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ENGINEERING EVALUATION/FACT SHEET

B ACKGROUND INFORMATION

Application No.:	R13-3252
Plant ID No.:	007-00006
Applicant:	Equitrans, LP
Facility Name:	Burnsville Compressor Station
Location:	Burnsville
NAICS Code:	486210
Application Type:	Construction
Received Date:	May 26, 2015
Engineer Assigned:	Edward S. Andrews, P.E.
Fee Amount:	$1,000.00
Date Received:	June 23, 2015
Complete Date:	May 5, 2016
Due Date:	August 3, 2016
Applicant Ad Date:	August 5, 2015
Newspaper:	*Braxton Citizens' News*
UTM's:	Easting: 529.40 km Northing: 4,301.40 km Zone: 17
Description:	The application is to address the compliance plan in Consent Order CO-R30-E-2015-11, which is for the construction of a replacement flare to control the still vent from an existing gas dehydration unit.

DESCRIPTION OF PROCESS

Equitrans LP (EQT) owns and operates the Burnsville Compressor Station (BCS). As part of operation at the BCS, EQT utilizes a glycol dehydration unit to remove the moisture (water) out of the field gas before it is transmitted to the Copley Run Compressor Station. The purpose of this glycol dehydration unit is to remove water from the inlet natural gas stream. Water is removed from the wet natural gas stream via physical absorption while it flows countercurrent to circulation of triethylene glycol (TEG) in a contactor tower. The dry natural gas then exits the BCS. The rich TEG, which is in a liquid state, is sent to a flash tank (aka oil skimmer) to reduce volatile hydrocarbons. The liquid enters the flash tank which allows some of the entrained hydrocarbons (methane, ethane, propane, etc.) to change to a gaseous state. The flash tank operates like a three phase separator. The vapors (gaseous hydrocarbons) from the flash tank are utilized as fuel gas for the reboiler of the dehydration unit; and the excess gas is routed to the flare.

From the flash tank, the rich glycol, which is in a liquid state, is sent to the regenerator side of the reboiler. Heat energy for the reboiler heats up the rich glycol to boil out the water. The remaining entrained hydrocarbons are released from the glycol solution. The temperature of the rich glycol is below the boiling point of the glycol so that the undesired water and hydrocarbons are boiled off and vented through the still vent of the regenerator of the reboiler. These hydrocarbon vapors are sent to a flare and is destroyed through incineration. This particular dehydrator uses a stripping gas. This stripping gas improves the water removal efficiency of the regenerator.

On November 24, 2014, EQT replaced the existing flare tip with a John Zink EEF-500 flare pilot. The existing flare did not meet the exit tip velocity criteria under 40 CFR §60.18.

SITE INSPECTION

This facility is an existing major source and is routinely inspected by the DAQ to verify compliance with the facility's Title V Operating Permit. The last inspection was conducted on January 7, 2016 by Mr. Eric Ray, P.E., a Compliance and Enforcement engineer of the Kanawha City Office. Mr. Ray determined that the facility was operating in compliance.

This writer visited the facility on May 17, 2016. Ms. Kim Gissy, Senior Environmental Coordinator for EQT Corporation, accompanied the writer during this visit. The main purpose of this inspection was to obtain site-specific information to verify EQT's claim that BCS is an area source of hazardous air pollutant for a gas production facility under Subpart HH of Part 63. This information included inlet conditions of the field gas gathering lines and turnovers of the waste fluid tank. During this visit, the writer did not notice any indicators of construction activities other than what was agreed upon in Consent Order CO-R30_E-2015-11.

ESTIMATE OF EMISSION BY REVIEWING ENGINEER

The applicant used GRI-GLYCalc to predict properties of the still vent and flash tank off gas streams. The applicant used pollutant specific emissions factors from AP-42 Chapter 1.4 to determine the combustion related emissions from the reboiler and flare. The emissions from the flare are dependent on the operation of the dehydration unit. GYLCalc is limited to predicting the outlet streams from affected process equipment of the dehydration units (i.e. absorber, flash tank, regenerator, etc.) without regards to the energy needed to maintain the process at a steady state.

The writer modelled the proposed dehydration using ProMax™ Version 4.0 developed by Bryan Engineering and Research (BR&E) to predict the energy streams needed for the reboiler and flare to operate properly.

