Competitive Power Ventures, Inc.

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January 31, 2014

Virginia Department of Environmental Quality
Attention: Rob Feagins, Air Permit Manager
Southwest Regional Office
355-A Deadmore Street
Abingdon, Virginia 24210

RE: CPV Smyth Generation Company, LLC Prevention of Significant Deterioration Air Permit Application

Dear Mr. Feagins,

Please find enclosed four copies of CPV Smyth Generation Company, LLC's Prevention of Significant Deterioration Air Permit Application.

Per our previous discussions with you and Michael Kiss, this application includes the engineering portions of our PSD air permit application, including: the project description; potential emissions calculations and applicability determination; a review of state and federal air quality regulations to which the project is subject; Best Available Control Technology analysis; and, the VDEQ application forms, emissions calculation backup, and detailed equipment and vendor data. The air quality modeling analyses will be submitted separately, following completion of the collection of on-site meteorological data, as previously discussed.

Also enclosed for your information with this transmittal is our permit fee transmittal to the Virginia Department of Environmental Quality sent in parallel with this application.

We look forward to working with the Virginia Department of Environmental Quality on the review of CPV Smyth Generating Company, LLC's application.

Should you have any questions or in need of any clarifications, please do not hesitate to contact me at your convenience.

Sincerely,

Gener G. Gotiangco, P.E.
ggotiangco@cpv.com
240-723-2307

cc: M. Kiss, VA DEQ (via email)
F. Sellars, Tetra Tech (via e-mail)
R. Burke, Competitive Power Ventures, Inc. (via e-mail)

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PREVENTION OF SIGNIFICANT DETERIORATION AIR PERMIT APPLICATION

CPV Smyth Generation Company, LLC

Atkins, Virginia

Prepared on behalf of:

CPV

CPV Smyth Generation Company, LLC
8403 Colesville Road, Suite 915
Silver Spring, MD 20910

For Submittal to:

Virginia Department of Environmental Quality
Southwest Regional Office
355 Deadmore St.
Abingdon, VA 24212

Prepared by:

TETRA TECH

Tetra Tech
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January 2014

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ACRONYMS AND ABBREVIATIONS

ACC	air cooled condenser
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
BHP	brake horsepower
Btu/kW-hr	British thermal unit per kilowatt-hour
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CARB	California Air Resources Board
CCS	carbon capture and storage
CFR	Code of Federal Regulations
CEMS	continuous emissions monitoring system
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CPV Smyth	CPV Smyth Generation Company, LLC
CSAPR	Cross State Air Pollution Rule
CTG	combustion turbine generator
DAHS	data acquisition handling system
DLN	dry-low NO_x
°F	degrees Fahrenheit
GHG	greenhouse gases
g/kW-hr	grams per kilowatt-hour
gr/100 scf	grains per 100 standard cubic feet
H_2SO_4	sulfuric acid
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HFCs	hydrofluorocarbons
HHV	higher heating value
HRSG	heat recovery steam generator
kW	kilowatt
LAER	Lowest Achievable Emission Rate
lb/MMBtu	pound per million British thermal units
lb/MW-hr	pound per megawatt-hour
lb/hr	pounds per hour
lbs	pounds
LLO	Low Load Operation
LNB	low NO_x burners
MACT	Maximum Achievable Control Technology
MMBtu	million British thermal units
MMBtu/hr	million British thermal units per hour
MW	megawatt

ACRONYMS AND ABBREVIATIONS (Continued)

MWh	megawatt-hour
$\mu g/m^3$	microgram per cubic meter
NAAQS	National Ambient Air Quality Standards
NESHAP	National Emission Standard for Hazardous Air Pollutants
NH_3	ammonia
N_2O	nitrous oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NNSR	Nonattainment New Source Review
NSPS	New Source Performance Standards
NSR	New Source Review
O_2	oxygen
O_3	ozone
Pb	lead
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 micrometers or less
PM_{10}	particulate matter with an aerodynamic diameter of 10 micrometers or less
ppm	parts per million
ppmvd @15%	parts per million volume dry at 15% oxygen
PSD	Prevention of Significant Deterioration
RBLC	RACT\BACT\LAER Clearinghouse
SAAC	Significant Ambient Air Concentration
SCR	selective catalytic reduction
SF_6	sulfur hexafluoride
SIP	State Implementation Plan
SO_2	sulfur dioxide
STG	steam turbine generator
SU/SD	start-up/shutdown operation
SWRO	Southwest Regional Office
TLV®	Threshold Limit Value
tpy	tons per year
ULSD	ultra low sulfur diesel
USEPA	United States Environmental Protection Agency
UTM	Universal Transverse Mercator
VAAQS	Virginia Ambient Air Quality Standards
VAC	Virginia Administrative Code
VDEQ	Virginia Department of Environmental Quality
VOC	volatile organic compound

1.0 INTRODUCTION

CPV Smyth Generation Company, LLC (CPV Smyth) proposes to construct and operate a nominal 700-megawatt (MW) natural gas-fired, combined-cycle generating facility in Atkins, Virginia. Construction of the CPV Smyth Generation Company (the Project) is scheduled to begin in early 2015 with commencement of commercial operation by mid-2017. The proposed project location is a greenfield site with no commercial history.

The proposed Project will include two natural gas-fired combustion turbine generators (CTGs), two heat recovery steam generators (HRSGs) and one steam turbine generator (STG). The Project will be configured as a "2 on 1" power block with steam from the two HRSGs feeding the single STG. The balance of the Project will include an auxiliary boiler, emergency generator engine, emergency fire pump engine, aqueous ammonia (NH_3) storage tank, and an air cooled condenser (ACC).

The Project will have potential emissions above the Prevention of Significant Deterioration (PSD) major source threshold for nitrogen oxides (NO_x), carbon monoxide (CO) and greenhouse gases (GHGs). As major source for NO_x emissions, the Project will also be considered major for ozone. Potential emissions of all size fractions of particulate matter ($PM/PM_{10}/PM_{2.5}$), volatile organic compounds (VOCs) and sulfuric acid mist (H_2SO_4) will be above their respective PSD significant emissions threshold. Therefore, the Project will be subject to PSD permitting for NO_x, CO, $PM/PM_{10}/PM_{2.5}$, VOC, H_2SO_4, and GHGs. CPV Smyth is applying for a PSD permit from the Virginia Department of Environmental Quality (VDEQ) for the Project. The PSD permit is required under 9 Virginia Administrative Code (VAC) 5-80, Part II, Article 8 (9 VAC 5-80-1600 et seq.). This document, along with the accompanying VDEQ forms and other appended materials, is the PSD application for the Project. The Project will not be subject to Nonattainment New Source Review (NNSR) because the site is located in Smyth County, which is designated as unclassified or attainment for all criteria pollutants. This application addresses the permitting requirements specified by the VDEQ under 9 VAC 5, Chapters 80 and 85 as well as those contained in Title 40 of the Code of Federal Regulations (CFR) Part 52.21 (40 CFR 52.21).

Emissions of sulfur dioxide (SO_2) will be below its PSD significant emissions rate threshold but above the VDEQ de minimis permitting thresholds based on uncontrolled potential emissions as specified in 9 VAC 5-80-1105. As a result, SO_2 emissions will trigger VDEQ Best Available Control Technology (BACT) requirements under 9 VAC 5-80 Part II Article 6 and this application also addresses the VDEQ permitting requirements for these pollutants. For informational purposes and completeness, emissions have been quantified and BACT analyses have been completed for NH_3 emissions from the CTGs due to its use as the reagent in the selective catalytic reduction (SCR) systems proposed in the HRSGs of these units.

To facilitate VDEQ's review of this document, individuals familiar with the Project are identified below. The VDEQ should contact these individuals if additional information or clarification is required during the review process. These contacts include the primary contact for the project developer and consultant who were responsible for the preparation of this application.

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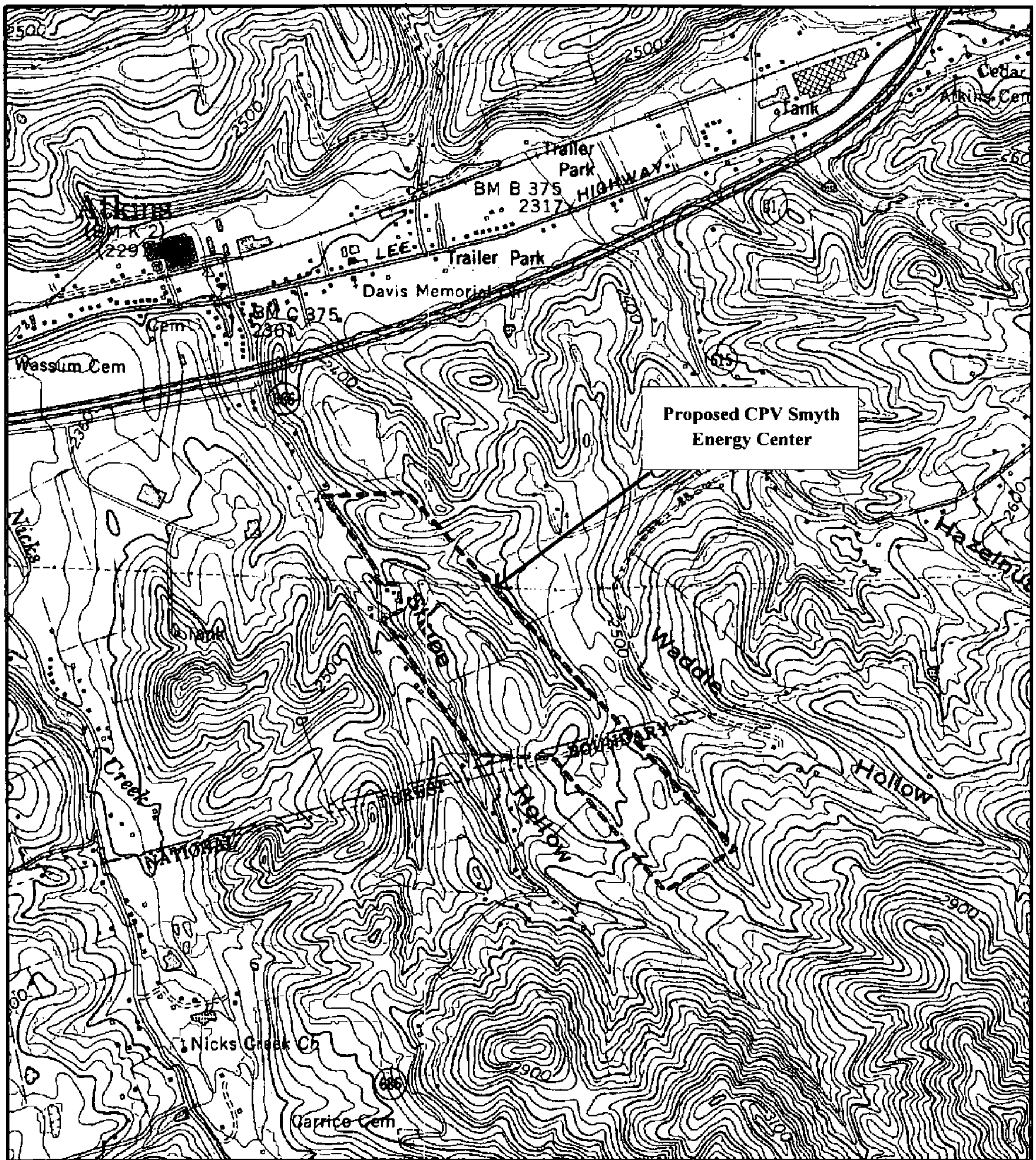
This application consists of the following five sections in addition to this Introduction:

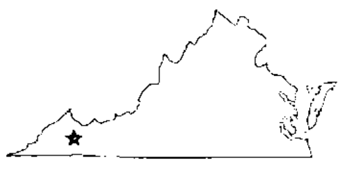
- Section 2 provides a project description, including information regarding the plant's location and equipment design information;
- Section 3 provides a description of potential emissions and the basis of calculation;
- Section 4 provides a review of state and federal air quality regulations applicable or potentially applicable to the Project;
- Section 5 provides the BACT analyses;
- Appendices A through C provide the VDEQ Forms, emission calculations, and detailed equipment and vendor data.

Provided in Figure 1-1 is a General Location Map showing the location of the Project and nearby area.

Figure 1-1 General Location Map



approximate quadrangle location



0 0.25 0.5

kilometers

N

Based on USGS 1:24,000 Quadrangle map for Atkins, Virginia, 1991.

CPV Smyth Generation Company, LLC

Figure 1-1
General Location

2.0 PROJECT DESCRIPTION

2.1 Site Location

The proposed Project will be constructed on a 108-acre parcel at a greenfield location in Atkins, VA. The site is located in east-central Smyth County, approximately 4 miles east-northeast of Marion, VA and approximately 0.5 miles south of Interstate 81. The site is in a rural valley at a 2,500 foot above mean sea level elevation with higher elevation mountains running generally in a southwest to northeast direction and located approximately 2 to 3 miles north and south of the property.

2.2 Project Description

The proposed nominal 700 MW[1] combined-cycle natural gas-fired facility will be configured as two operating units. The power plant will be configured in a "2 on 1" power block configuration with steam from the two HRSGs feeding the single STG. The HRSGs will be equipped with duct burners (supplementary firing) to provide additional generating capacity during periods of peak demand. The facility is designed to run as a base load plant with both combustion turbines operating concurrently but the facility will have the capability of operating with a single combustion turbine.

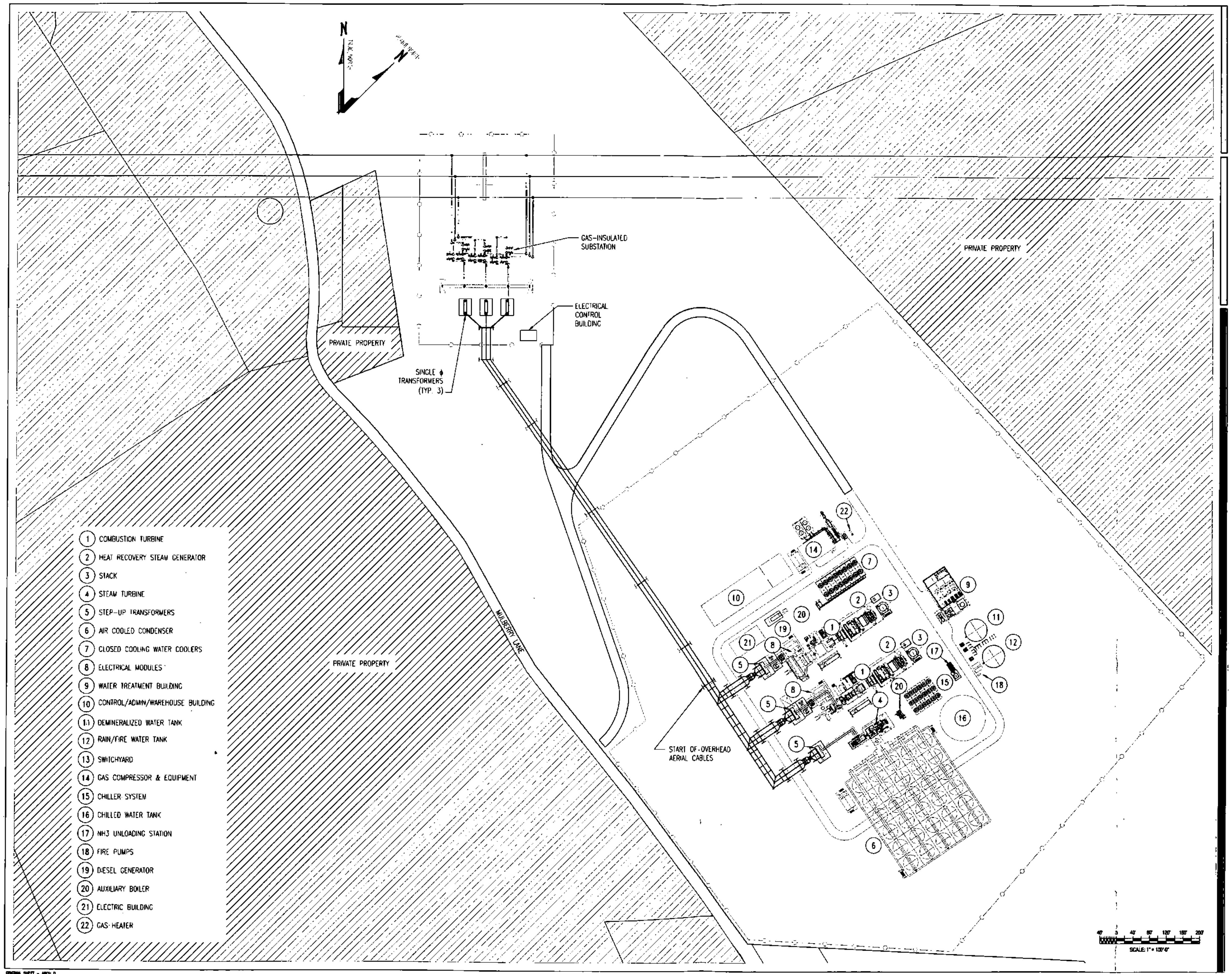
The Project will include a variety of power plant equipment including: two natural gas-fired CTGs; one STG; two HRSGs with SCR and oxidation catalyst emissions control equipment; generator step-up transformers; an electrical switchyard; an NH_3 storage tank; water tanks; and an ACC. In addition, the Project will include other buildings for administrative and operating staff; warehousing of parts and consumables; and maintenance shops and equipment servicing. An overview of equipment arrangement on the site is provided as Figure 2-1.

The first stage in the generation process of a combined-cycle power plant is the operation of the CTGs. Thermal energy, in the form of hot exhaust gas, is produced in the CTGs through the combustion of natural gas. The hot exhaust gases are then converted into mechanical energy by a turbine that drives a generator. The exhaust gas temperature exiting the gas turbine is in excess of 1,000 degrees Fahrenheit (°F) and still has remaining a significant amount of recoverable heat energy. This heat energy is recovered in the HRSG by generating steam that is sent to a STG to generate additional electrical energy. The generation of electricity using both a gas turbine and steam turbine defines the combined cycle, which the most efficient form of electrical generation available. The efficiency of the facility is further enhanced by using reheat systems as well as waste energy to heat feedwater in the HRSG by an additional economizer loop and also for fuel preheating. Once the steam leaves the steam turbine, it is condensed back into water using an ACC and this condensed water is returned to the HRSGs to minimize water use. Additional steam, and consequently additional electricity, may be generated when required by the use of supplemental natural gas-fired burners (duct burners) within the HRSGs.

Each of the two CTGs that will be used by the Project is an Alstom GT24 with a nominal generating capacity of 234 MW (at -10°F ambient conditions). The CTGs will be equipped with inlet air cooling via fogging and evaporative cooling or chillers. The single steam turbine will provide up to an additional 228 MW without duct firing (at -10°F ambient conditions) and 312 MW with duct firing in both HRSGs (90°F ambient conditions, at which the gas turbines produce 201 MW utilizing the chillers option installed and in operation).

[1] Based on 90°F ambient temperature, 50% relative humidity, and duct firing.

Figure 2-1 Equipment Arrangement Overview



Note: Site layout by Stantec Consulting Services, Inc.

Figure 2-1
CPV Smyth Generation Company, LLC
Equipment Arrangement

Pollutant emissions from the Project will be minimized through the use of natural gas as the sole fuel to be fired in the CTGs and duct burners. Each HRSG will be equipped with SCR and an oxidation catalyst to reduce emissions of NO_x, and CO and VOC, respectively. The SCR system will utilize 19% aqueous NH_3 as the reagent in the SCR systems. Continuous emissions monitoring systems (CEMS) will continuously sample, analyze, and record exhaust gas concentrations of NO_x, CO and NH_3 from each of the two HRSG exhaust flues. The CEMS will be installed and operated in accordance with United States Environmental Protection Agency (USEPA) and VDEQ requirements and will generate emissions data reports that will be consistent with anticipated permit requirements and send alarm signals to plant supervisory and control systems when emissions approach or exceed permitted limits.

Ancillary equipment at the proposed Project will include three additional fuel combustion emission units:

- A 93 million British thermal unit per hour (MMBtu/hr) natural gas-fired auxiliary boiler equipped with ultra low-NOx burners;
- A 1,500 kilowatt (kW) (standby rating) emergency generator firing 15 parts per million (ppm) ultra low sulfur distillate (ULSD) oil; and
- A 315 brake horsepower (BHP) emergency fire pump engine firing ULSD oil.

To support the SCR systems, a 20,000 gallon above-ground storage tank will contain 19% aqueous NH_3. The tank will be located within a concrete containment structure (dike) along with the ammonia transfer pumps, valves and piping.

The Project will interconnect with the 765 kilovolt transmission line that crosses the northern portion of the site via a new switchyard. Natural gas will be delivered from the existing gas pipeline located approximately 1.5 miles to the north of the site. A pipeline lateral will be installed to bring the gas from the existing pipeline to the site.

3.0 AIR EMISSIONS

This section presents short-term and long-term potential emissions from each emission source for the Project. Project emissions will be minimized through the application of BACT controls. CPV Smyth proposes to use dry low-NO_x combustion and SCR to minimize NO_x emissions from the combustion turbines. Combustion controls and an oxidation catalyst will be used to minimize CO and VOC emissions from the turbines. SO_2 and PM/PM_{10}/$PM_{2.5}$ will be controlled through the use of natural gas as the sole fuel for the turbines, duct burners and auxiliary boiler. ULSD oil will be used for the emergency generator and fire pump engines. Section 5 of this application contains control technology analysis to demonstrate that these controls meet BACT requirements. Appendix B of this application contains detailed emission calculations and Appendix C contains equipment specifications and vendor performance data for the proposed emission sources.

3.1 Emission Sources

The emission sources for the Project will include:

- One combined cycle power generation unit, consisting of two combustion turbines (Alstom GT24) serving two associated HRSG's with duct burners and one common STG. The combined cycle power generation units will be equipped with: inlet air cooling via high fogging and evaporative cooling or chillers; SCR for NO_x control; and an oxidation catalyst for control of CO and VOC;
- One natural gas fired auxiliary boiler rated at 93 MMBtu/hr, equipped with ultra low-NOx burners (Cleaver Brooks "Nebraska" D-type boiler or equivalent);
- One emergency generator rated at 1,500 kW (standby rating), firing ULSD oil (Caterpillar 3512C or equivalent);
- One fire pump engine rated at approximately 315 BHP, firing ULSD oil (Clarke JU6H-UFAD98 or equivalent); and

The following equipment will not have any potential air emissions under normal operation:

- ACC for condenser cooling; and
- One 20,000 gallon above ground aqueous NH_3 storage tank.

The facility will also include miscellaneous insignificant sources such as small ULSD and lubricant storage tanks, which will have insignificant emissions.

3.2 Short-Term Emissions

3.2.1 Combustion Turbine and HRSG Units

Short-term potential emission rates for each combined cycle unit, including the combustion turbine and associated duct burner, are presented in Table 3-1. The rates shown are based on 100% load operation at -10°F with duct burner firing, and represent the worst case operating scenario. Potential emission rates are presented in: parts per million by volume, dry basis (ppmvd), corrected to 15% oxygen (O_2); pounds per million British thermal units (lb/MMBtu) on a high heating value (HHV) basis; and pounds per hour (lb/hr). SO_2 emissions are based on a maximum natural gas sulfur content of 0.5 grains per 100 standard cubic feet (gr/100 scf).

Table 3-1: Short-Term Emission Rates for Turbine and HRSG Units (per unit)

Pollutant	ppmvd at 15% O_2	lb/MMBtu	lb/hr[1]
NO_x	2.0	0.0074	19.6
CO	2.0	0.0045	11.9
VOC, unfired	1.0	0.0013	2.9
VOC, duct-fired	2.0	0.0026	6.8
SO_2	0.3	0.0014	3.8
PM/ PM_{10}/ $PM_{2.5}$	N/A	N/A	12.9

[1] Includes duct firing except VOC, unfired

3.2.2 Ancillary Equipment

Short-term potential emission rates for the auxiliary boiler, the emergency generator, and the fire pump engine are presented in Table 3-2. Potential emission rates are presented in lb/MMBtu or grams per kilowatt-hour (g/kWh) as appropriate, and in lb/hr.

Table 3-2: Short-Term Emission Rates for Ancillary Equipment

	Auxiliary Boiler		Emergency Generator		Fire Pump	
Pollutant	lb/MMBtu	lb/hr	g/kWh	lb/hr	g/kWh	lb/hr
NO_x	0.011	1.01	6.4	21.16	4.0	2.07
CO	0.037	3.42	3.5	11.57	3.5	1.91
VOC	0.005	0.47	1.3	4.30	1.3	0.26
SO_2	0.0014	0.13	0.0015 lb/MMBtu	0.02	0.0015 lb/MMBtu	0.003
PM/ PM_{10}/ $PM_{2.5}$	0.005	0.46	0.2	0.66	0.2	0.10

3.3 Annual Emissions

The proposed potential annual emissions from the Project are summarized in Table 3-3. Potential annual emissions are based on the following operating assumptions:

- For the combustion turbines, 5,760 hours at 100% load, operating at 59°F, with no duct burner firing, and 3,000 hours at 100% load, operating at -10°F, with duct burner firing;
- For the auxiliary boiler, 4,000 hours at 100% load;
- For the emergency generator and fire pump engines, 500 hours each at maximum rated power;

Table 3-3: Facility-Wide Annual Potential Emissions

Pollutant	Unit 1 (CTG & HRSG) (tpy)	Unit 2 (CTG & HRSG) (tpy)	Auxiliary Boiler (tpy)	Emergency Generator (tpy)	Fire Pump (tpy)	Facility Total (tpy)
NO_x	74.7	74.7	2.02	5.29	0.52	157.2
CO	47.7	47.7	6.83	2.89	0.45	105.6
VOC	22.1	22.1	0.94	1.07	0.06	46.3
SO_2	13.2	13.2	0.26	0.005	0.001	26.6
$PM/PM_{10}/PM_{2.5}$	39.5	39.5	0.92	0.17	0.03	80.1
Carbon dioxide equivalent (CO_2e)	1,156,440	1,156,440	21,627	592	90	2,335,189
H_2SO_4	8.6	8.6	0.02	0.0004	0.0001	17.3
Lead (Pb)	4.5E-03	4.5E-03	9.1E-05	2.8E-06	4.2E-07	0.009
NH_3	65.2	65.2	N/A	N/A	N/A	130.3
Total HAPS	4.2	4.2	0.35	0.02	0.004	8.7

The combustion turbines have higher mass emissions of NO_x, CO and VOC during start-up and shutdown than during full-load operation. The impact of increased emissions during start-up and shutdown were evaluated to determine the total potential emissions for the Project, including startup and shutdown operation. Start-ups for combined-cycle systems are generally classified as cold, warm, and hot depending on the length of time the unit has been off-line prior to start-up. The length of start-ups will vary with the type of start-up and plant equipment temperatures.

The maximum number of starts per year per turbine was determined based upon turbine vendor recommendations and projected operation in the competitive power marketplace. Low Load Operation (LLO) is unique to Alstom's gas turbine featuring sequential combustion technology. For customers operating in markets where daily stop/starts and/or parking at low load are required, the LLO feature offers additional flexibility. LLO allows operators to park the entire plant down to 10% combined cycle power plant load with both CTGs and the STG in operation. Due to the sequential combustion technology, the emissions at the LLO point stay at BACT level emission rates. Compared to a 40-50% plant minimum load, which is the current industry standard, the LLO feature provides unique spinning reserve capability for the KA24-2 turbine, without a risk of start failure and without cyclic lifetime consumption of the gas turbine. The LLO is achieved by switching off the second combustor, while the first combustor operates in its optimal point (thus producing base-load like emissions). For emissions purposes, switching off the second combustor is considered "an event" similar to a startup or shutdown in that it has a defined period of transitional non-compliance before stabilizing at compliance levels. These transitional periods occur in both directions as the unit unloads to LLO and as the unit reloads to the normal minimum emission compliance point. This operating characteristic allows for cycling down of the turbine during periods of low demand rather than shutting the unit down. As a result, the number of starts and stops for the Alstom GT24 turbine could be greatly reduced, which would result in a reduction in annual emissions for the Project.

The increase in emissions per type of start was quantified using emissions and operating data provided by Alstom. The increase in emissions for each type of start was then compared to the reduction in emissions associated with the minimum turbine downtime per type of startup/shutdown event. Any increase in start-up/shutdown (SU/SD) emissions quantified for each type of start was added to the potential emissions for continuous full load operation for 8,760 hours per year. This potential to emit approach represents the worst-case maximum potential to emit for the Project. The potential annual emissions of NO_x, CO and VOC in Table 3-3 include the higher emissions from either a conservative number of startup and shutdown cycles (250 hot starts, 50 cold starts, 300 shutdowns) per unit or 250 transition events per unit. Since emissions during cold and warm starts are self-correcting (i.e., SU/SD emissions are equal to or lower than full load steady state emissions when downtime is considered), it was conservatively assumed that the majority of starts would be hot starts. Table 3-4 provides a summary of SU/SD net emissions increases for the CTGs as compared to steady state operation. SU/SD emissions calculations are provided in detail in Appendix B.

Table 3-4: Summary of Startup/Shutdown Net Emissions Increase (lb/hr)

Pollutant	Cold Start	Warm Start	Hot Start	Shutdown	Transition to/from LLO
NO_x	N/A	N/A	4.07	0.05	N/A
CO	N/A	N/A	4.40	0.41	1.17
VOC	N/A	N/A	4.08	0.65	2.23

As summarized above, there is a net increase in average hourly emissions during hot starts, shutdown and transition events. For NO_x, CO and VOC emissions, a combined hot start and shutdown event provides higher hourly emissions than a transition event to and from LLO event so these were used in adjusting the plant's annual potential to emit.

3.4 Hazardous Air Pollutant and Virginia Air Toxics Emissions

Potential annual hazardous air pollutant (HAP) emissions are presented in Table 3-5 for the Project. HAP is defined in Section 112(b) under the Clean Air Act (CAA) Amendments of 1990; and for Virginia "air toxics", as modified. The regulation of HAP emissions are administered by the VDEQ under 9 VAC 5 Chapter 60. Section 4 of this application provides a discussion of the applicability of 9 VAC 5 Chapter 60 to the Project. Total HAP emissions from the Project are 8.7 tpy; detailed HAP emissions calculations are provided in Appendix B.

