



Hiland Partners Holdings LLC
a Kinder Morgan company

1001 Louisiana Street, Suite 1000, Houston, Texas 77002

January 15, 2021

Electronic Submittal

Mr. Jim Semerad
Director of Air Quality
North Dakota Department of Environmental Quality
Division of Air Quality
918 E. Divide Ave, 2nd floor
Bismarck, ND 58501

Re: Updated PTE Site-Wide Emissions
Hiland Partners Holdings LLC
Alex Compressor Station
Permit to Operate PTO O13019
McKenzie County, North Dakota

Dear Mr. Semerad:

Hiland Partners Holdings LLC (Hiland) owns and operates the Alex Compressor Station authorized under Permit to Operate PTO O13019. Hiland is submitting the attached revised Potential to Emit (PTE) emission calculations based on findings discovered during an internal audit initiated June 22, 2020 and disclosed to the NDDEQ on December 18, 2020. The emission calculations update calculation methodologies for various sources and include existing sources previously not represented in the permit.

Hiland requests that PTO O13019 be updated to include the emission sources represented and establish federal enforceability.

Please contact me at 713-420-6314 or by email at brittany_brumley@kindermorgan.com if you have any questions or need additional information.

Sincerely,

Brittany Brumley
EHS Specialist
Enclosures



**Hiland Partners
Holdings LLC**
a Kinder Morgan company

**UPDATED POTENTIAL TO EMIT EMISSION
CALCULATIONS TO
AIR QUALITY
PERMIT TO OPERATE
NATURAL GAS COMPRESSOR STATION**

**Hiland Partners Holdings LLC
Alex Compressor Station
Permit to Operate PTO O13019
McKenzie County, North Dakota**

January 2021

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1.0 INTRODUCTION

1.1 Introduction

Hiland Partners Holdings LLC (Hiland) owns and operates the Alex Compressor Station (Alex CS) located in McKenzie County, North Dakota. The Alex CS is authorized under Permit to Operate PTO O13019. Hiland is submitting updated Potential to Emit (PTE) site-wide emissions at Alex CS based on an internal audit initiated June 22, 2020 and disclosed to the NDDEQ on December 18, 2020. Hiland requests that the permit be updated to include the emission sources represented and establish federal enforceability.

The following updates are being requested:

1. Increased the fuel heating value for combustion sources to reflect current fuel conditions.
2. Updated TEG Still Vent (EU8) emissions based on recent gas analysis and site specific information.
3. Updated Produced Water Tanks (EU2, EU3) emissions using ProMax process simulation and updated throughputs.
4. Addition of existing sources previously not represented in the permit:
 - a. Produced Water Truck Loading
 - b. Pigging
 - c. Compressor Blowdowns
 - d. NGL Truck Loading
 - e. Methanol Storage Tanks
 - f. Fugitives

Detailed information for the emission sources can be found in Section 2.0.

2.0 EMISSION SOURCES

2.1 Criteria Pollutant Emission Inventory

The criteria air pollutants that will be emitted are as follows: nitrogen oxides (NO_x), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}), sulfur dioxide (SO_2), volatile organic compounds (VOCs), and carbon monoxide (CO).

2.2 Glycol Dehydrator Emissions

Emissions from the dehydrator still vent were calculated using GRI-GLYCalc Version 4.0. The flash tank off-gas will be recycled. A condenser system is used to reduce the VOC emissions in the overhead stream from the reboiler with a control efficiency of 80%. Non-condensable gas from the condenser will be routed to the reboiler firebox with a destruction efficiency of 90%. The GRI-GLYCalc reports are found in Appendix A.

2.3 Produced Water Storage Tank Emissions

The station receives an oil/water mixture which is routed to a slug catcher. The slug catcher separates the oil fraction and water fraction. The oil fraction routes to the pressurized Natural Gas Liquids (NGL) tanks. The water fraction routes to the atmospheric produced water storage tanks. As part of the audit, Hiland obtained pressurized liquid samples from the slug catcher drain that routes to the produced water storage tanks. A liquid sample was obtained from Cedar Butte CS as representative site.

Using ProMax estimation software, working, breathing, and flashing losses were calculated for a tank with 15,000 bbls/year throughput. ProMax is a chemical process simulator that uses thermodynamic flash algorithms to determine flashing losses and follows AP-42 regulation to calculate working and breathing losses. Although historical throughput has been less than 15,000 bbls/year, a safety factor was applied to the total emissions. To be conservative, 1.0 TPY VOCs was chosen as the PTE per storage tank.

The ProMax simulation reports are found in Appendix B and the analyses are found in Appendix C. The analytical results show that Produced Water tanks contain primarily water (>99 % water).

2.4 Produced Water Truck Loading Emissions

The VOC emissions from tank truck loading were estimated using Equation 1 from EPA's AP-42 Section 2, 5th Edition, June 2008:

$$L = \frac{12.46 * S * P * M}{T}$$

where:

- L = Loading Losses, lb/1000 gallons
- S = Saturation Factor, see Table 5.2-1 in AP-42, Section 5.2.
- P = True vapor pressure, psia
- M = Molecular weight of vapors, lb/lb-mol
- T = Temperature of bulk liquid loaded, R (F + 460)

The contents being transported from the tanks will be mainly produced water. To be conservative, a 90% water content reduction has been taken on the total emissions.

2.5 Pigging Emissions

Gas lines are pigged to perform various maintenance activities on a pipeline. Emissions associated with pigging result from gaseous releases when the "pig" is loaded into a pig launcher or removed from a pig receiver.

The estimated MCF per event was calculated considering pig receiver/pig launcher volume, pressure, temperature, gas quality parameters, and gas compressibility. The estimated MCF per event was multiplied by lb/scf based on site specific gas analysis to calculate VOC emissions. To be conservative, pigging emissions are assumed to be 1.0 tpy of VOC.

2.6 Compressor Blowdown Emissions

At Hiland stations, compressor blowdowns are controlled manually. During the recycle process a pressure reduction valve is used to route compressor blowdowns directly into the suction header. Technicians manually open the valve during a blowdown event to route compressor discharge back to the suction header to be recycled back into the system. The discharge pressures range from 700 psig to 1250 psig. Technicians monitor a pressure gauge and when pressures reach 100 psig or lower the blowdown is vented to atmosphere. Emission calculations for compressor blowdowns assume the majority of compressor blowdowns occur at approximately 100 psig using this recycle design.

In certain instances the compressor blowdown must be vented directly to atmosphere. In these cases, there is a second compressor blowdown valve that a technician manually opens allowing the blowdown to vent directly to atmosphere.

Technicians monitor and document the number of blowdowns, discharge pressure and temperatures of each blowdown event.

The estimated MCF per event was calculated considering compressor volume, pressure, temperature, gas quality parameters, and gas compressibility. The estimated MCF per event was multiplied by lb/scf based on site specific gas analysis to calculate VOC emissions.

2.7 NGL Truck Loading Emissions

NGL truck loading emissions are conservatively estimated at 40,000 gallons/day. The calculation of depressurized volume assumes that any residual vapors in the loading arm at 1 psig and all vapors from the soft loading hose depressurize to atmospheric pressure.

2.8 Fugitives Emissions

Fugitive emissions are based on emission factors are from EPA's "Protocol for Equipment Leak Emission Estimates" EPA-453/R-95-017, 11/1995, Table 2-4. The total component count is based on estimated number of components for each compressor, tank, and TEG glycol dehydrator unit at the station.

2.9 HAP Emission Inventory

HAP emissions from natural gas combustion in the compressor engines (except formaldehyde) were estimated using data from AP-42 Tables. Formaldehyde emissions from compressor engines were estimated using emission factors from the manufacturer. HAP emissions from the TEG dehydrator still vent were calculated using GRI GlyCalc Version 4.0.

Potential HAP emissions will not exceed the major source thresholds of 10 tpy of any individual HAP or 25 tpy of any combination of HAPs.

3.0 EMISSION CALCULATIONS

Site specific Potential to Emit (PTE) emission calculations are included in this section.

Alex Compressor Station
Site Emissions Summary

Emission Unit #	Emission Unit Description	PM ₁₀ (tpy)	NO _x (tpy)	CO (tpy)	SO _x (tpy)	VOC (tpy)	HAPS (tpy)
EU1	Waukesha L7042GSI	1.39	14.29	28.58	0.04	10.15	0.77
EU2	Produced Water Tank - 400 bbl	--	--	--	--	1.00	--
EU3	Produced Water Tank - 400 bbl	--	--	--	--	1.00	--
EU4	Waukesha L7044GSI	1.32	16.22	16.22	0.04	11.52	0.76
EU5	Waukesha L7044GSI	1.32	16.22	16.22	0.04	11.52	0.76
EU6	Waukesha L7044GSI	1.32	16.22	16.22	0.04	11.52	0.76
EU7	TEG Reboiler (0.50 mmbtu/hr)	0.02	0.15	0.12	0.00	0.01	--
EU8	TEG Still Vent	--	--	--	--	0.98	0.57
NA	Produced Water Truck Loading	--	--	--	--	0.44	--
NA	Pigging	--	--	--	--	1.00	--
NA	Compressor Blowdowns	--	--	--	--	14.04	0.20
NA	Fugitive Emissions	--	--	--	--	4.20	0.07
NA	NGL Truck Loading	--	--	--	--	0.82	--
NA	Methanol Chemical Storage Tank	--	--	--	--	0.01	--
NA	Discharge Methanol Storage Tank	--	--	--	--	0.01	--
Total Sitewide Emissions:		5.36	63.11	77.37	0.16	68.21	3.88
Emissions <Title V Threshold?		Yes	Yes	Yes	Yes	Yes	Yes

Notes:

1. Pigging emissions are conservatively assumed to be 1.00 tpy of VOC.
2. Methanol storage tank emissions are conservatively assumed to be 0.01 tpy of VOC.
3. Minor sources are considered TEG Still Vent, Produced Water Tanks, Produced Water Truck Loading, Pigging, Compressor Blowdowns, and NGL Truck Loading.

