TENASKA ROAN'S PRAIRIE PARTNERS, LLC

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Omaha, Nebraska 68154-4446
402-691-9500
FAX: 402-691-9526

January 14, 2014

Mr. Quang Nguyen
U.S. Environmental Protection Agency
Mail Code 6PD-R
1445 Ross Avenue
Suite 1200
Dallas, TX 75202-2733

Via Overnight Courier and Electronic Mail

Re: GHG PSD Permit Application
Tenaska Roan's Prairie Generating Station

Dear Mr. Nguyen:

Tenaska Roan's Prairie Partners, LLC (Tenaska) herein provides responses to your e-mail dated December 30, 2013, as well as an administrative revision to the Core Data Form, regarding the Greenhouse Gas Prevention of Significant Deterioration permit application for the proposed Tenaska Roan's Prairie Generating Station. We have provided responses below following the sequence in your e-mail. Note that the numerous questions contained in the first item have been addressed below in separate responses.

1) **As indicated in the section 4.2.1.2 on Page 13, "Good operating practices include the use of operating procedures including startup, shutdown and malfunction procedures, the use of instrumentation and controls for operational control, and maintaining manufacturer recommended combustion parameters. Maintenance practices include performing manufacturer recommended preventative maintenance."**

   a) **Please provide supplemental information that discusses details of what operating parameters will be monitored and how will it be used to determine that the turbines are operating at optimal efficiency and fuel combustion is occurring such as temperature, pressure, etc. How will proper air/fuel ratio be assured? What type of analyzers will be utilized?**

      The turbine and plant supervisory and control systems will continuously monitor multiple parameters, including fuel flow, air inlet guide vane position, temperatures and pressures, and other parameters, to assure proper and safe operation of the turbine, while maintaining low emissions.

      Dry Low-NO_x (DLN) combustors are prone to flame instability under certain operating conditions. Resulting pressure pulsations (also known as combustion dynamics), when excessive, can damage the combustors and downstream components. Therefore, the combustion turbine will be equipped with an active combustion dynamic monitoring system to continuously monitor combustor pressure levels. The pressure monitoring

system will analyze the current combustion dynamic conditions and adjusts the engine's performance accordingly to protect the combustor and reduce combustion instability. Control valves will be used to regulate and distribute the fuel flow to each combustion turbine's multi-nozzle combustion system. The fuel flow control valves control the desired fuel flow in response to a control system fuel command. The response of the fuel flow to the control valves' commands is made predictable by maintaining a predetermined pressure upstream of the respective control valves. The upstream pressure is controlled by modulating these valves based on turbine speed and feedback from the pressure transducers.

The combustion system includes multiple combustion chambers arranged around the periphery of the compressor discharge casing. This system includes fuel nozzles, ignition system, flame detectors, and other equipment. Hot gases, generated from burning fuel in the combustion chambers, flow through transition pieces to the turbine section.

Turbine air inlet guide vanes are adjusted as required by the turbine control system to regulate the amount of air flow through the compressor section while controlling flame temperatures and minimizing emissions. High pressure air from the compressor discharge is directed around the transition pieces. Some of this air is used to cool the transition pieces. The remaining air enters the combustion zone. Fuel is supplied to each combustion chamber through multiple nozzles designed to disperse and mix the fuel with the proper amount of combustion air.

b) Will these analyzers provide continuous monitoring?

Yes, the turbine and plant control system, combustion dynamics monitoring system, and corresponding instrumentation will operate continuously during combustion turbine unit operation.

c) Will there be manual overrides and alarms to alert on-site personnel to operating abnormalities?

Yes.

d) How will the data be recorded and stored?

The plant control system will have a data historian which will be used to store historical operating data.

e) What is the company's proposed monitoring strategy (e.g., CEMs)?

A continuous emissions monitoring system (CEMS) will be utilized to monitor NO_x and CO emissions, as well as in-stack exhaust oxygen content. Fuel sulfur content will be analyzed periodically to estimate SO_2 and particulate matter emissions. VOC emissions will be monitored based upon initial stack test results and comparison with monitored CO emissions.

f) What will each maintenance level be involved? How often will each maintenance level be conducted?

Maintenance activities, including 'Combustion', 'Hot Gas Path', and 'Major' inspections, will be performed in accordance with the combustion turbine manufacturers' recommendations at intervals which are a function of unit operating hours and starts, borescope inspection findings, and previous maintenance inspection results. Borescope inspections will be performed periodically to visually inspect the physical condition of certain turbine components.

g) What are the monitoring and recordkeeping requirements?

Inspection and maintenance records will be maintained on-site. Recordkeeping and reporting will be per the air permit requirements.

h) How many startups and shutdowns are anticipated for the proposed plant? Also, include the rationale for the number of proposed startup and shutdowns.

For emission calculation purposes, 365 starts and shutdowns per year per turbine were assumed. This was derived by assuming one start and shutdown per day with an 8-hr run time per start (2,920 hrs/yr limit divided by assumed 8-hrs per run equals 365 starts/shutdowns per year). The actual number of starts/shutdowns per day and per year, as well as the actual run time per start, will be dictated by market forces and could be higher or lower than that assumed. However, annual emissions will not exceed the proposed maximum rates.

2) As indicated in the section 4.2.2.2 on page 14, "Due to the low concentration of CO2 and low pressure of combustion flue gases...." Please provide site-specific flue gas stream information (i.e., pressure, the quantity and concentration of CO2 that is in the flue gas stream, etc.)

Turbine Model	Exhaust Pressure [1] (psia)	CO_2 Quantity [2] (lb/hr)	CO_2 Concentration Range [3] (% volume)
Siemens SGT6-5000F5ee	14.7	291,749	3.5 - 4.1
GE 7FA.04	14.7	262,706	3.7 - 4.0
GE 7FA.05	14.7	284,119	3.5 - 4.0

Notes:
1. Estimate is static basis and based on atmospheric pressure of 14.511 psia (standard pressure based on the site specific elevation of 350 feet above sea level) and unit operating parameters for base load operation at 90°F DBT, 65% RH with evaporative cooler in operation; assumes losses for exhaust duct and stack.
2. Maximum rates per Table 1(a) of Appendix B of the application on a per-unit basis.
3. Expected range based on manufacturer's data for site specific conditions from minimum load to base load for ambient temperatures ranging from 7°F to 109°F dry bulb, with and without evaporative cooler in operation.

3) **The global warming potentials (GWP) have been revised. The final rule published on November 29, 2013 in the Federal Register will be effective for all permits issued on or after January 1, 2014. The methane value was increased from 21 to 25 (times more potent than CO_2), the N_2O value was decreased from 310 to 298 and the SF_6 value decreased from 23,900 to 22,800. Due to the prospective changes in the emissions for methane in the application, please provide updated emission tables using the new GWPs.**

   See Attachments 1-3 for revised applicable pages of the application. We would like to verify that, going forward, our permit will always be based on the November 29, 2013 version of the GWPs and not be subject to any future revisions of those values. This is to alleviate any potential non-compliance situation caused solely by a future change in the GWPs.

4) **The calculated gross gas turbine power and efficiency are as "measured" across the electric generator terminals at ISO (International Organization for Standardization) site conditions without allowances for inlet filter and duct losses, exhaust stack and silencer losses, gearbox efficiency and any auxiliary mechanical and electrical systems parasitic power consumption. ISO design ratings are typically provided to be 59°F and sea level. Please provide an efficiency estimate of the anticipated actual operational scenario for a simple-cycle combustion turbine located in Grimes County, Texas.**

   Corresponding new and clean outputs and heat rates for the combustion turbine models under consideration at expected summer conditions and actual site design conditions (elevation, fuel, inlet and exhaust losses, etc.) at base load and minimum load operation are as shown in Table 4-9 of the application. Additional supplemental expected performance information at site conditions is included in Appendix D.

5) **As indicated in section 4.5.5 on page 29,"Compliance with the demonstrated by appropriate documentation of the AVO and preventative maintenance plans". Please provide supplemental information that describes details on AVO program implementation (i.e., inspection frequency, control efficiency, record keeping, preventative maintenance, etc.)**

   We propose to conduct the SF_6 AVO inspections on a weekly basis. Components found leaking will be repaired or replaced as soon as practicable but no later than 30 days after leak detection. Preventative maintenance procedures will consist of installing SF_6-containing equipment with a maximum annual leakage rate of 0.5% by weight and use of density monitoring systems that will alarm in the control room if a density loss is detected. Should an alarm occur the cause will be investigated and any leaking component found will be repaired or replaced as soon as practicable but no later than 30 days after leak detection. Records will be kept of the weekly AVO inspection results, any required component repair or replacement, and any density alarms with resulting actions taken.

6) **Please provide emission point number(s) for fugitive emissions and the detailed process flow diagram with a representation of the GHG fugitive emission sources and associated EPNs.**

EPN FUG is the emission point number representing collective fugitive methane emissions from natural gas fuel piping component leaks. EPN CBFUG is the emission point number representing collective fugitive SF_6 emissions from circuit breaker leaks. See Attachment 4 for a revised Process Flow Diagram.

7) **Please provide detail information on additional ancillary equipment required to operate the units, their impact on the efficiency of the unit and overall environmental impacts.**

There are various ancillary equipment and sub-systems included with the turbine package as well as balance of plant ("BOP") systems required for overall facility operation. The primary ancillary equipment and BOP systems include the generator and excitation system, starting package, inlet air system filter and silencer, exhaust transition piece electrical and control package, transformers, fuel gas delivery system, lube oil cooler system, lubricating oil package, fire protection, water wash system, and hydraulic oil skid.

During normal facility operation certain systems operate continuously while others operate as needed resulting in parasitic loads and/or losses. These parasitic loads are very small relative to the turbine gross output. These systems and equipment are not included or operated to increase efficiency but to allow for normal, safe and reliable operation of the turbines.

8) **Has Tenaska Roans Prairie Partners, LLC performed any additional analysis to decide which combustion turbine model or power plant megawatt configuration it plans to build?**

No; all turbine models included in the application remain viable.

9) **Legal Company and Facility Name**

A last item we wish to address, not mentioned in your e-mail, are the Project's legal company and facility names. An apostrophe in "Roans" was inadvertently omitted from the application. Therefore, following are the correct names:

Legal Company Name: Tenaska Roan's Prairie Partners, LLC
Facility Name: Tenaska Roan's Prairie Generating Station

See attachment 5 for a revised Core Data form.

We trust these responses satisfactorily address your comments. Please let me know if you have any questions or require additional information. We look forward to a completeness determination and issuance of the draft permit.

Sincerely,

TENASKA ROAN'S PRAIRIE PARTNERS, LLC,
a Delaware limited liability company
By: Tenaska Roan's Prairie I, LLC, Its Manager

Larry G. Carlson, QEP
Director, Air Programs

Attachments

cc: Melanie Magee, USEPA (email only)
Jeff Robinson, USEPA (email only)
Brad Toups, USEPA (email only)
Sid Rajmohan, ERM (email only)

Updated Emission Calculations

Attachment 1

January 2014

Tenaska Roan's Prairie Partners, LLC

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	**Permit No.:**	TBD	**Regulated Entity No.:**	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			**Customer Reference No.:**	CN600698948

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			**2. Component or Air Contaminant Name**	**3. Air Contaminant Emission Rate**	
(A) EPN	**(B) FIN**	**(C) NAME**		**(A) POUND**	**(B) TPY**
1	1	Unit 1 (Siemens SGT6-5000F(5ee) Turbine)	NO_X	79.00	115.34
			NO_X (MSS)	91.08	8.21
			CO	32.40	47.30
			CO (MSS)	694.90	123.37
			VOC	3.00	4.38
			VOC (MSS)	109.85	19.73
			SO_2	3.45	5.15
			PM	13.23	15.95
			PM_{10}	13.23	15.95
			$PM_{2.5}$	13.23	15.95
			H_2SO_4	0.61	0.89
			Pb	0.01	0.02
			HAP (excluding Pb)	1.59	2.32
			Formaldehyde	0.83	1.21
			CO_2	291,749.39	425,954.12
			CH_4	5.38	7.86
			N_2O	0.54	0.79
			CO_2e	292,044.27	426,384.63

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	**Permit No.:**	TBD	**Regulated Entity No.:**	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			**Customer Reference No.:**	CN600698948

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1. Emission Point			**2. Component or Air Contaminant Name**	**3. Air Contaminant Emission Rate**	
(A) EPN	**(B) FIN**	**(C) NAME**		**(A) POUND**	**(B) TPY**
2	2	Unit 2 (Siemens SGT6-5000F(5ee) Turbine)	NO_X	79.00	115.34
			NO_X (MSS)	91.08	8.21
			CO	32.40	47.30
			CO (MSS)	694.90	123.37
			VOC	3.00	4.38
			VOC (MSS)	109.85	19.73
			SO_2	3.45	5.15
			PM	13.23	15.95
			PM_{10}	13.23	15.95
			$PM_{2.5}$	13.23	15.95
			H_2SO_4	0.61	0.89
			Pb	0.01	0.02
			HAP (excluding Pb)	1.59	2.32
			Formaldehyde	0.83	1.21
			CO_2	291,749.39	425,954.12
			CH_4	5.38	7.86
			N_2O	0.54	0.79
			CO_2e	292,044.27	426,384.63

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AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
3	3	Unit 3 (Siemens SGT6-5000F(5ee) Turbine)	NO_X	79.00	115.34
			NO_X (MSS)	91.08	8.21
			CO	32.40	47.30
			CO (MSS)	694.90	123.37
			VOC	3.00	4.38
			VOC (MSS)	109.85	19.73
			SO_2	3.45	5.15
			PM	13.23	15.95
			PM_{10}	13.23	15.95
			$PM_{2.5}$	13.23	15.95
			H_2SO_4	0.61	0.89
			Pb	0.01	0.02
			HAP (excluding Pb)	1.59	2.32
			Formaldehyde	0.83	1.21
			CO_2	291,749.39	425,954.12
			CH_4	5.38	7.86
			N_2O	0.54	0.79
			CO_2e	292,044.27	426,384.63
EMGEN	EMGEN	Emergency Generator Engine	NO_X	30.91	1.55
			CO	16.91	0.85
			VOC	2.07	0.10
			SO_2	0.03	<0.01
			PM	0.97	0.05
			PM_{10}	0.97	0.05
			$PM_{2.5}$	0.97	0.05
			H_2SO_4	<0.01	<0.01
			HAP (excluding Pb)	0.03	<0.01
			Formaldehyde	<0.01	<0.01
			CO_2	3,125.45	156.27
			CH_4	0.13	0.01
			N_2O	0.03	<0.01
			CO_2e	3,136.18	156.81

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	Permit No.:	TBD	Regulated Entity No.:	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			Customer Reference No.:	CN600698948

