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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-3337		
Plant ID No.:	039-00215		
Applicant:	Chesapeake Appalachia, L.L.C. (CHK)		
Facility Name:	Browns Creek Compressor Station		
Location:	St. Albans, Kanawha County		
NAICS Code:	211111 (Natural Gas Extraction)		
Application Type:	Construction		
Received Date:	August 29, 2016		
Engineer Assigned:	Jerry Williams, P.E.		
Fee Amount:	$2,000		
Date Received:	August 29, 2016		
Complete Date:	September 23, 2016		
Due Date:	December 22, 2016		
Applicant Ad Date	August 29, 2016		
Newspaper:	*Charleston Gazette Mail*		
UTM's:	Easting: 421.145 km	Northing: 4,248.644 km	Zone: 17
Latitude:	38.382526		
Longitude:	-81.902850		
Description:	Engine replacement.		

DESCRIPTION OF PROCESS

The following process description was taken from Permit Application R13-3337:

The natural gas inlet stream from surrounding area wells enters the facility through a separator that separates the inlet stream into two (2) streams: natural gas and pipeline fluids (hydrocarbons/water). Inlet gas in compressed via a reciprocating compressor. After the inlet gas passes through the compressor, it goes through the dehydration process before exiting the facility via a sales pipeline.

A triethylene glycol (TEG) dehydration unit is used to remove water from the gas. The unit is comprised of both a glycol dehydrator skid and a glycol regeneration skid. In the dehydration process, gas passes through a contactor vessel where water is absorbed by the glycol. The "rich"

glycol containing water goes to the glycol reboiler where heat is used to remove the water and regenerate the glycol. The heat is supplied by a natural gas-fired reboiler that exhausts to the atmosphere. Overhead still column emissions from the glycol regeneration skid are emitted to the atmosphere.

Pipeline fluids are stored onsite in an atmospheric storage tank that vents to atmosphere and are transported offsite via truck. Fugitive emissions from component leaks also occur.

This permit application requests authorization to replace an existing natural gas-fired compressor engine with a like-kind reconstructed engine that is subject to NSPS Subpart JJJJ. Other emission sources at the facility, which is currently exempt from permitting requirements, consist of one (1) pipeline fluids tank, pipeline fluids loading, and fugitive emissions. The grandfathered TEG dehydration unit and reboiler will retain their "grandfathered" status.

SITE INSPECTION

A site inspection was conducted on May 14, 2015 by Todd Shrewsbury of the DAQ Enforcement Section. The facility was in compliance at that time.

Directions as given in the permit application are as follows:

From Rt. 60 (near top of Coal Mountain) between St. Albans and Hurricane, turn onto Browns Creek Road (Rt 1), stay on main road and travel approximately 1.3 miles to a right turn onto a gravel road. Then travel approximately 0.2 mile to compressor station on left.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Emissions associated with this permitting action consist of the equipment listed in the following table. The following table indicates which methodology was used in the emissions determination:

Emission Unit ID#	**Process Equipment**	**Calculation Methodology**
EU-MC1648	225 hp Caterpillar G342 NA HCR engine w Non Selective Catalytic Reduction (NSCR)	Manufacturer's Data, EPA AP-42 Emission Factors
EU-TK1	25 bbl Pipeline Fluids Storage Tank	E&P Tanks, TANKS 4.09d
EU-LOAD	10,080 gal/yr Pipeline Fluids Truck Loading	EPA AP-42 Emission Factors

The following table indicates the control device efficiencies that are associated with this permitting action:

Emission Unit	Pollutant	Control Device	Control Efficiency
EU-MC1648	Nitrogen Oxides	NSCR	76.74 %
	Carbon Monoxide		70.80 %
	Volatile Organic Compounds		44.44 %

The total non-fugitive facility PTE for the Browns Creek Compressor Station is shown in the following table:

Pollutant	R13-3337 PTE (tons/year)
Nitrogen Oxides	6.66
Carbon Monoxide	8.76
Volatile Organic Compounds	47.12
Particulate Matter-10/2.5	0.10
Sulfur Dioxide	0.04
Formaldehyde	0.13
Total HAPs	6.03
Carbon Dioxide Equivalent	1,075

Maximum detailed controlled point source emissions were calculated by CHK and checked for accuracy by the writer and are summarized in the table on the next page.

