

## Dickson, Laura

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**From:** Juarez, Allie M. <AJuarez@marathonpetroleum.com>  
**Sent:** Thursday, November 17, 2022 7:17 AM  
**To:** Dickson, Laura  
**Subject:** [External] Harmon Creek 2 Final PTE  
**Attachments:** P22-0902-02.pdf; 2022-1117 Final HC2 PTE Estimates.pdf

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Good morning, Laura,

Please find the revised PTE and the emission guarantee from the vendor attached. I included a snip from the original guarantee to demonstrate that the only changed rate is for NOx. Additionally, to eliminate confusion, I revised the heater (H-2711) rating in the PTE to the maximum heat release referenced below rather than applying the 10% factor to convert from LHV to HHV, which was done for conservatism.

### Burner Performance:

Minimum Heat Release	MMBTU/ hr	<u>3.57</u>
Design Heat Release	MMBTU/ hr	<u>16.21</u>
Maximum Heat Release	MMBTU/ hr	<u>17.84</u>
Burner Turndown	Max:Min	<u>5.00</u>
Volumetric Ht. Release	BTU/ hr ft3	<u>6,967</u>
Pressure @ Arch	inH2O	<u>0.30</u>
Pressure @ Burner	inH2O	<u>4.35</u>
Combustion Air T @ Burner	°F	<u>60</u>
Flue Gas T @ Burner	°F	<u>1,230</u>

### Guaranteed Emissions:

Basis of Guarantee	- - -	<u>3.0% O2, dry (LHV)</u>
NOx Emissions	Lb/MMBTU	<u>0.040</u> <u>30 ppm</u>
SOx Emissions	Lb/MMBTU	<u>no quote</u>
CO Emissions	Lb/MMBTU	<u>0.040</u> <u>49 ppm</u>
VOC Emissions	Lb/MMBTU	<u>0.019</u> <u>15 ppm</u>
UHC Emissions	Lb/MMBTU	<u>0.007</u> <u>15 ppm</u>
SPM10 Emissions	Lb/MMBTU	<u>0.013</u> <u>15 ppm</u>
Noise Emissions	dBA @ 3ft	<u>85</u>

Please let me know if you have any questions or need anything else from me.

Thank you,  
Allie



**Allie Juarez**

G&P Engineer I

4600 J Barry Court, Suite 500

Canonsburg, PA 15317

Mobile: 412-815-8886

[ajuarez@marathonpetroleum.com](mailto:ajuarez@marathonpetroleum.com)

MarkWest Liberty Midstream & Resources, L.L.C.  
Harmon Creek Gas Plant

Summary of Potential Emissions

**Criteria Pollutant Potential Emissions**

Process/Facility	Source ID	Potential Emissions (lb/hr)					
		NOx	CO	VOC	SO <sub>2</sub>	PM <sup>1</sup>	HAPs
Cryo Plant 1 Regen Heater (H-1711)	031	0.47	0.47	0.22	0.01	0.09	0.02
Cryo Plant 2 Regen Heater (H-2711)	032	0.20	0.71	0.34	0.01	0.23	0.03
De-Ethanizer HMO Heater 1 (H-1767)	033	1.93	1.93	0.91	0.03	0.36	0.09
De-Ethanizer HMO Heater 2 (H-1768)	034	1.93	1.93	0.91	0.03	0.36	0.09
Stabilization HMO Heater (H-1769)	036	0.48	0.48	0.23	0.01	0.09	0.02
De-Ethanizer Regen Heater (H-1775)	035	0.26	0.26	0.13	0.00	0.05	0.01
Process Flare	C601	1.23	5.61	3.07	0.01	0.11	0.22
Generac SD015	102	0.26	0.14	0.08	0.10	0.02	0.00
Generac SD150	102	1.31	0.55	0.41	0.10	0.04	0.01
Fugitives Emissions	701	--	--	--	--	--	--
Pigging*	801	--	--	--	--	--	--
Rod Packing	601	--	--	0.21	--	--	0.00
Drain Tank Loadout*	--	--	--	--	--	--	--
Methanol Tanks	--	--	--	0.08	--	--	0.08
Measurement Devices	--	--	--	0.24	--	--	0.02
<b>Future Site-Wide Emissions (lb/hr)</b>		<b>8.07</b>	<b>12.09</b>	<b>6.85</b>	<b>0.30</b>	<b>1.35</b>	<b>0.60</b>

<sup>1</sup> PM = PM<sub>10</sub> = PM<sub>2.5</sub>

Process/Facility	Source ID	Potential Emissions (tpy)					
		NOx	CO	VOC	SO <sub>2</sub>	PM <sup>1</sup>	HAPs
Cryo Plant 1 Regen Heater (H-1711)	031	2.07	2.07	0.98	0.03	0.39	0.10
Cryo Plant 2 Regen Heater (H-2711)	032	0.86	3.13	1.48	0.05	1.02	0.14
De-Ethanizer HMO Heater 1 (H-1767)	033	8.44	8.44	4.01	0.12	1.57	0.39
De-Ethanizer HMO Heater 2 (H-1768)	034	8.44	8.44	4.01	0.12	1.57	0.39
Stabilization HMO Heater (H-1769)	036	2.10	2.10	1.00	0.03	0.39	0.10
De-Ethanizer Regen Heater (H-1775)	035	1.16	1.16	0.55	0.02	0.22	0.05
Process Flare	C601	5.39	24.56	13.46	0.04	0.50	0.98
Generac SD015	102	0.07	0.04	0.02	0.03	0.01	0.00
Generac SD150	102	0.33	0.14	0.10	0.03	0.01	0.00
Fugitives Emissions	701	--	--	10.72	--	--	0.50
Pigging*	801	--	--	--	--	--	--
Rod Packing	601	--	--	0.94	--	--	0.01
Drain Tank Loadout*	--	--	--	--	--	--	--
Methanol Tanks	--	--	--	0.35	--	--	0.35
Measurement Devices	--	--	--	1.04	--	--	0.08
<b>Future Site-Wide Emissions (tpy)</b>		<b>28.84</b>	<b>50.06</b>	<b>38.67</b>	<b>0.46</b>	<b>5.66</b>	<b>3.09</b>

<sup>1</sup> PM = PM<sub>10</sub> = PM<sub>2.5</sub>

\* Emissions are controlled by the flare and thus, are accounted for in the process flare emissions.

**Hazardous Air Pollutant Potential Emissions**

Process/Facility	Source ID	HAPs - Potential Emissions (lb/hr)								
		Acetaldehyde	Acrolein	Benzene	Ethylbenzene	Formaldehyde	Methanol	n-Hexane	Toluene	Xylenes
Cryo Plant 1 Regen Heater (H-1711)	031	--	--	2.44E-05	--	8.70E-04	--	0.02	3.95E-05	--
Cryo Plant 2 Regen Heater (H-2711)	032	--	--	3.67E-05	--	1.31E-03	--	0.03	5.95E-05	--
De-Ethanizer HMO Heater 1 (H-1767)	033	--	--	9.91E-05	--	3.54E-03	--	0.08	1.60E-04	--
De-Ethanizer HMO Heater 2 (H-1768)	034	--	--	9.91E-05	--	3.54E-03	--	0.08	1.60E-04	--
Stabilization HMO Heater (H-1769)	036	--	--	2.47E-05	--	8.82E-04	--	0.02	4.00E-05	--
De-Ethanizer Regen Heater (H-1775)	035	--	--	1.36E-05	--	4.85E-04	--	0.01	2.20E-05	--
Process Flare	C601	--	--	--	--	--	--	--	--	--
Generac SD015	102	2.89E-04	3.48E-05	3.51E-04	--	4.44E-04	--	--	1.54E-04	1.07E-04
Generac SD150	102	1.42E-03	1.72E-04	1.73E-03	--	2.19E-03	--	--	7.59E-04	5.29E-04
Fugitives Emissions	701	--	--	--	--	--	--	--	--	--
Pigging*	801	--	--	--	--	--	--	--	--	--
Rod Packing	601	--	--	--	--	--	--	0.00	--	--
Drain Tank Loadout*	--	--	--	--	--	--	--	--	--	--
Methanol Tanks	--	--	--	--	--	--	8.04E-02	--	--	--
Measurement Devices	--	--	--	--	--	--	--	0.02	--	--
<b>Future Site-Wide Emissions (lb/hr)</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.01</b>	<b>0.08</b>	<b>0.27</b>	<b>0.00</b>	<b>0.00</b>

Process/Facility	Source ID	HAPs - Potential Emissions (tpy)								
		Acetaldehyde	Acrolein	Benzene	Ethylbenzene	Formaldehyde	Methanol	n-Hexane	Toluene	Xylenes
Cryo Plant 1 Regen Heater (H-1711)	031	--	--	1.07E-04	--	3.81E-03	--	0.09	1.73E-04	--
Cryo Plant 2 Regen Heater (H-2711)	032	--	--	1.61E-04	--	5.75E-03	--	0.14	2.60E-04	--
De-Ethanizer HMO Heater 1 (H-1767)	033	--	--	4.34E-04	--	1.55E-02	--	0.37	7.03E-04	--
De-Ethanizer HMO Heater 2 (H-1768)	034	--	--	4.34E-04	--	1.55E-02	--	0.37	7.03E-04	--
Stabilization HMO Heater (H-1769)	036	--	--	1.08E-04	--	3.86E-03	--	0.09	1.75E-04	--
De-Ethanizer Regen Heater (H-1775)	035	--	--	5.95E-05	--	2.13E-03	--	0.05	9.64E-05	--
Process Flare	C601	--	--	--	--	--	--	--	--	--
Generac SD015	102	7.22E-05	8.70E-06	8.78E-05	--	1.11E-04	--	--	3.85E-05	2.68E-05
Generac SD150	102	3.56E-04	4.29E-05	4.33E-04	--	5.47E-04	--	--	1.90E-04	1.32E-04
Fugitives Emissions	701	--	--	--	--	--	--	--	--	--
Pigging*	801	--	--	--	--	--	--	--	--	--
Rod Packing	601	--	--	--	--	--	--	0.01	--	--
Drain Tank Loadout*	--	--	--	--	--	--	--	--	--	--
Methanol Tanks	--	--	--	--	--	--	3.52E-01	--	--	--
Measurement Devices	--	--	--	--	--	--	--	0.08	--	--
<b>Future Site-Wide Emissions (tpy)</b>		<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.05</b>	<b>0.35</b>	<b>1.20</b>	<b>0.00</b>	<b>0.00</b>

\* Emissions are controlled by the flare and thus, are accounted for in the process flare emissions.

