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2007_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.61459	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2007_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2008_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.53664	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2008_ADJUSTAR.SF	189	3	836
AERMOD 19191	Shell Franklin Increment_2009_PM10.SUM	PM10	ANNUAL	SHELL	1ST	2.51325	556578.18	4502335.71	243.22	343.47	0	1 YEARS	BEAVER_VALLEY_2009_ADJUSTAR.SF	189	3	836

8/20/20 - 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	22.54	NA	22.5	30	75%	Conservatively assumes all sources consume increment at PTE.
PM10	ANNUAL	INCREMNT	1ST	5.22	NA	5.2	17	31%	
NOX	ANNUAL	ALL	1ST	8.16	NA	8.2	25	33%	

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

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	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

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	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

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast 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

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast 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

Attachment D

Inhalation Risk Assessment for Shell Polymers Monaca Site

- Attachment A – Emissions Estimates
- Attachment B – Dispersion Modeling Analysis
- Attachment C – Inhalation Risk Assessment (Results)

ATTACHMENT A

EMISSION ESTIMATES FOR THE INHALATION RISK ASSESSMENT FOR SHELL POLYMERS MONACA SITE SHELL CHEMICAL APPALACHIA LLC BEAVER COUNTY, PENNSYLVANIA

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Initial Submittal January 2015
First Submittal Update February 2020
Second Submittal Update September 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[3]	PE 1&2	PE3	Total[4]
1,3-Butadiene		3.08E-05				3.74E-05		1.50E-02		3.00E-02	2.98E-02	8.22E-06						7.49E-02
2-Methylnaphthalene	7.54E-06		1.55E-06	1.55E-06	2.63E-08	2.51E-06	9.60E-08	2.52E-07				9.56E-07						5.97E-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										2.51E-04	9.83E-07					8.84E-03
Acrolein		4.58E-04										1.49E-04	3.07E-07					1.52E-03
Ammonia	2.36E+00	4.88E+00																3.12E+01
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
Barium	1.38E-03		2.84E-04	2.84E-04	4.81E-06	4.61E-04	1.76E-05	4.63E-05										1.08E-02
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	2.32E-02	2.53E-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	6.10E-06						1.48E-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	1.14E-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				1.54E-03	3.08E-06					3.37E-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	3.19E-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		7.20E-05						4.87E-02
Molybdenum	3.45E-04		7.10E-05	7.10E-05	1.20E-06	1.15E-04	4.40E-06	1.16E-05										2.69E-03
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	5.95E-08	5.87E-02	9.25E-03	3.29E-06	5.07E-06					7.14E-02
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										3.06E-06						4.75E-04
Pentane	8.16E-01		1.68E-01	1.68E-01	2.84E-03	2.72E-01	1.04E-02	2.73E-02										6.36E+00
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												6.91E-07		7.50E-07				1.44E-06
Propane	5.02E-01		1.03E-01	1.03E-01	1.75E-03	1.67E-01	6.40E-03	1.68E-02										3.92E+00
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				1.04E-07	1.45E-07					1.26E-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

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[3]	PE 1&2	PE3	Total[4]
Styrene						4.91E-04		0.00E+00		1.68E-02	3.51E-03	6.79E-07						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	8.06E-03	1.73E-05	1.10E-05					8.02E-02
Vanadium	7.22E-04		1.48E-04	1.48E-04	2.52E-06	2.41E-04	9.20E-06	2.42E-05										5.63E-03
Xylenes		4.58E-03				3.27E-05		0.00E+00		1.12E-03	2.33E-04	9.17E-06	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.

[3]Cooling Tower emissions were modeled as 13 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, 2 firewater pumps, and 13 modeled cooling water tower units

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	Emergency Engines Total	One Firewater Pump Engines	WWTP	Cooling Tower[3]	PE1&2	PE3	Total[4]
1,3-Butadiene		3.08E-05				3.74E-05		1.50E-02		3.00E-02	2.98E-02	7.20E-04						7.57E-02
2-Methylnaphthalene	7.54E-06		3.21E-05	3.21E-05	2.63E-08	5.88E-06	2.39E-06	2.52E-07				8.37E-05						2.09E-04
3-Methylchloranthrene	5.65E-07		2.40E-06	2.40E-06	1.97E-09	4.41E-07	1.79E-07	1.89E-08										9.41E-06
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										8.36E-05
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					4.31E-05
Acenaphthylene												6.02E-06	3.15E-05					6.91E-05
Acetaldehyde		2.86E-03										2.20E-02	8.61E-05					3.07E-02
Acrolein		4.58E-04										1.31E-02	2.69E-05					1.45E-02
Ammonia	2.36E+00	4.88E+00																3.12E+01
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					2.32E-05
Arsenic	6.28E-05		2.67E-04	2.67E-04	2.19E-07	4.90E-05	1.99E-05	2.10E-06										1.05E-03
Barium	1.38E-03		5.88E-03	5.88E-03	4.81E-06	1.08E-03	4.38E-04	4.63E-05										2.30E-02
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	2.32E-02	2.22E-03	2.65E-03	4.77E-02				2.77E-01
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					1.57E-05
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					8.25E-06
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					1.71E-05
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										6.27E-06
Benzo(g,h,l)perylene												5.82E-07	1.90E-06					4.38E-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					1.11E-05
Beryllium	3.77E-06		1.60E-05	1.60E-05	1.31E-08	2.94E-06	1.20E-06	1.26E-07										6.27E-05
Biphenyl									2.03E-09		8.65E-06	5.35E-04						5.43E-04
Cadmium	3.45E-04		1.47E-03	1.47E-03	1.20E-06	2.70E-04	1.10E-04	1.16E-05										5.75E-03
Chromium	4.40E-04															2.10E-04	1.07E-04	3.18E-03
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					2.03E-05
Cobalt	2.64E-05		1.12E-04	1.12E-04	9.19E-08	2.06E-05	8.37E-06	8.83E-07										4.39E-04
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					9.33E-06
Dichlorobenzene	3.77E-04		1.60E-03	1.60E-03	1.31E-06	2.94E-04	1.20E-04	1.26E-05										6.27E-03
Ethylbenzene		2.29E-03				8.64E-05		0.00E+00	5.77E-05	2.95E-03	6.44E-04	1.00E-04						1.07E-02
Ethylene Oxide								0.00E+00										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					5.23E-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					1.37E-04
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				1.35E-01	2.70E-04					6.79E-01
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	2.80E-03			0.068			1.10E+01
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					1.27E-05
Lead	1.57E-04		6.68E-04	6.68E-04	5.47E-07	1.23E-04	4.98E-05											2.61E-03
Manganese	1.19E-04		5.08E-04	5.08E-04	4.16E-07	9.31E-05	3.78E-05	4.00E-06										1.99E-03
Mercury	8.16E-05		3.47E-04	3.47E-04	2.84E-07	6.37E-05	2.59E-05	2.73E-06										1.36E-03
Methanol										4.86E-02		6.30E-03						5.49E-02
Molybdenum	3.45E-04		1.47E-03	1.47E-03	1.20E-06	2.70E-04	1.10E-04	1.16E-05										5.75E-03
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	2.89E-04	4.44E-04					7.43E-02
Nickel	6.59E-04		2.80E-03	2.80E-03	2.30E-06	5.15E-04	2.09E-04	2.21E-05										1.10E-02
PAH[2]		1.57E-04										2.68E-04						7.40E-04
Pentane	8.16E-01		3.47E+00	3.47E+00	2.84E-03	6.37E-01	2.59E-01	2.73E-02										1.36E+01
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					4.03E-04
Phenol												6.05E-05		3.73E-06				6.42E-05
Propane	5.02E-01		2.14E+00	2.14E+00	1.75E-03	3.92E-01	1.59E-01	1.68E-02										8.36E+00
Propylene Oxide		2.07E-03																6.22E-03
Pyrene	1.57E-06		6.68E-06	6.68E-06	5.47E-09	1.23E-06	4.98E-07	5.26E-08				9.12E-06	1.27E-05					6.06E-05
Selenium	7.54E-06		3.21E-05	3.21E-05	2.63E-08	5.88E-06	2.39E-06	2.52E-07										1.25E-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	Emergency Engines Total	One Firewater Pump Engines	WWTP	Cooling Tower[3]	PE1&2	PE3	Total[4]
Styrene						4.91E-04		0.00E+00		1.68E-02	3.51E-03	5.95E-05						2.09E-02
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	8.06E-03	1.52E-03	9.60E-04					9.31E-02
Vanadium	7.22E-04		3.07E-03	3.07E-03	2.52E-06	5.64E-04	2.29E-04	2.42E-05										1.20E-02
Xylenes		4.58E-03				3.27E-05		0.00E+00		1.12E-03	2.33E-04	8.03E-04	6.59E-04					1.72E-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.