Alex Compressor Station
Compressor Engine Emissions

Equipment Data:

Emission Unit (EU):	EU1
Emission Unit Name:	Waukesha L7042GSI
Engine Type:	4SRB

Emissions Data:

Fuel Usage = 95.525 MMscf/yr (Calculated value based on max fuel combustion rate)
 Horsepower = 1,480 bhp
 Speed = 1,200 rpm
 Hours of Operation = 8,760 hr/yr
 Max. Fuel Combustion Rate (HHV) = 11,052 Btu/bhp-hr
 Fuel Heating Value (HHV) = 1,500 MMbtu/MMscf
 Max. Heat Rate (HHV) = 16.36 MMbtu/hr

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
PM ₁₀	0.01941	lb/MMBtu	AP-42	0.32	1.39
NOx	1.0	g/bhp-hr	NSPS Subpart JJJJ	3.26	14.29
CO	2.0	g/bhp-hr	NSPS Subpart JJJJ	6.53	28.58
SOx	5.88E-04	lb/MMBtu	AP-42	<0.01	0.04
VOC	0.7	g/bhp-hr	NSPS Subpart JJJJ	2.32	10.15
Total HAPS			Engine Vendor/AP-42	0.18	0.77
Formaldehyde	0.010	g/bhp-hr	Engine Vendor	0.033	0.14
Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
CO ₂ e	--	--	--	1,900	8,324
GHG	--	--	--	1,803	7,897
CO ₂	110	lb/MMBtu	AP-42	1,799	7,881
CH ₄	0.23	lb/MMBtu	AP-42	3.76	16.48
N ₂ O	2.2	lb/MMscf	AP-42	0.02	0.11

Notes:

1. NO_x and VOC emissions based on 40 CFR 60 Subpart JJJJ standards. CO emissions based on data from the catalyst vendor indicating a post-catalyst emission rate of 1.0 g/hp-hr. Formaldehyde emissions are based on manufacturer data. PM/PM₁₀ and SO₂ emissions based on AP-42 Table 3.2-3.

1. Per AP-42, all particulate is considered to be less than 1.0 micrometer in diameter.
2. VOC emissions include formaldehyde.

Sample Calculation:

PM₁₀ Emissions (ton/yr) = (Emission Factor, lb/MMBtu) x (Max Heat Input Rate (HHV), MMBtu/hr) x (Hours of Operation, hr/yr) / (2,000 lb/ton)
 PM₁₀ Emissions (ton/yr) = (0.01941 lb/MMBtu) x (16.36 MMBtu/hr) x (8,760 hr/yr) / (2,000 lb/ton) = 1.39 ton/yr

VOC Emissions (ton/yr) = (Emission Factor, g/bhp-hr) x (Horsepower, bhp) x (Hours of Operation, hr/yr) / (2,000 lb/ton) / (453.59 grams/1 lb)
 VOC Emissions (ton/yr) = (0.7 g/bhp-hr) x (1480 bhp) x (8,760 hr/yr) / (2,000 lb/ton) / (453.59 g/lb) = 10.15 ton/yr

CO₂e Emissions (ton/yr) = (CO₂ emissions x 1) + (CH₄ emissions x 25) + (N₂O emissions x 298)
 CO₂e Emissions (ton/yr) = ((7880.78 ton/yr x 1) + (16.48 ton/yr x 25) + (0.11 ton/yr x 298)) = 8324.05 ton/yr

GHG Emissions (ton/yr) = (CO₂ emissions) + (CH₄ emissions) + (N₂O emissions)
 GHG Emissions (ton/yr) = (7880.78 ton/yr) + (16.48 ton/yr) + (0.11 ton/yr) = 7897.37 ton/yr

Alex Compressor Station
Compressor Engine HAP Emissions

Engines	Horsepower (hp)	Operating Hours	Heat Input (MMBtu/yr)	Fuel Input (MMscf/yr)
EU1	1,480	8,760	143,287	95.525

HAP	Emission Factor (lb/MMBtu)	Emission Factor (g/bhp-hr)	Control Efficiency (%)	Total Emissions (tpy)
1,3-Butadiene	6.63E-04	--	50	0.0237
Acetaldehyde	2.79E-03	--	50	0.0999
Acrolein	2.63E-03	--	50	0.09
Benzene	1.58E-03	--	50	0.0566
Formaldehyde	--	0.01	0	0.14
Methanol	3.06E-03	--	50	0.1096
Toluene	5.58E-04	--	50	0.0200
Cadmium	1.10E-03	--	50	0.0394
Chromium	1.40E-03	--	50	0.0502
Manganese	3.80E-04	--	50	0.0136
Nickel	2.10E-03	--	50	0.0752
Total HAP Emissions				0.77

1. Emission factors from AP-42 Table 3.2-3, Uncontrolled Emission Factors for 4-Stroke Rich-Burn Engines (July 2000) and AP-42 Table 1.4-4, Emission Factors for Metals from Natural Gas Combustion (July 1998).

2. Formaldehyde emission factor is from manufacturer's information.

3. Control efficiency is based on catalyst vendor specifications.

Alex Compressor Station
Engine Emissions

Equipment Data:

Emission Unit (EU):	EU4, EU5, EU6
Emission Unit Name:	Waukesha 7044GSI
Engine Type:	4SRB

Emissions Data:

Fuel Usage =	90.587 MMscf/yr (Calculated value based on max fuel combustion rate)
Horsepower =	1,680 bhp
Speed =	1,200 rpm
Hours of Operation =	8,760 hr/yr
Max. Fuel Combustion Rate (HHV) =	9,233 Btu/bhp-hr
Fuel Heating Value (HHV) =	1,500 MMBtu/MMscf
Max. Heat Rate (HHV) =	15.51 MMBtu/hr

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
PM ₁₀	0.01941	lb/MMBtu	AP-42	0.30	1.32
NOx	1.0	g/bhp-hr	NSPS Subpart JJJJ	3.70	16.22
CO	1.0	g/bhp-hr	Vendor Data	3.70	16.22
SOx	5.88E-04	lb/MMBtu	AP-42	0.01	0.04
VOC	0.7	g/bhp-hr	NSPS Subpart JJJJ	2.63	11.52
Total HAPs			Engine Vendor/AP-42	0.17	0.76
Formaldehyde	0.010	g/bhp-hr	Vendor Data	0.04	0.16

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
CO _{2e}	--	--	--	1,802	7,894
GHG	--	--	--	1,710	7,489
CO ₂	110	lb/MMBtu	AP-42	1,706	7,473
CH ₄	0.23	lb/MMBtu	AP-42	3.57	15.63
N ₂ O	2.2	lb/MMscf	AP-42	0.02	0.10

Notes:

1. NO_x and VOC emissions based on 40 CFR 60 Subpart JJJJ standards. CO emissions based on data from the catalyst vendor indicating a post-catalyst emission rate of 1.0 g/hp-hr. Formaldehyde emissions are based on manufacturer data. PM/PM₁₀ and SO₂ emissions based on AP-42 Table 3.2-3.
2. Per AP-42, all particulate is considered to be less than 1.0 micrometer in diameter.
3. VOC emissions include formaldehyde.

Sample Calculation:

PM ₁₀ Emissions (ton/yr) =	(Emission Factor, lb/MMBtu) x (Max Heat Input Rate (HHV), MMBtu/hr) x (Hours of Operation, hr/yr) / (2,000 lb/ton)
PM ₁₀ Emissions (ton/yr) =	(0.01941 lb/MMBtu) x (15.51 MMBtu/hr) x (8,760 hr/yr) / (2,000 lb/ton) = 1.32 ton/yr
VOC Emissions (ton/yr) =	(Emission Factor, g/bhp-hr) x (Horsepower, bhp) x (Hours of Operation, hr/yr) / (2,000 lb/ton) / (453.59 grams/1 lb)
VOC Emissions (ton/yr) =	(0.7 g/bhp-hr) x (1680 bhp) x (8,760 hr/yr) / (2,000 lb/ton) / (453.59 g/lb) = 11.52 ton/yr
CO _{2e} Emissions (ton/yr) =	(CO ₂ emissions x 1) + (CH ₄ emissions x 25) + (N ₂ O emissions x 298)
CO _{2e} Emissions (ton/yr) =	((7473.41 ton/yr x 1) + (15.63 ton/yr x 25) + (0.10 ton/yr x 298)) = 7893.76 ton/yr
GHG Emissions (ton/yr) =	(CO ₂ emissions) + (CH ₄ emissions) + (N ₂ O emissions)
GHG Emissions (ton/yr) =	(7473.41 ton/yr) + (15.63 ton/yr) + (0.10 ton/yr) = 7489.14 ton/yr

Alex Compressor Station
Compressor Engine HAP Emissions

Engines	Horsepower (hp)	Operating Hours	Heat Input (MMBtu/yr)	Fuel Input (MMscf/yr)
EU4, EU5, EU6	1,680	8,760	135,880	90.587

HAP	Emission Factor (lb/MMBtu)	Emission Factor (g/bhp-hr)	Control Efficiency (%)	Total Emissions (tpy)
1,3-Butadiene	6.63E-04	--	50	0.0225
Acetaldehyde	2.79E-03	--	50	0.0948
Acrolein	2.63E-03	--	50	0.09
Benzene	1.58E-03	--	50	0.0537
Formaldehyde	--	0.01	0	0.16
Methanol	3.06E-03	--	50	0.1039
Toluene	5.58E-04	--	50	0.0190
Cadmium	1.10E-03	--	50	0.0374
Chromium	1.40E-03	--	50	0.0476
Manganese	3.80E-04	--	50	0.0129
Nickel	2.10E-03	--	50	0.0713
Total HAP Emissions				0.76

1. Emission factors from AP-42 Table 3.2-3, Uncontrolled Emission Factors for 4-Stroke Rich-Burn Engines (July 2000) and AP-42 Table 1.4-4, Emission Factors for Metals from Natural Gas Combustion (July 1998).