Chesapeake Appalachia, L.L.C. – Browns Creek Compressor Station (R13-3337)

Emission	Source	NO_x		CO		VOC		PM-10		SO_2		Formaldehyde		Total HAPs		CO_2e
Point ID#		lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	lb/hr	ton/year	ton/year
EP-MC1648	CAT G342 NA HCR RICE	1.49	6.53	1.98	8.67	0.50	2.19	0.02	0.09	0.01	0.04	0.03	0.13	0.05	0.22	871
EP-DEHY1*	TEG Dehydration Unit	0	0	0	0	9.58	41.94	0	0	0	0	0	0	1.30	5.73	64
EP-RBL1*	TEG Reboiler	0.03	0.13	0.02	0.09	0.01	0.04	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	128
EP-TK1	Pipeline Fluids Storage Tank	0	0	0	0	0.67	2.93	0	0	0	0	0	0	0.02	0.07	12
EP-LOAD	Pipeline Fluids Truck Loading	0	0	0	0	NA	0.02	0	0	0	0	0	0	NA	0.01	0
Total Point Source		**1.52**	**6.66**	**2.00**	**8.76**	**10.76**	**47.12**	**0.02**	**0.10**	**0.01**	**0.04**	**0.03**	**0.13**	**1.37**	**6.03**	**1075**
Fugitive	Component Leaks	0	0	0	0	0.29	1.27	0	0	0	0	0	0	0.01	0.06	54
Total Fugitive		**0**	**0**	**0**	**0**	**0.29**	**1.27**	**0**	**0**	**0**	**0**	**0**	**0**	**0.01**	**0.06**	**54**
Total Sitewide		**1.52**	**6.66**	**2.00**	**8.76**	**11.05**	**48.39**	**0.02**	**0.10**	**0.01**	**0.04**	**0.03**	**0.13**	**1.38**	**6.09**	**1129**

* Grandfathered Equipment

REGULATORY APPLICABILITY

The following rules apply to this permitting action:

45CSR13 (Permits for Construction, Modification, Relocation and Operation of Stationary Sources of Air Pollutants, Notification Requirements, Administrative Updates, Temporary Permits, General Permits, and Procedures for Evaluation)

A 45CSR13 construction permit applies to this source due to the fact that CHK exceeds the regulatory emission threshold for uncontrolled criteria pollutants increase of 6 lb/hr and 10 ton/year of volatile organic compounds and are subject to a substantive requirement of an emission control rule (40CFR60 Subpart JJJJ).

CHK paid the appropriate application fee and published the required legal advertisement for a construction permit application.

45CSR16 (Standards of Performance for New Stationary Sources Pursuant to 40 CFR Part 60)

45CSR16 applies to this source by reference of 40CFR60, Subpart JJJJ. These requirements are discussed under that rule below.

45CSR22 (Air Quality Management Fee Program)

CHK is not subject to 45CSR30. The Browns Creek facility is subject to 40CFR60 Subpart JJJJ, however they are exempt from the obligation to obtain a permit under 40 CFR part 70 or 40 CFR part 71, provided they are not required to obtain a permit for a reason other than their status as an area source.

CHK is required to pay the appropriate annual fees and keep their Certificate to Operate current.

40CFR60 Subpart JJJJ (Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (SI ICE))

40CFR60 Subpart JJJJ establishes emission standards for applicable SI ICE.

The 225 hp, four stroke rich burn natural gas fired Caterpillar engine was reconstructed after the June 12, 2006 effective date.

The 225 hp Caterpillar G342 NA HCR engine will be subject to the following emission limits under §60.4233(f) for reconstructed engines: NOx – 3.0 g/hp-hr (1.49 lb/hr); CO – 4.0 g/hp-hr (1.98 lb/hr); and VOC – 1.0 g/hp-hr (0.50 lb/hr). Based on the manufacturer's specifications for this engines, the emission standards will be met.