[3] Cooling Tower emissions were modeled as 13 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, 2 firewater pumps, and 13 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
Size (bhp)	103	67	158	50	113
Fuel Fired	Diesel	Diesel	NG	NG	NG
Heat Input (MMBtu/hr)	-	-	1.42	0.37	0.73
Hours of Operation (hrs/yr)	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
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
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
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
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
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
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
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
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
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
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
Butyr/Isobutyraldehyde		1.01E-04					1.63E-06	4.30E-07	8.43E-07
Carbon Tetrachloride		3.67E-05					5.94E-07	1.56E-07	3.06E-07
Chlorobenzene		3.04E-05					4.92E-07	1.30E-07	2.54E-07
Chloroethane		1.87E-06					3.02E-08	7.97E-09	1.56E-08
Chloroform		2.85E-05					4.61E-07	1.21E-07	2.38E-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
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

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
Size (bhp)	103	67	158	50	113
Fuel Fired	Diesel	Diesel	NG	NG	NG
Heat Input (MMBtu/hr)	-	-	1.42	0.37	0.73
Hours of Operation (hrs/yr)	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
Ethylene Dibromide		4.43E-05					7.16E-07	1.89E-07	3.70E-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
Methylcyclohexane		1.23E-03					1.99E-05	5.24E-06	1.03E-05
Methylene Chloride		2.00E-05					3.23E-07	8.52E-08	1.67E-07
Hexane		1.11E-03					1.80E-05	4.73E-06	9.27E-06
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
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
Styrene		2.36E-05					3.82E-07	1.01E-07	1.97E-07
Tetrachloroethane		2.48E-06					4.01E-08	1.06E-08	2.07E-08
Vinyl Chloride		1.49E-05					2.41E-07	6.35E-08	1.24E-07
1,1,2,2-Tetrachloroethane		4.00E-05					6.47E-07	1.70E-07	3.34E-07
1,1,2-Trichloroethane		3.18E-05					5.14E-07	1.36E-07	2.65E-07
1,1-Dichloroethane		2.36E-05					3.82E-07	1.01E-07	1.97E-07
1,2,3-Trimethylbenzene		2.30E-05					3.72E-07	9.80E-08	1.92E-07
1,2,4-Trimethylbenzene		1.43E-05					2.31E-07	6.09E-08	1.19E-07
1,2-Dichloroethane		2.36E-05					3.82E-07	1.01E-07	1.97E-07
1,2-Dichloropropane		2.69E-05					4.35E-07	1.15E-07	2.25E-07
1,3,5-Trimethylbenzene		3.38E-05					5.47E-07	1.44E-07	2.82E-07
1,3-Dichloropropene		2.64E-05					4.27E-07	1.13E-07	2.20E-07
2-Methylnaphthalene		3.32E-05					5.37E-07	1.41E-07	2.77E-07
2,2,4-Trimethylpentane		2.50E-04					4.04E-06	1.07E-06	2.09E-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/hp-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,I)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]	[redacted]	8760	0.002	485	200	1	5.35E-05	2.20E-05	9.66E-05
[redacted]									
[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 associated 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 associated 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
Dibenzo(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 associated 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 associated 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 contribution 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
First Submittal Update February 2020
Second Submittal Update September 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 were 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. This update was submitted in February of 2020. This second update incorporates corrections to the modeled hexane emission rate and exit diameters for the facility cooling towers. This update also includes removal of a diesel fired emergency generator. 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.

