

APPENDIX D-3A

EMISSION ESTIMATES FOR THE INHALATION RISK ASSESSMENT FOR SHELL POLYMERS MONACA BEAVER COUNTY, PENNSYLVANIA



September 2024 (Revised May 2025, September 2025, October 2025)

Emission Estimates for Shell Polymers Monaca (SPM) Inhalation Risk Assessment

1.0 General Discussion

A summary of the COPCs addressed in this analysis is presented in Table 1. Detailed emissions calculations are provided in Appendix B of the plan approval application.

A summary of the one-hour emission rate estimates used in the chronic exposure analysis are presented in Tables 2a and 2b, and a summary of the one-hour emission rates used in the acute exposure analysis are presented in Tables 3a and 3b. The following subsections provide background on the calculation methodologies used for certain types of emissions units included in this analysis. References to hazardous air pollutants (HAPs) are for plan approval purposes and should be considered synonymous with COPCs for this analysis.

1.1 Combustion Sources

COPC emission rates from the combustion sources at SPM (i.e., ethane cracking furnaces, combustion turbine/duct burner units, emergency engines, flares, and thermal oxidizers) are based on stack test data or the application of the appropriate AP-42 or other publicly available emission factors and the firing rate of the combustion source. Emissions from waste gas combustion by flares and thermal oxidizers are based on actual process data and engineering judgement. Refer to Appendix B of the plan approval application for detailed calculations.

1.2 Polyethylene Units

The COPCs emitted from the polyethylene manufacturing units are hexavalent chromium (CrVI) from the catalyst heaters and n-hexane from equipment leaks. CrVI 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

the catalyst. After passing through the catalyst heater, the air exhausts through a filter-controlled stack to the atmosphere. Catalyst particulate entrained in the hot exhaust contains trace amounts of CrVI.

1.3 Storage Tanks

Uncontrolled COPC emission rates from certain fixed roof atmospheric storage tanks are presented in Appendix B of the plan approval application. These emission rates are estimated using the methodology outlined in AP-42, Chapter 7, Section 1. No routine emissions, other than fugitive emissions from equipment components, are estimated from pressurized storage tanks (i.e., the C3+ storage spheres).¹ These tanks are sealed and pressurized so working and breathing losses do not occur. Emissions from storage tanks with vents routed to the thermal oxidizer headers are accounted for in the estimated emission rates from the Continuous Vent Thermal Oxidizer (CVTO) and Spent Caustic Thermal Oxidizer (SCTO).

1.4 Process Cooling Tower

COPC emissions from the Process Cooling Tower are estimated by speciating the potential volatile organic compound (VOC) emissions based on sampling data and engineering judgement. The VOC emissions are based on the Process Cooling Tower's VOC lowest achievable emission rate (LAER) limit and the tower's design cooling water circulation rate. The Process Cooling Tower VOC emission rate estimate is presented in Appendix B of the plan approval application.

1.5 Wastewater Treatment Plant

The Wastewater Treatment Plant's potential emissions calculation model was revised from WATER9 to Toxchem, which is a widely recognized calculation tool used for estimating emissions from wastewater collection, preliminary/primary/secondary treatment, and disposal facilities. Controlled emissions are accounted for in the

¹ In Tables 2 and 3 below, fugitive emissions from storage tanks are included in the "outside the boundary limits" (OSBL) fugitives.

emission rate estimates from the SCTO. The updated Wastewater Treatment Plant emission rate estimates are presented in Appendix B of the plan approval application.

1.6 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 (i.e., emission factors and leak detection and repair control efficiencies). To determine the emission rate for an individual COPC, process knowledge of the chemical composition of the lines is applied to the VOC emission rate. Refer to Appendix B of the plan approval application for detailed calculations.

Table 1. Identified Compounds of Potential Concern¹

Acenaphthene	Fluoranthene
Acenaphthylene	Fluorene
Acetaldehyde	Formaldehyde
Acrolein	Heptane
Ammonia	Hexane
Anthracene	Indeno(1,2,3-cd)pyrene
Arsenic	Lead
Barium	Manganese
Benzene	Methylcyclohexane
Benzo(a)anthracene	Methylene Chloride
Benzo(a)pyrene	Mercury
Benzo(b)fluoranthene	Methanol
Benzo(e)pyrene	2-Methylnaphthalene
Benzo(g,h,i)perylene	3-Methylcholanthrene
Benzo(k)fluoranthene	Molybdenum
Beryllium	Naphthalene
Biphenyl	Nickel
1,3-Butadiene	Nonane
Butane	Octane
Butyr/Isobutyraldehyde	Polycyclic Aromatic Hydrocarbons (PAH)
Cadmium	Pentane
Carbon Tetrachloride	Perchloroethylene
Chlorobenzene	Phenanthrene
Chloroethane	Phenol
Chloroform	Propane
Chromium III ²	Propylene
Chromium VI ²	Propylene Oxide
Chrysene	Pyrene
Cobalt	Selenium
Copper	Styrene
Cyclopentane	1,1,2,2-Tetrachloroethane
Dibenzo(a,h)anthracene	Toluene
Dibutylphthalate	1,1,2-Trichloroethane
Dichlorobenzene	1,2,3-Trimethylbenzene
1,1-Dichloroethane	1,2,4-Trimethylbenzene
1,2-Dichloroethane	1,3,5-Trimethylbenzene
1,2-Dichloropropane	2,2,4-Trimethylpentane
1,3-Dichloropropene	Vanadium
7,12-Dimethylbenz(a)anthracene	Vinyl Chloride
Ethane	Xylenes
Ethylbenzene	Zinc
Ethylene Dibromide	

¹ Compounds of Potential Concern were identified from EPA's Compilation of AP-42 Emission Factors and process knowledge.

² Chromium emissions from natural gas/process gas combustion were estimated to equal 96% chromium III and 4% chromium VI.