Table 3-5: Summary of Potential HAP Emissions

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs	HRSGs	Auxiliary Boiler	Em. Generator	Fire Pump	
Organic Compounds						
Acetaldehyde	6.90E-01	5.18E-02		9.11E-05	4.22E-04	7.42E-01
Acrolein	1.10E-01	8.28E-03		2.85E-05	5.09E-05	1.19E-01
Benzene	2.07E-01	1.55E-02	3.88E-04	2.81E-03	5.13E-04	2.26E-01
1,3-Butadiene	7.41E-03	5.56E-04			2.15E-05	7.99E-03
Dichlorobenzene			2.22E-04			2.22E-04
Ethylbenzene	5.52E-01	4.14E-02				5.93E-01

Table 3-5: Summary of Potential HAP Emissions

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs	HRSGs	Auxiliary Boiler	Em. Generator	Fire Pump	
Formaldehyde	1.90E+00	4.53E-01	1.37E-02	2.85E-04	6.49E-04	2.36E+00
Hexane			3.33E-01			3.33E-01
Propylene oxide	5.00E-01	3.75E-02		1.39E-02	1.96E-03	5.53E-01
Toluene	2.24E+00	1.68E-01	6.10E-04	1.02E-03	2.25E-04	2.41E+00
Xylene	1.10E+00	8.28E-02		6.98E-04	1.57E-04	1.19E+00
PAHs						
Acenaphthene			3.33E-07	1.69E-05	7.81E-07	1.80E-05
Acenaphthylene			4.44E-07	3.34E-05	2.78E-05	6.16E-05
Anthracene			3.33E-07	4.45E-06	1.03E-06	5.81E-06
Benzo(a)anthracene			3.33E-07	2.25E-06	9.24E-07	3.51E-06
Benzo(a)pyrene			2.22E-07	9.29E-07	1.03E-07	1.25E-06
Benzo(b)fluoranthene			3.33E-07	4.01E-06	5.45E-08	4.40E-06
Benzo(g,h,i)perylene			2.22E-07	2.01E-06	2.69E-07	2.50E-06
Benzo(k)fluoranthene			3.33E-07	7.88E-07	8.53E-08	1.21E-06
Chrysene			3.33E-07	5.53E-06	1.94E-07	6.06E-06
Dibenz(a,h)anthracene			2.22E-07	1.25E-06	3.21E-07	1.79E-06
7,12-Dimethylbenz(a) anthracene			2.96E-06			2.96E-06
Fluoranthene			5.36E-07	1.46E-05	4.19E-06	1.93E-05
Fluorene			4.99E-07	4.63E-05	1.61E-05	6.28E-05
Indeno(1,2,3-cd)pyrene			3.33E-07	1.50E-06	2.06E-07	2.04E-06
3-Methylchloranthrene			3.33E-07			3.33E-07
2-Methylnaphthalene			4.44E-06			4.44E-06
Naphthalene	2.24E-02	1.68E-03	1.15E-04	4.70E-04	4.66E-05	2.47E-02
Phenanthrene			3.14E-06	1.48E-04	1.62E-05	1.67E-04
Pyrene			9.06E-07	1.34E-05	2.63E-06	1.69E-05
TOTAL PAH	3.79E-02	2.85E-03	1.26E-04	7.67E-04	9.24E-05	4.18E-02
Metals						
Arsenic	3.45E-03	2.59E-04	3.70E-05	1.67E-07	2.54E-08	3.74E-03
Beryllium	2.07E-04	1.55E-05	2.22E-06			2.25E-04
Cadmium	1.90E-02	1.42E-03	2.03E-04	1.85E-08	2.82E-09	2.06E-02
Chromium	2.41E-02	1.81E-03	2.59E-04	4.48E-05	6.82E-06	2.63E-02
Chromium VI	4.31E-03	3.23E-04	4.62E-05	8.10E-06	1.23E-06	4.69E-03
Cobalt	1.41E-03	1.06E-04	1.52E-05			1.53E-03
Lead	8.45E-03	6.34E-04	9.06E-05	2.78E-06	4.23E-07	9.18E-03
Manganese	6.38E-03	4.79E-04	6.84E-05	1.02E-06	1.55E-07	6.93E-03
Mercury	4.31E-03	3.23E-04	4.62E-05	3.72E-08	5.67E-09	4.68E-03
Nickel	3.62E-02	2.72E-03	3.88E-04	5.35E-06	8.14E-07	3.93E-02
Selenium	4.14E-04	3.11E-05	4.44E-06	9.26E-07	1.41E-07	4.50E-04
Max. Single HAP						**2.4**
Total All HAPs	**7.5E+00**	**8.7E-01**	**3.5E-01**	**2.0E-02**	**4.2E-03**	**8.7**

4.0 REGULATORY REVIEW AND APPLICABILITY

The USEPA and VDEQ have promulgated regulations that establish ambient air quality standards and emissions limits for sources of air pollution. This section of the application identifies the regulations that may apply to the Project and discusses how CPV Smyth will comply with all applicable requirements.

The federal regulations reviewed here include: National Ambient Air Quality Standards (NAAQS); PSD and New Source Review (NSR) requirements; New Source Performance Standards (NSPS); National Emission Standards for Hazardous Air Pollutants (NESHAP); Acid Rain Program; Title V Operating Permit Program; and the Clean Air Interstate Rule (CAIR) / Cross State Air Pollution Rule (CSAPR).

4.1 National Ambient Air Quality Standards

The USEPA has developed NAAQS for six air contaminants, known as criteria pollutants, for the protection of public health and welfare. These criteria pollutants are SO_2, $PM/PM_{10}/PM_{2.5}$, nitrogen dioxide (NO_2), CO, ozone (O_3), and Pb. The VDEQ also has adopted these limits as Virginia Ambient Air Quality Standards (VAAQS) under 9 VAC 5 Chapter 30. The NAAQS have been developed for short-term periods of 24 hours or less and annual averages. The NAAQS include both "primary" and "secondary" standards where the primary standards are set to protect human health, allowing an adequate margin of safety. Secondary standards are set to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air. Provided in Table 4-1 are the NAAQS and VAAQS.

One of the primary goals of federal and state air pollution regulations is to ensure that ambient air quality is in compliance with the NAAQS. Toward this end, every area of the United States has been designated as attainment, unclassifiable, or nonattainment for each criteria pollutant. In areas designated as attainment, the air quality with respect to the pollutant is equal to or better than the NAAQS. These areas are under a mandate to maintain, i.e., prevent significant deterioration of, such air quality. In areas designated as unclassifiable, there is limited air quality data and these areas are treated as attainment areas for regulatory purposes. In areas designated as nonattainment for a particular pollutant, the air quality with respect to that pollutant is worse than the NAAQS. These areas must take actions to improve air quality and attain the NAAQS within a certain period of time.

If a new major source of air pollution is proposed, it must undergo NSR air permitting. The NSR air permitting regulations contain two distinct programs, one for sources proposed in attainment/unclassifiable areas and one for sources in nonattainment areas. The NSR program for sources in attainment/unclassifiable areas is known as the PSD Program. The NSR program for sources being built in non-attainment areas is known as Nonattainment NSR or NNSR. The Project is located in an area classified as "attainment" or "attainment/ unclassifiable" for all criteria pollutants. Thus, emissions of criteria pollutants from the Project are evaluated under the PSD program. The requirements of the PSD program are discussed in Section 4.2.

Table 4-1: National and Virginia Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS / VAAQS (µg/m³)	
		Primary	Secondary
NO_2	Annual[1]	100	Same
	1-hour[2]	188	None
SO_2	Annual[1,3]	80	None
	24-hour[3,4]	365	None
	3-hour[4]	None	1,300
	1-hour[5,6]	196	None
$PM_{2.5}$	Annual[7]	12	Same
	24-hour[8]	35	Same
PM_{10}	24-hour[9]	150	Same
CO	8-hour[4]	10,000	None
	1-hour[4]	40,000	None
O_3	8-hr[10]	147	Same
Pb	3-month[1]	0.15	Same

1 Not to be exceeded.
2 Compliance based on 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area.
3 The 24-hour and annual average primary standards for SO_2 been revoked but remain in effect until one year after Smyth County has been designated for the 1-hour and 3-hour standards, which has yet to occur..
4 Not to be exceeded more than once per year.
5 Compliance based on 3-hear average of 99th percentile of the daily maximum 1-hour average at each monitor within an area.
6 The 1-hour SO_2 standard was effective as of August 23, 2010.
7 Compliance based on 3-year average of weighted annual mean $PM_{2.5}$ concentrations at community-oriented monitors.
8 Compliance based on 3-year average of 98th percentile of 24-hour concentrations at each population-oriented monitor within an area.
9 Not to be exceeded more than once per year on average over 3 years.
10 Compliance based on 3-year average of fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area.

4.2 Prevention of Significant Deterioration Review

The PSD Air Quality Program, which is implemented by the VDEQ, is a federally mandated program review of major new sources of criteria and other PSD-regulated pollutants primarily designed to maintain attainment with the NAAQS and prevent degradation of air quality in attainment/unclassifiable areas. Under the PSD program, a combined-cycle electric generation facility is considered a major source if emissions of any single criteria pollutant are greater than 100 tons per year (tpy) or if GHG emissions exceed 100,000 tpy. The Project will have potential emissions greater than 100 tpy for one or more criteria pollutants and potential GHG emissions greater than 100,000 tpy. Therefore, the proposed Project will be subject to the requirements of the PSD program.

Once a project exceeds one of the PSD major source thresholds, the PSD regulations also apply to each criteria pollutant that is emitted in excess of its respective defined significant emission rate. Table 4-2 presents a comparison of the Project's potential emissions versus the PSD major source and significant emission rate thresholds. As shown in Table 4-2, the facility is subject to PSD review for NO_x, CO,

$PM/PM_{10}/PM_{2.5}$, VOC, H_2SO_4 and GHGs. (See Section 3.2 for the assumptions used in determining annual potential emissions.)

Table 4-2: Prevention of Significant Deterioration Regulatory Threshold Evaluation

Pollutant	Project Potential Annual Emissions (tons)	PSD Major Source Threshold (tons)	PSD Significant Emission Rate (tons)	PSD Review Applies?
CO	105.6	100	100	Yes
NO_x	157.2	100	40	Yes
SO_2	26.6	100	40	No
PM	80.1	100	25	Yes
PM_{10}	80.1	100	15	Yes
$PM_{2.5}$	80.1	100	10	Yes
VOC (ozone precursor)	46.3	100	40	Yes
Sulfuric Acid Mist	17.3	100	7	Yes
GHGs (as CO_{2e})	2,335,189	100,000	75,000	Yes
Lead	0.009	100	0.6	No
Fluorides	Negligible	100	3	No
Hydrogen Sulfide (H_2S)	none expected	100	10	No
Total Reduced Sulfur (inc. H_2S)	none expected	100	10	No
Reduced Sulfur Compounds (inc. H_2S)	none expected	100	10	No

The key requirements for obtaining a PSD permit are a demonstration that BACT requirements are satisfied and an air quality impact analysis is completed to document compliance with the NAAQS and PSD increments, which are concentrations of allowable air quality degradation from a baseline ambient concentration. Section 5 of this application presents a detailed control technology analysis demonstrating how the Project will satisfy BACT under USEPA and VDEQ requirements. An air dispersion modeling analysis is being provided under separate cover to document that the Project will comply with the NAAQS and PSD increments.

4.3 Nonattainment New Source Review

If a major source of pollution is proposed in an area designated as nonattainment for a particular pollutant, the source is subject to NNSR for that pollutant. All of Virginia is designated as attainment or unclassifiable for all pollutants with the exception of the northeast portion of the state adjacent to the metropolitan Washington D.C. area, which has areas designated as nonattainment for ozone and $PM_{2.5}$. The Project will be located in southwest Virginia in Smyth County, which is designated as attainment or unclassifiable for all pollutants, and therefore, NNSR will not apply to the Project.

4.4 Virginia Minor Source Preconstruction Air Permitting (9 VAC 5-80)

9 VAC 5 Chapter 80, Part II, Article 6 specifies the preconstruction air permitting requirements for minor sources of air pollution. As discussed in Section 4.2, the Project is subject to PSD major source permitting for emissions of NO_x, CO, $PM/PM_{10}/PM_{2.5}$, VOC, H_2SO_4, and GHG, while potential controlled emissions of SO_2, and the other regulated pollutants listed in Table 4-2 are below their respective PSD permitting thresholds. However, potential emissions of SO_2 exceeds 10 tpy and, therefore, emissions of this pollutant are subject to the requirements of 9 VAC 5 Chapter 80, Part II, Article 6. Except for SO_2 and the PSD applicable pollutants, all other pollutant uncontrolled potential emissions are less than the thresholds specified in this article. Pursuant to 9 VAC 5-50-260.B, SO_2 emissions are subject to BACT requirements as defined under 9 VAC 5-50-250, which is similar to PSD BACT as discussed in Section 4.2. NH_3 emissions also exceed 10 tpy and a BACT analysis for this pollutant is included for completeness purposes.

4.5 New Source Performance Standards

The VDEQ regulations under 9 VAC 5 Chapter 50 (9 VAC 5-50-400) incorporate by reference all the federal NSPS promulgated by the USEPA in 40 CFR 60. The USEPA has established NSPS for numerous specific industries and emission source types. For the Project, the following NSPS are applicable to proposed emission sources:

- Stationary Combustion Turbines (40 CFR 60, Subpart KKKK);
- Small Industrial-Commercial-Institutional Steam Generating Units (40 CFR 60, Subpart Dc); and
- Stationary Compression Ignition Internal Combustion Engines (40 CFR 60, Subpart IIII).

4.5.1 40 CFR 60 Subpart KKKK

40 CFR 60 Subpart KKKK applies to stationary combustion turbines with a heat input rating greater than or equal to 10 MMBtu/hr, which commenced construction, reconstruction, or modification after February 18, 2005. 40 CFR 60 Subpart KKKK also applies to emissions from any associated HRSGs or duct burners and, therefore, includes both the combustion turbines and the supplementary gas-fired duct burners at the Project.

40 CFR 60 Subpart KKKK provides a NO_x concentration emission standard, expressed in units of ppmvd at 15% O_2, and an output-based emission standard expressed in units of pounds per megawatt-hour gross energy output (lb/MW-hr). A subject combustion turbine must comply with one of these standards. The applicable NO_x standards for the Project are 15 ppmvd at 15% O_2 or 0.43 lb/MW-hr. As discussed in Section 5, BACT for the Project is a NO_x concentration emission limit of 2 ppmvd at 15% O_2 and as a result, NO_x emissions from the combined cycle generating units will be well below the NSPS standard.

The SO_2 standards are an output-based emission limit of 0.90 lb/MWh or a fuel sulfur content limit equivalent to an emission limit of 0.060 lbs/MMBtu. The Project will meet the NSPS for SO_2 by using natural gas as the sole fuel with a sulfur content not exceeding 0.5 gr/100 scf of natural gas, which is equivalent to 0.0014 lbs/MMBtu, well below the NSPS standard.

4.5.2 40 CFR 60 Subpart Dc

The Project will include a natural gas-fired auxiliary boiler to provide steam during plant startup. Based on the design rating for the auxiliary boiler of 93 MMBtu/hour, this unit will be subject to the NSPS under 40 CFR 60, Subpart Dc, which applies to steam generating units for which construction, reconstruction, or modification is commenced after June 9, 1989, and that have a heat input rating between 10 and 100 MMBtu/hr. For boilers fired solely with natural gas, 40 CFR 60 Subpart Dc only requires initial notification and does not impose any pollutant-specific emission limits.

4.5.3 40 CFR 60 Subpart IIII

The emergency generator and fire pump engines will both be subject to the NSPS under 40 CFR 60, Subpart IIII. 40 CFR 60 Subpart IIII requires emergency generator engines to meet the non-road engine emission standards identified in 40 CFR 89.112 and 40 CFR 89.113. The fire pump engine will be subject to the emission standards identified in 40 CFR 60, Subpart IIII, Table 4. Subpart IIII requires manufacturers to produce engines that comply with these standards. CPV Smyth will purchase emergency generator and fire pump engines that comply with 40 CFR 60 Subpart IIII.

4.6 National Emission Standards for Hazardous Air Pollutants

Articles 1 and 2 of 9 VAC 5 Chapter 60 Part II incorporate by reference all the NESHAP standards promulgated by USEPA, codified in 40 CFR Parts 61 and 63. 40 CFR Part 61 was promulgated prior to the 1990 CAA Amendments and regulates eight types of hazardous substances: asbestos; benzene; beryllium; coke oven emissions; inorganic arsenic; mercury; radionuclides; and vinyl chloride. The proposed Project is not in one of the specific source categories regulated by 40 CFR Part 61 and, therefore, the requirements of 40 CFR Part 61 are not applicable.

The 1990 CAA Amendments established a list of 189 HAPs and a list of source categories believed to be the largest emitters of HAPs. The source category-specific emission standards are promulgated under 40 CFR 63 for both major and minor (area) sources of HAP emissions. 40 CFR Part 63 defines a major source of HAP as any source that has the potential to emit 10 tpy of any single HAP or 25 tpy of all HAPs in aggregate. The emission standards are based upon a Maximum Achievable Control Technology (MACT) analysis conducted by USEPA for each source category. As shown in Table 3-5, the Project will be an area source of HAPs.

NESHAPs that were evaluated for applicability to the Project include:

- Stationary Combustion Turbines (40 CFR 63, Subpart YYYY)
- Coal- and Oil-Fired Electric Utility Steam Generating Units (40 CFR 63, Subpart UUUUU)
- Industrial, Commercial, and Institutional Boilers and Process Heaters for Major Sources (40 CFR 63, Subpart DDDDD)
- Industrial, Commercial, and Institutional Boilers Area Sources (40 CFR 63, Subpart JJJJJJ)
- Stationary Reciprocating Internal Combustion Engines (40 CFR 63, Subpart ZZZZ)

40 CFR 63 Subpart YYYY, applicable to stationary combustion turbines, was promulgated on March 5, 2004. However, in April 2004, USEPA proposed to "delist" natural gas-fired combustion turbines from

the NESHAP program as USEPA believed that HAP emissions from stationary combustion turbines did not pose a hazard. In August 2004, USEPA stayed (indefinitely) the combustion turbine NESHAP for natural gas-fired turbines, and any unit that fires oil less than 1,000 hours per year, pending a final decision on delisting. Therefore, NESHAP 40 CFR 63 Subpart YYYY is not currently applicable to the Project's combustion turbines.

The HRSGs equipped with duct burners are considered electric utility steam generating units under the NESHAP regulations. 40 CFR 63 Subpart UUUUU provides standards for coal- and oil-fired electric utility steam generating units. However, natural gas-fired electric utility steam generating units are exempt from the requirements of 40 CFR 63 Subpart UUUUU. Since the duct burners are fired solely with natural gas, 40 CFR 63 Subpart UUUUU is not applicable to the Project.

40 CFR 63 Subparts DDDDD and JJJJJ are for the same source category, which is industrial, commercial and institutional boilers. 40 CFR 63 Subpart DDDDD applies to major sources of HAP emissions and Subpart JJJJJ applies to minor, or area, sources of HAP emissions. As shown in Table 3-5, the Project will be a minor source of HAP emissions and, therefore, would fall under 40 CFR 63 Subpart JJJJJJ. However, natural gas fired boilers are exempt from the requirements of 40 CFR 63 Subpart JJJJJJ and since the auxiliary boiler is fired solely with natural gas, it is exempt from 40 CFR 63 Subpart JJJJJJ.

40 CFR 63 Subpart ZZZZ applies to stationary reciprocating internal combustion engines at both major and non-major sources of HAP. The emergency generator and the fire pump engines for the project will be subject to 40 CFR 63 Subpart ZZZZ. In accordance with 40 CFR 63 Subpart ZZZZ, a new engine that satisfies the requirements of NSPS 40 CFR 60, Subpart IIII is deemed to be compliant with NESHAP 40 CFR 63 Subpart ZZZZ. As discussed in Section 4.5, the Project's emergency generator and fire pump engines will comply with NSPS 40 CFR 60, Subpart IIII and, therefore, will also comply with NESHAP 40 CFR 63 Subpart ZZZZ.

4.7 Federal Acid Rain Program

New electric generating units that have a generating capacity greater than 25 MW and produce electricity for sale, are subject to the federal Acid Rain Program under 40 CFR 72. The Project's two combined cycle generating units will be subject to the Acid Rain Program, which requires that an Acid Rain permit application be submitted to the permitting authority at least 24 months prior to commencement of operation. In addition to the requirement to obtain a permit, the Acid Rain program requires that subject sources secure SO_2 allowances to cover actual SO_2 emissions and install CEMS that satisfy the requirements of 40 CFR 75.

CPV Smyth will purchase each year sufficient Acid Rain SO_2 allowances to cover actual emissions from the combined cycle generating units. Since the units will be fired solely with natural gas, SO_2 emissions will be minor and the required offsets will be readily available.

The requirements of 40 CFR 75 will apply to the combined cycle combustion turbines and the associated duct burners, and include comprehensive requirements for monitoring, recordkeeping, and reporting of NO_x, SO_2 and carbon dioxide (CO_2) emissions. Affected generating units must install and operate a CEMS for NO_x, SO_2, and CO_2 emissions and must also prepare and maintain a monitoring plan that describes the methodologies used to measure and report emissions. The CEMS must satisfy detailed equipment specifications, test procedures, and quality assurance and quality control procedures to ensure the accuracy and validity of the CEMS data. CPV Smyth will install and operate CEMS that satisfy all of the requirements of 40 CFR 75, which will be documented in the monitoring plan required to be prepared and submitted to the VDEQ and USEPA.

4.8 Title V Operating Permit

Virginia has been delegated authority by USEPA to administer the federal Title V operating permit program (40 CFR 70) under its regulations at 9 VAC 5 Chapter 80. In accordance with the requirements of Virginia's Title V operating permit program, all facilities subject to the Acid Rain program are subject to the Title V operating permit program. The Title V operating permit program requirements for Acid Rain sources are provided under 9 VAC 5 Chapter 80, Part III, Article 3 of the VDEQ regulations. In accordance with 9 VAC 5-80-430(C) of these regulations, CPV Smyth shall submit a complete Title V operating permit application no later than 12 months after the commencement of operation of the facility.

4.9 Compliance Assurance Monitoring

The Compliance Assurance Monitoring requirements under 40 CFR Part 64 apply to any emission unit located at a source required to obtain a Title V operating permit, if that emission unit satisfies all of the following requirements:

- Is subject to an emission limit or standard for a regulated pollutant;
- Uses a control device to achieve compliance with that limit or standard; and
- Has uncontrolled potential emissions of that regulated pollutant in excess of the major source threshold.

The combined cycle turbines and duct burners have uncontrolled potential emissions of NO_x and CO above the major source threshold and use a control device to meet an emission limit. Therefore, the combined cycle turbines and duct burners meet all three requirements for CAM applicability. However, in accordance with 40 CFR 64.2(b)(vi), the CAM regulations exempt sources with a Title V Operating Permit that specifies a continuous compliance determination method for the pollutant(s) that would otherwise be subject CAM. The Project will install and operate CEMS to quantify NO_x and CO emissions in units of measure consistent with the applicable emission standards and, therefore, the combined cycle turbines and duct burners will be exempt from CAM requirements.

4.10 Clean Air Interstate Rule

The Project's two combined cycle generating units will be subject to the requirements of the Clean Air Interstate Rule (CAIR) program implemented under the VDEQ regulations at 9 VAC 5-140. Although the CAIR program was replaced by USEPA with the CSAPR program in August 2011, Virginia continues to maintain its CAIR requirements since the CSAPR was vacated by the United States Court of Appeals for the District of Columbia Circuit on August 12, 2012.

The CAIR program in Virginia consists of three separate emissions trading program: (1) annual NO_x emissions (9 VAC 5-140, Part II); (2) ozone season NO_x emissions (9 VAC 5-140, Part III); and (3) annual SO_2 emissions (9 VAC 5-140, Part IV). Similar to the Acid Rain program, CPV Smyth must obtain a CAIR permit prior to operation of the facility and install and operate CEMS to measure NO_x and SO_2 emissions. However, unlike the Acid Rain program, the facility will be allocated annual and ozone season NO_x emission allowances in accordance with 9 VAC 5-140-1420 and 9 VAC 5-140-2420, respectively. The allocated emission allowances may cover, in part or in whole, the facility's actual NO_x emissions in any given year. If insufficient NO_x allowances are allocated to the facility for any given year, then sufficient additional NO_x allowances will be secured to cover all of the facility's annual and ozone season NO_x emissions. No SO_2 emission allowances will be allocated to the facility and, therefore, SO_2 allowances will be secured to cover the facility's actual annual SO_2 emissions each year.

CPV Smyth will obtain a CAIR permit prior to the commencement of operation. The CEMS installed pursuant to the requirements of the Acid Rain program satisfy the CEMS requirements of the CAIR program. CPV Smyth will secure sufficient NO_x and SO_2 allowances, not otherwise allocated, to cover actual emissions each year.

4.11 Federal Greenhouse Gas Reporting

USEPA regulations at 40 CFR Part 98 require activities in certain source categories to report emissions of the greenhouse gases CO_2, methane (CH_4), and nitrous oxide (N_2O). The collective emissions of CO_2, CH_4, and N_2O are converted to CO_2e using the global warming potential of each substance in 40 CFR 98, Subpart A. Emission units subject to the Acid Rain program are categorically subject to the requirements of 40 CFR 98 Subpart D. The combined cycle combustion turbines and associated duct burners will be regulated under 40 CFR 98 Subpart D, which specifies that CO_2 emissions will be monitored as required under 40 CFR 75, and converted to metric tons for reporting under 40 CFR 98.

40 CFR 98 Subpart C applies to fuel combustion sources, excluding electric generating units under 40 CFR 98 Subpart D and emergency equipment as defined under 40 CFR Part 98.6, with a combined heat input capacity of 30 MMBtu/hr or greater at facilities emitting at least 25,000 metric tons of CO_2e per year. The auxiliary boiler is not an electric generating unit, and will be regulated under 40 CFR 98 Subpart C. Emissions of CO_2, CH_4, and N_2O from the auxiliary boiler will be calculated using the appropriate equations in 40 CFR 98 Subpart C of 40 CFR 98. The emergency generator and fire pump engines are emergency equipment as defined under 40 CFR Part 98.6 and, therefore, exempt from the requirements of 40 CFR 98.

Per the requirements of 40 CFR 98 Subpart D, emissions of CH_4 and N_2O from the combined cycle units will be calculated using the appropriate equations for combustion sources in 40 CFR 98 Subpart C.

Total CO_2e emissions from the combined cycle combustion turbines and auxiliary boiler and reported to the USEPA by March 31st each year via USEPA's Electronic Greenhouse Gas Reporting Tool.

4.12 Chemical Accident Prevention

Section 112(r) of the CAA and associated USEPA regulations at 40 CFR 68 apply to owners or operators of stationary sources producing, processing, handling or storing toxic or flammable substances. The substances regulated under Section 112(r) and their threshold quantities are listed at Section 68.130 of 40 CFR 68. The Project will not store any regulated substances above a threshold quantity and, therefore, is not required to prepare a Risk Management Plan in accordance with 40 CFR 68. However, the general duty clause in 112(r)(1) of the CAA will apply, which requires that the facility identify potential hazards from the accidental release of a substance, implement design safety features, and maintain a safe facility as necessary to minimize the consequences of an accidental release. CPV Smyth will take steps necessary to meet the general duty provisions.

4.13 Greenhouse Gas Permitting Requirements (9 VAC 5-85)

The project will be subject GHG permitting requirements as the in accordance with 9 VAC 5-85 as potential CO2e emissions will be in excess of 100,000 tpy. This application satisfies the GHG permitting requirements by meeting the PSD permitting requirements as discussed in Section 4.2.

4.14 Virginia Air Toxics (9 VAC 5-60)

Articles 1 and 2 of 9 VAC 5 Chapter 60 Part II incorporate by reference all the NESHAP standards promulgated by USEPA in 40 CFR 61 and 40 CFR 63. There are no 40 CFR 61 standards (Article 1 of 9 VAC 5 Chapter 60) that apply to the facility. As discussed in Section 4.5, the Project's combustion turbines, HRSGs with duct burners, auxiliary boiler and emergency engines are subject to NESHAP standards under 40 CFR 63. However, Article 5 of 9 VAC 5 Chapter 60 includes additional air toxics regulations for new sources of air toxics emission. Sources covered by an existing NESHAP standard are exempt from Article 5 in accordance with 5-60-300.C.4. However, as NESHAP Subpart YYYY has been stayed by the USEPA and is not currently in affect, the exemption under 5-60-300.C.4 is not available to the combustion turbines.

An analysis of air toxic emissions from the combustion turbines was conducted to determine if the potential emissions of any air toxic with a Threshold Limit Value (TLV®) exceeded an exemption threshold as defined under 5-60-300.C.1. Based upon this analysis, the potential emissions of three air toxics from the combustion turbines exceeded an exemption threshold. Sources subject to Article 5 of 9 VAC 5 Chapter 60 must implement BACT for subject pollutants and demonstrate that ambient impacts are less than the VDEQ's Significant Ambient Air Concentration (SAAC) as defined under 9 VAC 5-60-330. BACT will be satisfied by the firing of natural gas and the emission controls implemented to satisfy PSD BACT as discussed in Section 4.2. An evaluation of ambient air impacts from the combustion turbines for subject air toxics was conducted to demonstrate that maximum predicted impacts are below the applicable SAAC.

Emission calculations for air toxics are provided in Appendix B of this document. The ambient air impact analysis is provided under separate cover with the PSD ambient air impact analysis.

5.0 BEST AVAILABLE CONTROL TECHNOLOGY (BACT) ANALYSIS

5.1 Introduction

As discussed in Section 4.2, a PSD BACT analysis is required for emissions of NO_x, CO, $PM/PM_{10}/PM_{2.5}$, H_2SO_4, VOC, and GHGs from the Project in accordance with 9 VAC 5-80-1705 and 9 VAC 5-50-280. BACT is also required for minor source emissions of SO_2 in accordance with 9 VAC 5-50-260 as discussed in Section 4.4. The following control technology analysis satisfies the BACT requirements for all subject pollutants and emission units for the Project.

5.1.1 Definition of BACT

The VDEQ regulations define "Best Available Control Technology" under 9 VAC 5-50-250 as follows:

> "...a standard of performance (including a visible emission standard) based on the maximum degree of emission reduction for any pollutant which would be emitted from any proposed stationary source which the board, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such source through the application of production processes or available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard in Article 5 (9 VAC 5-50-400 et seq.) of this part or Article 1 (9 VAC 5-60-60 et seq.) of Part II of 9 VAC 5 Chapter 60. If the board determines that technological or economic limitations on the application of measurement methodology to particular emissions unit would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard, or combination of them, may be prescribed instead of requiring the application of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results."

With regard to pollutants subject to Article 6 of Part II of 9 VAC 5-80, SO_2 BACT is further defined under 9 VAC 5-50-250 as follows:

> "In determining best available control technology for stationary sources subject to Article 6 (9 VAC 5-80-1100 et seq.) of Part II of 9 VAC 5 Chapter 80, consideration shall be given to the nature and amount of the new emissions, emission control efficiencies achieved in the industry for the source type, and the cost-effectiveness of the incremental emission reduction achieved."

5.1.2 BACT Process

Per USEPA guidance, a PSD BACT analysis must be conducted using a "top down" approach. In a "top-down" BACT analysis, all control technologies for a subject pollutant are identified and ranked from most to least efficient. An evaluation of each technology is then conducted to determine if it is technically feasible for the proposed project and if so, the resulting energy, environmental and economic impacts from its application. The most efficient technology that is determined to be technically feasible and does not result in adverse energy, environmental and/or economic impacts, is selected as BACT.

The BACT process described in USEPA's draft document titled "*New Source Review Workshop Manual: Prevention of Significant Deterioration and Nonattainment Area Permitting*" (NSR Manual) (USEPA, 1990), which acts as a non-binding guidance document for USEPA, state permitting authorities and permit applicants during the permitting process. The BACT process is conducted on a pollutant by pollutant basis for each emission unit that emits that pollutant. The process involves the following five steps:

Step 1: Identify all potential control technologies applicable to the pollutant and process.

Step 2: Determine the technical feasibility of each control technology identified under Step 1 as applicable to the Project and eliminate those that are infeasible.

Step 3: Rank the technically feasible control technologies based on overall control efficiency.

Step 4: Evaluate the most effective control technology based on economic, energy, and environmental factors. If the most effective control technology causes unacceptable economic, energy, and/or environmental impacts, the next most effective technology is evaluated. This process continues until a technology is selected as BACT.

Step 5: Select the most effective option not eliminated in Steps 2 – 4 above as BACT and determine the corresponding emission limit for the subject pollutant and emission source.

Per this guidance, if a project elects to implement the "top" technically feasible level of control identified in Steps 1 and 2, then no further analysis is required.

5.1.3 Sources Reviewed To Identify BACT

Steps 1 and 2 in the BACT process are the identification of all available control technologies and the top level of control for each subject pollutant from each source type for the project. Per USEPA guidance, BACT may be achieved from a change in raw materials, a process modification, and/or add-on pollution controls. For the Project, the cleanest raw material (natural gas) and lowest emitting fossil-fuel generating process (combined cycle combustion turbines) have been selected. Therefore, the identification of the top level of control focused on add-on pollution controls.

Per USEPA guidance, BACT is expressed as an emission rate and the top level of control is determined from the following:

- The most stringent emissions limitation which is contained in any State Implementation Plan (SIP) for such class or category of stationary source; or
- The most stringent emissions limitation which is achieved in practice by such class or category of stationary source.

In order to identify the "most stringent emissions limitation which is achieved in practice" by a combined cycle combustion turbine facility, numerous sources of information were evaluated. These sources included the following:

- USEPA's RACT, BACT, LAER Clearinghouse (RBLC);
- The California Air Resources Board (CARB) BACT Clearinghouse;
- USEPA regional air permitting websites; and
- State environmental agency websites.

In addition to these sources of information, additional publicly available information obtained through Tetra Tech's experience, such as permits for individual projects not listed in the RBLC or agency websites, were also included in the analysis.

5.2 Combined Cycle Combustion Turbines and Duct Burners

The BACT analysis for the combustion turbines and duct burners is combined as the duct burners cannot operate without the combustion turbines in operation. Since the combustion turbines can operate with and without duct firing, BACT emission rates were reviewed for both of these operating scenarios. Provided in Table 5-1 is a summary of recently permitted emission limits for combined cycle combustion turbine projects larger than 100 MW. Table 5-1 provides the permitted emission limits for each criteria pollutant from the Project subject to BACT requirements. Permitted BACT GHG emission limits for combined cycle combustion turbine projects are provided separately in Section 5.2.8. The emission limits provided in Table 5-1 serve as the basis for determining the "most stringent emissions limitation which is achieved in practice" for large combined cycle combustion turbines.

