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ENGINEERING EVALUATION / FACT SHEET

BACKGROUND INFORMATION

Application No.:	R13-2373B
Plant ID No.:	073-00022
Applicant:	Pleasants Energy, LLC
Facility Name:	Waverly Facility
Location:	Pleasants County
NAICS Code:	221112
Application Type:	Modification
Received Date:	June 25, 2015
Engineer Assigned:	Steven R. Pursley, PE
Fee Amount:	$2,000.00
Date Received:	June 29, 2015
Complete Date:	July 24, 2015
Due Date:	October 22, 2015
Applicant Ad Date:	June 27, 2015
Newspaper:	*Pleasants County Leader*
UTM's:	Easting: 468.629 km Northing: 4,353.573 km Zone: 17
Description:	Application to add two TurboPhase systems to the existing turbines and change permitting status of five emergency generators.

DESCRIPTION OF PROCESS

The existing Pleasants Energy facility is a 300 MW simple cycle electric generating peaking stations. The facility includes two GE 7FA simple cycle combustion turbines each rated at 167.8 MW (natural gas, 59°F, 60% humidity). The turbines primary fuel is natural gas but low sulfur distillate fuel oil is utilized as a backup fuel.

In 2015, Pleasants Energy installed five 3-MW generators under general permit registration G60-C067. With this permit application, Pleasants requests to cover those engines in this permit and change the status from emergency to non-emergency under the NSPS (Subpart IIII). However, the engines will retain an annual operation limit 500 hours per year.

The project will include the addition of a TurboPhase system to increase the output of the existing combustion turbines by approximately 18 MW. The project will include one TurboPhase system for each turbine. The TurboPhase system injects externally supplied air into the combustion turbine after compressor discharge at the inlet to the combustor. This increases air mass flow through the turbines and, consequently, generator output.

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The air will be supplied by multistage compressors driven by internal combustion engines. Each combustion turbine will have one TurboPhase system consisting of four 2,750 hp spark ignition, natural gas fired engine. Each of the systems will be limited to 3,250 hours of operation per year.

SITE INSPECTION

No site inspection of the facility was deemed necessary for this permitting action. However, the writer is familiar with the facility and its location. The facility is located at the Pleasants County Industrial Center adjacent to Route 2 in Pleasants county (just across the county line from Wood county). Other than the industrial park, the immediate area is fairly rural (the site is adjacent to a farm), however, the town of Waverly is located approximately 1 mile west of the site.

ESTIMATE OF EMISSIONS BY REVIEWING ENGINEER

Increased emissions from this project occur due to emissions from the TurboPhase engines and increased emissions from the turbines themselves. Note that emissions from the backup generators are NOT increasing. They are simply being transferred from a general permit to R13-2373B. The generators are being moved because Pleasants wishes to classify them as "non-emergency" under 40 CFR 60 Subpart IIII. However, they will retain the annual 500 hours of operation limit. Additionally, since Pleasants used the more stringent non emergency emission limits from the NSPS in the original general permit application, neither the hourly nor annual emission limits will change.

All annual emissions from the TuboPhase engines are based on 3,250 hours of operation per year. Emissions of NO_x, CO, $PM/PM_{10}/PM_{2.5}$ and VOCs from the natural gas fired TurboPhase engines are based on vendor data. Emissions of SO_2 are based on AP-42 Table 3.2-1 while emissions of H_2SO_4 are based on a mass balance.

Pleasants has agreed to keep the existing annual emission limits for the turbines in place. However, hourly emissions will increase when the TurboPhase engines are in operation.

Maximum Criteria Pollutant emissions from the existing facility (taken directly from permit R13-2373A and general permit registration G60C-067):

Source[1]	CO		NO_x		VOCs		$PM/PM_{10}/PM_{2.5}$		SO_2	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Turbines[2]	64.0	116.0	130.0	241.0	6.0	12.0	36.0	75.0	5.0	53.0
Turbines[3]	144.0		940.0		16.0		78.0		206.0	
Generators	125.90	31.47	24.10	6.03	14.39	3.60	3.60	0.90	0.27	0.07
Total	**269.9**	**147.5**	**964.1**	**247**	**30.39**	**15.6**	**81.6**	**75.9**	**206.3**	**53.07**

[1]Two turbines combined and 5 generators combined.
[2]When firing Natural Gas
[3]When firing Fuel Oil

Maximum criteria pollutant emissions from the modified facility will be as follows:

Source[1]	CO		NO_x		VOCs		$PM/PM_{10}/PM_{2.5}$		SO_2	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Turbines[2]	72.0	116.0	150.0	241.0	6.8	12.0	40.40	75.0	5.60	53.0
Turbines[3]	144.0		940.0		16.0		78.0		206.0	
TP engines	5.34	8.66	24.26	39.4	1.46	2.36	1.60	2.60	0.08	0.12
Generators	125.90	31.47	24.10	6.03	14.39	3.60	3.60	0.90	0.27	0.07
Total	**275.2**	**156.1**	**988.4**	**286.4**	**31.85**	**17.96**	**83.2**	**78.5**	**206.4**	**53.19**