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AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
FWPUMP	FWPUMP	Fire Water Pump	NO_X	3.78	0.19
			CO	3.84	0.19
			VOC	1.45	0.07
			SO_2	0.01	<0.01
			PM	0.19	0.01
			PM_{10}	0.19	0.01
			$PM_{2.5}$	0.19	0.01
			H_2SO_4	<0.01	<0.01
			HAP (excluding Pb)	0.02	<0.01
			Formaldehyde	<0.01	<0.01
			CO_2	654.79	32.74
			CH_4	0.03	<0.01
			N_2O	0.01	<0.01
			CO_2e	657.04	32.85
CBFUG	CBFUG	Circuit Breaker Fugitives	SF_6	<0.01	0.01
			CO_2e	45.55	199.50
MSSFUG	MSSFUG	Maintenance Activites	NO_X	<0.01	<0.01
			CO	<0.01	<0.01
			VOC	0.30	<0.01
			PM	0.20	0.04
			PM_{10}	0.20	0.04
			$PM_{2.5}$	0.20	0.04
			HAP (excluding Pb)	0.30	<0.01
			CO_2	0.92	0.01
			CH_4	16.70	0.11
			CO_2e	418.43	2.88
FUG	FUG	Fugitives	VOC	0.01	0.06
			HAP (excluding Pb)	0.01	0.06
			CO_2	0.04	0.18
			CH_4	0.75	3.30
			CO_2e	18.87	82.65

EPN = Emission Point Number
FIN = Facility Identification Number

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

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AIR CONTAMINANT DATA			**EMISSION POINT DISCHARGE PARAMETERS**										
1. Emission Point			**4. UTM Coordinates of Emission Point**			**Source**							
						5. Building	**6. Height Above**	**7. Stack Exit Data**			**8. Fugitives**		
EPN (A)	**FIN (B)**	**Name (C)**	**Zone**	**East (Meters)**	**North (Meters)**	**Height (Ft.)**	**Ground (Ft.)**	**Diameter (Ft.) (A)**	**Velocity (FPS) (B)**	**Temperature (°F) (C)**	**Length (Ft.) (A)**	**Width (Ft.) (B)**	**Axis Degrees (C)**
1	1	Unit 1 (Siemens SGT6-5000F(5ee) Turbine)	15	219,403	3,387,566	21.0	60.0	20.0	134.7	1,059	--	--	--
2	2	Unit 2 (Siemens SGT6-5000F(5ee) Turbine)	15	219,420	3,387,523	21.0	60.0	20.0	134.7	1,059	--	--	--
3	3	Unit 3 (Siemens SGT6-5000F(5ee) Turbine)	15	219,438	3,387,480	21.0	60.0	20.0	134.7	1,059	--	--	--
EMGEN	EMGEN	Emergency Generator Engine	15	219,528	3,387,595	21.0	14.0	1.0	323.4	768	--	--	--
FWPUMP	FWPUMP	Fire Water Pump	15	219,380	3,387,593	10.5	14.0	1.0	75.9	884	--	--	--
CBFUG	CBFUG	Circuit Breaker Fugitives	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W
MSSFUG	MSSFUG	Maintenance Activites	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W
FUG	FUG	Fugitives	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W

EPN = Emission Point Number

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Table 1(a) Emission Point Summary

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AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
1	1	Unit 1 (GE 7FA.05 Turbine)	NO_X	86.33	110.96
			NO_X (MSS)	86.33	11.13
			CO	37.00	54.02
			CO (MSS)	801.33	143.99
			VOC	3.60	5.26
			VOC (MSS)	133.20	24.09
			SO_2	3.10	4.66
			PM	9.90	14.82
			PM_{10}	9.90	14.82
			$PM_{2.5}$	9.90	14.82
			H_2SO_4	0.32	0.47
			Pb	0.01	0.02
			HAP (excluding Pb)	1.55	2.26
			Formaldehyde	0.81	1.18
			CO_2	284,119.31	414,814.19
			CH_4	5.24	7.65
			N_2O	0.52	0.77
			CO_2e	284,406.47	415,233.44

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

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1. Emission Point			**2. Component or Air Contaminant Name**	**3. Air Contaminant Emission Rate**	
(A) EPN	**(B) FIN**	**(C) NAME**		**(A) POUND**	**(B) TPY**
2	2	Unit 2 (GE 7FA.05 Turbine)	NO_X	86.33	110.96
			NO_X (MSS)	86.33	11.13
			CO	37.00	54.02
			CO (MSS)	801.33	143.99
			VOC	3.60	5.26
			VOC (MSS)	133.20	24.09
			SO_2	3.10	4.66
			PM	9.90	14.82
			PM_{10}	9.90	14.82
			$PM_{2.5}$	9.90	14.82
			H_2SO_4	0.32	0.47
			Pb	0.01	0.02
			HAP (excluding Pb)	1.55	2.26
			Formaldehyde	0.81	1.18
			CO_2	284,119.31	414,814.19
			CH_4	5.24	7.65
			N_2O	0.52	0.77
			CO_2e	284,406.47	415,233.44

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AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
3	3	Unit 3 (GE 7FA.05 Turbine)	NO_X	86.33	110.96
			NO_X (MSS)	86.33	11.13
			CO	37.00	54.02
			CO (MSS)	801.33	143.99
			VOC	3.60	5.26
			VOC (MSS)	133.20	24.09
			SO_2	3.10	4.66
			PM	9.90	14.82
			PM_{10}	9.90	14.82
			$PM_{2.5}$	9.90	14.82
			H_2SO_4	0.32	0.47
			Pb	0.01	0.02
			HAP (excluding Pb)	1.55	2.26
			Formaldehyde	0.81	1.18
			CO_2	284,119.31	414,814.19
			CH_4	5.24	7.65
			N_2O	0.52	0.77
			CO_2e	284,406.47	415,233.44
EMGEN	EMGEN	Emergency Generator Engine	NO_X	30.91	1.55
			CO	16.91	0.85
			VOC	2.07	0.10
			SO_2	0.03	<0.01
			PM	0.97	0.05
			PM_{10}	0.97	0.05
			$PM_{2.5}$	0.97	0.05
			H_2SO_4	<0.01	<0.01
			HAP (excluding Pb)	0.03	<0.01
			Formaldehyde	<0.01	<0.01
			CO_2	3,125.45	156.27
			CH_4	0.13	0.01
			N_2O	0.03	<0.01
			CO_2e	3,136.18	156.81

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1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
FWPUMP	FWPUMP	Fire Water Pump	NO_X	3.78	0.19
			CO	3.84	0.19
			VOC	1.45	0.07
			SO_2	0.01	<0.01
			PM	0.19	0.01
			PM_{10}	0.19	0.01
			$PM_{2.5}$	0.19	0.01
			H_2SO_4	<0.01	<0.01
			HAP (excluding Pb)	0.02	<0.01
			Formaldehyde	<0.01	<0.01
			CO_2	654.79	32.74
			CH_4	0.03	<0.01
			N_2O	0.01	<0.01
			CO_2e	657.04	32.85
CBFUG	CBFUG	Circuit Breaker Fugitives	SF_6	<0.01	0.01
			CO_2e	45.55	199.50
MSSFUG	MSSFUG	Maintenance Activites	NO_X	<0.01	<0.01
			CO	<0.01	<0.01
			VOC	0.30	<0.01
			PM	0.20	0.04
			PM_{10}	0.20	0.04
			$PM_{2.5}$	0.20	0.04
			HAP (excluding Pb)	0.30	<0.01
			CO_2	0.92	0.01
			CH_4	16.70	0.11
			CO_2e	418.43	2.88
FUG	FUG	Fugitives	VOC	0.01	0.06
			HAP (excluding Pb)	0.01	0.06
			CO_2	0.04	0.18
			CH_4	0.75	3.30
			CO_2e	18.87	82.65

EPN = Emission Point Number
FIN = Facility Identification Number

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	**Permit No.:**	TBD	**Regulated Entity No.:**	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			**Customer Reference No.:**	CN600698948

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA			**EMISSION POINT DISCHARGE PARAMETERS**										
1. Emission Point			**4. UTM Coordinates of Emission Point**			**Source**							
						5. Building	**6. Height Above**	**7. Stack Exit Data**			**8. Fugitives**		
EPN (A)	**FIN (B)**	**Name (C)**	**Zone**	**East (Meters)**	**North (Meters)**	**Height (Ft.)**	**Ground (Ft.)**	**Diameter (Ft.) (A)**	**Velocity (FPS) (B)**	**Temperature (°F) (C)**	**Length (Ft.) (A)**	**Width (Ft.) (B)**	**Axis Degrees (C)**
1	1	Unit 1 (GE 7FA.05 Turbine)	15	219,403	3,387,566	21.0	60.0	20.0	125.4	1,055	--	--	--
2	2	Unit 2 (GE 7FA.05 Turbine)	15	219,420	3,387,523	21.0	60.0	20.0	125.4	1,055	--	--	--
3	3	Unit 3 (GE 7FA.05 Turbine)	15	219,438	3,387,480	21.0	60.0	20.0	125.4	1,055	--	--	--
EMGEN	EMGEN	Emergency Generator Engine	15	219,528	3,387,595	21.0	14.0	1.0	323.4	768	--	--	--
FWPUMP	FWPUMP	Fire Water Pump	15	219,380	3,387,593	10.5	14.0	1.0	75.9	884	--	--	--
CBFUG	CBFUG	Circuit Breaker Fugitives	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W
MSSFUG	MSSFUG	Maintenance Activites	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W
FUG	FUG	Fugitives	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W

EPN = Emission Point Number
FIN = Facility Identification Number

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	**Permit No.:**	TBD	**Regulated Entity No.:**	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			**Customer Reference No.:**	CN600698948

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			**2. Component or Air Contaminant Name**	**3. Air Contaminant Emission Rate**	
(A) EPN	**(B) FIN**	**(C) NAME**		**(A) POUND**	**(B) TPY**
1	1	Unit 1 (GE 7FA.04 Turbine)	NO_X	82.00	100.74
			NO_X (MSS)	82.00	10.77
			CO	33.00	48.18
			CO (MSS)	434.00	77.20
			VOC	3.60	5.26
			VOC (MSS)	37.20	6.57
			SO_2	2.88	4.33
			PM	9.90	14.82
			PM_{10}	9.90	14.82
			$PM_{2.5}$	9.90	14.82
			H_2SO_4	0.30	0.44
			Pb	0.01	0.01
			HAP (excluding Pb)	1.43	2.09
			Formaldehyde	0.75	1.09
			CO_2	262,705.55	383,550.10
			CH_4	4.85	7.07
			N_2O	0.48	0.71
			CO_2e	262,971.06	383,937.75

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	Permit No.:	TBD	Regulated Entity No.:	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			Customer Reference No.:	CN600698948

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
2	2	Unit 2 (GE 7FA.04 Turbine)	NO_X	82.00	100.74
			NO_X (MSS)	82.00	10.77
			CO	33.00	48.18
			CO (MSS)	434.00	77.20
			VOC	3.60	5.26
			VOC (MSS)	37.20	6.57
			SO_2	2.88	4.33
			PM	9.90	14.82
			PM_{10}	9.90	14.82
			$PM_{2.5}$	9.90	14.82
			H_2SO_4	0.30	0.44
			Pb	0.01	0.01
			HAP (excluding Pb)	1.43	2.09
			Formaldehyde	0.75	1.09
			CO_2	262,705.55	383,550.10
			CH_4	4.85	7.07
			N_2O	0.48	0.71
			CO_2e	262,971.06	383,937.75

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	Permit No.:	TBD	Regulated Entity No.:	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			Customer Reference No.:	CN600698948

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
3	3	Unit 3 (GE 7FA.04 Turbine)	NO_X	82.00	100.74
			NO_X (MSS)	82.00	10.77
			CO	33.00	48.18
			CO (MSS)	434.00	77.20
			VOC	3.60	5.26
			VOC (MSS)	37.20	6.57
			SO_2	2.88	4.33
			PM	9.90	14.82
			PM_{10}	9.90	14.82
			$PM_{2.5}$	9.90	14.82
			H_2SO_4	0.30	0.44
			Pb	0.01	0.01
			HAP (excluding Pb)	1.43	2.09
			Formaldehyde	0.75	1.09
			CO_2	262,705.55	383,550.10
			CH_4	4.85	7.07
			N_2O	0.48	0.71
			CO_2e	262,971.06	383,937.75
EMGEN	EMGEN	Emergency Generator Engine	NO_X	30.91	1.55
			CO	16.91	0.85
			VOC	2.07	0.10
			SO_2	0.03	<0.01
			PM	0.97	0.05
			PM_{10}	0.97	0.05
			$PM_{2.5}$	0.97	0.05
			H_2SO_4	<0.01	<0.01
			HAP (excluding Pb)	0.03	<0.01
			Formaldehyde	<0.01	<0.01
			CO_2	3,125.45	156.27
			CH_4	0.13	0.01
			N_2O	0.03	<0.01
			CO_2e	3,136.18	156.81

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	Permit No.:	TBD	Regulated Entity No.:	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			Customer Reference No.:	CN600698948

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA					
1. Emission Point			2. Component or Air Contaminant Name	3. Air Contaminant Emission Rate	
(A) EPN	(B) FIN	(C) NAME		(A) POUND	(B) TPY
FWPUMP	FWPUMP	Fire Water Pump	NO_X	3.78	0.19
			CO	3.84	0.19
			VOC	1.45	0.07
			SO_2	0.01	<0.01
			PM	0.19	0.01
			PM_{10}	0.19	0.01
			$PM_{2.5}$	0.19	0.01
			H_2SO_4	<0.01	<0.01
			HAP (excluding Pb)	0.02	<0.01
			Formaldehyde	<0.01	<0.01
			CO_2	654.79	32.74
			CH_4	0.03	<0.01
			N_2O	0.01	<0.01
			CO_2e	657.04	32.85
CBFUG	CBFUG	Circuit Breaker Fugitives	SF_6	<0.01	0.01
			CO_2e	45.55	199.50
MSSFUG	MSSFUG	Maintenance Activites	NO_X	<0.01	<0.01
			CO	<0.01	<0.01
			VOC	0.30	<0.01
			PM	0.20	0.04
			PM_{10}	0.20	0.04
			$PM_{2.5}$	0.20	0.04
			HAP (excluding Pb)	0.30	<0.01
			CO_2	0.92	0.01
			CH_4	16.70	0.11
			CO_2e	418.43	2.88
FUG	FUG	Fugitives	VOC	0.01	0.06
			HAP (excluding Pb)	0.01	0.06
			CO_2	0.04	0.18
			CH_4	0.75	3.30
			CO_2e	18.87	82.65

EPN = Emission Point Number
FIN = Facility Identification Number

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Table 1(a) Emission Point Summary

Date:	1/13/2014	**Permit No.:**	TBD	**Regulated Entity No.:**	TBD
Area Name:	Tenaska Roan's Prairie Generating Station			**Customer Reference No.:**	CN600698948

Review of applications and issuance of permits will be expedited by supplying all necessary information requested on this Table.