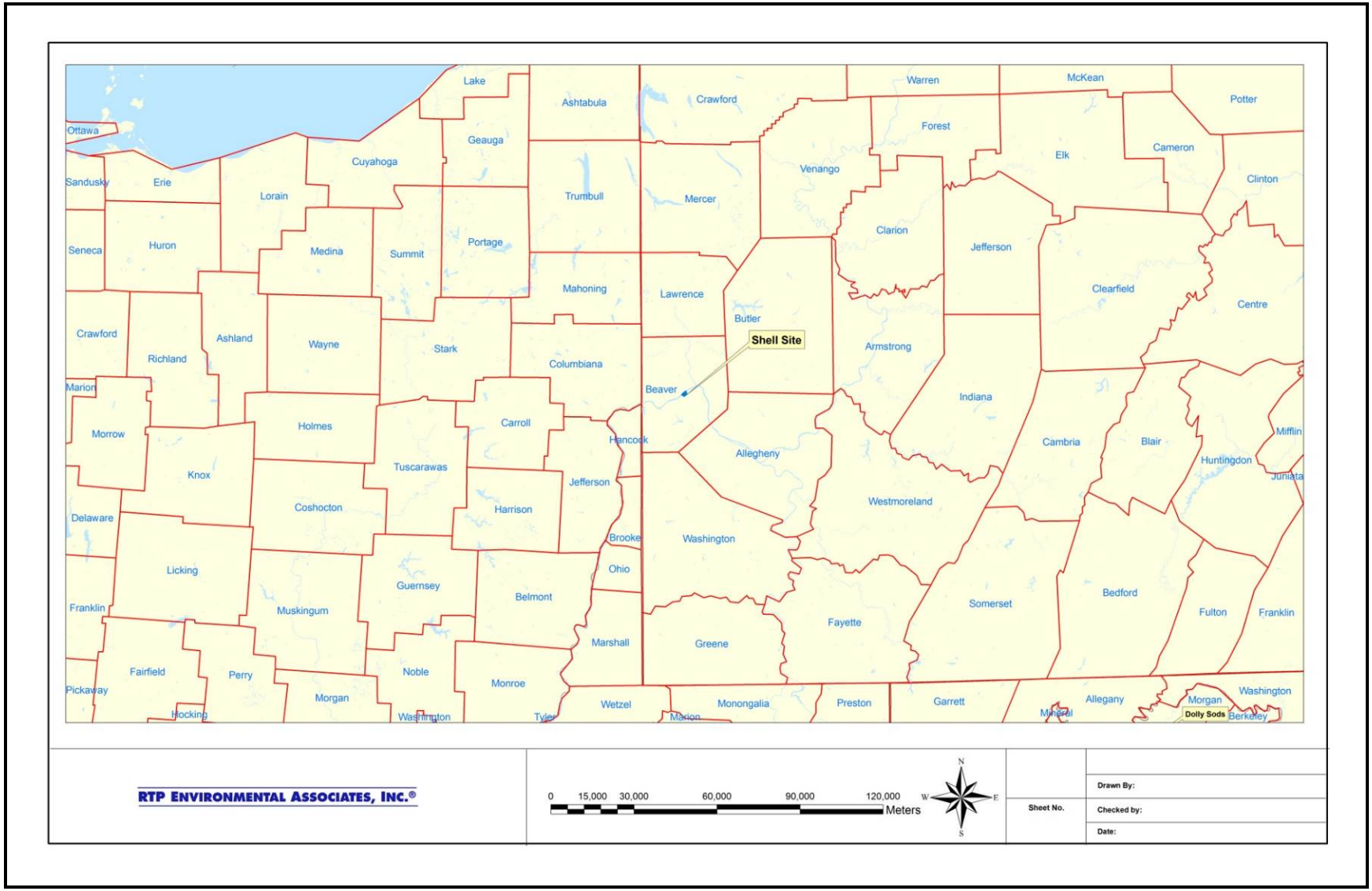

Figure 1. General Location of Shell Facility

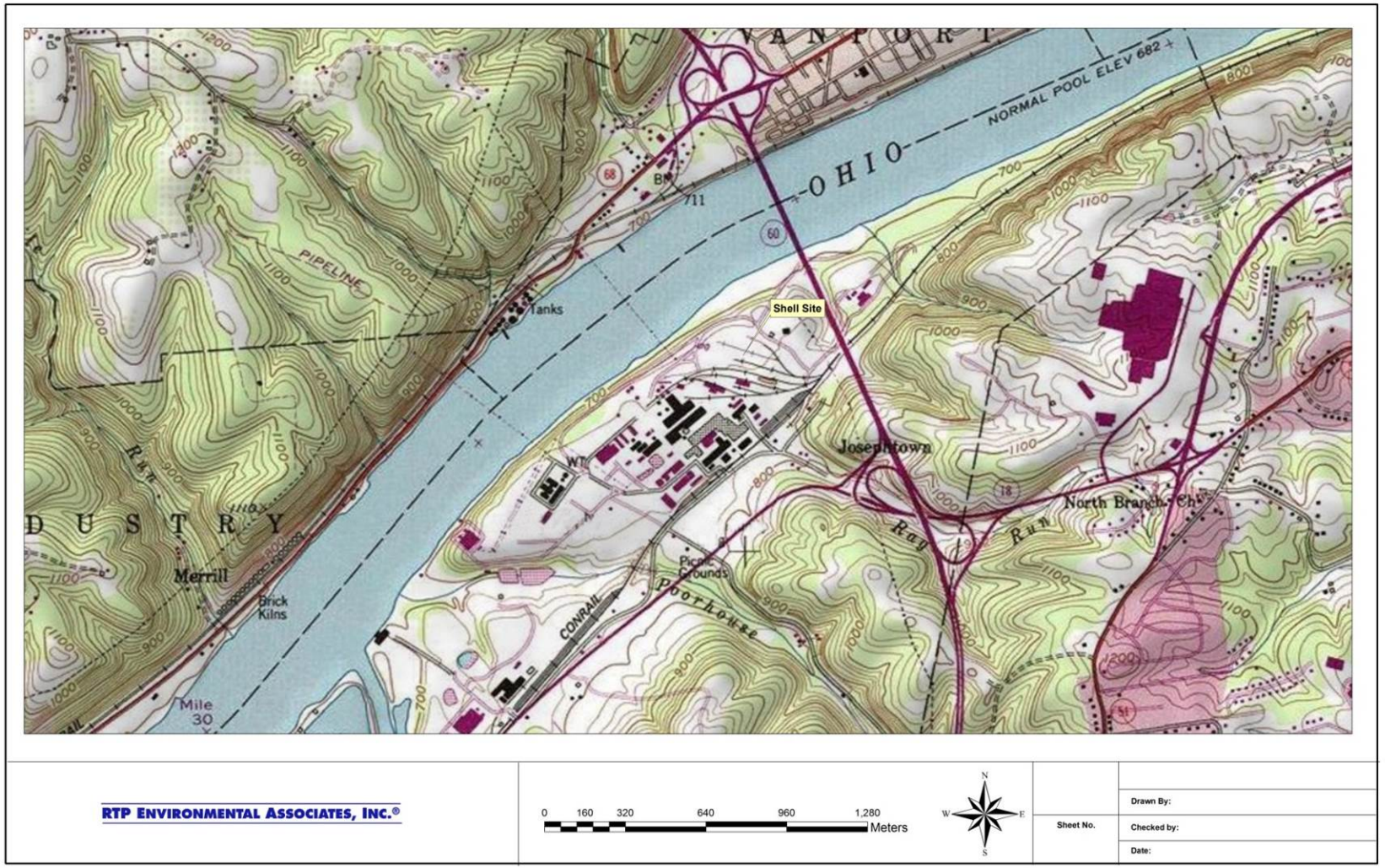

Figure 2. Specific Location of the Shell Facility

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.