[1]Two turbines combined, 8 TurboPhase engines combined and 5 generators combined.
[2]When firing Natural Gas
[3]When firing Fuel Oil

Therefore, the maximum increase in permitted emissions due to this modification is as follows:

CO		NO_x		VOCs		$PM/PM_{10}/PM_{2.5}$		SO_2	
lb/hr	tpy	lb/hr	tpy	lb/yr	tpy	lb/hr	tpy	lb/hr	tpy
5.34	8.66	24.26	39.4	1.46	2.36	1.60	2.60	0.08	0.12

Maximum Non Criteria pollutant emissions from the existing facility (taken directly from permit R13-2373A and general permit registration G60C-067):

Source[1]	Formaldehyde		H_2SO_4		PAHs		Total HAPs	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Turbines[2]	3.40	7.00	--	5.60	--	1.20	3.40	8.20
Turbines[3]	--		22.00		--		--	
Generators	--	--	--	--	--	--	0.04	0.17
Total	**3.40**	**7.00**	**22.00**	**5.60**	**--**	**1.20**	**3.44**	**8.37**

[1]Two turbines combined and 5 generators combined.
[2]When firing Natural Gas
[3]When firing Fuel Oil

Maximum non criteria pollutant emissions from the modified facility will be as follows:

Source[1]	Formaldehyde[4]		H_2SO_4		Acrolein		Acetaldehdye		Hexane		Methanol		PAHs		Total HAPs	
	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy	lb/hr	tpy
Turbines[2]	0.64	2.64	--	5.60	--	0.1	--	0.5	--	--	--	--	--	1.20	4.68	7.60
Turbines[3]	--		22.00		--		--		--		--		--		--	
TP Engines	3.59	5.84	--	--	0.35	0.57	0.57	0.92	0.08	0.12	0.17	0.28	0.02	0.04	4.91	7.94
Generators	--	--	--	--	0.01	0.03	--	--	--	--	--	--	--	--	0.65	0.17
Total	**4.23**	**8.48**	**22.0**	**5.60**	**0.36**	**0.61**	**0.57**	**0.97**	**0.08**	**0.12**	**0.17**	**0.28**	**0.02**	**1.24**	**10.24**	**16.69**

[1]Two turbines combined, 8 TurboPhase engines combined and 5 generators combined.
[2]When firing Natural Gas
[3]When firing Fuel Oil
[4]Formaldehyde emissions for the turbines change to due updated emission factor (Roy Sims EPA Memo "HAP Emission Control Technology for New Stationary Combustion Turbines")

It should be noted that comparing the two tables above do not give a true picture of the increase in HAP emissions. This is because HAP emissions from the post modification turbines appear to be going down. This is not actually the case. It only appears to be going down because an updated (much lower) emission factor is being used to calculate Formaldehyde emissions. In reality, the emission factors are all based on heat input to the turbines and since the heat input isn't changing, there should be no change in HAP emissions from the turbines. Therefore, the HAP emissions from the new TurboPhase engines will be assumed to equal the facility wide increase in HAP emissions.

REGULATORY APPLICABILITY

The proposed modification is subject to the following state and federal rules:

STATE RULES

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

The proposed modification of the Waverly Facility has a potential to emit in excess of six (6) lbs/hour and ten (10) TPY of a regulated pollutant and, therefore, pursuant to §45-13-2.24, the modification is defined as a "stationary source" under 45CSR13. Pursuant to §45-13-5.1, "[n]o person shall cause, suffer, allow or permit the construction . . . and operation of any stationary source to be commenced without . . . obtaining a permit to construct." Therefore, Pleasants is required to obtain a permit under 45CSR13 for the modification and operation of the facility.

As required under §45-13-8.3 ("Notice Level A"), Pleasants Energy placed a Class I legal advertisement in a "newspaper of general circulation in the area where the source

is . . . located." The ad ran on June 27, 2015 in the *Pleasants County Leader* and the affidavit of publication for this legal advertisement was submitted on July 1, 2015.

45CSR14: Permits for Construction and Major Modification of Major Stationary Sources of Air Pollution for the Prevention of Significant Deterioration

The existing facility is not a major source as defined in 45CSR14. However, with the issuance of this permit, permitted emissions of NO_x will exceed the 250 tpy threshold necessary to classify the facility as major. Therefore, the new facility will be classified as a major stationary source.