Table 2a. Annual Average COPC Emission Rates (lb/hr)

Source Description	Ethane Cracking Furnaces (per furnace)	Combustion Turbine/ Duct Burner Units (per unit)	Diesel-Fired and Natural Gas-Fired Emergency Generator Engines (total)	Fire Pump Engines (per engine)	Polyethylene Manufacturing Lines: PE1 and PE2 (per vent)	Polyethylene Manufacturing Lines: PE3 (per vent)	Process Cooling Tower (per cell)	CVTO	MPGF	TEGF A	TEGF B	HP Elevated Flare	SCTO	Liquid Loadout (Recovered Oil)	Liquid Loadout (C3+, Butene, Isopentane, Isobutane, C3 Ref)	Equipment Components: ECU ² (total)	Equipment Components: PE3	Equipment Components: OSBL ² (total)	Waste Water Treatment Plant
Source ID	031-037	101-103	105 and 107	106	202	202	203	C204A	C204B	C205A	C205B	C205C	C206	302	304	501	501	501	502
Model Source Type	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	EC#1-EC#7	CT1-CT3	GEN1-GEN4	FWP1 & FWP2	CAH1 & CAH2	CAA & CAB	COLTW1a/b-COLTW13a/b	INCIN	MPFLARE	GFLARE1	GFLARE2	HPFLARE	COI	ROTRUCK	C3RAIL	ECFUG1-ECFUG12	PE3FUG2	OSBLFUG1-OSBLFUG14	WWTP
Acenaphthene	5.94E-07	--	2.46E-08	5.54E-08	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	3.35E-05	1.96E-10	--	--	--	--	3.23E-05
Acenaphthylene	5.94E-07	--	9.23E-08	1.97E-07	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	2.56E-05	1.96E-10	--	--	--	--	1.64E-05
Acetaldehyde	--	2.00E-02	9.12E-05	2.99E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrolein	--	3.20E-03	6.57E-05	3.61E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia	2.39E+00	4.88E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	7.92E-07	--	2.54E-08	7.29E-08	--	--	--	4.26E-07	2.08E-07	3.31E-07	3.31E-07	3.31E-07	7.35E-06	3.42E-11	--	--	--	--	1.62E-05
Arsenic	6.60E-05	--	--	--	--	--	--	3.55E-05	1.73E-05	2.76E-05	2.76E-05	2.76E-05	2.17E-06	--	--	--	--	--	--
Barium	1.45E-03	--	--	--	--	--	--	7.81E-04	3.81E-04	6.06E-04	6.06E-04	6.06E-04	4.77E-05	--	--	--	--	--	--
Benzene	6.93E-04	1.12E-03	4.01E-05	3.64E-05	--	--	1.60E-03	3.03E-03	2.22E-03	7.80E-02	7.80E-02	7.80E-02	1.42E-02	1.37E-05	7.32E-05	1.37E-01	--	6.37E-02	8.41E-03
Benzo(a)anthracene	5.94E-07	--	2.28E-08	6.55E-08	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	1.95E-08	--	--	--	--	--	--
Benzo(a)pyrene	3.96E-07	--	2.55E-09	7.33E-09	--	--	--	2.13E-07	1.04E-07	1.65E-07	1.65E-07	1.65E-07	1.30E-08	--	--	--	--	--	--
Benzo(b)fluoranthene	5.94E-07	--	2.05E-09	3.86E-09	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	1.95E-08	--	--	--	--	--	--
Benzo(e)pyrene	--	--	1.77E-09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	3.96E-07	--	8.41E-09	1.91E-08	--	--	--	2.13E-07	1.04E-07	1.65E-07	1.65E-07	1.65E-07	1.30E-08	--	--	--	--	--	--
Benzo(k)fluoranthene	5.94E-07	--	2.11E-09	6.04E-09	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	1.95E-08	--	--	--	--	--	--
Beryllium	3.96E-06	--	--	--	--	--	--	2.13E-06	1.04E-06	1.65E-06	1.65E-06	1.65E-06	1.30E-07	--	--	--	--	--	--
Biphenyl	--	--	9.03E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.24E-08	--
1,3-Butadiene	--	2.15E-04	1.24E-05	1.52E-06	--	--	6.84E-03	2.77E-05	2.12E-05	4.50E-01	4.50E-01	4.50E-01	1.50E-03	2.82E-05	2.38E-04	7.15E-02	--	7.95E-02	--
Butane	6.93E-01	--	2.31E-06	--	--	--	--	1.91E+00	1.36E+00	6.97E-01	6.97E-01	6.97E-01	2.28E-02	--	--	1.34E-02	--	1.47E-02	--
Butyr/Isobutyraldehyde	--	--	1.22E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	3.63E-04	--	--	--	--	--	--	1.95E-04	9.54E-05	1.52E-04	1.52E-04	1.52E-04	1.19E-05	--	--	--	--	--	--
Carbon Tetrachloride	--	--	4.43E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	3.38E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	--	--	7.97E-09	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	--	--	3.43E-07	--	--	--	--	--	--	--	--	--	6.61E-07	--	--	--	--	--	3.33E-05
Chromium III	4.62E-04	--	--	--	4.10E-07	1.52E-05	--	2.48E-04	1.21E-04	1.93E-04	1.93E-04	1.93E-04	1.52E-05	--	--	--	--	--	--
Chromium VI	1.85E-05	--	--	--	4.10E-07	1.52E-05	--	9.94E-06	4.86E-06	7.72E-06	7.72E-06	7.72E-06	6.08E-07	--	--	--	--	--	--
Chrysene	5.95E-07	--	7.75E-09	1.38E-08	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	1.95E-08	--	--	--	--	--	--
Cobalt	2.77E-05	--	--	--	--	--	--	1.49E-05	7.28E-06	1.16E-05	1.16E-05	1.16E-05	9.11E-07	--	--	--	--	--	--
Copper	2.81E-04	--	--	--	--	--	--	1.51E-04	7.37E-05	1.17E-04	1.17E-04	1.17E-04	9.22E-06	--	--	--	--	--	--
Cyclopentane	--	--	9.67E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	3.96E-07	--	7.92E-09	2.27E-08	--	--	--	2.13E-07	1.04E-07	1.65E-07	1.65E-07	1.65E-07	1.30E-08	--	--	--	--	--	--
Dibutylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	9.70E-05	--	--	--	--	--	2.01E-07