**Greenhouse Gas Potential Emissions**

Process/Facility	Source ID	GHG
		CO <sub>2</sub> e (tpy)
Cryo Plant 1 Regen Heater (H-1711)	031	6857
Cryo Plant 2 Regen Heater (H-2711)	032	10335
De-Ethanizer HMO Heater 1 (H-1767)	033	27893
De-Ethanizer HMO Heater 2 (H-1768)	034	27893
Stabilization HMO Heater (H-1769)	036	6946
De-Ethanizer Regen Heater (H-1775)	035	3824
Process Flare	C601	10622
Generac SD015	102	15
Generac SD150	102	76
Fugitives Emissions	701	306
Pigging*	801	--
Rod Packing	601	2687
Methanol Tanks	--	--
Measurement Devices	--	83
<b>Future Site-Wide Emissions (tpy)</b>		<b>97,536.07</b>

\* Emissions are controlled by the flare and thus, are accounted for in the process flare emissions.

MarkWest Liberty Midstream & Resources, L.L.C.  
Harmon Creek Gas Plant

**Potential Emissions Increases from Project**

**Criteria Pollutant Potential Emissions Increase**

Process/Facility	Source ID	Potential Emissions (lb/hr)					
		NOx	CO	VOC	SO2	PM1	HAPs
Cryo Plant 2 Regen Heater (H-2711)	032	0.20	0.71	0.34	0.01	0.23	0.03
Process Flare	C601	0.00	0.00	0.00	0.00	0.00	0.00
Fugitives Emissions	701	--	--	--	--	--	--
Pigging (De Minimis)*	801	--	--	--	--	--	--
Rod Packing (De Minimis)	601	--	--	0.04	--	--	0.00
Drain Tank Loadout (De Minimis)*	--	--	--	--	--	--	--
Methanol Tanks (De Minimis)	--	--	--	0.04	--	--	0.04
Measurement Devices (Exempt)	--	--	--	0.06	--	--	0.00
<b>Future Site-Wide Emissions (lb/hr)</b>		<b>0.20</b>	<b>0.71</b>	<b>0.48</b>	<b>0.01</b>	<b>0.23</b>	<b>0.08</b>

1 PM = PM10 = PM2.5

Process/Facility	Source ID	Potential Emissions (tpy)					
		NOx	CO	VOC	SO2	PM1	HAPs
Cryo Plant 2 Regen Heater (H-2711)	032	0.86	3.13	1.48	0.05	1.02	0.14
Process Flare	C601	0.00	0.00	0.00	0.00	0.00	0.00
Fugitives Emissions	701	--	--	3.95	--	--	0.19
Pigging (De Minimis)*	801	--	--	--	--	--	--
Rod Packing (De Minimis)	601	--	--	0.20	--	--	0.00
Drain Tank Loadout (De Minimis)*	--	--	--	--	--	--	--
Methanol Tanks (De Minimis)	--	--	--	0.18	--	--	0.18
Measurement Devices (Exempt)	--	--	--	0.26	--	--	0.02
<b>Future Site-Wide Emissions (tpy)</b>		<b>0.86</b>	<b>3.13</b>	<b>6.07</b>	<b>0.05</b>	<b>1.02</b>	<b>0.53</b>

1 PM = PM10 = PM2.5

\* Emissions are controlled by the flare and thus, are accounted for in the process flare emissions.

**Hazardous Air Pollutant Potential Emissions**

Process/Facility	Source ID	HAPs - Potential Emissions (lb/hr)								
		Acetaldehyde	Acrolein	Benzene	Ethylbenzene	Formaldehyde	Methanol	n-Hexane	Toluene	Xylenes
Cryo Plant 2 Regen Heater (H-2711)	032	--	--	3.67E-05	--	1.31E-03	--	3.15E-02	5.95E-05	--
Process Flare	C601	--	--	--	--	--	--	--	--	--
Fugitives Emissions	701	--	--	--	--	--	--	--	--	--
Pigging (De Minimis)*	801	--	--	--	--	--	--	--	--	--
Rod Packing (De Minimis)	601	--	--	--	--	--	--	2.80E-05	--	--
Drain Tank Loadout (De Minimis)*	--	--	--	--	--	--	--	--	--	--
Methanol Tanks (De Minimis)	--	--	--	--	--	--	4.02E-02	--	--	--
Measurement Devices (Exempt)	--	--	--	--	--	--	--	4.35E-03	--	--
<b>Future Site-Wide Emissions (lb/hr)</b>		<b>0.00E+00</b>	<b>0.00E+00</b>	<b>3.67E-05</b>	<b>0.00E+00</b>	<b>1.31E-03</b>	<b>4.02E-02</b>	<b>3.59E-02</b>	<b>5.95E-05</b>	<b>0.00E+00</b>

Process/Facility	Source ID	HAPs - Potential Emissions (tpy)								
		Acetaldehyde	Acrolein	Benzene	Ethylbenzene	Formaldehyde	Methanol	n-Hexane	Toluene	Xylenes
Cryo Plant 2 Regen Heater (H-2711)	032	--	--	1.61E-04	--	5.75E-03	--	1.38E-01	2.60E-04	--
Process Flare	C601	--	--	--	--	--	--	--	--	--
Fugitives Emissions	701	--	--	--	--	--	--	--	--	--
Pigging (De Minimis)*	801	--	--	--	--	--	--	--	--	--
Rod Packing (De Minimis)	601	--	--	--	--	--	--	1.23E-04	--	--
Drain Tank Loadout (De Minimis)*	--	--	--	--	--	--	--	--	--	--
Methanol Tanks (De Minimis)	--	--	--	--	--	--	1.76E-01	--	--	--
Measurement Devices (Exempt)	--	--	--	--	--	--	--	1.90E-02	--	--
<b>Future Site-Wide Emissions (tpy)</b>		<b>0.00E+00</b>	<b>0.00E+00</b>	<b>1.61E-04</b>	<b>0.00E+00</b>	<b>5.75E-03</b>	<b>1.76E-01</b>	<b>1.57E-01</b>	<b>2.60E-04</b>	<b>0.00E+00</b>

\* Emissions are controlled by the flare and thus, are accounted for in the process flare emissions.

**Greenhouse Gas Potential Emissions**

Process/Facility	Source ID	GHG
		CO2(e) (tpy)
Cryo Plant 2 Regen Heater (H-2711)	032	1.03E+04
Process Flare	C601	0.00E+00
Fugitives Emissions	701	1.01E+02
Pigging (De Minimis)*	801	--
Rod Packing (De Minimis)	601	2.66E+03
Drain Tank Loadout (De Minimis)*	--	--
Methanol Tanks (De Minimis)	--	2.08E+01
<b>Future Site-Wide Emissions (tpy)</b>		<b>13,113.60</b>

\* Emissions are controlled by the flare and thus, are accounted for in the process flare emissions.

MarkWest Liberty Midstream & Resources, L.L.C.  
 Harmon Creek Gas Plant

**Cryo Plant I Regen Heater  
 H-1711**

<b>Source Designation:</b>	
Manufacturer:	Tulsa Heaters
Year Installed	2018
Fuel Used:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,153
Rated Duty (mmbtu/hr)	8.67
Maximim Fired Heat Input (HHV) (mmbtu/hr)	11.84
Fuel Consumption (mmscf/hr):	1.03E-02
Potential Annual Hours of Operation (hr/yr):	8,760

**Criteria and Manufacturer Specific Pollutant Emission Rates**

<b>Pollutant</b>	<b>Emission Factor (lb/mmbtu) (lb/MMscf)<sup>a,b</sup></b>	<b>Potential Emissions</b>	
		<b>(lb/hr)<sup>c</sup></b>	<b>(tons/yr)<sup>d</sup></b>
NOx	0.04	0.473	2.074
CO	0.04	0.473	2.074
VOC	0.019	0.225	0.985
SO <sub>2</sub>	0.68	0.0070	0.0305
PM Total	8.59	0.0882	0.3863
PM Condensable	6.44	0.066	0.290
PM <sub>10</sub> (Filterable)	2.15	0.022	0.097
PM <sub>2.5</sub> (Filterable)	2.15	0.022	0.097
CO <sub>2</sub>	59.9 kg/mmbtu	1,564	6,850
CH <sub>4</sub>	0.001 kg/mmbtu	0.02950	0.129
N <sub>2</sub> O	0.0001 kg/mmbtu	0.00295	0.013

### Hazardous Air Pollutant (HAP) Potential Emissions

Pollutant	Emission Factor (lb/MMscf) <sup>a</sup>	Potential Emissions	
		(lb/hr) <sup>c</sup>	(tons/yr) <sup>d</sup>
<b>HAPs:</b>			
3-Methylchloranthrene	2.03E-06	2.09E-08	9.15E-08
7,12-Dimethylbenz(a)anthracene	1.81E-05	1.86E-07	8.13E-07
Acenaphthene	2.03E-06	2.09E-08	9.15E-08
Acenaphthylene	2.03E-06	2.09E-08	9.15E-08
Anthracene	2.71E-06	2.78E-08	1.22E-07
Benz(a)anthracene	2.03E-06	2.09E-08	9.15E-08
Benzene	2.37E-03	2.44E-05	1.07E-04
Benzo(a)pyrene	1.36E-06	1.39E-08	6.10E-08
Benzo(b)fluoranthene	2.03E-06	2.09E-08	9.15E-08
Benzo(g,h,i)perylene	1.36E-06	1.39E-08	6.10E-08
Benzo(k)fluoranthene	2.03E-06	2.09E-08	9.15E-08
Chrysene	2.03E-06	2.09E-08	9.15E-08
Dibenzo(a,h) anthracene	1.36E-06	1.39E-08	6.10E-08
Dichlorobenzene	1.36E-03	1.39E-05	6.10E-05
Fluoranthene	3.39E-06	3.48E-08	1.52E-07
Fluorene	3.17E-06	3.25E-08	1.42E-07
Formaldehyde	8.48E-02	8.70E-04	3.81E-03
Hexane	2.03E+00	2.09E-02	9.15E-02
Indo(1,2,3-cd)pyrene	2.03E-06	2.09E-08	9.15E-08
Phenanthrene	1.92E-05	1.97E-07	8.64E-07
Pyrene	5.65E-06	5.80E-08	2.54E-07
Toluene	3.84E-03	3.95E-05	1.73E-04
Arsenic	2.26E-04	2.32E-06	1.02E-05
Beryllium	1.36E-05	1.39E-07	6.10E-07
Cadmium	1.24E-03	1.28E-05	5.59E-05
Chromium	1.58E-03	1.62E-05	7.12E-05
Cobalt	9.50E-05	9.75E-07	4.27E-06
Lead	5.65E-04	5.80E-06	2.54E-05
Manganese	4.30E-04	4.41E-06	1.93E-05
Mercury	2.94E-04	3.02E-06	1.32E-05
Nickel	2.37E-03	2.44E-05	1.07E-04
Selenium	2.71E-05	2.78E-07	1.22E-06
<b>Polycyclic Organic Matter:</b>			
Methylnaphthalene (2-)	2.71E-05	2.78E-07	1.22E-06
Naphthalene	6.90E-04	7.08E-06	3.10E-05
<b>Total HAP</b>		<b>2.19E-02</b>	<b>9.60E-02</b>

<sup>a</sup> Emission factors from manufacturers guarantees on VOC, NOx, and CO in lb/mmbtu. The remainder from AP-42 Section 1.4 "Natural Gas Combustion" Tables 1.4-1, 1.4-2, & 1.4-3 (07/98) for all criteria and HAP pollutants, corrected to site-specific gas heat content.

