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August 13, 2014

Ms. Sherry Fuerst
EPA Region 6
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Re: Lon C. Hill Power Station
Lon C. Hill, LP
Application for Greenhouse Gas Prevention of Significant Deterioration Permit

Dear Ms. Fuerst,

By means of this letter, we would like to update the Lon C. Hill Power Station proposed output-based BACT limit for normal operation, based on new vendor information received since initial submittal, and provide a BACT limit applicable during maintenance, startup and shutdown (MSS) events, as proposed by similar facilities that are being authorized under EPA Region 6 (e.g. Pinecrest Energy Center, LLC; Victoria Power Station). In addition, this letter outlines the Lon C. Hill proposal for the initial and continued compliance demonstration with the proposed limits on a 12-month rolling average.

The following table summarizes the proposed BACT limits. Detailed calculations are provide in Attachment A to this letter.

Combustion Turbine Model	Heat Rate, Net Basis (Btu/kWh) (HHV)(1)	Output Based Emission Limit, Net Basis (lb CO_2/MWh)(1),(2)	MSS Emission Limit (ton_{CO2}/hr)(2)
Siemens SCC6-5000F, or GE S207FA.04, or equivalent	7,840	935	115

(1) This limit applies with and without duct burner firing during normal operations
(2) Limits are based on a 12-month rolling average.

I. Proposed Heat Rate (Btu/kWh)

Lon C. Hill proposes a heat rate of **7,840 Btu/kWh (HHV)** for the proposed units at full load on a 12-month rolling average and net basis. The proposed heat rates are vendor estimates and account for combined cycle power generation.

The proposed heat rates incorporate full load operation with and without supplemental duct firing as follows:

$$Proposed\ Heat\ Rate\ \left(\frac{Btu}{kWh}\right) = \frac{\left[HR\left(\frac{Btu}{kWh}\right) \times \frac{hr}{yr}\right]_{Full\ Load\ Unfired} + \left[HR\left(\frac{Btu}{kWh}\right) \times \frac{hr}{yr}\right]_{Full\ Load\ Fired}}{\left[\left(\frac{hr}{yr}\right)_{Full\ Load\ Unfired} + \left(\frac{hr}{yr}\right)_{Full\ Load\ Fired}\right]}$$

To reflect actual versus design differences, degradation between maintenance overhauls, and degradation of plant auxiliary equipment, the unfired and fired calculated heat rates include an adjustment factor. Similar adjustment factors have been used in other applications authorized by EPA Region 6 (e.g. Calpine Channel Energy, La Paloma Energy Center). Detailed calculations are provided in Attachment A to this letter.

II. Proposed Output-Based CO_2 Emission Rate (lb_{CO2}/MWh)

Lon C. Hill proposes an output-based CO_2 emission rate of **935 lb_{CO2}/MWh** at full load on a 12-month rolling average and net basis. The proposed output-based CO_2 emission rate incorporates full load operation with and without supplemental duct firing.

The calculation is as follows:

$$Output\ Based\ CO_2\ Emission\ Limit\ \left(\frac{lb_{CO2}}{MWh}\right) =$$

$$Proposed\ Heat\ Rate\ \left(\frac{Btu}{kWh}\right) \times \frac{1MMBtu}{1{,}000{,}000\ Btu} \times CO_2\ Emission\ Factor\ \left(\frac{lb}{MMBtu}\right) \times \frac{1{,}000\ kW}{MW}$$

Where the CO_2 Emission Factor is calculated according to 40 CFR Part 75, Appendix G, Equation G-4, as referenced in §98.43(a):

$$CO_2\ Emission\ Factor = F_C\left(\frac{scf}{MMBtu}\right) \times \frac{1}{Standard\ Molar\ Volume\ \left(\frac{scf}{lbmole}\right)} \times MW_{CO2}\left(\frac{lb}{lbmole}\right)$$

Where,

Carbon based F-factor, FC = 1,040 scf/MMBtu
Standard Molar Volume = 385 scf/lbmole
Molecular Weight CO_2, MW_{CO2} = 44 lb/lbmole