2. Formaldehyde emission factor is from manufacturer's information.

3. Control efficiency is based on catalyst vendor specifications.

**Alex Compressor Station
Glycol Reboiler Emissions**

Equipment Data:

Emission Unit (EU):	EU2
Emission Unit Name:	TEG Reboiler
Rating:	0.5 MMBtu/hr

Emissions Data:

Maximum Fuel Usage =	2.92 MMscf/yr	(Calculated value based on max fuel combustion rate)
Maximum Fuel Usage =	0.0003 MMscf/hr	
Hours of Operation =	8,760 hr/yr	
design Heat Input Rate =	0.50 MMBtu/hr	
Fuel Heating Value (HHV) =	1,500 MMBtu/MMscf	
CO ₂ GWP (100 year) =	1	
CH ₄ GWP (100 year) =	25	
N ₂ O GWP (100 year) =	298	

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (ton/yr)
PM ₁₀	7.6	lb/MMscf	AP-42	0.004	0.02
NOx	100	lb/MMscf	AP-42	0.03	0.15
CO	84	lb/MMscf	AP-42	0.03	0.12
SOx	0.6	lb/MMscf	AP-42	0.0003	0.001
VOC	5.5	lb/MMscf	AP-42	0.003	0.01

Pollutant	Emission Factor	Units	Emission Factor Reference	Hourly Emissions (lb/hr)	Annual Emissions (tons/yr)
CO ₂ e	--	--	--	40.24	176.24
GHG	--	--	--	40.00	175.21
CO ₂	120,000	lb/MMscf	AP-42	40.00	175.20
CH ₄	2.3	lb/MMscf	AP-42	0.001	0.003
N ₂ O	2.2	lb/MMscf	AP-42	0.001	0.003

Notes:

1. Emission factors based on AP-42 Table 1.4-1 and Table 1.4-2. Per AP-42, all particulate is considered to be less than 1.0 micrometer in diameter.

Sample Calculation:

$$\begin{aligned} \text{Fuel Usage (MMscf/yr)} &= (\text{Design Heat Input Rate, MMBtu/hr}) / (\text{Fuel heating Value, MMBtu/MMscf}) * (\text{Hours of Operation, hr/yr}) \\ \text{Fuel Usage (MMscf/yr)} &= (0.5 \text{ MMBtu/hr}) / (1500 \text{ MMBtu/MMscf}) \times (8,760 \text{ hr/yr}) = 2.92 \text{ MMscf/yr} \end{aligned}$$

$$\begin{aligned} \text{PM}_{10} \text{ Emissions (lb/hr)} &= (\text{Emission Factor, lb/MMscf}) \times (\text{Fuel Heating Value, MMBtu/MMscf}) / (1,020 \text{ MMBtu/MMscf}) \times (\text{Fuel Usage, MMscf/yr}) / (\text{Hours of Operation, hr/yr}) \\ \text{PM}_{10} \text{ Emissions (lb/hr)} &= (7.6 \text{ lb/MMscf}) \times (1500 \text{ MMBtu/MMscf}) / (1,020 \text{ MMBtu/MMscf}) \times (7.6 \text{ MMscf/yr}) / (8760 \text{ hr/yr}) = 0.004 \text{ lb/hr} \end{aligned}$$

$$\begin{aligned} \text{PM}_{10} \text{ Emissions (ton/yr)} &= (\text{Hourly Emissions, lb/hr}) \times (8,760 \text{ hrs/yr}) / (2,000 \text{ lb/ton}) \\ \text{PM}_{10} \text{ Emissions (ton/yr)} &= (0.004 \text{ lb/hr}) \times (8760 \text{ hr/yr}) / (2000 \text{ lb/ton}) = 0.02 \text{ ton/yr} \end{aligned}$$

Alex Compressor Station
Glycol Still Vent Emissions

Equipment Data:

Emission Unit (EU):	EU8
Emission Unit Name:	TEG Dehydrator Still Vent

Emissions Data:

Wet Gas Pressure (psig)	1200
Wet Gas Temperature (°F)	100
Gas Throughput (mmscf/day)	20
Dry Gas Water Content (lb/H2O/mmscf)	7
Glycol Type =	TEG
Lean Glycol Water Content (wt% H2O)	1.5
Lean Glycol Flow Rate (gpm)	3.5
Glycol Pump Type	Pneumatic
Gas Injection Pump Ratio (acf m³/gpm glycol)	NA
Flash Tank Pressure (psig)	55
Flash Tank Temperature (°F)	180
Flash Tank Control	Recycle/Recomp.
Regen Controls	90% firebox

Pollutant	Uncontrolled		Control Efficiency		Controlled	
	Hourly Emissions		BTEX Condenser	Reboiler Firebox	Hourly Emissions	Annual Emissions
	lb/hr	tpy	%	%	lb/hr	tpy
-Propane	1.0539	4.6160	80%	90%	0.0211	0.0923
-Isobutane	0.2273	0.9954	80%	90%	0.0045	0.0199
-n-Butane	1.0002	4.3808	80%	90%	0.0200	0.0876
-Isopentane	0.2097	0.9166	80%	90%	0.0042	0.0184
-n-Pentane	0.4321	1.8927	80%	90%	0.0086	0.0379
-Cyclopentane	0.0645	0.2824	80%	90%	0.0013	0.0056
-n-Hexane	0.1985	0.8695	80%	90%	0.0040	0.0174
-Cyclohexane	0.6062	2.6551	80%	90%	0.0121	0.0531
-Other Hexanes	0.1854	0.8122	80%	90%	0.0037	0.0162
-Heptanes	0.4306	1.8858	80%	90%	0.0086	0.0377
-Methylcyclohexane	0.2362	1.0347	80%	90%	0.0047	0.0207
-2,2,4-Trimethylpentane	0.0067	0.0293	80%	90%	0.0001	0.0006
-Benzene	2.1917	9.5996	80%	90%	0.0438	0.1920
-Toluene	2.3231	10.1751	80%	90%	0.0465	0.2035
-Ethylbenzene	0.2458	1.0765	80%	90%	0.0049	0.0215
-Xylenes	1.5213	6.6632	80%	90%	0.0304	0.1333
-C8+ Heavies	0.2067	0.9055	80%	90%	0.0041	0.0181
Total VOC	11.1399	48.7924			0.2228	0.9758
Total HAPs	6.4871	28.4132			0.1297	0.5683
Total BTEX	6.2819	27.5144			0.1256	0.5503

Notes:

1. The flash tank off-gas will be recycled.
2. There is a JATCO condenser controlling the BTEX emissions with an 80% control efficiency.
3. The non-condensable gas from the condenser will be routed to the reboiler firebox. The efficiency of the firebox was assumed at 90%.

**Alex Compressor Station
Produced Water Storage Tank Emissions**

Equipment Data:

Emission Unit (EU):	EU2	EU3
Emission Unit Name:	Produced Water Storage Tank	Produced Water Storage Tank

Emissions Data:

Tank Contents Produced Water
 Tank Type VFR
 Tank Capacity = 16,800 gallons
 Annual Throughput = 15,000 bbl/year per tank
 Annual Throughput = 630,000 gallons/year per tank

Emission Unit	Standing Losses (lb/hr)	Working Losses (lb/hr)	Total Losses + 70% (lb/hr)	Standing Losses (ton/yr)	Working Losses (ton/yr)	Total Losses + 70% (ton/yr)
Produced Water Storage Tank	0.04	0.09	0.23	0.19	0.40	1.00
Produced Water Storage Tank	0.04	0.09	0.23	0.19	0.40	1.00

Notes:

1. Emissions calculated using ProMax model.
2. The liquid stored is essentially water. To be conservative, an additional 20 % safety factor was added to the emissions calculated via ProMax.

**Alex Compressor Station
Produced Water Truck Loading**

Parameter		
Product	Produced Water	
Saturation Factor, S ¹	0.6	
Vapor MW ²	62.00	lb/lb-mol
Maximum Vapor Pressure	10.06	psia
Average Vapor Pressure	7.93	psia
Max Temperature	78.28	°F
Average Temperature	64.9	°F
Short-Term Loading Loss Factor ^{4, 5}	8.67	lb/1000 gal
Annual Loading Loss Factor ^{4, 5}	7.01	lb/1000 gal
Hourly Throughput	7,560	gal/hr
Annual Throughput	1,260,000	gal/yr
Water Content Reduction (%) ⁷	90%	
Fugitive Losses		
Hourly Losses	65.52	lb/hr
Annual Losses	4.41	tpy
Hourly Losses (minus water)	6.55	lb/hr
Annual Losses (minus water)	0.44	tpy

Notes:

1. Saturation factor is from EPA's AP-42, 5th Edition, Section 5.2, Table 5.2-1; for submerged loading; dedicated normal service.
2. Molecular weight of vapors was taken from Tanks 4.09d.
3. Vapor pressure was determined using AP-42, Figure 7.1-13b.
4. Losses are based on the loading losses equation from EPA's AP-42, Section 2, 5th Edition, June, 2008, Equation 1:

$$L = \frac{12.46 * S * P * M}{T}$$

where:

L = Loading Losses, lb/1000 gallons

S = Saturation Factor, see Table 5.2-1 in AP-42, Section 5.2.

P = True vapor pressure, psia

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

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

5. Short-term loading loss factor is calculated based on the worst-case (highest) temperature and vapor pressure.
6. Annual loading loss factor is calculated based on the average temperature and vapor pressure.
7. The volume of liquids loaded are estimated to be 90% water; therefore, overall fugitive losses from loading are assumed to be 10% of the total emissions.

