LAUREL MOUNTAIN MIDSTREAM, LLC
Springhill Compressor Station
General Permit BAQ-GPA/GP-5 Permit Application

Startup, Shutdown and Maintenance (SSM) Emissions

SSM PTE Calculations

Unit	No of Compressors	Total Engine bhp	SSM Events/yr	Starting Gas scf/SSM	Blowdown Gas scf/SSM	Total Gas Vented MMscf/yr	CH4 Emissions 42,200 lb/MMscf		VOC Emissions 1,000 lb/MMscf	HAP Emissions 150 lb/MMscf
							lb/hr	tpy	tpy	tpy
Facility Wide SSM	3	4,180	365	1,400	25,980	9.99	1,155	210.86	5.00	0.75

Notes:

1 - SSM Emissions are the sum of unburned fuel resulting from "cold-start" of idle gas-fired engines plus the gas that is purged (blowdown) from the compressor and associated piping and equipment.

2 - Starting Gas Qty and Blowdown Gas Qty as per Engineering Department.

(e.g., 8577 scf/B-D of a compressor with a 1380 bhp engine equals 6.215 scf/bhp/B-D.)

Starting Gas is Constant at: **700.00** scf/start

Blowdown Gas is Related to bhp at: **6.215** scf/hp/B-D

3 - To be conservative, the following gas characteristics were assumed:

	Analysis	Estimated
CH4	40,894.8 lb/MMscf	42,200 lb/MMscf
VOC	480.3 lb/MMscf	1,000 lb/MMscf
HAP	10.3 lb/MMscf	150 lb/MMscf

4 - Conservatively assumed: **7** Blowdowns/compressor/week.

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Dehydrator Emissions

Glycol Dehydrator PTE Calculations

Unit	Description	Capacity		Emission Factor Source	Pollutant	Emission Factor lb/MMscf	Emission Factor lb/MMBtu	Uncontrolled Emissions		Control Efficiency
								lb/hr	tpy	%
Dehydrator 1	Regenerator Vent	Dry Gas Flow Rate	25 MMscfd	GRI-GLYCalc	VOC	na	na	2.12	9.30	0.0%
				GRI-GLYCalc	HAP	na	na	0.27	1.18	0.0%
				GRI-GLYCalc	CH4	na	na	91.32	400.00	0.0%
	Reboiler	Heat Input	0.25	EPA AP-42 Table 1.4-1	NOX	100.00	0.0980	0.02	0.11	0.0%
		MMBtu/hr		EPA AP-42 Table 1.4-1	CO	84.00	0.0824	0.02	0.09	0.0%
				EPA AP-42 Table 1.4-2	VOC	5.50	0.0054	0.00	0.01	0.0%
				EPA AP-42 Table 1.4-2	HAP	1.88	0.0018	0.00	0.00	0.0%

Notes: 1 - Used GRI-GLYCalc V4.0 to calculate Regenerator Vent Emissions.

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Fugitive Emissions

Fugitive PTE Calculations (Gas/Vapor)

Unit	Description	Component (Unit) Type	Unit Count	THC Em. Factor lb/Unit/hr	THC Emissions lb/hr	CH4 Emissions 100.00% THC Wgt lb/hr	CH4 Emissions 100.00% THC Wgt tpy	VOC Emissions 2.00% THC Wgt lb/hr	VOC Emissions 2.00% THC Wgt tpy	HAP Emissions 0.50% THC Wgt lb/hr	HAP Emissions 0.50% THC Wgt tpy
Process Fugitives	Process Piping Fugitives	Connectors	1,474	0.0004	0.65	0.65	2.85	0.01	0.06	0.00	0.01
		Flanges	240	0.0009	0.21	0.21	0.90	0.00	0.02	0.00	0.00
		Open-ended lines	28	0.0044	0.12	0.12	0.54	0.00	0.01	0.00	0.00
		Pump Seals	0	0.0053	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Valves	514	0.0099	5.10	5.10	22.34	0.10	0.45	0.03	0.11
		Other	60	0.0194	1.16	1.16	5.10	0.02	0.10	0.01	0.03
		TOTALS:				7.24	31.72	0.14	0.63	0.04	0.16

Notes:

1 - Assumed 8,760 hours per year of fugitive emissions.

2 - Gas/Vapor emissions calculated using EPA factors for Oil and Gas Production Operations.
   (Protocol for Equipment Leak Emission Estimates, 1995, EPA-453/R-95-017).

3 - Component counts are based on the default counts for compressor stations (GRI-HAPCalc model) multiplied by 2.

4 - "Other" components include compressor seals, relief valves, diaphragms, drains, meters etc.

5 - THC = Total Hydrocarbons, including Methane (CH4) and Ethane (C2H6).