AIR CONTAMINANT DATA			**EMISSION POINT DISCHARGE PARAMETERS**										
1. Emission Point			**4. UTM Coordinates of Emission Point**			**Source**							
						5. Building	**6. Height Above**	**7. Stack Exit Data**			**8. Fugitives**		
EPN (A)	**FIN (B)**	**Name (C)**	**Zone**	**East (Meters)**	**North (Meters)**	**Height (Ft.)**	**Ground (Ft.)**	**Diameter (Ft.) (A)**	**Velocity (FPS) (B)**	**Temperature (°F) (C)**	**Length (Ft.) (A)**	**Width (Ft.) (B)**	**Axis Degrees (C)**
1	1	Unit 1 (GE 7FA.04 Turbine)	15	219,403	3,387,566	21.0	60.0	20.0	114.9	1,055	--	--	--
2	2	Unit 2 (GE 7FA.04 Turbine)	15	219,420	3,387,523	21.0	60.0	20.0	114.9	1,055	--	--	--
3	3	Unit 3 (GE 7FA.04 Turbine)	15	219,438	3,387,480	21.0	60.0	20.0	114.9	1,055	--	--	--
EMGEN	EMGEN	Emergency Generator Engine	15	219,528	3,387,595	21.0	14.0	1.0	323.4	768	--	--	--
FWPUMP	FWPUMP	Fire Water Pump	15	219,380	3,387,593	10.5	14.0	1.0	75.9	884	--	--	--
CBFUG	CBFUG	Circuit Breaker Fugitives	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W
MSSFUG	MSSFUG	Maintenance Activites	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W
FUG	FUG	Fugitives	15	219,509	3,387,556	--	3.0	--	--	--	850	660	77 W

EPN = Emission Point Number
FIN = Facility Identification Number

TABLE B-2
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Project Potential Emissions Increase - Siemens Option

Project: Three (3) Turbines, no base-line case (new facility)

Pollutant	Single (one) Siemens SGT6-5000F(5ee) Turbine Emissions (tpy)	Total for Three Siemens Turbines (tpy)	Emergency Generator (tpy)	Emergency Fire Pump (tpy)	Fugitive SF_6 Leakage (tpy)	Maintenance Emissions (tpy)	Fugitive Natural Gas Emissions (tpy)	Total Project Emissions (tpy)
NO_X	123.55	370.66	1.55	0.19	-	5.97E-07	-	372.39
CO	170.67	512.02	0.85	0.19	-	3.63E-07	-	513.06
VOC	24.11	72.32	0.10	0.07	-	2.05E-03	0.06	72.56
SO_2	5.15	15.44	1.46E-03	3.06E-04	-	-	-	15.44
PM	15.95	47.85	0.05	0.01	-	0.04	-	47.95
PM_{10}	15.95	47.85	0.05	0.01	-	0.04	-	47.95
$PM_{2.5}$	15.95	47.85	0.05	0.01	-	0.04	-	47.95
H_2SO_4	0.89	2.67	1.46E-04	3.06E-05	-	-	-	2.67
Lead	0.02	0.05	-	-	-	-	-	0.046
CO_2	425,954.12	1,277,862.35	156.27	32.74	-	0.01	0.18	1,278,051.55
CH_4	7.86	23.57	0.01	1.33E-03	-	0.11	3.30	26.99
N_2O	0.79	2.36	1.27E-03	2.66E-04	-	-	-	2.36
SF_6	-	-	-	-	0.01	-	-	0.01
GHG (CO_2e)	426,384.63	1,279,153.89	156.81	32.85	199.50	2.88	82.65	1,279,628.59
Total HAPs (excluding lead)	2.32	6.96	1.51E-03	7.78E-04	-	2.05E-03	0.06	7.02
Formaldehyde	1.21	3.63	7.56E-05	7.85E-06	-	-	-	3.63

TABLE B-3
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Project Potential Emissions Increase - GE 7FA.05 Option

Project: Three (3) Turbines, no base-line case (new facility)

Pollutant	Single (one) GE 7FA.05 Tubine Emissions (tpy)	Total for Three GE 7FA.05 Tubines Emissions (tpy)	Emergency Generator (tpy)	Emergency Fire Pump (tpy)	Fugitive SF_6 Leakage (tpy)	Maintenance Emissions (tpy)	Fugitive Natural Gas Emissions (tpy)	Total Project Emissions (tpy)
NO_X	122.09	366.28	1.55	0.19	-	5.97E-07	-	368.01
CO	198.01	594.04	0.85	0.19	-	3.63E-07	-	595.07
VOC	29.35	88.04	0.10	0.07	-	2.05E-03	0.06	88.27
SO_2	4.66	13.97	1.46E-03	3.06E-04	-	-	-	13.97
PM	14.82	44.46	0.05	0.01	-	0.04	-	44.55
PM_{10}	14.82	44.46	0.05	0.01	-	0.04	-	44.55
$PM_{2.5}$	14.82	44.46	0.05	0.01	-	0.04	-	44.55
H_2SO_4	0.47	1.40	1.46E-04	3.06E-05	-	-	-	1.40
Lead	0.02	0.05	-	-	-	-	-	0.045
CO_2	414,814.19	1,244,442.56	156.27	32.74	-	0.01	0.18	1,244,631.76
CH_4	7.65	22.95	0.01	1.33E-03	-	0.11	3.30	26.37
N_2O	0.77	2.30	1.27E-03	2.66E-04	-	-	-	2.30
SF_6	-	-	-	-	0.01	-	-	0.01
GHG (CO_2e)	415,233.44	1,245,700.32	156.81	32.85	199.50	2.88	82.65	1,246,175.02
Total HAPs (excluding lead)	2.26	6.78	1.51E-03	7.78E-04	-	2.05E-03	0.06	6.84
Formaldehyde	1.18	3.54	7.56E-05	7.85E-06	-	-	-	3.54

TABLE B-4
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Project Potential Emissions Increase - GE 7FA.04 Option

Project: Three (3) Turbines, no base-line case (new facility)

Pollutant	Single (one) GE 7FA.04 Tubine Emissions (tpy)	Total for Three GE 7FA.04 Tubine Emissions (tpy)	Emergency Generator (tpy)	Emergency Fire Pump (tpy)	Fugitive SF_6 Leakage (tpy)	Maintenance Emissions (tpy)	Fugitive Natural Gas Emissions (tpy)	Total Project Emissions (tpy)
NO_X	111.51	334.52	1.55	0.19	-	5.97E-07	-	336.26
CO	125.38	376.13	0.85	0.19	-	3.63E-07	-	377.17
VOC	11.83	35.48	0.10	0.07	-	2.05E-03	0.06	35.71
SO_2	4.33	12.98	1.46E-03	3.06E-04	-	-	-	12.99
PM	14.82	44.46	0.05	0.01	-	0.04	-	44.55
PM_{10}	14.82	44.46	0.05	0.01	-	0.04	-	44.55
$PM_{2.5}$	14.82	44.46	0.05	0.01	-	0.04	-	44.55
H_2SO_4	0.44	1.31	1.46E-04	3.06E-05	-	-	-	1.31
Lead	0.014	0.042	-	-	-	-	-	0.042
CO_2	383,550.10	1,150,650.29	156.27	32.74	-	0.01	0.18	1,150,839.49
CH_4	7.07	21.22	0.01	1.33E-03	-	0.11	3.30	24.64
N_2O	0.71	2.12	1.27E-03	2.66E-04	-	-	-	2.12
SF_6	-	-	-	-	0.00875	-	-	0.01
GHG (CO_2e)	383,937.75	1,151,813.26	156.81	32.85	199.50	2.88	82.65	1,152,287.96
Total HAPs (excluding lead)	2.09	6.26	1.51E-03	7.78E-04	-	2.05E-03	0.06	6.33
Formaldehyde	1.09	3.27	7.56E-05	7.85E-06	-	-	-	3.27

TABLE B-5
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Siemens SGT6-5000F Emissions Calculations

Potential Emissions - Siemens SGT6-5000F Gas Turbine

Parameter	Value	Units	Source
Turbine Max. Heat Input Rating	2,441	MMBtu/hr per turbine	Manufacturer's Specifications
Turbine Min. Heat Input Rating	1,250	MMBtu/hr per turbine	Manufacturer's Specifications
Number of Turbines	1		
Turbine Operating Time	2,920	hrs	Maximum allowable hours per year for a peaking unit

Pollutant	Emissions Factor		Emissions from turbine (lb/hr)	Emissions from turbine (tpy)	Reference Footnote
NO_X	9 ppmvd @ 15% O_2	0.0332 lb/MMBtu	79.00	115.34	[1,2]
CO	9 ppmvd @ 15% O_2	0.0202 lb/MMBtu	32.40	47.30	[1,2]
VOC	1 ppmvd @ 15% O_2	0.0013 lb/MMBtu	3.00	4.38	[1,2]
SO_2	0.5 gr/100 dscf fuels	0.0014 lb/MMBtu	3.45	5.04	[3]
PM		0.004 lb/MMBtu	10.00	14.60	[4]
PM_{10}		0.004 lb/MMBtu	10.00	14.60	[4]
$PM_{2.5}$		0.004 lb/MMBtu	10.00	14.60	[4]
H_2SO_4	0.18 lb H_2SO_4/lb SO_2	0.00025 lb/MMBtu	0.61	0.89	[5]
Lead	0.005 lb/MMscf	4.35E-06 lb/MMBtu	0.0106	0.015	[6]
CO_2	54.22 kg/MMBtu	119.50 lb/MMBtu	291,749.39	425,954.12	[7]
CH_4	0.001 kg/MMBtu	0.002 lb/MMBtu	5.38	7.86	[8]
N_2O	0.0001 kg/MMBtu	0.0002 lb/MMBtu	0.54	0.79	[8]
CO_2e			292,044.27	426,384.63	[8]

[1] NO_X, CO, and VOC emission factors in ppmvd taken from BACT determination

[2] NO_X, CO, and VOC emission rates based on vendor guarantees

[3] SO_2: Emission rates based on vendor guarantees 0.5

[4] PM emission rate, including condensible PM, furnished by Siemens. All PM is $PM_{2.5}$ or less, Presumed BACT.

[5] Ratio of sulfuric acid mist emissions estimated by Siemens as 0.6 lb/hr, to SO_2 at 3.4 lb/hr, assuming sulfur content of natural gas as 0.5 gr/100 scf. Emission rate shown was calculated using Siemens ratio of 0.6/3.4 applied to calculated SO_2 emission rate using actual sulfur content of natural gas used. See Note 4.

[6] No factor for Turbines, Lead emission factor from AP-42 Table 1.4-2 (0.0005 lb/MMscf), assumed natural gas heat value of 1,050 Btu/scf for boilers.

[7] Based on projected fuel composition from supplier, see Appendix D.

[8] Based on USEPA's Mandatory Reporting Rule, Table C-2. To convert to CO_2e, the following global warming potentials were used - CH_4 = 25, N_2O = 298.

TABLE B-5
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Siemens SGT6-5000F Emissions Calculations

Potential HAP Emissions - Siemens SGT6-5000F(5ee) Gas Turbine

Pollutant	Emissions Factor		Emissions from Turbine (lb/hr)	Emissions from Turbine (tpy)	Reference Footnote
Toluene	1.30E-04	lb/MMBtu	0.32	0.46	[1]
Naphthalene	1.30E-06	lb/MMBtu	3.17E-03	4.63E-03	[1]
Formaldehyde	3.40E-04	lb/MMBtu	0.83	1.21	[2]
Benzene	1.20E-05	lb/MMBtu	0.03	0.04	[1]
Acetaldehyde	4.00E-05	lb/MMBtu	0.10	0.14	[1]
Ethylbenzene	3.20E-05	lb/MMBtu	0.08	0.11	[1]
Propylene Oxide	2.90E-05	lb/MMBtu	0.07	0.10	[1]
Xylenes	6.40E-05	lb/MMBtu	0.16	0.23	[1]
1,3-Butadiene	4.30E-07	lb/MMBtu	1.05E-03	1.53E-03	[1]
PAH	2.20E-06	lb/MMBtu	0.01	0.01	[1]
Total	6.51E-04	lb/MMBtu	1.59	2.32	

[1] Based on AP-42, Table 3.1-3, Emissions factors for HAP from gas-fired stationary gas turbines.
[2] Average of stack test results from Kiamichi and Rolling Hills facilities with a 3X compliance margin to reflect site-to-site variability.

Turbine Heat Input Rating =	2,441	MMBtu/hr per turbine
Number of Turbines =	1	
Turbine Operating Time =	2,920	hours per year

Startup and Shutdown Emissions - Siemens SGT6-5000F(5ee) Gas Turbine

	Startup (ignition to 100% load)	Shutdown (100% to fuel cut-off)	Reference Footnote
Est. Number of Events per year	365	365	[1]
Duration of Event (min/event)	15.00	10.00	[2]

[1] Numbers of Startup and Shutdown provided by TENASKA
[2] Peaking Startup and Peaking Shutdown Event Duration from Siemens Energy

TABLE B-5
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Siemens SGT6-5000F Emissions Calculations

Pollutant	Emissions (lb/event)		Reference Footnote
	Startup	Shutdown	
NO_X	25.0	20.0	[1]
CO	490.0	186.0	[1]
VOC	62.2	45.9	[1]
SO_2	0.33	0.28	[1]
PM	4.6	2.8	[1]

[1] Emissions per Event from Siemens Energy. Siemens SO_2 emission per event (su-0.13 lb/event, sd-0.11 lb/event) is based on sulfur content of natural gas as 0.2 gr/100 scf. SO_2 emission rate shown was adjusted by ratio for ratio of actual natural gas sulfur content (act S/0.2).

Pollutant	Startup and Shutdown Emissions (lb/hr)	Annual Startup/Shutdown Emissions per turbine (ton/yr)	Reference Footnote
NO_X	91.08	8.21	[1], [2]
CO	694.90	123.37	[1], [2]
VOC	109.85	19.73	[1], [2]
SO_2	2.61	0.11	[1], [2]
PM	13.23	1.35	[1], [2]

[1] Because the startup and shutdown events are less than 1 hr, the hourly startup and shutdown rates represent the mass of the event for both a startup and shutdown in one hour plus the worst-case emission rate scenario while at 100% load times the remainder of an hour ((60 minutes - event time in minutes)/60).

Sample calculation:

$$\frac{45.00 \text{ lb NOx}}{\text{event}} \times \frac{1 \text{ event}}{\text{hr}} + \frac{79.00 \text{ lb NOx}}{\text{hr}} \times \frac{60 - 25.00 \text{ min/hr}}{60 \text{ min/hr}} = \frac{91.08 \text{ lb NOx}}{\text{hr}}$$

[2] Annual Startup/Shutdown Emissions are calculated as the number of startup or shutdown events per year x the emissions per event.

