west virginia department of environmental protection

Division of Air Quality
601 57th Street, SE
Charleston, WV 25304-2345
Phone: 304 926 0475 • Fax: 304 926 0479

Earl Ray Tomblin, Governor
Randy C. Huffman, Cabinet Secretary
www.dep.wv.gov

ENGINEERING EVALUATION/FACT SHEET

B ACKGROUND INFORMATION

Application No.:	R13-3227
Plant ID No.:	041-00068
Applicant:	CONE Midstream Partners LP
Facility Name:	Camden Station
Location:	Weston
NAICS Code:	213112
Application Type:	Construction
Received Date:	November 20, 2013
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	$4,000.00
Date Received:	November 21, 2014
Complete Date:	March 13, 2015
Due Date:	June 11, 2015
Applicant Ad Date:	December 3, 2014
Newspaper:	*The Weston Democrat*
UTM's:	Easting: 536.90 km Northing: 4,327.76 km Zone: 17
Description:	The application is for the installation of 20 MMscf/day dehydration unit and produced fluids tank with a vapor destruction unit.

DESCRIPTION OF PROCESS

Cone Midstream Partners LP (Cone) proposed to construct and operate the Camden Station. The station will support the Camden 17 Well Pad, which has two horizontal wells operated by CNX Gas. The station will have a pig receiver, which will be used as needed. Natural gas from the well pad will normally by-pass the pig receiver and enter the station. During pigging operations, the liquids collected in the pig receiver are drained into Tank 2205.

As part of operation at the Camden Station, Cone plans on utilizing a glycol dehydration unit to remove the moisture (water) out of the natural gas before gas enter the pipeline segment, which will be Dominion Transmission Inc. pipeline system as sale gas.

The purpose of this glycol dehydration unit is to remove water from the inlet natural gas stream. Water is removed from the rich natural gas stream via physical absorption while it flows countercurrent to circulating triethylene glycol (TEG) in a contactor tower. The lean natural gas then exits the contact tower as sale gas. The rich TEG is sent to a flash tank to reduce volatile hydrocarbons. Vapors from the flash tank can be directly vented to the atmosphere, used as fuel in the reboiler of the dehydration unit.

From the flash tank, the rich glycol is sent to the regenerator side of the reboiler. Heat energy of the reboiler heats up the rich glycol that releases the remaining saturated water and entrained hydrocarbons in the glycol solution. The temperature of the liquid glycol is maintained at 375^0F, which is below the boiling point of the glycol to minimize the loss of glycol in the system.

The proposed vapor destruction unit (VDU) is an enclosed flare manufactured by ABUTEC™. This ABUTEC™ enclosed flare is a medium temperature flare (MTF) 2.7 Megawatts (MW). The MTF 2.7 MW is designed specifically for tank battery applications (controlling hydrocarbons from storage tanks). This particular flare is designed to handle effluents with a heat composition of 2200 Btu/standard cubic feet and has a minimum destruction efficiency of 98%.

SITE INSPECTION

A site inspection was conducted by John Moneypenny of the DAQ Enforcement Section and the writer on February 2, 2015. It was determined that the proposed site is appropriate for the facility.

The straight line distance from the Camden Pad 17 to the Camden Station is approximately 3,576 feet. Both sites are just off of County Route 9/3, Kemper Run Road.

ESTIMATE OF EMISSION BY REVIEWING ENGINEER

Emissions associated with this construction application consist of a vapor destruction unit (VDU-1), glycol dehydrator still vent (SV-1), glycol dehydrator reboiler (BLR-1), 4,200 gallon produced liquids tank, tanker truck loading station (BL-1) and fugitive emissions components. Fugitive emissions for the facility are based on calculation methodologies presented in EPA Protocol for Equipment Leak Emission Estimates. The following table indicates which methodology was used in the emissions determination:

Table #1 List of Estimation Methods Used		
Emission Unit ID#	**Process Equipment**	**Calculation Methodology**
Tank-2205	4,200 gallon Produced Fluids Storage Tank	ProMax Process Simulation (Working, Breathing & Flashing)
VDU-1	9.0 MMBTU/hr Vapor Destruction Unit	EPA AP-42 Emission Factors
SV-1	20 mmscfd TEG Dehydrator Still Vent w/ vapor combustor	GRI-GlyCalc 4.0
BLR-1	375 MBtu/hr TEG Dehydrator Reboiler	EPA AP-42 Emission Factors
	6 Catalytic Gas Heaters (Freez-Fiter Model 1800) with a Heat Input Rating of 2,500 Btu/hr (Combine Total Heat Input of 0.015 MMBtu/hr)	EPA AP-42 Emission Factors
BL-1	2,500 gal/yr Liquids Loading Product Loadout Rack	EPA AP-42 Emission Factors

The applicant used gas analysis from Camden Pad and ProMax to predict the gas composition as it would be received by Camden Station. This predicted gas composition was entered into Glycalc to predict the emissions from the dehydration unit's emission points which are the still vent of the regenerator and backpressure vent of the flash gas separator. This particular dehydration unit will utilize the gas generated from the separator as the primary fuel supply for the reboiler and natural gas from the pipeline as a secondary fuel source. The gas analysis was entered in on a dry basis then corrected to saturated conditions based on temperature and pressure of the incoming gas using the software.

The writer conducted several iterations of GLYCALC to determine the conditions that predicted the highest emission potential from the dehydrator. The difficult with predicting the highest potential for this particular dehydrator is that the gas composition entering the station has only being predicted using limited gas sample analysis and process simulators to forecast the gas going in. The two wells this station will be supporting have recently been placed into production. The following table is summary of the applicant's results and additional runs conducted by the writer.

Table #2 Summary of GLYCalc™ Results for the Proposed Dehydrator										
Run	Day Gas Thoughput (MMscf/day)	Temperature (F)	Pressure (psig)	Glycol Pump rate (gpm)	Volatile Organic Compounds (tpy)		BTEX (tpy)		Benzene (tpy)	
					Flash Gas	Still Vent	Flash Gas	Still Vent	Flash Gas	Still Vent
Applicant's	20	75	500	1.5	5.2	15.3	0.02	3.89	<0.01	0.83
1	20	75	500	1.5	5.1	15.0	0.02	3.85	<0.01	0.82
2	20	45	330	1.5	5.0	22.5	0.04	7.70	0.01	1.51
3	20	45	330	0.78*	2.6	11.5	0.02	4.25	<0.01	0.79
4	15	75	500	1.5	5.0	14.9	0.03	3.92	<0.01	0.82
5	15	45	330	1.5	5.0	22.5	0.03	7.70	0.01	1.51
6	15	45	330	0.77*	2.55	11.5	0.02	4.25	<0.01	0.79
7	3.3	75	500	1.5	5.12	14.4	0.02	2.68	<0.01	0.66
8	3.3	45	330	1.5	4.98	19.0	0.02	3.77	<0.01	0.97
9	3.3	45	330	0.4[1]	1.33	5.86	<0.01	1.84	<0.01	0.38

* Glycol circulation rate was optimized by GYLCALC™ using a ratio of 3.45 gal of glycol to 1 lb of water.
[1] Glycol circulation rate was set to the minimum setting of the pump.

The actual capacity of the dehydration is 15 MMscf/day at 500 psig. The applicant proposed 20 MMscf/day for this application to account for variability in the gas in establishing emission limits. The emission unit that unit is the main source of hazardous air pollutants (HAPs) at this facility is the TEG dehydration unit. For this part of the review, the main focus was to determine which conditions have the greatest potential to generate benzene emissions. One potentially applicable regulation, which will be discussed later in this evaluation, has an exclusion limit for TEG dehydration with potential benzene emissions less than 1 ton per year.