<sup>b</sup> Emission factors for GHG pollutants from 40 CFR Part 98, Subpart C and corrected to site-specific gas heat content.

<sup>c</sup> Emission Rate (lb/hr) = Rated Capacity (MMscf/hr) × Emission Factor (lb/MMscf).

<sup>d</sup> Annual Emissions (tons/yr)<sub>Potential</sub> = (lb/hr)<sub>Emissions</sub> × (Maximum Allowable Operating Hours, 8760 hr/yr) × (1 ton/2000 lb).



MarkWest Liberty Midstream & Resources, L.L.C.  
 Harmon Creek Gas Plant

**Cryo Plant II Regen Heater Equipped with FGR  
 H-2711**

<b>Source Designation:</b>	
Manufacturer:	Tulsa Heaters
Year Installed	<i>Planned 2023</i>
Fuel Used:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,153
Max Design Heat Release (mmbtu/hr)	17.84
Heat Release (LHV) (mmbtu/hr)	17.84
Fuel Consumption (mmscf/hr):	0.0155
Potential Annual Hours of Operation (hr/yr):	8,760

**Criteria and Manufacturer Specific Pollutant Emission Rates**

<b>Pollutant</b>	<b>Emission Factor (lb/mmbtu) (lb/MMscf)<sup>a,b</sup></b>	<b>Potential Emissions</b>	
		<b>(lb/hr)<sup>c</sup></b>	<b>(tons/yr)<sup>d</sup></b>
NOx	0.01	0.196	0.860
CO	0.04	0.714	3.126
VOC	0.019	0.339	1.485
SO <sub>2</sub>	0.68	0.0105	0.0460
PM Total	0.013	0.232	1.016
PM Condensable	0.013	0.232	1.016
PM <sub>10</sub> (Filterable)	0.013	0.232	1.016
PM <sub>2.5</sub> (Filterable)	0.013	0.232	1.016
CO <sub>2</sub>	59.9 kg/mmbtu	2,357	10,324
CH <sub>4</sub>	0.001 kg/mmbtu	0.04446	0.195
N <sub>2</sub> O	0.0001 kg/mmbtu	0.00445	0.019

### Hazardous Air Pollutant (HAP) Potential Emissions

Pollutant	Emission Factor (lb/MMscf) <sup>a</sup>	Potential Emissions	
		(lb/hr) <sup>c</sup>	(tons/yr) <sup>d</sup>
<b>HAPs:</b>			
3-Methylchloranthrene	2.03E-06	3.15E-08	1.38E-07
7,12-Dimethylbenz(a)anthracene	1.81E-05	2.80E-07	1.23E-06
Acenaphthene	2.03E-06	3.15E-08	1.38E-07
Acenaphthylene	2.03E-06	3.15E-08	1.38E-07
Anthracene	2.71E-06	4.20E-08	1.84E-07
Benz(a)anthracene	2.03E-06	3.15E-08	1.38E-07
Benzene	2.37E-03	3.67E-05	1.61E-04
Benzo(a)pyrene	1.36E-06	2.10E-08	9.19E-08
Benzo(b)fluoranthene	2.03E-06	3.15E-08	1.38E-07
Benzo(g,h,i)perylene	1.36E-06	2.10E-08	9.19E-08
Benzo(k)fluoranthene	2.03E-06	3.15E-08	1.38E-07
Chrysene	2.03E-06	3.15E-08	1.38E-07
Dibenzo(a,h) anthracene	1.36E-06	2.10E-08	9.19E-08
Dichlorobenzene	1.36E-03	2.10E-05	9.19E-05
Fluoranthene	3.39E-06	5.25E-08	2.30E-07
Fluorene	3.17E-06	4.90E-08	2.14E-07
Formaldehyde	8.48E-02	1.31E-03	5.75E-03
Hexane	2.03E+00	3.15E-02	1.38E-01
Indo(1,2,3-cd)pyrene	2.03E-06	3.15E-08	1.38E-07
Phenanthrene	1.92E-05	2.97E-07	1.30E-06
Pyrene	5.65E-06	8.75E-08	3.83E-07
Toluene	3.84E-03	5.95E-05	2.60E-04
Arsenic	2.26E-04	3.50E-06	1.53E-05
Beryllium	1.36E-05	2.10E-07	9.19E-07
Cadmium	1.24E-03	1.92E-05	8.43E-05
Chromium	1.58E-03	2.45E-05	1.07E-04
Cobalt	9.50E-05	1.47E-06	6.43E-06
Lead	5.65E-04	8.75E-06	3.83E-05
Manganese	4.30E-04	6.65E-06	2.91E-05
Mercury	2.94E-04	4.55E-06	1.99E-05
Nickel	2.37E-03	3.67E-05	1.61E-04
Selenium	2.71E-05	4.20E-07	1.84E-06
<b>Polycyclic Organic Matter:</b>			
Methylnaphthalene (2-)	2.71E-05	4.20E-07	1.84E-06
Naphthalene	6.90E-04	1.07E-05	4.67E-05
<b>Total HAP</b>	<b>2.135</b>	<b>0.033</b>	<b>0.145</b>

<sup>a</sup> Emission factors from manufacturers guarantees on VOC, NOx, CO, PM in lb/mmbtu. The remainder from AP-42 Section 1.4 "Natural Gas Combustion" Tables 1.4-1, 1.4-2, & 1.4-3 (07/98) for all criteria and HAP pollutants, corrected to site-specific gas heat content.

<sup>b</sup> Emission factors for GHG pollutants from 40 CFR Part 98, Subpart C and corrected to site-specific gas heat content.

<sup>c</sup> Emission Rate (lb/hr) = Rated Capacity (MMscf/hr) × Emission Factor (lb/MMscf).

<sup>d</sup> Annual Emissions (tons/yr)<sub>Potential</sub> = (lb/hr)<sub>Emissions</sub> × (Maximum Allowable Operating Hours, 8760 hr/yr) × (1 ton/2000 lb).

MarkWest Liberty Midstream & Resources, L.L.C.  
 Harmon Creek Gas Plant

**DeEthanizer HMO Heaters  
 H-1767, H-1768**

<b>Source Designation:</b>	
Manufacturer:	Scelerin Heaters LLC
Year Installed	2018
Fuel Used:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,153
Rated Duty (mmbtu/hr)	34.38
Maximim Fired Heat Input (HHV) (mmbtu/hr)	48.15
Fuel Consumption (mmscf/hr):	4.18E-02
Potential Annual Hours of Operation (hr/yr):	8,760

**Criteria and Manufacturer Specific Pollutant Emission Rates**

<b>Pollutant</b>	<b>Emission Factor (lb/mmbtu) (lb/MMscf)<sup>a,b</sup></b>	<b>Potential Emissions</b>	
		<b>(lb/hr)<sup>c</sup></b>	<b>(tons/yr)<sup>d</sup></b>
NO <sub>x</sub>	0.04	1.926	8.435
CO	0.04	1.926	8.435
VOC	0.019	0.915	4.007
SO <sub>2</sub>	0.7	0.0283	0.1240
PM Total	8.6	0.3587	1.5713
PM Condensable	6.4	0.269	1.178
PM <sub>10</sub> (Filterable)	2.1	0.090	0.393
PM <sub>2.5</sub> (Filterable)	2.1	0.090	0.393
CO <sub>2</sub>	59.9 kg/mmbtu	6,362	27,864
CH <sub>4</sub>	0.001 kg/mmbtu	0.11999	0.526
N <sub>2</sub> O	0.0001 kg/mmbtu	0.01200	0.053

### Hazardous Air Pollutant (HAP) Potential Emissions

Pollutant	Emission Factor (lb/MMscf) <sup>a</sup>	Potential Emissions	
		(lb/hr) <sup>c</sup>	(tons/yr) <sup>d</sup>
<b>HAPs:</b>			
3-Methylchloranthrene	2.03E-06	8.50E-08	3.72E-07
7,12-Dimethylbenz(a)anthracene	1.81E-05	7.55E-07	3.31E-06
Acenaphthene	2.03E-06	8.50E-08	3.72E-07
Acenaphthylene	2.03E-06	8.50E-08	3.72E-07
Anthracene	2.71E-06	1.13E-07	4.96E-07
Benz(a)anthracene	2.03E-06	8.50E-08	3.72E-07
Benzene	2.37E-03	9.91E-05	4.34E-04
Benzo(a)pyrene	1.36E-06	5.66E-08	2.48E-07
Benzo(b)fluoranthene	2.03E-06	8.50E-08	3.72E-07
Benzo(g,h,i)perylene	1.36E-06	5.66E-08	2.48E-07
Benzo(k)fluoranthene	2.03E-06	8.50E-08	3.72E-07
Chrysene	2.03E-06	8.50E-08	3.72E-07
Dibenzo(a,h) anthracene	1.36E-06	5.66E-08	2.48E-07
Dichlorobenzene	1.36E-03	5.66E-05	2.48E-04
Fluoranthene	3.39E-06	1.42E-07	6.20E-07
Fluorene	3.17E-06	1.32E-07	5.79E-07
Formaldehyde	8.48E-02	3.54E-03	1.55E-02
Hexane	2.03E+00	8.50E-02	3.72E-01
Indo(1,2,3-cd)pyrene	2.03E-06	8.50E-08	3.72E-07
Phenanthrene	1.92E-05	8.02E-07	3.51E-06
Pyrene	5.65E-06	2.36E-07	1.03E-06
Toluene	3.84E-03	1.60E-04	7.03E-04
Arsenic	2.26E-04	9.44E-06	4.13E-05
Beryllium	1.36E-05	5.66E-07	2.48E-06
Cadmium	1.24E-03	5.19E-05	2.27E-04
Chromium	1.58E-03	6.61E-05	2.89E-04
Cobalt	9.50E-05	3.97E-06	1.74E-05
Lead	5.65E-04	2.36E-05	1.03E-04
Manganese	4.30E-04	1.79E-05	7.86E-05
Mercury	2.94E-04	1.23E-05	5.38E-05
Nickel	2.37E-03	9.91E-05	4.34E-04
Selenium	2.71E-05	1.13E-06	4.96E-06
<b>Polycyclic Organic Matter:</b>			
Methylnaphthalene (2-)	2.71E-05	1.13E-06	4.96E-06
Naphthalene	6.90E-04	2.88E-05	1.26E-04
<b>Total HAP</b>		<b>8.91E-02</b>	<b>3.90E-01</b>

<sup>a</sup> Emission factors from manufacturers guarantees on VOC, NOx, and CO in lb/mmbtu. The remainder from AP-42 Section 1.4 "Natural Gas Combustion" Tables 1.4-1, 1.4-2, & 1.4-3 (07/98) for all criteria and HAP pollutants, corrected to site-specific gas heat content.