Maximum Hourly Emissions - Siemens SGT6-5000F(5ee) Gas Turbine

Pollutant	Emissions from turbine (lb/hr)	Startup and Shutdown Emissions (lb/hr)	Maximum Hourly Emissions (lb/hr)
NO_X	79.00	91.08	91.08
CO	32.40	694.90	694.90
VOC	3.00	109.85	109.85
SO_2	3.45	2.61	3.45
PM	10.00	13.23	13.23

TABLE B-6
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.05 Emissions Calculations

Potential Emissions - GE 7FA.05 Gas Turbine

Parameter	Value	Unit	Source
Turbine Max. Heat Input Rating	2,378	MMBtu/hr per turbine	Manufacturer's Specification
Number of Turbines	1		
Turbine Operating Time	2,920	hours per year	Maximum allowable hours per year for a peaking unit

Pollutant	Emissions Factor		Emissions from turbine (lb/hr)	Emissions from turbine (tpy)	Reference Footnote
NO_X	9.0 ppmvd @ 15% O_2	0.0332 lb/MMBtu	76.00	110.96	[1,2]
CO	9.0 ppmvd @ 15% O_2	0.0202 lb/MMBtu	37.00	54.02	[1,2]
VOC	1.4 ppmvd @ 15% O_2	0.0018 lb/MMBtu	3.60	5.26	[1,2]
SO_2	0.5 gr/100 dscf fuels	0.0014 lb/MMBtu	3.10	4.53	[3]
PM		0.00423 lb/MMBtu	9.30	13.58	[4]
PM_{10}		0.00423 lb/MMBtu	9.30	13.58	[4]
$PM_{2.5}$		0.00423 lb/MMBtu	9.30	13.58	[4]
H_2SO_4	0.10 lb H_2SO_4/lb SO_2	0.00014 lb/MMBtu	0.32	0.47	[5]
Lead	0.005 lb/MMscf	4.35E-06 lb/MMBtu	0.0103	0.015	[6]
CO_2	54.22 kg/MMBtu	119.50 lb/MMBtu	284,119.31	414,814.19	[7]
CH_4	0.001 kg/MMBtu	0.002 lb/MMBtu	5.24	7.65	[8]
N_2O	0.0001 kg/MMBtu	0.0002 lb/MMBtu	0.52	0.77	[8]
CO_2e			284,406.47	415,233.44	[8]

[1] NO_X, CO, and VOC emission factors in ppmvd taken from BACT determination

[2] NO_X, CO, and VOC emission rates based on vendor guarantees

[3] SO_2: Emission rates based on vendor guarantees 0.5

[4] All PM is $PM_{2.5}$ or less and includes condensible PM, Presumed BACT

[5] Ratio of sulfuric acid mist emissions estimated by GE as 0.16 lb/hr, with SO_2 at 1.55 lb/hr, and assumes sulfur content of natural gas as 8 ppmw. Emission rate shown was calculated using GE ratio of 0.16/1.55 applied to calculated SO_2 emission rate using actual sulfur content of natural gas used. See Note 4.

[6] No factor for Turbines, Lead emission factor from AP-42 Table 1.4-2 (0.0005 lb/MMscf), assumed natural gas heat value of 1,150 Btu/scf for boilers.

[7] Based on projected fuel composition from supplier, see Appendix D.

[8] Based on USEPA's Mandatory Reporting Rule, Table C-2. To convert to CO_2e, the following global warming potentials were used - CH_4 = 25, N_2O = 298.

TABLE B-6
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.05 Emissions Calculations

Potential HAP Emissions- GE 7FA.05 Gas Turbine

Pollutant	Emissions Factor		Emissions from Turbine (lb/hr)	Emissions from Turbine (tpy)	Reference Footnote
Toluene	1.30E-04	lb/MMBtu	0.31	0.45	[1]
Naphthalene	1.30E-06	lb/MMBtu	3.09E-03	4.51E-03	[1]
Formaldehyde	3.40E-04	lb/MMBtu	0.81	1.18	[2]
Benzene	1.20E-05	lb/MMBtu	0.03	0.04	[1]
Acetaldehyde	4.00E-05	lb/MMBtu	0.10	0.14	[1]
Ethylbenzene	3.20E-05	lb/MMBtu	0.08	0.11	[1]
Propylene Oxide	2.90E-05	lb/MMBtu	0.07	0.10	[1]
Xylenes	6.40E-05	lb/MMBtu	0.15	0.22	[1]
1,3-Butadiene	4.30E-07	lb/MMBtu	1.02E-03	1.49E-03	[1]
PAH	2.20E-06	lb/MMBtu	5.23E-03	0.01	[1]
Total	6.51E-04	lb/MMBtu	1.55	2.26	

[1] Based on AP-42, Table 3.1-3, Emissions factors for HAP from gas-fired stationary gas turbines.
[2] Average of stack test results from Kiamichi and Rolling Hills facilities with a 3X compliance margin to reflect site-to-site variability.

Startup and Shutdown Emissions - GE 7FA.05 Gas Turbine

		Startup	Shutdown	Reference Footnote
Est. Number of Events per year		365	365	[1]
Duration of Event (min/event)		20.0	20.0	[2]

[1] Numbers of Startup and Shutdown provided by TENASKA
[2] Startup and Shutdown Event Duration from GE

TABLE B-6
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.05 Emissions Calculations

Pollutant	Emissions (lb/event)		Reference Footnote
	Startup	Shutdown	
NO_X	33.0	28.0	[1]
CO	386.0	403.0	[1]
VOC	55.0	77.0	[1]
SO_2	0.37	0.34	[2]
PM	3.4	3.4	[1]

[1] Emissions per Event from GE

[2] SO_2 emission factor assumed unchanged from maximum operation shown above

Pollutant	Startup and Shutdown Emissions (lb/hr)	Annual Startup/Shutdown Emissions per turbine (ton/yr)	Reference Footnote
NO_X	86.33	11.13	[1], [2]
CO	801.33	143.99	[1], [2]
VOC	133.20	24.09	[1], [2]
SO_2	1.74	0.13	[1], [2]
PM	9.90	1.24	[1], [2]

[1] Because the startup and shutdown events are less than 1 hr, the hourly startup and shutdown rates represent the mass of the event for both a startup and shutdown in one hour plus the worst-case emission rate scenario while at 100% load times the remainder of an hour ((60 minutes - event time in minutes)/60).

Sample calculation:

$$\frac{61.00 \text{ lb NOx}}{\text{event}} \times \frac{1 \text{ event}}{\text{hr}} + \frac{76.00 \text{ lb NOx}}{\text{hr}} \times \frac{60 - 40.00 \text{ min/hr}}{60 \text{ min/hr}} = \frac{86.33 \text{ lb NOx}}{\text{hr}}$$

TABLE B-6
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.05 Emissions Calculations

[2] Annual Startup/Shutdown Emissions are calculated at the number of startup or shutdown events per year x the emissions per event.

Maximum Hourly Emissions - GE 7FA.05 Gas Turbine

Pollutant	Emissions from turbine (lb/hr)	Startup and Shutdown Emissions (lb/hr)	Maximum Hourly Emissions (lb/hr)
NO_X	76.00	86.33	86.33
CO	37.00	801.33	801.33
VOC	3.60	133.20	133.20
SO_2	3.10	1.74	3.10
PM	9.30	9.90	9.90

TABLE B-7
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.04 Emissions Calculations

Potential Emissions - GE 7FA.04 Gas Turbine

Parameter	Value	Unit	Source
Turbine Max. Heat Input Rating	2,198	MMBtu/hr per turbine	Manufacturer's Specification
Number of Turbines	1		
Turbine Operating Time	2,920	hours per year	Maximum allowable hours per year for a peaking unit

Pollutant	Emissions Factor		Emissions from turbine (lb/hr)	Emissions from turbine (tpy)	Reference Footnote
NO_X	9 ppmvd @ 15% O_2	0.0332 lb/MMBtu	69.00	100.74	[1,2]
CO	9 ppmvd @ 15% O_2	0.0202 lb/MMBtu	33.00	48.18	[1,2]
VOC	1.4 ppmvd @ 15% O_2	0.0018 lb/MMBtu	3.60	5.26	[1,2]
SO_2	0.5 gr/100 dscf fuels	0.0014 lb/MMBtu	2.88	4.20	[3]
PM		0.00403 lb/MMBtu	9.30	13.58	[4]
PM_{10}		0.00403 lb/MMBtu	9.30	13.58	[4]
$PM_{2.5}$		0.00403 lb/MMBtu	9.30	13.58	[4]
H_2SO_4	0.10 lb H_2SO_4/lb SO_2	0.00015 lb/MMBtu	0.30	0.44	[5]
Lead	0.005 lb/MMscf	4.35E-06 lb/MMBtu	0.0096	0.014	[6]
CO_2	54.22 kg/MMBtu	119.50 lb/MMBtu	262,705.55	383,550.10	[7]
CH_4	0.001 kg/MMBtu	0.002 lb/MMBtu	4.85	7.07	[8]
N_2O	0.0001 kg/MMBtu	0.0002 lb/MMBtu	0.48	0.71	[8]
CO_2e			262,971.06	383,937.75	[8]

[1] NO_X, CO, and VOC emission factors in ppmvd taken from BACT determination

[2] NO_X, CO, and VOC emission rates based on vendor guarantees

[3] SO_2: Emission rates based on vendor guarantees 0.5

[4] All PM is $PM_{2.5}$ or less and includes condensible PM, Presumed BACT

[5] Ratio of sulfuric acid mist emissions estimated by GE as 0.16 lb/hr, with SO_2 at 1.55 lb/hr, and assumes sulfur content of natural gas as 8 ppmw. Emission rate shown was calculated using GE ratio of 0.16/1.55 applied to calculated SO_2 emission rate using actual sulfur content of natural gas used. See Note 4.

[6] No factor for Turbines, Lead emission factor from AP-42 Table 1.4-2 (0.0005 lb/MMscf), assumed natural gas heat value of 1,150 Btu/scf for boilers.

[7] Based on projected fuel composition from supplier, see Appendix D.

[8] Based on USEPA's Mandatory Reporting Rule, Table C-2. To convert to CO_2e, the following global warming potentials were used - CH_4 = 25, N_2O = 298.

TABLE B-7
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.04 Emissions Calculations

Potential HAP Emissions- GE 7FA.04 Gas Turbine

Pollutant	Emissions Factor		Emissions from Turbine (lb/hr)	Emissions from Turbine (tpy)	Reference Footnote
Toluene	1.30E-04	lb/MMBtu	0.29	0.42	[1]
Naphthalene	1.30E-06	lb/MMBtu	2.86E-03	4.17E-03	[1]
Formaldehyde	3.40E-04	lb/MMBtu	0.75	1.09	[2]
Benzene	1.20E-05	lb/MMBtu	0.03	0.04	[1]
Acetaldehyde	4.00E-05	lb/MMBtu	0.09	0.13	[1]
Ethylbenzene	3.20E-05	lb/MMBtu	0.07	0.10	[1]
Propylene Oxide	2.90E-05	lb/MMBtu	0.06	0.09	[1]
Xylenes	6.40E-05	lb/MMBtu	0.14	0.21	[1]
1,3-Butadiene	4.30E-07	lb/MMBtu	9.45E-04	1.38E-03	[1]
PAH	2.20E-06	lb/MMBtu	4.84E-03	0.01	[1]
Total	6.51E-04	lb/MMBtu	1.43	2.09	

[1] Based on AP-42, Table 3.1-3, Emissions factors for HAP from gas-fired stationary gas turbines.
[2] Average of stack test results from Kiamichi and Rolling Hills facilities with a 3X compliance margin to reflect site-to-site variability.

Startup and Shutdown Emissions - GE 7FA.04 Gas Turbine

		Startup	Shutdown	Reference Footnote
Est. Number of Events per year		365	365	[1]
Duration of Event (min/event)		20.0	20.0	[2]

[1] Numbers of Startup and Shutdown provided by TENASKA
[2] Startup and Shutdown Event Duration from GE

TABLE B-7
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.04 Emissions Calculations

Pollutant	Emissions (lb/event)		Reference Footnote
	Startup	Shutdown	
NO_X	30.0	29.0	[1]
CO	186.0	237.0	[1]
VOC	15.0	21.0	[1]
SO_2	0.34	0.33	[2]
PM	3.4	3.4	[1]

[1] Emissions per Event from GE
[2] SO_2 emission factor assumed unchanged from maximum operation shown above

Pollutant	Startup and Shutdown Emissions (lb/hr)	Annual Startup/Shutdown Emissions per turbine (ton/yr)	Reference Footnote
NO_X	82.00	10.77	[1], [2]
CO	434.00	77.20	[1], [2]
VOC	37.20	6.57	[1], [2]
SO_2	1.64	0.12	[1], [2]
PM	9.90	1.24	[1], [2]

[1] Because the startup and shutdown events are less than 1 hr, the hourly startup and shutdown rates represent the mass of the event for both a startup and shutdown in one hour plus the worst-case air dispersion scenario while at 100% load times the remainder of an hour ((60 minutes - event time in minutes)/60).

Sample calculation:

$$\frac{59.00 \text{ lb NOx}}{\text{event}} \times \frac{1 \text{ event}}{\text{hr}} + \frac{69.00 \text{ lb NOx}}{\text{hr}} \times \frac{60}{60 \text{ min/hr}} \times \frac{-40.00 \text{ min/hr}}{} = \frac{82.00 \text{ lb NOx}}{\text{hr}}$$

TABLE B-7
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
GE 7FA.04 Emissions Calculations

[2] Annual Startup/Shutdown Emissions are calculated at the number of startup or shutdown events per year x the emissions per event.