5.2.1 Nitrogen Oxides (NO_x)

NO_x emissions can be controlled using combustion controls and/or flue gas treatment. For the combustion turbines, available combustion controls include dry low-NO_x (DLN) combustors and the most common flue gas treatment is SCR. DLN combustors are designed to minimize the formation of NO_x from fuel combustion while SCR is placed in the combustion turbine exhaust to further reduce emissions. For the duct burners, available combustion controls include low-NO_x burners (LNB). An SCR will control NO_x emissions from both the combustion turbines and duct burners.

An SCR system is composed of an ammonia storage tank, ammonia forwarding pumps and controls, an injection grid (a system of nozzles that spray ammonia into the exhaust gas ductwork), a catalyst reactor, and instrumentation and controls. The injection grid disperses NH_3 in the flue gas upstream of the catalyst, and NH_3 and NO_x are reduced to nitrogen and water by the catalyst. SCR catalysts operate efficiently within a wide range of temperatures. For base metal catalysts typically used on combined cycle combustion turbine projects, the effective operating temperature range is between 450°F and 850°F. Since combined cycle combustion turbine projects employ a HRSG to produce steam from the hot exhaust gases in order to generate additional electricity in a steam turbine, the SCR can be placed within the HRSG under its optimum temperature window to maximize NO_x reduction.

All of the projects listed in Table 5-1 have been permitted to utilize DLN combustors and SCR to achieve the permitted NO_x emission levels. Accordingly, the Project is proposing to use state of the art DLN combustors in combination with SCR to control NO_x emissions from the turbines as well as LNB for the duct burners.

Based on a review of recently permitted projects, 2.0 ppm corrected to 15% O_2 on a 1-hour averaging basis was determined to be the most stringent emission limit achieved in practice and is selected as BACT for the Project. Since the top level of control was selected, an evaluation of the economic, energy, and environmental impacts is not necessary. BACT will be demonstrated on a continuous basis through the application of a CEMS to monitor NO_x and O_2 concentrations and calculate the emission rate in units of the BACT emission limit.

Table 5-1: Summary Of Recent PSD Criteria Pollutant BACT Determinations for Large (>100MW) Gas Fired Combined-Cycle Generating Plants

Facility	Location	Permit Date	Turbine	Emission Limits and Controls				
				NO_x[1] (ppm)	CO[1] (ppm)	VOC[1] (ppm)	$PM_{10}/PM_{2.5}$[2] (lb/MMBtu)	H_2SO_4 (lb/MMBtu)
Green Energy Partners / Stonewall	Leesburg, VA	04/30/2013	GE 7FA	2.0 (w/ and w/o DF[3]) LAER	2.0 (w/ and w/o DF)	1.0 (w/o DF) 2.4 (w/ DF)	0.00334[4] (w/ and w/o DF)	N/A
Brunswick County Power	Freeman, VA	05/23/2012	Mitsubishi M501 GAC	2.0 (w/ and w/o DF)	1.5 (w/o DF) 2.4 (w/ DF)	0.7 (w/o DF) 1.6 (w/ DF)	0.0033 (w/o DF) 0.0047 (w/ DF)	0.0058 (w/o DF) 0.0067 (w/ DF)
Dominion Warren County	Front Royal, VA	12/21/2010	Mitsubishi M501 GAC	2.0 (w/ and w/o DF)	1.5 (w/o DF) 2.4 (w/ DF)	0.7 (w/o DF) 1.6 (w/ DF)	0.0027 (w/o DF) 0.0040 (w/ DF)	0.00013 (w/o DF) 0.00025 (w/ DF)
Carroll County Energy	Washington Twp., OH	11/5/2013	GE 7FA	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	1.0 (w/o DF) 2.0 (w/ DF)	0.0108 (w/o DF) 0.0078 (w/ DF)	0.0012 (w/o DF) 0.0016 (w/ DF)
Renaissance Power	Carson City, MI	11/1/2013	Siemens 501 FD2	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	0.0042 (w/ and w/o DF)	N/A
Langley Gulch Power	Payette, ID	08/14/2013	Siemens SGT6-5000F	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	0.0053 (w/ and w/o DF)	N/A
Kleen Energy	Middletown, CT	07/2/2013	Siemens SGT6-5000F	2.0 (w/ and w/o DF)	0.9 (w/o DF) 1.7 (w/ DF)	5.0 (w/ and w/o DF)	0.0051 (w/o DF) 0.0059 (w/ DF)	0.0006 (w/o DF) 0.0007 (w/ DF)
Oregon Clean Energy	Oregon, OH	06/18/2013	Siemens SCC6-8000H	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	0.0047 (w/o DF) 0.0055 (w/ DF)	0.0006 (w/o DF) 0.0007 (w/ DF)
TECO Polk Power 2	Mulberry, FL	05/15/2013	GE 7FA	2.0 (w/ and w/o DF)	4.1 (no ox. cat)	1.4 (no ox. cat)	N/A	2 gr S/100ft^3 of gas
Sunbury Generation	Sunbury, PA	04/01/2013	"F Class"	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	1.0 (w/o DF) 3.9 (w/ DF)	0.0088 (w/ and w/o DF)	0.0018
Hess Newark Energy	Newark, NJ	11/01/2012	GE 7FA.05	2.0 (w/ and w/o DF) LAER	2.0 (w/ and w/o DF)	1.0 (w/ and w/o DF)	0.00474 (w/o DF) 0.00583 (w/ DF)	0.00008 (w/o DF) 0.0006 (w/ DF)
Moxie Liberty LLC	Asylum Twp., PA	10/10/2012	"F Class"	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	1.0 (w/o DF) 1.5 (w/ DF)	0.0057 (w/ and w/o DF)	0.0002
Cricket Valley Energy Center	Middleton, NY	09/27/2012	"F Class)	2.0 (w/ and w/o DF) LAER	2.0 (w/ and w/o DF)	1.0 (w/o DF) 2.0 (w/ DF) LAER	0.005 (w/o DF) 0.006 (w/ DF)	N/A
Deer Park Energy	Harris, TX	09/26/2012	Siemens West. 501F	2.0 (w/ and w/o DF)	4.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	0.010 (w/ and w/o DF)	N/A

Table 5-1: Summary Of Recent PSD Criteria Pollutant BACT Determinations for Large (>100MW) Gas Fired Combined-Cycle Generating Plants

Facility	Location	Permit Date	Turbine	Emission Limits and Controls				
				NO_x[1] (ppm)	CO[1] (ppm)	VOC[1] (ppm)	$PM_{10}/PM_{2.5}$[2] (lb/MMBtu)	H_2SO_4 (lb/MMBtu)
ES Joslin Power	Calhoun, TX	09/12/2012	GE 7FA	2.0 (w/ and w/o DF)	4.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	0.010 (w/ and w/o DF)	N/A
Pioneer Valley Energy Center	Westfield, MA	04-12-2012	Mitsubishi 501G	2.0 (w/ and w/o DF) LAER	2.0 (w/ and w/o DF)	N/A	0.0040 (w/ and w/o DF)	N/A
Thomas C. Ferguson Power	Llano, TX	09/01/2011	GE 7FA	2.0 (no DF)	4.0 (no DF)	2.0 (no DF)	0.018 (no DF)	0.0078
Palmdale Hybrid Power	Palmdale, CA	10/18/2011	GE 7FA	2.0 (w/ and w/o DF)	2.0 (w/o DF) 3.0 (w/ DF)	N/A	0.0048 (w/o DF) 0.0049 (w/ DF)	N/A
Avenal Power Center	Avenal, CA	05/27/2011	GE 7FA	2.0 (w/ and w/o DF)	2.0 (w/ and w/o DF)	N/A	11.78 lb/hr w/ DF 8.91 lb/hr w/o DF	N/A
Portland Gen. Electric Carty Plant	Morrow, OR	12/29/2010	Mitsubishi M501GAC	2.0 (w/ and w/o DF)	N/A	N/A	0.0025 (w/ and w/o DF)	N/A
Live Oaks Power	Sterling, GA	03/30/2010	Siemens SGT6-5000F	2.5 (no DF)	2.0 (w/o DF) 3.2 (w/ DF)	2.0 (no DF)	N/A	0.5 gr S/100ft[3] of gas
Victorville 2 Hybrid	Victorville, CA	03-11-2010	GE 7FA	2.0 (w/ and w/o DF)	2.0 (w/o DF) 3.0 (w/ DF)	N/A	18.0 lb/hr w/ DF 12.0 lb/hr w/o DF	N/A
High Desert Power	Victorville, CA	03-11-2010	Siemens West. 501F	2.5 (w/ and w/o DF)	4.0 (w/ and w/o DF)	N/A	N/A	N/A
Wolf Hollow Power	Hood, TX	03/03/2010	GE 7FA	2.0 (w/ and w/o DF)	10.0 (no ox. cat)	3.0 (no ox. cat)	N/A	N/A
Panda Sherman Power	Grayson, TX	02/03/2010	GE 7FA	2.0 (w/ and w/o DF)	15.0 (no ox. cat)	4.0 (no ox. cat)	N/A	N/A

[1] Concentration in ppm is parts per million by volume, dry, at 15 percent O_2.

[2] Concentration in pounds per million Btu heat input (HHV), except as noted, including front (filterable) and back-half (condensable) PM.

[3] DF refers to duct firing

5.2.2 Carbon Monoxide (CO)

CO is emitted from combustion turbines and duct burners as a result of incomplete oxidation of the fuel. CO emissions can be minimized by the use of proper combustor design and good combustion practices. The most stringent CO add-on pollution control technology is an oxidation catalyst, which is a passive reactor that consists of a honeycomb grid of metal panels coated with a platinum catalyst; the catalyst oxidizes the CO to CO_2. For a combined cycle combustion turbine, the oxidation catalyst is placed in the HRSG in front of the SCR catalyst so that it will operate at or above the SCR catalyst temperature.

With a few exceptions, the great majority of projects listed in Table 5-1 have been permitted with an oxidation catalyst to achieve the permitted CO emission levels, including the three most recent projects in Virginia. Accordingly, the Project is proposing to use an oxidation catalyst to control CO emissions from the combustion turbines and duct burners.

A review of recently permitted projects shows that most are permitted at an emission rate at or above 2.0 ppm corrected to 15% O_2 on a 1-hour averaging basis during all operating periods. A few projects have marginally lower permitted limits without duct firing and one project has a lower limit with duct firing, but these projects have a different combustion turbine than the Alstom GT24 and cannot operate down to the very low minimum operating load of the Alstom GT24 turbine. For these reasons, 2.0 ppm corrected to 15% O_2 on a 1-hour averaging basis was selected as BACT for all operating cases, consistent with the preponderance of projects listed in Table 5-1. BACT will be demonstrated on a continuous basis through the application of a CEMS to monitor CO and O_2 concentrations and calculate the emission rate in units of the BACT emission limit.

5.2.3 Volatile Organic Compounds (VOCs)

Similar to CO emissions, VOCs are emitted from combustion turbines as a result of incomplete oxidation of the fuel. VOC emissions from combustion turbines can be minimized by the use of proper combustor design and good combustion practices. Depending upon the species of VOCs in the turbine exhaust, the oxidation catalyst employed to reduce CO emissions may also reduce VOC emissions but the reduction in VOC emissions is expected to be modest. Therefore, the critical control technique for VOC emissions is proper combustor design and good combustion practices.

VOC emissions from duct burners are typically higher than from the combustion turbine. A review of the permitted projects in Table 5-1 shows a range of permitted VOC emission limits, most with an allowable emission rate that is higher during duct firing of the HRSG. The permitted VOC emission limit for any combustion turbine project will be dependent upon the make and model of the combustion turbine selected and the vendor guaranteed emission rate. The combustion turbine selected for the Project is an Alstom GT24, for which there is no comparable project in Table 5-1.

The Alstom GT24 was selected for the Project due to its unique ability to enable the combined cycle power plant to meet its permitted BACT emission rates at LLO, allowing the GT24 unit to cycle up and down and follow the projected demand in the area. Since the turbines can operate at LLO, it will minimize startup and shutdown (SU/SD) operation during which VOC emissions are elevated as compared to steady state operation. For comparison, the combustion turbines permitted in Table 5-1 will typically have a minimum operating load of 50%, below which, they cannot meet their permitted BACT emission rates. As a result, these other turbine models could require a significant amount of SU/SD operation and consequently, increased VOC emissions as a result.

Based upon Alstom's expected VOC emissions from the combustion turbine, and installation of an oxidation catalyst, the proposed VOC BACT emission rates are 1.0 ppm corrected to 15% O_2 on a 1-hour averaging basis without duct firing and 2.0 ppm corrected to 15% O_2 on a 1-hour averaging basis with duct firing. These emission limits are consistent with the most stringent emission limits identified in Table 5-1 and equivalent to or less than the limits for the most recently permitted project in Virginia. Therefore, these limits are proposed as the top-level of control and an evaluation of the economic, energy, and environmental impacts is not necessary.

5.2.4 Particulate Matter (PM, PM_{10}, and $PM_{2.5}$)

Emissions of particulate matter result from trace quantities of ash (non-combustibles) in the fuel, products of incomplete combustion and conversion of SO_2 in the exhaust to condensable salts. Conservatively, all particulate matter (PM) emissions from the Project are presumed to be less than 2.5 microns in size ($PM_{2.5}$) and, therefore, emissions of PM, PM_{10} and $PM_{2.5}$ are presumed to be equal. Particulate emissions are minimized by utilizing state of the art combustion turbines firing natural gas since natural gas has the lowest ash and sulfur content available.

A review of the permitted emission limits in Table 5-1 shows a wide range of values on a lb/MMBtu basis. Similar to VOC emissions, the permitted PM emission limit for a combustion turbine project will be dependent upon the make and model of the combustion turbine selected and the vendor guaranteed emission rate. For example, GE guarantees a flat pound per hour PM emission rate across all operating loads for their combustion turbines. This results in a wide range PM emission rates on a lb/MMBtu basis for GE turbines. A comparison of the recently permitted Green Energy Partners project in Virginia to the Carroll County project in Ohio shows a permitted PM emission rate difference of a factor of three (on a lb/MMBtu basis) for the same model GE turbine. This discrepancy results from the Green Energy Partners permitted PM emission rate in lb/MMBtu being at full operating load while the Carroll County limit lb/MMBtu is at minimum operating load.

The combustion turbine selected for the Project is an Alstom GT24, for which there is no comparable project in Table 5-1. As discussed in Section 5.2.3, the Alstom GT24 was selected for the Project in part due to its unique ability to meet its permitted BACT emission rates at very low operating loads. Due to the unique operation of the Alstom GT24, CPV Smyth does not believe the Project can be directly compared to the projects listed in Table 5-1 for PM emissions.

BACT for PM emissions from the Project are proposed to be good combustion practices, the use of natural gas with a maximum sulfur content of 0.5 gr/100 scf and the guaranteed emission rates from Alstom. Alstom's guaranteed PM emissions on a lb/MMBtu basis change depending upon operating load and ambient conditions. In order to establish BACT as an emission rate, the following limits at full operating load are proposed for the Project, including filterable and condensable PM. The pound per hour limits are absolute maximum values while the lb/MMBtu limit represents all scenarios at full operating load, including duct firing. Therefore, higher emissions at reduced operating loads may occur in terms of lb/MMBtu but no increase in mass emissions will result.

- 12.9 lbs/hr with duct firing;
- 9.4 lbs/hr without duct firing; and
- 0.005 lb/MMBtu (at full load).

Full operating load limits are proposed to establish BACT since performance emissions testing will be conducted at full operating load and this approach is consistent with the most recent combined cycle generating project permitted in Virginia. The proposed limit on a lb/MMBtu basis is within the range of recently permitted projects in Table 5-1. Further reductions in PM emissions from the turbines are not technically feasible as there are no known combustion turbines equipped with add-on PM pollution controls and the natural gas delivered to the plant will be pipeline quality.

5.2.5 Sulfur Dioxide (SO_2)

SO_2 is emitted from the combustion turbines and duct burners as a result of the oxidation of the sulfur in the fuel. The only practical means for controlling SO_2 emissions from the combustion turbines and duct burners is to limit the sulfur content of the fuel. The Project proposes to use pipeline quality natural gas as the sole fuel. Pipeline quality natural gas is the lowest sulfur content fuel commercially available and the sulfur content of the natural gas will be no greater than 0.5 gr/100 scf of gas, or approximately 0.0015 lbs SO_2/MMBtu.

5.2.6 Sulfuric Acid Mist (H_2SO_4)

In any combustion process, the sulfur in the fuel is predominantly oxidized to SO_2 but a small percentage of the sulfur is oxidized to SO_3, which reacts with moisture in the exhaust to form sulfuric acid (H_2SO_4). Similar to SO_2 emissions, the top level of control for H_2SO_4 emissions is to limit the sulfur content of the fuel. The Project proposes to use pipeline quality natural gas as the sole fuel, which is the fuel with the lowest sulfur content commercially available and therefore, represents the top level of BACT for the Project.

Alstom provided CPV with guaranteed H_2SO_4 emissions based upon their estimate of sulfur to SO_3 conversion. The maximum H_2SO_4 emission rate shall be no greater than 0.00095 lb/MMBtu, which is consistent with the permitted emission limits for projects listed in Table 5-1.

5.2.7 Ammonia (NH_3)

NH_3 is injected into the exhaust of the combustion turbines prior to the SCR to facilitate the conversion of NO_x to nitrogen and water. NH_3 is injected at a ratio slightly greater than the amount required to convert 100% of the NO_x if the SCR operated at 100% efficiency. Additional NH_3 is required mostly to offset mixing inefficiencies in the exhaust and to some degree to offset insufficient residence time for reaction of the NH_3/NO_x mixture across the catalyst. Consequently, some of the injected NH_3 does passes through the SCR unreacted and is exhausted to the atmosphere. These NH_3 emissions are called the "ammonia slip." Ammonia slip will be limited to 5.0 ppm corrected to 15% O_2 during normal operation. Ammonia will not be injected until the SCR catalyst reaches the vendor recommended minimum operating temperature to ensure a high reaction efficiency.

5.2.8 Greenhouse Gases

USEPA issued a 2011 guidance document for completing GHG BACT analyses titled "*PSD and Title V Permitting Guidance for Greenhouse Gases*". This guidance is in addition to the 1990 USEPA BACT guidance document. Although the 2011 guidance document refers to the same top-down methodology described in the 1990 document, it provides additional clarification and detail with regard to some aspects of the analysis. The following analysis has been conducted in accordance with both the 1990 and 2011 guidance documents.

Step 1: Identify Potentially Feasible GHG Control Options

In Step 1, the applicant must identify all "available" control options which have the potential for practical application to the emission unit and regulated pollutant under evaluation, including lower-emitting process and practices. In assessing available GHG control measures, the sources of information reviewed in Section 5.1.3 were reviewed with regard to GHG controls and emissions. For a combined cycle turbine project, potential GHG controls include the following:

1. low carbon-emitting fuels;
2. carbon capture and storage (CCS); and
3. energy efficiency and heat rate.

Each of these GHG control measures is evaluated in Step 2 of this analysis.

Step 2: Technical Feasibility of Potential GHG Control Options

Low Carbon-Emitting Fuels

Natural gas combustion generates significantly lower GHG emissions on a per unit of heat throughput than distillate oil (approximately 27% less) and coal (approximately 50% less). Use of biofuels, such as biodiesel, would reduce fossil-based carbon dioxide emissions, since biofuels are produced from recently harvested plant material rather than ancient plant material that has transformed into fossil fuel. However, biofuels are in liquid form, and the Project is not being designed for liquid fuel. In addition, combined cycle turbines have technical issues with biofuels that have yet to be resolved and as a result, there are no known permitted or proposed combustion turbine projects firing biofuel. In order to feasibly fire biofuel in a combustion turbine, it is expected that distillate fuel would need to be blended with biofuel, which would offset some or all of the potential reductions in GHG emissions. For this reason, biofuels were eliminated from consideration as BACT. Therefore, natural gas represents the lowest carbon fuel commercially available for the Project.

Energy Efficiency and Heat Rate

USEPA's 2011 GHG permitting guidance states:

> "Evaluation of [energy efficiency options] need not include an assessment of each and every conceivable improvement that could marginally improve the energy efficiency of [a] new facility as a whole (e.g., installing more efficient light bulbs in the facility's cafeteria), since the burden of this level of review would likely outweigh any gain in emissions reductions achieved. USEPA instead recommends that the BACT analyses for units at a new facility concentrate on the energy efficiency of equipment that uses the largest amounts of energy, since energy efficient options for such units and equipment (e.g., induced draft fans, electric water pumps) will have a larger impact on reducing the facility's emissions..."

USEPA also recommends that permit applicants:

> "propose options that are defined as an overall category or suite of techniques to yield levels of energy utilization that could then be evaluated and judged by the permitting authority and the public against established benchmarks...which represent a high level of performance within an industry."

With regard to electric generation from combustion sources, the combined-cycle combustion turbine is considered to be the most efficient technology available. GHG emissions from electricity production are primarily a function of the amount of fuel burned. Therefore, a key factor in minimizing GHG emissions is to maximize the efficiency of electricity production, or otherwise known as minimizing the heat rate.

The heat rate of an electric generating unit is the amount of heat needed to generate an amount of electricity and is usually reported in units of Btus of fuel consumed per kilowatt-hour of electricity generated (Btu/kW-hr). An efficient unit will require less fuel to generate a kilowatt-hour of electricity and have a lower heat rate. Most existing fossil-fuel fired generating units are older boilers and turbines that are less efficient than new combined cycle combustion turbine projects. In general, boilers have a higher heat rate than combined cycle combustion turbine projects that use the waste heat from the combustion turbines to generate additional power in a steam turbine. In addition to the efficiency of the electricity generation cycle itself, there are a number of key plant internal energy sinks (parasitic losses) that can improve a plant's net heat rate (efficiency) if reduced.

Measures to increase energy efficiency are technically feasible and are addressed in more detail in Step 4 of this analysis.

Carbon Capture and Storage

USEPA has specifically stated that CCS is technically achievable and must be considered in a GHG PSD BACT analysis. CCS is composed of three main components which are CO_2 capture and/or compression, transport, and storage. CCS may be eliminated from a BACT analysis in Step 2 if it can be shown that there are significant differences pertinent to the successful operation for each of these three main components from what has already been applied to a differing source type. For example, if the temperature, pressure, pollutant concentration, and/or volume of the gas stream to be controlled differ significantly from previous applications, then it is not certain the GHG control device will work in the situation currently undergoing review. Furthermore, CCS may be eliminated from a BACT analysis in Step 2 if the three components working together are deemed technically infeasible for the proposed source, taking into account the integration of the CCS components with the base facility and site-specific considerations (e.g., space for CO_2 capture equipment at an existing facility, right-of-ways to build a pipeline or access to an existing pipeline for transport, access to suitable geologic reservoirs for sequestration or other storage options). While CCS is a promising technology and may be technically achievable for a specific project, USEPA has also stated that at this time CCS will be a technically feasible BACT option in certain limited cases.

As stated in the August 2010 *Report of the Interagency Task Force on Carbon Capture and Storage*, co-chaired by USEPA and the United States Department of Energy, while amine- or ammonia-based CO_2 capture technologies are commercially available, they have been implemented either in non-combustion applications (i.e., separating CO_2 from field natural gas) or on relatively small-scale combustion applications (e.g., slip streams from power plants with exhaust volumes that would correspond to approximately one megawatt of generating capacity). Scaling up these capture processes would represent a very significant technical challenge and potential barrier to widespread commercial deployment in the near term. It is unclear how transferable the experience with natural gas processing is to separation of power plant flue gases, given the significant differences in the chemical make-up of the two gas streams. In addition, integration of these technologies with the power cycle at generating plants present significant cost and operating issues that need to be addressed prior to widespread, cost-effective deployment of CO_2 capture. Current technologies could be used to capture CO_2 from new and existing fossil fuel energy power plants; however, they are not ready for widespread implementation primarily because they have not been demonstrated at the scale necessary to establish confidence for power plant applications. To date, United States power generating projects under consideration for using CCS technology have required significant government funding and have been targeted for coal fired boiler plants that have exhaust with higher CO_2 concentrations and lower exhaust volume as compared to a combustion turbine project.

Regarding pipeline transport for CCS, there does not exist a nearby existing CO_2 pipeline infrastructure (see Figure 5-1). The nearest CO_2 pipeline to the Project is in southern Mississippi, more than 500 miles from the Project in a straight line distance. The cost to construct a pipeline from the Project to Mississippi would make the Project uneconomical. Furthermore, the time necessary to acquire all required regulatory approvals and construct the pipeline would take many years.

With regard to storage for CCS, the Interagency Task Force concluded that while there is currently estimated to be a large volume of potential storage sites, "to enable widespread, safe, and effective CCS, CO_2 storage should continue to be field-demonstrated for a variety of geologic reservoir classes" and that "scale-up from a limited number of demonstration projects to wide scale commercial deployment may necessitate the consideration of basin-scale factors (e.g., brine displacement, overlap of pressure fronts, spatial variation in depositional environments, etc.)."

Based on the abovementioned USEPA guidance regarding technical feasibility, the distance to the nearest CO_2 pipeline and the conclusions of the Interagency Task Force for the CO_2 capture component alone, CCS has been determined to be not technically feasible for the Project.

Step 3: Ranking of Technically Feasible GHG Control Options by Effectiveness

Based on the results of Step 2, the only GHG control option technically feasible for the Project is energy efficiency.

Step 4: Evaluation of Energy Efficiency and Heat Rate

Improvements to energy efficiency and "heat rate" are important GHG control measures that can be employed to mitigate GHG emissions. The Project is proposing advanced combustion turbine combined cycle technology, which is recognized as the most efficient commercially available technology for producing electric power from fossil fuels. Improvements to the heat rate typically will not change the amount of fuel combusted for a given combustion turbine installation, but it will allow more power to be produced from a given amount of fuel (i.e., improve the heat rate) so that more GHG emissions will be displaced from existing sources.

Key factors addressed in the evaluation of energy efficiency and heat rate are the core efficiency of the selected turbines and the significant factors affecting overall net heat rate in combined cycle operating mode. The Project is proposing to install two "F" Class turbines in combined cycle configuration. "G" class turbines are slightly more efficient and thus have a lower heat rate. However, "G" class turbines generate approximately 25% more electricity per turbine and would not match the projected demand for the Project area. In addition, "G" class turbines generally have a higher low operating limit (the lowest MW output at which the facility can operate in compliance with its permits) than the proposed "F" class turbines. As previously discussed, the capability of the GT24 turbine to operate at LLO is integral to the design of the Project. By matching the projected demand for the area and minimizing startup and shutdown operation, the GT24 turbine provides greater operational flexibility and lower overall emissions. The expected heat rate differential between "F" and "G" class turbines in combined cycle mode, is expected to be less than 1 percent at ISO conditions, without duct firing. For these reasons, "G" class machines have been eliminated from consideration for the Proposed Project.

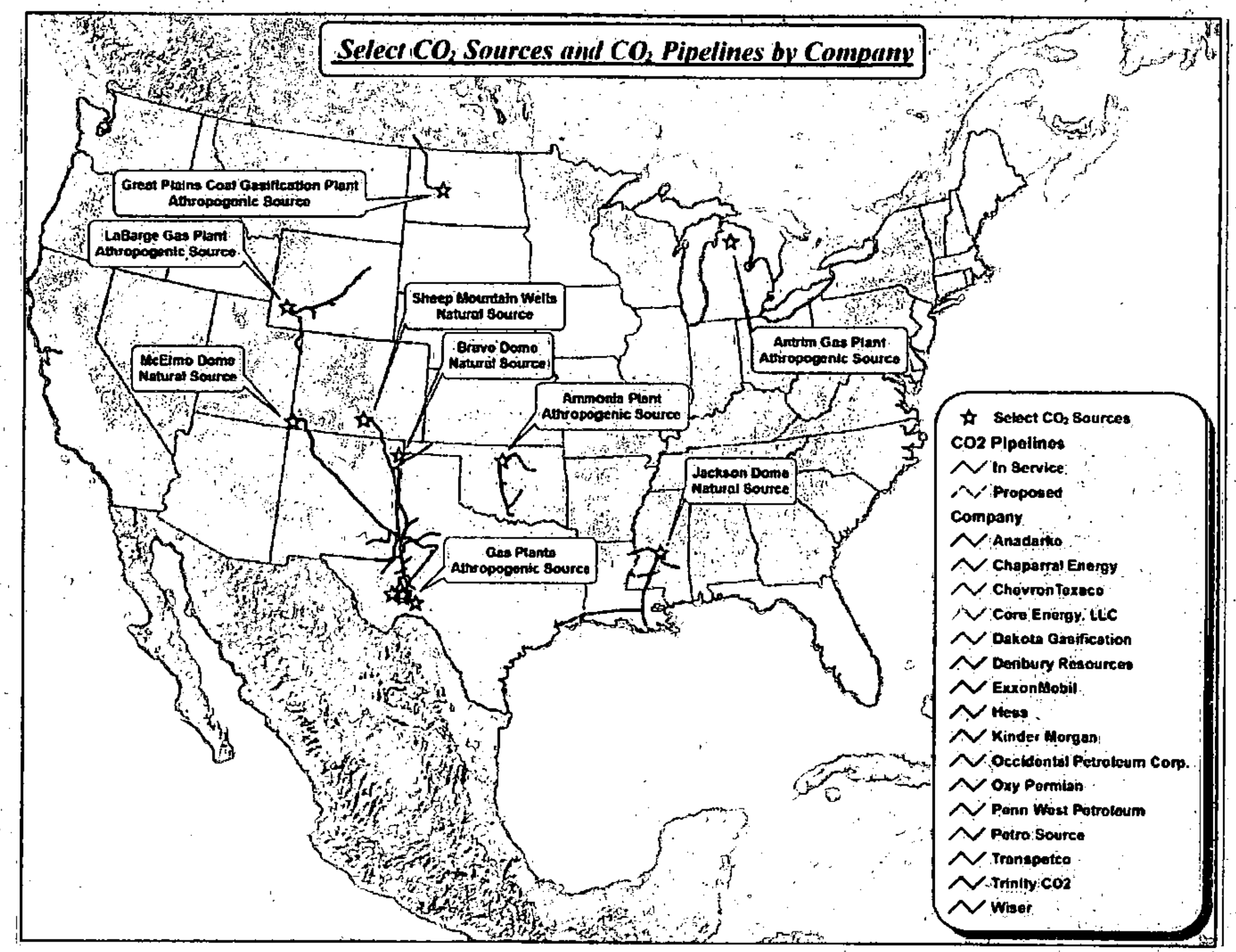


Figure 5-1 **CO_2 Pipelines in the United States**
From: "Report of the Interagency Task Force on Carbon Capture and Storage," August 2010, Appendix B.)

The Alstom GT24 combustion turbine is an advanced generation of "F" class machines that has higher output and improved heat rate compared to prior "F" class designs. The Alstom GT24 combustion turbine represents the current state-of-the-art for the evolving "F" class technology that has been in operation for more than 20 years with thousands of machines in operation. The steam cycle portion of the plant (HRSG, piping and steam turbine generator), designed with a single steam turbine in a "2 on 1" configuration will have a lower heat rate as compared to a separate steam turbine matched to each combustion turbine in a "1 on 1" configuration.

With regard to energy efficiency considerations in combined cycle combustion turbine facilities, the activity with the greatest effect on overall plant efficiency is the method of condenser cooling. As with all steam-based electric generation, combined cycle plants can use either dry cooling or wet cooling for condenser cooling. Dry cooling uses large fans to condense steam directly inside a series of pipes, similar in concept to the radiator of a car. Wet cooling can either be closed cycle evaporative cooling (using cooling towers), or "once-through" cooling using very large volumes of water. Wet cooling performance is superior for efficiency purposes because of the basic thermodynamics of cooling, which produces colder water as compared to dry cooling. Additionally, dry cooling requires more electricity than wet cooling and as a result, has a higher parasitic load. As a result, operation of a dry cooling system requires approximately 1-5% more energy than a wet cooling system depending on ambient conditions as the difference between wet and dry systems gets smaller at lower ambient temperatures.

However, there are significant drawbacks to a wet cooling system. Once-through cooling uses large quantities of water that is returned to the receiving water body at a higher temperature. Wet mechanical draft cooling towers also require a significant quantity of water, mostly due to evaporation to the atmosphere. The evaporative water losses from a wet mechanical draft cooling tower impose an additional burden with the creation of a visible fog plume during certain ambient conditions.

The higher water demand for a wet cooling tower is of significant importance to the Project as the area cannot support higher water usage. For this reason, a dry cooling system with an air cooled condenser was selected for the project as wet cooling was not technically feasible.