The proposed BACT limit will apply for all operational modes at full load but will not apply during MSS events. Lon C. Hill requests this exclusion because during the MSS events, the unit is not producing electricity efficiently. Rather specific procedures are implemented during these times, to quickly reach

the necessary operational conditions to stabilize the unit and then generate electricity efficiently, in the case of a startup, or to safely shut the unit down. During the unit ramp up, fuel may be consumed with no electricity production (e.g., full speed no load), as the energy input from the fuel would be used for heating the turbine casings, rotors, steam piping, etc. Startups could be cold, warm, or hot and could last up to 4 hours. During shutdown events, the electricity generation drops while fuel consumption is shutdown.

III. Proposed MSS BACT

For compliance purposes, Lon C. Hill proposes a MSS BACT CO_2 emission rate limit of **115 ton_{CO2}/hr** on a 12-month rolling average**.** The proposed MSS BACT limit is calculated based on the average heat input of the turbines, as provided in the manufacturer estimates, and 40 CFR Part 75, Appendix G, Equation G-4, CO_2 emission factor. Detailed calculations are provided in Attachment A of this letter.

IV. Initial Compliance Demonstration with Output-Based CO_2 Emission Rate

Lon C. Hill proposes to demonstrate initial compliance with this limit during the required emissions stack testing at full load for criteria pollutant emission rate limits by using the same methods proposed for the continuous compliance demonstration. Lon C. Hill requests the flexibility to adjust this emission rate limit as necessary to account for emissions during actual operations. The appropriateness of the proposed limit will be within 90 days after receipt of the stack test data from the vendor. If the emission rate limit needs to be increased, a request will be submitted to EPA and TCEQ in writing within this timeframe.

V. Continuous Compliance Demonstration with Output-Based CO_2 Emission Rate

Lon C. Hill proposes to operate the new facility in a 2x2x1 configuration or in 1x1x1 with either CT unit in combination with the ST. Lon C. Hill proposes to demonstrate compliance with the proposed CO_2 Emission Standard using reported Part 98 CO_2 mass emission rates and the plant net electricity generation, as detailed below.

A. 1x1x1 Combined Cycle Configuration Compliance Demonstration

During 1x1x1 configuration compliance demonstration is simplified as only one of the two combustion turbines will be contributing to the net electricity generation. The following approach is therefore proposed to demonstrate compliance.

$$\text{Output Based } CO_2 \text{ Emission Rate } \left(\frac{lb_{CO2}}{MWh}\right) =$$

$$\frac{CO_2 \text{ Annual Emission Rate } (ton_{CO2})}{\text{Plant Net Electricity Generation } (MWh)} \times 2{,}000 \frac{lb_{CO2}}{ton_{CO2}}$$

CO_2 Annual Emission Rate (ton_{CO2})

Lon C. Hill will be an electricity generating facility subject to 40 CFR 98 per §98.2(a)(1). As such, it will be required to meet the general requirements of Part 98 Subpart A and the specific monitoring, calculation methodologies, and recordkeeping requirements of Subparts C and D. Lon C. Hill will report its annual CO_2 emission rates following the 40 CFR 98 Tier 4 calculation methodology, which includes specific requirements related to quality assurance, fuel flow measurement, application of fuel heat content, and missing data procedures. The CO_2 annual emission rate will include the duct burner contribution to CO_2 emissions. Lon C. Hill proposes to use the reported CO_2 annual emission rate to demonstrate compliance with the proposed output based CO_2 emission standard.