Maximum Hourly Emissions - GE 7FA.04 Gas Turbine

Pollutant	Emissions from turbine (lb/hr)	Startup and Shutdown Emissions (lb/hr)	Maximum Hourly Emissions (lb/hr)
NO_X	69.00	82.00	82.00
CO	33.00	434.00	434.00
VOC	3.60	37.20	37.20
SO_2	2.88	1.64	2.88
PM	9.30	9.90	9.90

TABLE B-8
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Emergency Generator Engine Emissions Calculations

Project: Three (3) Turbines, no base-line case (new facility)

Potential Emissions - Emergency Generator

Parameter	Value	Units	Source
Manufacturer =	Caterpillar (or similar)		
Generator Model =	2000 kW		
Engine Model =	3516C ATAAC		
Serial Number =	TBD		
Fuel Type =	Diesel		
Fuel Density =	7.001	lb/gal	Manufacturer's Specification Sheet November 6, 2012
Fuel High Heat Value =	138,000	Btu/gal	40 CFR Part 98 Subpart C, Table C-1
Purpose =	Emergency Generator		
Displacement =	4,210.64	in^3	Manufacturer's Gen Set Package Performance Data [DM 8263]
Displacement =	69	L	Manufacturer's Gen Set Package Performance Data [DM 8263]
Number of Cylinders =	16		Manufacturer's Gen Set Package Performance Data [DM 8263]
Engine Rating =	2,937	hp	Manufacturer's Gen Set Package Performance Data [DM 8263]
Fuel Consumption =	138.9	gal/hr	Manufacturer's Gen Set Package Performance Data [DM 8263]
Heat Rate =	19.17	MMBtu/hr	Fuel Consumption * Fuel High Heat Value
Annual Hours of Operation =	100	hr/yr	Provided by TENASKA

Pollutant	Emission Factor		Emissions from Engine (lb/hr)	Emissions from Engine (tpy)	Reference Footnote
NO_X+NMHC	6.4 g/kW-hr	0.01 lb/hp-hr	30.91	1.55	[1]
CO	3.5 g/kW-hr	5.76E-03 lb/hp-hr	16.91	0.85	[1]
VOC (TOC)		7.05E-04 lb/hp-hr	2.07	0.10	[2]
SO_2	15 ppmw S	9.93E-06 lb/hp-hr	0.03	0.00	[3]
PM	0.20 g/kW-hr	3.29E-04 lb/hp-hr	0.97	0.05	[1]
PM_{10}	0.20 g/kW-hr	3.29E-04 lb/hp-hr	0.97	0.05	[4]
$PM_{2.5}$	0.20 g/kW-hr	3.29E-04 lb/hp-hr	0.97	0.05	[4]
H_2SO_4	0.10 lb H_2SO_4/lb SO_2	9.93E-07 lb/hp-hr	2.92E-03	1.46E-04	[5]
Total HAP	0.0016 lb/MMBtu	1.03E-05 lb/hp-hr	0.03	1.51E-03	[6]
CO_2	73.96 kg/MMBtu	1.06 lb/hp-hr	3,125.45	156.27	[7]
CH_4	3.0E-03 kg/MMBtu	4.32E-05 lb/hp-hr	0.13	0.01	[7]
N_2O	6.0E-04 kg/MMBtu	8.63E-06 lb/hp-hr	0.03	1.27E-03	[7]
CO_2e			3,136.18	156.81	[7]

TABLE B-8
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Emergency Generator Engine Emissions Calculations

Project: Three (3) Turbines, no base-line case (new facility)

[1] Engine will be subject to ICE NSPS (40 CFR Part 60, Subpart IIII) and therefore, subject to Tier 2 emissions limits (40 CFR 89.112) for engines greater than 750 hp. Emission factors are based on Tier 2 limits.

[2] Based on AP-42, Table 3.4-1, Gaseous Emission Factors for Large Stationary Diesel and All Stationary Duel-Fired Engines

[3] SO_2 emissions were estimated using a mass balance calculation based on the use of ultra-low sulfur content fuel and the fuel consumption rate.

Sample calculation:

$$\frac{15\text{ lb S}}{1{,}000{,}000\text{ lb diesel}} \times \frac{7.001\text{ lb diesel}}{\text{gal diesel}} \times \frac{138.9\text{ gal diesel}}{\text{hr}} \times \frac{1}{2{,}937\text{ hp}} \times \frac{\text{lbmol S}}{32\text{ lb S}} \times \frac{64\text{ lb SO2}}{\text{lbmol SO}_2} = \frac{9.93\text{E-06 lb SO2}}{\text{hp-hr}}$$

[4] Assumed that PM was $PM_{2.5}$.

[5] Estimated as 10% of SO_2 emissions

[6] Based on AP-42, Tables 3.4-3 and 3.4-4, Hazardous Air Pollutant Emission Factors for Large Stationary Diesel Engines.

[7] Based on USEPA's Mandatory Reporting Rule, Tables C-1 and C-2. To convert to CO_2e, the following global warming potentials were used - CH_4 = 25, N_2O = 298.

TABLE B-9
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Emergency Firewater Pump Engine Emissions Calculations

Project: Three (3) Turbines, no base-line case (new facility)

Potential Emissions - Firewater Pump

Parameter	Value	Units	Source
Manufacturer =	Cummins (or similar)		
Pump Model =			
Engine Model =	CFP15E-F30		
Serial Number =	TBD		
Fuel Type =	Diesel		
Fuel Density =	7.001	lb/gal	Manufacturer's Specification Sheet November 6, 2012
Fuel High Heat Value =	138,000	Btu/gal	40 CFR Part 98 Subpart C, Table C-1
Purpose =	Firewater Pump		
Displacement =	915.00	in^3	Manufacturer's Specification SheetCFP15E-F10-F70 (@2100 rpm)
Displacement =	15	L	Manufacturer's Specification SheetCFP15E-F10-F70 (@2100 rpm)
Number of Cylinders =	6		Manufacturer's Specification SheetCFP15E-F10-F70 (@2100 rpm)
Engine Rating =	575	hp	Manufacturer's Specification SheetCFP15E-F10-F70 (@2100 rpm)
Fuel Consumption =	29.1	gal/hr	Manufacturer's EPA & CARB Tier 3 Emission Data Sheet March 24, 2010
Heat Rate =	4.02	MMBtu/hr	Fuel Consumption * Fuel High Heat Value
Annual Hours of Operation =	100	hr/yr	Provided by TENASKA

Pollutant	Emission Factor		Emissions from Engine (lb/hr)	Emissions from Engine (tpy)	Reference Footnote
NO_X+NMHC	4.0 g/kW-hr	0.01 lb/hp-hr	3.78	0.19	[1]
CO		6.68E-03 lb/hp-hr	3.84	0.19	[2]
VOC (TOC)		2.51E-03 lb/hp-hr	1.45	0.07	[2]
SO_2	15 ppmw S	1.06E-05 lb/hp-hr	0.01	3.06E-04	[3]
PM	0.20 g/kW-hr	3.29E-04 lb/hp-hr	0.19	0.01	[1]
PM_{10}	0.20 g/kW-hr	3.29E-04 lb/hp-hr	0.19	0.01	[4]
$PM_{2.5}$	0.20 g/kW-hr	3.29E-04 lb/hp-hr	0.19	0.01	[4]
H_2SO_4	0.10 lb H_2SO_4/lb SO_2	1.06E-06 lb/hp-hr	6.11E-04	3.06E-05	[5]
Total HAP	0.0039 lb/MMBtu	2.71E-05 lb/hp-hr	0.02	7.78E-04	[6]
CO_2	73.96 kg/MMBtu	1.14 lb/hp-hr	654.79	32.74	[7]
CH_4	3.0E-03 kg/MMBtu	4.62E-05 lb/hp-hr	0.03	1.33E-03	[7]
N_2O	6.0E-04 kg/MMBtu	9.24E-06 lb/hp-hr	0.01	2.66E-04	[7]
CO_2e			657.04	32.85	[7]

TABLE B-9
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Emergency Firewater Pump Engine Emissions Calculations

Project: Three (3) Turbines, no base-line case (new facility)

[1] Engine will be subject to ICE NSPS (40 CFR Part 60, Subpart IIII). Emission factors are based on Table 4 to Subpart IIII.
[2] Based on AP-42, Table 3.3-1, Emission Factors for Uncontrolled Gasoline and Diesel Industrial Engines
[3] SO_2 emissions were estimated using a mass balance calculation based on the use of ultra-low sulfur content fuel and the fuel consumption rate.
Sample calculation:

15 lb S	7.001 lb diesel	29.1 gal diesel	1	lbmol S	64 lb SO2	=	1.06E-05 lb SO2
1,000,000 lb diesel	gal diesel	hr	575 hp	32 lb S	lbmol SO_2		hp-hr

[4] Assumed that PM was $PM_{2.5}$.
[5] Estimated as 10% of SO_2 emissions
[6] Based on AP-42, Table 3.3-2, Hazardous Air Pollutant Emission Factors for Uncontrolled Diesel Engines.
[7] Based on USEPA's Mandatory Reporting Rule, Tables C-1 and C-2. To convert to CO_2e, the following global warming potentials were used - CH_4 = 25, N_2O = 298.

TABLE B-10
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Fugitive Emissions Calculations

Project: Three (3) Turbines, no base-line case (new facility)

Potential Emissions - Fugitive Components

Annual Operating Hours	8,760	hr/yr
VOC Content of Natural Gas [1]	1.78	wt%
HAP Content of Natural Gas [2]	1.78	wt%
CO_2 Content of Natural Gas [3]	5.49	wt%
CH_4 Content of Natural Gas [4]	100	wt%

Component and Service	Number of Components [5]	Emission Factor [6]		Control Efficiency [7] (%)	Total Emissions lb/hr	Total Emissions tpy
Valves						
Gas/Vapor	936	0.0089	lb/hr-component	97	0.25	1.09
Light Liquid	0	0.0035	lb/hr-component	97	0	0
Heavy Liquid	0	0.0007	lb/hr-component	97	0	0
Pumps						
Light Liquid	0	0.0386	lb/hr-component	93	0	0
Heavy Liquid	0	0.0161	lb/hr-component	93	0	0
Flanges/Connectors						
Gas/Vapor	2,628	0.0029	lb/hr-component	97	0.23	1.00
Light Liquid	0	0.0005	lb/hr-component	97	0	0
Heavy Liquid	0	0.00007	lb/hr-component	97	0	0
Compressors						
Gas/Vapor	6	0.5027	lb/hr-component	95	0.15	0.66
Pressure Relief Valves						
Gas/Vapor	18	0.2293	lb/hr-component	97	0.12	0.54
Open Ended Lines						
All Liquids	0	0.004	lb/hr-component	97	0	0
				Total Emissions	0.75	3.30
				VOC Emissions [8]	0.01	0.06
				HAP Emissions [8]	0.01	0.06
				CO_2 Emissions [8]	0.04	0.18
				CH_4 Emissions [8]	0.75	3.30
				CO_2e Emissions [9]	18.87	82.65

TABLE B-10
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
Fugitive Emissions Calculations

Project: Three (3) Turbines, no base-line case (new facility)

[1] From Natural Gas Analysis provided by Tenaska on April 12, 2013.
[2] Conservatively assumed that HAP Content = VOC Content.
[3] Maximum pipeline specification (2 volume %) converted to weight percent assuming natural gas MW is equal to methane.
[4] Conservative assumption.
[5] Number of Components provided via email from Mr. Larry Carlson (Tenaska) on April 12, 2013.
[6] SOCMI without Ethylene (C_2) Fugitive Equipment Leak Factors from October 2000 Draft TCEQ Technical Guidance Package for Equipment Leak Fugitives.
[7] Control Efficiency for AVO Program from October 2000 Draft TCEQ Technical Guidance Package for Equipment Leak Fugitives.
[8] Total Emissions * Content of Natural Gas (wt%)
[9] Based on USEPA's Mandatory Reporting Rule, Table C-1. To convert to CO_2e, the following global warming potentials were used - CH_4 = 25, N_2O = 298.

TABLE B-11
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
SF6 Circuit Breaker Emissions

Project: Three (3) Turbines, no base-line case (new facility)

GHG Emissions from SF_6 Insulated Electrical Equipment

Sulfur hexafluoride (SF_6) is used in high voltage electrical equipment as an insulator and/or arc quenching medium. Fugitive emissions of SF_6 may result due to equipment leakage. Because SF_6 is a very potent greenhouse gas its emissions have been included in the facility-wide GHG emission estimation.

Description of SF_6 containing equipment	Number of Pieces of Equipment	Weight of SF_6 per piece of Equipment (lb)	Weight of SF_6 per Equipment Type (lb)	IEC standard for equipment leakage [1] (% per year)	Fugitive SF_6 (lb/hr)	Fugitive SF_6 (ton/yr)	Global Warming Potential [2]	Fugitive CO_2e (lb/hr)	Fugitive CO_2e (ton/yr)
Circuit Breakers	7	500	3,500	0.50%	0.00200	0.00875	22,800	45.55	199.50
		TOTAL	3,500	0.50%	0.00200	0.00875	22,800	45.55	199.50

[1] IEC, International Electrotechnical Commission Standard 62271-1, 2004, assume 100% loss of content upon leakage.
[2] Based on USEPA's Mandatory Reporting Rule, Table A-1.

TABLE B-12
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
MSS Emissions Calculations

Project: Three (3) Turbines, no base-line case (new facility)

Summary of Potential Emissions - Maintenance Operations

Pollutant	On-Line Turbine Washing (tpy)	Turbine Filter Changeouts (tpy)	Gaseous Fuel Venting (tpy)	CEMS Calibration (tpy)	Total Maintenance Emissions (tpy)
NO_X	-	-	-	5.97E-07	5.97E-07
CO	-	-	-	3.63E-07	3.63E-07
VOC	-	-	2.05E-03	-	2.05E-03
SO_2	-	-	-	-	-
PM	0.04	4.04E-05	-	-	0.04
PM_{10}	0.04	1.91E-05	-	-	0.04
$PM_{2.5}$	0.04	2.89E-06	-	-	0.04
H_2SO_4	-	-	-	-	-
Lead	-	-	-	-	-
CO_2	-	-	0.01	-	0.01
CH_4	-	-	0.11	-	0.11
N_2O	-	-	-	-	-
GHG (CO_2e)	-	-	2.88	-	2.88
Total HAPs (excluding lead)	-	-	2.05E-03	-	2.05E-03
Formaldehyde	-	-	-	-	-

TABLE B-12
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
MSS Emissions Calculations

Potential Emissions - Online Turbine Washing

Number of Combustion Turbines =	3

Input Data (per Combustion Turbine)			
Parameter	Per Combustion Turbine		Reference Footnote
Total Turbine Blade Surface Area	2,000	ft^2	[1]
% of Blade Covered by Dust	5	%	[2]
Depth of Blade Dust	2.50	microns	[2]
Flue Dust Density	81.13	lb / ft^3	[3]
Duration of Event	30.00	mins	[2]
Number of Events per Year	365.00	events / yr	[2]
Surface Area Covered by Dust	100	ft^2	[4]
Dust Volume	8.2021E-04	ft^3	[5]
Dust per Event	0.07	lb / event	[6]

[1] Washable surface area of turbine blades provided via email from Mr. Larry Carlson (Tenaska) on April 12, 2013.
[2] Calculation assumptions and input provided by Mr. Larry Carlson (Tenaska) on April 12, 2013.
[3] Flue Dust Density based on the average of representations at (in unit of lb/ft^3):
54 http://www.powderandbulk.com/resources/bulk_density/material_bulk_density_chart_f.htm
108.25 http://www.simetric.co.uk/si_materials.htm
[4] Surface Area Covered by Dust = Total Turbine Blade Surface Area * % of blade covered by dust
[5] Dust Volume (ft^3) = Surface Area Covered by Dust (ft^2) * Depth of Blade Dust (ft)
(2.5 microns = 8.2021E-06 ft)
[6] Dust per Event (lb/event) = Dust Volume (ft^3) * Flue Dust Density (lb/ft^3)