6 - VOC = Non-Methane/Non-Ethane THC. (Sometimes designated C3+)

7 - HAP = Hazardous Air Pollutants as designated by EPA, in this case n-Hexane and BTEX.

8 - To be conservative, the following gas characteristics were assumed:

	Gas Analysis	Estimated
CH4	94.77 % of THC	100.00 % of THC
VOC	1.11 % of THC	2.00 % of THC
HAP	0.02 % of THC	0.50 % of THC

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Truck Loading Emissions

Truck Loading PTE Calculations

Description	S	P	M	T	CE	L_L	T-Put	VOC Emission Rate (AP-42)	HAP Emission Rate 2.39% of VOC
	sat. fac.	psia	lb/lb-mol	°R	%	lb/kgal	kgal/yr	tpy	tpy
Condensate/Produced Water Load-Out	0.6	4.9	166	520	0.0%	11.69	249.20	1.46	0.03
								20%	20%
			AMOUNT OF VOC IN PRODUCED WATER:						
			TRUCK LOADING VOC EMISSIONS:					0.29	0.01

Notes: 1 - Emission factors and formulas are from AP-42 Section 5.2 Transportation and Marketing of Petroleum Liquids:

$$L_L = 12.46 \times S \times P \times M / T \times (1 - CE)$$

where: L_L =   loading loss, lb/1000 gal of liquid loaded

   S =   saturation factor, use 0.6 for submerged loading in dedicated service

   P =   true vapor pressure of liquid loaded, psia

   M =   molecular weight of vapors, lb/lb-mol

   T =   temperature of bulk liquid loaded, °R (°F + 460)

   CE =   overall emission reduction efficiency (collection efficiency x control efficiency)

2 - Temperature, vapor pressure and molecular weights are E&P TANK V2.0 defaults.

3 - It is estimated that each tank will be emptied up to: **14**   times per year.

4 - The total storage tank capacity at the facility is: **424**   bbls.

5 - Assume each truck carries 4,000 gallons, so there are: **64**   loads/yr.

6 - Assume it takes less than one hour to load a truck.

7 - The liquid loaded into tanker trucks is predominantly water with small amounts of hydrocarbon liquids; therefore, for calculating VOC emissions, 20% of the liquid is assumed to be VOC.

8 - HAP emissions are based on HAP to VOC proportions determined by E&P TANK V2.0.

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Storage Tank Emissions

Storage Tank PTE Calculations (E&P TANK V2.0)

Tank Data

Tank ID	Capacity bbls	Capacity gal	Diameter ft	Height ft	Roof Slope rise/run	Liq Hgt ft	Vent Pres psig	Paint Color	Paint Condition
1	150	6,300	10	15.0	0.06	6	0.06	Green	Good
2	150	6,300	10	15.0	0.06	15	0.06	Green	Good
3	100	4,200	8.5	10.0	0.06	15	0.06	Green	Good
4	24	1,000	5.3	6.0	0.06	15	0.06	Green	Good

Material Data

Tank ID	Material Stored	Throughput bbl/day	Throughput days/yr	Throughput bbls/yr	Gravity API	RVP psia	Bulk Temp °F	VOC Emissions lb/hr	VOC Emissions tpy	HAP Emissions lb/hr	HAP Emissions tpy
1	Condensate/Produced Water	5.75	365	2,100	46	7.7	60	0.18	0.78	0.005	0.02
2	Condensate/Produced Water	5.75	365	2,100	46	7.7	60	0.18	0.78	0.005	0.02
3	Condensate/Produced Water	3.84	365	1,400	46	7.7	60	0.11	0.48	0.002	0.01
4	Condensate/Produced Water	0.91	366	333	46	7.7	60	0.01	0.06	0.000	0.00

	lb/hr	tpy	lb/hr	tpy
TOTAL FOR FOUR TANKS:	0.48	2.09	0.01	0.05
ADJUSTMENT FOR HIGH WATER CONTENT:	20%	20%	20%	20%
TOTAL STORAGE TANK VOC EMISSIONS:	0.10	0.42	0.00	0.01
HAP as a % of VOC:				2.39%

Throughput Summary

424	bbls total capacity
17,800	gal total capacity
14	Turnovers/yr
5,933	bbl throughput/yr
249.20	kgal throughput/yr

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Notes:
1 - Tanks store condensate and produced water.
2 - Tank emissions were calculated by E&P TANK V2.0.
3 - Used "Tank with Separator" program and E&P TANK V2.0 default data (e.g. API gravity, specific gravity, vapor pressure).
4 - A liquid analysis showing 100% hydrocarbon liquids was used in E&P Tank; however, for calculating VOC emissions, 20% of the liquid is assumed to be VOC.
5 - This is a worst-case assumption as the stored liquids are expected to be mostly water.

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