Plant Net Electricity Generation (MWh)

Lon C. Hill will be equipped with a highly reliable meter to measure the plant's net electric output that is delivered to the transmission grid for billing purposes. Readings from this meter will be utilized to confirm Lon C. Hill electricity sales. Other meters in the facility will measure the gross output from each of the three generators in the facility with additional meters measuring energy used to operate plant parasitic load. Subtracting unit-specific parasitic load from the gross output meter for each generator provides a total of the net electric output for each unit. Summing the values of gross output and parasitic load for each of the generators provides a check total against the net billing meters. Slight differences between the totals will always be present and will vary depending on plant operating configuration and the effect of transformer and line losses. However, the billing meters will be calibrated regularly to Independent System Operator (ISO) standards and should be the controlling indication for total net output. Energy used to operate specific unit equipment and provide power for overall station requirements will be included in the parasitic load total and in the net output calculations. Major equipment such as that listed below will account for the majority of parasitic load. Energy required to support maintenance and admin functions (HVAC, lighting, shop power, etc.) will also be treated as parasitic load but makes up only a small percentage of the total and is not included in the list.

- Boiler Feed Water Pumps
- Closed Cooling Water Pumps
- Combustion turbine cranking motors or static frequency converters
- Condensate Pumps
- ACC fan motors
- SCR Vaporizer Heaters
- Boiler Water makeup plant
- Chilled Water package, including chilled water pumps, chiller compressors and circulating water pumps
- Cooling tower fan motors
- Steam turbine condenser circulating water pumps

In a 1x1 configuration, since only one CT will be operational, both the electricity generated by the STG and the parasitic load will be attributable fully to that one CT, therefore, direct readings from the billing meter may be used for compliance demonstration. The net electric generation billing meter will be a third party meter and will be calibrated regularly to ISO standards. As such, Lon C. Hill will not have physical control over the meter. Since this meter is subject to QA/QC controls by the third party controller, we request no QA/QC or operational requirements related to the billing meter to be imposed, as Lon C. Hill will not be allowed to perform them.

B. 2x2x1 Combined Cycle Configuration Compliance Demonstration

During operation in the 2x2x1 configuration, compliance demonstration for each unit will require some additional adjustments, as both CTs will be contributing to the net electricity generation. The following approach is therefore proposed to demonstrate compliance:

$$\text{Unit 1 Emission Standard } \left(\frac{\text{lb}_{\text{CO2}}}{\text{MWh}}\right) =$$

$$\frac{Unit\ 1\ CO_2\ Mass\ Emission\ Rate\ (ton_{CO2})}{Plant\ Net\ Electricty\ \ (MWh) \times \left(\frac{Unit\ 1\ Gross\ Electricity\ \ (MWh)}{Unit\ 1\ Gross\ \ Elect\ \ (MWh) + Unit\ 2\ Gross\ \ Elect\ (MWh)}\right)} \times 2{,}000\ \frac{lb_{CO2}}{ton_{CO2}}$$

$$Unit\ 2\ \ Emission\ Standard\ \left(\frac{lb_{CO2}}{MWh}\right) =$$

$$\frac{Unit\ 2\ CO_2\ Mass\ Emission\ Rate\ (ton_{CO2})}{Plant\ Net\ Electricty\ \ (MWh) \times \left(\frac{Unit\ 1\ Gross\ Electricity\ \ (MWh)}{Unit\ 1\ Gross\ \ Elect\ \ (MWh) + Unit\ 2\ Gross\ \ Elect\ (MWh)}\right)} \times 2{,}000\ \frac{lb_{CO2}}{ton_{CO2}}$$

Where,

CO_2 Annual Emission Rate (ton_{CO2})

As for the 1x1x1 combined cycle configuration, we propose to use the reported CO_2 annual emission rate under 40 CFR 98 to demonstrate compliance with the proposed output based CO_2 emission standard.

Plant Net Electricity Generation(MWh)

As for the 1x1x1 combined cycle configuration, we propose to use the net electricity generation measured by the plant's billing meter used to confirm Lon C. Hill electricity sales. As detailed above, the plant net electricity generation measurement accounts for the gross electricity generated by each of the CTGs and the STG, and subtract the electricity consumed by site equipment. Since the readings from this meter account for both CTGs in operation and the contribution of both CT to the ST and parasitic loads, we propose to ratio the plant net electricity generation according to the ratio of the CTGs gross electricity generation.