Blade Dust Emissions Calculations [1]				
Parameter	Per Combustion Turbine	For Three Combustion Turbines [4]	Units	Reference Footnote
Hourly $PM/PM_{10}/PM_{2.5}$ Emissions	0.07	0.20	lb / hr	[2]
Annual $PM/PM_{10}/PM_{2.5}$ Emissions	0.01	0.04	tpy	[3]

[1] Calculation assumes no TDS in deionized water.
[2] Hourly $PM/PM_{10}/PM_{2.5}$ Emissions for One Combustion Turbine (lb/hr) = Dust per Event (lb/event)
[3] Hourly $PM/PM_{10}/PM_{2.5}$ Emissions for One Combustion Turbine (tpy) = Dust per event (lb/event) * 365 (events/yr) / 2000 (lb/ton)
[4] Total $PM/PM_{10}/PM_{2.5}$ Emissions for Three Combustion Turbines = Hourly/Annual $PM/PM_{10}/PM_{2.5}$ Emission Rates * Number of Combustion Turbines

TABLE B-12
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
MSS Emissions Calculations

Potential Emissions - Turbine Filter Changeouts

Emission Factors				
Parameter		Value	Units	Reference Footnote
Mean Wind Speed	U	7.15	mph	[1]
Material Moisture Content	M	1	%	[2]
PM Particle Size Multiplier	K(PM)	0.74		[3]
PM_{10} Particle Size Multiplier	$K(PM_{10})$	0.35		[3]
$PM_{2.5}$ Particle Size Multiplier	$K(PM_{2.5})$	0.053		[3]
PM Emission Factor	E(PM)	0.0099	lb / ton	[4]
PM_{10} Emission Factor	$E(PM_{10})$	0.0047	lb / ton	[4]
$PM_{2.5}$ Emission Factor	$E(PM_{2.5})$	0.0007	lb / ton	[4]

[1] The Mean Wind Speed for Roan's Prairie, Texas was estimated using the average of the mean wind speeds for Austin and Houston, available in TANKS 4.09d program.
[2] Material Moisture Content is estimated based on process knowledge.
[3] Particle size multipliers are taken from AP-42, Chapter 13.2.4 "Aggregate Handling And Storage Piles".
[4] $PM/PM_{10}/PM_{2.5}$ Emission Factor calculated based on Equation (1) from AP-42, Chapter 13.2.4 "Aggregate Handling And Storage Piles".

E = k(0.0032) * ((U/5)^1.3) / ((M/2)^1.4) (lb / ton)

TABLE B-12
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
MSS Emissions Calculations

Input Data [1]		
Parameter	Value	Units
Filter Surface Area	11,000	ft^2
Assumed Dust Thickness before casing is opened	1	mm
	0.00328	ft
Assumed Dust Density	75	lb/ft^3
Activities per Combustion Turbine per year	2	activities/turbine/yr
Maximum Number of Combustion Turbines	3	for 3 x 1 scenario
Duration of Filter Changeouts	12	hr / activity

[1] Calculation assumptions and input confirmed by Mr. Larry Carlson (Tenaska) via email on April 12, 2013

Filter Changeout Emission Calculations (for three Combustion Turbines)			
Parameter	Value	Units	Reference Footnote
Activity Throughput	2,706	lb/activity	[1]
	1.35	ton/activity	[1]
Hourly Throughput	0.11	ton/hr	[2]
Hourly PM Emissions	1.12E-03	lb/hr	[3]
Hourly PM_{10} Emissions	5.31E-04	lb/hr	[3]
Hourly $PM_{2.5}$ Emissions	8.03E-05	lb/hr	[3]
Annual PM Emissions	4.04E-05	tpy	[4]
Annual PM_{10} Emissions	1.91E-05	tpy	[4]
Annual $PM_{2.5}$ Emissions	2.89E-06	tpy	[4]

[1] Activity Throughput (lb/activity) = Filter Surface Area (ft^2) * Dust Thickness (ft) * Dust Density (lb/ft^3)
It is conservatively assumed that no control occurs during filter changeouts
Activity Throughput (ton/activity) = Activity Throughput: lb/activity) / 2000 (lb/ton)
[2] Hourly Throughput (ton/hr) = Activity Throughput (ton/activity) / Duration of Filter Changeouts (hr/activity)
It is assumed that one filter changeout activity is performed at a time.
[3] Hourly PM Emissions (lb/hr) = Hourly Throughput (ton/hr) * PM Emission Factor (lb/ton)
[4] Annual PM Emissions (ton/yr) = (Hourly PM Emissions (lb/hr) * Duration of Filter Changeouts (hr/activity) * Activities per year (activities/turbine/yr) * Number of Turbines (turbines) / 2000 (lb/ton))

TABLE B-12
TRPP
Tenaska Roan's Prairie Generating Station
Grimes County, Texas
MSS Emissions Calculations

Potential Emissions - Gaseous Fuel Venting, Small Equipment and Fugitives

Emissions Calculation [1]

Piping Description	Initial Conditions				Final Conditions				Activity	VOC Emissions	
Location	Max Hourly Volume [2] V_i (ft^3)	Annual Volume [2] V_i (ft^3)	Pressure P_i (psia)	Temperature T_i (°F)	Standard Pressure P_f (psia)	Standard Temperature T_f (°F)	Max Hourly Volume [3] V_f (scf)	Volume [3] V_f (scf)	Frequency (hr/yr)	Hourly (lb/hr)	Annual (tpy)
Fuel Line	83	1,146	64.7	50	14.7	68	378.2	5,222.0	30	0.29	2.04E-03
Small Equipment	0.7	6.7	64.7	50	14.7	68	3.2	30.5	10	0.0025	1.19E-05
								Total VOC Emissions:		0.30	2.05E-03
								Total HAP Emissions:		0.30	2.05E-03
								Total CO_2 Emissions:		0.92	0.01
								Total CH_4 Emissions:		16.70	0.11
								Total CO_2e Emissions:		418.43	2.88

[1] Emission input data confirmed by Mr. Larry Carlson (Tenaska) on April 12, 2013
[2] Initial volumes of lines and gas condition provided by Mr. Larry Carlson(Tenaska)
[3] Final volume is calculated using Ideal Gas Law
[4] Additional assumptions:

Natural Gas M_W:	16.87	lb/lb-mole	(From Natural Gas Analysis provided by Tenaska on April 12, 2013)
VOC Content of Natural Gas	1.78%	by Wt.	(From Natural Gas Analysis provided by Tenaska on April 12, 2013)
HAP Content of Natural Gas	1.78%	by Wt.	(Conservatively assumed that HAP Content = VOC Content.)
CO2 Content of Natural Gas	5.49%	by Wt.	(Maximum pipeline specification (2 volume %) converted to weight percent assuming natural gas MW is equal to methane)
CH4 Content of Natural Gas	100.00%	by Wt.	(Conservative assumption)
Molar Volume of Gas	385.27	scf/lb-mol	(Based on Ideal Gas Law at Standard Pressure and Temperature - 14.7 psia and 68°F)

Based on USEPA's Mandatory Reporting Rule, Table C-1. To convert to CO_2e, the following global warming potentials were used - CH_4 = 21, N_2O = 310.

Example Calculation for Fuel Line:

$$\text{Hourly Emissions (lb/hr)} = \frac{378.2 \text{ scf}}{\text{hr}} \times \frac{\text{lb-mole}}{385.27 \text{ scf}} \times \frac{16.80 \text{ lb NG}}{\text{lb-mole}} \times \frac{0.0178 \text{ lb VOC}}{\text{lb Nat Gas}} = 0.29 \text{ lb/hr}$$

$$\text{Annual Emissions (tpy)} = \frac{5{,}222 \text{ scf}}{\text{yr}} \times \frac{\text{lb-mole}}{385.27 \text{ scf}} \times \frac{16.80 \text{ lb NG}}{\text{lb-mole}} \times \frac{0.0178 \text{ lb VOC}}{\text{lb Nat Gas}} \times \frac{1 \text{ ton}}{2{,}000 \text{ lb}} = 0.0020 \text{ ton/yr}$$

Updated Replacement Pages for Main Application Document

Attachment 2

January 2014

Tenaska Roan's Prairie Partners, LLC

3.1.3 Mandatory GHG Reporting Rule

Under the Mandatory Reporting Rule (40 CFR Part 98), beginning in 2010 facilities with fuel burning equipment with actual CO_2e emissions greater than or equal to 25,000 metric tons per year must submit an annual report for all source categories for which calculation methodologies are provided in subparts C of the rule. The PTE of GHG exceeds the reporting threshold. Therefore, TRPP will report GHG emissions under 40 CFR Part 98.

TABLE 3-1: PSD APPLICABILITY SUMMARY TABLE

Pollutant	Project Emissions Increases Siemens Turbines (tpy)	Project Emissions Increases GE 7FA.05 Turbines (tpy)	Project Emissions Increases GE 7FA.04 Turbines (tpy)	PSD Significance Threshold (tpy)	PSD Triggered? (Yes/No)
GHG (CO_2e)	1,279,629	1,246,175	1,152,288	100,000	Yes
CO_2	1,278,052	1,244,632	1,150,839	100	Yes
CH_4	26.99	26.37	24.64	100	Yes
N_2O	2.36	2.30	2.12	100	Yes

4.1 SUMMARY OF PROPOSED BACT

A summary of BACT limits and technologies proposed in this permit application are summarized in Tables 4-1 to Table 4-4.

TABLE 4-1: Summary of Proposed BACT for Combustion Turbines

Pollutant	Limit (Siemens)	Limit (GE 7FA.05)	Limit (GE 7FA.04)	Control Technology/ Standard	Averaging Time / Compliance Method
CO_2 (lb CO_2/MWh_{gross})	1,363	1,356	1,355	Good combustion practices, operations and maintenance Fuel Selection	720 hour rolling average/fuel monitoring / Records
CO_2e (tpy)	1,279,154	1,245,700	1,151,813		12 month rolling average/Fuel Monitoring

TABLE 4-2: Summary of Proposed BACT for Natural Gas Fugitives

Pollutant	Limit	Control Technology/Standard	Averaging Time / Compliance Method
CO_2e	83 tpy (12 month rolling average)	AVO[1], maintenance plan	12 month rolling average/ Maintenance and AVO plan documentation

[1] AVO (audio/visual/olfactory)

TABLE 4-3: Summary of Proposed BACT for Emergency Engines

Pollutant	Limit	Control Technology/Standard	Averaging Time / Compliance Method
CO_2	163 lb/MMBtu (HHV)	Good combustion practices, operation and maintenance	12 month rolling average / fuel monitoring

TABLE 4-4: Summary of Proposed BACT for Fugitive SF_6 Emissions

Pollutant	Limit	Control Technology/Standard	Averaging Time / Compliance Method
CO_2e	200 tpy (12 month rolling average)	AVO, maintenance program, state-of-the-art circuit breakers	12 month rolling average / Maintenance and AVO program documentation

4.2 BACT FOR COMBUSTION TURBINES

4.2.1 Step 1: Identify All Available Control Technologies

TRPP performed a search of the USEPA RACT/BACT/LAER Clearinghouse (RBLC) for natural-gas fired turbines and recently issued PSD permits for GHG emissions from gas turbines. A summary of previous BACT determinations are provided in Table C-1 in Appendix C. While all gas fired turbines were considered and included in this search for completeness, only comparable simple cycle peaking power production facilities were considered in the final BACT analysis.

TRPP reviewed the GHG BACT analysis of the Pio Pico Energy Center which includes three 100 MW GE LMS100, aero-derivative, simple cycle turbines. Therein, USEPA Region 9 reviewed the thermal efficiency of several power frames with thermal efficiencies ranging from 9,254 to 9,790 $Btu_{HHV}/kW\text{-}hr_{gross}$, and established a BACT limit of 1,328 lb CO_2/MW-hr on a 720 rolling hour basis. This efficiency limit was based on the thermal efficiency of the turbines at 50% load, including a 7.4% factor to account for non-standard conditions, site variability, and equipment degradation over time. Similarly, the York Generating Station was recently issued a permit by the Pennsylvania Department of Environmental Protection (PaDEP) for two aero-derivative LM6000 units rated at a combined heat input of 634 MMBtu/hr. PaDEP established a 1,330 lb CO2/MW-hr limit commensurate with the Region 9 permit for Pio Pico.

TRPP also reviewed the GHG BACT analysis of the Montana Power Station which includes four 100 MW GE LMS100, aero-derivative, simple cycle turbines. The proposed BACT limits for the facility are an efficiency limit of 1,194 lb CO_2/MW-hr on a 365 day rolling average, and an annual limit on CO_2e emissions. This proposed limit was based on the thermal efficiency at 50% load, but appears to be artificially low, as it does not take into account performance degradation, site variability, or variability in fuel carbon density. As such, TRPP does not consider the proposed limit on the Montana station a viable comparison, until those factors listed above are taken into account.

The Pio Pico and EPE Montana projects are much smaller, at 300 MW and 400 MW, respectively, than the proposed TRPGS at 660 MW (all nominal values). Each of these projects identified specific needs for relatively small incremental capacity to respond to very localized needs, including up to four daily starts per turbine. Thus, smaller turbines may be more appropriate for

TRPP proposes an emission limit of 83 tpy of CO_2e (12-month rolling average) for the facility. Compliance with be demonstrated by proper documentation of the maintenance and AVO programs.

4.4 DIESEL FIRED EMERGENCY ENGINES

4.4.1 Step 1: Identify All Available Control Technologies

TRPP performed a search of the USEPA RBLC for diesel fired emergency engines and the results are shown in Table C-3 in Appendix C. The BACT identified for these emergency generators were good combustion practices or fuel-efficient design. Based on this information, TRPP has identified the following control options for emergency generators and fire pump engines:

- Good combustion practices, operation and maintenance;
- Alternative fuels; and
- Carbon Capture and Sequestration.

4.4.1.1 Good Combustion Practices, Operation and Maintenance

Proper combustion, operation and maintenance ensure the boilers maintain optimal efficiency and perform as designed. These operational practices include:

- Combustion optimization;
- Operation procedures including startup, shutdown, and malfunction;
- Instrumentation and controls;
- Reduce air leakages; and
- Preventative maintenance.

4.4.1.2 Alternative Fuels

The use of fuels like natural gas or propane may reduce carbon emissions by changing the carbon to energy density of the fuel. The use of these fuels does not meet the purpose of the emergency engines, namely being able to supply power quickly and reliably in case of an emergency; necessitating a self-contained, stable and independent fuel supply. As such, lower carbon to energy density fuels do not meet the business purpose of the emergency engines, and are not considered for BACT.

4.4.1.3 Carbon Capture and Sequestration

Carbon capture and sequestration is discussed in Section 4.2.1.4.

4.5.4 *Step 4: Evaluate and Document Remaining Control Technologies*

TRPP has determined that the control technologies identified in table 4-12 have no adverse impacts that require additional consideration or evaluation.