Step 5: GHG BACT

The very low heat rates (high efficiency) associated with the combined cycle combustion turbine technology selected for the Project and the use of the lowest carbon fossil fuel, natural gas, as the exclusive fuel, represent GHG BACT for the Project.

A review of recently permitted GHG BACT emission rates was conducted and the results of this review are provided in Table 5-2. The USEPA has also proposed an NSPS standard for GHG emissions from new natural gas fired generating plants of 1,000 lb/MW-hr on a gross output basis.

The emission limits in Table 5-2 and the NSPS are all based upon CO_2e emissions over a 12-month operating period (except as noted in the table) and, therefore, account for both duct firing and non-duct firing operation. Each limit also takes into account an estimate of performance degradation of the combustion turbines over their expected lifetime. Based upon performance data of the GT24 turbine provided by Alstom and expected operation during duct firing and non-duct firing operation and predicted performance degradation, the GHG BACT emission rate for the Project was determined to be 888 lb/MW-hr on a gross output basis over a 12-month operating period.

Table 5-2: Summary Of Recent PSD GHG BACT Determinations for Large (>100MW) Gas Fired Combined-Cycle Generating Plants

Project	Location	Permit Date	Combustion Turbine	Source	CO_2e Emission Limit		Degradation Allowance
Green Energy Partners / Stonewall	Leesburg, VA	04/30/2013	GE 7FA	CT - gas firing w/ DF	903	lb/MW-hr (gross)	12.0%
Brunswick County Power	Freeman, VA	05/23/2012	Mitsubishi M501 GAC	CT - gas firing w/ DF	920	lb/MW-hr (net)	12.0%
Carroll County Energy	Washington Twp., OH	11/5/2013	GE 7FA	CT - gas firing w/ DF	859	lb/MW-hr (gross, excluding duct firing)	Unknown
Renaissance Power	Carson City, MI	11/1/2013	Siemens 501 FD2	CT - gas firing w/ DF	1,000	lb/MW-hr (gross)	Unknown
Oregon Clean Energy Center	Lucas, OH	18-Jun-2013	Mitsubishi M501 or Siemens SGT-8000H	CT - gas firing w/ DF	840	lb/MW-hr	12.8%
Calpine Deer Park	Deer Park, TX	29-Nov-2012	Siemens 501F	CT - gas firing	920	lb/MW-hr (30-day rolling)	12.8%
Channel Energy Center	Pasadena, TX	29-Nov-2012	Siemens 501F	CT - gas firing	920	lb/MW-hr (30-day rolling)	12.8%
Hess Newark Energy Center	Newark, NJ	1-Nov-2012	GE 7FA	CT - gas firing w/ DF	887	lb/MW-hr (gross)	12.8%
Cricket Valley Energy Center	Middletown, NY	09/27/2012	"F" Class	CT - gas firing w/ DF	925	lb/MW-hr (gross)	12.8%
Deer Park Energy	Harris, TX	09/26/2012	Siemens West. 501F	CT - gas firing w/ DF	920	lb/MW-hr (gross)	12.8%
Pioneer Valley Energy Center	Westfield, MA	04-12-2012	Mitsubishi 501G	CT - gas firing w/ DF	895	lb/MW-hr (gross)	8.5%
Thomas C. Ferguson	Horseshoe Bay, TX	10-Nov-2011	GE 7FA	CT - gas firing w/ DF	918	lb/MW-hr (gross)	5%
Palmdale Hybrid Power	Palmdale, CA	10/18/2011	GE 7FA	CT – gas firing w/ DF & solar thermal	774	lb/MW-hr (net, including solar)	Unknown

The emissions and operating data used to determine the CO_2e BACT emission rate are provided below.

Non-Duct Firing Operation

Avg. Annual Temp:	59°F
Annual Operating Hours:	5,760 hrs/yr
CO_2e emissions:	468,295 lb/hr at 100% load
Gross Heat Input:	3,936 MMBtu/hr
Gross Output:	602.0 MW

Duct Firing Operation

Avg. Annual Temp:	90°F
Annual Operating Hours:	3,000 hrs/yr
CO_2e emissions:	584,699 lb/hr at 100% load
Gross Heat Input:	4,914 MMBtu/hr
Gross Output:	713.3 MW

The proposed GHG BACT emission rate takes into account a performance degradation value of 12.0% from the original design performance data. The degradation rate takes into account three performance factors predicted to impact operation of the combustion turbine over time. These factors were derived from a detailed analysis conducted by the Bay Area Air Quality Management District (BAAQMD) for the Russell City Energy Center, which used a 12.8% degradation factor and has been included in several GHG BACT decisions by USEPA. The 12.0% used for the Project was chosen to be consistent with recent VDEQ GHG BACT determinations.

The first factor taken into account in the degradation rate by the BAAQMD is design margin to reflect the likelihood that the equipment as constructed and installed may not fully achieve the optimal vendor specified design performance. A design margin of 3.3% was factored into the GHG BACT emission rate.

The second factor taken into account by the BAAQMD is performance margin to reflect normal wear and tear of the combustion turbine over its useful life. A performance margin of 6.0% was factored into the GHG BACT emission rate.

The third and final factor taken into account by the BAAQMD is degradation of auxiliary plant equipment to reflect normal wear and tear. A degradation margin for auxiliary equipment of 3.0% was factored into the GHG BACT emission rate.

These three factors were expected to compound upon each preceding factor such that the overall degradation rate used in the Russell City project was 12.8% over the useful life of the combustion turbines.

The lower degradation factors for the Thomas C. Ferguson and Pioneer Valley projects listed in Table 5-2 do not take into account all three factors that will impact the project's heat rate over its useful life. The Green Energy Partners and Brunswick County Power projects recently permitted in Virginia take into account three degradation factors in the determination of the CO_2e emission limit, however, these factors differ slightly from the BAAQMD's Russell City Energy Center analysis. The Virginia projects include the following three degradation factors: 3.4% performance margin of the combustion turbines, 1.2% degradation margin for auxiliary power, and a 7.1% degradation margin for the steam turbine system. Application of these factors yields an overall degradation factor of 12.0%, which is slightly less than the value derived at for the Russell City Energy Center.

CPV Smyth believes it is important that the GHG BACT emission rate take into account design margin, degradation of generating equipment and auxiliary power degradation, consistent with the Russell City Energy Center analysis and recent VDEQ determinations. CPV Smyth proposes a 12.0% degradation factor consistent with projects recently approved by the VDEQ.

5.2.9 Summary of Proposed Combustion Turbine BACT Emission Rates

Provided in Table 5-3 is a summary of proposed BACT emission rates for the combined cycle combustion turbines.

Table 5-3: Proposed Combustion Turbine BACT Emission Limits – Steady State Operation

Pollutant	Emission Controls	Short Term Limit(s)	Long Term Limit (per unit)
NO_x	DLN Combustors (CTs) LNB (Duct Burners) SCR	2.0 ppmvd @15% O2 (all operating modes)	74.7 tpy
CO	Good Combustion Practices Oxidation Catalyst	2.0 ppmvd @15% O2 (all operating modes)	47.7 tpy
$PM/PM_{10}/PM_{2.5}$	Good Combustion Practices Natural Gas Sole Fuel	12.9 lbs/hr (full load with duct firing) 9.4 lbs/hr (full load without duct firing) 0.005 lb/MMBtu (all operating modes)	39.5 tpy
VOC	Good Combustion Practices Oxidation Catalyst	1.0 ppmvd @15% O2 (without duct firing) 2.0 ppmvd @15% O2 (with duct firing)	22.1 tpy
H_2SO_4	Natural Gas Sole Fuel Sulfur ≤0.5 gr/100 CF gas	0.0010 lbs/MMBtu	8.6 tpy
CO_2e	Natural Gas Sole Fuel Energy Efficiency	888 lb/gross MW-hr (12-month average)	1,156,440 tpy

5.2.10 Startup/Shutdown (SU/SD) Emissions

Combustion turbines experience increased VOC, CO and NO_x emissions during startup and shutdown operation. In addition, initial low operating temperatures during startup preclude the use of the SCR and limit the efficiency of the oxidation catalyst. BACT for startup and shutdown is good operating practices by following the manufacturer's recommendations during startup, and limiting the startup time. The Alstom GT24 combustion turbines proposed for the project enables the plant to meet the proposed BACT emission rates at very low operating loads, down to approximately 5 percent CTG load (10% plant load). This design feature of the GT24 turbines reduces the number of starts and stops by allowing the units to cycle down during periods of low demand rather than requiring the unit to be shutdown.

Although the number of starts and stops will be minimized, startup and shutdown operation cannot be completely avoided. During SU/SD operation, VOC, CO and NO_x emissions will be minimized by proper operational practices. The combustion turbines will be operated in accordance with manufacturer specifications during SU/SD periods to ensure that emissions are minimized during these short periods. Additionally, NH_3 injection will be initiated as a soon as practicable after the SCR catalyst reaches the vendor specified minimum operating temperature to minimize NO_x emissions during these periods. The estimated startup/shutdown emissions for the combustion turbines are provided in Table 5-4. Any increase in emissions during SU/SD operation is included in the potential annual emissions provided in Table 5-3; detailed emission calculations are provided in Appendix B.

Table 5-4: Transient Emission Limits (lbs per event)

Pollutant	Cold Start	Warm Start	Hot Start	Shutdown	Transition to and from LLOC
NO_x	61	56	50	4.6	2.9
CO	77	71	47	17	32
VOC	73	69	39	25	48

For the purposes of Table 5-4, the following definitions are applied:

- Cold Startup refers to restarts made at least 60 hours or more after shutdown and shall not last longer than 180 minutes per occurrence.
- Warm Startup refers to restarts made between 8 and 60 hours after shutdown and shall not last longer than 126 minutes per occurrence.
- Hot Startup refers to restarts made between 0 and 8 hours after shutdown and shall not last longer than 56 minutes per occurrence.
- Shutdown refers to the period between the time the turbine load drops below 5 percent operating load and the fuel supply to the turbine is cut. Shutdown operation shall not last longer than 11 minutes per occurrence.
- Transition to and from LLO refers to the period between LLO (5% turbine load) and compliance load and shall not last longer than 24 minutes for ramp down (12 minutes) and ramp up (12 minutes) combined.

5.3 Auxiliary Boiler

The Project will include an auxiliary boiler rated at 93 MMBtu/hr fired solely with natural gas. The auxiliary boiler will provide steam to warm up the steam turbine to minimize the duration of plant startups. Annual operation of the auxiliary boiler will be limited to a full load equivalent of 4,000 hours per year. Emissions from the boiler are subject to BACT requirements and a review was conducted of recently permitted emission rates from natural gas fired boilers; the results of this review are provided in Table 5-5. The emission limits provided in Table 5-5 serve as the basis for determining the "most stringent emissions limitation which is achieved in practice" for natural gas fired auxiliary boilers.

5.3.1 Nitrogen Oxides (NO_x)

Similar to the combustion turbines, NO_x emissions can be controlled using combustion controls and/or flue gas treatment. For the auxiliary boiler, the most advanced level of control identified in Table 5-5 is ultra LNB. Ultra LNB can achieve a NO_x emission rate of 9 ppm corrected to 3% O_2. Based upon recently permitted projects listed in Table 5-5, this is the top level of control for a gas-fired auxiliary boiler rated at less than 100 MMBtu/hr.

Further reductions in NO_x emissions could be achieved through installation of an SCR. However, the installation of an SCR on the auxiliary boiler would not be cost effective due to the already very low NOx emissions from the boiler. Potential NO_x emissions from the boiler are only 1.0 lbs/hr and limited to 2.0 tpy due to the proposed operating restriction of 4,000 hrs/yr. The VDEQ's engineering analysis for the recently permitted Brunswick Energy project, showed a cost to control of over $60,000 per ton of NO_x removed for SCR on an auxiliary boiler equipped with ultra-low NOx burners. Furthermore, the Green Energy Partners / Stonewall project was recently approved by the VDEQ with ultra-low NOx burners as lowest achievable emission rate (LAER) for the auxiliary boiler.

Based on a review of recently permitted projects, 9.0 ppm corrected to 3% O_2 was determined to be the most stringent emission limit achieved in practice and is selected as BACT for the auxiliary boiler.

5.3.2 Carbon Monoxide (CO)

CO is emitted from the auxiliary boiler as a result of incomplete oxidation of the fuel. CO emissions can be minimized by the use of proper combustor design and good combustion practices. For the auxiliary boiler, the most advanced level of control identified in Table 5-5 is advanced ultra LNB. Ultra LNB can minimize CO emissions and achieve an emission rate of 50 ppm corrected to 3% O_2. Based upon recently permitted projects listed in Table 5-5, this is the top level of control for a gas-fired auxiliary boiler rated at less than 100 MMBtu/hr.

Further reductions in CO emissions could be achieved through installation of an oxidation catalyst. However, the installation of an oxidation catalyst on the auxiliary boiler would not be cost effective due to the already low CO emissions from the boiler. Potential CO emissions from the boiler are only 3.4 lbs/hr and limited to 6.8 tpy due to the proposed operating restriction of 4,000 hrs/yr. The VDEQ's engineering analysis for the recently permitted Brunswick Energy project, showed a cost to control of $10,000 per ton of CO removed for an oxidation catalyst on an auxiliary boiler equipped with ultra-low NO_x burners. Furthermore, the Green Energy Partners / Stonewall project concluded that an oxidation catalyst would not be cost effective on an auxiliary boiler emitting over 12 tpy, nearly double the emissions from the Project's auxiliary boiler.

Based on a review of recently permitted projects, 50 ppm corrected to 3% O_2 was determined to be the most stringent emission limit achieved in practice and is selected as BACT for the auxiliary boiler.

Table 5-5: Summary Of Recent PSD Criteria Pollutant BACT Determinations for Natural Gas-Fired Auxiliary Boilers

Facility	Location	Permit Date	Controls	Emission Limits and Controls			
				NO_x[1] (ppm)	CO[1] (ppm)	VOC[1] (lb/MMBtu)	$PM_{10}/PM_{2.5}$[2] (lb/MMBtu)
Green Energy Partners / Stonewall	Leesburg, VA	04/30/2013	Ultra LNB	9.0	50	0.002 (LAER)	0.002
Brunswick County Power	Freeman, VA	05/23/2012	Ultra LNB	9.0	50	0.006	0.0075
Dominion Warren County	Front Royal, VA	12/21/2010	Ultra LNB	9.0	50	0.0053	0.005
Carroll County Energy	Washington Twp., OH	11/5/2013	Ultra LNB	16.4	75	0.006	0.008
Renaissance Power	Carson City, MI	11/1/2013	LNB	30	50	0.005	0.005
Kleen Energy	Middletown, CT	07/2/2013	LNB	37	100	0.004	0.006
Oregon Clean Energy	Oregon, OH	06/18/2013	Ultra LNB	16.4	75	0.006	0.008
Hickory Run Energy	North Beaver Twp., PA	04/23/2013	Ultra LNB	9.0	50	N/A	0.005
Sunbury Generation	Sunbury, PA	04/01/2013	LNB	30	100	0.005	0.008
Hess Newark Energy	Newark, NJ	11/01/2012	Ultra LNB	9.0	50	0.004	0.005
Cricket Valley Energy Center	Middleton, NY	09/27/2012	Ultra LNB	9.0	50	0.0015 (LAER)	0.005
Pioneer Valley Energy Center	Westfield, MA	04-12-2012	LNB	25	50	N/A	0.0048
Palmdale Hybrid Power	Palmdale, CA	10/18/2011	Ultra LNB	9.0	50	N/A	0.008
Avenal Power Center	Avenal, CA	05/27/2011	Ultra LNB	9.0	50	N/A	0.005
Portland Gen. Electric Carty Plant	Morrow, OR	12/29/2010	LNB	40	N/A	N/A	0.0025
Victorville 2 Hybrid	Victorville, CA	03-11-2010	Ultra LNB	9.0	50	N/A	0.003

[1] Concentration in ppm is parts per million by volume, dry, at 3 percent O_2.

[2] Concentration in pounds per million Btu heat input (HHV), except as noted, including front (filterable) and back-half (condensable) PM.

5.3.3 Volatile Organic Compounds (VOCs)

Similar to CO, VOCs are emitted from the auxiliary boiler as a result of incomplete oxidation of the fuel. CO emissions can be minimized by the use of proper combustor design and good combustion practices. For the auxiliary boiler, the most advanced level of control identified in Table 5-5 is advanced ultra LNB. There are no technically feasible add-on control technologies that can reduce VOC emissions from the auxiliary boiler by significantly measurable amounts.

The lowest permitted VOC emission rates identified in Table 5-5 are for the Green Energy Partners / Stonewall and Cricket Valley Energy projects. However, both of these projects are located in ozone non-attainment areas and were required to meet LAER for VOC emissions. The PSD BACT determinations identified in Table 5-5 are consistently at or close to an emission rate of 0.005 lb/MMBtu. Based upon these recent PSD BACT determinations, 0.005 lb/MMBtu was determined to be BACT for the auxiliary boiler.

5.3.4 Particulate Matter (PM, PM_{10}, and $PM_{2.5}$)

Emissions of particulate matter result from trace quantities of ash (non-combustibles) in the fuel, products of incomplete combustion and conversion of SO_2 in the exhaust to condensable salts. Particulate emissions from a combustion source are minimized by utilizing state of the art combustion technology while firing natural gas since natural gas has the lowest ash and sulfur content available. The permitted PM emission rates identified in Table 5-5 range from 0.002 to 0.008 lb/MMBtu, with most projects at 0.005 lb/MMBtu. The three most recent projects permitted in VA cover the full range of these permitted limits. The reason for the difference in permitted PM emission from the auxiliary boiler is most likely due to differences in vendor specified emission rates.

Based upon recent PSD BACT determinations, 0.005 lb/MMBtu was selected as BACT for the auxiliary boiler.

5.3.5 Sulfur Dioxide (SO_2) and Sulfuric Acid Mist (H_2SO_4)

Sulfur dioxide and sulfuric acid mist are emitted from the auxiliary boiler as a result of the oxidation of the sulfur in the fuel. The only practical means for controlling SO_2 and H_2SO_4 emissions from the auxiliary boiler is to limit the sulfur content of the fuel. The Project proposes BACT to be the use of pipeline quality natural gas with a sulfur content no greater than 0.5 gr/100 scf of gas, or approximately 0.0014 lbs SO_2/MMBtu.

5.3.6 Greenhouse Gases

As discussed in Section 5.2.8, there are three control mechanisms for reducing GHG emissions from combustion processes: (1) low carbon-emitting fuels; (2) carbon capture and storage (CCS); and (3) energy efficiency.

The combined cycle combustion turbines account for 99% of the facility's GHG emissions. As discussed in Section 5.2.8, CCS is not technically or economically feasible for the GHG emissions from the combustion turbines. Since CCS becomes more feasible at larger scales, it is concluded that it is not feasible for the auxiliary boiler as it is not feasible for the combined cycle combustion turbines.

BACT for the auxiliary boiler is proposed to be firing natural gas as the sole fuel and efficient boiler design.

5.4 Emergency Generator and Fire Pump Engines

The Project will include an emergency diesel generator engine and a diesel fire pump engine. Both engines will be fired with ULSD fuel. Both engines will be used only during emergency situations, with the exception of periodic maintenance/readiness testing, and will be limited to a maximum of 500 operating hours per rolling 12 month period.

There are no post-combustion controls that have been demonstrated in practice for small, emergency internal combustion engines. In order to satisfy BACT requirements, CPV Smyth proposes that the engines meet NSPS 40 CFR 60 Subpart IIII requirements. Under 40 CFR 60 Subpart IIII, the emergency generator engine must meet the Tier 2 standards and the fire pump engine must meet the Tier 3 standards for off-road diesel engines under 40 CFR 89. Emissions will be controlled through the use of ULSD, engine design, good combustion practices and limited annual operation. With the exception of emergency situations, the engines will only operate for maintenance and readiness testing purposes; operation for these purposes shall be limited to 100 hours per year. The specific BACT emission limits for each engine are provided in Table 5-6.

Table 5-6: Emergency Engine Emission Standards

Pollutant	Emergency Generator Tier 2 Standard (g/kW-hr)	Fire Pump Tier 3 Standard (g/kW-hr)
NO_x	6.4[1]	4.0[2]
CO	3.5	3.5
VOC	1.3[1]	0.5[2]
$PM/PM_{10}/PM_{2.5}$	0.2	0.2
SO_2[3]	N/A	N/A

[1] Tier 2 standard for NO_x and VOC is 6.4 g/kWh, combined. To estimate potential emissions, assumed NO_x emissions equal to this level and VOC emissions equal to the older Tier 1 limit of 1.3 g/kWh.

[2] Tier 3 standard for NO_x and VOC is 6.4 g/kWh, combined. To estimate potential emissions, assumed NO_x emissions equal to this level and VOC emissions equal to 0.5 g/kWh.

[3] SO_2 emissions will be limited based upon a maximum fuel sulfur content of 15 ppm (0.0015 lb/MMBtu).

5.5 Fugitive GHG Emission Sources

The project will include natural gas handling systems and sulfur hexafluoride (SF_6) containing circuit breakers. Fugitive losses of natural gas and SF_6 will contribute to GHG emissions from the Project. At this time, the CPV Smyth does not have the design details necessary (i.e., number of natural gas pipeline connections and circuit breaker SF_6 capacity) to quantify fugitive CO_2e emissions from this equipment. Although fugitive CO_2e emissions cannot be quantified at this time, the project will implement current BACT standards for these emission sources, including the following:

- The facility will implement an auditory/visual/olfactory leak detection program for the natural gas piping components and make daily observations.
- The facility will equip the circuit breaker with a low pressure alarm and low pressure lockout. SF_6 emissions from the circuit breaker will be calculated annually (calendar year) in accordance with

the mass balance approach in Equation DD-1 of 40 CFR Part 98, Subpart DD. The maximum annual leakage rate for SF_6 will not exceed 1% of the total SF_6 storage capacity of the plant's circuit breakers.

- The facility shall maintain records of all measurements and reports related to the fugitive emission sources including those related to maintenance as well as compliance with the Monitoring and QA/QC defined under 40 CFR 98.304 Subpart DD.

APPENDIX A

Application Forms

DOCUMENT CERTIFICATION

Facility Name: CPV Smyth Generation Company, LLC

Registration No. ____________________

Facility Location: Atkins, VA

Type of Submittal Attached: Major NSR Air Permit Application

Certification: I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering and evaluating the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name of Responsible Official (Print): Peter Podurgiel

Title: Sr. Vice President

Signature: [signature] Date: 1/30/14

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY - AIR PERMITS

LOCAL GOVERNING BODY CERTIFICATION FORM

Facility Name: CPV Smyth Generation Company	Registration Number:
Applicant's Name: CPV Smyth Generation Company, LLC	Name of Contact Person at the site: Gener Gotiangco
Applicant's Mailing address: 8403 Colesville Road Suite 915 Silver Spring, MD 20910	Contact Person Telephone Number: (240) 723-2307

Facility location (also attach map): The proposed Project will be constructed on a 108 acre parcel at a greenfield location in Atkins, VA. Facility site is located in east-central Smyth County, 4 miles east-northeast of Marion, VA, approximately 0.5 miles south of Interstate 81.

Facility type, and list of activities to be conducted: 700 MW combined-cycle natural gas-fired power generating facility with two combustion turbines and associated duct burners. The facility will run as a base load plant with both combustion turbines operating concurrently but the facility will have the capability of operating with a single combustion turbine. Additional plant equipment will include an auxiliary boiler, emergency generator engine, emergency fire pump engine, aqueous ammonia storage tank; air cooled condenser; and various electrical transmission and switching equipment.

The applicant is in the process of completing an application for an air pollution control permit from the Virginia Department of Environmental Quality. In accordance with § 10.1-1321.1. Title 10.1, Code of Virginia (1950), as amended, before such a permit application can be considered complete, the applicant must obtain a certification from the governing body of the county, city or town in which the facility is to be located that the location and operation of the facility are consistent with all applicable ordinances adopted pursuant to Chapter 22 (§§ 15.2-2200 et seq.) of Title 15.2. The undersigned requests that an authorized representative of the local governing body sign the certification below.

Applicant's signature:	Date:

The undersigned local government representative certifies to the consistency of the proposed location and operation of the facility described above with all applicable local ordinances adopted pursuant to Chapter 22 (§§15.2-2200 et seq.) of Title 15.2. of the Code of Virginia (1950) as amended, as follows:

(Check one block)

☐ The proposed facility is **fully consistent** with all applicable local ordinances.

☐ The proposed facility is **inconsistent** with applicable local ordinances; see attached information.

Signature of authorized local government representative:	Date:
Type or print name:	Title:
County, city or town:	

[THE LOCAL GOVERNMENT REPRESENTATIVE SHOULD FORWARD THE SIGNED CERTIFICATION TO THE APPROPRIATE DEQ REGIONAL OFFICE AND SEND A COPY TO THE APPLICANT.]

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY - AIR PERMITS

<table>
<tr><th colspan="2">LOCAL GOVERNING BODY CERTIFICATION FORM</th></tr>
<tr><td>Facility Name: CPV Smyth Generation Company</td><td>Registration Number:</td></tr>
<tr><td>Applicant's Name: CPV Smyth Generation Company, LLC</td><td>Name of Contact Person at the site:
Gener Gotiangco</td></tr>
<tr><td>Applicant's Mailing address: 8403 Colesville Road
Suite 915
Silver Spring, MD 20910</td><td>Contact Person Telephone Number:
(240) 723-2307</td></tr>
<tr><td colspan="2">Facility location (also attach map): The proposed Project will be constructed on a 108 acre parcel at a greenfield location in Atkins, VA. Facility site is located in east-central Smyth County, 4 miles east-northeast of Marion, VA, approximately 0.5 miles south of Interstate 81.</td></tr>
<tr><td colspan="2">Facility type, and list of activities to be conducted: 700 MW combined-cycle natural gas-fired power generating facility with two combustion turbines and associated duct burners. The facility will run as a base load plant with both combustion turbines operating concurrently but the facility will have the capability of operating with a single combustion turbine. Additional plant equipment will include an auxiliary boiler, emergency generator engine, emergency fire pump engine, aqueous ammonia storage tank; air cooled condenser; and various electrical transmission and switching equipment.</td></tr>
<tr><td colspan="2">The applicant is in the process of completing an application for an air pollution control permit from the Virginia Department of Environmental Quality. In accordance with § 10.1-1321.1. Title 10.1, Code of Virginia (1950), as amended, before such a permit application can be considered complete, the applicant must obtain a certification from the governing body of the county, city or town in which the facility is to be located that the location and operation of the facility are consistent with all applicable ordinances adopted pursuant to Chapter 22 (§§ 15.2-2200 <u>et seq</u>.) of Title 15.2. The undersigned requests that an authorized representative of the local governing body sign the certification below.</td></tr>
<tr><td>Applicant's signature:</td><td>Date:</td></tr>
<tr><td colspan="2">The undersigned local government representative certifies to the consistency of the proposed location and operation of the facility described above with all applicable local ordinances adopted pursuant to Chapter 22 (§§15.2-2200 et seq.) of Title 15.2. of the Code of Virginia (1950) as amended, as follows:

(Check one block)

☑ The proposed facility is fully consistent with all applicable local ordinances.

☐ The proposed facility is inconsistent with applicable local ordinances; see attached information.</td></tr>
<tr><td>Signature of authorized local government representative: Clegg Williams</td><td>Date: 1/29/14</td></tr>
<tr><td>Type or print name: Clegg Williams</td><td>Title: Building & Zoning Administrator</td></tr>
<tr><td colspan="2">County, city or town: Smyth County</td></tr>
</table>

[THE LOCAL GOVERNMENT REPRESENTATIVE SHOULD FORWARD THE SIGNED CERTIFICATION TO THE APPROPRIATE DEQ REGIONAL OFFICE AND SEND A COPY TO THE APPLICANT.]

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY – 2014 AIR PERMIT APPLICATION FEE

As of July 1, 2012, air permit applications are subject to a fee. The fee does not apply to administrative amendments or true minor sources. Applications will be considered incomplete if the proper fee is not paid and will not be processed until full payment is received. Air permit application fees are not refundable.
Fees are adjusted every January 1st for CPI. THIS FORM IS VALID JANUARY 1, 2013 TO DECEMBER 31, 2013.
Send this form and a check (or money order) payable to "Treasurer of Virginia" to:
Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, VA 23218

Send a copy of this form with the permit application to:
The DEQ Regional Office

Please retain a copy for your records. Any questions should be directed to the DEQ regional office to which the application will be submitted. **Unsure of your fee? Contact the Regional Air Permit Manager.**

COMPANY NAME:	**CPV Smyth Generation Company, LLC**	**FIN:**	
COMPANY REPRESENTATIVE:	**Peter Podurgiel**	**REG. NO.**	
MAILING ADDRESS:	**50 Braintree Hill Office Park Suite 300 Braintree, MA 02184**		
BUSINESS PHONE:	**(781) 848-2786**	**FAX:**	**(240) 723-2339**
FACILITY NAME:	**CPV Smyth Generation Company**		
PHYSICAL LOCATION:	**Atkins, VA**		

PERMIT ACTIVITY	APPLICATION FEE AMOUNT	CHECK ONE
Sources subject to Title V permitting requirements:		
• Major NSR permit (Articles 7, 8, 9)	$30,970	X
• Major NSR permit amendment (Articles 7, 8, 9) *	$7,226	
• State major permit (Article 6)	$15,485	
• Title V permit (Articles 1, 3)	$20,647	
• Title V permit renewal (Articles 1, 3)	$10,323	
• Title V permit modification (Articles 1, 3)	$3,613	
• Minor NSR permit (Article 6)	$1,548	
• Minor NSR amendment (Article 6) *	$774	
• State operating permit (Article 5)	$7,226	
• State operating permit amendment (Article 5) *	$3,613	
Sources subject to Synthetic Minor permitting requirements:		
• Minor NSR permit (Article 6)	$516	
• Minor NSR amendment (Article 6) *	$258	
• State operating permit (Article 5)	$1,548	
• State operating permit amendment (Article 5) *	$825	
*FEES DO NOT APPLY TO ADMINISTRATIVE AMENDMENTS		

DEQ OFFICE TO WHICH PERMIT APPLICATION WILL BE SUBMITTED (check one)

☒ SWRO/Abingdon	☐ NRO/Woodbridge	☐ PRO/Richmond	**FOR DEQ USE ONLY** Date: ____ DC #: ____
☐ VRO/Harrisonburg	☐ BRRO/Lynchburg or Roanoke	☐ TRO/Virginia Beach	Reg. No.: ____

Commonwealth of Virginia
Department of Environmental Quality

AIR PERMIT APPLICATION
CHECK ALL PAGES ATTACHED AND LIST ALL ATTACHED DOCUMENTS

1	Local Government Certification Form, Page 2
1	Application Fee Form, Pages 3
1	Document Certification Form, Page 1
1	General Information, Pages 5-6
1	Fuel Burning Equipment, Page 7
1	Stationary Internal Combustion Engines, Page 8
___	Incinerators,
___	Processing,
___	Inks, Coatings, Stains, and Adhesives,
___	VOC/Petroleum Storage Tanks, Pages
___	Loading Rack and Oil-Water Separators,
___	Fumigation Operations,
1	Air Pollution Control and Monitoring Equipment, Page 9
1	Air Pollution Control/Supplemental Information, Page 10
1	Stack Parameters and Fuel Data, Page 11
1	Proposed Permit Limits for Criteria Pollutants, Page 12
1	Proposed Permit Limits for Toxic Pollutants/HAPs, Page 13
1	Proposed Permit Limits for Other Reg. Pollutants, Page 14
1	Proposed Permit Limits for GHGs on Mass Basis, Page 15
1	Proposed Permit Limits for GHGs on CO_2e Basis, Page 16
___	BAE for Criteria Pollutants, Page 27
___	BAE for GHGs on Mass Basis, Page 28
___	BAE for GHGs on CO_2e Basis, Page 29
1	Operating Periods, Page 30
___	ATTACHED DOCUMENTS:
1	Map of Site Location
1	Facility Site Plan
___	Process Flow Diagram/Schematic
___	MSDS or CPDS Sheets
8	Estimated Emission Calculations
___	Stack Tests
___	Air Modeling Data
___	Confidential Information (see Instructions)
1	BACT Analysis (see Section 5)

Check added form sheets above; also indicate the number of copies of each form in blank provided.

DOCUMENT CERTIFICATION FORM

I certify under penalty of law that this document and all attachments [as noted above] were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering and evaluating the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I certify that I understand that the existence of a permit under [Article 6 of the Regulations] does not shield the source from potential enforcement of any regulation of the board governing the major NSR program and does not relieve the source of the responsibility to comply with any applicable provision of the major NSR regulations.