CTG Gross Electricity Generation (MWh)

Unit 1 and Unit 2 gross electricity generation will be continually recorded, and the appropriate data sent to the Data Acquisition and Handling System (DAHS) for use in emission rate calculations. We propose to use this measured gross electricity generation to ratio the measured plant net electricity generation.

VI. Continuous Compliance Demonstration with MSS Emission Rate

Lon C. Hill proposes to demonstrate compliance on a 12-month rolling average with the proposed MSS mass emission rate by using the measured fuel heat input during the MSS events, that will be recorded continually in the DAHS, and Part 75 CO_2 emission factor (40 CFR 75, Appendix G, Eq. G-4).

VII. Proposed Special Condition Language

Compliance with the proposed full load output-based CO_2 emission rate of **935 lb_{CO2}/MWh** will preliminarily be calculated on a 12-month rolling average net basis using the following formulas:

1x1x1 Configuration

$$\text{Output Based } CO_2 \text{ Emission Rate } \left(\frac{lb_{CO2}}{MWh}\right) =$$

$$\frac{CO_2 \ Annual \ Emission \ Rate \ (ton_{CO2})}{Plant \ Net \ Electricity \ Generation \ (MWh)} \times 2{,}000 \frac{lb_{CO2}}{ton_{CO2}}$$

2x2x1 Configuration

$$Unit \ 1 \ \ Emission \ Standard \ \left(\frac{lb_{CO2}}{MWh}\right) =$$

$$\frac{Unit \ 1 \ CO_2 \ Mass \ Emission \ Rate \ (ton_{CO2})}{Plant \ Net \ Electricty \ \ (MWh) \times \left(\frac{Unit \ 1 \ Gross \ Electricity \ \ (MWh)}{Unit \ 1 \ Gross \ \ Elect \ \ (MWh) + Unit \ 2 \ Gross \ \ Elect \ (MWh)}\right)} \times 2{,}000 \frac{lb_{CO2}}{ton_{CO2}}$$

$$Unit \ 2 \ \ Emission \ Standard \ \left(\frac{lb_{CO2}}{MWh}\right) =$$

$$\frac{Unit \ 2 \ CO_2 \ Mass \ Emission \ Rate \ (ton_{CO2})}{Plant \ Net \ Electricty \ \ (MWh) \times \left(\frac{Unit \ 1 \ Gross \ Electricity \ \ (MWh)}{Unit \ 1 \ Gross \ \ Elect \ \ (MWh) + Unit \ 2 \ Gross \ \ Elect \ (MWh)}\right)} \times 2{,}000 \frac{lb_{CO2}}{ton_{CO2}}$$

Where

- CO_2 emissions associated with the units will be calculated according to the 40 CFR 98 Tier 4 calculation methodology and will include fuel consumption by the duct burners;

- Plant Net Electricity Generation (MWh) as measured by the plants future billing meter.
- Gross Electricity Generation (MWh) per unit as monitored by plant operations equipment and logged in the DAHS.

The summed hourly CO_2 mass emission values for each calendar month are to be divided by the corresponding hourly summed net energy output. The resulting quotient is to be added to the sum of quotients of the previous 11 calendar months and divided by 12 to determine compliance with the 12-month rolling average. The proposed BACT limit (lb_{CO2}/MWh) will not apply during MSS periods.

Compliance of with the MSS CO_2 mass emission rate of **115 ton_{CO2}/hr** will be demonstrated on a 12-month rolling average using the measured fuel heat input during the MSS events, recorded continually in the DAHS, and Part 75 CO_2 emission factor (40 CFR 75, Appendix G, Eq. G-4).

The appropriateness of this plan will be confirmed within 60 days after achieving the maximum production rate at which the affected facility will be operated, but not later than 180 days after the date of initial startup of the units. Any changes necessary to this methodology will be submitted to EPA and TCEQ in writing before the conclusion of this timeframe.

Please let us know if this proposal is acceptable. We look forward to issuance of the draft and final permit. Should you require any additional information, please do not hesitate to contact me at mjohnson@camsesparc.com or (281) 333-3339 x201.

