

US EPA ARCHIVE DOCUMENT

Table A-3 GHG Emission Calculations

Enterprise Operating Products LLC
 Mont Belvieu Complex - PDH Unit
 Process Flare

EPN	FIN	Description	Fuel	Firing Rate (mmBtu/yr)	Firing Rate (scf/yr)	Carbon Content (CC)	MW (lb/lbmol)	Emission Rates (tpy) ¹				
								CO ₂	CH ₄	N ₂ O	CO ₂ e	
SK25.801	SK25.801	Process Flare, Routine										
		Pilots	Natural Gas	9,011	8,760,000	0.723	17.46	534	0.0099	0.0010	534	
		Purge	Natural Gas	16,399	15,943,200	0.723	17.46	972	0.0181	0.0018	973	
		Routine Steams Str	Vent Gas	3,354	7,545,545	0.835	43.09	1,312	0.0111	0.0022	1,313	
		Routine Total						2,818	0.04	0.005	2,821	
		Process Flare, MSS										
		Misc. MSS	Vent Gas	2,061	8,613,636	0.835	43.09	1,498	0.0068	0.0014	1,499	
		Startup MSS	Vent Gas	46,006	45,913,143	0.735	17.96	2,928	0.1521	0.0304	2,941	
		Shutdown MSS	Vent Gas	6,944	8,613,636	0.832	43.29	1,498	0.0230	0.0046	1,500	
		MSS Total						4,426	0.16	0.03	4,439	

part of not related to SIS
COLO SW

¹ Note all emission rates are in units of short tons. Eq. C-5 in 40 CFR Part 98 Chapter C yields emissions in metric tons. Metric tons were converted to short tons by multiplying by 1.102311 short tons per metric ton.

Carbon Factor Calculations:

Component	Molecular Weight (lb/lb-mol)	Number of Carbons per mole	Composition (mole %)			
			Natural Gas	Startup Flaring	MSS Flaring	Shutdown Flaring
Nitrogen	28.013	0	0.683	0.000	0.000	0.000
Carbon Dioxide	44.010	1	1.797	2.000	0.000	0.000
Carbon Monoxide	28.010	1	0.035	0.000	0.000	0.000
Helium	4.003	0	0.000	0.000	0.000	0.000
Argon	39.95	0	0.000	0.000	0.000	0.000
Hydrogen	2.02	0	0.000	0.000	0.000	0.000
Methane	16.04	1	93.361	93.000	0.000	0.000
Ethane	30.07	2	3.043	0.000	0.000	0.000
Propane	44.10	3	0.557	3.000	50.000	60.000
Iso-Butane	58.12	4	0.191	0.000	0.000	0.000
n-Butane	58.12	4	0.143	0.000	0.000	0.000
Iso-Pentane	72.15	5	0.039	0.000	0.000	0.000
n-Pentane	72.15	5	0.027	0.000	0.000	0.000
n-Hexane	86.18	6	0.088	0.000	0.000	0.000
n-Heptane	100.20	7	0.000	0.000	0.000	0.000
C10+	140.00	10	0.000	0.000	0.000	0.000
Ethylene	28.05	2	0.000	0.000	0.000	0.000
Propylene	42.08	3	0.000	2.000	50.000	40.000
neo-Pentane	72.15	5	0.000	0.000	0.000	0.000
Acetylene	26.04	2	0.000	0.000	0.000	0.000
Hydrogen Sulfide	34.00	0	0.000	0.000	0.000	0.000
Oxygen	32.00	0	0.037	0.000	0.000	0.000
Water	18.02	0	0.000	0.000	0.000	0.000
MW (lb/lbmole):			17.46	17.96	43.09	43.29
Carbon Content (kg C/kg Fuel):			0.723	0.735	0.835	0.832
Heating Value (btu/scf, HHV):			1028.6	1028.6	311.0	927.6
CO ₂ emission factor (lb/mmBtu, HHV):			118.55			

Routine streams
CO₂ emissions
Analysis purges
compressor purges
constant streams
mostly CH₄ (MSS)
to suppress O₂ levels below LEL w/min tur share holder.

Emission Factors:

Eq. C-5 from 40 CFR Part 98 Chapter C

$$CO_2 = \frac{44}{12} \cdot Fuel \cdot CC = \frac{MW}{MFC} \cdot 0.001 \quad (\text{Eq. C-5})$$

CO₂ = CO₂ emissions, metric tons/yr
 Fuel = firing rate in mmBtu/yr
 MVC = 836.6 (per Part 98)
 CC = as calculated above
 MW = as calculated above

CH₄ and N₂O Emission factors from Table C-2 of Appendix A to 40 CFR Part 98 Chapter C

	kg CH ₄ /mmBtu	kg N ₂ O/mmBtu
Natural Gas	0.001	0.0001
Process Gas	0.003	0.0006

kg to lb conversion factor: 2.20462

CO₂e Equivalents:

CO ₂	1.0
CH ₄	21.0
N ₂ O	310.0

Rd Bergman to Rms via phone 1/2/2014

FOR THE FLARE

Misc streams represent:
 • compressor seal purges
 • Analyzer purges
 • Purge seal purges
 • constant streams

MSS

cold start / start down / misc

values used are provided by contracter, since Rellogg