<sup>b</sup> Emission factors for GHG pollutants from 40 CFR Part 98, Subpart C and corrected to site-specific gas heat content.

<sup>c</sup> Emission Rate (lb/hr) = Rated Capacity (MMscf/hr) × Emission Factor (lb/MMscf).

<sup>d</sup> Annual Emissions (tons/yr)<sub>Potential</sub> = (lb/hr)<sub>Emissions</sub> × (Maximum Allowable Operating Hours, 8760 hr/yr) × (1 ton/2000 lb).

MarkWest Liberty Midstream & Resources, L.L.C.  
 Harmon Creek Gas Plant

**Stabilization HMO Heater  
 H-1769**

<b>Source Designation:</b>	
Manufacturer:	Tulsa Heaters
Year Installed	2018
Fuel Used:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,153
Rated Duty (mmbtu/hr)	8.92
Maximim Fired Heat Input (HHV) (mmbtu/hr)	11.99
Fuel Consumption (mmscf/hr):	1.04E-02
Potential Annual Hours of Operation (hr/yr):	8,760

**Criteria and Manufacturer Specific Pollutant Emission Rates**

<b>Pollutant</b>	<b>Emission Factor (lb/mmbtu) (lb/MMscf)<sup>a,b</sup></b>	<b>Potential Emissions</b>	
		<b>(lb/hr)<sup>c</sup></b>	<b>(tons/yr)<sup>d</sup></b>
NO <sub>x</sub>	0.04	0.480	2.101
CO	0.04	0.480	2.101
VOC	0.019	0.228	0.998
SO <sub>2</sub>	0.7	0.0071	0.0309
PM Total	8.6	0.0893	0.3913
PM Condensable	6.4	0.067	0.293
PM <sub>10</sub> (Filterable)	2.1	0.022	0.098
PM <sub>2.5</sub> (Filterable)	2.1	0.022	0.098
CO <sub>2</sub>	59.9 kg/mmbtu	1,584	6,939
CH <sub>4</sub>	0.001 kg/mmbtu	0.02988	0.131
N <sub>2</sub> O	0.0001 kg/mmbtu	0.00299	0.013

### Hazardous Air Pollutant (HAP) Potential Emissions

Pollutant	Emission Factor (lb/MMscf) <sup>a</sup>	Potential Emissions	
		(lb/hr) <sup>c</sup>	(tons/yr) <sup>d</sup>
<b>HAPs:</b>			
3-Methylchloranthrene	2.03E-06	2.12E-08	9.27E-08
7,12-Dimethylbenz(a)anthracene	1.81E-05	1.88E-07	8.24E-07
Acenaphthene	2.03E-06	2.12E-08	9.27E-08
Acenaphthylene	2.03E-06	2.12E-08	9.27E-08
Anthracene	2.71E-06	2.82E-08	1.24E-07
Benz(a)anthracene	2.03E-06	2.12E-08	9.27E-08
Benzene	2.37E-03	2.47E-05	1.08E-04
Benzo(a)pyrene	1.36E-06	1.41E-08	6.18E-08
Benzo(b)fluoranthene	2.03E-06	2.12E-08	9.27E-08
Benzo(g,h,i)perylene	1.36E-06	1.41E-08	6.18E-08
Benzo(k)fluoranthene	2.03E-06	2.12E-08	9.27E-08
Chrysene	2.03E-06	2.12E-08	9.27E-08
Dibenzo(a,h) anthracene	1.36E-06	1.41E-08	6.18E-08
Dichlorobenzene	1.36E-03	1.41E-05	6.18E-05
Fluoranthene	3.39E-06	3.53E-08	1.54E-07
Fluorene	3.17E-06	3.29E-08	1.44E-07
Formaldehyde	8.48E-02	8.82E-04	3.86E-03
Hexane	2.03E+00	2.12E-02	9.27E-02
Indo(1,2,3-cd)pyrene	2.03E-06	2.12E-08	9.27E-08
Phenanthrene	1.92E-05	2.00E-07	8.75E-07
Pyrene	5.65E-06	5.88E-08	2.57E-07
Toluene	3.84E-03	4.00E-05	1.75E-04
Arsenic	2.26E-04	2.35E-06	1.03E-05
Beryllium	1.36E-05	1.41E-07	6.18E-07
Cadmium	1.24E-03	1.29E-05	5.66E-05
Chromium	1.58E-03	1.65E-05	7.21E-05
Cobalt	9.50E-05	9.87E-07	4.32E-06
Lead	5.65E-04	5.88E-06	2.57E-05
Manganese	4.30E-04	4.47E-06	1.96E-05
Mercury	2.94E-04	3.06E-06	1.34E-05
Nickel	2.37E-03	2.47E-05	1.08E-04
Selenium	2.71E-05	2.82E-07	1.24E-06
<b>Polycyclic Organic Matter:</b>			
Methylnaphthalene (2-)	2.71E-05	2.82E-07	1.24E-06
Naphthalene	6.90E-04	7.17E-06	3.14E-05
<b>Total HAP</b>		<b>2.22E-02</b>	<b>9.72E-02</b>

<sup>a</sup> Emission factors from manufacturers guarantees on VOC, NOx, and CO in lb/mmbtu. The remainder from AP-42 Section 1.4 "Natural Gas Combustion" Tables 1.4-1, 1.4-2, & 1.4-3 (07/98) for all criteria and HAP pollutants, corrected to site-specific gas heat content.

<sup>b</sup> Emission factors for GHG pollutants from 40 CFR Part 98, Subpart C and corrected to site-specific gas heat content.

<sup>c</sup> Emission Rate (lb/hr) = Rated Capacity (MMscf/hr) × Emission Factor (lb/MMscf).

<sup>d</sup> Annual Emissions (tons/yr)<sub>Potential</sub> = (lb/hr)<sub>Emissions</sub> × (Maximum Allowable Operating Hours, 8760 hr/yr) × (1 ton/2000 lb).

MarkWest Liberty Midstream & Resources, L.L.C.  
 Harmon Creek Gas Plant

**DeEthanization Regen Heater  
 H-1775**

<b>Source Designation:</b>	
Manufacturer:	Tulsa Heaters
Year Installed	2018
Fuel Used:	Natural Gas
Higher Heating Value (HHV) (Btu/scf):	1,153
Rated Duty (mmbtu/hr)	4.82
Maximim Fired Heat Input (HHV) (mmbtu/hr)	6.60
Fuel Consumption (mmscf/hr):	5.72E-03
Potential Annual Hours of Operation (hr/yr):	8,760

**Criteria and Manufacturer Specific Pollutant Emission Rates**

<b>Pollutant</b>	<b>Emission Factor (lb/mmbtu) (lb/MMscf)<sup>a,b</sup></b>	<b>Potential Emissions</b>	
		<b>(lb/hr)<sup>c</sup></b>	<b>(tons/yr)<sup>d</sup></b>
NO <sub>x</sub>	0.04	0.264	1.156
CO	0.04	0.264	1.156
VOC	0.019	0.125	0.549
SO <sub>2</sub>	0.7	0.0039	0.0170
PM Total	8.6	0.0492	0.2154
PM Condensable	6.4	0.037	0.162
PM <sub>10</sub> (Filterable)	2.1	0.012	0.054
PM <sub>2.5</sub> (Filterable)	2.1	0.012	0.054
CO <sub>2</sub>	59.9 kg/mmbtu	872	3,820
CH <sub>4</sub>	0.001 kg/mmbtu	0.01645	0.072
N <sub>2</sub> O	0.0001 kg/mmbtu	0.00164	0.007

### Hazardous Air Pollutant (HAP) Potential Emissions

Pollutant	Emission Factor (lb/MMscf) <sup>a</sup>	Potential Emissions	
		(lb/hr) <sup>c</sup>	(tons/yr) <sup>d</sup>
<b>HAPs:</b>			
3-Methylchloranthrene	2.03E-06	1.16E-08	5.10E-08
7,12-Dimethylbenz(a)anthracene	1.81E-05	1.04E-07	4.53E-07
Acenaphthene	2.03E-06	1.16E-08	5.10E-08
Acenaphthylene	2.03E-06	1.16E-08	5.10E-08
Anthracene	2.71E-06	1.55E-08	6.80E-08
Benz(a)anthracene	2.03E-06	1.16E-08	5.10E-08
Benzene	2.37E-03	1.36E-05	5.95E-05
Benzo(a)pyrene	1.36E-06	7.76E-09	3.40E-08
Benzo(b)fluoranthene	2.03E-06	1.16E-08	5.10E-08
Benzo(g,h,i)perylene	1.36E-06	7.76E-09	3.40E-08
Benzo(k)fluoranthene	2.03E-06	1.16E-08	5.10E-08
Chrysene	2.03E-06	1.16E-08	5.10E-08
Dibenzo(a,h) anthracene	1.36E-06	7.76E-09	3.40E-08
Dichlorobenzene	1.36E-03	7.76E-06	3.40E-05
Fluoranthene	3.39E-06	1.94E-08	8.50E-08
Fluorene	3.17E-06	1.81E-08	7.94E-08
Formaldehyde	8.48E-02	4.85E-04	2.13E-03
Hexane	2.03E+00	1.16E-02	5.10E-02
Indo(1,2,3-cd)pyrene	2.03E-06	1.16E-08	5.10E-08
Phenanthrene	1.92E-05	1.10E-07	4.82E-07
Pyrene	5.65E-06	3.24E-08	1.42E-07
Toluene	3.84E-03	2.20E-05	9.64E-05
Arsenic	2.26E-04	1.29E-06	5.67E-06
Beryllium	1.36E-05	7.76E-08	3.40E-07
Cadmium	1.24E-03	7.12E-06	3.12E-05
Chromium	1.58E-03	9.06E-06	3.97E-05
Cobalt	9.50E-05	5.44E-07	2.38E-06
Lead	5.65E-04	3.24E-06	1.42E-05
Manganese	4.30E-04	2.46E-06	1.08E-05
Mercury	2.94E-04	1.68E-06	7.37E-06
Nickel	2.37E-03	1.36E-05	5.95E-05
Selenium	2.71E-05	1.55E-07	6.80E-07
<b>Polycyclic Organic Matter:</b>			
Methylnaphthalene (2-)	2.71E-05	1.55E-07	6.80E-07
Naphthalene	6.90E-04	3.95E-06	1.73E-05
<b>Total HAP</b>		<b>0.01</b>	<b>0.05</b>

<sup>a</sup> Emission factors from manufacturers guarantees on VOC, NOx, and CO in lb/mmbtu. The remainder from AP-42 Section 1.4 "Natural Gas Combustion" Tables 1.4-1, 1.4-2, & 1.4-3 (07/98) for all criteria and HAP pollutants, corrected to site-specific gas heat content.