Alex Compressor Station
Compressor Blowdown Emissions

Emission Unit	Designation	Compressor Volume	Compressor Pressure	Number of Events ¹	Gas VOC Weight %	Gas MW	Average Gas Temperature	Estimated MCF per event	Estimated SCF per event	Estimated SCF per year	Estimated VOC Emissions		
		(ft ³)	(psig)	(#/ per Year)	(%)	(lb/lb-mol)	(°F)				lb/scf	lb/year	tons per year
Controlled Emissions													
EU1, EU4-6 ²	Compressor	197.00	100	450	32.9	24.9	62	1.58	1580	711000	0.022	15341	7.67
EU1, EU4-6 ³	Compressor	197.00	1,000	24	32.9	24.9	62	24.6	24600	590400	0.022	12739	6.37
												Total VOC Controlled Emissions	14.04

Notes:

1. To be conservative, a 20% buffer is added to the total number of controlled blowdown events.
2. Assumes the majority of blowdowns are using the recycle process of reducing the pressure to 100 psig.
3. Assumes 24 blowdowns/year released to atmosphere.

Calculation:

Pound "X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.5 scf

Emissions (tpy) = (Estimated scf/event * number of events per year * lb/scf)/2000 (lb/ton)

Component	MW (g/mol)	Mol%	Gas Weight (lb/lbmol)	Wt %
CO2	44.010	1.007	0.4432	1.78%
Nitrogen	28.013	1.876	0.5255	2.11%
methane (C1)	16.042	63.034	10.1122	40.68%
ethane (C2)	30.069	18.596	5.5916	22.49%
propane (C3)	44.096	8.823	3.8906	15.65%
iso-butane (C4)	58.122	1.039	0.6039	2.43%
nor-butane (C4)	58.122	3.098	1.8006	7.24%
iso-pentane (C5)	72.149	0.626	0.4517	1.82%
nor-pentane (C5)	72.149	0.936	0.6753	2.72%
hexanes (C6+)	86.180	0.3730	0.3215	1.29%
heptane (C7+)	100.200	0.247	0.2475	1.00%
octane (C8+)	114.230	0.056	0.0640	0.26%
nonane (C9+)	128.260	0.003	0.0038	0.02%
decane (C10+)	142.290	0.007	0.0100	0.04%
benzene	78.110	0.027	0.0211	0.08%
toluene	92.140	0.022	0.0203	0.08%
Ethylbenzene	106.170	0.002	0.0021	0.01%
xylenes (M, P, O)	106.170	0.009	0.0096	0.04%
n-hexane	86.180	0.077	0.0664	0.27%
H2S	34.082	0.0000	0.0000	0.00%
Total	99.8580	24.8607	1.0000	
Vapor MW (lb/lb-mol)	24.8607			
VOC Weight (%)	32.9361		0.3294	

Emissions (tpy)
0.76
0.90
17.34
9.59
6.67
1.04
3.09
0.77
1.16
0.55
0.42
0.11
0.01
0.02
0.04
0.03
0.00
0.02
0.11
0.00
42.63
Total
14.04
VOC Total
0.20
HAPs Total

Alex Compressor Station
Pigging Blowdown Emissions

Pig Launcher/Pig Receiver	# of Pig Launchers/Receivers	Pigging Volume (ft ³)	Pig Receiver or Launcher Pressure (psig)	Number of Events (#/ per Year)	Gas VOC Weight % (%)	Gas MW (lb/lb-mol)	Average Gas Temperature (°F)	Estimated MCF per event	Estimated SCF per event	Estimated SCF per year	Potential VOC Emissions		
											lb/scf	lb/year	(tpy)
LP Receivers	4	10.47	250	208	32.94	24.86	60	0.2	200	41600	0.022	898	0.45
LP Launchers	1	10.38	250	52	32.94	24.86	60	0.2	200	10400	0.022	224	0.11
HP Launchers	1	7.07	1200	12	32.94	24.86	60	1.02	1020	12240	0.022	264	0.13
											Total Losses	0.69	

Notes:

1. Assume 12 events per year for each high pressure (HP) launcher/receiver and 52 events per year for each low pressure (LP) launcher/receiver.

VOC weight percentage is from 2019 Inlet Gas Analysis.

Molecular Weight of G 24.8607 approx

VOC Weight Percent : 0.329361 approx

Universal Gas Content = 379.5 ft³/lb-mol @ 60 F and 14.696 psia

Calculation:

Pound " X"/ scf = Wt Fraction (wt%) * MW of Gas * 1 lb mol/379.5 scf

Ibs NM/E VOC/scf = 0.02157614

Estimated MCF per event from using Blowdown Volumes Compressibility Spreadsheet

Emissions (tpy) = (Estimated scf/event * number of events per year * lb/scf)/2000 (lb/ton)

Alex Compressor Station
Fugitive Emissions

Component Type	Service	Emission Factor ¹ (lb/hr/comp)	Component Count	Total Loss (lb/hr)	Total Loss (tpy)
Valves	Gas/Vapor	0.00992	73	0.72	3.17
	Light Liquid	0.0055	29	0.16	0.70
Pumps	Gas Vapor	0.00529	0	0.00	0.00
	Light Liquid	0.02866	1	0.03	0.13
Flanges²	Gas/Vapor	0.00086	1311	1.13	4.94
	Light Liquid	0.000243	60	0.01	0.06
Connectors	Gas/Vapor	0.00044	0	0.00	0.00
	Light Liquid	0.000463	0	0.00	0.00
Open Ended Lines	Gas/Vapor	0.00441	0	0.00	0.00
	Light Liquid	0.00309	0	0.00	0.00
Other³	Gas/Vapor	0.0194	0	0.00	0.00
	Light Liquid	0.0165	0	0.00	0.00
Compressors	Gas/Vapor	0.0194	4	0.08	0.34
	Light Liquid	0.0165	0	0.00	0.00
Component Emission Total Losses				2.13	9.34
Gas/Vapor Emissions				1.93	8.45
Light Liquid Emissions				0.20	0.89

Component	Gas (wt%)	Gas/Vapor Emissions		Total Emissions⁴	
		(lb/hr)	(tpy)	(lb/hr)	(tpy)
CO ₂	1.237	0.024	0.104	0.024	0.104
Nitrogen	1.785	0.034	0.151	0.034	0.151
H ₂ S	0.000	0.00E+00	0.00E+00	0.000	0.000
Methane	34.835	0.672	2.944	0.672	2.944
Ethane	22.920	0.442	1.937	0.442	1.937
Propane	18.281	0.353	1.545	0.353	1.545
i-Butane	3.052	0.059	0.258	0.059	0.258
n-Butane	9.189	0.177	0.777	0.177	0.777
i-Pentane	2.250	0.043	0.190	0.043	0.190
n-Pentane	3.292	0.064	0.278	0.064	0.278
Benzene	0.071	0.001	0.006	0.001	0.006
n-Hexane	0.678	0.013	0.057	0.013	0.057
Hexanes	1.131	0.022	0.096	0.022	0.096
Toluene	0.066	0.001	0.006	0.001	0.006
Heptanes	0.833	0.016	0.070	0.016	0.070
Ethylbenzene	0.016	0.000	0.001	0.000	0.001
Xylenes	0.048	0.001	0.004	0.001	0.004
Octanes	0.271	0.005	0.023	0.005	0.023
Nonanes	0.019	0.000	0.002	0.000	0.002
C10+	0.027	0.001	0.002	0.001	0.002
Total	100.000	1.929	8.450	1.929	8.450
Total VOC	39.224	0.757	3.314	0.959	4.202
Total HAPs	0.878	0.017	0.074	0.017	0.074

Notes:

1. Emission factors are from EPA's "Protocol for Equipment Leak Emission Estimates" EPA-453/R-95-017, 11/1995, Table 2-4.
2. Maintenance Plugs & Blind Flanges are treated as screwed connectors. Per TCEQ's "Air Permit Technical Guidance for Chemical Sources: Equipment Leak Fugitives" dated October 2000, screwed fittings should be estimated as flanges.
3. For Oil and Gas Production Operations, "Other" includes compressors, diaphragms, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves, and vents.
4. The total emissions include the light liquid emissions assuming 100% VOC of light liquid.

**Alex Compressor Station
NGL Truck Loading Emissions**

Emissions Data:

Emission Unit (EU):	NA
Expected Max NGL Daily Volume =	40,000 gal/day
Expected Max NGL Annual Volume =	14,600,000 gal/yr
Average Tank Truck Capacity =	9,000 gal

Loading Arm Diameter	Soft Hose Length	Loading Arm Pipe Length	Loading Arm Overpressure	Depressurized Volume
(in)	(ft)	(ft)	(psig)	(ft³/truck)
4	6	10	1	0.62

Product Transferred	Vapor Molecular Weight	Vapor Pressure at 60°F	Unloading Emissions	VOC Content	Loading VOC Emissions	Loading VOC Emissions
	(lb/lb-mole)	(psia)	(lb/truck)	wt. %	(lb/truck)	(tpy)
Y-Grade	56	164	1.01	100%	1.01	0.82

Notes:

1. The calculation of depressurized volume assumes that any residual vapors in the loading arm at 1 psig and all vapors from the soft loading hose depressurize to atmospheric pressure.