SIGNATURE:	[signature]	DATE:	1-30-14
NAME:	Peter Podurgiel	REGISTRATION NO:	
TITLE:	Sr. Vice President	COMPANY:	CPV Smyth Generation Company, LLC
PHONE:	(781) 848-2786	ADDRESS:	50 Braintree Hill Office Park, Suite 300
EMAIL:	ppodurgiel@cpv.com		Braintree, MA 02184

References: Virginia Regulations for the Control and Abatement of Air Pollution (Regulations), 9 VAC 5-20-230B and 9 VAC 5-80-1140E.

GENERAL INFORMATION

Person Completing Form: Steven Babcock	Date: 01/27/2014	Registration Number:
Company and Division Name: Tetra Tech		FIN: 95-4148514
Mailing Address: 160 Federal St., 3rd Floor Boston, MA 02110		
Exact Source Location – Include Name of City (County) and Full Street Address or Directions: Atkins, VA		
Telephone Number:	No. of Employees:	Property Area at Site:
Person to Contact on Air Pollution Matters – Name and Title: Gener Gotiangco Vice President	Phone Number: (240) 723-2307 Fax: (240) 723-2339 Email: GGotiangco@cpv.com	
Latitude and Longitude Coordinates OR UTM Coordinates of Facility:		

Reason(s) for Submission (Check all that apply):

☐ State Operating Permit — This permit is applied for pursuant to provisions of the Virginia Administrative Code, 9 VAC 5 Chapter 80, Article 5 (SOP)

☒ New Source

☐ Modification of a Source

☐ Relocation of a Source

This permit is applied for pursuant to the following provisions of the Virginia Administrative Code:
- ☐ 9 VAC 5 Chapter 80, Article 6 (Minor Sources)
- ☒ 9 VAC 5 Chapter 80, Article 8 (PSD Major Sources)
- ☐ 9 VAC 5 Chapter 80, Article 9 (Non-Attainment Major Sources)

☐ Amendment to a Permit Dated: ________ Permit Type: ☐ SOP (Art. 5) ☐ NSR (Art. 6, 8, 9)

Amendment Type:
- ☐ Administrative Amendment
- ☐ Minor Amendment
- ☐ Significant Amendment

This amendment is requested pursuant to the provisions of:

☐ 9 VAC 5-80-970 (Art. 5 Adm.)	☐ 9 VAC 5-80-1935 (Art. 8 Adm.)
☐ 9 VAC 5-80-980 (Art. 5 Minor)	☐ 9 VAC 5-80-1945 (Art. 8 Minor)
☐ 9 VAC 5-80-990 (Art. 5 Sig.)	☐ 9 VAC 5-80-1955 (Art. 8 Sig.)
☐ 9 VAC 5-80-1270 (Art. 6 Adm.)	☐ 9 VAC 5-80-2210 (Art. 9 Adm.)
☐ 9 VAC 5-80-1280 (Art. 6 Minor)	☐ 9 VAC 5-80-2220 (Art. 9 Minor)
☐ 9 VAC 5-80-1290 (Art. 6 Sig.)	☐ 9 VAC 5-80-2230 (Art. 9 Sig.)

☐ Other (specify): ____________

Explanation of Permit Request (attach documents if needed):

Application for a proposed combined cycle electric generating facility required to obtain a Major NSR Air Permit subject to Prevention of Significant Deterioration requirements. This document contains a detailed description of the project and potential emission estimates for all pollutants.

For Portable Plants: NOT APPLICABLE

Is this facility designed to be portable? [ ] Yes [X] No

- If yes, is this facility already permitted as a portable plant? [ ] Yes [ ] No Permit Date: ____

If not permitted, is this an application to be permitted as a portable plant? [ ] Yes [ ] No

If permitted as a portable facility, is this a notification of relocation? [ ] Yes [ ] No

- Describe the new location or address (include a site map): ____
- Will the portable facility be co-located with another source? [ ] Yes [ ] No Reg. No. ____
- Will the portable facility be modified or reconstructed as a result of the relocation? [ ] Yes [ ] No
- Will there be any new emissions other than those associated with the relocation? [ ] Yes [ ] No
- Is the facility suitable for the area to which it will be located? (attach documentation) [ ] Yes [ ] No

Describe the products manufactured and/or services performed at this facility:

A proposed 714 MW combined-cycle natural gas-fired power generating facility with two combustion turbines and associated duct burners. The facility will run as a base load plant with both combustion turbines operating concurrently but the facility will have the capability of operating with a single combustion turbine. Additional plant equipment will include an auxiliary boiler, emergency generator engine, emergency fire pump engine, aqueous ammonia storage tank; air cooled condenser; and various electrical transmission and switching equipment.

List the Standard Industrial Classification (SIC) Code(s) for the facility:

4911

List the North American Industry Classification System (NAICS) Code(s) for the facility:

221112

List all the facilities in Virginia under common ownership or control by the owner of this facility:

Not Applicable

Milestones: This section is to be completed if the permit application includes a new emissions unit or modification to existing operations.

Milestones*:	Starting Date:	Estimated Completion Date:
New Equipment Installation	January 2015	April 2016
Modification of Existing Process or Equipment		
Start-up Dates	May 2017	

*For new or modified installations to be constructed in phased schedule, give construction/installation starting and completion date for each phase.

FUEL BURNING EQUIPMENT: (Boilers, Turbines, Kilns, and Other External Combustion Units)

Company Name: CPV Smyth Generation Company, LLC	**Date:** 01/27/2014	**Registration Number:**

Unit Ref. No.	Equipment Manufacturer, Type, and Model Number	Date of Manuf.	Date of Const.	Max. Rated Input Heat Capacity For Each Fuel (Million Btu/hr)	Type of Fuel	Type of Equip. (use Code A)	Usage (use Code B)	Requested Throughput* (hrs/yr OR fuel/yr)	Federal Regulations that Apply
CT1	Alstom GT24 Combustion Turbine #1			2,270 @ -10°F	Natural Gas	19	6	8,760 hrs/yr	40 CFR 60 Subpart KKKK
CT2	Alstom GT24 Combustion Turbine #2			2,270 @ -10°F	Natural Gas	19	6	8,760 hrs/yr	40 CFR 60 Subpart KKKK
DB1	Duct Burner #1 (Vogt or equivalent)			431	Natural Gas	12	6	1,259 MMCF/yr of natural gas	40 CFR 60 Subpart KKKK
DB2	Duct Burner #2 (Vogt or equivalent)			431	Natural Gas	12	6	1,259 MMCF/yr of natural gas	40 CFR 60 Subpart KKKK
AB	CB Nebraska Model NB-300D-70 Auxiliary Boiler (or equivalent)			92.4	Natural Gas	12	4	359.5 MMCF/yr of natural gas	40 CFR 60 Subpart Dc 40 CFR 63 Subpart JJJJJJ

[X] Estimated Emission Calculations Attached (include references of emission factors) and/or Stack Test Results if Available

Code A – Equipment

BOILER TYPE:
1. Pulverized Coal - Wet Bottom
2. Pulverized Coal - Dry Bottom
3. Pulverized Coal - Cyclone Furnace
4. Circulating Fluidized Bed
5. Spreader Stoke
6. Chain or Travelling Grate Stoker
7. Underfeed Stoker
8. Hand Fired Coal
9. Oil, Tangentially Fired
10. Oil, Horizontally Fired (except rotary cup)
11. Gas, Tangentially Fired
12. Gas, Horizontally Fired
13. Wood with Flyash Reinjection
14. Wood without Flyash Reinjection
15. Other (specify): Natural Gas Heater

OTHER COMBUSTION UNITS:
16. Oven / Kiln
17. Rotary Kiln
18. Process Furnace
19. Other (specify) Combustion Turbine

Code B - Usage

1. Steam Production
2. Drying / Curing
3. Space Heating
4. Process Heat
5. Food Processing
6. Electrical Generation
7. Mechanical Work
8. Other (specify) ______________

***Pick only one option for a requested throughput.**

STATIONARY INTERNAL COMBUSTION ENGINES:

Company Name: CPV Smyth Generation Company, LLC	**Date:** 01/27/2014	**Registration Number:**

Unit Ref. No.	Equipment Manufacturer, Type, and Model Number	Date of Manuf.	Date of Const.	Output Brake Horsepower (bhp)	Output Electrical Power (kW)	Type of Fuel	Usage* (use Code C)	Requested Throughput** (hrs/yr OR fuel/yr)	Federal Regulations that Apply
EG	Emergency diesel fired generator engine. Make & model TBD			N/A	1,500	Diesel (15 ppmw S)	1	500 hrs/yr	40 CFR 60 Subpart IIII 40 CFR 63 Subpart ZZZZ
FP	Emergency diesel fired fire pump engine. Make & model TBD			315	N/A	Diesel (15 ppmw S)	1	500 hrs/yr	40 CFR 60 Subpart IIII 40 CFR 63 Subpart ZZZZ

[X] Estimated Emission Calculations Attached (include references of emission factors and manufacturer specifications per engine) and/or Stack Test Results if Available

Code C = Usage

1. Emergency Generator
2. Participates in Emergency Load Response Program
3. Non-Emergency Generator
4. Participates in Demand Response Program(s)
5. Other (specify) ____________________

***Can pick more than one option**
(i.e. 1 and 2 **OR** 3 and 4)

****Pick only one option for a requested throughput.**

AIR POLLUTION CONTROL AND MONITORING EQUIPMENT:

Company Name: CPV Smyth Generation Company, LLC	**Date:** 01/27/2014	**Registration Number:**

Unit Ref. No.	Vent/ Stack No.	Device Ref. No.	Pollutant/Parameter	Air Pollution Control Equipment			Monitoring Instrumentation
				Manufacturer and Model No.	Type (use Code N)	Percent Efficiency (%)	Specify Type, Measured Pollutant, and Recorder Used
CT1 & DB1	1	SCR1	NOx	TBD	16	90	40 CFR 75 Compliant CEMS & DAHS for NO_x & O_2
CT1 & DB1	2	OC1	CO	TBD	11	90	40 CFR 60 Compliant CEMS & DAHS for CO
CT2 & DB2	1	SCR2	NOx	TBD	16	90	40 CFR 75 Compliant CEMS & DAHS for NO_x & O_2
CT2 & DB2	2	OC2	CO	TBD	11	90	40 CFR 60 Compliant CEMS & DAHS for CO

☐ Manufacturer Specifications Included **(To be provided once vendor is selected)**

Code N – Type of Air Pollution Control Equipment

1. Settling Chamber
2. Cyclone
3. Multicyclone
4. Cyclone scrubber
5. Orifice scrubber
6. Mechanical scrubber
7. Venturi scrubber
   a. Fixed throat
   b. Variable throat
8. Mist eliminator
9. Filter
   a. Baghouse
   b. Other:__________
10. Electrostatic Precipitator
    a. Hot side
    b. Cold side
    c. High voltage
    d. Low voltage
    e. Single stage
    f. Two stage
    g. Other:__________
11. Catalytic Afterburner
12. Direct Flame Afterburner
13. Diesel Oxidation Catalyst (DOC)
14. Thermal Oxidizer
15. Regenerative Thermal Oxidizer (RTO)
16. Selective Catalytic Reduction (SCR)
17. Selective Non-Catalytic Reduction (SNCR)
17. Absorber
    a. Packed tower
    b. Spray tower
    c. Tray tower
    d. Venturi
    e. Other:__________
18. Adsorber
    a. Activated carbon
    b. Molecular sieve
    c. Activated alumina
    d. Silica gel
    e. Other:__________
19. Condenser (specify)
20. Other:__________

AIR POLLUTION CONTROL EQUIPMENT - SUPPLEMENTAL INFORMATION:

Company Name: CPV Smyth Generation Company, LLC	Date: 01/27/2014	Registration Number:

Device Ref. No.	Type (use Code N)	Liquid Flow Rate (gpm) (4, 5, 6, 7, 17 ,19)	Liquid Medium (4, 5, 6, 7, 17, 19)	Cleaning Method (9, 10, 17, 18)	Number of Fields (10)	Number of Sections (9, 10)	Air to Cloth Ratio (fpm) (9)	Filter Material (9)	Inlet Temp. (°F)	Regeneration Method & Cycle Time (sec) (18)	Chamber Temp. (°F) (11, 12, 14, 15)	Retention Time (sec) (11, 12, 14, 15)	Pressure Drop (inch H_2O) (3, 4, 5, 6, 7, 9, 17)
SCR1	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	650*	N/A	650*	TBD	TBD
OC1	11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	650*	N/A	650*	TBD	TBD
SCR2	16	N/A	N/A	N/A	N/A	N/A	N/A	N/A	650*	N/A	650*	TBD	TBD
OC2	11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	650*	N/A	650*	TBD	TBD

* Design value at steady state operation.

<u>NOTE:</u> Numbers listed in parenthesis in the columns above represent the Control Equipment in Code N below.

Code N = Type of Air Pollution Control Equipment

1. Settling Chamber
2. Cyclone
3. Multicyclone
4. Cyclone scrubber
5. Orifice scrubber
6. Mechanical scrubber
7. Venturi scrubber
   a. Fixed throat
   b. Variable throat
8. Mist eliminator
9. Filter
   a. Baghouse
   b. Other:________________
10. Electrostatic Precipitator
    a. Hot side
    b. Cold side
    c. High voltage
    d. Low voltage
    e. Single stage
    f. Two stage
    g. Other:________________
11. Catalytic Afterburner
12. Direct Flame Afterburner
13. Diesel Oxidation Catalyst (DOC)
14. Thermal Oxidizer
15. Regenerative Thermal Oxidizer (RTO)
16. Selective Catalytic Reduction (SCR)
17. Selective Non-Catalytic Reduction (SNCR)
17. Absorber
    a. Packed tower
    b. Spray tower
    c. Tray tower
    d. Venturi
    e. Other:________________
18. Adsorber
    a. Activated carbon
    b. Molecular sieve
    c. Activated alumina
    d. Silica gel
    e. Other:________________
19. Condenser (specify)
20. Other:________________

STACK PARAMETERS AND FUEL DATA:

Company Name: CPV Smyth Generation Company, LLC	Date: 01/27/2014	Registration Number:

Unit Ref. No.	Vent/ Stack No.	Vent/Stack or Exhaust Data						Fuel(s) Data				
		Vent/Stack Config. (use Code O)	Vent/Stack Height (feet)	Exit Diameter (feet)	Exit Gas Velocity (ft/sec)	Exit Gas Flow Rate (acfm)	Exit Gas Temp. (°F)	Type of Fuel	Heating Value* (Btu/____)	Max. Rated Burned/hr (specify units)	Max. Sulfur %	Max. Ash %
CT1 & DB1	1	5	Determined via modeling	22	17.5-46.6	4,300,000 – 12,400,000	170 - 204	Natural Gas	1,028 Btu/ft^3 (40CFR98, Sub. C)	2,587 MMCF/hr (CT & DB)	0.0009	N/A
CT2 & DB2	2	5	Determined via modeling	22	17.5-46.6	4,300,000 – 12,400,000	170 - 204	Natural Gas	1,028 Btu/ft^3 (40CFR98, Sub. C)	2,587 MMCF/hr (CT & DB)	0.0009	N/A
AB	3	5	30	4	26.0 @ 100% load	19,580	260	Natural Gas	1,028 Btu/ft^3 (40CFR98, Sub. C)	0.090 MMCF/hr	0.0009	N/A
EG	5	5	10	1.25	150 @ 100% load	11,061	763	Diesel	138,000 Btu/gal (40CFR98, Sub. C)	104.8 gal/hr	0.0015	N/A
FP	6	5	10	0.42	171 @ 100% load	1,400	961	Diesel	138,000 Btu/gal (40CFR98, Sub. C)	15.9 gal/hr	0.0015	N/A

Code O – Vent/Stack Configuration

1. Stack discharging downward, or nearly download
2. Equivalent stack representing a combination of multiple actual stacks
3. Gooseneck stack
4. Stack discharging in a horizontal direction
5. Stack with an unobstructed opening discharge in a vertical direction
6. Vertical stack with a weather cap or equivalent obstruction in exhaust system

*** Specify units for each heating value in Btus per unit of fuel.**

PROPOSED PERMIT LIMITS FOR CRITERIA POLLUTANTS:

Company Name: CPV Smyth Generation Company, LLC	Date: 01/27/2014	Registration Number:

Unit Ref. No.	Proposed Permit Limits for Criteria Pollutants															
	PM [a] (Particulate Matter)		PM-10 [a,b] (10 µM or smaller particulate matter)		PM 2.5 [a,b] (2.5 µM or smaller particulate matter)		SO_2 (Sulfur Dioxide)		NO_X (Nitrogen Oxides)		CO (Carbon Monoxide)		VOC [a] (Volatile Organic Compounds)		Pb (Lead)	
	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
CT1 & DB1	12.9	39.5	12.9	39.5	12.9	39.5	3.8	13.2	19.6	74.7	11.9	47.7	6.8	22.1	N/A	N/A
CT2 & DB2	12.9	39.5	12.9	39.5	12.9	39.5	3.8	13.2	19.6	74.7	11.9	47.7	6.8	22.1	N/A	N/A
AB	0.46	0.92	0.46	0.92	0.46	0.92	0.13	0.26	1.01	2.02	3.42	6.83	0.47	0.94	N/A	N/A
EG	0.66	0.17	0.66	0.17	0.66	0.17	0.022	0.01	21.2	5.29	11.6	2.89	4.30	1.07	N/A	N/A
FP	0.10	0.03	0.10	0.03	0.10	0.03	0.003	0.001	2.07	0.52	1.81	0.45	0.26	0.06	N/A	N/A
TOTAL:	27.0	80.1	27.0	80.1	27.0	80.1	7.76	26.6	63.5	157.2	40.6	105.6	18.6	46.3		

[X] Estimated Emission Calculations Attached (totals and per Unit Ref. No.)

[a] PM, PM-10, PM 2.5, and VOC should also be split up by component and reported under the Proposed Permit Limits for Toxic Pollutants/HAPs.

[b] PM-10 and PM 2.5 includes filterable and condensable.

PROPOSED PERMIT LIMITS FOR TOXIC POLLUTANTS/HAPS:

Company Name: CPV Smyth Generation Company, LLC	**Date:** 01/27/2014	**Registration Number:**

Unit Ref. No.	Proposed Permit Limits for Toxic/HAP Pollutants*															
	HAP Name: Acrolein **CAS #:** 107028		**HAP Name:** Formaldehyde **CAS #:** 50000		**HAP Name:** Cadmium **CAS #:** 7440439		**HAP Name:** **CAS #:**		**HAP Name:** **CAS #:**		**HAP Name:** **CAS #:**		**HAP Name:** **CAS #:**		**HAP Name:** **CAS #:**	
	lbs/hr	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**
CT1	0.0145	0.064	0.250	1.09	0.0025	0.0109										
CT2	0.0145	0.064	0.250	1.09	0.0025	0.0109										
TOTAL:	0.029	0.127	0.499	2.19	0.0050	0.0219										

[X] Estimated Emission Calculations Attached (totals and per Unit Ref. No.)

*** Specify the name of the toxic pollutant/HAP for each Unit Ref. No. along with the respective CAS Number.** Toxic Pollutant means a pollutant on the designated list in the Form 7 Instructions document. Particulate matter and volatile organic compounds are not toxic pollutants as generic classes of substances, but individual substances within these classes may be toxic pollutants because their toxic properties or because a TLV (tm) has been established.

PROPOSED PERMIT LIMITS FOR OTHER REGULATED POLLUTANTS:

Company Name: CPV Smyth Generation Company, LLC	**Date:** 01/27/2014	**Registration Number:**	

Unit Ref. No.	Proposed Permit Limits for Other Regulated Pollutants*															
	Pollutant Name: Ammonia		Pollutant Name: Sulfuric Acid		Pollutant Name: CO_2e		Pollutant Name:		Pollutant Name:		Pollutant Name:		Pollutant Name:		Pollutant Name:	
	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
CT1 & DB1	18.1	65.2	2.5	8.6	321,399	1,156,440										
CT2 & DB2	18.1	65.2	2.5	8.6	321,399	1,156,440										
AB	N/A	N/A	0.01	0.02	10,813	21,627										
EG	N/A	N/A	0.0017	0.0004	2,366	592										
FP	N/A	N/A	0.0003	0.0001	360	90										
TOTAL:	36.2	130.4	5.0	17.2	656,337	2,335,189										

[X] Estimated Emission Calculations Attached (totals and per Unit Ref. No.)

* **Other Regulated Pollutant** include Fluorides, Sulfuric Acid Mist, Hydrogen Sulfide (H_2S), Total Reduced Sulfur (including H_2S), Reduced Sulfur Compounds (including H_2S), Municipal Waste Combustor Organics (measured as total tetra-through octa-chlorinated dibenzo-p-dioxins and dibenzofurans), Municipal

Waste Combustor Metals (measured as particulate matter), Municipal Waste Combustor Acid Gases (measured as the sum of SO_2 and HCl), and Municipal Solid Waste Landfill Emissions (measured as nonmethane organic compounds).

PROPOSED PERMIT LIMITS FOR GREENHOUSE GASES (GHGs) ON MASS BASIS: FOR PSD MAJOR SOURCES ONLY

Company Name: CPV Smyth Generation Company, LLC	Date: 01/27/2014	Registration Number:

Unit Ref. No.	Proposed Permit Limits for GHG Pollutants on Mass Basis													
	CO_2 (Carbon Dioxide)		N_2O (Nitrous Oxide)		CH_4 (Methane)		HFCs (Hydrofluoro-carbons)		PFCs (Perfluoro-carbons)		SF_6 (Sulfur Hexafluoride)		Total GHGs	
	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
CT1 & DB1	321,071	1,155,266	0.60	2.14	5.96	21.4	N/A	N/A	N/A	N/A	N/A	N/A	321,078	1,155,290
CT2 & DB2	321,071	1,155,266	0.60	2.14	5.96	21.4	N/A	N/A	N/A	N/A	N/A	N/A	321,078	1,155,290
AB	10,802	21,605	0.020	0.041	0.204	0.41	N/A	N/A	N/A	N/A	N/A	N/A	10,802	21,606
EG	2,359	590	0.019	0.0048	0.096	0.024	N/A	N/A	N/A	N/A	N/A	N/A	2,359	590
FP	359	90	0.0029	0.0007	0.015	0.0036	N/A	N/A	N/A	N/A	N/A	N/A	359	90
TOTAL:	655,662	2,332,816	1.24	4.33	12.2	43.3							655,676	2,335,189

[X] Estimated Emission Calculations Attached (totals and per Unit Ref. No.)

PROPOSED PERMIT LIMITS FOR GREENHOUSE GASES (GHGs) ON CO_2 EQUIVALENT EMISSIONS (CO_2e) BASIS: <u>FOR PSD MAJOR SOURCES ONLY</u>

Company Name: CPV Smyth Generation Company, LLC	Date: 01/27/2014	Registration Number:

Unit Ref. No.	Proposed Permit Limits for GHG Pollutants on CO_2 Equivalent Basis													
	CO_2 (Carbon Dioxide)		N_2O (Nitrous Oxide)		CH_4 (Methane)		HFCs (Hydrofluoro-carbons)		PFCs (Perfluoro-carbons)		SF_6 (Sulfur Hexafluoride)		Total GHGs	
	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
CT1 & DB1	321,071	1,155,266	179	638	149	535	N/A	N/A	N/A	N/A	N/A	N/A	321,399	1,156,440
CT2 & DB2	321,071	1,155,266	179	638	149	535	N/A	N/A	N/A	N/A	N/A	N/A	321,399	1,156,440
AB	10,802	21,605	6	13	4	9	N/A	N/A	N/A	N/A	N/A	N/A	10,813	21,627
EG	2,359	590	6	1	2	0.5	N/A	N/A	N/A	N/A	N/A	N/A	2,366	592
FP	359	90	1	0.2	0.03	0.08	N/A	N/A	N/A	N/A	N/A	N/A	360	90
TOTAL:	655,662	2,332,816	371	1,290	280	1,080	N/A	N/A	N/A	N/A	N/A	N/A	656,337	2,355,189

[X] Estimated Emission Calculations Attached (totals and per Unit Ref. No.)

OPERATING PERIODS:

Company Name: CPV Smyth Generation Company, LLC	Date: 01/27/2014	Registration Number:

Unit Ref. No.	Percent Annual Use/Throughput by Season				Normal Process/Equipment Operating Schedule			Maximum Process/Equipment Operating Schedule		
	December February	March May	June August	September November	Hours per Day	Days per Week	Weeks per Year	Hours per Day	Days per Week	Weeks per Year
CT1	25	25	25	25	24	7	52	24	7	52
CT2	25	25	25	25	24	7	52	24	7	52
DB1	25	25	25	25	24	5	25	≤ 3,000 hours per year dependent upon demand		
DB2	25	25	25	25	24	5	25	≤ 3,000 hours per year dependent upon demand		
AB	25	25	25	25	12	2	52	≤ 4,000 hours per year dependent upon demand		
EG	25	25	25	25	1	1	52	≤ 500 hours per year dependent upon duration of emergency situations		
FP	25	25	25	25	1	1	52	≤ 500 hours per year dependent upon duration of emergency situations		

Maximum Facility Operating Schedule		
Hours per Day	Days per Week	Weeks per Year
24	7	52

APPENDIX B

Emission Calculations

Summary of Facility-Wide Potential Annual Emissions
CPV Smyth Generation Company, LLC

Facility-Wide Potential Annual Emissions (TPY)

Pollutant	Unit 1 (CT & HRSG) (tpy)	Unit 2 (CT & HRSG) (tpy)	Auxiliary Boiler (tpy)	Emergency Generator (tpy)	Fire Pump (tpy)	Facility Total (tpy)
NO_x	74.7	74.7	2.02	5.29	0.52	157.2
CO	47.7	47.7	6.83	2.89	0.45	105.6
VOC	22.1	22.1	0.94	1.07	0.06	46.3
SO_2	13.2	13.2	0.26	0.005	0.001	26.6
$PM/PM_{10}/PM_{2.5}$	39.5	39.5	0.92	0.17	0.03	80.1
CO2	1,155,266	1,155,266	21,605	590	89.69	2,332,816
CH4	21.4	21.4	0.407	0.024	0.0036	43.3
N2O	2.14	2.14	0.041	0.005	0.0007	4.33
CO_2e	1,156,440	1,156,440	21,627	592	90	2,335,189
H_2SO_4	8.6	8.6	0.02	0.0004	0.0001	17.3
Lead (Pb)	4.5E-03	4.5E-03	9.1E-05	2.8E-06	4.2E-07	0.009
NH_3	65.2	65.2	N/A	N/A	N/A	130.3
Total HAPS	4.17	4.17	0.35	0.02	0.004	8.7

Vendor Emissions from Combustion Turbines & Duct Burner
CPV Smyth Generation Company, LLC

AMBIENT CONDITIONS:			**100°F**					**90°F**		
ALSTOM CASE #:	**#22**	**#21**	**#8**	**#9**	**#10**	**#20**	**#19**	**#3**	**#4**	**#5**
Number of GTs Operating	2	2	2	2	2	2	2	2	2	2
Operating Load	100%	100%	75%	50%	4%	100%	100%	75%	50%	4%
Fuel Heating Value, Btu/lb (LHV)	20,885	20,885	20,885	20,885	20885.00	20,885	20885.00	20,885	20,885	20,885
Fuel Heating Value, Btu/lb (HHV)	23,156	23,156	23,156	23,156	23156.00	23,156	23156.00	23,156	23,156	23,156
Eavporative Cooler Status	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
Duct Burner Status	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
Chiller Status	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF
Ambient Relative Humidity, %	100	100	30	30	30.00	100	100.00	50	50	50
BAROMETRIC PRESSURE, psia	14.38	14.38	14.38	14.38	15.38	16.38	17.38	18.38	19.38	20.38
GT Heat Input (MMBtu/hr/unit, LHV)	1,827	1,827	1,200	914	355	1,827	1,827	1,245	944	363
GT Heat Input (MMBtu/hr/unit, HHV)	2,026	2,026	1,331	1,013	394.08	2,026	2025.88	1,381	1,047	402
DB Heat Input (MMBtu/hr/unit, LHV)	389	0	0	0	0.00	389	0.00	0	0	0
DB Heat Input (MMBtu/hr/unit, HHV)	431	0	0	0	0	431	0	0	0	0
Net Power (kW)	703,900	604,600	385,000	274,900	55,300	711,800	611,400	406,900	290,100	58,600
Gross Power (kW)	705,400	606,100	386,500	276,400	56800.00	713,300	612900.00	408,400	291,600	60,100
Heat Rate (Btu/kW-hr, gross)	6,967	6,685	6,887	7,333	13876.02	6,890	6610.79	6,762	7,181	13,380
HRSG STACK EXHAUST GAS										
Exhaust Flow, lb/hr	3,745,747	3,727,139	2,511,261	2,063,268	1428654.10	3,745,747	3727138.90	2,562,907	2,096,519	1,443,985
Stack Temprature, °F	182.7	204.1	178.7	174.2	195.6	178.5	195.5	175.1	170.4	193.8
O_2, Vol. %	10.00%	11.79%	11.87%	12.49%	15.97%	10.00%	11.79%	11.65%	12.28%	15.84%
CO_2, Vol. %	4.93%	4.11%	3.99%	3.71%	2.11%	4.93%	4.11%	4.05%	3.76%	2.13%
H_2O, Vol. %	10.87%	9.26%	9.80%	9.25%	6.17%	10.87%	9.26%	10.38%	9.83%	6.68%
N_2, Vol. %	73.33%	73.96%	73.45%	73.66%	74.85%	73.33%	73.96%	73.04%	73.26%	74.47%
Ar, Vol. %	0.88%	0.88%	0.88%	0.88%	0.90%	0.88%	0.88%	0.87%	0.88%	0.89%
MW, lb/lb-mole	28.22	28.32	28.25	28.28	28.48	28.22	28.32	28.19	28.23	28.43
HRSG EXHAUST STACK EMISSIONS (PER STACK):										
NOX, ppmvd @ 15% O 2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NOX, lb/hr as NO2	17.8	14.7	9.7	7.4	2.9	17.8	14.7	10.0	7.6	2.9
VOC, ppmvd @ 15% O 2 as CH4	2.0	1.0	1.0	1.0	2.0	2.0	1.0	1.0	1.0	2.0
VOC, lb/hr as CH4	6.2	2.6	1.7	1.3	1.0	6.2	2.6	1.7	1.3	1.0
CO, ppmvd @ 15% O 2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
CO, lb/hr	10.8	8.9	5.9	4.5	1.7	10.8	8.9	6.1	4.6	1.8
SO2, lb/hr	3.2	2.7	1.8	1.3	0.5	3.2	2.7	1.8	1.4	0.5
H2SO4, lb/hr	2.0	1.7	1.1	0.9	0.3	2.0	1.7	1.2	0.9	0.3
H2SO4, lb/MMBtu	0.00081	0.00084	0.00083	0.00089	0.00076	0.00081	0.00084	0.00087	0.00086	0.00075
$PM/PM_{10}/PM_{2.5}$, lb/hr	12.0	7.2	8.7	8.0	2.1	12.0	7.2	9.0	8.2	2.1
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0049	0.0036	0.0065	0.0079	0.0053	0.0049	0.0036	0.0065	0.0078	0.0052
NH_3, ppmvd @ 15% O 2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH_3, lb/hr	16.5	13.6	8.9	6.8	2.6	16.5	13.6	9.3	7.0	2.7
CO_2, lb/hr	292,053	240,790	158,189	120,456	46,839	292,053	240,790	164,123	124,443	47,791
CH_4, lb/hr	5.42	4.47	2.93	2.23	0.87	5.42	4.47	3.04	2.31	0.89
N_2O, lb/hr	0.54	0.45	0.29	0.22	0.09	0.54	0.45	0.30	0.23	0.09
CO_2e, lb/hr	292,350	241,035	158,350	120,579	46,887	292,350	241,035	164,290	124,569	47,839
CO_2e, lb/MW-hr (gross)	828.9	795.4	819.4	872.5	1650.9	819.7	786.5	804.6	854.4	1592.0

V[illegible]r Emissions from Combustion Turbines & Duct Burner
CPV Smyth Generation Company, LLC