40CFR63 Subpart HH (National Emission Standards for Hazardous Air Pollutants for Oil and Natural Gas Production Facilities)

Subpart HH establishes national emission limitations and operating limitations for HAPs emitted from oil and natural gas production facilities located at major and area sources of HAP emissions. The glycol dehydration unit at the Browns Creek Compressor Station is subject to the area source requirements for glycol dehydration units. However, because the facility is an area source of HAP emissions and the actual annual average flowrate of natural gas is less than 85 thousand standard cubic meters per day, it is exempt from all requirements of Subpart HH except to maintain records of actual average flowrate of natural gas to demonstrate a continuous exemption status.

40CFR63 Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines)

Subpart ZZZZ establishes national emission limitations and operating limitations for HAPs emitted from stationary RICE located at major and area sources of HAP emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations and operating limitations. The engine at the Browns Creek Compressor Station is subject to the area source requirements for non-emergency spark ignition engines.

The applicability requirements for reconstructed stationary RICEs located at an area source of HAPs, is the requirement to meet the standards of 40CFR60 Subpart JJJJ. These requirements were outlined above. The proposed engine meets these standards.

The following rules do not apply to this permitting action:

40CFR60 Subpart Kb (Standards of Performance for VOC Liquid Storage Vessels)

The affected facility to which this subpart applies is each storage vessel with a capacity greater than or equal to 75 cubic meters (m^3) (19,813 gallons) that is used to store volatile organic liquids (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984. The largest tank is 25 bbl (1,050 gal or 3.98 m^3), therefore, CHK is not subject to this rule.

40CFR60, Subpart OOOO (Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution for which Construction, Modification or Reconstruction Commenced after August 23, 2011, and on or before September 18, 2015)

EPA published its New Source Performance Standards (NSPS) and air toxics rules for the oil and gas sector on August 16, 2012. EPA published amendments to the Subpart on September 23, 2013 and June 3, 2016.

40CFR60 Subpart OOOO establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO_2) emissions from affected facilities that commence construction, modification or reconstruction after August 23, 2011.

There is no applicable equipment at this facility that commenced construction, modification or reconstruction after August 23, 2011. Furthermore, no additional horsepower capacity was added, therefore, it would not be deemed a modification in relation to the fugitive emissions requirements.

40CFR60 Subpart OOOOa (Standards of Performance for Crude Oil and Natural Gas Facilities for which Construction, Modification or Reconstruction Commenced after September 18, 2015)

EPA published its New Source Performance Standards (NSPS) and air toxics rules for the oil and gas sector on August 16, 2012. EPA published amendments to the Subpart on September 23, 2013 and June 3, 2016. 40CFR60 Subpart OOOOa establishes emission standards and compliance schedules for the control of the pollutant greenhouse gases (GHG). The greenhouse gas standard in this subpart is in the form of a limitation on emissions of methane from affected facilities in the crude oil and natural gas source category that commence construction, modification or reconstruction after September 18, 2015. This subpart also establishes emission standards and compliance schedules for the control of volatile organic compounds (VOC) and sulfur dioxide (SO_2) emissions from affected facilities that commence construction, modification or reconstruction after September 18, 2015. The effective date of this rule is August 2, 2016.

There is no applicable equipment at this facility that commenced construction, modification or reconstruction after September 18, 2015. Furthermore, no additional horsepower capacity was added, therefore, it would not be deemed a modification in relation to the fugitive emissions requirements.

45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants)

45CSR19 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution which Cause or Contribute to Nonattainment)

The Browns Creek facility is located in Kanawha County, which is an attainment area for all criteria pollutants, therefore this facility is not applicable to 45CSR19.

As shown in the following table, CHK is not a major source subject to 45CSR14 or 45CSR19 review. According to 45CSR14 Section 2.43.e, fugitive emissions are not included in the major source determination because it is not listed as one of the source categories in Table 1. Therefore, the fugitive emissions are not included in the PTE below.