4.5.5 *Step 5: Select BACT*

TRPP proposes the following design and work practices as BACT for the SF_6 circuit breakers:

- Implementing an AVO program;
- Use of good operations and preventative maintenance practices; and

TRPP proposes an annual emission limit of 200 tpy of CO_{2e} (12-month rolling average) for all SF_6 containing components at the facility. Compliance with be demonstrated by appropriate documentation of the AVO and preventative maintenance plans.

TABLE 5-1: Turbine Maximum Design Data per Turbine

Turbine Manufacturer and Model Number	Rated Capacity (MW)[2]	"New and Clean" Thermal Efficiency (Btu/kW-hr, HHV)[2]	Marginal[1] Thermal Efficiency (Btu/kW-hr, HHV)[2]	Maximum Heat Input (MMBtu/Hr)
Siemens SGT6-5000F(5ee)	231.2	9,778	10,561	2,441
GE 7FA.05	227.6	9,672	10,446	2,378
GE 7FA.04	207.0	9,833	10,620	2,198

[1] Includes an 8% adjustment above new and clean to account for non-standard conditions, and performance degradation.
2 These performance numbers were taken at an Ambient Temperature of 7F and humidity of 53%.

TABLE 5-2: Natural Gas-fired Turbine GHG Emission Factors

Pollutant	Emission Factor (kg/MMBtu)	Global Warming Potential (100 Yr)	Basis
CO_2	54.22	1	Based on representative fuel sample data described above
CH_4	0.001	25	40 CFR Part 98, Subpart C, Table C-2& Subpart A, Table A-1
N_2O	0.0001	298	40 CFR Part 98, Subpart C, Table C-2& Subpart A, Table A-1

TABLE 5-3: Total GHG (CO_2e) Emissions from the Natural Gas Turbines

Greenhouse Gas Emissions from Turbines (tpy)			
Pollutant	Three (3) Siemens - SGT6-5000F(5ee)	Three (3) GE – 7FA.05	Three (3) GE – 7FA.04
CO_2	1,277,862	1,244,443	1,150,650
CH_4	23.57	22.95	21.22
N_2O	2.36	2.30	2.12
GHG (CO_2e)	1,279,154	1,245,700	1,151,813

5.1.2 Diesel Fired Emergency Engines

The proposed project includes two diesel emergency engines. The first emergency engine with a rating of 2,937 horsepower will drive a generator to supply electrical power in the event of the loss from the local utility. The second emergency engine with a rating of 575 horsepower will drive the fire water pump. The maximum hourly heat input rate for each engine was estimated based on the maximum hourly fuel consumption rate supplied by the prospective engine manufacturers (Appendix D) and the higher heating value of 0.138 MMBtu per gallon from Table C-1 from Subpart C of 40 CFR Part 98. The GHG emissions were then calculated using the default GHG emission factors from Subpart C of 40 CFR Part 98 shown in Table 5-5 for No. 2 distillate fuel oil.

TABLE 5-4: Emergency Engine GHG Emission Factors

Pollutant	Emission Factor (kg/MMBtu)	Basis
CO_2	73.96	40 CFR Part 98, Subpart C, Table C-1
CH_4	3.0E-03	40 CFR Part 98, Subpart C, Table C-2
N_2O	6.0E-04	40 CFR Part 98, Subpart C, Table C-2

PTE for the emergency engines is based on 100 hours per year each as prescribed in Mr. John Seitz' memo to EPA regional directors[4]. The total potential GHG emissions from the emergency engines are shown in the Table 5-6.

TABLE 5-5: GHG Emissions from the Emergency Engines

GHG Pollutant	Potential Emissions (tpy)
CO_2	189.01
CH_4	0.008
N_2O	0.0015
GHG (CO_2e)	189.66

5.1.3 Fugitive SF_6 Emissions from Electrical Equipment

SF_6 is used in high voltage electrical equipment as an insulator and arc quenching medium. Fugitive emissions of SF_6 may result due to equipment leakage. Because SF_6 is a very potent greenhouse gas its emissions have been included in the facility-wide GHG emission estimation.

The fugitive emissions were calculated for each device as the product of the mass of SF_6 contained in each piece of equipment, the likelihood of an equipment leak (0.5 percent per year), and the amount of SF_6 lost due to leakage (defined as 100% of the device capacity). The total estimated SF_6 fugitive loss was found by summing the losses for each device type and number estimated for use at the facility.

The likelihood of fugitive emissions from SF_6 containing equipment such as circuit breakers was estimated based on the annual leakage percentage standard for new equipment established by the International Electrotechnical Commission (IEC) Standard 62271-1 from October 2007 of 0.5 percent. For purposes of estimating emissions, the entire capacity of a leaking device was assumed to be lost.

To convert the mass of SF_6 lost into terms of CO_2e, the global warming potential from Part 98, Subpart A was used and is provided in Table 5-7. The resulting CO_2e emissions from leaking high voltage electrical equipment are shown in Table 5-8.

[4] United States Environmental Protection Agency. 1995. Memorandum from Mr. John S. Seitz, Director of the Office Air Quality Planning and Standards. *Potential to Emit for MACT Standards – Guidance on Timing Issues.* May 16, 1995.

TABLE 5-6: GHG Emissions and Global Warming Potential of Sulfur Hexafluoride

Pollutant	SF_6 Emissions (tpy)	Global Warming Potential (100 Yr)	GHG (CO_2e) Emissions (tpy)	Basis
SF_6	0.00875	23,900	199.50	40 CFR Part 98, Subpart A, Table A-1

5.1.4 GHG Emissions from Fugitive Natural Gas Losses due to Leaks and Equipment Maintenance

Additional GHG emissions result from fugitive leaks of natural gas from the equipment piping and from losses that occur during maintenance activities. Fugitive natural gas losses were estimated using *Synthetic Organic Chemical Manufacturing Industry (SOCMI) Fugitive Equipment Leak Factors* from the October 2000 Draft TCEQ Technical Guidance Package, and the type and number of various pieces of equipment and fittings. The losses from the equipment gas piping were estimated based on the volume of gas contained in the piping and the number of times per year the piping will be opened during maintenance. Detailed emission calculations are included in Appendix B. The GHG emissions from fugitive leaks and from maintenance are included in the facility summary shown below as part of Tables 5-7 to 5-9.

5.1.5 Summary of GHG Emissions from Project

The total GHG potential emissions from the project are summarized in Tables, 5-9, 5-10, and 5-11 for each of the three different models of turbines under consideration.

TABLE 5-7: Summary of Potential Annual Project Emissions with Siemens Turbines

Pollutant	Single (one) Siemens Turbine (tpy)	Total for Three Siemens Turbines (tpy)	Emergency Generator Engine (tpy)	Emergency Fire Pump Engine (tpy)	Fugitive Losses of SF_6 from Electrical Breakers (tpy)	Turbine Maintenance (tpy)	Fugitive Natural Gas Losses (tpy)	Total Project Emissions (tpy)
CO_2	425,954	1,277,862	156.27	32.74	-	0.0063	0.18	1,278,052
CH_4	7.86	23.57	0.01	0.0013	-	0.12	3.30	26.99
N_2O	0.79	2.36	0.0013	0.00027	-	-	-	2.36
SF_6	-	-	-	-	0.01	-	-	0.01
GHG (CO_2e)	426,385	1,279,154	156.81	32.85	199.50	2.88	82.65	1,279,629

TABLE 5-8: Summary of Potential Annual Project Emissions with GE-7FA.05 Turbines

Pollutant	Single (one) GE-7FA.05 Turbine (tpy)	Total for Three GE-7FA.05 Turbines (tpy)	Emergency Generator Engine (tpy)	Emergency Fire Pump Engine (tpy)	Fugitive Losses of SF_6 from Electrical Breakers (tpy)	Turbine Maintenance (tpy)	Fugitive Natural Gas Losses (tpy)	Total Project Emissions (tpy)
CO_2	414,814	1,244,443	156.27	32.74	-	0.01	0.18	1,244,632
CH_4	7.65	22.95	0.01	0.0013	-	0.12	3.30	26.37
N_2O	0.77	2.30	0.0013	0.00027	-	-	-	2.30
SF_6	-	-	-	-	0.01	-	-	0.01
GHG (CO_2e)	415,233	1,245,700	156.81	32.85	199.50	2.88	82.65	1,246,175

TABLE 5-9: Summary of Potential Annual Project Emissions with GE-7FA.04 Turbines

Pollutant	Single (one) GE-7FA.04 Turbine (tpy)	Total for Three GE-7FA.04 Turbines (tpy)	Emergency Generator Engine (tpy)	Emergency Fire Pump Engine (tpy)	Fugitive Losses of SF_6 from Electrical Breakers (tpy)	Turbine Maintenance (tpy)	Fugitive Natural Gas Losses (tpy)	Total Project Emissions (tpy)
CO_2	383,550	1,150,650	156.27	32.74	-	0.01	0.18	1,150,839
CH_4	7.07	21.22	0.01	0.0013	-	0.12	3.30	24.64
N_2O	0.71	2.12	0.0013	0.00027	-	-	-	2.12
SF_6	-	-	-	-	0.01	-	-	0.01
GHG (CO_2e)	383,938	1,151,813	156.81	32.85	199.50	2.88	82.65	1,152,288

Updated PI-1 Forms

Attachment 3

January 2014

Tenaska Roan's Prairie Partners, LLC

Texas Commission on Environmental Quality
Form PI-1 General Application for
Air Preconstruction Permit and Amendment

Important Note: The agency **requires** that a Core Data Form be submitted on all incoming applications unless a Regulated Entity and Customer Reference Number have been issued *and* no core data information has changed. For more information regarding the Core Data Form, call (512) 239-5175 or go to www.tceq.texas.gov/permitting/central_registry/guidance.html.

I. Applicant Information		
A. Company or Other Legal Name: Tenaska Roan's Prairie Partners, LLC		
Texas Secretary of State Charter/Registration Number (*if applicable*):		
B. Company Official Contact Name: Mr. Greg Kunkel		
Title: Vice President, Environmental Affairs		
Mailing Address: 1044 N. 115th Street, Suite 400		
City: Omaha	State: NE	ZIP Code: 68154-4446
Telephone No.: 402-691-9500	Fax No.: 402-691-9530	E-mail Address: gkunkel@tenaska.com
C. Technical Contact Name: Mr. Larry Carlson		
Title: Director, Air Programs		
Company Name: Tenaska, Inc.		
Mailing Address: 1044 N. 115th Street, Suite 400		
City: Omaha	State: NE	ZIP Code: 68154-4446
Telephone No.: 402-938-1661	Fax No.: 402-691-9530	E-mail Address: lcarlson@tenaska.com
D. Site Name: Tenaska Roan's Prairie Generating Station		
E. Area Name/Type of Facility: Electric Generating Station		☒ Permanent ☐ Portable
F. Principal Company Product or Business: Electricity Generation		
Principal Standard Industrial Classification Code (SIC): 4911		
Principal North American Industry Classification System (NAICS): 221112		
G. Projected Start of Construction Date: January 2015		
Projected Start of Operation Date: June 2016		
H. Facility and Site Location Information (If no street address, provide clear driving directions to the site in writing.):		
From College Station, Texas, head northeast on Farm to Market Rd 60/University Dr. toward Jane St. Turn right onto TX-6 Frontage S. Turn left onto Harvey Rd. Slight right onto TX-30 E. Site is approximately 22.4 miles down TX-30 E on the right hand side.		
City/Town: Shiro	County: Grimes	ZIP Code: 77873
Latitude (nearest second): 30° 35' 16" N	Longitude (nearest second): 95° 55' 38" W	

III. Type of Permit Action Requested (continued)		
H. Federal Operating Permit Requirements (30 TAC Chapter 122 Applicability) *(continued)*		
2. Identify the type(s) of FOP(s) issued and/or FOP application(s) submitted/pending for the site. (check all that apply)		
GOP Issued ☐	GOP application/revision application submitted or under APD review ☐	
SOP Issued ☐	SOP application/revision application submitted or under APD review ☐	
IV. Public Notice Applicability		
A. Is this a new permit application or a change of location application?		☒ YES ☐ NO
B. Is this application for a concrete batch plant? If Yes, complete V.C.1 – V.C.2.		☐ YES ☒ NO
C. Is this an application for a major modification of a PSD, nonattainment, FCAA 112(g) permit, or exceedance of a PAL permit?		☐ YES ☒ NO
D. Is this application for a PSD or major modification of a PSD located within 100 kilometers or less of an affected state or Class I Area?		☐ YES ☒ NO
If *Yes*, list the affected state(s) and/or Class I Area(s).		
E. Is this a state permit amendment application? If Yes, complete IV.E.1. – IV.E.3. --- NO		
1. Is there any change in character of emissions in this application?		☐ YES ☐ NO
2. Is there a new air contaminant in this application?		☐ YES ☐ NO
3. Do the facilities handle, load, unload, dry, manufacture, or process grain, seed, legumes, or vegetables fibers (agricultural facilities)?		☐ YES ☐ NO
F. List the total annual emission increases associated with the application (*list* **all** *that apply and attach additional sheets as needed*):		
Volatile Organic Compounds (VOC): 35.71 tpy		
Sulfur Dioxide (SO_2): 12.99 tpy		
Carbon Monoxide (CO): 377.17 tpy		
Nitrogen Oxides (NO_x): 336.26 tpy		
Particulate Matter (PM): 44.55 tpy		
PM_{10} microns or less (PM_{10}): 44.55 tpy		
$PM_{2.5}$ microns or less ($PM_{2.5}$): 44.55 tpy		
Sulfuric Acid Mist (H_2SO_4): 1.31 tpy		
Lead (Pb): 0.042 tpy		
Hazardous Air Pollutants (HAPs): 6.33 tpy		
Other speciated air contaminants **not** listed above: CO_2 = 1,150,839 tpy, CO_2e = 1,152,288 tpy		

Texas Commission on Environmental Quality
Form PI-1 General Application for
Air Preconstruction Permit and Amendment

Important Note: The agency **requires** that a Core Data Form be submitted on all incoming applications unless a Regulated Entity and Customer Reference Number have been issued *and* no core data information has changed. For more information regarding the Core Data Form, call (512) 239-5175 or go to www.tceq.texas.gov/permitting/central_registry/guidance.html.

