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July 14, 2014

Ms. Melanie Magee
EPA Region 6
magee.melanie@epa.gov

Re: Victoria Power Station
Victoria WLE LP
Application for Greenhouse Gas
Prevention of Significant Deterioration Permit

Dear Ms. Magee,

By means of this letter, we would like to update the Victoria Power Station proposed performance standards as provided on June 20, 2014. The previously submitted standards did not include periods of startup and shutdown of the unit. Following our discussions and the review of similar facilities that are being authorized under EPA Region 6 (e.g. Pinecrest Energy Center, LLC), Victoria would like to update its proposed standards.

The proposed initial and continued compliance demonstration methodology with the limits on a 12-month rolling average remains unchanged from our proposal on May 15, 2014. The following table summarizes Victoria's proposed BACT limits.

Combustion Turbine Model	Combustion Turbine Annual Firing Rate (mmBtu/hr) (HHV)	Duct Burners Annual Firing Rate (mmBtu/hr) (HHV)	Heat Rate, Gross basis (Btu/kWh) (HHV)	Output Based Emission Limit, Gross Basis (lb CO_2/MWh)	MSS Emission Limit (ton_{CO2}/hr)
GE.7FA.04 or equivalent	1,816	483	8,074	960	108

* The lb/MWh BACT limit applies for full load operation with and without supplemental duct burner firing and does not apply during MSS.

Proposed Heat Rate (Btu/kWh)

Victoria proposes a heat rate of **8,074 Btu/kWh (HHV)** for VIC10 at full load on a 12-month rolling average and gross basis. The proposed heat rate accounts for the power generation of the new unit

(VIC10) and for the power generation at the existing steam turbine generator (STG) attributed to VIC10 during either 2x2x1 or 1x1x1 configuration. The proposed heat rate incorporates 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 adjusting factor. Similar adjusting factors have been used in other applications authorized by EPA Region 6 (e.g. Calpine Channel Energy, La Paloma Energy Center, etc.).

The STG nominal gross output attributed to VIC10 on an annual basis has been estimated based on the performance of the STG in the current configuration (1x1x1 configuration with the existing unit VIC7). Detailed calculations are provided in Attachment A of this letter.

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

Victoria proposes an output-based CO_2 emission rate of **960 lb_{CO2}/MWh** for VIC10 at full load on a 12-month rolling average and gross 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).

The proposed BACT limit will apply for all operational modes at full load but will not apply during startup, shutdown, or maintenance periods (MSS). Victoria requests this exclusion because during the MSS events, the goal of the unit is not to produce electricity, but to quickly reach the necessary operational conditions to stabilize the unit and then generate electricity or stop running. 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 10 hours. During shutdown events, the electricity generation drops while fuel consumption is shutdown. For compliance purposes, Victoria proposes a

BACT MSS CO_2 emission rate limit of **108 ton of CO_2 per hour**. Detailed calculations are provided in Attachment A of this letter.

Initial Compliance Demonstration with Output-Based CO_2 Emission Rate

Victoria 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. Victoria requests the flexibility to adjust this emission rate limit as necessary to account for emissions during actual operations.

Continuous Compliance Demonstration with Output-Based CO_2 Emission Rate

Victoria proposes to operate the new facility in a 2x2x1 configuration utilizing the existing unit (VIC7), the new unit (VIC10), and the existing ST, or in 1x1x1 with either CT unit in combination with the existing ST. Since the NSPS output-based limit applies only to new sources, VIC7 is currently not subject to this standard. Consequently, Victoria has identified an appropriate method to demonstrate compliance with this standard for VIC10 only on a 12-month rolling average basis. The following paragraphs summarize the proposed approach to establish the VIC10 output-based CO_2 emission rate based on VIC10 gross output and the proportion of the STG gross output that may be attributed to steam production by VIC10 heat recovery steam generating (HRSG) unit.