AMBIENT CONDITIONS:	59°F				-10°F				
ALSTOM CASE #:	#11	#12	#13	#14	#23	#15	#16	#17	#18
Number of GTs Operating	2	2	2	2	2	2	2	2	2
Operating Load	100%	75%	50%	5%	100%	100%	75%	50%	5%
Fuel Heating Value, Btu/lb (LHV)	20,885	20,885	20,885	20,885	20,885	20,885	20,885	20,885	20,885
Fuel Heating Value, Btu/lb (HHV)	23,156	23,156	23,156	23,156	23,156	23,156	23,156	23,156	23,156
Eavporative Cooler Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Chiller Status	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
Ambient Relative Humidity, %	60	60	60	60	60	60	60	60	60
BAROMETRIC PRESSURE, psia	15.38	16.38	17.38	18.38		19.38	20.38	21.38	22.38
GT Heat Input (MMBtu/hr/unit, LHV)	1,775	1,347	1,013	380	2,047	2,047	1,535	1,156	404
GT Heat Input (MMBtu/hr/unit, HHV)	1,968	1,493	1,123	422	2,270	2,270	1,702	1,282	448
DB Heat Input (MMBtu/hr/unit, LHV)	0	0	0	0	389	0	0	0	0
DB Heat Input (MMBtu/hr/unit, HHV)	0	0	0	0	431	0	0	0	0
Net Power (kW)	600,500	449,100	316,800	61,300	797,700	693,700	516,600	366,900	65,000
Gross Power (kW)	602,000	450,600	318,300	62,800	799,200	695,200	518,100	368,400	66,500
Heat Rate (Btu/kW-hr, gross)	6,538	6,627	7,057	13,432	6,760	6,531	6,571	6,960	13,463
HRSG STACK EXHAUST GAS									
Exhaust Flow, lb/hr	3,655,834	2,698,747	2,184,041	1,504,290	4,110,576	4,091,969	3,016,883	2,345,388	1,575,354
Stack Temprature, °F	187.3	173.6	170.2	197.5	167.5	196.7	181.5	171.8	194.5
O_2, Vol. %	11.91%	11.67%	12.30%	16.09%	10.17%	11.82%	11.66%	11.95%	16.19%
CO_2, Vol. %	4.07%	4.18%	3.89%	2.15%	4.96%	4.21%	4.28%	4.15%	2.19%
H_2O, Vol. %	8.98%	9.20%	8.64%	5.26%	9.76%	8.29%	8.42%	8.17%	4.49%
N_2, Vol. %	74.15%	74.07%	74.28%	75.60%	74.22%	74.80%	74.74%	74.84%	76.22%
Ar, Vol. %	0.89%	0.89%	0.89%	0.90%	0.89%	0.89%	0.89%	0.89%	0.91%
MW, lb/lb-mole	28.35	28.34	28.37	28.58	28.34	28.44	28.42	28.44	28.67
HRSG EXHAUST STACK EMISSIONS (PER STACK):									
NOX, ppmvd @ 15% O 2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NOX, lb/hr as NO2	14.3	10.8	8.1	3.1	19.6	16.5	12.3	9.3	3.2
VOC, ppmvd @ 15% O 2 as CH4	1.0	1.0	1.0	2.0	2.0	1.0	1.0	1.0	2.0
VOC, lb/hr as CH4	2.5	1.9	1.4	1.1	6.8	2.9	2.2	1.6	1.1
CO, ppmvd @ 15% O 2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
CO, lb/hr	8.7	6.6	5.0	1.9	11.9	10.0	7.5	5.7	2.0
SO2, lb/hr	2.6	2.0	1.5	0.6	3.8	3.0	2.3	1.7	0.6
H2SO4, lb/hr	1.7	1.3	0.9	0.4	2.5	1.9	1.4	1.1	0.4
H2SO4, lb/MMBtu	0.00086	0.00087	0.00080	0.00095	0.00093	0.00084	0.00082	0.00086	0.00089
$PM/PM_{10}/PM_{2.5}$, lb/hr	7.0	9.0	8.5	2.2	12.9	8.0	9.4	9.0	2.4
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0036	0.0060	0.0076	0.0052	0.0048	0.0035	0.0055	0.0070	0.0054
NH_3, ppmvd @ 15% O 2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH_3, lb/hr	13.2	10.0	7.5	2.8	18.1	15.2	11.4	8.6	3.0
CO_2, lb/hr	233,909	177,466	133,485	50,130	321,071	269,808	202,307	152,383	53,204
CH_4, lb/hr	4.34	3.29	2.48	0.93	5.96	5.01	3.75	2.83	0.99
N_2O, lb/hr	0.43	0.33	0.25	0.09	0.60	0.50	0.38	0.28	0.10
CO_2e, lb/hr	234,147	177,647	133,621	50,181	321,397	270,082	202,513	152,538	53,258
CO_2e, lb/MW-hr (gross)	777.9	788.5	839.6	1598.1	804.3	777.0	781.8	828.1	1601.8

Summary of Annual Emissions
CPV Smyth Generation Company, LLC

1/27/2014

Startup/Shutdown Operating Data

hot starts/unit	250	number/yr	0.93	hours/event	0	Min hours downtime with event	55.8	minutes per event
warm starts/unit	0	number/yr	2.10	hours/event	8	Min hours downtime with event	125.8	minutes per event
cold starts/unit	50	number/yr	2.99	hours/event	60	Min hours downtime with event	179.5	minutes per event
Transition To/From Low Load	250	number/yr	0.40	hours/event	0	Min hours downtime with event	24.0	minutes per event
shutdowns/unit	300	number/yr	0.18	hours/event	0	Min hours downtime with event	10.7	minutes per event

Startup/Shutdown Emissions Self-Correcting Analysis

		NOx	CO	VOC
Emissions per hot start	lbs	50.0	47.0	38.8
Emissions per warm start	lbs	56.0	71.0	69.0
Emissions per cold start	lbs	61.0	77.0	73.0
Emissions per transition	lbs	2.9	32.0	48.0
Emissions per shutdown	lbs	4.6	17.0	25.0
Hot start - duration (including downtime)	hrs	0.9	0.9	0.9
Warm start - duration (including downtime)	hrs	10.1	10.1	10.1
Cold start - duration (including downtime)	hrs	63.0	63.0	63.0
Transition - duration (including downtime)	hrs	0.4	0.4	0.4
Shutdown - duration of event (include downtime	hrs	0.2	0.2	0.2
Hot start - avg hourly emissions	lb/hr	51.14	47.69	39.08
Warm start - avg hourly emissions	lb/hr	5.55	7.03	6.83
Cold start - avg hourly emissions	lb/hr	0.97	1.22	1.16
Transition - avg hourly emissions	lb/hr	4.82	33.20	48.66
Shutdown - avg hourly emissions	lb/hr	17.83	25.04	28.26
Steady state average hourly (annual)	lb/hr	16.12	9.80	3.97
Transition hourly emissions (-10°F)	lb/hr	3.20	2.00	1.10
Hot start - self correcting?	lb/hr	no	no	no
Warm start - self correcting?	lb/hr	yes	yes	no
Cold start - self correcting?	lb/hr	yes	yes	yes
Transition - self correcting?	lb/hr	yes	no	no
shutdown - self correcting?	lb/hr	no	no	no

Startup/Shutdown Potential Emissions Increase (tpy/unit)

SUSD Type	NOx	CO	VOC
Hot Start	4.07	4.40	4.08
Warm Start	-	-	0.00
Cold Start	-	-	-
Transition	-	1.17	2.23
Shutdown	0.05	0.41	0.65
TOTAL	**4.11**	**4.81**	**4.73**

Emissions From Ancillary Equipment
CPV Smyth Generation Company, LLC

Emissions from Ancillary Equipment (tpy)

Pollutant	Auxiliary Boiler	Emergency Generator	Fire Pump
	92.4 MMBtu/hr	1500 kW	235 kW
NO_x	9 ppmvd @ 3% O_2	6.4 g/BHP	4.0 g/kW
	0.011 lb/MMBtu	1.46 lb/MMBtu	0.94 lb/MMBtu
	1.010 lb/hr	21.16 lb/hr	2.07 lb/hr
	2.02 TPY	5.29 TPY	0.52 TPY
CO	50 ppmvd @ 3% O_2	3.5 g/kW	3.5 g/kW
	0.0370 lb/MMBtu	0.80 lb/MMBtu	0.82 lb/MMBtu
	3.4158 lb/hr	11.57 lb/hr	1.81 lb/hr
	6.83 TPY	2.89 TPY	0.45 TPY
VOC	12 ppmvd @ 3% O_2	1.3 g/kW	0.5 g/kW
	0.0051 lb/MMBtu	0.16 lb/MMBtu	0.10 lb/MMBtu
	0.4691 lb/hr	4.30 lb/hr	0.26 lb/hr
	0.94 TPY	1.07 TPY	0.06 TPY
$PM_{10}/PM_{2.5}$	N/A ppmvd @ 3% O_2	0.2 g/kW	0.2 g/kW
	0.005 lb/MMBtu	0.01 lb/MMBtu	0.01 lb/MMBtu
	0.4620 lb/hr	0.66 lb/hr	0.10 lb/hr
	0.92 TPY	0.17 TPY	0.03 TPY
SO_2	0.0014 lb/MMBtu	0.00 lb/MMBtu	0.00 lb/MMBtu
	0.1294 lb/hr	0.02 lb/hr	0.00 lb/hr
	0.26 TPY	0.01 TPY	0.001 TPY
H_2SO_4	0.00011 lb/MMBtu	0.00011 lb/MMBtu	0.00011 lb/MMBtu
	0.0099 lb/hr	0.00166092 lb/hr	0.00025266 lb/hr
	0.02 TPY	0.0004 TPY	0.0001 TPY
Pb	4.8E-07 lb/MMBtu	1.4E-05 lb/MMBtu	1.4E-05 lb/MMBtu
	4.5E-05 lb/hr	2.0E-04 lb/hr	0.0000308 lb/hr
	8.9E-05 TPY	5.1E-05 TPY	7.7E-06 TPY
CO_2	116.9 lb/MMBtu	163.1 lb/MMBtu	163.1 lb/MMBtu
	10,802 lb/hr	2,359 lb/hr	359 lb/hr
	21,605 TPY	590 TPY	90 TPY
CH_4	0.0022 lb/MMBtu	0.0066 lb/MMBtu	0.0066 lb/MMBtu
	0.2037 lb/hr	0.096 lb/hr	0.015 lb/hr
	0.41 TPY	0.0239 TPY	0.0036 TPY
N_2O	0.00022 lb/MMBtu	0.0013 lb/MMBtu	0.0013 lb/MMBtu
	0.0204 lb/hr	1.9E-02 lb/hr	0.0029106 lb/hr
	0.041 TPY	4.8E-03 TPY	7.3E-04 TPY
CO_2e	10,814 lb/hr	2,367 lb/hr	360 lb/hr
	21,627 TPY	592 TPY	90 TPY

NOTES:

Natural Gas SO2 emissions based upon a sulfur content of 0.5 gr/100 dscf
ULSD SO2 emissions based upon a sulfur content of 15 ppmw
Aux Boiler and Gas Heater criteria pollutant emission factors from BACT analysis
Emergency Generator criteria polluant emission factors based on Tier 2 emission standards in 40 CFR 89.
Fire Pump criteria pollutant emission factors based on post -2009 emission standards in 40 CFR 60 Subpart IIII.
H2SO4 emissions assume a 5% conversion of SO2 --> SO3 (on a molar basis)
Fuel specific CO2, CH4 and N2O emission factors from 40 CFR 98, Subpart C
Pb emission factor for ULSD from AP-42 Section 3.1

Potential HAP Emissions
CPV Smyth Generation Company, LLC

HAP	Emission Rates										Total (tpy)
	(2) CTGs		(2) HRSGs		Auxiliary Boiler		Em. Generator		Fire Pump		
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	
Organic Compounds											
Acetaldehyde	4.00E-05	1.57E-01	4.00E-05	3.45E-02			0.00	3.64E-04	7.67E-04	1.69E-03	7.42E-01
Acrolein	6.40E-06	2.52E-02	6.40E-06	5.52E-03			0.00	1.14E-04	9.25E-05	2.04E-04	1.19E-01
Benzene	1.20E-05	4.72E-02	1.20E-05	1.04E-02	2.10E-06	1.94E-04	7.76E-04	1.12E-02	9.33E-04	2.05E-03	2.26E-01
1,3-Butadiene	4.30E-07	1.69E-03	4.30E-07	3.71E-04					3.91E-05	8.60E-05	7.99E-03
Dichlorobenzene					0.00	1.11E-04					2.22E-04
Ethylbenzene	3.20E-05	1.26E-01	3.20E-05	2.76E-02							5.93E-01
Formaldehyde	1.10E-04	4.33E-01	3.50E-04	3.02E-01	7.40E-05	6.84E-03	7.89E-05	1.14E-03	1.18E-03	2.60E-03	2.36E+00
Hexane					1.80E-03	1.66E-01					3.33E-01
Propylene oxide	2.90E-05	1.14E-01	2.90E-05	2.50E-02			0.00	5.57E-02	3.56E-03	7.83E-03	5.53E-01
Toluene	1.30E-04	5.12E-01	1.30E-04	1.12E-01	0.00	3.05E-04	0.00	4.06E-03	4.09E-04	9.00E-04	2.41E+00
Xylene	6.40E-05	2.52E-01	6.40E-05	5.52E-02			1.93E-04	2.79E-03	2.85E-04	6.27E-04	1.19E+00
PAHs											
Acenaphthene					0.00	1.66E-07	0.00	6.77E-05	1.42E-06	3.12E-06	1.80E-05
Acenaphthylene					0.00	2.22E-07	0.00	1.33E-04	5.06E-05	1.11E-04	6.16E-05
Anthracene					1.80E-09	1.66E-07	1.23E-06	1.78E-05	1.87E-06	4.11E-06	5.81E-06
Benzo(a)anthracene					0.00	1.66E-07	0.00	9.00E-06	1.68E-06	3.70E-06	3.51E-06
Benzo(a)pyrene					0.00	1.11E-07	0.00	3.72E-06	1.88E-07	4.14E-07	1.25E-06
Benzo(b)fluoranthene					1.80E-09	1.66E-07	1.11E-06	1.61E-05	9.91E-08	2.18E-07	4.40E-06
Benzo(g,h,i)perylene					1.20E-09	1.11E-07	5.56E-07	8.04E-06	4.89E-07	1.08E-06	2.50E-06
Benzo(k)fluoranthene					1.80E-09	1.66E-07	2.18E-07	3.15E-06	1.55E-07	3.41E-07	1.21E-06
Chrysene					1.80E-09	1.66E-07	1.53E-06	2.21E-05	3.53E-07	7.77E-07	6.06E-06
Dibenz(a,h)anthracene					1.20E-09	1.11E-07	3.46E-07	5.00E-06	5.83E-07	1.28E-06	1.79E-06
7,12-Dimethylbenz(a) anthracene					1.60E-08	1.48E-06					2.96E-06
Fluoranthene					2.90E-09	2.68E-07	4.03E-06	5.83E-05	7.61E-06	1.67E-05	1.93E-05
Fluorene					2.70E-09	2.49E-07	1.28E-05	1.85E-04	2.92E-05	6.42E-05	6.28E-05
Indeno(1,2,3-cd)pyrene					1.80E-09	1.66E-07	4.14E-07	5.99E-06	3.75E-07	8.25E-07	2.04E-06
3-Methylchloranthrene					1.80E-09	1.66E-07					3.33E-07
2-Methylnaphthalene					2.40E-08	2.22E-06					4.44E-06
Naphthalene	1.30E-06	5.12E-03	1.30E-06	1.12E-03	0.000	5.73E-05	0.000	1.88E-03	8.48E-05	1.87E-04	2.47E-02
Phenanthrene					1.70E-08	1.57E-06	4.08E-05	5.90E-04	2.94E-05	6.47E-05	1.67E-04
Pyrene					4.90E-09	4.53E-07	3.71E-06	5.37E-05	4.78E-06	1.05E-05	1.69E-05
TOTAL PAH	2.20E-06	8.66E-03	2.20E-06	1.90E-03	6.80E-07	6.28E-05	2.12E-04	3.07E-03	1.68E-04	3.70E-04	4.18E-02
Metals											
Arsenic	2.00E-07	7.87E-04	2.00E-07	1.73E-04	2.00E-07	1.85E-05	4.62E-08	6.68E-07	4.62E-08	1.02E-07	3.74E-03
Beryllium	1.20E-08	4.72E-05	1.20E-08	1.04E-05	1.20E-08	1.11E-06					2.25E-04
Cadmium	1.10E-06	4.33E-03	1.10E-06	9.49E-04	1.10E-06	1.02E-04	5.13E-09	7.42E-08	5.13E-09	1.13E-08	2.06E-02
Chromium	1.40E-06	5.51E-03	1.40E-06	1.21E-03	1.40E-06	1.29E-04	1.24E-05	1.79E-04	1.24E-05	2.73E-05	2.63E-02
Chromium VI	2.50E-07	9.84E-04	2.50E-07	2.16E-04	2.50E-07	2.31E-05	2.24E-06	3.24E-05	2.24E-06	4.93E-06	4.69E-03
Cobalt	8.20E-08	3.23E-04	8.20E-08	7.07E-05	8.20E-08	7.58E-06					1.53E-03
Lead	4.90E-07	1.93E-03	4.90E-07	4.23E-04	4.90E-07	4.53E-05	7.69E-07	1.11E-05	7.69E-07	1.69E-06	9.18E-03
Manganese	3.70E-07	1.46E-03	3.70E-07	3.19E-04	3.70E-07	3.42E-05	2.82E-07	4.08E-06	2.82E-07	6.20E-07	6.93E-03
Mercury	2.50E-07	9.84E-04	2.50E-07	2.16E-04	2.50E-07	2.31E-05	1.03E-08	1.49E-07	1.03E-08	2.27E-08	4.68E-03
Nickel	2.10E-06	8.27E-03	2.10E-06	1.81E-03	2.10E-06	1.94E-04	1.48E-06	2.14E-05	1.48E-06	3.26E-06	3.93E-02
Selenium	2.40E-08	9.45E-05	2.40E-08	2.07E-05	2.40E-08	2.22E-06	2.56E-07	3.70E-06	2.56E-07	5.63E-07	4.50E-04
Max. Single HAP											**2.4**

Potential HAP Emissions
CPV Smyth Generation Company, LLC

HAP	Emission Rates										Total (tpy)
	(2) CTGs		(2) HRSGs		Auxiliary Boiler		Em. Generator		Fire Pump		
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	
Total All HAPs	4.34E-04	1.71E+00	6.74E-04	5.81E-01	1.89E-03	1.74E-01	5.65E-03	8.18E-02	7.66E-03	1.69E-02	8.7

Notes:
1. Blank entry indicates no emission factor reportedin the reference cited.
2. Organic HAP emission factors for CTGs are from Table 3.1-3 of AP-42 except for formaldehyde which is based on the California Air Resources Board air toxics emission factor database. H2SO4 is based on vendor performance data. Metal HAP emission factors are from AP-42 Table 1.4-4.
3. Emission factors for the auxiliary boiler are from AP-42 Tables 1.4-3 and 1.4-4.
4. Emission factors for organics the emergency diesel generator are from AP-42 Tables 3.4-3 and 3.4-4 for the fire pump Table 3.3-2.
5. Metal emissions for the emergency generator and fire pump are based on the paper "Survey of Ultra-Trace Metals in Gas Turbine Fuels", 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detectedin any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit was used.
6. Hexavalent chrome is based on 18% of the total chrome emissions per EPA 453/R-98-004a.
7. H2SO4 emissions for aux boiler, emergency generator and fire pump are based on 5% of SO2 emissions (mass basis).

8. TPY based upon the following annual operating hours: CTGs - 8,760; HRSGs - 3000; Aux Boiler - 4,000; Gas Heater - 2,000; Em. Engines - 500.

Potential VA Air Toxics Emissions
CPV Smyth Generation Company, LLC

HAP	(2) CTG Emission Rates		TLV-TWA	TLV-STEL	Emissions Threshold	Emissions Threshold	Modeling	SAAC 1-Hour	SAAC Annual
	lb/hr	TPY	(mg/m³)	(mg/m³)	(lb/hr)	(tpy)	Required?	(ug/m³)	(ug/m³)
Acetaldehyde	1.82E-01	6.90E-01	180	270	8.91E+00	2.61E+01	N	N/A	N/A
Acrolein	2.91E-02	1.10E-01	0.23	0.69	2.28E-02	3.34E-02	Y	17.25	0.46
Benzene	5.45E-02	2.07E-01	32		2.11E+00	4.64	N	N/A	N/A
1,3-Butadiene	1.95E-03	7.41E-03	22		1.45E+00	3.19	N	N/A	N/A
Ethylbenzene	1.45E-01	5.52E-01	434	543	1.79E+01	6.29E+01	N	N/A	N/A
Formaldehyde	4.99E-01	1.90E+00	1.2	2.5	8.25E-02	1.74E-01	Y	62.5	2.4
Propylene oxide	1.32E-01	5.00E-01	48		3.17E+00	6.96	N	N/A	N/A
Toluene	5.90E-01	2.24E+00	377	565.00	1.86E+01	54.67	N	N/A	N/A
Xylene	2.91E-01	1.10E+00	434	651	2.15E+01	6.30E+01	N	N/A	N/A
Naphthalene	5.90E-03	2.24E-02	52	79	2.61E+00	7.54E+00	N	N/A	N/A
Arsenic	9.08E-04	3.45E-03	0.2		1.32E-02	0.03	N	N/A	N/A
Beryllium	5.45E-05	2.07E-04	0.002		1.32E-04	0.00	N	N/A	N/A
Cadmium	4.99E-03	1.90E-02	0.05		3.30E-03	7.25E-03	Y	2.5	0.1
Chromium	6.36E-03	2.41E-02	0.5		3.30E-02	7.25E-02	N	N/A	N/A
Chromium VI	1.14E-03	4.31E-03	0.05		3.30E-03	0.01	N	N/A	N/A
Cobalt	3.72E-04	1.41E-03	0.05		3.30E-03	0.01	N	N/A	N/A
Lead	2.22E-03	8.45E-03	0.15		9.90E-03	2.18E-02	N	N/A	N/A
Manganese	1.68E-03	6.38E-03	5		3.30E-01	0.73	N	N/A	N/A
Mercury	1.14E-03	4.31E-03	0.05		3.30E-03	0.01	N	N/A	N/A
Nickel	9.53E-03	3.62E-02	1		6.60E-02	1.45E-01	N	N/A	N/A
Selenium	1.09E-04	4.14E-04	0.2		1.32E-02	2.90E-02	N	N/A	N/A

APPENDIX C

Equipment Specifications and Vendor Performance Data

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1 The corrections from 'Gross Output / Efficiency' to 'Net Output / Efficiency' reflects current aux. consumption/losses for Alstom equipment only.
2 Values for Information only.
3 Gas turbine output does not include the OTC heat rejection energy.
4 Ambient Pressure: 13.56 psia
5 Air Cooled Condenser
6 CO & SCR Catalyst considered for HRSG pressure drop calculations and stack emissions
7 PM10/PM2.5 measurements per EPA Method 201/a + 202
8 Particulate Matter exhaust emissions are the net emission values, i.e. the emission contribution above those pre-existing in the ambient air. Alstom therefore reserves the right to correct for the pre-existing ambient air quality if required.
9 Particulate matter emissions are often below the detection limits of most of the measuring systems. Therefore if no particulate matter is detected within maximum 4 hours of measurement, the particulate emission is deemed to have been fulfilled.
10 Particulate Matter emission limits are valid for steady state gas turbine operating conditions and are based on a three-hour average.
11 Prior to any Particulate Matter measurements, the gas turbine must be in operation continuously for at least 8 hours at or near base load. Gas turbine inlet and exhaust system are assumed to be fully commissioned and clean condition before the measurement.
12 Particulate Matter measurements may have to be repeated in order to fulfil the particulate emissions.
13 All values are based on the following fuel composition:

Constituent	Volume (%)
Nitrogen	0.664
Carbon Dioxide	0.548
Methane	96.2274
Ethane	2.175
Propane	0.26
Butane	0.08
Pentane	0.0[illegible]3
Hexane	0.016
Heptane	0.[illegible]2
Octane	[illegible]0006

Sulfur Content is 0.[illegible] grains/100 SCF Fuel

LHV (Btu/lb)	20885
HHV (Btu/lb)	23156

14 The performance summary is based on the following case descriptions:

CASE 1	2x100%, PO, 90F, 50% RH, EC+HF=ON, SF=ON
CASE 2	2x100%, PO, 90F, 50% RH, EC+HF=ON, SF=OFF
CASE 3	2x75%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF
CASE 4	2x50%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF
CASE 5	2xLLOC%, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF
CASE 6	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=ON
CASE 7	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=OFF
CASE 8	2x75%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF
CASE 9	2x50%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF
CASE 10	2xLLOC%, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF
CASE 11	2x100%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 12	2x75%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 13	2x50%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 14	2xLLOC%, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 15	2x100%, PO, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF
CASE 16	2x75%, PO, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF

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CASE 17	2x50%, PO, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF
CASE 18	2xLLOC%, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF
CASE 19	2x100%, PO, 90F, 50% RH, CH=ON*,SF=OFF
CASE 20	2x100%, PO, 90F, 50% RH, CH=ON*, SF=ON
CASE 21	2x100%, PO, 100F, 30% RH, CH=ON*,SF=OFF
CASE 22	2x100%, PO, 100F, 30% RH, CH=ON*, SF=ON
CASE 23	2x100%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=ON

PO Performance Optimized
LLOC Low Load Operating Concept
RH Relative Humidity
EC Evaporative Cooler
HF High Fogging
CH Chiller
APH Air Preheater
SF Supplementary Firing
* Chiller ON reduces inlet temperature to 50F

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Smyth County (USA): KA24-2 (2011) MS, ACC, SF

Performance Summary

01/06/2014
1AHV424657
Rev E

		CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10	CASE 11	CASE 12	CASE 13
		2x100%, PO, 90F, 50% RH, EC+HF=ON, SF=ON	2x100%, PO, 90F, 50% RH, EC+HF=ON, SF=OFF	2x75%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF	2x50%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF	2xLLOC%, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=ON	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=OFF	2x75%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF	2x50%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF	2xLLOC%, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF	2x100%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x75%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x50%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
Ambient Temperature	°F	90.0	90.0	90.0	90.0	90.0	100.0	100.0	100.0	100.0	100.0	59.0	59.0	59.0
Relative Humidity	%	50.0	50.0	50.0	50.0	50.0	30.0	30.0	30.0	30.0	30.0	60.0	60.0	60.0
Number of GTs Operating	-	2	2	2	2	2	2	2	2	2	2	2	2	2
Evap Cooler Status	-	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
High Fogging Status	-	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
Supplementary Firing	-	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Combined Cycle Performance														
Gross Output	MW	690.6	591.2	408.4	291.6	60.1	681.0	583.0	386.5	276.4	56.8	602.0	450.6	318.3
Gross Efficiency (LHV)	%	54.4	56.7	55.9	52.7	28.3	53.7	56.1	54.9	51.6	27.3	57.9	57.1	53.6
Gross Heat Rate (LHV)	Btu/kWh	6276	6017	6100	6476	12061	6350	6085	6211	6614	12509	5897	5977	6364
Net Output	MW	689.1	589.7	406.9	290.1	58.6	679.5	581.5	385.0	274.9	55.3	600.5	449.1	316.8
Net Efficiency (LHV)	%	54.25	56.56	55.73	52.42	27.58	53.62	55.93	54.72	51.31	26.56	57.72	56.90	53.36
Net Heat Rate (LHV)	Btu/kWh	6290	6032	6122	6509	12370	6364	6100	6235	6650	12848	5912	5997	6395
Gas Turbine														
GT Load %		100.0	100.0	75.0	50.0	LLOC	[illegible]	100.0	75.0	50.0	LLOC	100.0	75.0	50.0
Gross Output	MW	193.50	193.50	124.41	82.94	7.57	[illegible]	192.71	117.48	78.32	6.75	192.69	141.24	94.16
GT Heat Input (LHV)	MMBtu/hr	1778.74	1778.74	1245.42	944.31	362.65	[illegible]	1773.57	1200.39	914.06	355.43	1774.98	1346.67	1012.93
GT Heat Input (HHV)	MMBtu/hr	1972	1972	1381	1047	402	[illegible]	1966	[illegible]	1013	394	1968	1493	1123
Exhaust Gas Temperature	°F	1136.7	1136.7	1202.0	1202.0	929.4	1136.5	1136.5	1202.0	1202.0	936.8	1119.7	1198.8	1202.0
Exhaust Gas Mass Flow	lb/hr	3509150	3509150	2562907	2096519	1443985	3506293	[illegible]	2511261	2063268	1428654	3655834	2698747	2184041
GT Cooler Energy	MWth	19.66	19.66	13.46	8.11	[illegible]	19.85	19.85	14.22	8.81	3.91	25.72	10.90	5.96
HRSG														
DB Heat Input (per/HRSG) (LHV)	MMBtu/hr	389	0	0	0	0	389	0	0	0	0	0	0	0
DB Heat Input (per/HRSG) (HHV)	MMBtu/hr	431	0	0	0	0	431	0	0	0	0	0	0	0
Stack Outlet Temperature	°F	177.0	195.8	175.1	170.4	[illegible]	181.0	202.5	178.7	174.2	195.6	187.3	173.6	170.2
Stack Outlet Mass Flow	lb/hr	3527757.9	3509150.3	2562907.2	2096519.0	[illegible]	[illegible]	3506292.9	2511261.0	2063268.4	1428654.1	3655833.7	2698747.1	2184041.1
Gas Side Pressure Drop	in H2O	15.4	15.4	8.4	5.6	2.4	[illegible]	15.3	8.1	5.5	2.3	16.5	9.3	6.1
Steam Turbine														
Gross Output	MW	303.6	204.2	159.5	[illegible]	45.0	[illegible]	197.5	151.6	119.8	43.3	216.6	168.1	130.0
Condenser Pressure	psia	2.259	1.679	1.412	[illegible]	1.088	[illegible]	2.152	1.813	1.618	1.267	1.088	1.088	1.088
Stack Composition														
N2	vol %	70.71%	71.35%	73.04%	[illegible]	[illegible]	[illegible]	71.48%	73.45%	73.66%	74.85%	74.15%	74.07%	74.28%
O2	vol %	9.05%	10.92%	[illegible]	[illegible]	15.84%	9.10%	10.97%	11.87%	12.49%	15.97%	11.91%	11.67%	12.30%
H2O	vol %	14.34%	12.69%	10.38%	9.83%	[illegible]	14.17%	12.51%	9.80%	9.25%	6.17%	8.98%	9.20%	8.64%
CO2	vol %	5.05%	4.19%	4.05%	3.76%	2.13%	5.05%	4.18%	3.99%	3.71%	2.11%	4.07%	4.18%	3.89%
AR	vol %	0.85%	0.85%	[illegible]	0.88%	[illegible]	0.85%	0.85%	0.88%	0.88%	0.90%	0.89%	0.89%	0.89%
Emissions Per HRSG														
CO	ppmvd @ 15% O_2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
CO	lb/hr	10.6	8.7	6.1	4.0	1.8	10.6	8.7	5.9	4.5	1.7	8.7	6.6	5.0
CO_2	vol %	5.1%	4.2%	4.1%	3.8%	2.1%	5.0%	4.2%	4.0%	3.7%	2.1%	4.1%	4.2%	3.9%
CO_2	lb/hr	281544	231370	162064	122953	47518	280876	230702	156227	119034	46580	230992	175217	131866
NO_x	ppmvd @ 15% O_2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NO_x as NO_2	lb/hr	17.4	14.3	10.0	7.6	2.9	17.4	14.3	9.7	7.4	2.9	14.3	10.8	8.1
VOC (as CH4)	ppmvd @ 15% O_2	2.0	1.0	1.0	1.0	2.0	2.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0
VOC	lb/hr	6.1	2.5	1.7	1.3	1.0	6.1	2.5	1.7	1.3	1.0	2.5	1.9	1.4
SO_x as SO_2	lb/hr	3.2	2.6	1.8	1.4	0.5	3.2	2.6	1.8	1.3	0.5	2.6	2.0	1.5
H_2SO_4	lb/hr	2.0	1.7	1.2	0.9	0.3	2.0	1.7	1.1	0.9	0.3	1.7	1.3	0.9
PM10 (front half) Expected	lb/hr	6.4	5.2	6.1	4.6	1.8	6.4	5.2	5.9	4.5	1.7	5.2	6.6	5.0
PM10 (back half) inc. H_2SO_4 Expected	lb/hr	5.5	1.8	2.9	3.6	0.3	5.5	1.7	2.9	3.5	0.3	1.7	2.4	3.5
$PM_{10}/PM_{2.5}$ Total	lb/hr	11.9	7.0	9.0	8.2	2.1	11.9	7.0	8.7	8.0	2.1	7.0	9.0	8.5
NH_3	ppmvd @ 15% O_2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH_3	lb/hr	16.1	13.2	9.3	7.0	2.7	16.1	13.2	8.9	6.8	2.6	13.2	10.0	7.5