Source Description	Ethane Cracking Furnaces (per furnace)	Combustion Turbine/ Duct Burner Units (per unit)	Diesel-Fired and Natural Gas-Fired Emergency Generator Engines (total)	Fire Pump Engines (per engine)	Polyethylene Manufacturing Lines: PE1 and PE2 (per vent)	Polyethylene Manufacturing Lines: PE3 (per vent)	Process Cooling Tower (per cell)	CVTO	MPGF	TEGF A	TEGF B	HP Elevated Flare	SCTO	Liquid Loadout (Recovered Oil)	Liquid Loadout (C3+, Butene, Isopentane, Isobutane, C3 Ref)	Equipment Components: ECU ² (total)	Equipment Components: PE3	Equipment Components: OSBL ² (total)	Waste Water Treatment Plant
Source ID	031-037	101-103	105 and 107	106	202	202	203	C204A	C204B	C205A	C205B	C205C	C206	302	304	501	501	501	502
Model Source Type	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	EC#1-EC#7	CT1-CT3	GEN1-GEN4	FWP1 & FWP2	CAH1 & CAH2	CAA & CAB	COLTW1a/b-COLTW13a/b	INCIN	MPFLARE	GFLARE1	GFLARE2	HPFLARE	COI	ROTRUCK	C3RAIL	ECFUG1-ECFUG12	PE3FUG2	OSBLFUG1-OSBLFUG14	WWTP
Dichlorobenzene	3.96E-04	--	--	--	--	--	--	2.13E-04	1.04E-04	1.65E-04	1.65E-04	1.65E-04	1.30E-05	--	--	--	--	--	--
1,1-Dichloroethane	--	--	2.83E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	2.83E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	3.25E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene	--	--	3.18E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	5.28E-06	--	--	--	--	--	--	2.84E-06	1.39E-06	2.21E-06	2.21E-06	2.21E-06	1.74E-07	--	--	--	--	--	--
Ethane	1.02E+00	--	1.59E-03	--	--	--	--	1.45E+00	6.74E+00	8.63E+00	8.63E+00	8.63E+00	3.36E-02	--	--	9.16E-01	--	4.82E-02	--
Ethylbenzene	--	1.60E-02	5.70E-07	--	--	--	4.15E-06	1.07E-04	8.25E-05	2.01E-04	2.01E-04	2.01E-04	8.11E-04	1.44E-07	--	5.59E-03	--	1.10E-03	1.35E-03
Ethylene Dibromide	--	--	5.33E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	9.90E-07	--	1.08E-07	2.97E-07	--	--	--	5.32E-07	2.60E-07	4.13E-07	4.13E-07	4.13E-07	1.15E-05	1.80E-13	--	--	--	--	2.77E-06
Fluorene	9.24E-07	--	4.21E-07	1.14E-06	--	--	--	4.97E-07	2.43E-07	3.86E-07	3.86E-07	3.86E-07	2.91E-05	2.39E-10	--	--	--	--	1.32E-05
Formaldehyde	2.48E-02	1.65E-01	5.73E-04	4.60E-05	--	--	--	1.33E-02	6.50E-03	1.03E-02	1.03E-02	1.03E-02	8.14E-04	--	--	--	--	--	--
Heptane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.74E-03	--	1.87E-04	--
Hexane	1.37E-01	--	4.73E-06	--	--	--	--	5.45E-03	2.74E-03	6.74E-02	6.74E-02	6.74E-02	3.15E-04	--	--	--	2.63E-03	4.94E-03	--
Indeno(1,2,3-cd)pyrene	5.94E-07	--	5.09E-09	1.46E-08	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	1.95E-08	--	--	--	--	--	--
Lead	1.65E-04	3.51E-04	--	--	--	--	--	8.87E-05	4.34E-05	6.89E-05	6.89E-05	6.89E-05	5.42E-06	--	--	--	--	--	--
Manganese	1.25E-04	--	--	--	--	--	--	6.74E-05	3.29E-05	5.24E-05	5.24E-05	5.24E-05	4.12E-06	--	--	--	--	--	--
Methylcyclohexane	--	--	5.24E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	7.52E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	8.58E-05	--	--	--	--	--	--	4.61E-05	2.25E-05	3.58E-05	3.58E-05	3.58E-05	2.82E-06	--	--	--	--	--	--
Methanol	--	--	6.01E-05	--	--	--	--	--	--	--	--	--	--	--	--	1.37E-01	--	4.08E-02	--
2-Methylnaphthalene	7.92E-06	--	1.41E-07	--	--	--	--	4.26E-06	2.08E-06	3.31E-06	3.31E-06	3.31E-06	2.60E-07	--	--	--	--	--	--
3-Methylcholanthrene	5.94E-07	--	--	--	--	--	--	3.19E-07	1.56E-07	2.48E-07	2.48E-07	2.48E-07	1.95E-08	--	--	--	--	--	--
Molybdenum	3.63E-04	--	--	--	--	--	--	1.95E-04	9.54E-05	1.52E-04	1.52E-04	1.52E-04	1.19E-05	--	--	--	--	--	--
Naphthalene	2.01E-04	6.50E-04	3.04E-06	3.31E-06	--	--	--	1.28E-04	6.79E-05	8.41E-05	8.41E-05	8.41E-05	9.77E-04	1.50E-08	--	1.67E-02	--	8.81E-03	2.10E-04
Nickel	6.93E-04	--	--	--	--	--	--	3.73E-04	1.82E-04	2.89E-04	2.89E-04	2.89E-04	2.28E-05	--	--	--	--	--	--
n-Nonane	--	--	4.69E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Octane	--	--	1.50E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH ¹	--	1.10E-03	4.68E-06	6.55E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentane	8.58E-01	--	1.11E-05	--	--	--	--	1.33E+00	1.77E+00	1.25E+00	1.25E+00	1.25E+00	2.82E-02	--	--	--	--	--	--
Perchloroethylene	--	--	1.06E-08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	5.61E-06	--	4.44E-07	1.15E-06	--	--	--	3.02E-06	1.47E-06	2.34E-06	2.34E-06	2.34E-06	3.72E-05	2.57E-12	--	--	--	--	8.45E-06
Phenol	--	--	1.02E-07	--	--	--	--	--	--	--	--	--	2.29E-04	6.15E-09	--	--	--	--	1.28E-07
Propane	5.28E-01	--	1.79E-04	--	--	--	--	2.84E-01	1.39E-01	9.04E-01	9.04E-01	9.04E-01	1.74E-02	--	--	2.86E-01	--	2.51E-01	--
Propylene	--	--	3.50E-05	1.01E-04	--	--	--	--	--	--	--	--	--	--	--	4.57E-02	--	5.52E-02	--