<sup>b</sup> Emission factors for GHG pollutants from 40 CFR Part 98, Subpart C and corrected to site-specific gas heat content.

<sup>c</sup> Emission Rate (lb/hr) = Rated Capacity (MMscf/hr) × Emission Factor (lb/MMscf).

<sup>d</sup> Annual Emissions (tons/yr)<sub>Potential</sub> = (lb/hr)<sub>Emissions</sub> × (Maximum Allowable Operating Hours, 8760 hr/yr) × (1 ton/2000 lb).



MarkWest Liberty Midstream & Resources, L.L.C.  
Harmon Creek Gas Plant

**Flare**

Source Designation:	
Manufacturer:	John Zink
Operating Hours: (hr/yr)	8,760
Pilot + Purge Gas Heat Input (MMBtu/hr)	3.205
Pilot + Purge Gas Annual Fuel Use (mmscf/yr)	26.518
Pilot Fuel Consumption (mmscf/hr):	2.00E-04
Purge Fuel Consumption (mmscf/hr):	2.83E-03
Fuel HHV (Btu/scf)	1,059

**Combustion of Hydrocarbons**

Source Designation:	
Annual Gas Flow (mmscf/yr)	100.00
Heating value (btu/scf)	1,303.99
Maximum Heat Release of Flare (mmbtu/yr)	130,399

**Total Emissions**

Pollutant	Emission Factor (lb/MMBtu)	lb/hr	tpy
VOC	--	3.07	13.46
HAP	--	0.22	0.98
NO <sub>x</sub>	0.068	1.23	5.39
CO	0.31	5.61	24.56
SO <sub>2</sub>	0.0005	0.01	0.04
PM Total	0.0063	0.11	0.50
PM Condensable	0.0047	0.09	0.37
PM <sub>10</sub> (Filterable)	0.0016	0.03	0.12
PM <sub>2.5</sub> (Filterable)	0.0016	0.03	0.12
CO <sub>2</sub>	117.05	2119.50	9283.43
CH <sub>4</sub>	0.002	12.18	53.33
N <sub>2</sub> O	0.0002	0.00	0.02

<sup>a</sup> The NO<sub>x</sub> and CO emission factors are from AP-42 Section 13.5 "Industrial Flares" Table 13.5-1.

<sup>b</sup> Emission factors for GHG pollutants from 40 CFR Part 98, Subpart C. Tables C-1 and C-2.

<sup>c</sup> The remaining factors are from AP-42 Section 1.4 "Natural Gas Combustion" Tables 1.4-1 and 1.4-2.

<sup>d</sup> VOC and HAP emissions are based on mass balance.

<sup>e</sup> The flare calculations assume the composition to the flare is inlet gas. Additionally, the flare volume is conservative as the actual flow to the flare during the 2019 reporting period was approximately 26.5

**Admin Room Emergency Generator  
 (G-1)**

<b>Source Designation:</b>	
Generator Manufacturer	Generac
Generator Model No:	SD015
Engine Manufacturer:	Generac
Engine Model No.:	A2400T-Gen1
EPA Tier Designation	Tier 4 Interim
Stroke Cycle:	4-stroke
Type of Burn:	Diesel
Year Installed	2019
Fuel Used:	Diesel
Fuel High Heating Value (HHV) (Btu/gal):	137,380
Rated Horsepower (bhp):	49.0
Maximum Fuel Consumption at 100% Load (gal/hr):	2.7
Heat Input (MMBtu/hr)	0.38

**Operational Details:**

Potential Annual Hours of Operation (hr/yr):	500
Potential Fuel Consumption (gal/yr):	1,370

**Criteria and Manufacturer Specific Pollutant Emission Factors:**

<b>Pollutant</b>	<b>Emission Factors<sup>b,c</sup></b>	<b>Units</b>
NOx	2.44	g/bhp-hr
CO	1.34	g/bhp-hr
SO <sub>2</sub>	9.30E-01	g/bhp-hr
PM <sub>10</sub> (Filterable)	1.90E-01	g/bhp-hr
PM <sub>2.5</sub> (Filterable)	1.90E-01	g/bhp-hr
PM Condensable	1.90E-01	g/bhp-hr
PM Total	1.90E-01	g/bhp-hr
VOC	0.77	g/bhp-hr
CO2	73.96	kg/mmbtu
CH4	3E-03	kg/mmbtu
N2O	6E-04	kg/mmbtu

**Admin Room Emergency Generator  
 (G-1)**

**Criteria and Manufacturer Specific Pollutant Emission Rates**

Pollutant	Potential Emissions	
	(lb/hr) <sup>d</sup>	(tons/yr) <sup>e</sup>
NO <sub>x</sub>	0.26	0.07
CO	0.14	0.04
SO <sub>2</sub>	0.10	0.03
PM <sub>10</sub> (Filterable)	0.02	0.01
PM <sub>2.5</sub> (Filterable)	0.02	0.01
PM Condensable	0.02	0.01
PM Total	0.02	0.01
VOC	0.08	0.02
CO <sub>2</sub>	61.42	15.35
CH <sub>4</sub>	0.00	0.00
N <sub>2</sub> O	0.00	0.00

**Hazardous Air Pollutant (HAP) Potential Emissions**

Pollutant	Emission Factor (lb/MMBtu) <sup>a</sup>	Potential Emissions	
		(lb/hr) <sup>d</sup>	(tons/yr) <sup>e</sup>
<b>HAPs:</b>			
Acetaldehyde	7.67E-04	2.89E-04	7.22E-05
Acrolein	9.25E-05	3.48E-05	8.70E-06
Benzene	9.33E-04	3.51E-04	8.78E-05
1,3-Butadiene	3.91E-05	1.47E-05	3.68E-06
Formaldehyde	1.18E-03	4.44E-04	1.11E-04
Toluene	4.09E-04	1.54E-04	3.85E-05
Xylene	2.85E-04	1.07E-04	2.68E-05
<b>Polycyclic Organic Matter:</b>			
Naphthalene	8.48E-05	3.19E-05	7.98E-06
<b>Total HAP</b>		<b>1.43E-03</b>	<b>3.57E-04</b>

<sup>a</sup> HAP emission factors from AP-42 Section 3.2, Table 3.3-2 "Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines,"

<sup>b</sup> Criteria pollutant emission factors are based on Manufacturer Data for NO<sub>x</sub>, CO, PM and VOC. The NO<sub>x</sub> + NMHC factor is assumed to be 76% NO<sub>x</sub> and 24% VOC. SO<sub>2</sub> is from AP-42 Table 3.3-1.

<sup>c</sup> GHG pollutant emission factors are from Part 98 Tables C-1 and C-2 for Distillate Fuel No. 2.

<sup>d</sup> Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr or bhp) × Emission Factor (lb/MMBtu or lb/bhp-hr).

<sup>e</sup> Annual Emissions (tons/yr)<sub>potential</sub> = (lb/hr)<sub>Emissions</sub> × (Maximum Allowable Operating Hours/yr) × (1 ton/2000 lb).

**Electrical Room Emergency Generator  
 (G-2)**

<b>Source Designation:</b>	
Generator Manufacturer	Generac
Generator Model No:	SD150
Engine Manufacturer:	Generac
Engine Model No.:	4BT3.3-G5
EPA Tier Designation:	Tier 3
Stroke Cycle:	4-stroke
Type of Burn:	Diesel
Year Installed	2019
Fuel Used:	Diesel
Fuel High Heating Value (HHV) (Btu/gal):	137,380
Nameplate Horsepower (bhp):	279.0
Maximum Fuel Consumption at 100% Load (gal/hr):	13.5
Heat Input (MMBtu/hr)	1.85

**Operational Details:**

Potential Annual Hours of Operation (hr/yr):	500
Potential Fuel Consumption (gal/yr):	6,750

**Criteria and Manufacturer Specific Pollutant Emission Factors:**

Pollutant	Emission Factors <sup>b,c</sup>	Units
NOx	2.13	g/bhp-hr
CO	0.90	g/bhp-hr
SO <sub>2</sub>	1.70E-01	g/bhp-hr
PM <sub>10</sub> (Filterable)	6.00E-02	g/bhp-hr
PM <sub>2.5</sub> (Filterable)	6.00E-02	g/bhp-hr
PM Condensable	6.00E-02	g/bhp-hr
PM Total	6.00E-02	g/bhp-hr
VOC	0.67	g/bhp-hr
CO <sub>2</sub>	73.96	kg/mmbtu
CH <sub>4</sub>	3E-03	kg/mmbtu
N <sub>2</sub> O	6E-04	kg/mmbtu

**Electrical Room Emergency Generator  
(G-2)**

**Criteria and Manufacturer Specific Pollutant Emission Rates**

Pollutant	Potential Emissions	
	(lb/hr) <sup>d</sup>	(tons/yr) <sup>e</sup>
Nox	1.31	0.33
CO	0.55	0.14
SO <sub>2</sub>	0.10	0.03
PM <sub>10</sub> (Filterable)	0.04	0.01
PM <sub>2.5</sub> (Filterable)	0.04	0.01
PM Condensable	0.04	0.01
PM Total	0.04	0.01
VOC	0.41	0.10
CO <sub>2</sub>	302.59	75.65
CH <sub>4</sub>	0.01	0.00
N <sub>2</sub> O	0.00	0.00

**Hazardous Air Pollutant (HAP) Potential Emissions**

Pollutant	Emission Factor (lb/MMBtu) <sup>a</sup>	Potential Emissions	
		(lb/hr) <sup>d</sup>	(tons/yr) <sup>e</sup>
<b>HAPs:</b>			
Acetaldehyde	7.67E-04	0.0014	0.0004
Acrolein	9.25E-05	0.0002	0.0000
Benzene	9.33E-04	0.0017	0.0004
1,3-Butadiene	3.91E-05	0.0001	0.0000
Formaldehyde	1.18E-03	0.0022	0.0005
Toluene	4.09E-04	0.0008	0.0002
Xylene	2.85E-04	0.0005	0.0001
<b>Polycyclic Organic Matter:</b>			
Naphthalene	8.48E-05	0.0002	0.0000
<b>Total HAP</b>		<b>0.01</b>	<b>0.00</b>

<sup>a</sup> HAP emission factors from AP-42 Section 3.2, Table 3.3-2 "Speciated Organic Compound Emission Factors for Uncontrolled Diesel Engines," Supplement F, October 1996.