Sincerely

Mona Caesar Johnson, P.E.
CAMS eSPARC, LLC
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cc: **TCEQ:** Tzvi Shalem (Tzvi.Shalem@tceq.texas.gov)

CAMS: Mr. Gary Clark (GClark@camstex.com)
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Attachment A – Detailed Calculations

LON C HILL REDEVELOPMENT PROJECT
LON C. HILL, LP

Proposed BACT Limit Summary Table (2x2x1 Configuration, Net Basis)

System	Heat Rate Net Basis (Btu/kWh) (HHV)	Output-Based CO_2 Emission Rate Net Basis (lb_{CO2}/MWh)[(1),(2)]	MSS CO_2 Emission Rate (ton_{CO2}/hr)[(2)]
Siemens SCC6-5000F, or GE S207FA.04, or equivalent	7,840	935	115

Notes
(1) This limit applies with and without duct burner firing during normal operations
(2) Limits are based on a 12-month rolling average.

BACT Limits Summary Table (2x2x1 Configuration, Net Basis)

System	Heat Rate Net Basis (Btu/kWh) (HHV)	Output-Based CO_2 Emission Rate Net Basis (lb_{CO2}/MWh)[(1),(2)]	MSS CO_2 Emission Rate (ton_{CO2}/hr)[(2)]
Siemens SCC6-5000F	7,810	928	113
GE S207FA.04 (with cooling tower)	7,786	925	111
GE S207FA.04 (with air condenser)	7,836	931	112

Notes
(1) This limit applies with and without duct burner firing during normal operations
(2) Limits are based on a 12-month rolling average.

LON C HILL REDEVELOPMENT PROJECT
LON C. HILL, LP

Siemens SCC6-5000F Output-Based CO_2 Emission Rate (Full Load)

Parameter	Units	Unfired	Fired	Proposed
Heat Rate, Net Basis [(1)]	Btu/kWh (LHV)	6,120	6,225	
Heat Rate, Net Basis [(2)]	Btu/kWh (HHV)	6,788	6,905	
Compliance Margin [(3)]	-	14.0%	14.0%	
Annual Hours of Operation [(4)]	hr/yr	3,785	4,375	8,160
Adjusted Heat Rate, Net Basis [(5),(6)]	Btu/kWh (HHV)	7,739	7,871	7,810
CO_2 Emission Factor [(7)]	lb_{CO2}/MMBtu	118.8	118.8	118.8
Output-Based CO_2 Emission Rate, Net Basis [(8)]	lb_{CO2}/MWh	919	935	928

Notes

(1) As provided by vendor performance data.

(2) Heat Rate Net Basis (Btu/kWh) (HHV) = Heat Rate Net Basis (Btu/kWh) (LHV) * Ratio HHV/LHV

HHV/LHV Ratio =	1.1	based on fuel heating value (Btu/lbm) per vendor data

(3) Compliance margin (14.0%) accounts for the variance of the design heat rate and the achieved heat rate, losses due to equipment degradation and variability on auxiliary plant equipment.

Design margin	5.0%	reflects possible variation in design vs actual heat rate given actual operating and ambient conditions.
Performance margin	6.0%	reflects efficiency losses due to equipment degradation prior to maintenance overhauls.
Degradation margin	3.0%	reflects the variability in operation of auxiliary plant equipment due to use over time.

(4) Estimated annual hours of operation represent one exptected operating scenario and are not intended to limit the permitted operations of Lon C. Hill Power Station. Lon C. Hill Power Station will meet the proposed output-based CO_2 emission rate on a 12-month rolling average and gross basis, regardless of the actual hours of run time in each of the operational modes

Unfired =	3,785 hr
Fired =	4,375 hr
MSS =	600 hr

(5) Adjusted Heat Rate Net Basis (Btu/kWh) (HHV) = Heat Rate Net Basis (Btu/kWh) (HHV) * (1 + Compliance Margin)

Adjusted Heat Rate Net Basis (Unfired) = 6,788 Btu/kWh (HHV) * (1 + 0.140) = 7,739 Btu/kWh (HHV)