Source Description	Ethane Cracking Furnaces (per furnace)	Combustion Turbine/ Duct Burner Units (per unit)	Diesel-Fired and Natural Gas-Fired Emergency Generator Engines (total)	Fire Pump Engines (per engine)	Polyethylene Manufacturing Lines: PE1 and PE2 (per vent)	Polyethylene Manufacturing Lines: PE3 (per vent)	Process Cooling Tower (per cell)	CVTO	MPGF	TEGF A	TEGF B	HP Elevated Flare	SCTO	Liquid Loadout (Recovered Oil)	Liquid Loadout (C3+, Butene, Isopentane, Isobutane, C3 Ref)	Equipment Components: ECU ² (total)	Equipment Components: PE3	Equipment Components: OSBL ² (total)	Waste Water Treatment Plant
Source ID	031-037	101-103	105 and 107	106	202	202	203	C204A	C204B	C205A	C205B	C205C	C206	302	304	501	501	501	502
Model Source Type	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	EC#1-EC#7	CT1-CT3	GEN1-GEN4	FWP1 & FWP2	CAH1 & CAH2	CAA & CAB	COLTW1a/b-COLTW13a/b	INCIN	MPFLARE	GFLARE1	GFLARE2	HPFLARE	COI	ROTRUCK	C3RAIL	ECFUG1-ECFUG12	PE3FUG2	OSBLFUG1-OSBLFUG14	WWTP
Propylene Oxide	--	1.45E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	1.65E-06	--	7.07E-08	1.86E-07	--	--	--	8.87E-07	4.34E-07	6.89E-07	6.89E-07	6.89E-07	1.15E-05	4.51E-30	--	--	--	--	1.65E-06
Selenium	7.92E-06	--	--	--	--	--	--	4.26E-06	2.08E-06	3.31E-06	3.31E-06	3.31E-06	2.60E-07	--	--	--	--	--	--
Styrene	--	--	2.93E-07	--	--	--	--	6.29E-04	4.83E-04	--	--	--	1.32E-03	9.43E-07	--	6.63E-03	--	2.85E-03	2.53E-02
1,1,2,2-Tetrachloroethane	--	--	5.80E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	1.12E-03	1.75E-01	1.63E-05	1.59E-05	--	--	8.73E-05	1.75E-03	1.17E-03	4.71E-03	4.71E-03	4.71E-03	7.36E-03	4.21E-06	6.10E-06	9.04E-02	--	3.28E-02	2.58E-02
1,1,2-Trichloroethane	--	--	3.83E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trimethylbenzene	--	--	9.80E-08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	--	--	6.09E-08	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	--	--	1.44E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2,4-Trimethylpentane	--	--	1.07E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	7.59E-04	--	--	--	--	--	--	4.08E-04	1.99E-04	3.17E-04	3.17E-04	3.17E-04	2.50E-05	--	--	--	--	--	--
Vinyl Chloride	--	--	1.80E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes	--	3.20E-02	7.81E-06	1.11E-05	--	--	--	1.00E-04	7.67E-05	--	--	--	7.76E-04	1.35E-07	--	1.04E-02	--	2.98E-04	3.70E-03
Zinc	9.57E-03	--	--	--	--	--	--	5.15E-03	2.51E-03	4.00E-03	4.00E-03	4.00E-03	3.15E-04	--	--	--	--	--	--

¹AP-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.

² Emission rates for each ECU and OSBL fugitive source are presented in Table 2b.

Table 2b. ECU and OSBL Equipment Component Annual Average COPC Emission Rates (lb/hr)