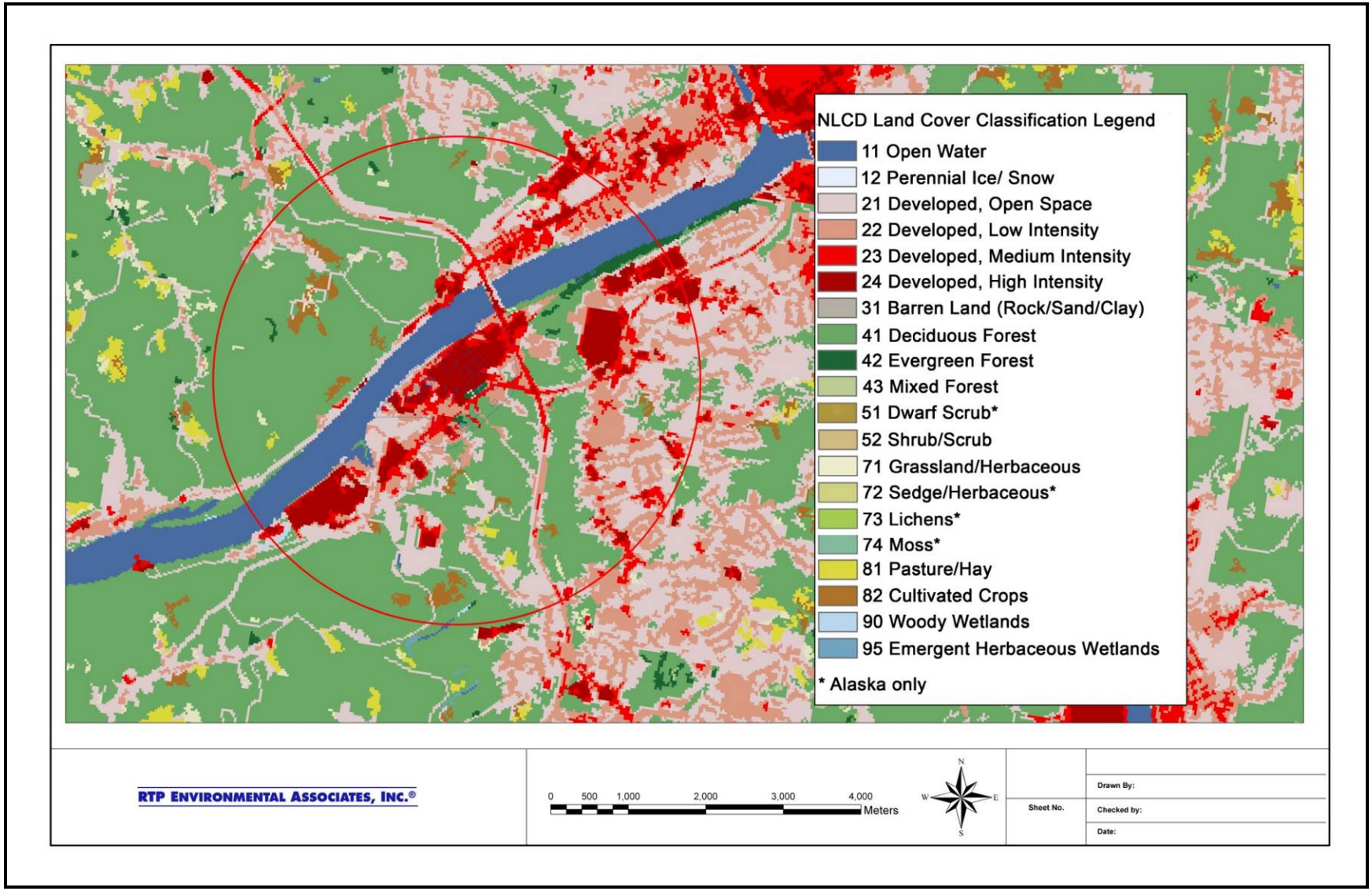

Figure 3. Land Use within Three Kilometers

Table 1. Point Source Input Parameters

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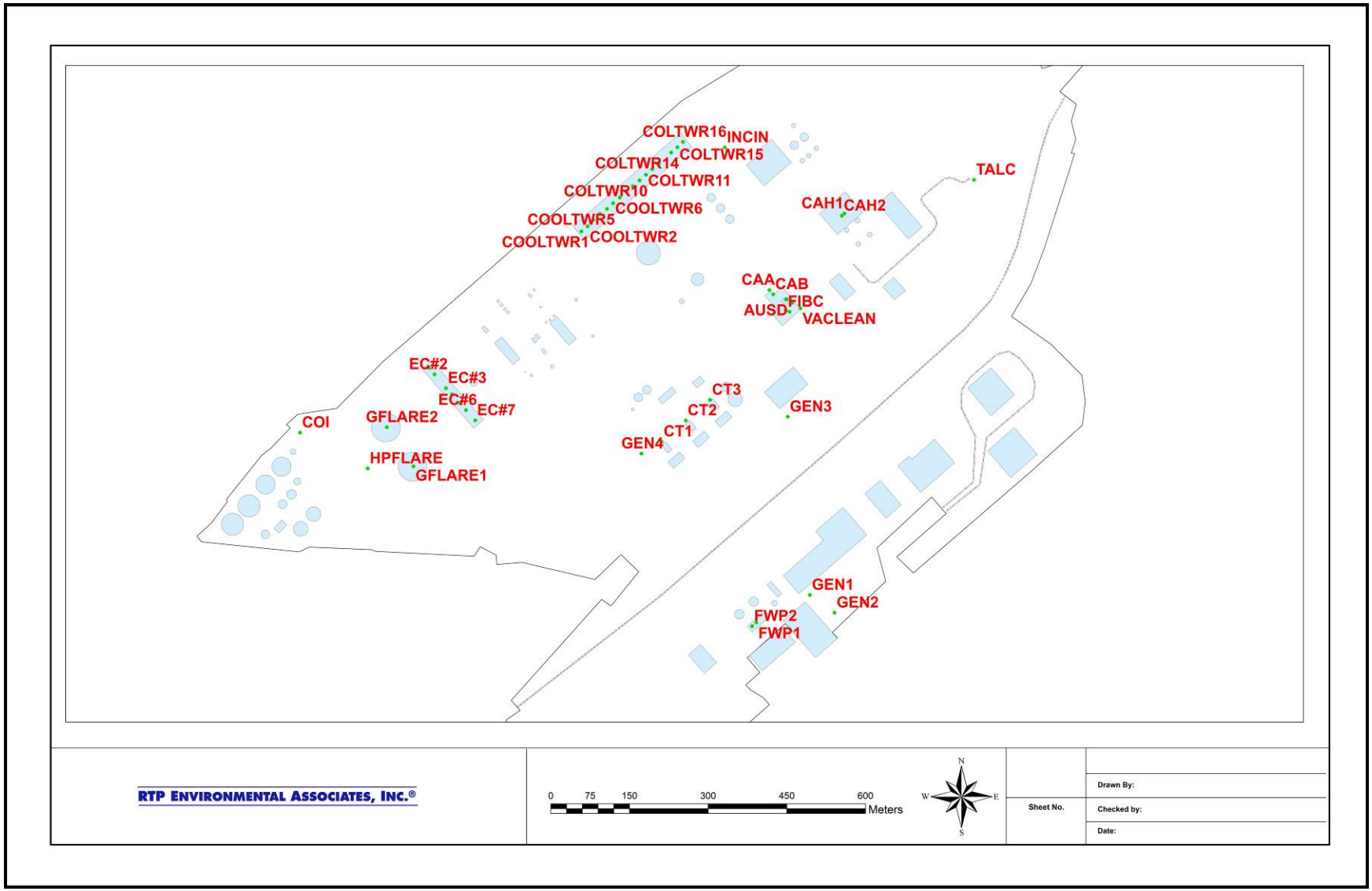

Figure 4. Modeled Point Source Locations

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 Calculations

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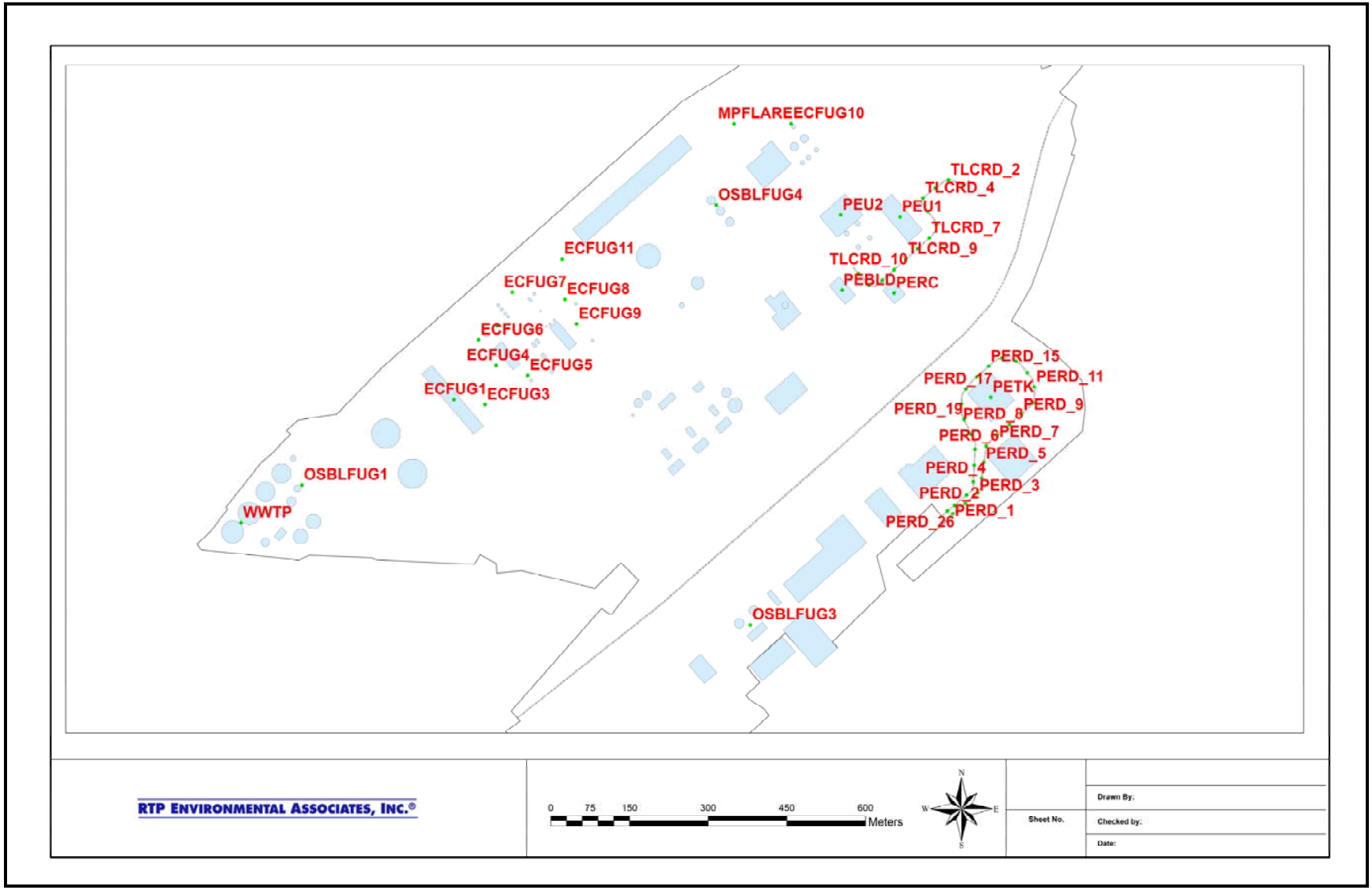

Figure 5. Modeled Volume Source Locations

Load/Operating Conditions

The combustion turbines may operate at a reduced load. Therefore, a range of conditions was evaluated to identify the condition which results in the worst-case impact. 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.