<sup>b</sup> Criteria pollutant emission factors are based on Manufacturer Data for NO<sub>x</sub>, CO, PM and VOC. The NO<sub>x</sub> + NMHC factor is assumed to be 76% NO<sub>x</sub> and 24% VOC. SO<sub>2</sub> is from AP-42 Table 3.3-1.

<sup>c</sup> GHG pollutant emission factors are from Part 98 Tables C-1 and C-2 for Distillate Fuel No. 2.

<sup>d</sup> Emission Rate (lb/hr) = Rated Capacity (MMBtu/hr or bhp) × Emission Factor (lb/MMBtu or lb/bhp-hr).

<sup>e</sup> Annual Emissions (tons/yr)<sub>potential</sub> = (lb/hr)<sub>Emissions</sub> × (Maximum Allowable Operating Hours/yr) × (1 ton/2000 lb).

MarkWest Liberty Midstream and Resources, L.L.C.  
Harmon Creek Gas Plant

**Condensate Truck Loadout Emissions**

Source	Volume Loaded (gal/yr)	Saturation Factor <sup>1</sup>	Vapor Pressure <sup>2</sup> (psia)	Vapor Molecular Weight <sup>2</sup> (lb/lb-mol)	Liquid Temp <sup>3</sup> (°F)	Liquid Temp (°R)	Loading Loss <sup>4</sup> (lb VOC/1000 gal)	Loading Loss (lb/yr) (tpy)	
Harmon Creek Closed Drain Tank	220,000	0.6	8.1621	60	58.5	518.2	7.1	1,554.44	0.78

<sup>1</sup> From AP-42 Table 5.2-1, for tank trucks in submerged loading: dedicated normal service

<sup>2</sup> From AP42 Table 7.1-2, Gasoline (RVP 15), 60 deg

<sup>3</sup> Daily average liquid surface temperature (TANKS 4.09d)

<sup>4</sup> Loading Loss (lb VOC/1000 gal) =  $(12.46 * S * P * M) / T$  [AP42 Section 5.2 (1/95)]

<sup>5</sup> Loading losses are controlled by the flare. Thus, emissions associated with the Condensate Truck Loadout Emissions are captured under the Flare Emission estimates.

**Fugitive Emissions**

Component Type	Stream Type (Gas Vapor, Light Liquid, Heavy Liquid)	Gas Type	From LeakDAS	Number of Components <sup>a</sup>	AP-42 Leak Emission Factors kg/hr/component <sup>b</sup>	Reduction Factors <sup>c</sup>	Final Leak Factor lb/hr/component	Weight Percent <sup>e</sup>				Total Emissions (tpy)	Potential VOC Emissions		Potential HAP Emissions		Potential CH4 Emissions		Potential CO2 Emissions	
								VOC	HAP	CH4	CO2		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Compressor	GV	INLET	7	11	8.80E-03	80%	3.88E-03	23.6%	1.7%	75.1%	0.2%	0.190	0.01	0.04	0.00	0.00	0.03	0.14	0.00	0.00
Compressor	GV	RESIDUE	12	19	8.80E-03	0%	1.94E-02	0.1%	0.0%	87.5%	0.3%	1.633	0.00	0.00	0.00	0.00	0.33	1.43	0.00	0.01
Compressor	GV	ETHAN	3	5	8.80E-03	0%	1.94E-02	0.5%	0.1%	0.0%	0.0%	0.408	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Compressor	GV	CO2	2	3	8.80E-03	0%	1.94E-02	0.5%	0.1%	0.0%	100.0%	0.272	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.27
Compressor	GV	PROPANE	11	18	8.80E-03	80%	3.88E-03	100.0%	0.0%	0.0%	0.0%	0.299	0.07	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Compressor	LL	INLET	4	6	7.50E-03	80%	3.31E-03	23.6%	1.7%	75.1%	0.2%	0.093	0.01	0.02	0.00	0.00	0.02	0.07	0.00	0.00
Connector	GV	INLET GAS	19	30	2.00E-04	75%	1.10E-04	23.6%	1.7%	75.1%	0.2%	0.015	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Connector	GV	C3+	424	678	2.00E-04	75%	1.10E-04	100.0%	0.0%	0.0%	0.0%	0.328	0.07	0.33	0.00	0.00	0.00	0.00	0.00	0.00
Connector	GV	REFRIG C3	42	67	2.00E-04	75%	1.10E-04	100.0%	0.0%	0.0%	0.0%	0.032	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Connector	GV	REGEN De-Eth	10	16	2.00E-04	75%	1.10E-04	0.5%	0.1%	0.0%	0.0%	0.008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	GV	FLARE GAS	1254	2006	2.00E-04	75%	1.10E-04	23.6%	1.7%	75.1%	0.2%	0.969	0.05	0.23	0.00	0.02	0.17	0.73	0.00	0.00
Connector	GV	C3+	1	2	2.00E-04	75%	1.10E-04	100.0%	0.0%	0.0%	0.0%	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	GV	INLET	69	110	2.00E-04	75%	1.10E-04	23.6%	1.7%	75.1%	0.2%	0.053	0.00	0.01	0.00	0.00	0.01	0.04	0.00	0.00
Connector	GV	REGEN GAS De-Eth	13	21	2.00E-04	75%	1.10E-04	0.5%	0.1%	0.0%	0.0%	0.010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	GV	C2+	112	179	2.00E-04	75%	1.10E-04	51.4%	5.3%	0.1%	0.1%	0.087	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00
Connector	GV	INLET	252	403	2.00E-04	75%	1.10E-04	23.6%	1.7%	75.1%	0.2%	0.195	0.01	0.05	0.00	0.00	0.03	0.15	0.00	0.00
Connector	GV	REGEN De-Eth	1	2	2.00E-04	75%	1.10E-04	0.5%	0.1%	0.0%	0.0%	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	GV	C3+	3	5	2.00E-04	75%	1.10E-04	100.0%	0.0%	0.0%	0.0%	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	LL	FLARE GAS	1	2	2.10E-04	75%	1.16E-04	23.6%	1.7%	75.1%	0.2%	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	LL	METHANOL	102	163	2.10E-04	75%	1.16E-04	100.0%	100.0%	0.0%	0.0%	0.083	0.02	0.08	0.02	0.08	0.00	0.00	0.00	0.00
Connector	LL	REGEN GAS De-Eth	108	173	2.10E-04	75%	1.16E-04	0.5%	0.1%	0.0%	0.0%	0.088	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	LL	ETHAN	47	75	2.10E-04	75%	1.16E-04	0.5%	0.1%	0.0%	0.0%	0.038	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	LL	ETHAN	20	32	2.10E-04	75%	1.16E-04	0.5%	0.1%	0.0%	0.0%	0.016	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Connector	LL	C3+	857	1371	2.10E-04	75%	1.16E-04	100.0%	0.0%	0.0%	0.0%	0.696	0.16	0.70	0.00	0.00	0.00	0.00	0.00	0.00
Connector	LL	METHANOL	25	40	2.10E-04	75%	1.16E-04	100.0%	100.0%	0.0%	0.0%	0.020	0.00	0.02	0.00	0.02	0.00	0.00	0.00	0.00
Connector	LL	INLET GAS	238	381	2.10E-04	75%	1.16E-04	23.6%	1.7%	75.1%	0.2%	0.193	0.01	0.05	0.00	0.00	0.03	0.15	0.00	0.00
Connector	LL	C3+	310	496	2.10E-04	75%	1.16E-04	100.0%	0.0%	0.0%	0.0%	0.252	0.06	0.25	0.00	0.00	0.00	0.00	0.00	0.00
Connector	LL	INLET GAS	100	160	2.10E-04	75%	1.16E-04	23.6%	1.7%	75.1%	0.2%	0.081	0.00	0.02	0.00	0.00	0.01	0.06	0.00	0.00
Pressure Relief	GV	REGEN De-Eth	28	45	8.80E-03	97%	5.82E-04	0.5%	0.1%	0.0%	0.0%	0.114	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Relief	GV	FLARE	467	747	8.80E-03	97%	5.82E-04	23.6%	1.7%	75.1%	0.2%	1.906	0.10	0.45	0.01	0.03	0.33	1.43	0.00	0.00
Pressure Relief	GV	FLARE GAS	344	550	8.80E-03	97%	5.82E-04	23.6%	1.7%	75.1%	0.2%	1.404	0.08	0.33	0.01	0.02	0.24	1.05	0.00	0.00
Pressure Relief	LL	C3	148	237	7.50E-03	97%	4.96E-04	100.0%	0.0%	0.0%	0.0%	0.515	0.12	0.51	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Relief	LL	C2+	782	1251	7.50E-03	97%	4.96E-04	51.4%	5.3%	0.1%	0.1%	2.720	0.32	1.40	0.03	0.14	0.00	0.00	0.00	0.00
Pressure Relief	LL	REGEN GAS De-Eth	337	539	7.50E-03	97%	4.96E-04	0.5%	0.1%	0.0%	0.0%	1.172	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Relief	LL	FLARE	79	126	7.50E-03	97%	4.96E-04	23.6%	1.7%	75.1%	0.2%	0.275	0.01	0.06	0.00	0.00	0.05	0.21	0.00	0.00
Pressure Relief	LL	C3+	4	6	7.50E-03	97%	4.96E-04	100.0%	0.0%	0.0%	0.0%	0.014	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Relief	LL	REGEN GAS	26	42	7.50E-03	97%	4.96E-04	23.6%	1.7%	75.1%	0.2%	0.090	0.00	0.02	0.00	0.00	0.02	0.07	0.00	0.00
Pressure Relief	LL	REGEN GAS	80	128	7.50E-03	97%	4.96E-04	23.6%	1.7%	75.1%	0.2%	0.278	0.02	0.07	0.00	0.00	0.05	0.21	0.00	0.00
Pressure Relief	LL	C3	403	645	7.50E-03	97%	4.96E-04	100.0%	0.0%	0.0%	0.0%	1.402	0.32	1.40	0.00	0.00	0.00	0.00	0.00	0.00
Pump	GV	FLARE	5	8	2.40E-03	0%	5.29E-03	23.6%	1.7%	75.1%	0.2%	0.186	0.01	0.04	0.00	0.00	0.03	0.14	0.00	0.00
Pump	GV	FLARE	129	206	2.40E-03	0%	5.29E-03	23.6%	1.7%	75.1%	0.2%	4.786	0.26	1.13	0.02	0.08	0.82	3.59	0.00	0.01
Pump	LL	C2+	6	10	1.30E-02	85%	4.30E-03	51.4%	5.3%	0.1%	0.1%	0.181	0.02	0.09	0.00	0.01	0.00	0.00	0.00	0.00