The actual output-based CO_2 emission rate will be calculated on a rolling 12-month basis using the following formula:

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

$$\frac{VIC10\ CO_2\ Annual\ Emission\ Rate\ (ton_{CO2})}{(VIC10\ Gross\ Output\ (MWh) + STG\ Gross\ Ouput\ \ attributed\ to\ VIC10(MWh))} \times \frac{2{,}000 lb_{CO2}}{1 ton_{CO2}}$$

VIC10 CO_2 Annual Emission Rate

Victoria is an electricity generating facility subject to 40 CFR 98 per §98.2(a)(1). As such, it is 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. Victoria will report VIC7 and VIC10 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 VIC10 CO_2 annual emission rate will include the duct burner contribution to CO_2 emissions.

VIC10 Gross Output

The VIC10 gross output will be continuously recorded, and the appropriate data will be sent to the Data Acquisition and Handling System (DAHS) for use in emission rate calculations. The VIC10 gross output will include the duct burner contribution to the power generation.

STG Gross Output Attributed to VIC10

The STG gross output will be sent to the DAHS so that the contribution of both VIC7 and VIC10 may be calculated. The VIC10 contribution to the total STG gross output will be estimated based on the steam contribution (pounds of steam) from each HRSG. As represented in the flow diagram (refer to Attachment B), each HRSG is equipped with a low pressure (LP) drum, an intermediate pressure (IP) drum, and a high pressure (HP) drum, and each drum supplies steam to the appropriate section of the ST.

Victoria will continuously measure the amount of steam supplied by each drum. As the STG gross output is directly dependent on the steam supply, the STG total gross output attributed to VIC10 may be estimated by scaling the gross STG output by the ratio of the total steam supplied from VIC10 HRSG steam drums to the total steam supplied.

$$\text{STG Gross Output attributed to VIC10(MWh)} =$$

$$\text{STG Total Gross Output (MWh)} \times \frac{\text{VIC10 Steam Supply (lbs)}}{\text{VIC10 Steam Supply (lbs)} + \text{VIC7 Steam Supply (lbs)}}$$

Continuous Compliance Demonstration with MSS Emission Rate

Victoria 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, recorded continually in the DAHS, and Part 75 CO_2 emission factor (40 CFR 75, Appendix G, Eq. G-4).

Proposed Special Condition Language

Compliance of VIC10 with the full load output-based CO_2 emission rate of **960 lb_{CO2}/MWh** will preliminarily be calculated on a 12-month rolling average gross basis using the following formula:

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

$$\frac{CO_2 \text{ Emission Rate Associated with VIC10 } (ton_{CO2})}{(VIC10 \text{ Gross Output } (MWh) + STG \text{ Gross Ouput attributed to } VIC10(MWh))} \times \frac{2{,}000 lb_{CO2}}{1 ton_{CO2}}$$

Where

- CO_2 emissions associated with VIC10 will be calculated according to the 40 CFR 98 Tier 4 calculation methodology and will include fuel consumption by the duct burners;
- VIC10 gross output will be monitored by plant operations equipment and logged in the DAHS; and
- STG total gross output attributed to VIC10 steam production will be estimated by scaling the gross STG output by the ratio of the steam supplied from the VIC10 HRSG steam drums (including duct burner contribution) to the total steam supply.

The summed hourly CO_2 mass emission values for each calendar month are to be divided by the corresponding hourly summed gross 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 VIC10 with the MSS CO_2 mass emission rate of 108 ton of CO_2 per hour, 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 to demonstrate the apportionment of the gross electric output 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 combustion turbine generator. 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
Texas Registered Engineering Firm F-15310

cc: **TCEQ:** Marc Sturdivant (Marc.Sturdivant@tceq.texas.gov)
CAMS: Mr. Gary Clark (GClark@camstex.com)
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Attachment A – Detailed Calculations