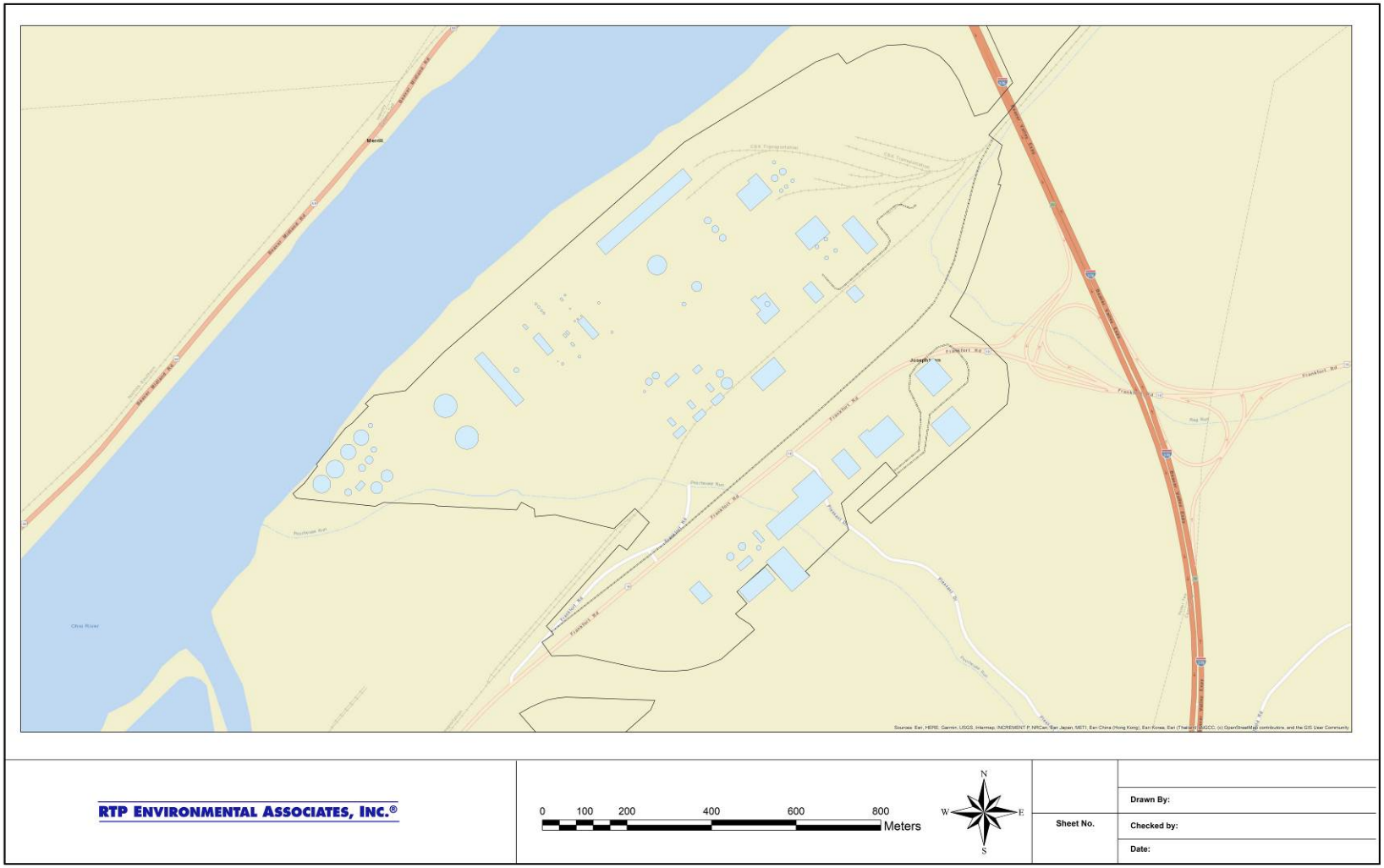

Figure 6. Shell Facility Plot Plan

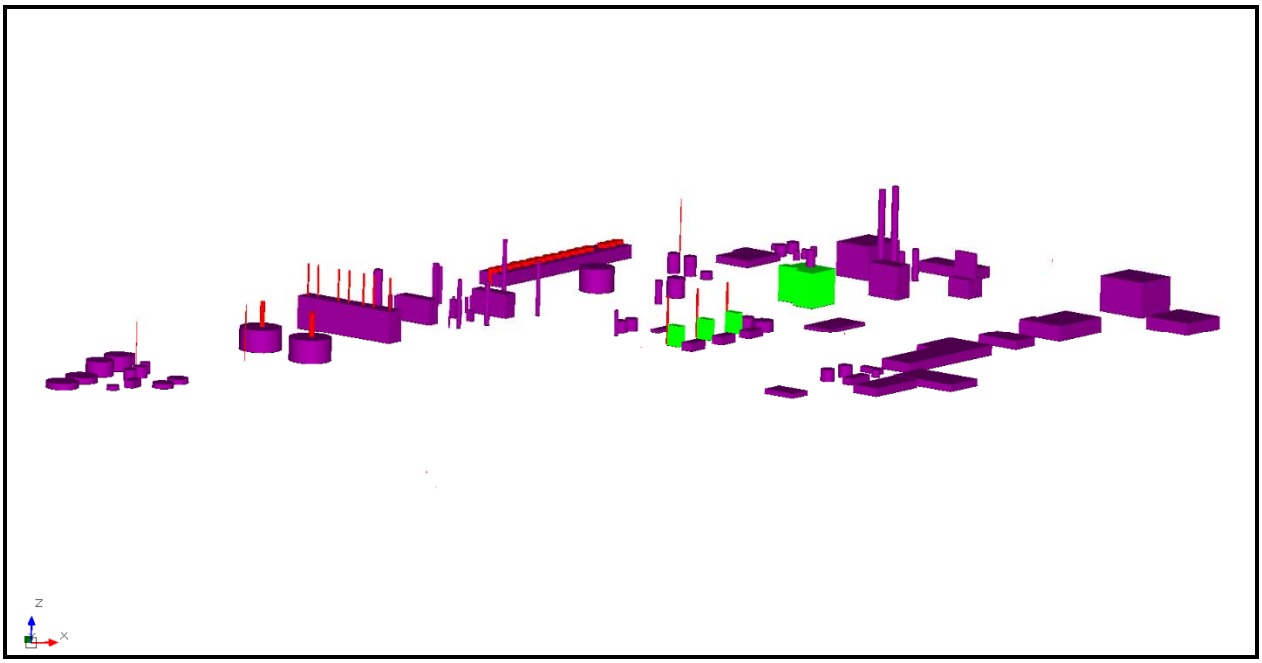

Figure 7. Shell Three Dimensional Plot Plan (View from SW)

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.