Source Description	Ethane Cracking	Precooling and Drying/ Fuel Gas System	Wash Water System/ Analyzer House	Cracked Gas Compression	Caustic Scrubbing/ Spent Caustic Treatment/ Chemicals and Wash Oil	Process Steam System/ Gasoline Redistillation/ Slop and Sewer System	C2/C3 Separation	C2 Hydrogenation/ Methanol System	Low Temperature Section/ C1/C2 Separation/ Refrigerant System/ PSA Unit	Spent Caustic Treatment	Feed Preheating/ Blow Down System	Flare System	Wastewater Collection/ Wastewater Treatment	Cogen	Fire Pump Diesel	Butene, Hexene, Isopentane, and PE3 Heavies Storage	Railcar Loading	Pipeline Interconnect	C3+, Ethylene, Methanol, and PFO/LGO Storage	Pipe Rack Segment 1-7
Source ID	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501
Model Source Type	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	ECUFUG1	ECUFUG2	ECUFUG3	ECUFUG4	ECUFUG5	ECUFUG6	ECUFUG7	ECUFUG8	ECUFUG9	ECUFUG10	ECUFUG11	ECUFUG12	OSBLFUG1	OSBLFUG2	OSBLFUG3	OSBLFUG4	OSBLFUG5	OSBLFUG6	OSBLFUG7	OSBLFUG8-OSBLFUG14
1,3-Butadiene	2.51E-03	1.74E-03	4.56E-03	6.38E-03	2.82E-03	1.14E-03	4.80E-02	2.17E-04	2.07E-03	8.82E-05	2.00E-03	1.62E-05	--	--	--	--	2.24E-02	--	7.15E-03	5.00E-02
Benzene	3.67E-03	3.12E-03	2.07E-02	1.27E-02	2.95E-02	4.77E-02	1.45E-02	4.34E-06	5.35E-04	1.30E-03	2.15E-03	1.16E-03	9.06E-04	--	--	--	1.58E-02	--	5.88E-03	4.11E-02
Biphenyl	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.24E-08	--	--	--	--	--
Butane	1.21E-03	4.04E-04	4.00E-04	9.08E-04	3.20E-04	6.90E-05	6.53E-03	6.66E-05	2.80E-03	2.00E-04	2.48E-04	2.53E-04	1.24E-04	1.55E-03	--	--	3.05E-03	5.91E-05	1.25E-03	8.72E-03
Ethane	3.10E-01	3.30E-02	6.61E-02	1.21E-01	1.75E-02	2.61E-03	7.22E-02	4.91E-03	4.76E-02	2.41E-03	2.34E-01	3.67E-03	1.51E-03	1.50E-02	--	3.89E-03	9.71E-04	1.02E-02	2.08E-03	1.45E-02
Ethylbenzene	1.12E-04	8.80E-05	1.27E-03	7.71E-04	5.81E-04	1.93E-03	2.09E-04	7.81E-05	2.75E-04	9.65E-05	1.62E-04	1.83E-05	6.86E-06	--	1.26E-06	--	3.63E-04	--	9.10E-05	6.37E-04
Heptane	--	--	--	--	--	--	--	--	--	--	--	8.74E-03	--	--	--	--	--	--	2.34E-05	1.64E-04
Hexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.94E-03	--	--	--	--
Methanol	--	2.82E-04	1.07E-03	--	9.35E-02	--	7.82E-03	2.24E-02	7.37E-03	--	4.80E-03	--	--	--	--	--	--	--	5.09E-03	3.57E-02
Naphthalene	3.28E-04	8.64E-05	1.57E-03	3.02E-04	1.51E-03	1.26E-02	5.91E-06	--	--	8.82E-05	2.12E-04	2.31E-06	--	--	7.31E-08	--	3.96E-03	--	6.07E-04	4.25E-03
Propane	8.98E-03	1.32E-02	3.87E-04	9.38E-03	1.80E-04	9.80E-05	1.99E-02	4.31E-05	2.14E-01	6.57E-04	8.72E-03	1.06E-02	3.91E-04	5.65E-03	--	--	1.31E-02	4.19E-04	2.89E-02	2.02E-01
Propylene	2.11E-03	1.11E-03	2.32E-03	3.88E-03	1.03E-03	9.42E-05	3.33E-02	3.47E-05	6.28E-04	--	1.24E-03	1.18E-06	--	--	--	--	1.55E-02	2.04E-05	4.96E-03	3.47E-02
Styrene	1.61E-04	9.41E-05	1.26E-03	7.72E-05	4.79E-04	4.17E-03	5.91E-06	--	--	2.10E-04	1.60E-04	1.43E-05	6.86E-06	--	--	--	1.18E-03	--	2.08E-04	1.45E-03
Toluene	1.15E-03	1.30E-03	1.34E-02	7.82E-03	2.08E-02	3.69E-02	2.80E-03	8.11E-04	2.87E-03	3.65E-04	1.18E-03	9.28E-04	2.20E-04	--	1.34E-07	--	7.72E-03	--	3.11E-03	2.17E-02
Xylenes	8.53E-05	7.49E-05	1.08E-03	1.87E-03	2.00E-04	1.01E-03	2.16E-03	8.16E-04	2.87E-03	8.82E-05	1.73E-04	3.73E-06	--	--	--	--	1.13E-04	--	2.31E-05	1.61E-04

Table 3a. Maximum Hourly COPC Emission Rates (lb/hr)

Source Description	Ethane Cracking Furnaces (per furnace)	Combustion Turbine/ Duct Burner Units (per unit)	Diesel-Fired and Natural Gas-Fired Emergency Generator Engines (total)	Fire Pump Engines (per engine)	Polyethylene Manufacturing Lines: PE1 and PE2 (per vent)	Polyethylene Manufacturing Lines: PE3 (per vent)	Process Cooling Tower (per cell)	CVTO	MPGF	TEGF A	TEGF B	HP Elevated Flare	SCTO	Liquid Loadout (Recovered Oil)	Liquid Loadout (C3+, Butene, Isopentane, Isobutane, C3 Ref)	Equipment Components: ECU ² (total)	Equipment Components: PE3	Equipment Components: OSBL ² (total)	Waste Water Treatment Plant
Source ID	031-037	101-103	105 and 107	106	202	202	203	C204A	C204B	C205A	C205B	C205C	C206	302	304	501	501	501	502
Model Source Type	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	EC#1-EC#7	CT1-CT3	GEN1-GEN4	FWP1 & FWP2	CAH1 & CAH2	CAA & CAB	COLTW1a/b-COLTW13a/b	INCIN	MPFLARE	GFLARE1	GFLARE2	HPFLARE	COI	ROTRUCK	C3RAIL	ECFUG1-ECFUG12	PE3FUG2	OSBLFUG1-OSBLFUG14	WWTP
Acenaphthene	5.94E-07	--	2.16E-06	4.85E-06	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	3.35E-05	3.24E-08	--	--	--	--	3.23E-05
Acenaphthylene	5.94E-07	--	8.09E-06	1.73E-05	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	2.56E-05	3.24E-08	--	--	--	--	1.64E-05
Acetaldehyde	--	2.00E-02	7.99E-03	2.62E-03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrolein	--	3.20E-03	5.76E-03	3.16E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ammonia	2.39E+00	4.88E+00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Anthracene	7.92E-07	--	2.23E-06	6.39E-06	--	--	--	4.68E-07	9.20E-07	9.18E-06	9.18E-06	9.18E-06	7.35E-06	5.66E-09	--	--	--	--	1.62E-05
Arsenic	6.60E-05	--	--	--	--	--	--	3.90E-05	7.67E-05	7.65E-04	7.65E-04	7.65E-04	2.17E-06	--	--	--	--	--	--
Barium	1.45E-03	--	--	--	--	--	--	8.59E-04	1.69E-03	1.68E-02	1.68E-02	1.68E-02	4.77E-05	--	--	--	--	--	--
Benzene	6.93E-04	1.12E-03	3.51E-03	3.19E-03	--	--	1.60E-03	3.07E-03	5.40E-02	3.68E+00	3.68E+00	3.68E+00	1.42E-02	2.27E-03	7.32E-05	1.37E-01	--	6.37E-02	8.41E-03
Benzo(a)anthracene	5.94E-07	--	2.00E-06	5.74E-06	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	1.95E-08	--	--	--	--	--	--
Benzo(a)pyrene	3.96E-07	--	2.24E-07	6.42E-07	--	--	--	2.34E-07	4.60E-07	4.59E-06	4.59E-06	4.59E-06	1.30E-08	--	--	--	--	--	--
Benzo(b)fluoranthene	5.94E-07	--	1.80E-07	3.39E-07	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	1.95E-08	--	--	--	--	--	--
Benzo(e)pyrene	--	--	1.55E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	3.96E-07	--	7.36E-07	1.67E-06	--	--	--	2.34E-07	4.60E-07	4.59E-06	4.59E-06	4.59E-06	1.30E-08	--	--	--	--	--	--
Benzo(k)fluoranthene	5.94E-07	--	1.84E-07	5.29E-07	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	1.95E-08	--	--	--	--	--	--
Beryllium	3.96E-06	--	--	--	--	--	--	2.34E-06	4.60E-06	4.59E-05	4.59E-05	4.59E-05	1.30E-07	--	--	--	--	--	--
Biphenyl	--	--	7.91E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.24E-08	--
1,3-Butadiene	--	2.15E-04	1.09E-03	1.34E-04	--	--	6.84E-03	2.77E-05	5.53E-04	2.05E+01	2.05E+01	2.05E+01	1.50E-03	4.66E-03	2.38E-04	7.15E-02	--	7.95E-02	--
Butane	6.93E-01	--	2.02E-04	--	--	--	--	1.95E+00	3.16E+01	1.71E+02	1.71E+02	1.71E+02	2.28E-02	--	--	1.34E-02	--	1.47E-02	--
Butyr/Isobutyraldehyde	--	--	1.07E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	3.63E-04	--	--	--	--	--	--	2.15E-04	4.22E-04	4.21E-03	4.21E-03	4.21E-03	1.19E-05	--	--	--	--	--	--
Carbon Tetrachloride	--	--	3.88E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	2.96E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	--	--	6.98E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	--	--	3.00E-05	--	--	--	--	--	--	--	--	--	6.61E-07	--	--	--	--	--	3.33E-05
Chromium III	4.62E-04	--	--	--	5.25E-05	5.26E-05	--	2.73E-04	5.37E-04	5.35E-03	5.35E-03	5.35E-03	1.52E-05	--	--	--	--	--	--
Chromium VI	1.85E-05	--	--	--	5.25E-05	5.26E-05	--	1.09E-05	2.15E-05	2.14E-04	2.14E-04	2.14E-04	6.08E-07	--	--	--	--	--	--
Chrysene	5.95E-07	--	6.79E-07	1.21E-06	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	1.95E-08	--	--	--	--	--	--
Cobalt	2.77E-05	--	--	--	--	--	--	1.64E-05	3.22E-05	3.21E-04	3.21E-04	3.21E-04	9.11E-07	--	--	--	--	--	--
Copper	2.81E-04	--	--	--	--	--	--	1.66E-04	3.26E-04	3.25E-03	3.25E-03	3.25E-03	9.22E-06	--	--	--	--	--	--
Cyclopentane	--	--	8.47E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	3.96E-07	--	6.94E-07	1.99E-06	--	--	--	2.34E-07	4.60E-07	4.59E-06	4.59E-06	4.59E-06	1.30E-08	--	--	--	--	--	--
Dibutylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	9.70E-05	--	--	--	--	--	2.01E-07