EQT determined that the inlet conditions to the dehydration unit to be pressure of 125 psig at a temperature 120^0 F with a wet gas flow rate of 25 million standard cubic feet per day (MMSCFD) as worst case situation. The writer reviewed this submittal and noted that this analysis configured the absorber with 13 stages. The issue with entering 13 stages in GLYCalc is that the model treats them as ideal stages. During the May 17, 2016 site visit, the writer reviewed the actual drawings for the absorber, which contains 13 trays. Based on locations and number of trays within the column, the writer approximated the number of ideal stages in this absorber column to be 3.5. Also, the writer requested the most recent extended gas analysis for this application, which was sampled on October 8, 2015. The following table is a comparison of the GLYCalc™ and ProMax™ at the sample conditions of maximum wet gas throughput.

Table #1 – Comparison of Predicted Uncontrolled Emission

Source/Location	Pollutant	GLYCalc w/stripping as dry gas (lb/hr)	GLYCalc w/stripping as flash gas (lb/hr)	ProMax w/mixture of dry & flash gas as stripping gas(lb/hr)
Flash Tank	Volatile Organic Compounds (VOCs)	28.61	28.59	2.34
	Total Hazardous Air Pollutants (HAPs)	0.68	0.68	0.18
	Benzene	0.02	0.02	0.01
Still Vent	Volatile Organic Compounds (VOCs)	90.72	118.20	91.47
	Total Hazardous Air Pollutants (HAPs)	26.91	27.54	21.53
	Benzene	2.03	2.05	2.00

The writer compared the two models at the flash tank and still vent to see the difference between the two models. The issue of simply using GLYCalc is how the actual dehydration is configured and the arrangement of the fuel gas system. GLYCalc can be configured with the stripping gas as dry gas on a user inputted flow rate or all of the flash gas as a stripping gas. In ProMax, the user can nearly configure the model to the actual system being simulated. For this case, the actual stripping gas is a mixture of dry and flash gases metered in the regenerator at a flow rate of 1.75 scfh.

Before considering which model or settings to use when establishing emission potentials for the new flare, the flare operating conditions needs to be considered. A flare that meets the criteria of 40 CFR 60.18 is understood to have a destruction efficiency of at least 98% for hydrocarbons and VOCs, which includes BTEX. As part of the compliance plan in Consent Order CO-R30-E-2015-11, EQT conducted a flare assessment to demonstrate that the replacement flare meets the criteria of 40 CFR 60.18 on June 9, 2015. This flare assessment satisfactory demonstrated that the new flare meets the criteria of 40 CFR 60.18 with adding 500 scfh of auxiliary gas to the flare (supplemental fuel). Mr. Eric Ray, P.E. has observed during follow-up inspections a supplemental fuel rate to the flare being maintained at 700 scfh (0.7 MSCFH).

This writer compared the flare emissions from the GLYCalc run with flash gas as the stripping gas and ProMax predicted results, which are presented in the following table.

Table #2 – Comparison of the Flare Emissions using GLYCalc and ProMax

Pollutant	GLYCalc (lb/hr)	ProMax (lb/hr)
Volatile Organic Compounds (VOCs)	2.36	1.98
Total Hazardous Air Pollutants (HAPs)	0.55	0.44
Benzene	0.04	0.04

Both are predicting emissions fairly close to the other. The ProMax run was limited to a supplemental fuel gas rate of 700 scfh while the GLYCalc run didn't include any supplemental fuel. Boilers in general are assumed to have a combustion efficiency of 95% for hydrocarbons and VOCs. It is this writer's conclusion that the new flare potential to emit of VOC and HAPs should be based on the GLYCalc run using the flash gas as stripping gas at a maximum wet gas flow rate of 34 MMSCFD. ProMax predicted the carbon dioxide equivalent potential from the flare to be 407.80 pound per hour and 1,786 tons per year.

Emissions of oxides of nitrogen and carbon monoxide for the flare were estimated using the predicted heat release rate at maximum wet gas throughput rate through the dehydration unit. The heat release rate was predicted to be 1.2 MMBtu/hr. NO_x and CO emissions were based on factors from TCEQ Publication RG-360A/11 Technical Supplement 4 for non-assisted flares with a low heat release rate (effluent less than 1,000 Btu/scf). SO_2 was based on the predicted hydrogen sulfide using two models. The following table is a summary of potential emissions from the flare.