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

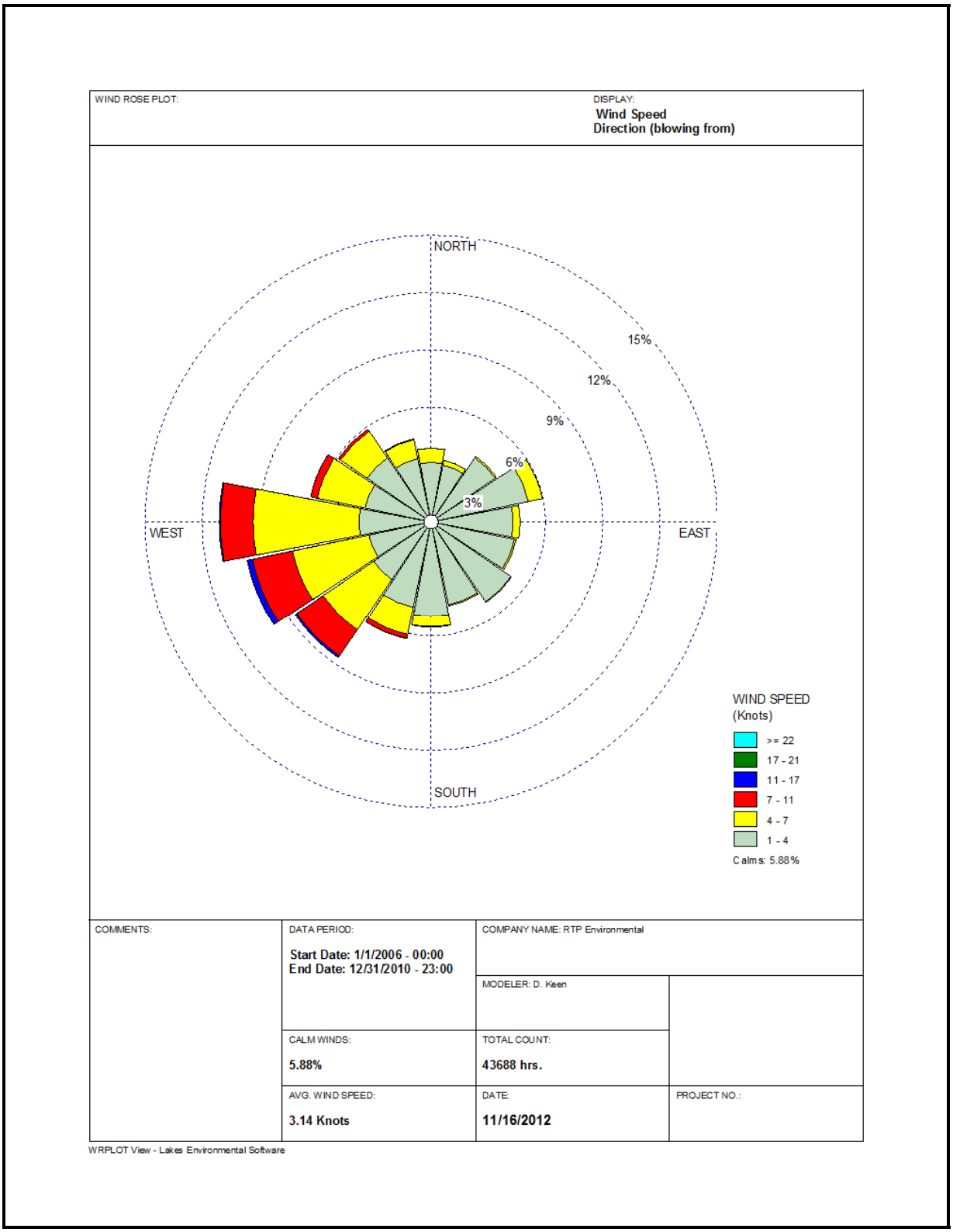

Figure 11. Beaver Valley Windrose 2006-2010

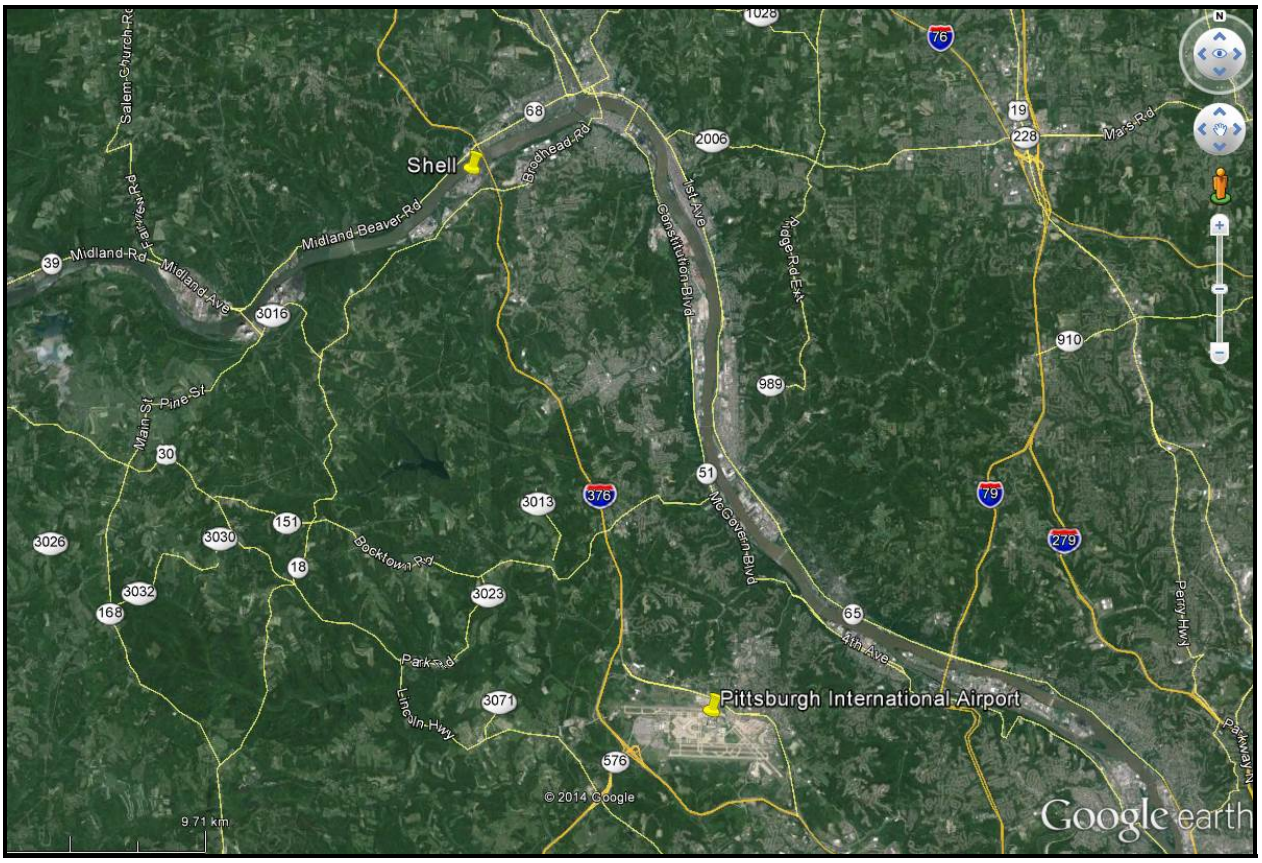

Figure 12. Pittsburgh International Airport Location Relative to Shell

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.

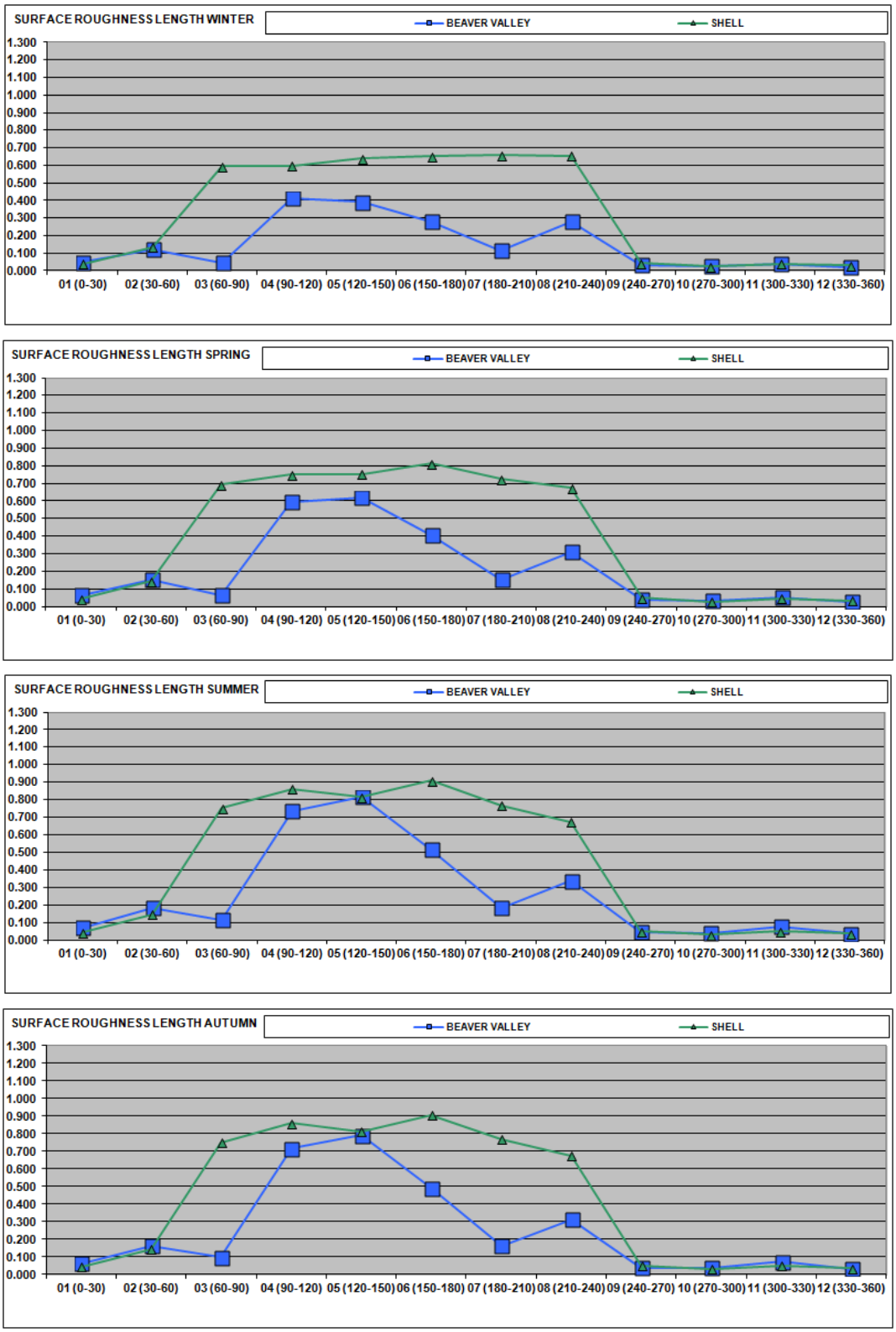

Figure 13. Meteorological Data Representativeness Analysis Results

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 (µg/m^3)

