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January 28, 2014

Ms. Traci A. Donaldson
Environmental Engineer
Air Permits Section (6PD-R)
U.S. Environmental Protection Agency, Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733

Subject: Response to Questions on Prevention of Significant Deterioration Greenhouse Gas Permit Application for a Combined Cycle Electricity Generating Unit at Austin Energy Sand Hill Energy Center

Dear Ms. Donaldson:

On January 14, 2014 you submitted seven (7) questions to Mr. Ravi Joseph to clarify details of the Prevention of Significant Deterioration (PSD) Permit application. On behalf of The City of Austin dba Austin Energy (Austin Energy), TRC Environmental Corporation hereby submits the response to those questions. The questions and the responses are detailed below.

Question 1. I am trying to marry the emission sources in the proposed permit with Figure 2-1 of the application: Are CC AMSFUG (combined cycle ammonia fugitives), CC MS FUG (combined cycle natural gas meter skid unit 8) and CC PB FUG (combined cycle power block fugitives unit 8) included as part of your emission calculations for Natural Gas fugitives?

Answer: Table 3-2 of application has natural gas piping total emissions 118.6 tpy CO2e resulting from 194 gas/vapor valves, 161 gas/vapor flanges and 35 gas/vapor relief valves. The source CC AMSFUG (combined cycle ammonia fugitives) only has emissions of ammonia. There are no greenhouse gas emissions from this source.

The MS FUG and PB FUG are included as part of the emission calculations. Table 1 below documents how the total fugitive counts represented in the permit application are distributed between MS FUG and PB FUG.

Table 1
Fugitive Component Counts

Source	Component Type	Component Count
MS FUG	Valves	166
	Flanges	161
	Relief Valve	15
PB Fug	Valves	28
	Flanges	0
	Relief Valve	20
Total Component Counts	Valves	194
	Flanges	161
	Relief Vales	35

There is not a proposed EPN for SF_6 emissions in Figure 2-1.

Answer: Attached is an updated plot plan that includes the EPN SF6 FUG

Question 2. EPA would like to know if Austin Energy is considering any of these Control Options that are not identified in the application. Please be specific:

Combustion Turbine:

- ***Periodic Burner Tuning – Periodic combustion inspections involving tuning of the combustors to restore highly efficient low-emission operation.***
- Answer: We will perform, at a minimum, tuning of the DLN burners twice per year.
- ***Reduction in Heat Loss – Insulation blankets are applied to the combustion turbine casing. These blankets minimize the heat loss through the combustion turbine shell and help improve the overall efficiency of the machine.***
- The new gas turbine (GE7FA.04) is more efficient than our current GE7FA.03 turbine. The higher efficiency is achieved through tighter blade clearances. Tighter clearance will require cooling. The GE design for GE7FA.04 does not call for the use of insulated blankets.

- ***Instrumentation and Controls– The control system is a digital type supplied with the combustion turbine. The control system monitors the operation of the unit and modulates the fuel flow and turbine operation to achieve optimal high-efficiency low-emission performance for full load and part-load conditions.***

  Answer: Austin Energy will incorporate automatic Dry Low NOx (DLN) tuning into the control system. The automatic tuning will include tracking and modulating to optimize heat rate and emissions, real time.

Heat Recovery Steam Generator:

- ***Heat Exchanger Design Considerations – The HRSG's are designed with multiple pressure levels. Each pressure level incorporates an economizer section(s), evaporator section, and superheater section(s). These heat transfer sections are made up of many thin-walled tubes to provide surface area to maximize the transfer of heat to the working fluid.***

  Answer: The proposed HRSG design includes multiple pressure levels. Thin wall tubes will be part of the design to maximize heat transfer and enable the HRSG to reach its operating load faster (soak time will be less)

- ***Insulation – Insulation minimizes heat loss to the surrounding air thereby improving the overall efficiency of the HRSG. Insulation is applied to the HRSG panels that make up the shell of the unit, to the high-temperature steam and water lines, and typically to the bottom portion of the stack.***

  Answer: The proposed HRSG design includes insulation on the HRSG panels.

- ***Minimizing Fouling of Heat Exchange Surfaces – Filtration of the inlet air to the combustion turbine is performed to minimize fouling. Additionally, cleaning of the tubes is performed during periodic outages. By reducing the fouling, the efficiency of the unit is maintained.***

  Answer: The 7FA will have an air filtration system just like our existing one. . Tube cleaning will only be performed on an as needed basis.