Excluding runs 2 and 5 since the benzene emissions exceed 1 ton per year, the runs that GLYCALC predicted the highest and 2nd highest emissions rates were 8 and the applicant's. Run 8 was set at the low end of the design capacity at the glycol pump maximum flow rate. This is not a realistic operating condition. The applicant's run and Run No. 4 should be considered in establishing the emission potential for this dehydration unit. The glycol circulation rate is approaching the optimum rate at the maximum design and operating conditions for this dehydration unit.

The hourly emissions for these two runs are presented in the following table with the VOC and BTEX emissions from the reboiler. The reboiler will be fueled primarily using the flash tank off gas. In this particular designed reboiler, the flash tank off gas is introduced in the burner as fuel for it. This design configuration typically achieves minimum combustion efficiency 95% for hydrocarbons. This reboiler is equipped with combustion controllers to regulate the call for heat or firing to maintain the temperature of glycol. The rule of thumb for the time needed to heat the glycol is 50% of the time. Thus, the overall control efficiency for the reboiler to control the flash tank off emissions would be 47.5%. The annual emissions from the flash gas back pressure vent are 2.76 tons of VOC per year after controls. The still vent would have a VOC rate of 15.3 tons per year.

Table #3 Hourly Emissions from Dehydrator									
	Volatile Organic Compounds (lb/hr)			Total HAPs (lb/hr)			BTEX (lb/hr)		
Run/Emission Point	Flash Tank Backpressure Vent	Still Vent	Reboiler	Flash Tank Backpressure Vent	Still Vent	Reboiler	Flash Tank Backpressure Vent	Still Vent	Reboiler
Applicant's	1.19	3.49	0.06	0.06	1.06	0.003	0.006	0.89	0.0003
4	1.15	3.44	0.06	0.06	1.05	0.003	0.006	0.88	0.0003

Combustion related emissions from the station are generated from three sources, which is the reboiler, vapor destruction unit (VDU), and the six instrument gas freeze heaters. The applicant use emission factors from Chapter 1.4 AP-42 for the reboiler and freeze heaters. The VDU will be discussed in detail in the portion covering emissions from produced fluids. The applicant has projected that the flash gas generated by the flash tank will not be a sufficient fuel source for the reboiler. Due to this projected fuel short coming for the reboiler, the VOC and total HAPs emissions project using emission factors was summed with the projected controlled values for the reboiler in Table 3 to account for the total emissions from the reboiler. The freeze heaters are fairly small and the emissions were summed together as one source and assumed to be operated on a continuous basis.

Table #4 – Emissions from the Reboiler & Six Freeze Heaters				
Source	Reboiler		Freeze Heaters	
Pollutant	Hourly Rates (lb/hr)	Annual (tpy)	Hourly Rates (lb/hr)	Annual (tpy)
$PM/PM_{10}/PM_{2.5}$	0.003	0.01	0.0001	0.0004
Oxides of Nitrogen (NO_x)	0.037	0.16	0.001	0.004
Carbon Monoxide (CO)	0.031	0.14	0.001	0.004
Volatile Organic Compounds (VOCs)	0.06	0.26	0.0001	0.0004
Total Hazardous Air Pollutants (HAPs)	0.007	0.03	0.0002	0.0009
Carbon Dioxide Equivalent (CO_2e)	43.91	192.33	1.76	7.71

Produced fluids (drips) are expected to be generated at the station in the gas filters on continuous basis and in pig receiver during pigging operations. The produced fluids was predicted by treating the two gas filters as 2 - two phase separators in ProMax (process gas simulator) and setting the environment simulation to Soave modification of Redlick-Kwong equation of state (SRK) to predicted vapor and liquid phase of the natural gas in these filters. The use of SRK for gas separators is generally acceptable and would be The predicted liquids is routed to third two phase separator, which is used to represent an atmospheric tank (Tank-2205).