Model	File	COPC	Conc/Dep	East (X)	North (Y)	Elev	Hill	Flag	Time	Met File	Sources	Groups	Receptors
AERMOD 19191	Acute HRA_5yrs_13Buta.SUM	13BUTA	1.87188	555623.1	4502392	235.47	347.82	0	6112609	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	23	1	13756
AERMOD 19191	Acute HRA_5yrs_2methy.SUM	2METHY	0.00567	556271.2	4501695	247.59	340.38	0	10072522	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	16	1	13756
AERMOD 19191	Acute HRA_5yrs_3methy.SUM	3METHY	0	556676.2	4502429	262.77	342.87	0	10022109	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_712Dimeth.SUM	712DIMET	0.00004	556676.2	4502429	262.77	342.87	0	10022109	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Acenap.SUM	ACENAP	0.00161	556250	4501600	287.38	340.38	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Acenapl.SUM	ACENAPL	0.00317	556250	4501600	287.38	340.38	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	4	1	13756
AERMOD 19191	Acute HRA_5yrs_Acet.SUM	ACET	1.43866	556271.2	4501695	247.59	340.38	0	10072522	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	10	1	13756
AERMOD 19191	Acute HRA_5yrs_Acrol.SUM	ACROL	0.88021	556271.2	4501695	247.59	340.38	0	10072522	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	10	1	13756
AERMOD 19191	Acute HRA_5yrs_Anthra.SUM	ANTHRA	0.0005	556250	4501600	287.38	340.38	0	6121404	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_AS.SUM	AS	0.00092	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_BA.SUM	BA	0.02028	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Be.SUM	BE	0.00003	556676.2	4502429	262.77	342.87	0	10022109	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Bensoap.SUM	BENSOAP	0.00001	556667.4	4502406	255.07	343.47	0	8031320	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Benzoaa.SUM	BENZOAA	0.00031	556250	4501600	287.38	340.38	0	6121404	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Benzob.SUM	BENZOB	0.00031	556150	4501500	289	340.38	0	8032421	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Benzog.SUM	BENZOG	0	556676.2	4502429	262.77	342.87	0	10022109	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_BENZOG2.SUM	BENZOG2	0.00013	556441.1	4501880	286.06	329.48	0	8090820	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	4	1	13756
AERMOD 19191	Acute HRA_5yrs_Benzok.SUM	BENZOK	0.00001	556667.4	4502406	255.07	343.47	0	8031320	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_BIPH.SUM	BIPH	0.03624	556271.2	4501695	247.59	340.38	0	10072522	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	4	1	13756
AERMOD 19191	Acute HRA_5yrs_BZ.SUM	BZ	15.88784	555086.2	4501902	216.21	354.2	0	6012217	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	35	1	13756
AERMOD 19191	Acute HRA_5yrs_Cd.SUM	CD	0.00509	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Chrys.SUM	CHRYS	0.00053	556250	4501600	287.38	340.38	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Co.SUM	CO	0.00033	556488.1	4501921	268.99	334.89	0	8022009	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Cr.SUM	CR	0.00742	556288.03	4502061	245.55	339.71	0	9110909	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	11	1	13756
AERMOD 19191	Acute HRA_5yrs_CU.SUM	CU	0.00269	554950	4502800	339.65	341.68	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	7	1	13756
AERMOD 19191	Acute HRA_5yrs_Dibenz.SUM	DIBENZ	0.0001	556361.7	4501834	260.05	340.38	0	9112422	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Dichlb.SUM	DICHLB	0.00556	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_EB.SUM	EB	0.12991	555571.1	4502346	235.81	347.91	0	7123002	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	15	1	13756
AERMOD 19191	Acute HRA_5yrs_Fl.SUM	FL	0.00599	556250	4501600	287.38	340.38	0	6121404	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Fluor.SUM	FLUOR	0.00176	556250	4501600	287.38	340.38	0	6121404	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Form.SUM	FORM	9.05281	556271.2	4501695	247.59	340.38	0	10072522	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	23	1	13756
AERMOD 19191	Acute HRA_5yrs_Hex.SUM	HEX	24.09149	555778.8	4502528	233.86	345.23	0	8082122	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	30	1	13756
AERMOD 19191	Acute HRA_5yrs_HG.SUM	HG	0.0012	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Ideno.SUM	IDENO	0.0001	556441.1	4501880	286.06	329.48	0	8090820	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_MEOH.SUM	MEOH	2.22551	555675	4502437	234.91	347.64	0	10120922	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	5	1	13756
AERMOD 19191	Acute HRA_5yrs_MN.SUM	MN	0.00175	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_MOLYB.SUM	MOLYB	0.00509	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Napth.SUM	NAPTH	2.84358	555571.1	4502346	235.81	347.91	0	10020722	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	31	1	13756
AERMOD 19191	Acute HRA_5yrs_NH3.SUM	NH3	25.84956	557800	4501550	368.87	372.27	0	7012209	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	10	1	13756
AERMOD 19191	Acute HRA_5yrs_Nickel.SUM	NICKEL	0.00968	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_PAH.SUM	PAH	0.02806	556394.1	4501839	272.7	337.48	0	8050305	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	8	1	13756
AERMOD 19191	Acute HRA_5yrs_PB.SUM	PB	0.00231	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	12	1	13756
AERMOD 19191	Acute HRA_5yrs_PENT.SUM	PENT	11.9899	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Phen.SUM	PHEN	0.0041	556271.2	4501695	247.59	340.38	0	10072522	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	4	1	13756
AERMOD 19191	Acute HRA_5yrs_Phenan.SUM	PHENAN	0.01401	556250	4501600	287.38	340.38	0	10052720	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	17	1	13756
AERMOD 19191	Acute HRA_5yrs_Prop.SUM	PROP	0.00701	557800	4501500	371.98	371.98	0	10011903	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	3	1	13756
AERMOD 19191	Acute HRA_5yrs_PROPANE.SUM	PROPANE	7.3606	556067.3	4502759	230.77	355.13	0	6112509	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Pyr.SUM	PYR	0.00146	556200	4501550	289.89	340.38	0	9040920	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	21	1	13756
AERMOD 19191	Acute HRA_5yrs_Sel.SUM	SEL	0.0001	556488.1	4501921	268.99	334.89	0	8022009	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	13	1	13756
AERMOD 19191	Acute HRA_5yrs_Sty.SUM	STY	0.74004	555571.1	4502346	235.81	347.91	0	7123002	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	11	1	13756
AERMOD 19191	Acute HRA_5yrs_Tol.SUM	TOL	1.53378	555571.1	4502346	235.81	347.91	0	7123002	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	33	1	13756
AERMOD 19191	Acute HRA_5yrs_VAN.SUM	VAN	0.00735	554950	4502800	339.65	341.68	0	9120224	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	12	1	13756
AERMOD 19191	Acute HRA_5yrs_Xy.SUM	XY	0.08373	556200	4501550	289.89	340.38	0	9040920	BEAVER_VALLEY_2006-2010_ADJUSTAR.SFC	18	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

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Initial Submittal January 2015
First Submittal Update February 2020
Second Submittal Update September 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. In the February 2020 HRA revision the location of the receptor with the maximum aggregate ELCR had shifted from southwest (January 2015) to northeast of the facility's fenceline due primarily to the 7-fold increase in the risk factor for hexavalent chromium and the proximity of the catalyst activation heaters. With this revision, the location of the ELCR remains unchanged from the February 2020 location. 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. In the February 2020 analysis, the location of the receptor with the maximum aggregate HI shifted from the southwest (January 2015) to north of the

[1] Email from A. Binder, PaDEP to P. May, RTP Environmental Assoc., January 12, 2015
[2] http://rais.ornl.gov

facility's fenceline due to a combination of changes to the model. The location of the receptor with the maximum aggregate HI is unchanged by this analysis. The facility HI at this receptor is 0.064, 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. Propane not a listed chemical in the RAIS database.