- ***Minimizing Vented Steam and Repair of Steam Leaks – Steam is vented from the system from de-aerator vents, blow-down tank vents, and vacuum pumps/steam jet air ejectors. These vents are necessary to improve the overall heat transfer within the HRSG and condenser by removing solids and air that potentially blankets the heat transfer surfaces lowering the equipment's performance. Steam leaks are repaired as soon as possible to maintain facility performance.***

Answer: Steam leaks are repaired as soon as practicable since they result in a loss of efficiency that affects our profits.

Other Plant-wide Energy Efficiency Features

- **Fuel Gas Preheating – The overall efficiency of the combustion turbine is increased with increased fuel inlet temperatures.**

  Answer: Fuel gas preheating system will be part of the design just like our existing 7FA unit.

- ***Drain Operation – Drains are required to allow for draining the equipment for maintenance, and also allow condensate to be removed from steam piping and drains for operation. Closing the drains as soon as the appropriate steam conditions are achieved will minimize the loss of energy from the cycle.***

  Answer: Drains will be closed as soon as the appropriate steam conditions are achieved.

- ***Multiple Combustion Turbine/HRSG Trains* – Multiple trains allow the unit to achieve higher overall plant part-load efficiency by shutting down a train operating at less efficient part-load conditions and ramping up the remaining train to high-efficiency full-load operation.**

  Answer: This is the purpose for adding the second train.

- **Boiler Feed Pump Variable Speed Drives – To minimize the power consumption at part-loads, the use of variable speed drives will be used improving the facility's overall efficiency.**

  Answer: At this point, our design does not include pumps with variable speed drives.

Question 3. Greenhouse Gas Emission Calculations: In the application, 10% CO_2e is added to account for measurement error, equipment and site variations, and degradations over time. Please be more specific as to how the 10% is apportioned and the technical basis for the applicable percentages along with any supporting documentation from prospective vendors.

Answer: To date the equipment vendors have not given a CO2e emission guarantee. Therefore, Austin Energy considered the following when try to quantify an emission rate that could be used in a permit as an enforceable limit:

- Flowmeters under the Acid Rain rules are accurate to $\pm$2% of full scale
- Analyzer calibrations under the same program are accurate to $\pm$2.5% of span value
- Linearities are accurate to $\pm$5% of reference gas value

- Stack flowmeters are accurate to ±3% of span
- Relative Accuracy Test (RATA) where we compare our analyzer to a third party certified analyzer is accurate (relative accuracy) to +10%

Austin Energy believes that a 10% increase is appropriate to account for these uncertainties.

Question 4. Change in Global Warming Potentials: 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. Please provide an updated emission tables using the new GWPs so that EPA can cross-check its own calculations.

Answer: The Table below is an update of Table 3-4 Annual GHG Emissions – total Project, included on page 3-6 of the permit application. This table reflects the changes in GHG $CO2_e$ resulting from the changes in November 29, 2013 GWP. Based on the changes in the GWP, the $CO2_e$ increased 99 tons per year from 1,461,941 to 1,462,040.

Table 3-4
Annual GHG Emissions Total Project

Source	Emissions				
	CO_2	CH_4	N_2O	SF_6	GHG, CO2e
Combined Cycle (10% margin)	1,460,386	27.5	2.8	0	1,461,896
Natural Gas Pipeline Fugitives	0.13	5.64	0	0	141.2
Electrical Equipment Leaks	0	0	0	0.00015	3.36
Total Project	1,460,386	33.2	2.8	0.0001475	1,462,040

Question 5. Start Up, Shut Down, and Maintenance: Please identify more specifically the # of SSM events from the Combustion Turbine Unit. Can Austin Energy meet the proposed BACT limit in your permit application at all times where a separate BACT is not needed for SSM emissions?

Answer: The startup and shutdown of the combined cycle is dictated by the Electic Reliability Council of Texas. For the purpose of the permit we have assumed 365 startups per year each lasting 7 hours. During the startup mode, the DLN will not be operating at its optimum point. Even with the SCR in operation, we will be not be able to meet meet the BACT limit of 0.81 tons CO2e/MWh for routine operations.