(6) Proposed Heat Rate (Btu/kWh) = [[HR (Btu/kWh) * Annual Op (hr/yr)]$_{Unfired}$ + [HR (Btu/kWh) * Annual Op (hr/yr)]$_{Fired}$] / [Annual Op (hr/yr)$_{Unfired}$ + Annual Op (hr/yr)$_{Fired}$]

Proposed Heat Rate = [7,739 Btu/kWh * 3,785 hr/yr + 7,871 Btu/kWh * 4,375 Btu/kWh] / 8,160 hr/yr = 7,810 Btu/kWh

(7) CO_2 emission factor calculated per 40 CFR Part 75, Appendix G, Equation G-4, as referenced in §98.43(a), where:

CO2 Emission Factor = 1,040 scf/MMBtu / 385scf/lbmole * 44lb/lbmole = 118.8 lb/MMBtu

Carbon based F-factor, F_C =	1,040	scf/MMBtu
Standard Molar Volume =	385	scf/lbmole
Molecular Weight CO_2, MW_{CO2} =	44	lb/lbmole

(8) CO_2 Emission Rate Net Basis (lb_{CO2}/MWh) = Heat Rate Net Basis (Btu/kWh) * 1MMBtu/1,000,000 Btu * CO_2 Emission Factor (lb_{CO2}/MMBtu) * 1,000 kW/MW

CO2 Output-Based Emission Rate (Unfired), Net Basis = 7,739 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 919 lbCO2/MWh

CO2 Output-Based Emission Rate (Fired), Net Basis = 7,871 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 935 lbCO2/MWh

CO2 Output-Based Emission Rate (Proposed), Net Basis = 7,810 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 928 lbCO2/MWh

LON C HILL REDEVELOPMENT PROJECT
LON C. HILL, LP

GE S207FA.04 with Cooling Tower Output-Based CO_2 Emission Rate (Full Load)

Parameter	Units	Unfired	Fired	Proposed
Heat Rate, Net Basis (1)	Btu/kWh (LHV)	6,041	6,266	
Heat Rate, Net Basis (2)	Btu/kWh (HHV)	6,696	6,946	
Compliance Margin (3)	-	14.0%	14.0%	
Annual Hours of Operation (4)	hr/yr	3,785	4,375	8,160
Adjusted Heat Rate, Net Basis (5),(6)	Btu/kWh (HHV)	7,634	7,918	7,786
CO_2 Emission Factor (7)	lb_{CO2}/MMBtu	118.8	118.8	118.8
Output-Based CO_2 Emission Rate, Net Basis (8)	lb_{CO2}/MWh	907	941	925

Notes

(1) As provided by vendor performance data.

(2) Heat Rate Net Basis (Btu/kWh) (HHV) = Heat Rate Net Basis (Btu/kWh) (LHV) * Ratio HHV/LHV

HHV/LHV Ratio =	1.1	based on fuel heating value (Btu/lbm) per vendor data

(3) Compliance margin (14.0%) accounts for the variance of the design heat rate and the achieved heat rate, losses due to equipment degradation and variability on auxiliary plant equipment.

Design margin =	5.0%	reflects possible variation in design vs actual heat rate given actual operating and ambient conditions.
Performance margin =	6.0%	reflects efficiency losses due to equipment degradation prior to maintenance overhauls.
Degradation margin =	3.0%	reflects the variability in operation of auxiliary plant equipment due to use over time.

(4) Estimated annual hours of operation represent one exptected operating scenario and are not intended to limit the permitted operations of Lon C. Hill Power Station. Lon C. Hill Power Station will meet the proposed output-based CO_2 emission rate on a 12-month rolling average and gross basis, regardless of the actual hours of run time in each of the operational modes

Unfired =	3,785 hr
Fired =	4,375 hr
MSS =	600 hr

(5) Adjusted Heat Rate Net Basis (Btu/kWh) (HHV) = Heat Rate Net Basis (Btu/kWh) (HHV) * (1 + Compliance Margin)