Table 3 Flare 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)	0.08	0.35
Carbon Monoxide (CO)	0.66	2.89
Sulfur Dioxide	<0.01	<0.04
Volatile Organic Compounds (VOCs)	2.36	10.34
Total Hazardous Air Pollutants (HAPs)	0.55	2.41
Benzene	0.04	0.18
Carbon Dioxide Equivalent (CO_2e)	407.80	1,786.16

The only emission source that has changed as part of the consent order was the new flare. No other changes are bring proposed at the BCS. Thus, no other emission source is required to be evaluated under the permitting rule (Rule 13). However, EQT is requesting the benzene exclusion under 40 CFR Subpart HH for the existing dehydration unit. Thus, the following discussions pertain to verifying if the BCS is an area source of hazardous air pollutants (HAPs) as defined in 40 CFR §63.761. This definition includes sources engaged with field gas production activities but excludes compressor stations.

At the BCS, the HAP emissions from the compressors and compressor engines are excluded for the HAP potential under Subpart HH. Sources that must be included are Tank-1, the dehydration unit, and the pig launcher.

The writer used the October 7, 2015 gas analysis, and ProMax to obtain estimates of HAPs emissions from Tank-1 and the whole dehydration unit, which includes the reboiler and still vent. The area source applicability determination will evaluate the fuel gas stream to the reboiler as uncontrolled and still vent as controlled by the proposed flare. Tank-1 vents to the atmosphere and therefore it is uncontrolled.

The following is presented here to illustrate the emission rate of VOCs and HAPs by source and determine which would have the higher emission rate.

Table #4 – VOC and Total HAP Emissions from the Production Gas Activities					
Pollutant	Tank-1	Reboiler	Flare (Controlled by 98%)	Pig Launcher	Total Emissions
VOCs (tpy)	0.36	7.12	10.34	0.90	18.72
Total HAPs (tpy)	0.001	1.28	2.41	0.002	3.693

The estimates in the above table were determined using the maximum wet gas flow rate of 34 MMSCFD and with one pig being launched per year. Because the total HAP potential of the BCS is less than 10 tons per year, speciation of the individual HAP is not necessary for this determination. The reboiler should be reduce the VOCs and total HAPs by at least 95%. Therefore, the BCS would be classified as an area-source of HAPs under Subpart HH of Part 63 for having a potential to emit of HAPs of less than 10 tons per year of any single HAP and 25 tons per year of total HAPs from the gas production facility.

REGULATORY APPLICABLILITY

The Burnsville Compressor Station is a major source under Title V (45CSR30) and currently possesses a valid Title V Operating Permit. Under this program, new emission units have 12 months after start-up to be incorporated into the facility's operating permit.

The facility is currently classified as a major source for NO_x under Prevention of Significant Deterioration (PSD). The first step in determining major modification applicability is to determine which pollutants that the project is major for, which is illustrated in the following table.

Table #5 Step One of PSD Applicability			
Pollutant	New Potential from the Replacement Flare (tpy)	Significance Threshold (tpy)	Significance Trigger (Yes/No)
PM	0.40	25	No
PM_{10}	0.40	15	No
$PM_{2.5}$ Direct	0.40	10	No
NO_x (precursor of Ozone and $PM_{2.5}$)	0.35	40	No
SO_2	0.01	40	No
CO	2.89	100	No
VOCs	10.34	40	No

This project does not represent a “significant emission increase” (45CSR§14-2.75) for any NSR pollutant. Thus, no further review is required.

With regards to the National Ambient Air Quality Standards, Braxton County is classified as attainment for all pollutants. Thus, no further review of this application with regards to 45 CSR 19, West Virginia Non-Attainment Permitting Rule is required.

The replacement flare is subject to Rules 6 & 10 (WV State Rules on PM and SO_2). 45 CSR §6-4.1. establishes an a allowable PM emission limit from this flare at 0.62 pounds per hour. This allowable is based on mass rate of 230 pounds of effluent per hour being routed to the flare. The effluent to this flare is in a gaseous state and should not cause the PM emissions to increase beyond this allowable, with the predicted potential being at 0.01 pounds of PM per hour. 45 CSR §6-4.3 limits visible emission from incinerators to less than 20% opacity. A visible indicator of proper operation of a flare is no visible emissions (zero opacity). EQT plans on operating this particular flare in such a manner.

45 CSR §10-5.1 established a hydrogen sulfide (H_2S) limit on the combustion of process gas streams to 50 grains of H_2S per 100 cubic feet of carrier gas. EQT’s Burnsville Station receives field gas which may contain hydrogen sulfide. The field gas received by the BCS typically has concentration levels of hydrogen sulfide less of than 1 ppm.