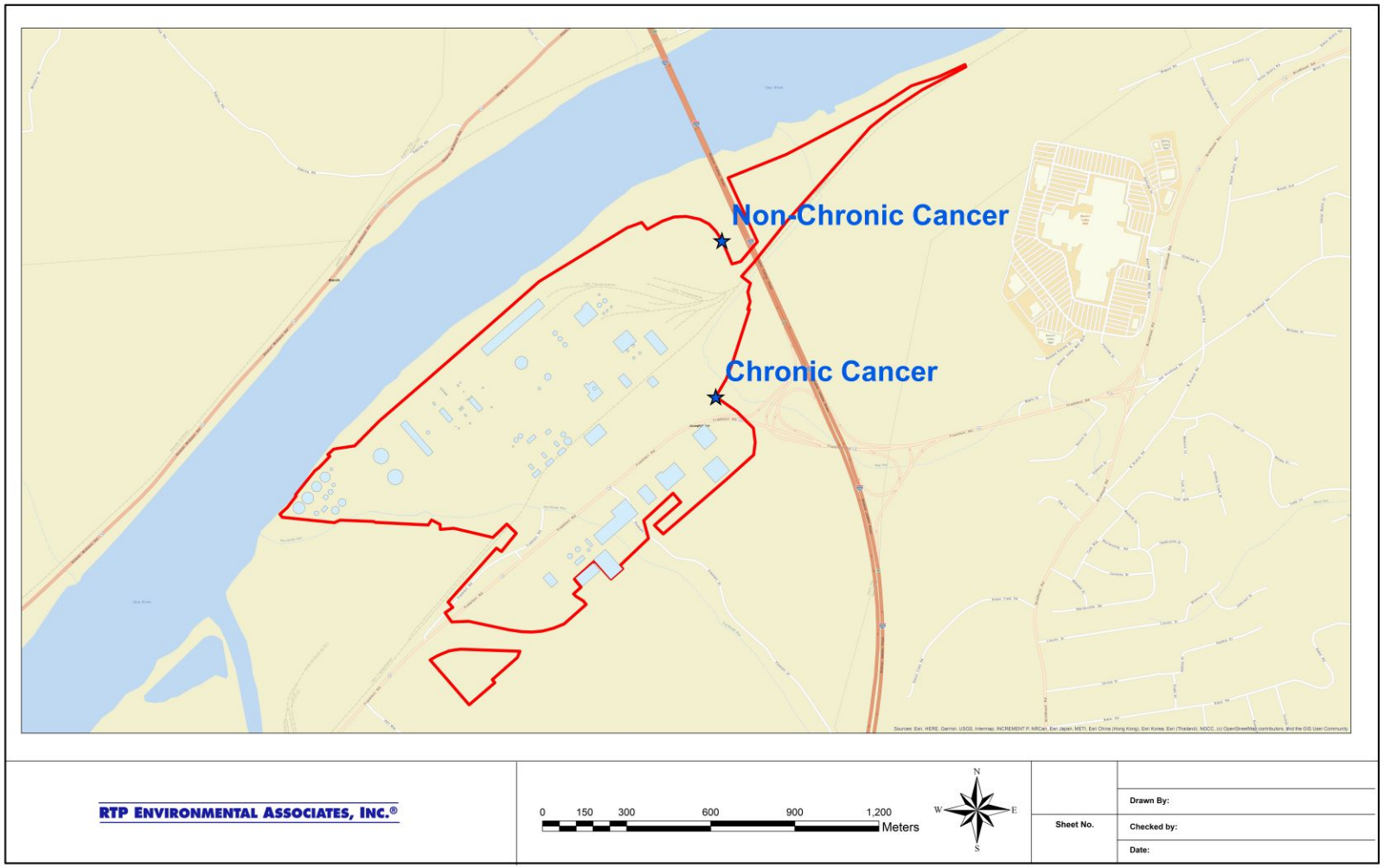

Figure 1. Location of Receptors with the Highest ELCR and Highest HI

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	4.9E-02
2-Methylnaphthalene		
3-Methylchloranthrene	4.1E-10	
7,12-Dimethylbenz(a)anthracene	4.1E-08	
Acenaphthene		
Acenaphthylene		
Acetaldehyde	2.6E-10	7.6E-06
Acrolein		1.7E-03
Anthracene		
Arsenic	3.1E-08	2.7E-04
Benzene	3.6E-07	1.8E-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		1.1E-05
Cadmium	7.1E-08	2.2E-03
Chromium[1]	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	0.0E+00	
Ethylbenzene	3.7E-09	9.9E-07
Ethylene Oxide	0.0E+00	0.0E+00
Fluoranthene		
Fluorene	0.0E+00	
Formaldehyde	4.7E-08	2.1E-04
Hexane		6.3E-04
Indeno(1,2,3-cd)pyrene	4.2E-12	
Manganese		1.5E-04
Mercury	0.0E+00	1.7E-05
Methanol		8.5E-07
Molybdenum		5.2E-05
Naphthalene	0.0E+00	
Nickel	1.8E-08	3.0E-03
PAH[2]	2.2E-07	
Phenanthrene		

Compound of Potential Concern	Excess Lifetime Cancer Risk	Chronic Non-cancer HQ
Phenol		1.2E-09
Propylene Oxide	5.0E-11	3.6E-07
Pyrene		
Selenium	0.0E+00	2.4E-08
Styrene		5.4E-06
Toluene	0.0E+00	2.7E-06
Xylenes		3.9E-06
Lead	2.1E-10	
Pentane	0.0E+00	4.9E-05
Propane	0.0E+00	
Barium	0.0E+00	1.7E-04
Copper	0.0E+00	
Molybdenum	0.0E+00	5.2E-05
Vanadium	0.0E+00	
Total Risk at Receptor with Highest Risk=	**7.6E-06**	**0.064**

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
"0" or " " Denotes no available risk factor

Table 3. Acute Non-Cancer Risk Assessment

Pollutant	Modeled 1-hr Impact	Modeled 1-hr Impact	Updated Acute Non-Cancer RfC[1]	HQ
	(µg/m^3)	(mg/m^3)	(mg/m^3)	
1,3-Butadiene	1.87E+00	1.87E-03	6.60E-01	2.84E-03
2-Methylnaphthalene	5.67E-03	5.67E-06		
3-Methylchloranthrene	0.00E+00	0.00E+00		
7,12-Dimethylbenz(a)anthracene	4.00E-05	4.00E-08		
Acenaphthene	1.61E-03	1.61E-06		
Acenaphthylene	3.17E-03	3.17E-06		
Acetaldehyde	1.44E+00	1.44E-03	4.70E-01	3.06E-03
Acrolein	8.80E-01	8.80E-04	6.88E-03	1.28E-01
Ammonia	2.58E+01	2.58E-02	1.18E+00	2.18E-02
Anthracene	5.00E-04	5.00E-07		
Arsenic	9.20E-04	9.20E-07	2.00E-04	4.60E-03
Barium	2.03E-02	2.03E-05		
Beryllium	3.00E-05	3.00E-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	3.62E-02	3.62E-05		
Benzene	1.59E+01	1.59E-02	2.88E-02	5.53E-01
Cadmium	5.09E-03	5.09E-06	3.00E-05	1.70E-01
Chrysene	5.30E-04	5.30E-07		
Cobalt	3.30E-04	3.30E-07		
Chromium[2]	7.42E-03	7.42E-06		
Copper	2.69E-03	2.69E-06	1.00E-01	2.69E-05
Dibenzo(a,h)anthracene	1.00E-04	1.00E-07		
Dichlorobenzene	5.56E-03	5.56E-06		
Ethylbenzene	1.30E-01	1.30E-04	2.17E+01	5.99E-06
Fluoranthene	1.76E-03	1.76E-06		
Fluorene	5.99E-03	5.99E-06		
Formaldehyde	9.05E+00	9.05E-03	4.91E-02	1.84E-01
Hexane	2.41E+01	2.41E-02		
Mercury	1.20E-03	1.20E-06	6.00E-04	2.00E-03
Indeno(1,2,3-cd)pyrene	1.00E-04	1.00E-07		
Methanol	2.23E+00	2.23E-03	2.80E+01	7.95E-05
Manganese	1.75E-03	1.75E-06		
Molybdenum	5.09E-03	5.09E-06		
Naphthalene	2.84E+00	2.84E-03		

Pollutant	Modeled 1-hr Impact	Modeled 1-hr Impact	Updated Acute Non-Cancer RfC[1]	HQ
	(µg/m^3)	(mg/m^3)	(mg/m^3)	
Nickel	9.68E-03	9.68E-06	2.00E-04	4.84E-02
PAH[3]	2.81E-02	2.81E-05	0.019	1.48E-03
Lead	2.31E-03	2.31E-06		
Pentane	1.20E+01	1.20E-02		
Phenol	4.10E-03	4.10E-06	5.80E+00	7.07E-07
Phenanthrene	1.40E-02	1.40E-05		
Propane	7.01E-03	7.01E-06	2.70E+02	2.60E-08
Pyrene	1.46E-03	1.46E-06		
Selenium	1.00E-04	1.00E-07		
Styrene	7.40E-01	7.40E-04	2.13E+01	3.48E-05
Toluene	1.53E+00	1.53E-03	7.60E+00	2.02E-04
Vanadium	7.35E-03	7.35E-06		
Xylenes	8.37E-02	8.37E-05	8.68E+00	9.64E-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
“ ” Denotes no available risk factor