Victoria Power Station
Proposed Standards VIC10

Victoria will operate with the existing unit (VIC7), the new unit (VIC10), and the existing ST in a 2x2x1 configuration. Both CTs (VIC7 and VIC10) will supply steam to the ST. Victoria could also potentially operate in a 1x1x1 configuration with either CT (VIC7 or VIC10) in combination with the existing ST. Because only one CT will contribute to steam production, the ST will not be able to achieve its full capacity in a 1x1x1 configuration. Since VIC7 is an existing unit, it is not subject to a CO_2 output-base emission rate; therefore, this analysis is required only for VIC10. During operation in the 2x2x1 configuration, it is necessary to separate the emissions and power generation contribution of VIC10 from that of VIC7 to obtain a VIC10-specific output-based emission rate.

Compliance with the proposed CO2 output-based BACT emission rate limit (960 lbCO2/MWh) will be demonstrated on a 12-month rolling average and gross basis. This limit applies only during full load with and without supplemental duct burning. The lb/MWh BACT limit does not apply during part load maintenance, startup or shutdown (MSS) periods. VIC10 MSS emissions will be limited to 108 ton CO2/hr on a 12-month rolling average basis.

Proposed Output-Based Emission Rate (Full Load)

Parameter	Units	VIC10 (Full Load, Gross Basis)		
		Unfired	Fired	Proposed
VIC10 CTG Nominal Gross Output (1)	MW	177.3	177.3	
STG Gross Output attributed to VIC10 (2)	MW	89.8	101.5	
Max. Heat Input (HHV) (3)	MMBtu/hr (HHV)	1,816	2,088	
Compliance Margin (4)	%	12.3%	12.3%	
Annual Hours of Operation (5)	hr/yr	3,385	4,375	7,760
Heat Rate, Gross Basis (6), (7)	Btu/kWh (HHV)	7,636	8,412	8,074
CO_2 Emission Factor (8)	lb_{CO2}/MMBtu (HHV)	118.9	118.9	118.9
CO_2 Output-Based Emission Rate, Gross Basis (9)	lb_{CO2}/MWh	908	1,000	960

Notes:

(1) Estimated units output per vendor and actual data. Final values may vary depending on final design and ambient temperatures:

Mitsubishi 501F (VIC7) = 177.3 MW
General Electric 7FA.04 or equivalent (VIC10) = 177.3 MW
General Electric D5 Steam Turbine Unfired (ST) = 173.3 MW
Duct Fired Capacity (total both units) = 11.7 MW

(2) ST Gross Output attributed to VIC10 has been estimated based on VIC10 Gross Output and 2012 actual heat balance data for current configuration with VIC7.

	VIC7 CT	ST (operating with VIC7)
Avg. Gross Capacity CY 2012	165.3 MW	83.7 MW

ST Gross Output attributed to VIC10 (Unfired) = ST Gross Output operating with VIC7 * VIC 10 Gross Output / VIC7 Gross Output
ST Capacity Operating with VIC10 (Unfired) = 83.7 MW * 177.3 MW / 165.3 MW = 89.8 MW
ST Gross Output attributed to VIC10 (Fired) = ST Gross Output operating with VIC7 * VIC 10 Gross Output / VIC7 Gross Output + DB Gross Output
ST Capacity Operating with VIC10 (Fired) = 83.7 MW * 177.3 MW / 165.3 MW + 11.7 MW = 101.5 MW

(3) Maximum Heat Input:

CT Heat Input (HHV) = 1,816 MMBtu/hr (manufacturer data)
DB Heat Input (HHV) = 483 MMBtu/hr (manufacturer data)

Max. Heat Input (HHV) (Fired) = CT Heat Input * Unfired Hours of Operation + (CT + DB) Heat Input * Fired Hours of Operation / Total Hours of Operation
Max. Heat Input (HHV) (Fired) = [1,816 MMBtu/hr * 3,385 hr/yr + (1,816 MMBtu/hr + 483 MMBtu/hr) * 4,375 hr/yr] / [3,385 hr/yr unfired + 4,375 hr/yr fired] = 2,088 MMBtu/hr

(4) Compliance margin is an adjustment factor to the design rates to arrive at the proposed efficiency standards.
It includes a margin to reflect actual vs. design differences, degradation between maintenance overhauls, and degradation of plant auxiliary equipment.