I. Applicant Information		
A. Company or Other Legal Name: Tenaska Roan's Prairie Partners, LLC		
Texas Secretary of State Charter/Registration Number (*if applicable*):		
B. Company Official Contact Name: Mr. Greg Kunkel		
Title: Vice President, Environmental Affairs		
Mailing Address: 1044 N. 115th Street, Suite 400		
City: Omaha	State: NE	ZIP Code: 68154-4446
Telephone No.: 402-691-9500	Fax No.: 402-691-9530	E-mail Address: gkunkel@tenaska.com
C. Technical Contact Name: Mr. Larry Carlson		
Title: Director, Air Programs		
Company Name: Tenaska, Inc.		
Mailing Address: 1044 N. 115th Street, Suite 400		
City: Omaha	State: NE	ZIP Code: 68154-4446
Telephone No.: 402-938-1661	Fax No.: 402-691-9530	E-mail Address: lcarlson@tenaska.com
D. Site Name: Tenaska Roan's Prairie Generating Station		
E. Area Name/Type of Facility: Electric Generating Station		☒ Permanent ☐ Portable
F. Principal Company Product or Business: Electricity Generation		
Principal Standard Industrial Classification Code (SIC): 4911		
Principal North American Industry Classification System (NAICS): 221112		
G. Projected Start of Construction Date: January 2015		
Projected Start of Operation Date: June 2016		
H. Facility and Site Location Information (If no street address, provide clear driving directions to the site in writing.):		
From College Station, Texas, head northeast on Farm to Market Rd 60/University Dr. toward Jane St. Turn right onto TX-6 Frontage S. Turn left onto Harvey Rd. Slight right onto TX-30 E. Site is approximately 22.4 miles down TX-30 E on the right hand side.		
City/Town: Shiro	County: Grimes	ZIP Code: 77873
Latitude (nearest second): 30° 35' 16" N	Longitude (nearest second): 95° 55' 38" W	

III. Type of Permit Action Requested (continued)		
H. Federal Operating Permit Requirements (30 TAC Chapter 122 Applicability) *(continued)*		
2. Identify the type(s) of FOP(s) issued and/or FOP application(s) submitted/pending for the site. (check all that apply)		
GOP Issued ☐	GOP application/revision application submitted or under APD review ☐	
SOP Issued ☐	SOP application/revision application submitted or under APD review ☐	
IV. Public Notice Applicability		
A. Is this a new permit application or a change of location application?		☒ YES ☐ NO
B. Is this application for a concrete batch plant? If Yes, complete V.C.1 – V.C.2.		☐ YES ☒ NO
C. Is this an application for a major modification of a PSD, nonattainment, FCAA 112(g) permit, or exceedance of a PAL permit?		☐ YES ☒ NO
D. Is this application for a PSD or major modification of a PSD located within 100 kilometers or less of an affected state or Class I Area?		☐ YES ☒ NO
If *Yes*, list the affected state(s) and/or Class I Area(s).		
E. Is this a state permit amendment application? If Yes, complete IV.E.1. – IV.E.3. --- NO		
1. Is there any change in character of emissions in this application?		☐ YES ☐ NO
2. Is there a new air contaminant in this application?		☐ YES ☐ NO
3. Do the facilities handle, load, unload, dry, manufacture, or process grain, seed, legumes, or vegetables fibers (agricultural facilities)?		☐ YES ☐ NO
F. List the total annual emission increases associated with the application (*list* **all** *that apply and attach additional sheets as needed*):		
Volatile Organic Compounds (VOC): 88.27 tpy		
Sulfur Dioxide (SO_2): 13.97 tpy		
Carbon Monoxide (CO): 595.07 tpy		
Nitrogen Oxides (NO_x): 368.01 tpy		
Particulate Matter (PM): 44.55 tpy		
PM_{10} microns or less (PM_{10}): 44.55 tpy		
$PM_{2.5}$ microns or less ($PM_{2.5}$): 44.55 tpy		
Sulfuric Acid Mist (H_2SO_4): 1.40 tpy		
Lead (Pb): 0.045 tpy		
Hazardous Air Pollutants (HAPs): 6.84 tpy		
Other speciated air contaminants **not** listed above: CO_2 = 1,244,632 tpy, CO_2e = 1,246,175 tpy		

Texas Commission on Environmental Quality
Form PI-1 General Application for
Air Preconstruction Permit and Amendment

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I. Applicant Information		
A. Company or Other Legal Name: Tenaska Roan's Prairie Partners, LLC		
Texas Secretary of State Charter/Registration Number (*if applicable*):		
B. Company Official Contact Name: Mr. Greg Kunkel		
Title: Vice President, Environmental Affairs		
Mailing Address: 1044 N. 115th Street, Suite 400		
City: Omaha	State: NE	ZIP Code: 68154-4446
Telephone No.: 402-691-9500	Fax No.: 402-691-9530	E-mail Address: gkunkel@tenaska.com
C. Technical Contact Name: Mr. Larry Carlson		
Title: Director, Air Programs		
Company Name: Tenaska, Inc.		
Mailing Address: 1044 N. 115th Street, Suite 400		
City: Omaha	State: NE	ZIP Code: 68154-4446
Telephone No.: 402-938-1661	Fax No.: 402-691-9530	E-mail Address: lcarlson@tenaska.com
D. Site Name: Tenaska Roan's Prairie Generating Station		
E. Area Name/Type of Facility: Electric Generating Station		☒ Permanent ☐ Portable
F. Principal Company Product or Business: Electricity Generation		
Principal Standard Industrial Classification Code (SIC): 4911		
Principal North American Industry Classification System (NAICS): 221112		
G. Projected Start of Construction Date: January 2015		
Projected Start of Operation Date: June 2016		
H. Facility and Site Location Information (If no street address, provide clear driving directions to the site in writing.):		
From College Station, Texas, head northeast on Farm to Market Rd 60/University Dr. toward Jane St. Turn right onto TX-6 Frontage S. Turn left onto Harvey Rd. Slight right onto TX-30 E. Site is approximately 22.4 miles down TX-30 E on the right hand side.		
City/Town: Shiro	County: Grimes	ZIP Code: 77873
Latitude (nearest second): 30° 35' 16" N	Longitude (nearest second): 95° 55' 38" W	

III. Type of Permit Action Requested (continued)		
H. Federal Operating Permit Requirements (30 TAC Chapter 122 Applicability) *(continued)*		
2. Identify the type(s) of FOP(s) issued and/or FOP application(s) submitted/pending for the site. (check all that apply)		
GOP Issued ☐	GOP application/revision application submitted or under APD review ☐	
SOP Issued ☐	SOP application/revision application submitted or under APD review ☐	
IV. Public Notice Applicability		
A. Is this a new permit application or a change of location application?		☒ YES ☐ NO
B. Is this application for a concrete batch plant? If Yes, complete V.C.1 – V.C.2.		☐ YES ☒ NO
C. Is this an application for a major modification of a PSD, nonattainment, FCAA 112(g) permit, or exceedance of a PAL permit?		☐ YES ☒ NO
D. Is this application for a PSD or major modification of a PSD located within 100 kilometers or less of an affected state or Class I Area?		☐ YES ☒ NO
If *Yes*, list the affected state(s) and/or Class I Area(s).		
E. Is this a state permit amendment application? If Yes, complete IV.E.1. – IV.E.3. --- NO		
1. Is there any change in character of emissions in this application?		☐ YES ☐ NO
2. Is there a new air contaminant in this application?		☐ YES ☐ NO
3. Do the facilities handle, load, unload, dry, manufacture, or process grain, seed, legumes, or vegetables fibers (agricultural facilities)?		☐ YES ☐ NO
F. List the total annual emission increases associated with the application (*list* **all** *that apply and attach additional sheets as needed*):		
Volatile Organic Compounds (VOC): 72.56 tpy		
Sulfur Dioxide (SO_2): 15.44 tpy		
Carbon Monoxide (CO): 513.06 tpy		
Nitrogen Oxides (NO_x): 372.39 tpy		
Particulate Matter (PM): 47.95 tpy		
PM_{10} microns or less (PM_{10}): 47.95 tpy		
$PM_{2.5}$ microns or less ($PM_{2.5}$): 47.95 tpy		
Sulfuric Acid Mist (H_2SO_4): 2.67 tpy		
Lead (Pb): 0.046 tpy		
Hazardous Air Pollutants (HAPs): 7.02 tpy		
Other speciated air contaminants **not** listed above: CO_2 = 1,278,052 tpy, CO_2e = 1,279,629 tpy		

Updated Process Flow Diagram

Attachment 4

January 2014

Tenaska Roan's Prairie Partners, LLC

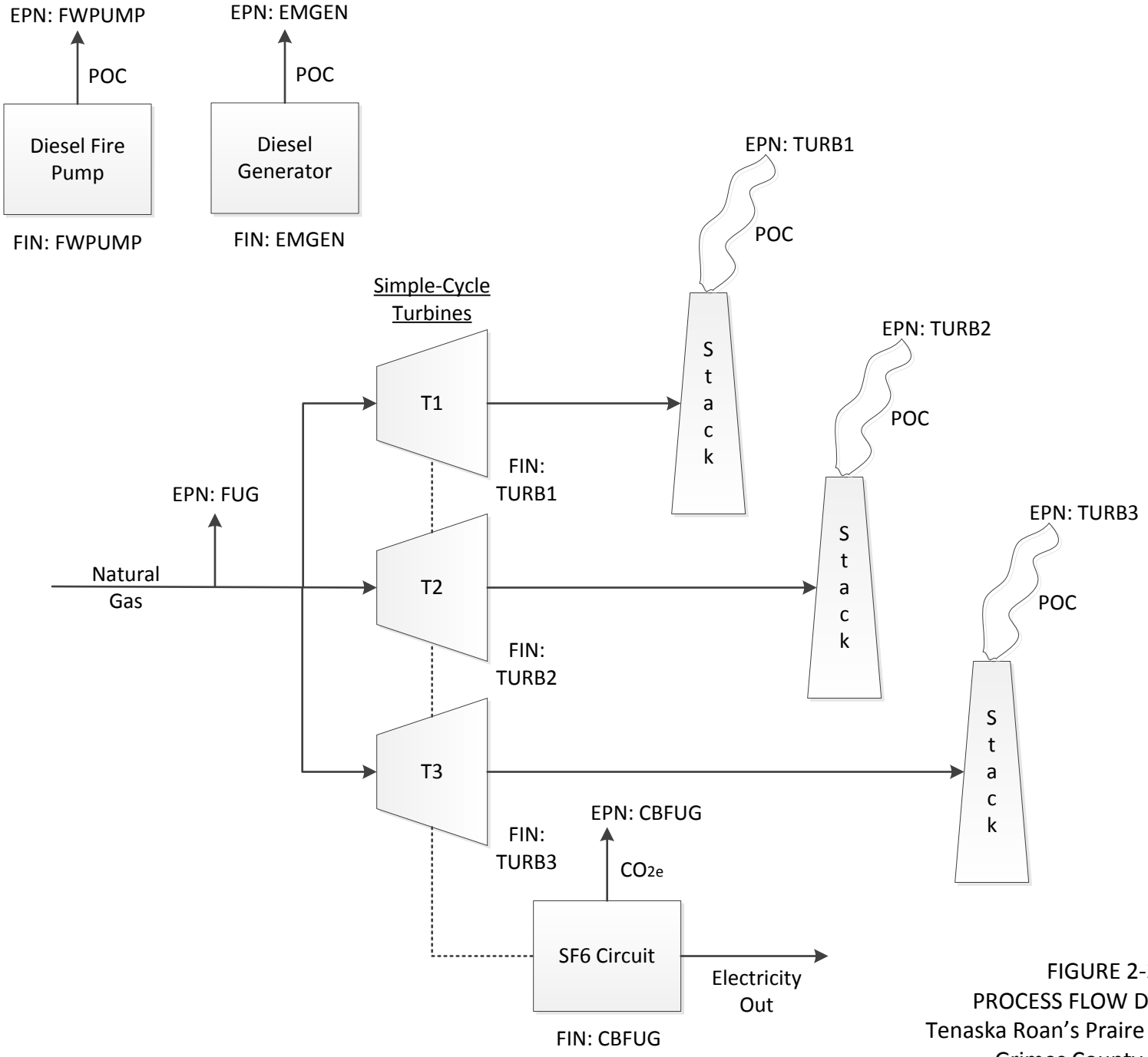

FIGURE 2-3
PROCESS FLOW DIAGRAM
Tenaska Roan's Praire Partners, LLC
Grimes County, Texas

H:\DWG\A14\0189555_PFD.vsd, 1/13/2014

Updated Core Data Form

Attachment 5

January 2014

Tenaska Roan's Prairie Partners, LLC

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions regarding completion of this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission *(If other is checked please describe in space provided)*

☒ New Permit, Registration or Authorization *(Core Data Form should be submitted with the program application)*

☐ Renewal *(Core Data Form should be submitted with the renewal form)* ☐ Other

2. Attachments — Describe Any Attachments: *(ex. Title V Application, Waste Transporter Application, etc.)*

☒ Yes ☐ No — PSD Permit Application

3. Customer Reference Number *(if issued)*	Follow this link to search for CN or RN numbers in Central Registry**	4. Regulated Entity Reference Number *(if issued)*
CN		RN

SECTION II: Customer Information

5. Effective Date for Customer Information Updates (mm/dd/yyyy): 7/22/2013

6. Customer Role (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check only one of the following:*

☐ Owner ☐ Operator ☒ Owner & Operator
☐ Occupational Licensee ☐ Responsible Party ☐ Voluntary Cleanup Applicant ☐ Other: _____

7. General Customer Information

☒ New Customer ☐ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State) ☐ No Change**

If "No Change" and Section I is complete, skip to Section III – Regulated Entity Information.

8. Type of Customer:	☒ Corporation	☐ Individual	☐ Sole Proprietorship- D.B.A
☐ City Government	☐ County Government	☐ Federal Government	☐ State Government
☐ Other Government	☐ General Partnership	☐ Limited Partnership	☐ Other:

9. Customer Legal Name *(If an individual, print last name first: ex: Doe, John)*	*If new Customer, enter previous Customer below*	*End Date:*
Tenaska Roan's Prairie Partners, LLC		

10. Mailing Address:	1044 N. 115th Street, Suite 400						
	City	Omaha	State	NE	ZIP	68154	ZIP + 4	4446

11. Country Mailing Information *(if outside USA)*	12. E-Mail Address *(if applicable)*

13. Telephone Number	14. Extension or Code	15. Fax Number *(if applicable)*
(402) 938-1661		(402) 691-9530

16. Federal Tax ID *(9 digits)*	17. TX State Franchise Tax ID *(11 digits)*	18. DUNS Number *(if applicable)*	19. TX SOS Filing Number *(if applicable)*
462009341	TBD	78708590	

20. Number of Employees: ☒ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

21. Independently Owned and Operated? ☒ Yes ☐ No

SECTION III: Regulated Entity Information

22. General Regulated Entity Information *(If 'New Regulated Entity" is selected below this form should be accompanied by a permit application)*

☒ New Regulated Entity ☐ Update to Regulated Entity Name ☐ Update to Regulated Entity Information ☐ No Change** *(See below)*

**If "NO CHANGE" is checked and Section I is complete, skip to Section IV, Preparer Information.

23. Regulated Entity Name *(name of the site where the regulated action is taking place)*

Tenaska Roan's Prairie Generating Station