Source Description	Ethane Cracking Furnaces (per furnace)	Combustion Turbine/ Duct Burner Units (per unit)	Diesel-Fired and Natural Gas-Fired Emergency Generator Engines (total)	Fire Pump Engines (per engine)	Polyethylene Manufacturing Lines: PE1 and PE2 (per vent)	Polyethylene Manufacturing Lines: PE3 (per vent)	Process Cooling Tower (per cell)	CVTO	MPGF	TEGF A	TEGF B	HP Elevated Flare	SCTO	Liquid Loadout (Recovered Oil)	Liquid Loadout (C3+, Butene, Isobutane, C3 Ref)	Equipment Components: ECU ² (total)	Equipment Components: PE3	Equipment Components: OSBL ² (total)	Waste Water Treatment Plant
Source ID	031-037	101-103	105 and 107	106	202	202	203	C204A	C204B	C205A	C205B	C205C	C206	302	304	501	501	501	502
Model Source Type	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	EC#1-EC#7	CT1-CT3	GEN1-GEN4	FWP1 & FWP2	CAH1 & CAH2	CAA & CAB	COLTW1a/b-COLTW13a/b	INCIN	MPFLARE	GFLARE1	GFLARE2	HPFLARE	COI	ROTRUCK	C3RAIL	ECFUG1-ECFUG12	PE3FUG2	OSBLFUG1-OSBLFUG14	WWTP
Dichlorobenzene	3.96E-04	--	--	--	--	--	--	2.34E-04	4.60E-04	4.59E-03	4.59E-03	4.59E-03	1.30E-05	--	--	--	--	--	--
1,1-Dichloroethane	--	--	2.48E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	2.48E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	2.85E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichloropropene	--	--	2.78E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7,12-Dimethylbenz(a)anthracene	5.28E-06	--	--	--	--	--	--	3.12E-06	6.14E-06	6.12E-05	6.12E-05	6.12E-05	1.74E-07	--	--	--	--	--	--
Ethane	1.02E+00	--	1.39E-01	--	--	--	--	1.50E+00	2.50E+01	1.01E+03	1.01E+03	1.01E+03	3.36E-02	--	--	9.16E-01	--	4.82E-02	--
Ethylbenzene	--	1.60E-02	5.00E-05	--	--	--	4.15E-06	1.07E-04	2.15E-03	1.91E-02	1.91E-02	1.91E-02	8.11E-04	2.39E-05	--	5.59E-03	--	1.10E-03	1.35E-03
Ethylene Dibromide	--	--	4.67E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	9.90E-07	--	9.47E-06	2.60E-05	--	--	--	5.86E-07	1.15E-06	1.15E-05	1.15E-05	1.15E-05	1.15E-05	2.97E-11	--	--	--	--	2.77E-06
Fluorene	9.24E-07	--	3.69E-05	9.97E-05	--	--	--	5.47E-07	1.07E-06	1.07E-05	1.07E-05	1.07E-05	2.91E-05	3.95E-08	--	--	--	--	1.32E-05
Formaldehyde	2.48E-02	1.65E-01	5.02E-02	4.03E-03	--	--	--	1.46E-02	2.88E-02	2.87E-01	2.87E-01	2.87E-01	8.14E-04	--	--	--	--	--	--
Heptane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8.74E-03	--	1.87E-04	--
Hexane	1.37E-01	--	4.14E-04	--	--	--	--	5.96E-03	1.71E-02	8.46E-01	8.46E-01	8.46E-01	3.15E-04	--	--	--	2.63E-03	4.94E-03	--
Indeno(1,2,3-cd)pyrene	5.94E-07	--	4.46E-07	1.28E-06	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	1.95E-08	--	--	--	--	--	--
Lead	1.65E-04	3.51E-04	--	--	--	--	--	9.76E-05	1.92E-04	1.91E-03	1.91E-03	1.91E-03	5.42E-06	--	--	--	--	--	--
Manganese	1.25E-04	--	--	--	--	--	--	7.42E-05	1.46E-04	1.45E-03	1.45E-03	1.45E-03	4.12E-06	--	--	--	--	--	--
Methylcyclohexane	--	--	4.59E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	6.58E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	8.58E-05	--	--	--	--	--	--	5.08E-05	9.97E-05	9.94E-04	9.94E-04	9.94E-04	2.82E-06	--	--	--	--	--	--
Methanol	--	--	5.27E-03	--	--	--	--	--	--	--	--	--	--	--	--	1.37E-01	--	4.08E-02	--
2-Methylnaphthalene	7.92E-06	--	1.24E-05	--	--	--	--	4.68E-06	9.20E-06	9.18E-05	9.18E-05	9.18E-05	2.60E-07	--	--	--	--	--	--
3-Methylcholanthrene	5.94E-07	--	--	--	--	--	--	3.51E-07	6.90E-07	6.88E-06	6.88E-06	6.88E-06	1.95E-08	--	--	--	--	--	--
Molybdenum	3.63E-04	--	--	--	--	--	--	2.15E-04	4.22E-04	4.21E-03	4.21E-03	4.21E-03	1.19E-05	--	--	--	--	--	--
Naphthalene	2.01E-04	6.50E-04	2.66E-04	2.90E-04	--	--	--	1.39E-04	6.24E-04	2.33E-03	2.33E-03	2.33E-03	9.77E-04	2.47E-06	--	1.67E-02	--	8.81E-03	2.10E-04
Nickel	6.93E-04	--	--	--	--	--	--	4.10E-04	8.05E-04	8.03E-03	8.03E-03	8.03E-03	2.28E-05	--	--	--	--	--	--
n-Nonane	--	--	4.11E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Octane	--	--	1.31E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PAH ¹	--	1.10E-03	4.10E-04	5.74E-04	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentane	8.58E-01	--	9.71E-04	--	--	--	--	1.38E+00	1.80E+02	3.24E+02	3.24E+02	3.24E+02	2.82E-02	--	--	--	--	--	--
Perchloroethylene	--	--	9.26E-07	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	5.61E-06	--	3.89E-05	1.00E-04	--	--	--	3.32E-06	6.52E-06	6.50E-05	6.50E-05	6.50E-05	3.72E-05	4.25E-10	--	--	--	--	8.45E-06
Phenol	--	--	8.96E-06	--	--	--	--	--	--	--	--	--	2.29E-04	1.02E-06	--	--	--	--	1.28E-07
Propane	5.28E-01	--	1.56E-02	--	--	--	--	3.12E-01	6.14E-01	1.52E+02	1.52E+02	1.52E+02	1.74E-02	--	--	2.86E-01	--	2.51E-01	--
Propylene	--	--	3.07E-03	8.81E-03	--	--	--	--	--	--	--	--	--	--	--	4.57E-02	--	5.52E-02	--