Number of Trucks (#/yr) = Expected Max NGL Volume (gal/yr) /Avg Tank Truck capacity (gal)

Number of Trucks (#/yr) = 1,623 per year

Emissions (lb/truck) = Depr. Vol (ft³/truck)/St. Pressure (psia) * TVP (psia) / Gas Constant (scf/lb-mole) * MW (lb/lbmole)

Emissions (lb/truck) = 1.01 lb/truck

Emissions (tpy) = Number of Trucks x Emissions (lb/truck) / 2000 lb/ton

Emissions (tpy) = 0.82 tpy

APPENDIX A: GRI-GLYCalc REPORTS

GRI-GLYCalc VERSION 4.0 - SUMMARY OF INPUT VALUES

Case Name: Alex CS

File Name: \\houdata2\l\EHS\AIR\States\ND\General\2020 Audit\Glycol Dehydrators\South System\Alex CS\Alex Dehy Run.ddf

Date: January 05, 2021

DESCRIPTION:

Description: Glycol Dehy EU7

Annual Hours of Operation: 8760.0 hours/yr

WET GAS:

Temperature: 100.00 deg. F

Pressure: 1200.00 psig

Wet Gas Water Content: Saturated

Component	Conc.
	(vol %)

Carbon Dioxide 1.0070

Nitrogen 1.8760

Methane 63.0340

Ethane 18.5960

Propane 8.8230

Isobutane 1.0390

n-Butane 3.0980

Isopentane 0.6260

n-Pentane 0.9200

Cyclopentane 0.0160

n-Hexane 0.2190

Cyclohexane 0.0830

Other Hexanes 0.2900

Heptanes 0.2160

Methylcyclohexane 0.0310

2,2,4-Trimethylpentane 0.0100

Benzene 0.0270

Toluene 0.0220

Ethylbenzene 0.0020

Xylenes 0.0090

C8+ Heavies 0.0560

DRY GAS:

Flow Rate: 20.0 MMSCF/day

Water Content: 7.0 lbs. H₂O/MMSCF

LEAN GLYCOL:

Glycol Type: TEG
Water Content: 1.5 wt% H₂O
Flow Rate: 3.5 gpm

PUMP:

Glycol Pump Type: Electric/Pneumatic

FLASH TANK:

Flash Control: Recycle/recompression
Temperature: 180.0 deg. F
Pressure: 55.0 psig

GRI-GLYCalc VERSION 4.0 - AGGREGATE CALCULATIONS REPORT

Case Name: Alex CS

File Name: \\houdata2v\EHS\AIR\States\ND\General\2020 Audit\Glycol Dehydrators\South System\Alex CS\Alex Dehy Run.ddf

Date: January 05, 2021

DESCRIPTION:

Description: Glycol Dehy EU7

Annual Hours of Operation: 8760.0 hours/yr

EMISSIONS REPORTS:

UNCONTROLLED REGENERATOR EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.2094	5.026	0.9173
Ethane	0.7259	17.422	3.1795
Propane	1.0541	25.298	4.6169
Isobutane	0.2273	5.456	0.9956
n-Butane	1.0004	24.009	4.3817
Isopentane	0.2098	5.035	0.9188
n-Pentane	0.4322	10.373	1.8931
Cyclopentane	0.0645	1.548	0.2825
n-Hexane	0.1986	4.766	0.8697
Cyclohexane	0.6063	14.551	2.6556
Other Hexanes	0.1855	4.451	0.8124
Heptanes	0.4306	10.335	1.8862
Methylcyclohexane	0.2363	5.671	1.0349
2,2,4-Trimethylpentane	0.0067	0.160	0.0293
Benzene	2.1921	52.611	9.6015
Toluene	2.3235	55.765	10.1771
Ethylbenzene	0.2458	5.900	1.0767
Xylenes	1.5216	36.518	6.6645
C8+ Heavies	0.2068	4.963	0.9057
Total Emissions	12.0774	289.858	52.8991
Total Hydrocarbon Emissions	12.0774	289.858	52.8991
Total VOC Emissions	11.1421	267.410	48.8023
Total HAP Emissions	6.4883	155.720	28.4189
Total BTEX Emissions	6.2831	150.794	27.5199

FLASH GAS EMISSIONS

Note: Flash Gas Emissions are zero with the
Recycle/recompression control option.

FLASH TANK OFF GAS

Component	lbs/hr	lbs/day	tons/yr
Methane	5.4009	129.622	23.6559
Ethane	6.2491	149.978	27.3711
Propane	4.5767	109.841	20.0459
Isobutane	0.7325	17.580	3.2083
n-Butane	2.5919	62.206	11.3526
Isopentane	0.5176	12.422	2.2671
n-Pentane	0.8907	21.378	3.9014
Cyclopentane	0.0343	0.823	0.1502
n-Hexane	0.2558	6.140	1.1205
Cyclohexane	0.2021	4.850	0.8852
Other Hexanes	0.3042	7.301	1.3325
Heptanes	0.3073	7.375	1.3459
Methylcyclohexane	0.0670	1.609	0.2936
2,2,4-Trimethylpentane	0.0089	0.214	0.0391
Benzene	0.1299	3.117	0.5689
Toluene	0.1001	2.402	0.4383
Ethylbenzene	0.0068	0.164	0.0299
Xylenes	0.0306	0.733	0.1339
C8+ Heavies	0.1061	2.547	0.4648
Total Emissions	22.5126	540.301	98.6050
Total Hydrocarbon Emissions	22.5126	540.301	98.6050
Total VOC Emissions	10.8626	260.701	47.5780
Total HAP Emissions	0.5321	12.770	2.3306
Total BTEX Emissions	0.2673	6.416	1.1710

COMBINED REGENERATOR VENT/FLASH GAS EMISSIONS

Component	lbs/hr	lbs/day	tons/yr
Methane	0.2094	5.026	0.9173
Ethane	0.7259	17.422	3.1795
Propane	1.0541	25.298	4.6169
Isobutane	0.2273	5.456	0.9956
n-Butane	1.0004	24.009	4.3817
Isopentane	0.2098	5.035	0.9188
n-Pentane	0.4322	10.373	1.8931
Cyclopentane	0.0645	1.548	0.2825
n-Hexane	0.1986	4.766	0.8697

Cyclohexane	0.6063	14.551	2.6556
Other Hexanes	0.1855	4.451	0.8124
Heptanes	0.4306	10.335	1.8862
Methylcyclohexane	0.2363	5.671	1.0349
2,2,4-Trimethylpentane	0.0067	0.160	0.0293
Benzene	2.1921	52.611	9.6015
Toluene	2.3235	55.765	10.1771
Ethylbenzene	0.2458	5.900	1.0767
Xylenes	1.5216	36.518	6.6645
C8+ Heavies	0.2068	4.963	0.9057
Total Emissions	12.0774	289.858	52.8991
Total Hydrocarbon Emissions	12.0774	289.858	52.8991
Total VOC Emissions	11.1421	267.410	48.8023
Total HAP Emissions	6.4883	155.720	28.4189
Total BTEX Emissions	6.2831	150.794	27.5199

COMBINED REGENERATOR VENT/FLASH GAS EMISSION CONTROL REPORT:

Component	Uncontrolled tons/yr	Controlled tons/yr	% Reduction
Methane	24.5733	0.9173	96.27
Ethane	30.5505	3.1795	89.59
Propane	24.6628	4.6169	81.28
Isobutane	4.2039	0.9956	76.32
n-Butane	15.7344	4.3817	72.15
Isopentane	3.1859	0.9188	71.16
n-Pentane	5.7946	1.8931	67.33
Cyclopentane	0.4326	0.2825	34.71
n-Hexane	1.9902	0.8697	56.30
Cyclohexane	3.5408	2.6556	25.00
Other Hexanes	2.1449	0.8124	62.12
Heptanes	3.2321	1.8862	41.64
Methylcyclohexane	1.3285	1.0349	22.10
2,2,4-Trimethylpentane	0.0684	0.0293	57.19
Benzene	10.1704	9.6015	5.59
Toluene	10.6154	10.1771	4.13
Ethylbenzene	1.1066	1.0767	2.70
Xylenes	6.7984	6.6645	1.97
C8+ Heavies	1.3705	0.9057	33.91
Total Emissions	151.5041	52.8991	65.08
Total Hydrocarbon Emissions	151.5041	52.8991	65.08
Total VOC Emissions	96.3803	48.8023	49.36
Total HAP Emissions	30.7494	28.4189	7.58

EQUIPMENT REPORTS:**ABSORBER**

NOTE: Because the Calculated Absorber Stages was below the minimum allowed, GRI-GLYCalc has set the number of Absorber Stages to 1.25 and has calculated a revised Dry Gas Dew Point.

Calculated Absorber Stages: 1.25
 Calculated Dry Gas Dew Point: 2.83 lbs. H₂O/MMSCF

Temperature: 100.0 deg. F

Pressure: 1200.0 psig

Dry Gas Flow Rate: 20.0000 MMSCF/day

Glycol Losses with Dry Gas: 2.8065 lb/hr

Wet Gas Water Content: Saturated

Calculated Wet Gas Water Content: 52.24 lbs. H₂O/MMSCF

Calculated Lean Glycol Recirc. Ratio: 5.10 gal/lb H₂O

Component	Remaining in Dry Gas	Absorbed in Glycol
-----------	----------------------	--------------------

Water	5.40%	94.60%
Carbon Dioxide	99.72%	0.28%
Nitrogen	99.97%	0.03%
Methane	99.97%	0.03%
Ethane	99.94%	0.06%
Propane	99.93%	0.07%
Isobutane	99.93%	0.07%
n-Butane	99.91%	0.09%
Isopentane	99.93%	0.07%
n-Pentane	99.91%	0.09%
Cyclopentane	99.60%	0.40%
n-Hexane	99.89%	0.11%
Cyclohexane	99.47%	0.53%
Other Hexanes	99.91%	0.09%
Heptanes	99.84%	0.16%
Methylcyclohexane	99.55%	0.45%
2,2,4-Trimethylpentane	99.94%	0.06%
Benzene	94.99%	5.01%
Toluene	94.56%	5.44%
Ethylbenzene	94.58%	5.42%
Xylenes	92.60%	7.40%

FLASH TANK

Flash Control: Recycle/recompression
 Flash Temperature: 180.0 deg. F
 Flash Pressure: 55.0 psig

Component	Left in Glycol	Removed in Flash Gas
Water	99.80%	0.20%
Carbon Dioxide	24.39%	75.61%
Nitrogen	3.65%	96.35%
Methane	3.73%	96.27%
Ethane	10.41%	89.59%
Propane	18.72%	81.28%
Isobutane	23.68%	76.32%
n-Butane	27.85%	72.15%
Isopentane	29.20%	70.80%
n-Pentane	33.01%	66.99%
Cyclopentane	65.47%	34.53%
n-Hexane	43.98%	56.02%
Cyclohexane	75.80%	24.20%
Other Hexanes	38.50%	61.50%
Heptanes	58.57%	41.43%
Methylcyclohexane	78.78%	21.22%
2,2,4-Trimethylpentane	43.67%	56.33%
Benzene	94.69%	5.31%
Toluene	96.20%	3.80%
Ethylbenzene	97.58%	2.42%
Xylenes	98.29%	1.71%
C8+ Heavies	70.16%	29.84%

REGENERATOR

No Stripping Gas used in regenerator.