Pollutant	**PSD (45CSR14) Threshold (tpy)**	**NANSR (45CSR19) Threshold (tpy)**	**Browns Creek PTE (tpy)**	**45CSR14 or 45CSR19 Review Required?**
Carbon Monoxide	250	NA	8.76	No
Nitrogen Oxides	250	NA	6.66	No
Sulfur Dioxide	250	NA	0.04	No
Particulate Matter 2.5	250	NA	0.10	No
Ozone (VOC)	250	NA	47.12	No

45CSR30 (Requirements for Operating Permits)

CHK is not subject to 45CSR30. The Browns Creek facility is subject to 40CFR60 Subpart JJJJ, however they are exempt from the obligation to obtain a permit under 40 CFR part 70 or 40 CFR part 71, provided they are not required to obtain a permit for a reason other than their status as an area source.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

The majority of non-criteria regulated pollutants fall under the definition of HAPs which, with some revision since, were 188 compounds identified under Section 112(b) of the Clean Air Act (CAA) as pollutants or groups of pollutants that EPA knows or suspects may cause cancer or other serious human health effects. Small amounts of non-criteria regulated hazardous air pollutants such as BTEX and formaldehyde may be emitted when natural gas is combusted in reciprocating engines or combusted in the fuel burning unit.

BTEX
BTEX is the term used for benzene, toluene, ethylbenzene, and xylene. Each of these possible hazardous air pollutants are identified in this section.

Benzene
Benzene is found in the air from emissions from burning coal and oil, gasoline service stations, and motor vehicle exhaust. Acute (short-term) inhalation exposure of humans to benzene may cause drowsiness, dizziness, headaches, as well as eye, skin, and respiratory tract irritation, and, at high levels, unconsciousness. Chronic (long-term) inhalation exposure has caused various disorders in the blood, including reduced numbers of red blood cells and aplastic anemia, in occupational settings. Reproductive effects have been reported for women exposed by inhalation to high levels, and adverse effects on the developing fetus have been observed in animal tests. Increased incidence of leukemia (cancer of the tissues that form white blood cells) have been observed in humans occupationally exposed to benzene. EPA has classified benzene as a Group A human carcinogen.

Toluene
The acute toxicity of toluene is low. Toluene may cause eye, skin, and respiratory tract irritation. Short-term exposure to high concentrations of toluene (e.g., 600 ppm) may produce fatigue, dizziness, headaches, loss of coordination, nausea, and stupor; 10,000 ppm may cause death from respiratory failure. Ingestion of toluene may cause nausea and vomiting and central nervous system depression. `Contact of liquid toluene with the eyes causes temporary irritation. Toluene is a skin irritant and may cause redness and pain when trapped beneath clothing or shoes; prolonged or repeated contact with toluene may result in dry and cracked skin. Because of its odor and irritant effects, toluene is regarded as having good warning properties. The chronic effects of exposure to toluene are much less severe than those of benzene. No carcinogenic effects were reported in animal studies. Equivocal results were obtained in studies to determine developmental effects in animals. Toluene was not observed to be mutagenic in standard studies.

Ethylbenzene
Ethyl benzene is mainly used in the manufacturing of styrene. Acute (short-term) exposure to ethyl benzene in humans results in respiratory effects, such as throat irritation and chest constriction, irritation of the eyes, and neurological effects, such as dizziness. Chronic (long-term) exposure to ethyl benzene by inhalation in humans has shown conflicting results regarding its effects on the blood. Animal studies have reported effects on the blood, liver, and kidneys from chronic inhalation exposure to ethyl benzene. Limited information is available on the carcinogenic effects of ethyl benzene in humans. In a study by the National Toxicology Program (NTP), exposure to ethyl benzene by inhalation resulted in an increased incidence of kidney and

testicular tumors in rats, and lung and liver tumors in mice. EPA has classified ethyl benzene as a Group D, not classifiable as to human carcinogenicity.