Source Description	Ethane Cracking Furnaces (per furnace)	Combustion Turbine/ Duct Burner Units (per unit)	Diesel-Fired and Natural Gas-Fired Emergency Generator Engines (total)	Fire Pump Engines (per engine)	Polyethylene Manufacturing Lines: PE1 and PE2 (per vent)	Polyethylene Manufacturing Lines: PE3 (per vent)	Process Cooling Tower (per cell)	CVTO	MPGF	TEGF A	TEGF B	HP Elevated Flare	SCTO	Liquid Loadout (Recovered Oil)	Liquid Loadout (C3+, Butene, Isopentane, Isobutane, C3 Ref)	Equipment Components: ECU ² (total)	Equipment Components: PE3	Equipment Components: OSBL ² (total)	Waste Water Treatment Plant
Source ID	031-037	101-103	105 and 107	106	202	202	203	C204A	C204B	C205A	C205B	C205C	C206	302	304	501	501	501	502
Model Source Type	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Point	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	EC#1-EC#7	CT1-CT3	GEN1-GEN4	FWP1 & FWP2	CAH1 & CAH2	CAA & CAB	COLTW1a/b- COLTW13a/b	INCIN	MPFLARE	GFLARE1	GFLARE2	HPFLARE	COI	ROTRUCK	C3RAIL	ECFUG1- ECFUG12	PE3FUG2	OSBLFUG1- OSBLFUG14	WWTP
Propylene Oxide	--	1.45E-02	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	1.65E-06	--	6.20E-06	1.63E-05	--	--	--	9.76E-07	1.92E-06	1.91E-05	1.91E-05	1.91E-05	1.15E-05	7.46E-28	--	--	--	--	1.65E-06
Selenium	7.92E-06	--	--	--	--	--	--	4.68E-06	9.20E-06	9.18E-05	9.18E-05	9.18E-05	2.60E-07	--	--	--	--	--	--
Styrene	--	--	2.57E-05	--	--	--	--	6.29E-04	1.26E-02	--	--	--	1.32E-03	1.56E-04	--	6.63E-03	--	2.85E-03	2.53E-02
1,1,2,2-Tetrachloroethane	--	--	5.08E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	1.12E-03	1.75E-01	1.43E-03	1.40E-03	--	--	8.73E-05	1.81E-03	2.42E-02	4.15E-01	4.15E-01	4.15E-01	7.36E-03	6.96E-04	6.10E-06	9.04E-02	--	3.28E-02	2.58E-02
1,1,2-Trichloroethane	--	--	3.35E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trimethylbenzene	--	--	8.59E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	--	--	5.34E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	--	--	1.26E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,2,4-Trimethylpentane	--	--	9.33E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	7.59E-04	--	--	--	--	--	--	4.49E-04	8.82E-04	8.80E-03	8.80E-03	8.79E-03	2.50E-05	--	--	--	--	--	--
Vinyl Chloride	--	--	1.57E-05	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes	--	3.20E-02	6.84E-04	9.74E-04	--	--	--	1.00E-04	2.00E-03	--	--	--	7.76E-04	2.23E-05	--	1.04E-02	--	2.98E-04	3.70E-03
Zinc	9.57E-03	--	--	--	--	--	--	5.66E-03	1.11E-02	1.11E-01	1.11E-01	1.11E-01	3.15E-04	--	--	--	--	--	--

¹ 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.