The writer used GLYCalc to develop an inlet concentration of H_2S that demonstrated compliance with the 50 grain standard of effluent going to the flare. The hydrogen sulfide level of the wet gas that was entered into GLYCalc was 100 ppm which a predicted the flare would see a hydrogen sulfide loading of 23.4 grains per 100 cubic feet of carrier gas. The predicted hydrogen sulfide loading would have a sulfur dioxide rate of 0.12 pounds per hour.

The writer recommends setting an inlet concentration for gas coming into the dehydration unit at 100 ppm for the purpose of demonstrating compliance with 45 CSR §10-5.1. (50 grain standard) and the corresponding sulfur dioxide emission limit.

The Burnsville Compressor Station is classified as a natural gas production facility. Under the Subpart HH – National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities of Part 63. Based on the predicted HAP emissions in Table 6, the Burnsville Compressor Station will remain as an area source of HAPs. Subpart HH has requirements for area sources of HAPs. EQT has elected to maintain the benzene emissions from the dehydration unit below 1.0 tons per year. Therefore, 40 CFR §63.764(e)(1) excludes the dehydration unit from the emission limitation and the work practice requirements of 40 CFR §63.764(d). Thus, EQT must determine actual average benzene emissions from the dehydration unit in accordance with 40 CFR §63.772(b)(2).

EQT prepared and submitted a complete application, paid the filing fee, and published a Class I Legal ad in Braxton Citizens’ News on August 5, 2015, which is required under Rule 13 for a construction permit. The facility currently holds a valid Title V Operating Permit and included Attachment S of the application for a significant modification of this operating permit.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The new replacement flare will not emit any pollutants that aren't already being emitted by another emission source at the facility. Therefore, no information about the toxicity of the hazardous air pollutants (HAPs) is presented in this evaluation.

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

For this flare, the writer recommends monitoring to ensuring proper operation of the flare. The writer conducted several different simulation to see if any particular situation would result in a condition that the flare would not operate in accordance with the heat content and exit velocity criteria of 40 CFR §60.18. The writer observe that at least 900 to 1,000 scfh of fuel gas is required to satisfy the energy requirements to operate the dehydration unit within the model. When the dehydration unit operating

This writer recommends the following parameters to be monitored for the purpose of ensuring proper operation of the control device and compliance with the emission limits.

- Wet gas processing rate on a daily basis;
- Monitoring the pilot light of the flare.
- Amount of supplemental fuel sent to the flare, which can include the fuel for the pilot light on a daily basis.
- Conduct visible emissions observations on a quarterly basis.

A flare design criteria worksheet was included in the application. However, this assessment was based on a flawed GLYCalc run, which assumed 13 ideal stages in the absorber column. As part of the agreed consent order, EQT conducted a flare assessment to demonstrate that the replacement flare meets the criteria of 40 CFR §60.18 for a non-assisted flare.

The following are the criteria for a non-assisted flare and the results of the assessment.

Table 6 – Non-assisted Flare Criteria and Assessment Results		
Parameter	60.18 Criteria	Results of Assessment
Heat Content (Btu/scf)	200 or greater than	532.
Exit Velocity at the tip (feet per second)	60 or less than	58.1
Supplement Fuel (scf/hour)	N/A	500
Visible Emissions	No more than 5 minutes in any 2 hour period	Zero

The writer conducted several simulation runs in ProMax to see what process changes would affect the flare assessment. These simulations yielded heat content of the effluent from 1500 Btu/scf to 376 Btu/scf with exit velocities ranging from 3 feet per second to just over 12 feet per second. The writer believes that the exit velocity from the flare assessment was not calculated based on the dry corrected flow rate. Using the dry corrected flow rate of 64 cubic feet per minute and a cross-section area of the flare tip of 0.09 square feet (ft^2), the average exit velocity should have been 11.85 feet per second.

The monitoring of the flare should focus on ensuring good operation of the flare, which would be a function of being in compliance with the VOC and HAP emission limits. Because the supplemental fuel was added to the flare during the assessment, monitoring the amount of fuel added to the flare needs to be part of the monitoring plan. The writer recommends quarterly, one hour observations to verify proper operation of the flare. Another key parameter is verifying that a flame is present. To determine the presence of flame in the flare, the applicant plans on using a thermocouple or flame rod. For compliance purposes, the applicant only needs to record the time period that no flame was present when the dehydration unit was operating.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates the proposed construction of the replacement flare will meet all the requirements of the applicable rules and regulations when operated in accordance with the permit application. Therefore, the writer recommends granting Equitrans, LP a Rule 13 construction permit for their Burnsville Compressor Station located in Burnsville, WV.

Edward S. Andrews, P.E.
Engineer

June 7, 2016
Date