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Smyth County (USA): KA24-2 (2011) MS, ACC, SF

Performance Summary

01/06/2014
1AHV424657
Rev E

		CASE 14	CASE 15	CASE 16	CASE 17	CASE 18	CASE 19	CASE 20	CASE 21	CASE 22	CASE 23
		2xLLOC%, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x100%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x75%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x50%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2xLLOC%, -10F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x100%, PO, 90F, 50% RH, CH=ON,SF=OFF	2x100%, PO, 90F, 50% RH, CH=ON, SF=ON	2x100%, PO, 100F, 30% RH, CH=ON,SF=OFF	2x100%, PO, 100F, 30% RH, CH=ON, SF=ON	2x100%, PO, -10F, 60% RH, SF=ON
Ambient Temperature	°F	59.0	-10.0	-10.0	-10.0	-10.0	90.0	90.0	100.0	100.0	-10.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	100.0	100.0	100.0	100.0	60.0
Number of GTs Operating	-	2	2	2	2	2	2	2	2	2	2
Evap Cooler Status	-	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF
High Fogging Status	-	OFF	OFF	OFF	OFF	OFF	N/A	N/A	N/A	N/A	OFF
Supplementary Firing	-	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
Combined Cycle Performance											
Gross Output	MW	62.8	695.2	518.1	368.4	66.5	612.9	713.3	606.1	705.4	799.2
Gross Efficiency (LHV)	%	28.2	57.9	57.6	54.4	28.1	57.2	54.9	56.6	54.3	56.0
Gross Heat Rate (LHV)	Btu/kWh	12118	5890	5927	6277	12146	5963	6213	6029	6282	6096
Net Output	MW	61.3	693.7	516.6	366.9	65.0	611.4	711.8	604.6	703.9	797.7
Net Efficiency (LHV)	%	27.49	57.80	57.41	54.14	27.46	57.09	54.81	56.46	54.20	55.89
Net Heat Rate (LHV)	Btu/kWh	12414	5903	5944	6303	12427	5977	6226	6044	6296	6107
Gas Turbine											
GT Load %		LLOC	100.0	75.0	50.0	LLOC	1[illegible]0	100.0	100.0	100.0	100.0
Gross Output	MW	9.75	233.77	171.69	114.46	12.25	200[illegible]3	200.63	200.63	200.63	233.77
GT Heat Input (LHV)	MMBtu/hr	380.40	2047.39	1535.17	1156.33	403.73	[illegible]	1827.19	[illegible]827.19	1827.19	2047.39
GT Heat Input (HHV)	MMBtu/hr	422	2270	1702	1282	448	202[illegible]	2026	[illegible]26	2026	2270
Exhaust Gas Temperature	°F	903.8	1103.3	1159.7	1202.0	876.8	1118.3	[illegible]18.3	[illegible]118.3	1118.3	1103.3
Exhaust Gas Mass Flow	lb/hr	1504290	4091969	3016883	2345388	1575354	3[illegible]27139	372[illegible]39	3727139	3727139	4091969
GT Cooler Energy	MWth	3.53	20.24	7.07	5.20	[illegible]	24.85	[illegible]4.85	24.85	24.85	20.24
HRSG											
DB Heat Input (per/HRSG) (LHV)	MMBtu/hr	0	0	0	0	0	0	38[illegible]	0	389	389
DB Heat Input (per/HRSG) (HHV)	MMBtu/hr	0	0	0	0	0	0	431	0	431	431
Stack Outlet Temperature	°F	197.5	196.7	181.5	171.8	[illegible].5	195.5	[illegible]8.5	204.1	182.7	167.5
Stack Outlet Mass Flow	lb/hr	1504290.0	4091968.8	3016882.8	2345387[illegible]	157[illegible]953.9	37271[illegible]	3745746.5	3727138.9	3745746.5	4110576.0
Gas Side Pressure Drop	in H2O	2.5	20.6	11.5	7.1	2.7	1[illegible]2	17.2	17.2	17.2	20.6
Steam Turbine											
Gross Output	MW	43.3	227.6	174.7	[illegible]39.5	42.0	[illegible]1.6	312.1	204.9	304.2	331.7
Condenser Pressure	psia	1.088	1.088	1.088	[illegible]088	1.088	1.[illegible]	2.259	2.172	2.873	1.088
Stack Composition											
N2	vol %	75.60%	74.80%	74.74%	[illegible]84%	76.2[illegible]	[illegible].96%	73.33%	73.96%	73.33%	74.22%
O2	vol %	16.09%	11.82%	[illegible]	[illegible].95%	16.1[illegible]%	11.79%	10.00%	11.79%	10.00%	10.17%
H2O	vol %	5.26%	8.29%	8.42%	8.17%	[illegible]	9.26%	10.87%	9.26%	10.87%	9.76%
CO2	vol %	2.15%	4.21%	4.28%	4.15%	2.19%	4.11%	4.93%	4.11%	4.93%	4.96%
AR	vol %	0.90%	0.89%	[illegible]89%	0.89%	[illegible].91%	0.88%	0.88%	0.88%	0.88%	0.89%
Emissions Per HRSG											
CO	ppmvd @ 15% O_2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
CO	lb/hr	1.9	10.0	7.5	[illegible]	2.0	8.9	10.8	8.9	10.8	11.9
CO_2	vol %	2.2%	4.2%	4.3%	4.1%	2.2%	4.1%	4.9%	4.1%	4.9%	5.0%
CO_2	lb/hr	49846	266395	199724	150471	52897	237767	287941	237767	287941	316602
NO_x	ppmvd @ 15% O_2	2.0	2.0	2.0	[illegible].0	2.0	2.0	2.0	2.0	2.0	2.0
NO_x as NO_2	lb/hr	3.1	16.5	12.3	9.3	3.2	14.7	17.8	14.7	17.8	19.6
VOC (as CH4)	ppmvd @ 15% O_2	2.0	1.0	1.0	1.0	2.0	1.0	2.0	1.0	2.0	2.0
VOC	lb/hr	1.1	2.9	2.2	1.6	1.1	2.6	6.2	2.6	6.2	6.8
SO_x as SO_2	lb/hr	0.6	3.0	2.3	1.7	0.6	2.7	3.2	2.7	3.2	3.8
H_2SO_4	lb/hr	0.4	1.9	1.4	1.1	0.4	1.7	2.0	1.7	2.0	2.5
PM10 (front half) Expected	lb/hr	1.9	6.0	7.5	5.7	2.0	5.4	6.5	5.4	6.5	7.2
PM10 (back half) inc. H_2SO_4 Expected	lb/hr	0.4	2.0	1.9	3.3	0.4	1.8	5.5	1.8	5.5	5.7
$PM_{10}/PM_{2.5}$ Total	lb/hr	2.2	8.0	9.4	9.0	2.4	7.2	12.0	7.2	12.0	12.9
NH_3	ppmvd @ 15% O_2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH_3	lb/hr	2.8	15.2	11.4	8.6	3.0	13.6	16.5	13.6	16.5	18.1

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Plant Start-Up and Shutdown Emissions

KA24-2 Smyth County

Projects and Customer's Information:
KA24-2 (2011)
Space for Stamping (Review and Validation status)

Cross checked			
Department	Name	Date	Signature

Revision History					
Rev.	Revision Date	Created by	Checked by	Approved by	Brief Description
	Description current Revision				

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Main Contractor

ALSTOM

Alstom (Switzerland) Ltd., Brown Boveri Strasse 7, CH 5401-Baden

Replaces	Customer Code	ALSTOM Document Code	
Responsible dept. GASNAM-US	Created by E. Brown	Checked by M. Feeney	Approved by C. Dougherty / Format A4
Originator: ALSTOM POWER GAS BUSINESS	Document Type: Design Concept	Document Status: Electronically Released	
	Title, Subtitle: Plant Start-Up and Shutdown Emissions	Identification number: 1AHV423411	
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Table of Contents:

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1. Introduction

This document gives an indication of the CCPP exhaust emission per GT during cold, warm, and hot start-up conditions as well as the shutdown and low load transient operation for the Smyth County project. The start-up emissions consist from GT ignition to time when plant reaches full compliance (2 ppmvd @ 15% O2 CO and 2 ppmvd @ 15% O2 NOx), i.e., when CO & SCR catalyst are fully operational and assumes HRSG purge credit as well as evacuation of the condenser as stated in the tables provided. Start-up emissions are based on both units starting at the same time. All figures for plant start-up emissions do include estimated CO and SCR reduction.

2. Fuel Gas Composition

For the stated emissions, sulfur content considered in the fuel is 0.5 grains/100scf with the below fuel chemical composition.

Constituent	Volume (%)
Methane CH_4	96.2274
Ethane C_2H_6	2.175
Propane C_3H_8	0.264
Butane C_4H_{10}	0.08
Pentane C_5H_{12}	0.013
Hexanes C_6H_{14}	0.016
Heptane C_7H_{16}	0.012
Octane C_8H_{18}	0.0006
Nitrogen N_2	0.664
Carbon Dioxide CO_2	0.548
TOTAL	100

LHV (Btu/lb)	20885
HHV (Btu/lb)	23156

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3. Startup Emissions Data

3.1. Normal Hot Start-Up to Compliance (After Approx. 8 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min from ign	60	56	54	53
Nox as NO2	lb/event	47	44	43	43
CO	lb/event	47	36	35	35
VOC as CH4	lb/event.	38.8	28	25.7	26.3
PM10/2.5 Total	lb/event	8.1	6.3	6.5	6.2
H2SO4	lb/event	1.0	0.8	0.8	0.7
Heat Consumption	MMBTU HHV	856	717	657	628

Worst-Case estimated 1-hr average exhaust flow = 1840 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

3.2. Fast Hot Start-Up to Compliance (After Approx. 8 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Condenser Evacuation Prior to Start Initiation					
Duration	min from ign	42	40	39	38
Nox as NO2	lb/event	50	48	47	47
CO	lb/event	25	20	20	20
VOC as CH4	lb/event	17	12	11	11
PM10/2.5 Total	lb/event	6.9	5.0	6.1	4.8
H2SO4	lb/event	0.8	0.7	0.7	0.7
Heat Consumption	MMBTU HHV	815	730	694	676

Worst-Case estimated 1-hr average exhaust flow = 2150 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

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3.3. Non-Spinning Reserve Start-up to Compliance (After Approx. 8 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Condenser Evacuation Prior to Start Initiation					
Duration	min from ign	42	40	39	38
Nox as NO2	lb/event	50	49	48	47
CO	lb/event	15	13	13	13
VOC as CH4	lb/event	7.9	6.2	5.7	5.8
PM10/2.5 Total	lb/event	7.2	5.0	6.4	4.6
H2SO4	lb/event	0.8	0.8	0.7	0.7
Heat Consumption	MMBTU HHV	851	776	731	700

Worst-Case estimated 1-hr average exhaust flow = 2400 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 1[illegible]0F

3.4. Normal Warm Start-Up to Compliance (After Approx. 60 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min from ign	125	124	125	125
Nox as NO2	lb/event	56	52	50	50
CO	lb/event	71	52	50	50
VOC as CH4	lb/event	69	46	40	41
PM10/2.5 Total	lb/event	10.4	9.0	9.0	9.0
H2SO4	lb/event	1.3	1.1	1.1	1.1
Heat Consumption	MMBTU HHV	1102	977	963	945

Worst-Case estimated 1-hr average exhaust flow = 1280 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 140F

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3.5. Normal Cold Start-Up to Compliance (After Approx. 200 hours standstill)

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min from ign	183	178	179	178
Nox as NO2	lb/event	61	57	55	54
CO	lb/event	77	56	53	53
VOC as CH4	lb/event	73	48	42	44
PM10/2.5 Total	lb/event	14	12	12	12
H2SO4	lb/event	1.7	1.6	1.6	1.6
Heat Consumption	MMBTU HHV	1502	1354	1324	1299

Worst-Case estimated 1-hr average exhaust flow = 1280 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 120F

3.6. Shutdown: Minimum Emissions Load to Flameout

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min	13	11	9.7	9.2
Nox as NO2	lb/event	4.6	3.5	2.9	2.7
CO	lb/event	17	10	8.9	8.9
VOC as CH4	lb/event	25	15	12	13
PM10/2.5 Total	lb/event	1.9	1.4	1.2	1.2
H2SO4	lb/event	0.2	0.2	0.1	0.1
Heat Consumption	MMBTU HHV	179	132	112	103

Worst-Case estimated 1-hr average exhaust flow = 1640 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

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3.7. Compliance to Low Load Operation

Note: During Low Load Operation Emissions are in compliance.

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min	12	9.9	8.8	8.3
Nox as NO2	lb/event	1.4	1.1	0.9	0.9
CO	lb/event	17	10	8.7	8.7
VOC as CH4	lb/event	24	15	11	13
PM10/2.5 Total	lb/event	1.8	1.3	1.2	1.1
H2SO4	lb/event	0.2	0.2	0.1	0.1
Heat Consumption	MMBTU HHV	168	125	106	98.3

Worst-Case estimated 1-hr average exhaust flow = 1660 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

3.8. Low Load Operation to Compliance

Note: During Low Load Operation Emissions are in compliance.

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min	12	9.9	8.8	8.3
Nox as NO2	lb/event	1.5	1.1	1.0	0.9
CO	lb/event	15	10	8.4	8.4
VOC as CH4	lb/event	24	15	11	13
PM10/2.5 Total	lb/event	1.9	1.3	1.2	1.1
H2SO4	lb/event	0.2	0.2	0.1	0.1
Heat Consumption	MMBTU HHV	168	125	106	98.3

Worst-Case estimated 1-hr average exhaust flow = 1660 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

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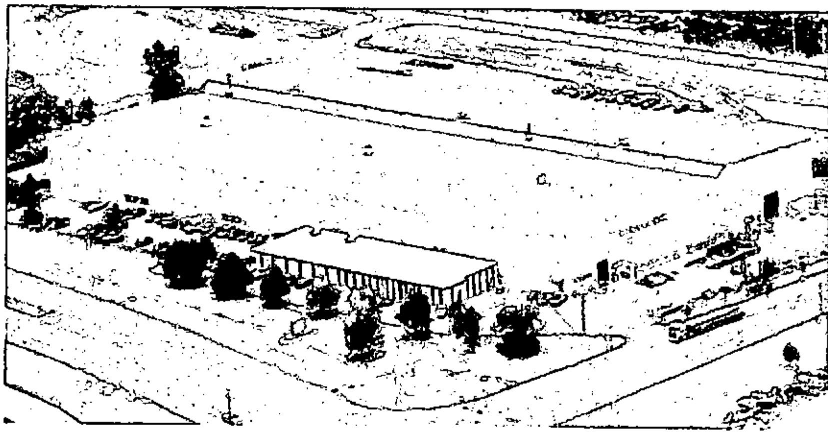
1.0 INTRODUCTION



CB Nebraska Boiler & **CB Natcom** form the engineered boiler/burner division of the **Cleaver-Brooks** family of companies. We are committed to offering integrated boiler/burner solutions to the industry. This group of companies has been in this business for more than 80 years and continues to enjoy a large percentage of the market share. We maintain our leadership in the industrial watertube market by offering innovative solutions and a true single-source responsibility to our customers for boilers, burners, controls & auxiliary equipment. This commitment to overall system design ensures that your equipment operates efficiently and lasts for years to come.

For your unique application, we are offering a packaged solution with the following design features:

1.1 OUTLET STEAM CONDITIONS:

Capacity:	77000 LB/HR ¤
Operating Pressure:	200 PSIG (at exit of non-return valve) ¤
Steam Temperature:	Saturated at 387 °F
Steam Quality:	99.5% dry steam ¤

1.2 BOILER DESIGN:

Type:	D-Type Industrial Watertube
Model:	NB-300D-70
Vessel Design Pressure:	250 psig

1.3 BURNER DESIGN:

Type:	Ultra Low-NOx Register
Main Fuel:	Natural Gas
Emissions:	9 PPM Nox

1.4 ECONOMIZER DESIGN:

Type:	Rectangular Finned-Tube
Arrangement:	Vertical Gas Flow; Counter-Current Water Flow
Design Pressure:	300 psig
Inlet Feedwater Temp:	228°F

1.5 STACK DESIGN:

Type:	Freestanding
Diameter (at exit):	78"
Height (from grade):	125 ft

3.0 BOILER DESIGN DATA

Boiler Dimensions:		**Units**
Height to Main Steam Outlet	14 Ft 7 In	FT
Overall Width of Unit	11 Ft 7.5 In	FT
Overall Length of Unit*	25.33 Ft.	FT
**Add approximately 6-8 ft length for burner.*		
Weight of Unit (Dry)	80,249.49	LBS
Weight of Unit (Wet)	102,381.53	LBS
Surface Area / Volume:		**Units**
Furnace Volume	1,379	FT3
Furnace Projected Area	819	FT2
Evaporator Area	4,277	FT2
Total Area	5,096	FT2
Economizer Area	13,317	FT2
Superheater Area	-	FT2
Tubing Data:		**Units**
Tube OD	2.0	IN
Tube Wall Thickness – Furnace Section	0.105	IN
Tube Wall Thickness – Convection Section	0.105	IN
Tube Material	SA178A	
Corrosion Allowance	NA	IN
Steam Drum:		**Units**
Inside Drum Diameter:	42 In	IN
Drum Length	25.33 Ft. Seam/Seam	FT
Drum Material:	SA516 Grade 70	
Corrosion Allowance:	NA	IN
Water Drum:		**Units**
Drum Diameter:	24 In	IN
Drum Length	25.33 Ft. Seam/Seam	FT
Drum Material:	SA106 Grade B	
Corrosion Allowance:	NA	IN
Standard Drum Connections:	**Quantity**	**Type**
Main Steam Outlet:	One	Flanged
Safety Valves:	Per ASME Code	Flanged
Feedwater Inlet:	One	Flanged
Bottom Drum Blowoff:	Two	Flanged
Water Column:	Two	Threaded (NPT)
Feedwater Regulator:	Two	Flanged
Vent:	One	NPT
Continuous Blowdown:	One	NPT
Chemical Feed:	One	NPT
Sootblower:	Two	Flanged
Auxiliary L.W. Cutouts:	One	NPT

**The above information is preliminary and shall be confirmed at time of engineering submittal.*

4.0 BOILER PERFORMANCE DATA

Fuel: Natural Gas

Boiler load - %	100%	75%	50%	25%	Units
Steam Flow - ¤	77,000	57,750	38,500	19,250	Lb/Hr
Steam Pressure – Operating - ¤	200.0	200.0	200.0	200.0	PSIG
Steam Temperature - ¤	387.0	387.0	387.0	387.0	°F
Fuel Input (HHV)	92.4	69.1	46.0	23.2	MMBTU/Hr
Ambient Air Temperature	80.0	80.0	80.0	80.0	°F
Relative Humidity	60	60	60	60	%
Excess Air	25	25	25	25	%
Flue Gas Recirculation	25	25	25	25	%
Steam Output Duty	77	58	39	19	MMBTU/hr
Heat Release Rate	67,012	50,097	33,366	16,805	BTU/FT3-Hr
Heat Release Rate	112,882	84,389	56,204	28,308	BTU/FT2-Hr
Deaerator Pegging Steam	-	-	-	-	Lb/Hr
Feed Water Temperature	227	227	227	227	°F
Water Temp. Leaving Economizer	321	309	297	288	±10°F
Blow Down	1.0	1.0	1.0	1.0	%
Boiler Gas Exit Temperature	543	498	451	409	±10°F
Economizer Gas Exit Temp.	299	282	266	251	±10°F
Air Flow	84,454	63,137	42,050	21,179	Lb/Hr
Flue Gas to Stack	88,692	66,305	44,160	22,241	Lb/Hr
Flue Gas Including FGR	110,865	82,881	55,200	27,802	Lb/Hr
Fuel Flow	4,237	3,167	2,109	1,062	Lb/Hr
Flue Gas Losses/Efficiency-%					
Dry Gas Loss	4.5	4.2	3.8	3.5	%
Air Moisture Loss	0.1	0.1	0.1	0.1	%
Fuel Moisture Loss	10.6	10.6	10.5	10.4	%
Casing Loss	0.5	0.7	1.0	2.0	%
Margin	0.5	0.5	0.5	0.5	%
Efficiency - LHV	92.8	93.1	93.2	92.5	%
Efficiency – HHV - ¤	83.7	84.0	84.1	83.5	%
Total Pressure Drop Including Economizer	9.46	5.30	2.35	0.56	IN WC
Products of Combustion - CO_2	7.7	7.7	7.7	7.7	%
- H_2O	16.9	16.9	16.9	16.9	%
-N_2	71.7	71.7	71.7	71.7	%
-O_2	3.8	3.8	3.8	3.8	%
-SO_2	-	-	-	-	%
GAS- % volume	**NG**				
methane	90.00				
ethane	5.00				
nitrogen	5.00				
LHV-Btu/lb	19,687				
HHV-Btu/lb	21,815				

**The above information is preliminary and shall be confirmed at time of engineering submittal.*

DIESEL GENERATOR SET

CATERPILLAR®

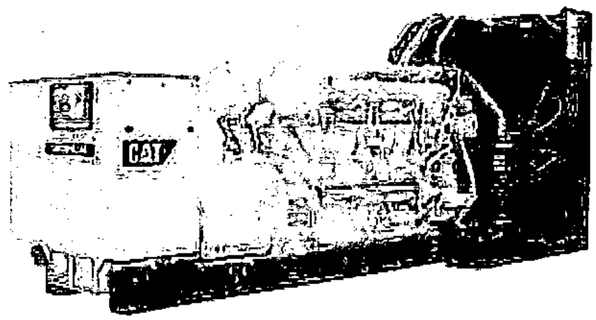


Image shown may not reflect actual package.

STANDBY
1500 ekW 1875 kVA
60 Hz 1800 rpm 480 Volts

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

FEATURES

FUEL/EMISSIONS STRATEGY
- EPA Certified for Stationary Emergency Application (EPA Tier 2 emissions levels)

DESIGN CRITERIA
- The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response.

UL 2200
- UL 2200 listed packages available. Certain restrictions may apply. Consult with your Cat® Dealer.

FULL RANGE OF ATTACHMENTS
- Wide range of bolt-on system expansion attachments, factory designed and tested
- Flexible packaging options for easy and cost effective installation

SINGLE-SOURCE SUPPLIER
- Fully prototype tested with certified torsional vibration analysis available

WORLDWIDE PRODUCT SUPPORT
- Cat dealers provide extensive post sale support including maintenance and repair agreements
- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- The Cat® S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

CAT 3512C DIESEL ENGINE
- Reliable, rugged, durable design
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight

CAT GENERATOR
- Designed to match the performance and output characteristics of Cat diesel engines
- Single point access to accessory connections
- UL 1446 recognized Class H insulation

CAT EMCP 3 SERIES CONTROL PANELS
- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway

SEISMIC CERTIFICATION
- Seismic Certification available
- Anchoring details are site specific, and are dependent on many factors such as generator set size, weight, and concrete strength.
  IBC Certification requires that the anchoring system used is reviewed and approved by a Professional Engineer
- Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007
- Pre-approved by OSHP and carries an OPA#(OSP-0084-01) for use in healthcare projects in California

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FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	• Single element canister type air cleaner with service indicator	[ ] Dual element & heavy duty air cleaners (with pre-cleaners) [ ] Air inlet adapters & shutoff
Cooling	• Radiator fan and fan drive • Fan and belt guards • Coolant level sensors* • Cat Extended Life Coolant*	[ ] Coolant level switch gauge [ ] Heat exchanger and expansion tank
Exhaust	• Exhaust manifold - dry - dual - 8 in • 203 mm (8 in) ID round flanged outlet	[ ] Mufflers [ ] Stainless steel exhaust flex fittings [ ] Elbows, flanges, expanders & Y adapters
Fuel	• Secondary fuel filters • Fuel cooler* • Fuel priming pump • Flexible fuel lines-shipped loose	[ ] Duplex secondary fuel filter [ ] Primary fuel filter with fuel water separator
Generator	• Class H insulation • Cat digital voltage regulator (CDVR) with kVAR/PF control, 3-phase sensing • Winding temperature detectors • Anti-condensation heaters • Reactive Droop	[ ] Oversize & premium generators [ ] Bearing temperature detectors
Power Termination	• Bus bar (NEMA or IEC mechanical lug holes)- right side standard • Top and bottom cable entry	[ ] Circuit breakers, UL listed, 3 pole with shunt trip, 100% rated, manual or electrically operated [ ] Circuit breakers, IEC compliant, 3 or 4 pole with shunt trip, manual or electrically operated [ ] Bottom cable entry [ ] Power terminations can be located on the right, left and/or rear as an option
Governor	• ADEM™ 3	[ ] Load share module
Control Panel	• EMCP 3.1 • User Interface panel (UIP) - rear mount • AC & DC customer wiring area (right side) • Emergency stop pushbutton	[ ] EMCP 3.2 ... [ ] EMCP 3.3 [ ] Option for right or left mount UIP [ ] Local & remote annunciator modules [ ] Digital I/O Module [ ] Generator temperature monitoring & protection [ ] Remote monitoring software
Lube	• Lubricating oil and filter • Oil drain line with valves • Fumes disposal • Gear type lube oil pump	[ ] Oil level regulator [ ] Deep sump oil pan [ ] Electric & air prelube pumps [ ] Manual prelube with sump pump [ ] Duplex oil filter
Mounting	• Rails - engine / generator / radiator mounting • Anti-vibration mounts (shipped loose)	[ ] Spring-type vibration isolator [ ] IBC Isolators
Starting/Charging	• 24 volt starting motor(s) • Batteries with rack and cables • Battery disconnect switch	[ ] Battery chargers (10 & 20 Amp) [ ] 45 amp charging alternator [ ] Oversize batteries [ ] Ether starting aids [ ] Heavy duty starting motors [ ] Barring device (manual) [ ] Air starting motor with control & silencer
Note	Standard and optional equipment may vary for UL 2200 Listed Packages. UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics.	
General	• Right hand service • Paint - Caterpillar Yellow (with high gloss black rails & radiator) • SAE standard rotation • Flywheel and flywheel housing - SAE No. 00	[ ] CSA certification [ ] CE Certificate of Conformance [ ] Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007 * Not included with packages without radiators

CATERPILLAR

SPECIFICATIONS

CAT GENERATOR

SR4B Generator
Frame Size..697
Excitation..Permanent Magnet
Pitch...0.7333
Number of poles...4
Number of bearings...1
Number of Leads...006
Insulation........................UL 1446 Recognized Class H with tropicalization and antiabrasion
IP Rating..Drip Proof IP22
Alignment...Pilot Shaft
Overspeed capability- % of rated..150
Wave form..003.00
Paralleling kit/Droop transformer.............................Standard
Voltage Regulator3 Phase sensing with selectible volts/Hz
Telephone influence factor...................................Less than 50

CAT DIESEL ENGINE

3512C ATAAC, V-12, 4 stroke, water-cooled diesel
Bore... 170.00 mm (6.69 in)
Stroke... 190.00 mm (7.48 in)
Displacement......................................51.80 L (3161.03 in³)
Compression Ratio...14.7:1
Aspiration..TA
Fuel System...Electronic unit injection
Governor Type...ADEM3

CAT EMCP SERIES CONTROLS

- EMCP 3.1 (Standard)
- EMCP 3.2 / EMCP 3.3 (Option)
- Single location customer connector point
- True RMS AC metering, 3-phase
- Controls
  - Run / Auto / Stop control
  - Speed Adjust
  - Voltage Adjust
  - Emergency Stop Pushbutton
  - Engine cycle crank
- Digital Indication for:
  - RPM
  - Operating hours
  - Oil pressure
  - Coolant temperature
  - System DC volts
  - L-L volts, L-N volts, phase amps, Hz
  - ekW, kVA, kVAR, kW-hr, %kW, PF (EMCP 3.2 / 3.3)
- Shutdowns with common indicating light for:
  - Low oil pressure
  - High coolant temperature
  - Low coolant level
  - Overspeed
  - Emergency stop
  - Failure to start (overcrank)
- Programmable protective relaying functions: (EMCP 3.2 & 3.3)
  - Under and over voltage
  - Under and over frequency
  - Overcurrent (time and inverse time)
  - Reverse power (EMCP 3.3)
- MODBUS isolated data link, RS-485 half-duplex (EMCP 3.2 & 3.3)
- Options
  - Vandal door
  - Local annunciator module
  - Remote annunciator module
  - Input / Output module
  - RTD / Thermocouple modules
  - Monitoring software

STANDBY 1500 ekW 1875 kVA

60 Hz 1800 rpm 480 Volts

CATERPILLAR

TECHNICAL DATA

Open Generator Set - - 1800 rpm/60 Hz/480 Volts	DM8260	
EPA Certified for Stationary Emergency Application (EPA Tier 2 emissions levels)		
Generator Set Package Performance		
Genset Power rating @ 0.8 pf	1875 kVA	
Genset Power rating with fan	1500 ekW	
Coolant to aftercooler		
Coolant to aftercooler temp max	50 ° C	122 ° F
Fuel Consumption		
100% load with fan	396.9 L/hr	104.8 Gal/hr
75% load with fan	310.9 L/hr	82.1 Gal/hr
50% load with fan	219.8 L/hr	58.1 Gal/hr
Cooling System[1]		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Air flow (max @ rated speed for radiator arrangement)	2075 m³/min	73278 cfm
Engine Coolant capacity with radiator/exp. tank	390.8 L	103.2 gal
Engine coolant capacity	156.8 L	41.4 gal
Radiator coolant capacity	234.0 L	61.8 gal
Inlet Air		
Combustion air inlet flow rate	129.5 m³/min	4573.3 cfm
Exhaust System		
Exhaust stack gas temperature	406.4 ° C	763.5 ° F
Exhaust gas flow rate	313.2 m³/min	11060.6 cfm
Exhaust flange size (internal diameter)	203.2 mm	8.0 in
Exhaust system backpressure (maximum allowable)	6.7 kPa	26.9 in. water
Heat Rejection		
Heat rejection to coolant (total)	616 kW	35032 Btu/min
Heat rejection to exhaust (total)	1327 kW	75466 Btu/min
Heat rejection to aftercooler	482 kW	27411 Btu/min
Heat rejection to atmosphere from engine	124 kW	7052 Btu/min
Heat rejection to atmosphere from generator	64.1 kW	3645.4 Btu/min
Alternator[2]		
Motor starting capability @ 30% voltage dip	2670 skVA	
Frame	697	
Temperature Rise	130 ° C	234 ° F
Lube System		
Sump refill with filter	310.4 L	82.0 gal
Emissions (Nominal)[3]		
NOx g/hp-hr	4.97 g/hp-hr	
CO g/hp-hr	.45 g/hp-hr	
HC g/hp-hr	.11 g/hp-hr	
PM g/hp-hr	.03 g/hp-hr	

[1] For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.

[2] UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics. Generator temperature rise is based on a 40 degree C ambient per NEMA MG1-32.

[3] Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77°F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

RATING DEFINITIONS AND CONDITIONS

Meets or Exceeds International Specifications: AS1359, CSA, IEC60034-1, ISO3046, ISO8528, NEMA MG 1-22, NEMA MG 1-33, UL508A, 72/23/EEC, 98/37/EC, 2004/108/EC

Standby - Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year. Standby power in accordance with ISO8528. Fuel stop power in accordance with ISO3046. Standby ambients shown indicate ambient temperature at 100% load which results in a coolant top tank temperature just below the shutdown temperature.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions.

Fuel rates are based on fuel oil of 35° API [16° C (60° F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29° C (85° F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.). Additional ratings may be available for specific customer requirements, contact your Cat representative for details. For information regarding Low Sulfur fuel and Biodiesel capability, please consult your Cat dealer.

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DIMENSIONS

Package Dimensions		
Length	5895.0 mm	232.09 in
Width	2537.5 mm	99.9 in
Height	2749.5 mm	108.25 in
Weight	14 035 kg	30,942 lb

NOTE: For reference only - do not use for installation design. Please contact your local dealer for exact weight and dimensions. (General Dimension Drawing #2846048).

Performance No.: DM8260

Feature Code: 512DE6C

Gen. Arr. Number: 2628100

Source: U.S. Sourced

October 27 2010

16297533

www.CAT-ElectricPower.com

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Materials and specifications are subject to change without notice.
The International System of Units (SI) is used in this publication.

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CLARKE

Fire Protection Products, Inc.