ProMax predicted that the filters would collect 11.6 barrels of liquids per day. These liquids, which are under pressure, will create flash emissions of 64.18 tons per year of volatile organic compounds (VOCs). The working and breathing losses from the tank were estimated to be 0.83 tons of VOC per year. Losses during tanker truck loading were determined to be 0.13 tons of VOCs per year. These emissions are uncontrolled potentials.

Cone proposed to use a VDU to control the emissions from Tank TK-2205 and tanker truck loading operations. This VDU has a destruction efficiency rating of 98% for organics. These un-controlled emissions are reduced to 1.3 tons of VOC per year. To account for variations in the gas and actual operating parameters, the writer assumed the VDU has a destruction efficiency of 95% instead of 98%. The VOC rate from the VDU is 0.74 pounds per hour and 3.25 tons per year. The combustion emissions from the VDU were based on maximum heat input that the VDU is designed to handle.

The combustion related emissions from the VDU is presented in the following table.

Table 5 VDU Emissions

Pollutant	Flare Emissions	
	Hourly Rates (lb/hr)	Annual (tpy)
$PM/PM_{10}/PM_{2.5}$	0.01	0.04
Oxides of Nitrogen (NO_x)	0.63	2.76
Carbon Monoxide (CO)	5.06	22.16
Volatile Organic Compounds (VOCs)	0.74	3.25
Total Hazardous Air Pollutants (HAPs)	0.001	0.004
Carbon Dioxide Equivalent (CO_2e)	1078.47	4,723.70

The applicant estimated VOCs and total HAPs emissions from equipment leaks to be 3.1 tpy and 0.02 tpy respectively. This estimate was determined by number of components in gas service using EPA default emission factors in GRI-HAPCalc 3.01.

The following table gives the potential emissions for the proposed Camden Station.

Table 6 Potential Emissions for the Camden Station	
Pollutant	Annual (tpy)
$PM/PM_{10}/PM_{2.5}$	0.17
Oxides of Nitrogen (NO_x)	2.93
Sulfur Dioxide (SO_2)	0.22
Carbon Monoxide (CO)	22.29
Volatile Organic Compounds (VOCs)	24.29*
Total Hazardous Air Pollutants (HAPs)	4.79*
Carbon Dioxide Equivalent (CO_2e)	4,778.68

* Includes fugitive VOC emissions from leaking equipment.

REGULATORY APPLICABLILITY

The proposed station will be a minor source for criteria pollutants and classified as an area source for HAPs. Benzene emissions from the dehydration unit will be less than 1 ton per year, which means that Subpart HH – National Emissions Standard for Hazardous Air Pollutants From Oil and Natural Gas Production Facilities of Part 63 would not be applicable to the emission standards of this subpart (40 CFR §63.764(e)(1)(ii)). Thus, the only rules that are applicable to the dehydration unit are Rules 2 & 10, which established allowables for PM, visual emissions, and sulfur dioxide. These rules are focused on the reboiler of the dehydration unit.

The proposed dehydration unit will have a design heat input of less than 10 MMBtu/hr which excludes the PM and SO_2 allowables for fuel burning units from the proposed reboiler (45 CSR §2-11.1 and 45 CSR §10-10.1). Since the reboiler will be consuming a gaseous fuel with little to no ash content, the visual emission standard (10% opacity limit) should be achieved without the use of add-on controls.

The primary fuel for this reboiler will be flash tank off gas from the dehydration unit, which would be considered as process gas under Rule 10 and 45 CSR §10-5.1 would be applicable to this reboiler. 45 CSR §10-5.1. limits the amount of hydrogen sulfide in process gas streams to 50 grains per 100 cubic feet of gas being combusted. Typical natural gas produced in West Virginia has a low concentration of hydrogen sulfide. The hydrogen sulfide content of the produced natural gas will be measured. To correlate the future measured values to the concentration that the reboiler would see, the writer conducted several additional runs of GLYCALC to predict the concentration at the flash tank off gas by inputting values of hydrogen sulfide in the wet gas inputs (trial and error approach) with a target set at 50 grain standard.