Design Margin = 3.3%
Performance Margin on CTG and STG = 6.0%
Degradation Margin for the Auxiliary Plant Equipment = 3.0%

(5) Estimated annual hours of operation are based on engineering knowledge of the plant performance but are not intended to contractually limit Victoria operation. Victoria will meet the proposed output-based CO_2 emission rate on a 12-month rolling average and gross basis, independently of the final hours running in each of the operational modes.

Annual Hours of Operation Unfired = 3,385 hr/yr
Annual Hours of Operation Fired = 4,375 hr/yr
Annual Startup Hours = 1,000 hr/yr

(6) Heat Rate (Btu/kWh) = Heat Input (MMBtu/hr) * 1,000,000 Btu/MMBtu / (VIC10 Output + STG Output attributed to VIC10) (MW) * 1 MW / 1,000 kW * Comp. Margin

Heat Rate (Unfired), Gross Basis = 1,816 MMBtu/hr * 1,000,000 Btu/MMBtu / (177.3 MW + 89.8 MW) * 1 MW / 1,000 kW * 1.12 = 7,636 Btu/kWh (HHV)
Heat Rate (Fired), Gross Basis = 2,088 MMBtu/hr * 1,000,000 Btu/MMBtu / (177.3 MW + 101.5 MW) * 1 MW / 1,000 kW * 1.12 = 8,412 Btu/kWh (HHV)

(7) 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 = [7,636 Btu/kWh * 3,385 hr/yr + 8,412 Btu/kWh * 4,375 hr/yr] / 7,760 hr/yr = 8,074 Btu/kWh

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

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

CO2 Emission Factor = 1,040 scf/MMBtu / 385scf/lbmole * 44lb/lbmole = 118.9 lb/MMBtu

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

CO2 Output-Based Emission Rate (Unfired), Gross Basis = 7,636 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.9 lbCO2/MMBtu * 1,000 kW/MW = 908 lbCO2/MWh
CO2 Output-Based Emission Rate (Fired), Gross Basis = 8,412 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.9 lbCO2/MMBtu * 1,000 kW/MW = 1,000 lbCO2/MWh
CO2 Output-Based Emission Rate (Fired), Gross Basis = 8,074 Btu/kWh * 1 MMBtu/1,000,000 Btu * 118.9 lbCO2/MMBtu * 1,000 kW/MW = 960 lbCO2/MWh

Victoria Power Station
Proposed Standards VIC10

Proposed MSS BACT Limit

Parameter	Units	VIC10
Max. Heat Input (HHV) (2)	MMBtu/hr (HHV)	1,816
CO_2 Emission Factor (3)	lb_{CO2}/MMBtu (HHV)	118.9
CO_2 Emission Rate Limit (SU/SD) (4)	ton_{CO2}/hr	108

Notes:

(1) Estimated annual hours of operation are based on engineering knowledge of the plant performance but are not intended to contractually limit Victoria operation. Victoria will meet the proposed CO_2 mass emission rate for SU/SD on a 12-month rolling average, independently of the final hours running in each of the operational mode.

(2) Maximum heat input per manufacturer data

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

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

CO2 Emission Factor = 1,040 scf/MMBtu / 385scf/lbmole * 44lb/lbmole = 118.9 lb/MMBtu

(4) 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 (SU/SD) = 1,816 MMBtu/hr * 118.9 lb/MMBtu * 1ton/2000lb = 108 ton/hr

Attachment B – Flow Diagram

Proposed Expansion Configuration