Question 6. Simple Cycle to Combined Cycle Calculations: Austin Energy indicated on page 5-17 that your proposed BACT was based on all operating conditions, including using evaporative cooling and with duct burner firing. How was the final proposed BACT limit in your application determined from Appendix B, Table 1 and Table 5-3? Please provide any additional calculations detailing how the information from the tables was used to derive the proposed BACT.

Answer: The BACT is defined as 0.81 ton CO2e/MWh. Table 5-3 has 0.806 t CO2e/MWh for the base case (temperature 68°F, evaporative cooler on and, duct burner on).

The caculations for the 0.81 ton CO2e on Page 5-17 are as follows:

CTG output = 179,025 kW,

CO2e = 288,470 lb/hr

BACT (CO2e/MWh) is:

(288,470 lb CO2e/hr) / (2000 lb/ton) / (179,025 kW) * (1,000 kW/MW) = 0.806 ton CO2e/MWh.

The calculations for 0.81 ton CO2e from Appendix B Table 1 are as follows:

CTG output (simple cycle) for the base case = 179,025 kW.

CO2e emissions from the gas turbine = 208,728 lb/hr (page 2 of 4)

CO2e emissions from the duct burner = 79,741 lb/hr (page 3 of 4)

Total CO2e emisssons from the sysetm = 208,728 lb/hr+ 79,741lb/hr = 288,468 lb/hr

BACT is (CO2e/MWh) is:

(288,468 lb CO2e/hr) / (2000 lb/ton) / (179,025 kW) * (1,000 kW/MW) = 0.806 ton CO2e/MWh.

Question 7. Combustion Turbine Selection: Was the GE 7AF.05 turbine considered for this project? Please provide details.

Answer: Yes it was considered. It was not chosen because the existing Steam turbine is sized for two HRSG's with two 7FA.03. The 7FA.05 is a significantly larger machine and would produce more steam in the associated HRSG than the existing steam turbine could handle. Using a 7FA.05 engine will result in the generation of excess steam that has to be either condensed or vented leading to loss of efficiency of the Combined Cycle.

Should you have technical questions regarding this application, please contact Mr. Ravi Joseph, P.E. of Austin Energy via telephone at 512.322.6284 or email at Ravi.Joseph@austinenergy.com .