**Fugitive Emissions**

Component Type	Stream Type (Gas Vapor, Light Liquid, Heavy Liquid)	Gas Type	From LeakDAS	Number of Components <sup>a</sup>	AP-42 Leak Emission Factors kg/hr/component <sup>b</sup>	Reduction Factors <sup>c</sup>	Final Leak Factor lb/hr/component	Weight Percent <sup>e</sup>				Total Emissions (tpy)	Potential VOC Emissions		Potential HAP Emissions		Potential CH4 Emissions		Potential CO2 Emissions										
								VOC	HAP	CH4	CO2		(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)									
Valve	GV	REGEN GAS De-Eth	63	101	4.50E-03	97%	2.98E-04	0.5%	0.1%	0.0%	0.0%	0.131	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	GV	C2+	44	70	4.50E-03	97%	2.98E-04	51.4%	5.3%	0.1%	0.1%	0.092	0.01	0.05	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	GV	C3	3	5	4.50E-03	97%	2.98E-04	100.0%	0.0%	0.0%	0.0%	0.006	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	GV	INLET GAS	44	70	4.50E-03	97%	2.98E-04	23.6%	1.7%	75.1%	0.2%	0.092	0.00	0.02	0.00	0.00	0.02	0.07	0.00	0.00									
Valve	GV	C3+	113	181	4.50E-03	97%	2.98E-04	100.0%	0.0%	0.0%	0.0%	0.236	0.05	0.24	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	GV	C3	489	782	4.50E-03	97%	2.98E-04	100.0%	0.0%	0.0%	0.0%	1.021	0.23	1.02	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	GV	REFRIG C3	154	246	4.50E-03	97%	2.98E-04	100.0%	0.0%	0.0%	0.0%	0.321	0.07	0.32	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	GV	INLET	12	19	4.50E-03	97%	2.98E-04	23.6%	1.7%	75.1%	0.2%	0.025	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00									
Valve	GV	REFRIG C3	2	3	4.50E-03	97%	2.98E-04	100.0%	0.0%	0.0%	0.0%	0.004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	GV	C3	140	224	4.50E-03	97%	2.98E-04	100.0%	0.0%	0.0%	0.0%	0.292	0.07	0.29	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	LL	C2+	290	464	2.50E-03	97%	1.65E-04	51.4%	5.3%	0.1%	0.1%	0.336	0.04	0.17	0.00	0.02	0.00	0.00	0.00	0.00									
Valve	LL	INLET	935	1496	2.50E-03	97%	1.65E-04	23.6%	1.7%	75.1%	0.2%	1.084	0.06	0.26	0.00	0.02	0.19	0.81	0.00	0.00									
Valve	LL	REGEN GAS	2	3	2.50E-03	97%	1.65E-04	23.6%	1.7%	75.1%	0.2%	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	LL	METHANOL	2	3	2.50E-03	97%	1.65E-04	100.0%	100.0%	0.0%	0.0%	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	LL	INLET	390	624	2.50E-03	97%	1.65E-04	23.6%	1.7%	75.1%	0.2%	0.452	0.02	0.11	0.00	0.01	0.08	0.34	0.00	0.00									
Valve	LL	C3+	2	3	2.50E-03	97%	1.65E-04	100.0%	0.0%	0.0%	0.0%	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	LL	METHANOL	1	2	2.50E-03	97%	1.65E-04	100.0%	100.0%	0.0%	0.0%	0.001	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	LL	REFRIG C3	181	290	2.50E-03	97%	1.65E-04	100.0%	0.0%	0.0%	0.0%	0.210	0.05	0.21	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	LL	REFRIG C3	92	147	2.50E-03	97%	1.65E-04	100.0%	0.0%	0.0%	0.0%	0.107	0.02	0.11	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	LL	FLARE	19	30	2.50E-03	97%	1.65E-04	23.6%	1.7%	75.1%	0.2%	0.022	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00									
Valve	LL	FLARE	3	5	2.50E-03	97%	1.65E-04	23.6%	1.7%	75.1%	0.2%	0.003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Connector	HL	HMO		1708	7.50E-06	0%	1.65E-05	100.0%	0.0%	0.0%	0.0%	0.124	0.03	0.12	0.00	0.00	0.00	0.00	0.00	0.00									
Valve	HL	HMO		569	8.40E-06	0%	1.85E-05	100.0%	0.0%	0.0%	0.0%	0.046	0.01	0.05	0.00	0.00	0.00	0.00	0.00	0.00									
Pressure Relief	HL	HMO		16	3.20E-05	0%	7.06E-05	100.0%	0.0%	0.0%	0.0%	0.005	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Connector	HL	CO2		569	7.50E-06	0%	1.65E-05	0.5%	0.1%	0.0%	100.0%	0.041	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.04									
Valve	HL	CO2		190	8.40E-06	0%	1.85E-05	0.5%	0.1%	0.0%	100.0%	0.015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02									
Pressure Relief	HL	CO2		5	3.20E-05	0%	7.06E-05	0.5%	0.1%	0.0%	100.0%	0.002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
Connector	GV	Residue		1900	2.00E-04	75%	1.10E-04	0.1%	0.0%	87.5%	0.3%	0.918	0.00	0.00	0.00	0.00	0.18	0.80	0.00	0.00									
Valve	GV	Residue		600	4.50E-03	97%	2.98E-04	0.1%	0.0%	87.5%	0.3%	0.783	0.00	0.00	0.00	0.00	0.16	0.69	0.00	0.00									
<b>21,343</b>																													
											<b>Total</b>	<b>2.45</b>	<b>10.72</b>	<b>0.11</b>	<b>0.50</b>	<b>2.79</b>	<b>12.23</b>	<b>0.09</b>	<b>0.38</b>										

**Notes:**

- <sup>a</sup> Component counts are based on a combination of counts from LeakDas and PIDs and estimates based on studies at similar facilities.
- <sup>b</sup> Table 2-4. Oil & Gas Production Operations Average Emission Factors, Protocol for Equipment Leak Emission Estimates, EPA 453/R-95-017, November 1995. Emission factors based on average measured TOC from component types indicated in gas or light oil service at O&G Production Operations.
- <sup>c</sup> Table V: Control Efficiencies for LDAR for 28VHP programs, Air Permit Technical Guidance for Chemical Sources Fugitive Guidance, TCEQ (APDG 6422v2, Revised 06/2018). Compressors are monitored quarterly via OGI.
- <sup>d</sup> Table 5-1. Summary of Equipment Modifications, Protocol for Equipment Leak Emission Estimates, EPA 453/R-95-017, November 1995.
- <sup>e</sup> CO2 and C2 service are estimated at 0.5 VOC wt% to be conservative.



**MarkWest Liberty Midstream & Resources, L.L.C.**  
**Harmon Creek Gas Plant**  
**Rod Packing Emissions**

<b>Rod Packing</b>
--------------------

**Total Rod Packing Emissions**

Pollutant	Emissions	
	lb/hr	tpy
VOC	0.27	1.18
Total HAPs	0.00	0.01
Methane	24.54	107.48
Carbon Dioxide	24.23	106.15
n-Hexane	0.00	0.01
Total HAPs	0.00	0.01

**Proposed Residue Compressors**

Emission Rate <sup>a</sup>	215.0	(scf/hr)
Density	0.043	(lb/scf)
Number of Compressors	3	
Total Emissions	27.923	(lb/hr)

<sup>a</sup>Based on residue compressor monitoring data.

Pollutant	Mass %	Emissions	
		lb/hr	tpy
VOC	0.15%	0.041	0.180
Total HAPs	0.00%	0.000	0.000
Methane	87.54%	24.444	107.066
Carbon Dioxide	0.31%	0.087	0.382
n-Hexane	0.00%	0.000	0.000
Total HAPs	0.00%	0.000	0.000

**Existing Residue Compressors**

Emission Rate <sup>a</sup>	215.0	(scf/hr)
Density	0.043	(lb/scf)
Number of Compressors	4	
Total Emissions	37.230	(lb/hr)

<sup>a</sup>Based on residue compressor monitoring data.

Pollutant	Mass %	Emissions	
		lb/hr	tpy
VOC	0.15%	0.055	0.240
Total HAPs	0.00%	0.000	0.000
Methane	87.54%	32.593	142.755
Carbon Dioxide	0.31%	0.116	0.509
n-Hexane	0.00%	0.000	0.000
Total HAPs	0.00%	0.000	0.000

Stabilization Compressors

Emission Factor <sup>a</sup>	0.018	(scf CH <sub>4</sub> /min)
Mole fraction Methane	0.440	
Total Emission Factor	0.041	(scf/min)
MW	29.162	(lb/lbmole)
Number of Compressors	2	
Total Emissions	0.378	(lb/hr)

<sup>a</sup>Based on 40 CFR Part 98 Subpart W Section 233 Emissions Factors

Pollutant	Mass %	Emissions	
		lb/hr	tpy
VOC	44.89%	0.170	0.743
Total HAPs	0.60%	0.002	0.010
Methane	24.26%	0.092	0.402
Carbon Dioxide	0.24%	0.001	0.004
n-Hexane	0.60%	0.002	0.010
Total HAPs	0.60%	0.002	0.010

CO<sub>2</sub> Compressor

Emission Rate <sup>a</sup>	215.0	(scf/hr)
MW	0.115	(lb/scf)
Number of Compressors	1	
Total Emissions	24.684	(lb/hr)

<sup>a</sup>Based on residue compressor monitoring data.