Adjusted Heat Rate Net Basis (Unfired) = 6,696 Btu/kWh (HHV) * (1 + 0.140) = 7,634 Btu/kWh (HHV)

(6) Proposed Heat Rate (Btu/kWh) = [[HR (Btu/kWh) * Annual Op (hr/yr)]$_{Unfired}$ + [HR (Btu/kWh) * Annual Op (hr/yr)]$_{Fired}$] / [Annual Op (hr/yr)$_{Unfired}$ + Annual Op (hr/yr)$_{Fired}$]

Proposed Heat Rate = [7,634 Btu/kWh * 3,785 hr/yr + 7,918 Btu/kWh * 4,375 Btu/kWh] / 8,160 hr/yr = 7,786 Btu/kWh

(7) CO_2 emission factor calculated per 40 CFR Part 75, Appendix G, Equation G-4, as referenced in §98.43(a), where:

CO2 Emission Factor = 1,040 scf/MMBtu / 385scf/lbmole * 44lb/lbmole = 118.8 lb/MMBtu

Carbon based F-factor, F_C =	1,040	scf/MMBtu
Standard Molar Volume =	385	scf/lbmole
Molecular Weight CO_2, MW_{CO2} =	44	lb/lbmole

(8) CO_2 Emission Rate Net Basis (lb_{CO2}/MWh) = Heat Rate Net Basis (Btu/kWh) * 1MMBtu/1,000,000 Btu * CO_2 Emission Factor (lb_{CO2}/MMBtu) * 1,000 kW/MW

CO2 Output-Based Emission Rate (Unfired), Net Basis = 7,634 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 907 lbCO2/MWh

CO2 Output-Based Emission Rate (Fired), Net Basis = 7,918 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 941 lbCO2/MWh

CO2 Output-Based Emission Rate (Proposed), Net Basis = 7,786 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 925 lbCO2/MWh

LON C HILL REDEVELOPMENT PROJECT
LON C. HILL, LP

GE S207FA.04 with Air Condenser Output-Based CO_2 Emission Rate (Full Load)

Parameter	Units	Unfired	Fired	Proposed
Heat Rate, Net Basis (1)	Btu/kWh (LHV)	6,081	6,305	
Heat Rate, Net Basis (2)	Btu/kWh (HHV)	6,741	6,989	
Compliance Margin (3)	-	14.0%	14.0%	
Annual Hours of Operation (4)	hr/yr	3,785	4,375	8,160
Adjusted Heat Rate, Net Basis (5),(6)	Btu/kWh (HHV)	7,684	7,968	7,836
CO_2 Emission Factor (7)	lb_{CO2}/MMBtu	118.8	118.8	118.8
Output-Based CO_2 Emission Rate, Net Basis (8)	lb_{CO2}/MWh	913	947	931

Notes

(1) As provided by vendor performance data.

(2) Heat Rate Net Basis (Btu/kWh) (HHV) = Heat Rate Net Basis (Btu/kWh) (LHV) * Ratio HHV/LHV

HHV/LHV Ratio =	1.1	based on fuel heating value (Btu/lbm) per vendor data

(3) Compliance margin (14.0%) accounts for the variance of the design heat rate and the achieved heat rate, losses due to equipment degradation and variability on auxiliary plant equipment.

Design margin =	5.0%	reflects possible variation in design vs actual heat rate given actual operating and ambient conditions.
Performance margin =	6.0%	reflects efficiency losses due to equipment degradation prior to maintenance overhauls.
Degradation margin =	3.0%	reflects the variability in operation of auxiliary plant equipment due to use over time.