Sincerely,

TRC Environmental Corporation

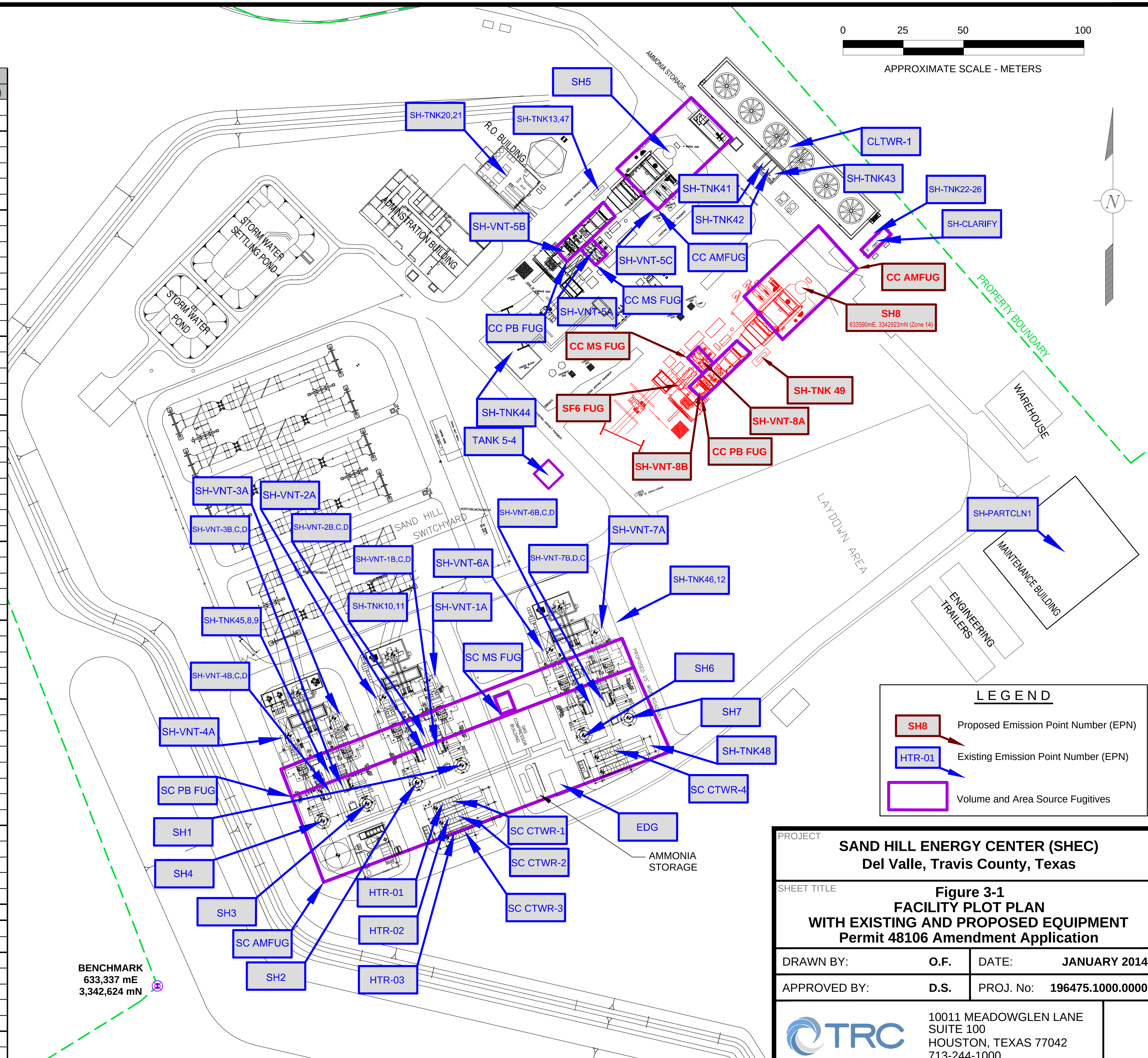
Bruce Broberg
Project Manager

Attachments

cc: Mr. David Van Soest, Austin Regional Director, TCEQ
Ms. Janet Pichette, Austin-Travis County Health and Human Services Dept.
Mr. Jeffery Robinson, U.S. Environmental Protection Agency Region VI, Permit Section Chief
Mr. Ravi Joseph, P.E., The City of Austin dba Austin Energy (e-mail)

HOU L:\Sand Hill Energy Center - SHEC\ Figs A-1 n 3-1 - CofA-SHEC - Plot Plan-w-EXISTINGnPROPOSED Equipment.dwg 01/27/14