Pollutant	Mass %	Emissions	
		lb/hr	tpy
VOC	0.02%	0.004	0.018
Total HAPs	0.00%	0.000	0.000
Methane	0.01%	0.002	0.010
Carbon Dioxide	97.82%	24.146	105.760
n-Hexane	0.00%	0.000	0.000
Total HAPs	0.00%	0.000	0.000

**Pigging Emissions (Controlled by Flare)**

Description	Gas Source Basis	Pressure Type	High to Low Pressure Jumper	Control Device	L/R	Size	Max Events/Yr	Pressure (PSIG) <sup>a</sup>	Temp (deg F)	Vessel Volume (acf)	Z Factor <sup>a</sup>	R Factor <sup>b</sup>	MW of Gas <sup>a</sup>	Maximum Volume		Controlled VOC		Controlled HAP	
								Pre-Jump			Pre-Jump			Per Event (scf)	Annually (scf/yr)	Wt% <sup>a</sup>	tpy <sup>c</sup>	Wt% <sup>a</sup>	tpy <sup>c</sup>
Houston Plant HP NGL Launcher	Harmon Creek Plant	HP	N	Flare	Launcher	12	1	1100	85	19.04	0.956	1,545	21.6	1,509.8	1,510	23.6%	0.000	1.72%	0.0000
Mariner West HP Ethane Launcher	Harmon Creek Plant	HP	N	Flare	Launcher	10	1	1100	85	15.95	0.956	1,545	21.6	1,264.8	1,265	23.6%	0.000	1.72%	0.0000
National Fuel Line N HP Residue Launcher	Harmon Creek Plant	HP	N	Flare	Launcher	20	1	1300	85	55.07	0.956	1,545	21.6	5,150.3	5,150	23.6%	0.001	1.72%	0.0001
Rover HP Interconnect Launcher	Harmon Creek Plant	HP	N	Flare	Launcher	24	1	1300	85	108.94	0.758	1,545	21.6	12,852.0	12,852	23.6%	0.002	1.72%	0.0002
Smith CS to Harmon Creek Plant HP Receiver	Harmon Creek Plant	HP	N	Flare	Receiver	20	365	1060	54.2	26.50	0.956	1,545	21.0	2,025.9	739,460	20.2%	0.099	1.67%	0.0082
<b>Total</b>														<b>760,236</b>		<b>0.102</b>		<b>0.008</b>	

\* Pigging emissions are controlled by the flare and emission associated with pigging events are accounted for in the flare emissions section.

<sup>a</sup> Actual factors for PSIG, Z-factor, MW of gas, VOC wt% of gas and LHV of gas have been calculated but the numbers in the spreadsheet are provided to be very conservative in the event that the composition of the gas field changes over time.

<sup>b</sup> R Factor = (psfa\*ft<sup>3</sup>\* lbmol/(lb\*R))

<sup>c</sup> Per the Consent Decree filed in April 2018, the mass of VOC emissions from pigging operations are multiplied by a factor of:

1.2

CO<sub>2</sub> wt% 0.24%  
 CH<sub>4</sub> wt% 75.1%  
 CO<sub>2</sub> emissions 0.001 tpy  
 CH<sub>4</sub> emissions 0.32 tpy

**Methanol Emission Estimates**

Source Information:	
Contents:	Methanol
Quantity:	2
Tank Orientation/Geometry:	Horizontal Cylinder
Approx. Height (ft):	5.0
Approx. Diameter (ft):	4.2
Volume (gal):	500
Turnovers per year:	0.10
Maximum Fill Level:	90%
Insulation:	None
Tank Color:	Red
Control Percentage:	0
Site-Wide Throughput (gal/yr)	100
Site-Wide Throughput (bbl/day)	0.007

**Total Methanol Emissions (Sum of Tank Emissions + Process Emissions below):**

Pollutant	Conservative Losses	
	lb/hr	tpy
Total VOC	0.080	0.352
Total HAP	0.080	0.352

Tank Emissions:

Pollutant	Tank Losses	
	lb/hr	tpy
Total VOC	0.003	0.013
Total HAP	0.003	0.013

Methanol tank losses are conservatively based on 50 gallons of use annually and modeled using ProMax 5.0. Please note, MarkWest uses no more than five (5) gallons of methanol per year.

Process Emissions:

Pollutant	Conservative Losses	
	lb/hr	tpy
Total VOC	0.077	0.339
Total HAP	0.077	0.339

Methanol losses from the process conservatively assumes all methanol injected into the system is emitted to the atmosphere, however, only a portion of the injected methanol will be emitted. Additionally, MarkWest uses no more than five (5) gallons of methanol per year, however, emission estimates are based on 10 times that quantity.

Sample Calculation:

$$\text{Methanol emissions (tpy)} = \text{Methanol usage (gal/yr)} * \text{Density (lb/gal)} / 2000 \text{ (ton/lbs)}$$

MarkWest Liberty Midstream & Resources, L.L.C.  
 Harmon Creek Gas Plant

**Measurement Devices**  
*Exempt under Section 127.14(a) #7*

Source Information:	
Analyzer Vent Rate (scf/hr)	2.12
Spectra Analyzers	8.00
GC Vent Rate (scf/hr)	0.04
GC Streams	21.00
Total Number of Measurement Vents to Atm	29.0
Potential Annual Hours of Operation (hr/yr)	8,760
Potential Volume Emitted (scf/yr)	18,561

Pollutant	Per Analyzer		Per GC Stream		Total	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Carbon Dioxide	0.000	0.001	0.000	0.000	0.00	0.011
Methane	0.09	0.397	0.00	0.007	0.76	3.311
VOC	0.03	0.125	0.00	0.002	0.24	1.042
n-Hexane	2.07E-03	0.009	3.45E-05	0.000	0.02	0.076
Total HAPs	2.07E-03	0.009	3.45E-05	0.000	0.02	0.076

**MarkWest Liberty Midstream & Resources, L.L.C.**  
**Harmon Creek Gas Plant**

**Harmon Creek Gas Analysis**

Component	MW	Unit	Inlet Gas	Residue Gas - Recovery	Residue Gas	Stabilizer Overhead	CO2	C2+
Nitrogen	28.0135	mole %	0.44	0.51	0.48	0.10	0.00	0.00
CO2	44.01	mole %	0.12	0.20	0.12	0.16	96.84	0.06
H2S	34.1	mole %	0.00	0.00	0.00	0.00	0.00	0.00
Methane	16.042	mole %	75.08	97.41	92.99	44.04	0.03	0.10
Ethane	30.069	mole %	15.76	1.84	6.35	29.62	3.12	59.23
Propane	44.096	mole %	5.12	0.04	0.06	17.14	0.02	23.38
i-Butane	58.122	mole %	0.53	0.00	0.00	1.86	0.00	2.95
n-Butane	58.122	mole %	1.40	0.00	0.00	4.96	0.00	7.05
i-Pentane	72.149	mole %	0.32	0.00	0.00	0.79	0.00	1.69
n-Pentane	72.149	mole %	0.45	0.00	0.00	1.06	0.00	2.18
n-Hexane	86.175	mole %	0.43	0.00	0.00	0.20	0.00	3.46
n-Heptane	100.202	mole %	0.32	0.00	0.00	0.05	0.00	0.00
n-Octane	114.229	mole %	0.01	0.00	0.00	0.00	0.00	0.00
n-Nonane	128.255	mole %	0.00	0.00	0.00	0.00	0.00	0.00
n-Decane	142.282	mole %	0.00	0.00	0.00	0.00	0.00	0.00

Component	MW	Unit	Inlet Gas	Residue Gas - Recovery	Residue Gas	Stabilizer Overhead	CO2	C2+
23 Nitrogen	28.0135	wt%	0.5707	0.8738	0.7852	0.0965	0.0000	0.0000
24 CO2	44.01	wt%	0.2445	0.5278	0.3121	0.2440	97.8220	0.1187
25 H2S	34.1	wt%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26 Methane	16.042	wt%	75.0800	95.1232	87.5426	24.2604	0.0092	0.0736
27 Ethane	30.069	wt%	21.9424	3.3662	11.2128	30.5465	2.1522	48.5233
28 Propane	44.096	wt%	10.4539	0.1031	0.1442	25.9200	0.0166	27.2355
29 i-Butane	58.122	wt%	1.4263	0.0025	0.0011	3.7135	0.0000	3.8104
30 n-Butane	58.122	wt%	3.7677	0.0035	0.0013	9.8881	0.0000	9.4580
31 i-Pentane	72.149	wt%	1.0690	0.0000	0.0002	1.9617	0.0000	2.4280
32 n-Pentane	72.149	wt%	1.5033	0.0000	0.0005	2.6260	0.0000	3.1565
33 n-Hexane	86.175	wt%	1.7158	0.0000	0.0001	0.5960	0.0000	5.3212
34 n-Heptane	100.202	wt%	1.4847	0.0000	0.0000	0.1622	0.0000	0.0000
35 n-Octane	114.229	wt%	0.0529	0.0000	0.0000	0.0192	0.0000	0.0000
36 n-Nonane	128.255	wt%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37 n-Decane	142.282	wt%	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

*Dry Basis	VOC wt %	23.62	0.11	0.15	44.89	0.02	51.41
	LHV =	1178.81	916.57	949.85	1562.36	51.09	
	HHV =	1303.99	1022.94	1058.62	1715.11	61.37	
	Density (lb	0.0569	0.0433	0.0449	0.0768	0.1148	
	Gas MW=	21.60	16.43	17.04	29.16	43.57	
	HAP wt%=	1.7158	0.0000	0.0001	0.5960	0.0000	5.3212

Notes:

<sup>a</sup> The inlet gas composition is based on a sample collected on 6/3/2021 from the Harmon Creek plant feed inlet and a 10% factor is applied for conservatism. An inlet sample analyzed in 2022, see appended, was lower in VOC than the 2021 sample. The residue gas and C2+ gas compositions are the annual average from GC readings.

<sup>b</sup> Stabilizer Overhead and CO2 compositions are modeled.

**Allie Juarez**  
**Marathon Petroleum**  
**G&P Engineer I**

4600 J Barry Court, Suite 500  
Canonsburg, PA 15317  
Phone: (412)815-8886  
Email: [ajuarez@marathonpetroleum.com](mailto:ajuarez@marathonpetroleum.com)

Quote Number: P22-0902-02  
Date: November 15th, 2022  
RE: NOx Reduction

Allie,

Please see the following proposal for NOx reduction with FGR for existing heater, per your request:

DELIVERABLES

FGR Blower  
Ducting  
Burner  
FGR control damper  
BMS re-programming to include FGR logic  
New burner mounting adapter plate  
Relevant Datasheets/Drawings

THM SCOPE

Equipment listed above, and re-programming for added control loop. Installation by others.

ADDITIONAL OPERATING COSTS (basis = \$0.12/kWh, \$3/MMBtu)

- FGR blower hp: \$3,919/yr.

GUARANTEED EMISSIONS @ 3.0% O<sub>2</sub>

- NOx: 9 ppmv
- CO: 49 ppmv
- VOC: 15 ppmv

Notes: The change in efficiency is negligible with this option. The burner end wall will need to be modified to accommodate the new burner. This option will take a slip stream of flue gases from the stack and run through a blower back into the burner. The flow will be controlled with an automated butterfly valve downstream of the blower. This will require the addition of another control loop in the BMS logic. This programming has been included in the pricing.

Price: \$220,000

Lead Time: 30 weeks



**Brandon Rutter**

Tulsa Heaters Midstream, LLC 1215 South Boulder, Ste 1040 Tulsa OK 74119  
Cell: 918-671-3985 [www.tulsaheatersmidstream.com](http://www.tulsaheatersmidstream.com)

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Quote is valid for 30 days

Freight by others or prepay and add

If you have any questions or comments, please feel free to contact me directly.

Best Regards,

Brandon Rutter  
Mechanical Engineer  
Tulsa Heaters Midstream, LLC