² Emission rates for each ECU and OSBL fugitive source are presented in Table 3b.

Table 3b. ECU and OSBL Equipment Component Maximum Hourly COPC Emission Rates (lb/hr)

Source Description	Ethane Cracking	Precooling and Drying/ Fuel Gas System	Wash Water System/ Analyzer House	Cracked Gas Compression	Caustic Scrubbing/ Spent Caustic Treatment/ Chemicals and Wash Oil	Process Steam System/ Gasoline Redistillation/ Slop and Sewer System	C2/C3 Separation	C2 Hydrogenation/ Methanol System	Low Temperature Section/ C1/C2 Separation/ Refrigerant System/ PSA Unit	Spent Caustic Treatment	Feed Preheating/ Blow Down System	Flare System	Wastewater Collection/ Wastewater Treatment	Cogen	Fire Pump Diesel	Butene, Hexene, Isopentane, Isobutane, and PE3 Heavies Storage	Railcar Loading	Pipeline Interconnect	C3+, Ethylene, Methanol, and PFO/LGO Storage	Pipe Rack Segment 1-7
Source ID	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501	501
Model Source Type	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume	Volume
AERMOD ID	ECUFUG1	ECUFUG2	ECUFUG3	ECUFUG4	ECUFUG5	ECUFUG6	ECUFUG7	ECUFUG8	ECUFUG9	ECUFUG10	ECUFUG11	ECUFUG12	OSBLFUG1	OSBLFUG2	OSBLFUG3	OSBLFUG4	OSBLFUG5	OSBLFUG6	OSBLFUG7	OSBLFUG8-OSBLFUG14
1,3-Butadiene	2.51E-03	1.74E-03	4.56E-03	6.38E-03	2.82E-03	1.14E-03	4.80E-02	2.17E-04	2.07E-03	8.82E-05	2.00E-03	1.62E-05	--	--	--	--	2.24E-02	--	7.15E-03	5.00E-02
Benzene	3.67E-03	3.12E-03	2.07E-02	1.27E-02	2.95E-02	4.77E-02	1.45E-02	4.34E-06	5.35E-04	1.30E-03	2.15E-03	1.16E-03	9.06E-04	--	--	--	1.58E-02	--	5.88E-03	4.11E-02
Biphenyl	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.24E-08	--	--	--	--	--
Butane	1.21E-03	4.04E-04	4.00E-04	9.08E-04	3.20E-04	6.90E-05	6.53E-03	6.66E-05	2.80E-03	2.00E-04	2.48E-04	2.53E-04	1.24E-04	1.55E-03	--	--	3.05E-03	5.91E-05	1.25E-03	8.72E-03
Ethane	3.10E-01	3.30E-02	6.61E-02	1.21E-01	1.75E-02	2.61E-03	7.22E-02	4.91E-03	4.76E-02	2.41E-03	2.34E-01	3.67E-03	1.51E-03	1.50E-02	--	3.89E-03	9.71E-04	1.02E-02	2.08E-03	1.45E-02
Ethylbenzene	1.12E-04	8.80E-05	1.27E-03	7.71E-04	5.81E-04	1.93E-03	2.09E-04	7.81E-05	2.75E-04	9.65E-05	1.62E-04	1.83E-05	6.86E-06	--	1.26E-06	--	3.63E-04	--	9.10E-05	6.37E-04
Heptane	--	--	--	--	--	--	--	--	--	--	--	8.74E-03	--	--	--	--	--	--	2.34E-05	1.64E-04
Hexane	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.94E-03	--	--	--	--
Methanol	--	2.82E-04	1.07E-03	--	9.35E-02	--	7.82E-03	2.24E-02	7.37E-03	--	4.80E-03	--	--	--	--	--	--	--	5.09E-03	3.57E-02
Naphthalene	3.28E-04	8.64E-05	1.57E-03	3.02E-04	1.51E-03	1.26E-02	5.91E-06	--	--	8.82E-05	2.12E-04	2.31E-06	--	--	7.31E-08	--	3.96E-03	--	6.07E-04	4.25E-03
Propane	8.98E-03	1.32E-02	3.87E-04	9.38E-03	1.80E-04	9.80E-05	1.99E-02	4.31E-05	2.14E-01	6.57E-04	8.72E-03	1.06E-02	3.91E-04	5.65E-03	--	--	1.31E-02	4.19E-04	2.89E-02	2.02E-01
Propylene	2.11E-03	1.11E-03	2.32E-03	3.88E-03	1.03E-03	9.42E-05	3.33E-02	3.47E-05	6.28E-04	--	1.24E-03	1.18E-06	--	--	--	--	1.55E-02	2.04E-05	4.96E-03	3.47E-02
Styrene	1.61E-04	9.41E-05	1.26E-03	7.72E-05	4.79E-04	4.17E-03	5.91E-06	--	--	2.10E-04	1.60E-04	1.43E-05	6.86E-06	--	--	--	1.18E-03	--	2.08E-04	1.45E-03
Toluene	1.15E-03	1.30E-03	1.34E-02	7.82E-03	2.08E-02	3.69E-02	2.80E-03	8.11E-04	2.87E-03	3.65E-04	1.18E-03	9.28E-04	2.20E-04	--	1.34E-07	--	7.72E-03	--	3.11E-03	2.17E-02
Xylenes	8.53E-05	7.49E-05	1.08E-03	1.87E-03	2.00E-04	1.01E-03	2.16E-03	8.16E-04	2.87E-03	8.82E-05	1.73E-04	3.73E-06	--	--	--	--	1.13E-04	--	2.31E-05	1.61E-04