EPN / FIN	SOURCE NAME	UTM COORDINATES	
		Easting (m)	Northing (m)
EXISTING SOURCES			
SH1	GE LM 6000 Simple Cycle Gas Turbine 1	633,456	3,342,718
SH2	GE LM 6000 Simple Cycle Gas Turbine 2	633,438	3,342,710
SH3	GE LM 6000 Simple Cycle Gas Turbine 3	633,419	3,342,703
SH4	GE LM 6000 Simple Cycle Gas Turbine 4	633,401	3,342,695
SH5	GE 7FA.03 Combined Cycle Unit 5	633,535	3,342,976
SH6	GE LM 6000 Simple Cycle Gas Turbine 6	633,506	3,342,733
SH7	GE LM 6000 Simple Cycle Gas Turbine 7	633,524	3,342,740
HTR-01	Inlet Air Heater 1	633,448	3,342,701
HTR-02	Inlet Air Heater 2	633,451	3,342,695
HTR-03	Inlet Air Heater 3	633,453	3,342,689
SC CTWR-1	Simple Cycle Cooling Tower 1	633,453	3,342,703
SC CTWR-2	Simple Cycle Cooling Tower 2	633,456	3,342,697
SC CTWR-3	Simple Cycle Cooling Tower 3	633,458	3,342,691
SC CTWR-4	Simple Cycle Cooling Tower 4	633,521	3,342,721
CLTWR-1	Cooling Tower 1 (Combined Cycle)	633,587	3,342,971
SC PB FUG	Simple Cycle Power Block Fugitives	633,388	3,342,704
SC MS FUG	Simple Cycle Natural Gas Meter Skid	633,475	3,342,738
CC PB FUG	Combined Cycle Power Block Fugitives	633,502	3,342,926
CC MS FUG	Combined Cycle Natural Gas Meter Skid	633,514	3,342,925
SC AMFUG	Simple Cycle Ammonia Fugitives	633,403	3,342,669
CC AMFUG	Combined Cycle Ammonia Fugitives	633,513	3,342,965
TANK 5-4	Oil/Water Separator	633,495	3,342,838
EDG	Emergency Diesel Generator	633,494	3,342,713
SH-VNT-1A	Generator Lube Oil Vent-1A	633,448	3,342,754
SH-VNT-1B,C,D	Lube Oil Vents-1B,C,D	633,449	3,342,724
SH-VNT-2A	Generator Lube Oil Vent-2A	633,424	3,342,744
SH-VNT-2B,C,D	Lube Oil Vents-2B,C,D	633,443	3,342,722
SH-VNT-3A	Generator Lube Oil Vent-3A	633,408	3,342,738
SH-VNT-3B,C,D	Lube Oil Vents-3B,C,D	633,409	3,342,708
SH-VNT-4A	Generator Lube Oil Vent-4A	633,384	3,342,728
SH-VNT-4B,C,D	Lube Oil Vents-4B,C,D	633,404	3,342,706
SH-VNT-5A	Hydraulic Oil/Lube Oil Vent on Unit 5A Gas Turbine	633,513	3,342,930
SH-VNT-5B	Generator Seal Oil Vent for Unit 5 Gas Turbine	633,502	3,342,930
SH-VNT-5C	Lube Oil Vent on Unit 5C Steam Turbine	633,539	3,342,948
SH-VNT-6A	Generator Lube Oil Vent-6A	633,493	3,342,764
SH-VNT-6B,C,D	Lube Oil Vents-6B,C,D	633,512	3,342,742
SH-VNT-7A	Generator Lube Oil Vent-7A	633,517	3,342,773
SH-VNT-7B,D,C	Lube Oil Vents-7B,D,C	633,518	3,342,744
SH-PARTCLN1	Parts Cleaner	633,709	3,342,806
SH-TNK10,11	Underground Wash Water Tanks	633,444	3,342,728
SH-TNK13,47	Underground Wash Water Tanks	633,478	3,342,961
SH-TNK20,21	Nalco Tote Tanks	633,516	3,342,955
SH-TNK22-26	Nalco Tote Tanks	633,630	3,342,938
SH-TNK46,12	Oil/Water Seperator Tank for Units 6-7	633,523	3,342,776
SH-TNK41	Circulating Water Pump/Lube Oil Reservoir	633,584	3,342,967
SH-TNK42	Circulating Water Pump/Lube Oil Reservoir	633,586	3,342,965
SH-TNK43	Circulating Water Pump/Lube Oil Reservoir	633,589	3,342,962
SH-TNK44	Unit 5 Gas Compressor Oil Reservoir	633,480	3,342,889
SH-TNK45	Oil/Water Seperator Tank for Units 1-4	633,404	3,342,713
SH-TNK48	Underground Wash Water Tank	633,537	3,342,725
SH-CLARIFY	Water Treatment Chemical Storage Tanks	633,631	3,342,935
PROPOSED SOURCES			
SH8	GE 7FA.04 Combined Cycle Unit 8	633,590	3,342,923
CC AMFUG	Combined Cycle Ammonia Fugitives Unit 8	633,576	3,342,911
CC MS FUG	Combined Cycle Natural Gas Meter Skid Unit 8	633,553	3,342,885
CC PB FUG	Combined Cycle Power Block Fugitives Unit 8	633,553	3,342,874
SF6 FUG	SF6 Fugitives	633,549	3,342,875
SH-TNK49	Underground Wash Water Tank	633,583	3,342,886
SH-VNT-8A	Hydraulic Oil/Lube Oil Vent on Unit 8 Gas Turbine	633,559	3,342,885
SH-VNT-8B	Generator Seal Oil Vent for Unit 8 Gas Turbine	633,558	3,342,872



PROJECT
SAND HILL ENERGY CENTER (SHEC)
Del Valle, Travis County, Texas

SHEET TITLE
Figure 3-1
FACILITY PLOT PLAN
WITH EXISTING AND PROPOSED EQUIPMENT
Permit 48106 Amendment Application

DRAWN BY:	O.F.	DATE:	JANUARY 2014
APPROVED BY:	D.S.	PROJ. No:	196475.1000.0000

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