(4) Estimated annual hours of operation represent one exptected operating scenario and are not intended to limit the permitted operations of Lon C. Hill Power Station. Lon C. Hill Power Station will meet the proposed output-based CO_2 emission rate on a 12-month rolling average and gross basis, regardless of the actual hours of run time in each of the operational modes

Unfired =	3,785 hr
Fired =	4,375 hr
MSS =	600 hr

(5) Adjusted Heat Rate Net Basis (Btu/kWh) (HHV) = Heat Rate Net Basis (Btu/kWh) (HHV) * (1 + Compliance Margin)

Adjusted Heat Rate Net Basis (Unfired) = 6,741 Btu/kWh (HHV) * (1 + 0.140) = 7,684 Btu/kWh (HHV)

(6) Proposed Heat Rate (Btu/kWh) = [[HR (Btu/kWh) * Annual Op (hr/yr)]$_{Unfired}$ + [HR (Btu/kWh) * Annual Op (hr/yr)]$_{Fired}$] / [Annual Op (hr/yr)$_{Unfired}$ + Annual Op (hr/yr)$_{Fired}$]

Proposed Heat Rate = [7,684 Btu/kWh * 3,785 hr/yr + 7,968 Btu/kWh * 4,375 Btu/kWh] / 8,160 hr/yr = 7,836 Btu/kWh

(7) CO_2 emission factor calculated per 40 CFR Part 75, Appendix G, Equation G-4, as referenced in §98.43(a), where:

CO2 Emission Factor = 1,040 scf/MMBtu / 385scf/lbmole * 44lb/lbmole = 118.8 lb/MMBtu

Carbon based F-factor, F_C =	1,040	scf/MMBtu
Standard Molar Volume =	385	scf/lbmole
Molecular Weight CO_2, MW_{CO2} =	44	lb/lbmole

(8) CO_2 Emission Rate Net Basis (lb_{CO2}/MWh) = Heat Rate Net Basis (Btu/kWh) * 1MMBtu/1,000,000 Btu * CO_2 Emission Factor (lb_{CO2}/MMBtu) * 1,000 kW/MW

CO2 Output-Based Emission Rate (Unfired), Net Basis = 7,684 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 913 lbCO2/MWh

CO2 Output-Based Emission Rate (Fired), Net Basis = 7,968 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 947 lbCO2/MWh

CO2 Output-Based Emission Rate (Proposed), Net Basis = 7,836 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.8 lbCO2/MMBtu * 1,000 kW/MW = 931 lbCO2/MWh

LON C HILL REDEVELOPMENT PROJECT
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Proposed MSS BACT Limit

Parameter	Units	Siemens SCC6-5000F	GE S207FA.04 with Cooling Tower	GE S207FA.04 with Air Condenser
Max. Heat Input at Reduced Loads (HHV) (1)	MMBtu/hr (HHV)	1,899	1,864	1,881
CO_2 Emission Factor (2)	lb_{CO2}/MMBtu (HHV)	118.8	118.8	118.8
CO_2 Emission Rate Limit (SU/SD) (3)	ton_{CO2}/hr	113	111	112

Notes:

(1) Average CT heat input per manufacturer data for 75% load or higher

(2) CO_2 emission factor calculated per 40 CFR Part 75, Appendix G, Equation G-4, as referenced in §98.43(a), where:

CO2 Emission Factor = 1,040 scf/MMBtu / 385scf/lbmole * 44lb/lbmole = 118.8 lb/MMBtu

Carbon based F-factor, F_C =	1,040	scf/MMBtu
Standard Molar Volume =	385	scf/lbmole
Molecular Weight CO_2, MW_{CO2} =	44	lb/lbmole

(3) CO_2 Emission Rate Limit (SU/SD) (ton/hr) = Max. Heat Input (MMBtu/hr) * CO_2 Emission Factor (lb_{CO2}/MMBtu) * 1 ton / 2,000 lb

CO2 Emission Rate Limit (Siemens SCC6-5000F) = 1,899 MMBtu/hr * 118.8 lb/MMBtu * 1ton/2000lb = 113 tonCO2/hr

CO2 Emission Rate Limit (GE S207FA.04 with Cooling Tower) = 1,864 MMBtu/hr * 118.8 lb/MMBtu * 1ton/2000lb = 111 tonCO2/hr

CO2 Emission Rate Limit (GE S207FA.04 with Air Condenser) = 1,881 MMBtu/hr * 118.8 lb/MMBtu * 1ton/2000lb = 112 tonCO2/hr