45CSR30: Requirements for Operating Permits

45CSR30 provides for the establishment of a comprehensive air quality permitting system consistent with the requirements of Title V of the Clean Air Act. The Pleasants Energy, LLC facility is an existing Title V source with an issued Title V permit. Pleasants will be required to modify that permit in accordance with the timing requirements of 45CSR30.

FEDERAL RULES

40 CFR 60, Subpart GG: Standards of Performance for Stationary Gas Turbines

It should be noted that the turbines are subject to Subpart GG and not Subpart KKKK because they were constructed before February 18, 2005. Additionally, in the opinion of the writer, the addition of the TurboPhase system does not constitute a modification to the turbines as defined in Subpart A.

Subpart GG of 40 CFR 60 establishes limits for NO_x and SO_2 emissions from stationary gas-fired turbines with a heat input at peak load equal to or greater than 10.7 gigajoules per hour (10MMBTU/hr), based on the lower heating value of the fuel fired. The Pleasants Energy Project turbines will each have a heat input (fuel flow) of approximately 1, 571 MMBTU per hour at 59°F at full load, making each turbine subject to the requirements of Subpart GG as per 40 CFR 60.332(b). Subpart GG contains emission standards (for NO_x and SO_2) in addition to notification, monitoring and testing requirements. The applicable standard limiting the discharge of NO_x into the atmosphere from each turbine is expressed as:

$$STD = 0.0075^* (14.4/Y) + F$$

where:
STD = allowable NOx emissions (percent volume at 15 percent oxygen and on a dry basis)

Y = manufacturer=s rated heat rate at manufacturers rated load (kilojoules per watt hour) or, actual measured heat rate based on lower heating value of fuel as measured at actual peak load for the facility. The value of Y shall not to exceed 14.4 kilojoules per watt hour.

F = NOx emission allowance for fuel-bound nitrogen as defined in paragraph (a)(3) of this section.

The heat input rate for each of the GE 7FA turbines on natural gas firing is 9.87 kJ/W-hr at 100% load and 59° F. Therefore, the NSPS limitation for NO_x is 109 ppmvd at 15% oxygen. The anticipated emission rate for the Pleasants Energy Project turbines is 9.0 ppmvd at 15% O_2 while combusting natural gas and 56 ppmvd at 15% O_2 when combusting fuel oil both of which are well below the NSPS emission limit for NOx. The emissions limit set forth in the permit will be more stringent than the limit specified under the NSPS.

Under the Subpart GG NSPS, SO_2 is limited to 0.015% SO_2 by volume (150 ppmvd corrected to 15 percent O_2), and fuel sulfur content is limited to less than 0.8 percent by weight. The Pleasants Energy Project will meet these criteria by using natural gas as the primary fuel source. The natural gas is expected to contain sulfur at approximately 0.6 lb/MMCF (0.0007 percent by weight). Further, the distillate fuel oil that is proposed as a backup fuel is limited to 0.05 percent sulfur by weight. Fuel sulfur content for the Pleasants Energy Project will, therefore, be below the NSPS requirements. The corresponding maximum flue gas SO_2 concentrations will also be well below the NSPS standards, with SO_2 emissions of about 1 ppmvd corrected to 15 percent O_2 during gas firing and 10 ppmvd corrected to 15 percent O_2 during oil firing.

40 CFR 60, Subpart IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

Subpart IIII contains requirements relating to the performance of compression ignition engines. In 2015, Pleasants Energy installed five 3-MW generators under general permit registration G60-C067. With this permit application, Pleasants requests to cover those engines in this permit and change the status from emergency to non-emergency under the NSPS (Subpart IIII). The following discusses the substantive applicable requirements of Subpart IIII relating to the facility.

Subpart IIII Applicability - Section §60.4200

Pursuant to §60.4200, compression ignition engines manufactured after July 11, 2005 are subject to the subpart. Therefore, Subpart IIII is applicable to the engines.

Subpart IIII Emission Standards

Engines that are operated (per the subpart) as emergency engines have to meet the emission requirements of §60.4202. However, since Pleasants has stated that the engines will no longer be operated as emergency engines they must meet the requirements of §60.4204(b). §60.4204(b) references §60.4201(c) which in turn references §1039.102. Table 7 of §1039.102 sets the following standards for the generator engines (all standards converted from g/kW-hr to g/hp-hr):

NO_x	CO	PM	NMHC
0.50	2.61	0.07	0.30

Compliance with these standards are met primarily by purchasing an engine certified to the emission standards. Pleasants Energy has provided an EPA Certificate of Conformity showing this engine family is certified as in compliance with Subpart IIII.