Component	Remaining in Glycol	Distilled Overhead
Water	41.82%	58.18%
Carbon Dioxide	0.00%	100.00%
Nitrogen	0.00%	100.00%
Methane	0.00%	100.00%
Ethane	0.00%	100.00%

Propane	0.00%	100.00%
Isobutane	0.00%	100.00%
n-Butane	0.00%	100.00%
Isopentane	1.71%	98.29%
n-Pentane	1.51%	98.49%
Cyclopentane	0.76%	99.24%
n-Hexane	1.14%	98.86%
Cyclohexane	4.22%	95.78%
Other Hexanes	2.60%	97.40%
Heptanes	0.85%	99.15%
Methylcyclohexane	5.08%	94.92%
2,2,4-Trimethylpentane	3.43%	96.57%
Benzene	5.28%	94.72%
Toluene	8.22%	91.78%
Ethylbenzene	10.67%	89.33%
Xylenes	13.17%	86.83%
C8+ Heavies	17.11%	82.89%

STREAM REPORTS:

WET GAS STREAM

Temperature: 100.00 deg. F

Pressure: 1214.70 psia

Flow Rate: 8.35e+005 scfh

Component	Conc.	Loading
	(vol%)	(lb/hr)
Water	1.10e-001	4.36e+001
Carbon Dioxide	1.01e+000	9.74e+002
Nitrogen	1.87e+000	1.15e+003
Methane	6.30e+001	2.22e+004
Ethane	1.86e+001	1.23e+004
Propane	8.81e+000	8.55e+003
Isobutane	1.04e+000	1.33e+003
n-Butane	3.09e+000	3.96e+003
Isopentane	6.25e-001	9.92e+002
n-Pentane	9.19e-001	1.46e+003
Cyclopentane	1.60e-002	2.47e+001
n-Hexane	2.19e-001	4.15e+002
Cyclohexane	8.29e-002	1.53e+002
Other Hexanes	2.90e-001	5.49e+002
Heptanes	2.16e-001	4.76e+002
Methylcyclohexane	3.10e-002	6.69e+001

2,2,4-Trimethylpentane 9.99e-003 2.51e+001
 Benzene 2.70e-002 4.63e+001
 Toluene 2.20e-002 4.45e+001
 Ethylbenzene 2.00e-003 4.67e+000
 Xylenes 8.99e-003 2.10e+001
 C8+ Heavies 5.59e-002 2.10e+002

Total Components 100.00 5.50e+004

DRY GAS STREAM

Temperature: 100.00 deg. F
 Pressure: 1214.70 psia
 Flow Rate: 8.33e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	5.96e-003	2.36e+000
Carbon Dioxide	1.00e+000	9.71e+002
Nitrogen	1.88e+000	1.15e+003
Methane	6.30e+001	2.22e+004
Ethane	1.86e+001	1.23e+004
Propane	8.82e+000	8.54e+003
Isobutane	1.04e+000	1.33e+003
n-Butane	3.10e+000	3.95e+003
Isopentane	6.26e-001	9.92e+002
n-Pentane	9.20e-001	1.46e+003
Cyclopentane	1.59e-002	2.46e+001
n-Hexane	2.19e-001	4.14e+002
Cyclohexane	8.26e-002	1.53e+002
Other Hexanes	2.90e-001	5.49e+002
Heptanes	2.16e-001	4.75e+002
Methylcyclohexane	3.09e-002	6.66e+001
2,2,4-Trimethylpentane	1.00e-002	2.51e+001
Benzene	2.57e-002	4.40e+001
Toluene	2.08e-002	4.21e+001
Ethylbenzene	1.89e-003	4.41e+000
Xylenes	8.34e-003	1.94e+001
C8+ Heavies	5.59e-002	2.09e+002
Total Components	100.00	5.49e+004

LEAN GLYCOL STREAM

Temperature: 100.00 deg. F
 Flow Rate: 3.50e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.85e+001	1.94e+003
Water	1.50e+000	2.95e+001
Carbon Dioxide	1.40e-011	2.76e-010
Nitrogen	1.97e-012	3.88e-011
Methane	9.57e-018	1.88e-016
Ethane	1.67e-007	3.29e-006
Propane	1.16e-008	2.29e-007
Isobutane	1.46e-009	2.88e-008
n-Butane	4.52e-009	8.91e-008
Isopentane	1.86e-004	3.65e-003
n-Pentane	3.38e-004	6.65e-003
Cyclopentane	2.52e-005	4.96e-004
n-Hexane	1.16e-004	2.28e-003
Cyclohexane	1.36e-003	2.67e-002
Other Hexanes	2.51e-004	4.95e-003
Heptanes	1.88e-004	3.71e-003
Methylcyclohexane	6.42e-004	1.26e-002
2,2,4-Trimethylpentane	1.21e-005	2.38e-004
Benzene	6.21e-003	1.22e-001
Toluene	1.06e-002	2.08e-001
Ethylbenzene	1.49e-003	2.94e-002
Xylenes	1.17e-002	2.31e-001
C8+ Heavies	2.17e-003	4.27e-002
Total Components	100.00	1.97e+003

RICH GLYCOL STREAM

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.47e+001	1.94e+003
Water	3.46e+000	7.08e+001
Carbon Dioxide	1.35e-001	2.76e+000
Nitrogen	1.90e-002	3.88e-001
Methane	2.74e-001	5.61e+000
Ethane	3.41e-001	6.97e+000
Propane	2.75e-001	5.63e+000
Isobutane	4.69e-002	9.60e-001
n-Butane	1.75e-001	3.59e+000
Isopentane	3.57e-002	7.31e-001

n-Pentane	6.49e-002	1.33e+000
Cyclopentane	4.85e-003	9.93e-002
n-Hexane	2.23e-002	4.57e-001
Cyclohexane	4.08e-002	8.35e-001
Other Hexanes	2.42e-002	4.95e-001
Heptanes	3.62e-002	7.42e-001
Methylcyclohexane	1.54e-002	3.16e-001
2,2,4-Trimethylpentane	7.74e-004	1.58e-002
Benzene	1.19e-001	2.44e+000
Toluene	1.28e-001	2.63e+000
Ethylbenzene	1.38e-002	2.82e-001
Xylenes	8.71e-002	1.78e+000
C8+ Heavies	1.74e-002	3.56e-001
Total Components	100.00	2.05e+003

FLASH TANK OFF GAS STREAM

Temperature: 180.00 deg. F

Pressure: 69.70 psia

Flow Rate: 3.08e+002 scfh

Component	Conc.	Loading
(vol%)	(lb/hr)	
Water	9.79e-001	1.43e-001
Carbon Dioxide	5.85e+000	2.09e+000
Nitrogen	1.65e+000	3.74e-001
Methane	4.15e+001	5.40e+000
Ethane	2.56e+001	6.25e+000
Propane	1.28e+001	4.58e+000
Isobutane	1.55e+000	7.32e-001
n-Butane	5.50e+000	2.59e+000
Isopentane	8.85e-001	5.18e-001
n-Pentane	1.52e+000	8.91e-001
Cyclopentane	6.03e-002	3.43e-002
n-Hexane	3.66e-001	2.56e-001
Cyclohexane	2.96e-001	2.02e-001
Other Hexanes	4.35e-001	3.04e-001
Heptanes	3.78e-001	3.07e-001
Methylcyclohexane	8.42e-002	6.70e-002
2,2,4-Trimethylpentane	9.64e-003	8.93e-003
Benzene	2.05e-001	1.30e-001
Toluene	1.34e-001	1.00e-001
Ethylbenzene	7.94e-003	6.83e-003
Xylenes	3.55e-002	3.06e-002
C8+ Heavies	7.68e-002	1.06e-001
Total Components	100.00	2.51e+001

FLASH TANK GLYCOL STREAM

Temperature: 180.00 deg. F

Flow Rate: 3.61e+000 gpm

Component	Conc. (wt%)	Loading (lb/hr)
TEG	9.58e+001	1.94e+003
Water	3.49e+000	7.07e+001
Carbon Dioxide	3.33e-002	6.73e-001
Nitrogen	7.00e-004	1.42e-002
Methane	1.04e-002	2.09e-001
Ethane	3.59e-002	7.26e-001
Propane	5.21e-002	1.05e+000
Isobutane	1.12e-002	2.27e-001
n-Butane	4.95e-002	1.00e+000
Isopentane	1.06e-002	2.13e-001
n-Pentane	2.17e-002	4.39e-001
Cyclopentane	3.21e-003	6.50e-002
n-Hexane	9.93e-003	2.01e-001
Cyclohexane	3.13e-002	6.33e-001
Other Hexanes	9.41e-003	1.90e-001
Heptanes	2.15e-002	4.34e-001
Methylcyclohexane	1.23e-002	2.49e-001
2,2,4-Trimethylpentane	3.42e-004	6.92e-003
Benzene	1.14e-001	2.31e+000
Toluene	1.25e-001	2.53e+000
Ethylbenzene	1.36e-002	2.75e-001
Xylenes	8.66e-002	1.75e+000
C8+ Heavies	1.23e-002	2.49e-001
Total Components	100.00	2.02e+003

FLASH GAS EMISSIONS

Control Method: Recycle/recompression

Control Efficiency: 100.00

Note: Flash Gas Emissions are zero with the
Recycle/recompression control option.