Xylenes
Commercial or mixed xylene usually contains about 40-65% m-xylene and up to 20% each of o-xylene and p-xylene and ethyl benzene. Xylenes are released into the atmosphere as fugitive emissions from industrial sources, from auto exhaust, and through volatilization from their use as solvents. Acute (short-term) inhalation exposure to mixed xylenes in humans results in irritation of the eyes, nose, and throat, gastrointestinal effects, eye irritation, and neurological effects. Chronic (long-term) inhalation exposure of humans to mixed xylenes results primarily in central nervous system (CNS) effects, such as headache, dizziness, fatigue, tremors, and incoordination; respiratory, cardiovascular, and kidney effects have also been reported. EPA has classified mixed xylenes as a Group D, not classifiable as to human carcinogenicity. Mixed xylenes are used in the production of ethylbenzene, as solvents in products such as paints and coatings, and are blended into gasoline.

Formaldehyde
Formaldehyde is used mainly to produce resins used in particle board products and as an intermediate in the synthesis of other chemicals. Exposure to formaldehyde may occur by breathing contaminated indoor air, tobacco smoke, or ambient urban air. Acute (short-term) and chronic (long-term) inhalation exposure to formaldehyde in humans can result in respiratory symptoms, and eye, nose, and throat irritation. Limited human studies have reported an association between formaldehyde exposure and lung and nasopharyngeal cancer. Animal inhalation studies have reported an increased incidence of nasal squamous cell cancer. EPA considers formaldehyde a probable human carcinogen (Group B1).

All HAPs have other non-carcinogenic chronic and acute effects. These adverse health effects may be associated with a wide range of ambient concentrations and exposure times and are influenced by source-specific characteristics such as emission rates and local meteorological conditions. Health impacts are also dependent on multiple factors that affect variability in humans such as genetics, age, health status (e.g., the presence of pre-existing disease) and lifestyle. As stated previously, *there are no federal or state ambient air quality standards for these specific chemicals*. For a complete discussion of the known health effects of each compound refer to the IRIS database located at *www.epa.gov/iris*.

AIR QUALITY IMPACT ANALYSIS

Modeling was not required of this source due to the fact that the facility is not subject to 45CSR14 (Permits for Construction and Major Modification of Major Stationary Sources of Air Pollutants) as seen in the table listed in the Regulatory Discussion Section.

SOURCE AGGREGATION

"Building, structure, facility, or installation" is defined as all the pollutant emitting activities which belong to the same industrial grouping, are located on one or more contiguous and adjacent properties, and are under the control of the same person.

The Source Determination Rule for the oil and gas industry was published in the Federal Register on June 3, 2016 and will become effective on August 2, 2016. EPA defined the term "adjacent" and stated that equipment and activities in the oil and gas sector that are under common control will be considered part of the same source if they are located on the same site or on sites that share equipment and are within ¼ mile of each other.

The Browns Creek will operate under SIC code 1311 (Natural Gas Extraction). There are other compressor stations operated by CHK that share the same two-digit major SIC code of 13 for natural gas extraction. Therefore, the Browns Creek facility does share the same SIC code as other CHK compressor stations.

"Contiguous or Adjacent" determinations are made on a case by case basis. There are no other equipment and activities in the oil and gas sector that are under common control of CHK that are located on the same site or on sites that share equipment and are within ¼ mile of each other.

Because the Browns Creek facility is not located on contiguous or adjacent properties with other facilities under common control, the emissions from this facility shall not be aggregated with other facilities for the purposes of making Title V and PSD determinations.

MONITORING OF OPERATIONS

CHK will be required to perform the following monitoring and recordkeeping associated with this permit application:

- Monitor and record hours of operation for the natural gas fired compressor engine.
- Monitor and record tank and truck loading throughput.
- Maintain records of testing conducted in accordance with the permit. Said records shall be maintained on-site or in a readily accessible off-site location
- Maintain the corresponding records specified by the on-going monitoring requirements of and testing requirements of the permit.
- Maintain a record of all potential to emit (PTE) HAP calculations for the entire facility. These records shall include the natural gas compressor engines and ancillary equipment.
- The records shall be maintained on site or in a readily available off-site location maintained by CHK for a period of five (5) years.

RECOMMENDATION TO DIRECTOR

The information provided in the permit application indicates that CHK meets all the requirements of applicable regulations. Therefore, impact on the surrounding area should be minimized and it is recommended that the Browns Creek location should be granted a 45CSR13 construction permit for their facility.

Jerry Williams, P.E.
Engineer

Date