The results of this approach determined that incoming natural gas with a hydrogen sulfide concentration of 65 ppm to the proposed dehydration units would generate flash gas that has a hydrogen sulfide concentration of 48 grains per 100 cubic feet of gas.

The only other process equipment that is subject to an applicable rule or regulation is Tank TK-2205 and VDU. Cone has elected to install controls to reduce the VOC emissions from Tank TK-2205 to less than 6 tons per year. Cone has elected to do this prior to installing and placing the vessel into service; and make the control device federally enforceable through the State of West Virginia's minor source permitting program to avoid the vessel being subject to Subpart OOOO – Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution of Part 60. The VOC limit will be 3.25 tons per year, which is the less than applicability threshold value of 6 tons per year under 40 CFR §60.5365(e).

VDU is an incinerator and subject to 45 CSR 6 (Rule 6). Rule 6 establishes allowable PM and visual emission rates from incinerators. The allowable PM for the proposed VDU is 0.03 pounds per hour and 20% opacity. The VDU should operate in a smokeless mode for this application and generate little to no particulate matter. Thus, the proposed VDU should meet the emission standards of Rule 6.

Cone prepared and submitted a complete application, paid the filing fee, and published a Class I Legal ad in *The Weston Democrat* on December 3, 2014, which is required under Rule 13 for a construction permit. The facility will be a 9M source under Rule 22.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

There will be small amounts of various non-criteria regulated pollutants emitted from the combustion of natural gas. However, due to the small concentrations emitted, detailed toxicological information is not included in this evaluation. The facility will be classified as a area-source of HAPs with a potential to emit of total HAP of less than 5 tons per year with benzene being less than 1 ton per year.

AIR QUALITY IMPACT ANALYSIS

The writer deemed that an air dispersion modeling study or analysis was not necessary, because the proposed modification does not meet the definition of a major modification of a major source as defined in 45CSR14.

MONITORING OF OPERATIONS

Monitoring of this facility is broken into two sections, which are the dehydration unit and Tank TK-2205 with the VDU.

The dehydration unit needs to ensure that benzene emissions are being minimized to less than 1.0 ton per year. The factors that affect this are temperature, pressure and volumetric flow rate of the gas being dehydrated. These conditions need to be monitored daily and average on a monthly basis. For the actual dehydration unit, only the circulation rate of the glycol and presence of flame in the reboiler needs to be monitored. The circulation rate is once per month and the presence of a flame needs to be continuous. The facility will be required to check this condition to ensure that the optimized circulation rate of glycol has not been affected due to gas conditions each month.

Tank TK-2205 with the VDU is really a two stepped approach as well. The throughput of fluids entering into the tank would require a continuous flow meter with counter. With the tank emissions being controlled using a VDU, a flow meter would aid in determining compliance with any emission or operating limits other than a straight throughput limit for the vessel. The writer recommends tracking produced fluids being loaded out of Tank TK-2205 and comparing it to the predicted rate of 9.27 barrels per day. Less than this predicted amount would indicate that the amount of VOCs generated in Tank TK-2205, which mean less than the predicted rate going to the VDU and thus would be in compliant with the stated VOC limit if the VDU was operated correctly.

To ensure proper operation of the VDU, the permittee will be required to conduct an initial visual emission observation in accordance with EPA Method 22 for 2 hours. After that initial observation, verification of proper operation will rely on monitoring the temperature of the combustion zone of the VDU with a set point of 1,400^{0}F as the minimum operating temperature.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates the proposed modification of the facility will meet all the requirements of the applicable rules and regulations when operated in accordance with the permit application. Therefore, the writer recommends granting Cone Midstream Partners LP a Rule 13 construction permit for their Camden Station located near Camden, WV.

Edward S. Andrews, P.E.
Engineer

May 7, 2015
Date