REGENERATOR OVERHEADS STREAM

Temperature: 212.00 deg. F

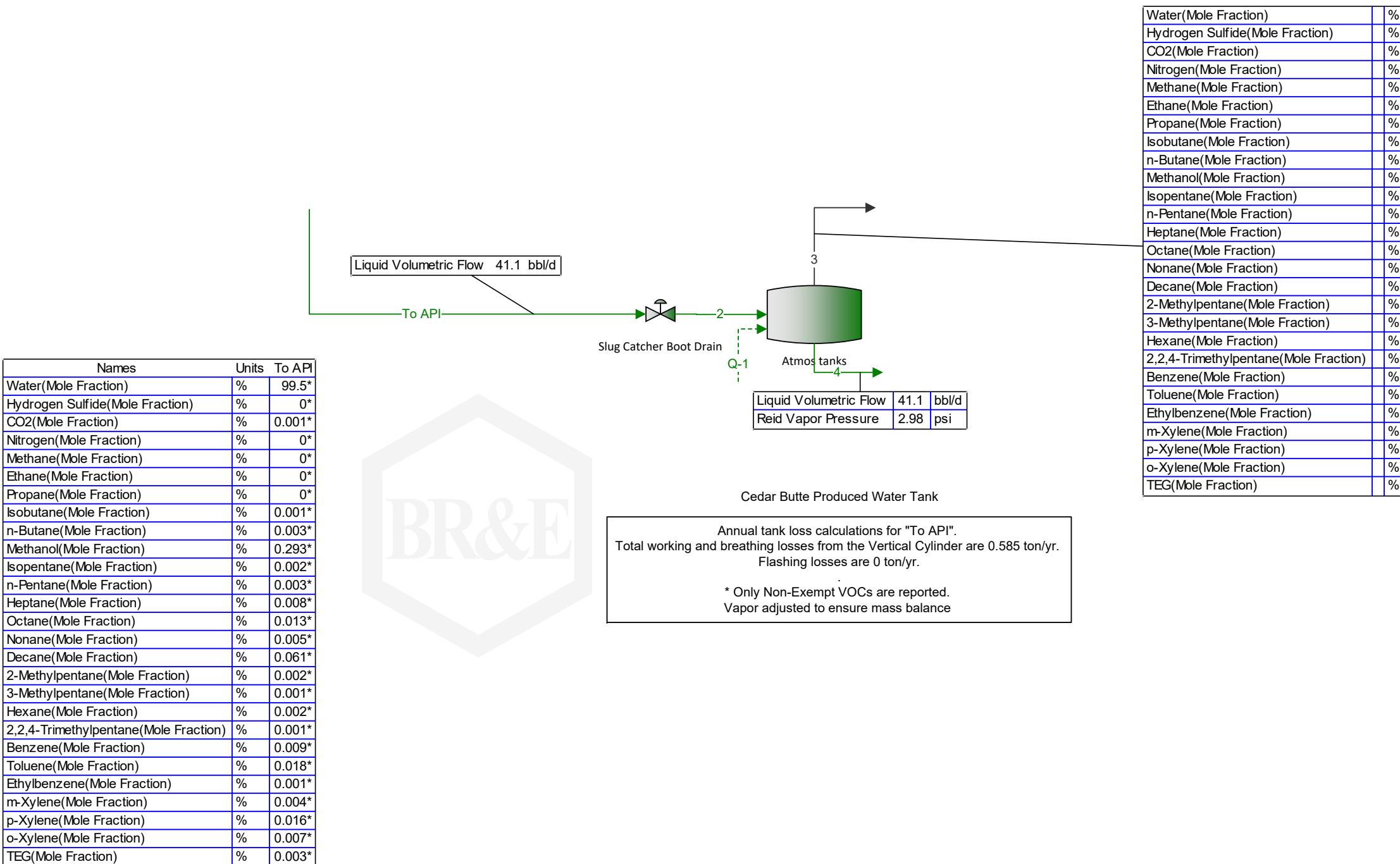
Pressure: 14.70 psia

Flow Rate: 9.41e+002 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	9.20e+001	4.11e+001
Carbon Dioxide	6.17e-001	6.73e-001
Nitrogen	2.04e-002	1.42e-002
Methane	5.27e-001	2.09e-001
Ethane	9.74e-001	7.26e-001
Propane	9.64e-001	1.05e+000
Isobutane	1.58e-001	2.27e-001
n-Butane	6.94e-001	1.00e+000
Isopentane	1.17e-001	2.10e-001
n-Pentane	2.42e-001	4.32e-001
Cyclopentane	3.71e-002	6.45e-002
n-Hexane	9.29e-002	1.99e-001
Cyclohexane	2.91e-001	6.06e-001
Other Hexanes	8.68e-002	1.85e-001
Heptanes	1.73e-001	4.31e-001
Methylcyclohexane	9.70e-002	2.36e-001
2,2,4-Trimethylpentane	2.36e-003	6.68e-003
Benzene	1.13e+000	2.19e+000
Toluene	1.02e+000	2.32e+000
Ethylbenzene	9.34e-002	2.46e-001
Xylenes	5.78e-001	1.52e+000
C8+ Heavies	4.90e-002	2.07e-001
Total Components	100.00	5.39e+001

APPENDIX B: PROMAX SIMULATION REPORTS

Cedar Butte Compressor Station
Produced Water Tank Analysis



	To API
Tank Geometry	Vertical Cylinder
Shell Length	12 ft
Shell Diameter	20 ft
Number of Storage Tanks Employed	1
Location	Villiston, North Dakota
Time Frame	Year
Report Components	Non-exempt VOC
Set Bulk Temperature to Stream Temperature?	FALSE
Use AP42 Raoult's Vapor Pressure?	FALSE
Maximum Fraction Fill of Tank	90 %
Average Fraction Fill of Tank	50 %
Material Category	Light Organics
Tank Color	Tan
Shell Paint Condition	Good
Operating Pressure	0.25 psig
Breather Vent Pressure	0.25 psig
Breather Vacuum Pressure	-2.50E-02 psig
Roof Type	Cone
Slope of Coned Roof	0.0625
Roof Color	Tan
Roof Paint Condition	Good
Flashing Temperature	54.57398917 °F
Maximum Average Temperature	53.81666667 °F
Minimum Average Temperature	29.04166667 °F
Average Absolute Pressure	13.8185 psia
Daily Solar Insolation	1217.5 Btu/ft^2/day
Average Wind Speed	9.991666667 mi/h
Underground Tank?	TRUE
Calculate Loading Losses?	TRUE
Output Loading Losses?	FALSE
Output Flashing Losses?	TRUE
Output Working/Breathing Losses?	TRUE

Atmospheric Pressure	13.82	psia
True Vapor Pressure at Average Temperature	1.32	psia
Average Liquid Surface Temperature	46.45	°F
Maximum Liquid Surface Temperature	54.57	°F
Bulk Liquid Temperature	43.01	°F
Annual Tank Turnover Rate	24.83	
Flashing Losses	0.00	ton/yr
Total W/B Losses	0.58	ton/yr
Working Losses per Tank	0.39	ton/yr
Standing Losses per Tank	0.1938	ton/yr
Rim Seal Losses per Tank	0	ton/yr
Withdrawal Loss per Tank	0	ton/yr
Deck Fitting Losses per Tank	0	ton/yr
Deck Seam Losses per Tank	0	ton/yr

ProMax AP-42 Emissions Report

Annual Emissions
Vertical Cylinder

Components	Working Losses (ton/yr)	Breathing Losses (ton/yr)	Total Losses (ton/yr)
Mixture	0.3911	0.1938	0.5850
Propane	0.0000	0.0000	0.0000
Isobutane	0.0396	0.0196	0.0592
n-Butane	0.1186	0.0588	0.1774
Methanol	0.0009	0.0004	0.0013
Isopentane	0.0505	0.0250	0.0755
n-Pentane	0.0570	0.0282	0.0852
Heptane	0.0152	0.0075	0.0228
Octane	0.0070	0.0035	0.0105
Nonane	0.0009	0.0004	0.0013
Decane	0.0033	0.0016	0.0049
2-Methylpentane	0.0173	0.0086	0.0259
3-Methylpentane	0.0076	0.0038	0.0114
Hexane	0.0113	0.0056	0.0169
2,2,4-Trimethylpentane	0.0024	0.0012	0.0035
Benzene	0.0282	0.0140	0.0422
Toluene	0.0219	0.0109	0.0328
Ethylbenzene	0.0004	0.0002	0.0006
m-Xylene	0.0014	0.0007	0.0020
p-Xylene	0.0057	0.0028	0.0085
o-Xylene	0.002054	0.001018	0.003071
TEG	5.26E-12	2.61E-12	7.87E-12

Flashing Emissions Report

Annual Emissions

Tank flashed at the daily maximum surface temperature (54.57 °F) and the average atmospheric pressure of Williston, North Dakota (13.82 psia)

There are no flashing losses at the given temperature and pressure.

Source

Shell Length	12 ft
Shell Diameter	20 ft
Breather Vent Pressure	0.25 psig
Breather Vacuum Pressure	-0.025 psig
Operating Pressure	0.25 psig
Average Fraction Fill of Tank	50 %
Maximum Fraction Fill of Tank	90 %
Net Throughput	41.12 bbl/day
Overall Reduction Efficiency	0
Maximum Hourly Loading Rate	140 gpm
Flashing Temperature	54.57398917 °F
Land Based Mode of Operation	Submerged Loading: Dedicated Normal Service
Cargo Carrier	Tank Truck or Rail Tank Car

APPENDIX C: GAS AND LIQUID ANALYSES



AMERICAN MOBILE RESEARCH, INC.