40 CFR 60, Subpart JJJJ: Standards of Performance for Stationary Spark Ignition Internal Combustion Engines

Subpart JJJJ of 40 CFR 60 is the NSPS for stationary spark ignition internal combustion engines. Section §60.4230 states that "provisions of [Subpart JJJJ] are applicable to manufacturers, owners, and operators of stationary spark ignition (SI) internal combustion engines (ICE)." Specifically, §60.4230(a)(4) states that Subpart JJJJ applies to "Owners and operators of stationary SI ICE that commence construction after July 12, 2006, where the stationary SI ICE are manufactured:

(i) On or after July 1, 2007, for engines with a maximum engine power greater than or equal to 500 HP"

Pleasants Energy has proposed the construction of eight (8) new SI ICE TurboPhase engines (manufactured in 2015 or later) that are subject to Subpart JJJJ. Based on the standards for owner/operators of SI ICE's under §60.4233(e), the following table details the emission standards for the engine (g/hp-hr):

NO_x	CO	VOCs
1.0	2.0	0.7

In their application Pleasants stated that the manufacturer of the TurboPhase engines has indicated that the engines will NOT be certified. Therefore, Pleasants will have to demonstrate compliance with the above standards in accordance with §60.4243(b)(2)(ii). Specifically, they will have to "keep a maintenance plan and records of conducted maintenance and must, to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions. In addition, you must conduct an initial performance test and conduct subsequent performance testing every 8,760 hours or 3 years, whichever comes first, thereafter to demonstrate compliance."

40 CFR 63, Subpart ZZZZ: National Emission Standard for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

According to Pleasant Energy's application, the facility is a minor source of HAPs and, therefore, the generators and TurboPhase engines are subject to the area source provisions of the MACT. In order to comply with the area source provisions of Subpart ZZZZ Pleasants Energy has to comply with 40 CFR 60 Subpart IIII and 40 CFR 60 Subpart JJJJ.

TOXICITY OF NON-CRITERIA REGULATED POLLUTANTS

This section provides an analysis for those regulated pollutants that may be emitted from the Waverly Facility and that are not classified as "criteria pollutants." Criteria pollutants are defined as Carbon Monoxide (CO), Lead (Pb), Oxides of Nitrogen (NO_x), Ozone, Particulate Matter (PM), Particulate Matter less than 10 microns (PM_{10}), Particulate Matter less than 2.5 microns ($PM_{2.5}$), and Sulfur Dioxide (SO_2). These pollutants have National Ambient Air Quality Standards (NAAQS) set for each that are designed to protect the public health and welfare. Other pollutants of concern, although designated as non-criteria and without national concentration standards, are regulated through various federal programs designed to limit their emissions and public exposure. These programs include federal source-specific Hazardous Air Pollutants (HAPs) standards promulgated under 40 CFR 61 (NESHAPS) and 40 CFR 63 (MACT). Any potential applicability to these programs were discussed above under REGULATORY APPLICABILITY.

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. Pleasants included the HAPs listed in the following table as emitted in substantive amounts (at least 0.01 lb/hr or 0.01 tpy) in their emissions estimate. The following table lists each HAP's carcinogenic risk (as based on analysis provided in the Integrated Risk Information System (IRIS)):

HAPs	Type	Known/Suspected Carcinogen	Classification
Acetaldehyde	VOC	Yes	B2 - Probable Human Carcinogen
Acrolein	VOC	No	Not Assessed
Benzene	VOC	Yes	A - Human Carcinogen
2,2,4-Trimethylpentane	VOC	No	Inadequate Data
Formaldehyde	VOC	Yes	B1 - Probable Human Carcinogen
Hexane	VOC	No	Inadequate Data
Biphenyl	VOC	No	D- Not Classifiable
1,3-Butadiene	VOC	Yes	Carcinogenic
Methanol	VOC	No	Inadequate Data
Toluene	VOC	No	Inadequate Data
Xylene	VOC	No	Inadequate Data

AIR QUALITY IMPACT ANALYSIS

Since the existing facility is not a major source as defined in 45CSR14, no modeling was performed.

MONITORING OF OPERATIONS

R13-2373B will require Pleasants Energy to monitor and record the following:

* The hours of operation of each TurboPhase engine.
* Maintenance performed on each TurboPhase engine.
* The hours of operation of each generator.
* Maintenance performed on each generator.
* The amount of natural gas consumed by the turbines.
* The amount of distillate fuel consumed by the turbines.
* The sulfur content of the natural gas combusted by the turbines.
* The sulfur content of the distillate fuel combusted by the turbines.

CHANGES TO PERMIT R13-2373A

R13-2373B will practically be an entirely new permit except it will retain a few turbine emission limits and monitoring requirements.

RECOMMENDATION TO DIRECTOR

Information supplied in the application indicates that compliance with all applicable regulations will be achieved. Therefore it is the recommendation of the writer that permit R13-2373B to install two TurboPhase systems at their plant near Waverly be granted to Pleasants Energy, LLC

Steven R. Pursley, PE
Engineer

10-1-15
October 1, 2015