P.O. BOX 2909
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EXTENDED HYDROCARBON GAS (GLYCALC) STUDY CERTIFICATE OF ANALYSIS

Company **KINDER MORGAN, INC.**

Lab Number CR-20004

Date Sampled 11-19-2019

Time Sampled 11:25 AM

Method of Analysis Dual TCD-FID Chromatography

Study Number CR-1

Date Tested 12-6-2019

Time Tested 11:22 AM

Ambient Temp at Sampling 38 F

Sample Identification **GAS TAKEN BEFORE DEHYDRATOR
ALEX COMPRESSOR STATION**

Sample Location ALEXANDER, NORTH DAKOTA.

Type Sample Spot

Effective Date N/A

Sample Pressure 1,100 PSIG

Cylinder ID AMR 043

Instrument Used Shimadzu GC-2014

Sample Method Trap & Purge

Test Method GPA-2286

County N/A

Composite From N/A

Sample Temperature 105 F

Cylinder Heated To 130 F

Calibration Date 12-6-2019

Un-Normalized Total 98.15 %

Sampled By KMI - K. Knutson

Components	Mole %	Weight %	Liq. Vol. %
Carbon Dioxide.....	1.007	1.774	0.828
Hydrogen Sulfide.....	0.000	0.000	0.000
Nitrogen.....	1.876	2.104	0.994
Methane.....	63.034	40.481	51.485
Ethane.....	18.596	22.384	23.961
Propane.....	8.823	15.574	11.711
iso-Butane.....	1.039	2.417	1.638
n-Butane.....	3.098	7.208	4.706
iso-Pentane.....	0.626	1.808	1.103
n-Pentane.....	0.920	2.657	1.607
Cyclopentane.....	0.016	0.045	0.023
n-Hexane.....	0.219	0.755	0.434
Cyclohexane.....	0.083	0.280	0.136
Other Hexanes	0.290	1.000	0.575
Heptanes.....	0.216	0.866	0.480
Methylcyclohexane.....	0.031	0.122	0.060
2,2,4-Trimethylpentane..	0.010	0.046	0.025
Benzene.....	0.027	0.084	0.036
Toluene.....	0.022	0.081	0.035
Ethylbenzene.....	0.002	0.009	0.004
Xylenes.....	0.009	0.038	0.017
Octanes	0.046	0.210	0.114
Nonanes	0.003	0.015	0.008
Decanes +	0.007	0.040	0.021
Totals	100.000	100.000	100.000

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
Cyclopentane	0.016	0.045	0.023
Cyclohexane	0.083	0.280	0.136
2-Methylpentane	0.207	0.715	0.411
3-Methylpentane	0.083	0.285	0.164
n-Hexane	0.219	0.755	0.434
Methylcyclohexane	0.031	0.122	0.060
2,2,4-Trimethylpentane	0.010	0.046	0.025
Benzene	0.027	0.084	0.036
Toluene	0.022	0.081	0.035
Ethylbenzene	0.002	0.009	0.004
m-Xylene	0.001	0.004	0.002
p-Xylene	0.006	0.027	0.012
o-Xylene	0.002	0.007	0.003
Hexanes, Total	0.608	2.080	1.167
Heptanes, Total	0.284	1.118	0.602
Octanes, Total	0.079	0.338	0.170
Nonanes, Total	0.003	0.015	0.008
Decanes+, Total	0.007	0.040	0.021

SPECIFIC GRAVITY AT 60/60 F, calculated..... 0.86250

TOTAL GPM (ETHANE INCLUSIVE)..... 9.666

CALCULATED BTU / REAL CF AT 14.73 PSIA, dry basis..... 1446.305

CALCULATED BTU / REAL CF AT 14.73 PSIA, wet basis..... 1421.395

AVERAGE MOLECULAR WEIGHT..... 24.980

MOLAR MASS RATIO..... 0.86250

RELATIVE DENSITY (G x Z (Air) / Z), calculated..... 0.86700

IDEAL GROSS HEATING VALUE, BTU / IDEAL CF AT 14.696 PSIA, calculated..... 1435.502

COMPRESSIBILITY FACTOR (Z)..... 0.99481

ETHANE GPM..... 4.9605

PROPANE GPM..... 2.4245

iso-BUTANE GPM..... 0.3391

n-BUTANE GPM..... 0.9742

iso-PENTANE GPM..... 0.2284

n-PENTANE GPM..... 0.3326

GASOLINE RANGE (HEXANES+) GPM..... 0.4063

FIELD H2S AT TIME OF SAMPLING, PPM..... N/A PPM

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-09, THE TABLES
 OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST
 TO THE NATURAL GAS INDUSTRY.

James A. Kane, President
 American Mobile Research, Inc.



AMERICAN MOBILE RESEARCH, INC.

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EXTENDED WATER GLYCALC STUDY CERTIFICATE OF ANALYSIS

Company KINDER MORGAN, INC.

Lab Number CR-20730
Date Sampled 8-24-2020

Study Number CR-2
Date Tested 9-3-2020

Sample Identification PRODUCED WATER
CEDAR BUTTE STATION

Sample Location NORTH DAKOTA

Sample Pressure 120 PSIG

Sample Temperature 45 F

Type Sample SPOT

County N/A

Test Method GPA 2186M

Cylinder ID AMR 066

Components	Mole %	Weight %	Liq. Vol. %
Water	99.546	98.388	97.936
Hydrogen Sulfide	0.000	0.000	0.000
Carbon Dioxide	0.001	0.002	0.003
Nitrogen	0.000	0.000	0.000
Methane	0.000	0.000	0.000
Ethane	0.000	0.000	0.000
Propane	0.000	0.000	0.000
iso-Butane	0.001	0.003	0.006
n-Butane	0.003	0.010	0.016
Methanol	0.293	0.515	0.644
iso-Pentane	0.002	0.008	0.013
n-Pentane	0.003	0.012	0.019
Hexanes	0.003	0.014	0.021
Heptanes	0.008	0.044	0.064
Octanes	0.013	0.081	0.115
Nonanes	0.005	0.035	0.048
Decanes+	0.061	0.554	0.736
Benzene	0.009	0.039	0.043
Toluene	0.018	0.091	0.104
Ethylbenzene	0.001	0.006	0.007
Xylenes	0.027	0.157	0.181
n-Hexane	0.002	0.009	0.014
2,2,4-Trimethylpentane	0.001	0.006	0.009
Glycol	0.003	0.025	0.022
Totals	100.000	100.000	100.000

ADDITIONAL BETX DATA

Components	Mole %	Weight %	Liq. Vol. %
2-Methylpentane	0.002	0.009	0.014
3-Methylpentane	0.001	0.005	0.007
n-Hexane	0.002	0.009	0.014
2,2,4-Trimethylpentane	0.001	0.006	0.009
Benzene	0.009	0.039	0.043
Toluene	0.018	0.091	0.104
Ethylbenzene	0.001	0.006	0.007
m-Xylene	0.004	0.024	0.027
p-Xylene	0.016	0.094	0.108
o-Xylene	0.007	0.039	0.045

API GRAVITY AT 60/60 F, calculated	10.65
SPECIFIC GRAVITY AT 60/60 F, calculated	0.99540
RELATIVE SPECIFIC GRAVITY OF DECANES+ (C10+) FRACTION, calculated	0.74899
AVERAGE MOLECULAR WEIGHT	18.227
AVERAGE MOLECULAR WEIGHT OF DECANES+ (C10+) FRACTION, calculated	165.428
TRUE VAPOR PRESSURE AT 100 F, PSIA, calculated	0.964
AVERAGE BOILING POINT, F, calculated	214.021
CUBIC FEET OF GAS / GALLON OF LIQUID, as Ideal Gas, calculated	172.790
BTU / GALLON OF LIQUID AT 14.73 PSIA, calculated	10,876.54
LBS / GALLON OF LIQUID, calculated	8.299

NOTATION: ALL CALCULATIONS PERFORMED USING PHYSICAL CONSTANTS FROM GPA 2145-16, THE TABLES OF PHYSICAL CONSTANTS FOR HYDROCARBONS AND OTHER COMPOUNDS OF INTEREST TO THE NATURAL GAS INDUSTRY.

James A. Kane, President
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CERTIFICATE OF ANALYSIS OXYGENATES IN HYDROCARBON GASES

Company KINDER MORGAN, INC.

Lab Number CR-20730

Study Number CR-2B

Date Sampled 8-24-2020

Date Tested 9-9-2020

Sample Identification CEDAR BUTTE STATION PRODUCED WATER

Sample Location CEDAR BUTTE STATION, WATFORD CITY, NORTH DAKOTA.

Sample Pressure 120 PSIG

Sample Temperature 45 F

Sample Type SPOT

County N/A

Test Method ASTM D-7423

Sample Container KMI 1087

Component	Concentration, ppm by Volume
Dimethyl Ether (DME)	< 1.0 PPMV
Acetone	45.14 PPMV
sec-Butyl Methyl Ether	< 1.0 PPMV
Methyl tert-Butyl Ether (MTBE)	< 1.0 PPMV
Methyl Ethyl Ketone (MEK)	< 1.0 PPMV
Methyl Alcohol (MeOH)	5,148.45 PPMV
Ethyl tert-Butyl Ether (EtBE)	< 1.0 PPMV
Ethyl Alcohol (EtOH)	3.05 PPMV
tert-Amyl Methyl Ether (TAME)	< 1.0 PPMV
iso-Propanol (IPA)	112.58 PPMV
tert-Butyl Alcohol (tBA)	< 1.0 PPMV
n-Propanol (nPA)	8.66 PPMV
sec-Butyl Alcohol	1.93 PPMV
2-Methyl-1-Propanol	< 1.0 PPMV
Butyl Alcohol	4.78 PPMV
Total Glycols (EG, DEG, TEG).....	246.31 PPMV
Total Oxygenates	5,570.90 PPMV

Analysis performed according to methodology outlined in ASTM D-7423, Determination of Oxygenates in C2, C3, C4, and C5 Hydrocarbon Matrices.

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