Engine Selection / De-rate Calculator / Speed Interpolator

USA Purchased, USA Installed, 2011 Models, UL/FM Approved, Heat Exchanger Cooled

DATE: 2/18/2011

PUMP REQUIREMENTS:
Pump Max Power: 315 BHP
RPM(s): 1800

DERATE PARAMETERS:
Altitude: 185 (feet)
Ambient Temperature: 77 (°F)
Right Angle Gear Loss: 0%
Derate Percent: .0

APPLICATION INFO:
Customer:
Job Name:
Job Number:
Run By:

RESULTS:

Model	RPM	Rated HP (KW)	Derate HP (KW)	Emissions Tier	Interpolation Data (RPM, HP)
JU6H-UFAD98	1800	315 (235)		T3-Certified	Not used

NOTE:
Derated HP takes into account all the input derates for altitude, temperature and Right Angle Gearbox. When no derates are input, this column will be blank and engine selection(s) will be based upon Rated HP. When the Derated HP column is filled in, then the engine selection(s) are based upon this value

DEFINITIONS:

©UL/FM - Engine that is Underwriters Laboratories Listed and Factory Mutual Approved

©LPCB - Engine that is Loss Prevention Council Board Approved

©NL - Non-Listed Engine has no private agency certification, like UL, or insurance company certification, like FM. It applies to any engine that is not UL Listed or FM Approved, and is built to meet individual European country specifications

North American Offices. 3133 East Kemper Road * Cincinnati, Ohio * 45241 * USA * Tel: +1 (513) 475-3473 * Fax. +1 (513) 771-0726
European Office Grange Works * Lomond Road * Coatbridge, Scotland * ML5 2NN * Tel: +44 (0)1236 429 946 * Fax: +44 (0)1236 427 274

CLARKE

Fire Protection Products, Inc.

Exhaust Backpressure Calculator - Results
Calculations made 2/18/2011

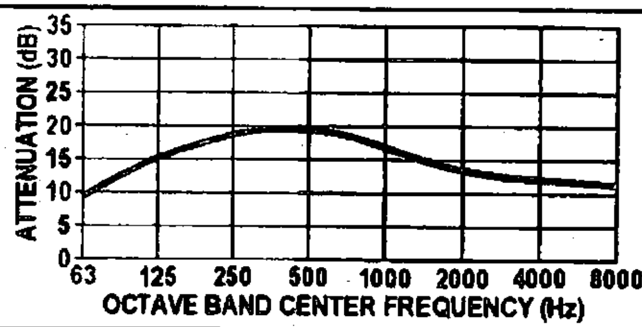
Data input by:

Input Data:

Customer:	Job Name:	Job Number:
Engine Data:	**Piping Data:**	**Silencer Data:**
Manufacturer: Clarke	Pipe Size: 5"	Manufacturer: Clarke USA
Model: JU6H-UFAD98	#90° elbow or Y:	Pipe Size (in): 5
RPM: 1760	Number 45° elbows:	Model: C06545
HP:315	Number Tees:	Application: Industrial
	Straight Pipe (Feet): 30	Connection: 150# Flange

Output Data:

Exh Flow (CFM): 1400	
Temperature (° F): 961	
Max Backpressure (inches water): 30	
Min Backpressure (inches water): 0	
Std. Exhaust Dia (in): 5	



Exhaust Pipe Recommendation:

BACKPRESSURE CALCULATIONS (inches water)	6.5	Pipe
	+ 8.0	Silencer (see note 1)
	14.5	Total
	30.0	Maximum Allowable Backpressure
	Result: Total Backpressure is lower than minimum	

1) CAUTION Silencer Backpressure is based upon a Clarke USA provided Silencer Actual Silencer Backpressure will vary depending upon the actual Silencer used (manufacturer, size, type and model) If the total Backpressure from the pipe, Silencer and orifice plate (if required) is close to the engine Maximum Allowed Backpressure, it is highly recommended you obtain the actual Backpressure (for the engine exhaust flow given above) on the Silencer being used and then confirm that the total Backpressure is still under the Maximum Allowed Backpressure
2) Schedule 40 pipe used in calculations
3) All pipe sizes and lengths are in inches and feet.
4) WARNING: The total Backpressure is less than the engine permissible Backpressure In order to get the maximum Backpressure above the engine permissible limit, you must change one or more of the following: pipe size; pipe length; Silencer size, Silencer type.

North American Offices:
3133 East Kemper Road * Cincinnati, Ohio * 45241 * USA * Tel +1 (513) 771-2200 * Fax: +1 (513) 771-0726

European Office.
Grange Works * Lomond Road * Coatbridge, Scotland * ML5 2NN * Tel. +44 (0)1236 429 946 * Fax: +44 (0)1236 427 274

Feagins, Rob (DEQ)

From: Gener Gotiangco [GGotiangco@cpv.com]
Sent: Tuesday, February 04, 2014 2:06 PM
To: Feagins, Rob (DEQ)
Cc: 'Sellars, Fred (Fred.Sellars@tetratech.com)'; Babcock, Steven
Subject: CPV Smyth - updated PSD Application transmittal
Attachments: CPV Smyth VA DEQ PSD Transmittal 02042014.pdf

Good afternoon Rob,

Please find the attached transmittal that address your comments to our January 31, 2014 CPV Smyth PSD Air Permit Application. This transmittal includes the amended Appendix A page 5 General Information and the amended Appendix C. The transmittal original is also being sent to you via hardcopy.

Thank you again for your timely review and these comments.

Feel free to advise should you have further questions or comments.

Regards,

Gener Gotiangco
Competitive Power Ventures, Inc.
8403 Colesville Road
Suite 915
Silver Spring, MD 20910
Office: (240) 723-2307
Cell: (301) 346-5738
Fax: (240) 723-2339

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Competitive Power Ventures, Inc.

February 4, 2014

Virginia Department of Environmental Quality
Attention: Rob Feagins, Air Permit Manager
Southwest Regional Office
355-A Deadmore Street
Abingdon, Virginia 24210

RE: CPV Smyth Generation Company, LLC Prevention of Significant Deterioration Air Permit Application – updated

Dear Mr. Feagins,

In response to your February 3, 2014 communication requesting a correction and clarification to CPV Smyth's referenced Air Permit application, please find enclosed for your use and retention with the original submittal the following:

Appendix A to application, Page 5 of Form 7 updating the General Information with the correct entity and contact (1 sheet).

Appendix C Equipment Specifications and Vendor Performance Data, revised to remove "Confidentiality" notation as the major equipment supplier, Alstom, has withdrawn its request to seek confidentiality for their emissions and performance information (23 sheets).

Should you have further questions or clarifications, please do not hesitate to contact me at your convenience.

Sincerely,

Gener G. Gotiangco, P.E.
ggotiangco@cpv.com
240-723-2307

cc: M. Kiss, VA DEQ (via email)
F. Sellars, Tetra Tech (via e-mail)
R. Burke, Competitive Power Ventures, Inc. (via e-mail)

GENERAL INFORMATION

Person Completing Form: Gener Gotiangco	Date: 01/27/2014	Registration Number:
Company and Division Name: CPV Smyth Generation Company, LLC		FIN: 52-2306411
Mailing Address: 8403 Colesville Road, Suite 915 Silver Spring, MD 20910		
Exact Source Location – Include Name of City (County) and Full Street Address or Directions: Atkins, VA		
Telephone Number:	No. of Employees:	Property Area at Site:
Person to Contact on Air Pollution Matters – Name and Title: Gener Gotiangco Vice President	Phone Number: (240) 723-2307 Fax: (240) 723-2339 Email: GGotiangco@cpv.com	
Latitude and Longitude Coordinates **OR** UTM Coordinates of Facility:		

Reason(s) for Submission (Check all that apply):

☐ State Operating Permit — This permit is applied for pursuant to provisions of the Virginia Administrative Code, 9 VAC 5 Chapter 80, Article 5 (SOP)

☒ New Source
☐ Modification of a Source
☐ Relocation of a Source

This permit is applied for pursuant to the following provisions of the Virginia Administrative Code:
- ☐ 9 VAC 5 Chapter 80, Article 6 (Minor Sources)
- ☒ 9 VAC 5 Chapter 80, Article 8 (PSD Major Sources)
- ☐ 9 VAC 5 Chapter 80, Article 9 (Non-Attainment Major Sources)

☐ Amendment to a Permit Dated: __________ Permit Type: ☐ SOP (Art. 5) ☐ NSR (Art. 6, 8, 9)

Amendment Type:
- ☐ Administrative Amendment
- ☐ Minor Amendment
- ☐ Significant Amendment

This amendment is requested pursuant to the provisions of:

☐ 9 VAC 5-80-970 (Art. 5 Adm.)	☐ 9 VAC 5-80-1935 (Art. 8 Adm.)
☐ 9 VAC 5-80-980 (Art. 5 Minor)	☐ 9 VAC 5-80-1945 (Art. 8 Minor)
☐ 9 VAC 5-80-990 (Art. 5 Sig.)	☐ 9 VAC 5-80-1955 (Art. 8 Sig.)
☐ 9 VAC 5-80-1270 (Art. 6 Adm.)	☐ 9 VAC 5-80-2210 (Art. 9 Adm.)
☐ 9 VAC 5-80-1280 (Art. 6 Minor)	☐ 9 VAC 5-80-2220 (Art. 9 Minor)
☐ 9 VAC 5-80-1290 (Art. 6 Sig.)	☐ 9 VAC 5-80-2230 (Art. 9 Sig.)

☐ Other (specify): ____________________

Explanation of Permit Request (attach documents if needed):

Application for a proposed combined cycle electric generating facility required to obtain a Major NSR Air Permit subject to Prevention of Significant Deterioration requirements. This document contains a detailed description of the project and potential emission estimates for all pollutants.

APPENDIX C

Equipment Specifications and Vendor Performance Data

1 The corrections from 'Gross Output / Efficiency' to 'Net Output / Efficiency' reflects current aux. consumption/losses for Alstom equipment only.
2 Values for Information only.
3 Gas turbine output does not include the OTC heat rejection energy.
4 Ambient Pressure: 13.56 psia
5 Air Cooled Condenser
6 CO & SCR Catalyst considered for HRSG pressure drop calculations and stack emissions
7 PM10/PM2.5 measurements per EPA Method 201/a + 202
8 Particulate Matter exhaust emissions are the net emission values, i.e. the emission contribution above those pre-existing in the ambient air. Alstom therefore reserves the right to correct for the pre-existing ambient air quality if required.
9 Particulate matter emissions are often below the detection limits of most of the measuring systems. Therefore if no particulate matter is detected within maximum 4 hours of measurement, the particulate emission is deemed to have been fulfilled.
10 Particulate Matter emission limits are valid for steady state gas turbine operating conditions and are based on a three-hour average.
11 Prior to any Particulate Matter measurements, the gas turbine must be in operation continuously for at least 8 hours at or near base load. Gas turbine inlet and exhaust system are assumed to be fully commissioned and clean condition before the measurement.
12 Particulate Matter measurements may have to be repeated in order to fullfil the particulate emissions.
13 All values are based on the following fuel composition:

Constituent	Volume (%)
Nitrogen	0.664
Carbon Dioxide	0.548
Methane	96.2274
Ethane	2.175
Propane	0.264
Butane	0.08
Pentane	0.013
Hexane	0.016
Heptane	0.012
Octane	0.0006

Sulfur Content is 0.5 grains/100 SCF Fuel

LHV (Btu/lb)	20885
HHV (Btu/lb)	23156

14 The performance summary is based on the following case descriptions:

CASE 1	2x100%, PO, 90F, 50% RH, EC+HF=ON, SF=ON
CASE 2	2x100%, PO, 90F, 50% RH, EC+HF=ON, SF=OFF
CASE 3	2x75%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF
CASE 4	2x50%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF
CASE 5	2xLLOC%, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF
CASE 6	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=ON
CASE 7	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=OFF
CASE 8	2x75%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF
CASE 9	2x50%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF
CASE 10	2xLLOC%, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF
CASE 11	2x100%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 12	2x75%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 13	2x50%, PO, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 14	2xLLOC%, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF
CASE 15	2x100%, PO, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF
CASE 16	2x75%, PO, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF

CASE 17	2x50%, PO, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF
CASE 18	2xLLOC%, -10F, 60% RH, EC=OFF, HF=OFF, APH=ON, SF=OFF
CASE 19	2x100%, PO, 90F, 50% RH, CH=ON*,SF=OFF
CASE 20	2x100%, PO, 90F, 50% RH, CH=ON*, SF=ON
CASE 21	2x100%, PO, 100F, 30% RH, CH=ON*,SF=OFF
CASE 22	2x100%, PO, 100F, 30% RH, CH=ON*, SF=ON
CASE 23	2x100%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=ON

PO Performance Optimized
LLOC Low Load Operating Concept
RH Relative Humidity
EC Evaporative Cooler
HF High Fogging
CH Chiller
APH Air Preheater
SF Supplementary Firing
* Chiller ON reduces inlet temperature to 50F

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	)%, PO, 90F, 50% RH, EC+HF=ON, SF=ON	2x100%, PO, 90F, 50% RH, EC+HF=ON, SF=OFF	2x75%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF	2x50%, PO, 90F, 50% RH, EC=OFF, HF=OFF, SF=OFF	2xLLOC%, 90. RH, EC=OFF, HF=OFF, SF=OFF	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=ON	2x100%, PO, 100F, 30% RH, EC+HF=ON, SF=OFF	2x75%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF	2x50%, PO, 100F, 30% RH, EC=OFF, HF=OFF, SF=OFF	2xLL(00F, 30% RH, EC=OFF, HF=OFF, SF=OFF	2x100%, P(60% RH, E(HF=OFF, S
°F	90.0	90.0	90.0	90.0	90.0	100.0	100.0	100.0	100.0	100.0	59.0
%	50.0	50.0	50.0	50.0	50.0	30.0	30.0	30.0	30.0	30.0	60.0
-	2	2	2	2	2	2	2	2	2	2	2
-	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
-	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF
-	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
MW	690.6	591.2	408.4	291.6	60.1	681.0	583.0	386.5	276.4	56.8	602.(
%	54.4	56.7	55.9	52.7	28.3	53.7	56.1	54.9	51.6	27.3	57.9
Btu/kWh	6276	6017	6100	6476	12061	6350	6085	6211	6614	12509	5897
MW	689.1	589.7	406.9	290.1	58.6	679.5	581.5	385.0	274.9	55.3	600.5
%	54.25	56.56	55.73	52.42	27.58	53.62	55.93	54.72	51.31	26.56	57.7
Btu/kWh	6290	6032	6122	6509	12370	6364	6100	6235	6650	12848	5912
	100.0	100.0	75.0	50.0	LLOC	100.0	100.0	75.0	50.0	LLOC	100.(
MW	193.50	193.50	124.41	82.94	7.57	192.71	192.71	117.48	78.32	6.75	192.6
MMBtu/hr	1778.74	1778.74	1245.42	944.31	362.65	1773.57	1773.57	1200.39	914.06	355.43	1774.!
MMBtu/hr	1972	1972	1381	1047	402	1966	1966	1331	1013	394	1968
°F	1136.7	1136.7	1202.0	1202.0	929.4	1136.5	1136.5	1202.0	1202.0	936.8	1119.
lb/hr	3509150	3509150	2562907	2096519	1443985	3506293	3506293	2511261	2063268	1428654	36558
MWth	19.66	19.66	13.46	8.11	3.81	19.85	19.85	14.22	8.81	3.91	25.7
MMBtu/hr	389	0	0	0	0	389	0	0	0	0	0
MMBtu/hr	431	0	0	0	0	431	0	0	0	0	0
°F	177.0	195.8	175.1	170.4	193.8	181.0	202.5	178.7	174.2	195.6	187.:
lb/hr	3527757.9	3509150.3	2562907.2	2096519.0	1443984.8	3524900.5	3506292.9	2511261.0	2063268.4	1428654.1	365583
in H2O	15.4	15.4	8.4	5.6	2.4	15.3	15.3	8.1	5.5	2.3	16.5
MW	303.6	204.2	159.5	125.8	45.0	295.6	197.5	151.6	119.8	43.3	216.(
psia	2.259	1.679	1.412	1.246	1.088	2.871	2.152	1.813	1.618	1.267	1.08
vol %	70.71%	71.35%	73.04%	73.26%	74.47%	70.84%	71.48%	73.45%	73.66%	74.85%	74.15
vol %	9.05%	10.92%	11.65%	12.28%	15.84%	9.10%	10.97%	11.87%	12.49%	15.97%	11.91
vol %	14.34%	12.69%	10.38%	9.83%	6.68%	14.17%	12.51%	9.80%	9.25%	6.17%	8.98
vol %	5.05%	4.19%	4.05%	3.76%	2.13%	5.05%	4.18%	3.99%	3.71%	2.11%	4.07
vol %	0.85%	0.85%	0.87%	0.88%	0.89%	0.85%	0.85%	0.88%	0.88%	0.90%	0.89
ppmvd @ 15% O_2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
lb/hr	10.6	8.7	6.1	4.6	1.8	10.6	8.7	5.9	4.5	1.7	8.7
vol %	5.1%	4.2%	4.1%	3.8%	2.1%	5.0%	4.2%	4.0%	3.7%	2.1%	4.1%
lb/hr	281544	231370	162064	122953	47518	280876	230702	156227	119034	46580	23099
ppmvd @ 15% O_2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
lb/hr	17.4	14.3	10.0	7.6	2.9	17.4	14.3	9.7	7.4	2.9	14.3
ppmvd @ 15% O_2	2.0	1.0	1.0	1.0	2.0	2.0	1.0	1.0	1.0	2.0	1.0
lb/hr	6.1	2.5	1.7	1.3	1.0	6.1	2.5	1.7	1.3	1.0	2.5
lb/hr	3.2	2.6	1.8	1.4	0.5	3.2	2.6	1.8	1.3	0.5	2.6
lb/hr	2.0	1.7	1.2	0.9	0.3	2.0	1.7	1.1	0.9	0.3	1.7
lb/hr	6.4	5.2	6.1	4.6	1.8	6.4	5.2	5.9	4.5	1.7	5.2
lb/hr	5.5	1.8	2.9	3.6	0.3	5.5	1.7	2.9	3.5	0.3	1.7
lb/hr	11.9	7.0	9.0	8.2	2.1	11.9	7.0	8.7	8.0	2.1	7.0
ppmvd @ 15% O_2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
lb/hr	16.1	13.2	9.3	7.0	2.7	16.1	13.2	8.9	6.8	2.6	13.2

	C%, 59F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x100%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x75%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2x50%, PO, -10F, 60% RH, EC=OFF, HF=OFF, SF=OFF	2xLLOC%, -10 RH, EC=OFF, HF=OFF, SF=OFF	2x100%, PO, 90F, 50% RH, CH=ON,SF=OFF	2x100%, PO, 90F, 50% RH, CH=ON, SF=ON	2x100%, PO, 100F, 30% RH, CH=ON,SF=OFF	2x100%, PO, 100F, 30% RH, CH=ON, SF=ON	2x100%, PO, -10F, 60% RH, SF=ON
°F	59.0	-10.0	-10.0	-10.0	-10.0	90.0	90.0	100.0	100.0	-10.0
%	60.0	60.0	60.0	60.0	60.0	100.0	100.0	100.0	100.0	60.0
-	2	2	2	2	2	2	2	2	2	2
-	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF
-	OFF	OFF	OFF	OFF	OFF	N/A	N/A	N/A	N/A	OFF
-	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
MW	62.8	695.2	518.1	368.4	66.5	612.9	713.3	606.1	705.4	799.2
%	28.2	57.9	57.6	54.4	28.1	57.2	54.9	56.6	54.3	56.0
Btu/kWh	12118	5890	5927	6277	12146	5963	6213	6029	6282	6096
MW	61.3	693.7	516.6	366.9	65.0	611.4	711.8	604.6	703.9	797.7
%	27.49	57.80	57.41	54.14	27.46	57.09	54.81	56.46	54.20	55.89
Btu/kWh	12414	5903	5944	6303	12427	5977	6226	6044	6296	6107
	LLOC	100.0	75.0	50.0	LLOC	100.0	100.0	100.0	100.0	100.0
MW	9.75	233.77	171.69	114.46	12.25	200.63	200.63	200.63	200.63	233.77
MMBtu/hr	380.40	2047.39	1535.17	1156.33	403.73	1827.19	1827.19	1827.19	1827.19	2047.39
MMBtu/hr	422	2270	1702	1282	448	2026	2026	2026	2026	2270
°F	903.8	1103.3	1159.7	1202.0	876.8	1118.3	1118.3	1118.3	1118.3	1103.3
lb/hr	1504290	4091969	3016883	2345388	1575354	3727139	3727139	3727139	3727139	4091969
MWth	3.53	20.24	7.07	5.20	3.19	24.85	24.85	24.85	24.85	20.24
MMBtu/hr	0	0	0	0	0	0	389	0	389	389
MMBtu/hr	0	0	0	0	0	0	431	0	431	431
°F	197.5	196.7	181.5	171.8	194.5	195.5	178.5	204.1	182.7	167.5
lb/hr	1504290.0	4091968.8	3016882.8	2345387.6	1575353.9	3727138.9	3745746.5	3727138.9	3745746.5	4110576.0
in H2O	2.5	20.6	11.5	7.1	2.7	17.2	17.2	17.2	17.2	20.6
MW	43.3	227.6	174.7	139.5	42.0	211.6	312.1	204.9	304.2	331.7
psia	1.088	1.088	1.088	1.088	1.088	1.698	2.259	2.172	2.873	1.088
vol %	75.60%	74.80%	74.74%	74.84%	76.22%	73.96%	73.33%	73.96%	73.33%	74.22%
vol %	16.09%	11.82%	11.66%	11.95%	16.19%	11.79%	10.00%	11.79%	10.00%	10.17%
vol %	5.26%	8.29%	8.42%	8.17%	4.49%	9.26%	10.87%	9.26%	10.87%	9.76%
vol %	2.15%	4.21%	4.28%	4.15%	2.19%	4.11%	4.93%	4.11%	4.93%	4.96%
vol %	0.90%	0.89%	0.89%	0.89%	0.91%	0.88%	0.88%	0.88%	0.88%	0.89%
ppmvd @ 15% O_2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
lb/hr	1.9	10.0	7.5	5.7	2.0	8.9	10.8	8.9	10.8	11.9
vol %	2.2%	4.2%	4.3%	4.1%	2.2%	4.1%	4.9%	4.1%	4.9%	5.0%
lb/hr	49846	266395	199724	150471	52897	237767	287941	237767	287941	316602
ppmvd @ 15% O_2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
lb/hr	3.1	16.5	12.3	9.3	3.2	14.7	17.8	14.7	17.8	19.6
ppmvd @ 15% O_2	2.0	1.0	1.0	1.0	2.0	1.0	2.0	1.0	2.0	2.0
lb/hr	1.1	2.9	2.2	1.6	1.1	2.6	6.2	2.6	6.2	6.8
lb/hr	0.6	3.0	2.3	1.7	0.6	2.7	3.2	2.7	3.2	3.8
lb/hr	0.4	1.9	1.4	1.1	0.4	1.7	2.0	1.7	2.0	2.5
lb/hr	1.9	6.0	7.5	5.7	2.0	5.4	6.5	5.4	6.5	7.2
lb/hr	0.4	2.0	1.9	3.3	0.4	1.8	5.5	1.8	5.5	5.7
lb/hr	2.2	8.0	9.4	9.0	2.4	7.2	12.0	7.2	12.0	12.9
ppmvd @ 15% O_2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
lb/hr	2.8	15.2	11.4	8.6	3.0	13.6	16.5	13.6	16.5	18.1

Plant Start-Up and Shutdown Emissions

KA24-2 Smyth County

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KA24-2 (2011)
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Table of Contents:

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1. Introduction

This document gives an indication of the CCPP exhaust emission per GT during cold, warm, and hot start-up conditions as well as the shutdown and low load transient operation for the Smyth County project. The start-up emissions consist from GT ignition to time when plant reaches full compliance (2 ppmvd @ 15% O2 CO and 2 ppmvd @ 15% O2 NOx), i.e., when CO & SCR catalyst are fully operational and assumes HRSG purge credit as well as evacuation of the condenser as stated in the tables provided. Start-up emissions are based on both units starting at the same time. All figures for plant start-up emissions do include estimated CO and SCR reduction.

2. Fuel Gas Composition

For the stated emissions, sulfur content considered in the fuel is 0.5 grains/100scf with the below fuel chemical composition.

Constituent	Volume (%)
Methane CH4	96.2274
Ethane C2H6	2.175
Propane C3H8	0.264
Butane C4H10	0.08
Pentane C5H12	0.013
Hexanes C6H14	0.016
Heptane C7H16	0.012
Octane C8H18	0.0006
Nitrogen N2	0.664
Carbon Dioxide CO2	0.548
TOTAL	100

LHV (Btu/lb)	20885
HHV (Btu/lb)	23156

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3. Startup Emissions Data

3.1. Normal Hot Start-Up to Compliance (After Approx. 8 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min from ign	60	56	54	53
Nox as NO2	lb/event	47	44	43	43
CO	lb/event	47	36	35	35
VOC as CH4	lb/event	38.8	28	25.7	26.3
PM10/2.5 Total	lb/event	8.1	6.3	6.5	6.2
H2SO4	lb/event	1.0	0.8	0.8	0.7
Heat Consumption	MMBTU HHV	856	717	657	628

Worst-Case estimated 1-hr average exhaust flow = 1840 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

3.2. Fast Hot Start-Up to Compliance (After Approx. 8 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Condenser Evacuation Prior to Start Initiation					
Duration	min from ign	42	40	39	38
Nox as NO2	lb/event	50	48	47	47
CO	lb/event	25	20	20	20
VOC as CH4	lb/event	17	12	11	11
PM10/2.5 Total	lb/event	6.9	5.0	6.1	4.8
H2SO4	lb/event	0.8	0.7	0.7	0.7
Heat Consumption	MMBTU HHV	815	730	694	676

Worst-Case estimated 1-hr average exhaust flow = 2150 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

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3.3. Non-Spinning Reserve Start-up to Compliance (After Approx. 8 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Condenser Evacuation Prior to Start Initiation					
Duration	min from ign	42	40	39	38
Nox as NO2	lb/event	50	49	48	47
CO	lb/event	15	13	13	13
VOC as CH4	lb/event	7.9	6.2	5.7	5.8
PM10/2.5 Total	lb/event	7.2	5.0	6.4	4.6
H2SO4	lb/event	0.8	0.8	0.7	0.7
Heat Consumption	MMBTU HHV	851	776	731	700

Worst-Case estimated 1-hr average exhaust flow = 2400 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

3.4. Normal Warm Start-Up to Compliance (After Approx. 60 hours standstill).

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min from ign	129	124	125	125
Nox as NO2	lb/event	56	52	50	50
CO	lb/event	71	52	50	50
VOC as CH4	lb/event	69	46	40	41
PM10/2.5 Total	lb/event	10.4	9.0	9.0	9.0
H2SO4	lb/event	1.3	1.1	1.1	1.1
Heat Consumption	MMBTU HHV	1102	977	963	945

Worst-Case estimated 1-hr average exhaust flow = 1280 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 140F

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3.5. Normal Cold Start-Up to Compliance (After Approx. 200 hours standstill)

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min from ign	183	178	179	178
Nox as NO2	lb/event	61	57	55	54
CO	lb/event	77	56	53	53
VOC as CH4	lb/event	73	48	42	44
PM10/2.5 Total	lb/event	14	12	12	12
H2SO4	lb/event	1.7	1.6	1.6	1.6
Heat Consumption	MMBTU HHV	1502	1354	1324	1299

Worst-Case estimated 1-hr average exhaust flow = 1280 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 120F

3.6. Shutdown: Minimum Emissions Load to Flameout

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min	13	11	9.7	9.2
Nox as NO2	lb/event	4.6	3.5	2.9	2.7
CO	lb/event	17	10	8.9	8.9
VOC as CH4	lb/event	25	15	12	13
PM10/2.5 Total	lb/event	1.9	1.4	1.2	1.2
H2SO4	lb/event	0.2	0.2	0.1	0.1
Heat Consumption	MMBTU HHV	179	132	112	103

Worst-Case estimated 1-hr average exhaust flow = 1640 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

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3.7. Compliance to Low Load Operation

Note: During Low Load Operation Emissions are in compliance.

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min	12	9.9	8.8	8.3
Nox as NO2	lb/event	1.4	1.1	0.9	0.9
CO	lb/event	17	10	8.7	8.7
VOC as CH4	lb/event	24	15	11	13
PM10/2.5 Total	lb/event	1.8	1.3	1.2	1.1
H2SO4	lb/event	0.2	0.2	0.1	0.1
Heat Consumption	MMBTU HHV	168	125	106	98.3

Worst-Case estimated 1-hr average exhaust flow = 1660 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

3.8. Low Load Operation to Compliance

Note: During Low Load Operation Emissions are in compliance.

Ambient Temperature		-10°F	59°F	90°F	100°F
Duration	min	12	9.9	8.8	8.3
Nox as NO2	lb/event	1.5	1.1	1.0	0.9
CO	lb/event	15	10	8.4	8.4
VOC as CH4	lb/event	24	15	11	13
PM10/2.5 Total	lb/event	1.9	1.3	1.2	1.1
H2SO4	lb/event	0.2	0.2	0.1	0.1
Heat Consumption	MMBTU HHV	168	125	106	98.3

Worst-Case estimated 1-hr average exhaust flow = 1660 klb/hr on the hot day

Worst-Case estimated 1-hr average stack temperature = 150F

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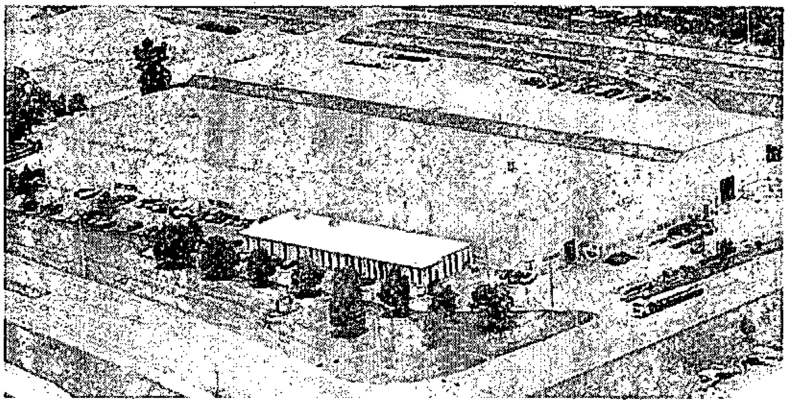
1.0 INTRODUCTION



CB Nebraska Boiler & **CB Natcom** form the engineered boiler/burner division of the **Cleaver-Brooks** family of companies. We are committed to offering integrated boiler/burner solutions to the industry. This group of companies has been in this business for more than 80 years and continues to enjoy a large percentage of the market share. We maintain our leadership in the industrial watertube market by offering innovative solutions and a true single-source responsibility to our customers for boilers, burners, controls & auxiliary equipment. This commitment to overall system design ensures that your equipment operates efficiently and lasts for years to come.

For your unique application, we are offering a packaged solution with the following design features:

1.1 OUTLET STEAM CONDITIONS:

Capacity:	77000 LB/HR ¤
Operating Pressure:	200 PSIG (at exit of non-return valve) ¤
Steam Temperature:	Saturated at 387 °F
Steam Quality:	99.5% dry steam ¤

1.2 BOILER DESIGN:

Type:	D-Type Industrial Watertube
Model:	NB-300D-70
Vessel Design Pressure:	250 psig

1.3 BURNER DESIGN:

Type:	Ultra Low-NOx Register
Main Fuel:	Natural Gas
Emissions:	9 PPM Nox

1.4 ECONOMIZER DESIGN:

Type:	Rectangular Finned-Tube
Arrangement:	Vertical Gas Flow; Counter-Current Water Flow
Design Pressure:	300 psig
Inlet Feedwater Temp:	228°F

1.5 STACK DESIGN:

Type:	Freestanding
Diameter (at exit):	78"
Height (from grade):	125 ft

3.0 BOILER DESIGN DATA

Boiler Dimensions:		**Units**
Height to Main Steam Outlet	14 Ft 7 In	FT
Overall Width of Unit	11 Ft 7.5 In	FT
Overall Length of Unit*	25.33 Ft.	FT
**Add approximately 6-8 ft length for burner.*		
Weight of Unit (Dry)	80,249.49	LBS
Weight of Unit (Wet)	102,381.53	LBS
Surface Area / Volume:		**Units**
Furnace Volume	1,379	FT3
Furnace Projected Area	819	FT2
Evaporator Area	4,277	FT2
Total Area	5,096	FT2
Economizer Area	13,317	FT2
Superheater Area	-	FT2
Tubing Data:		**Units**
Tube OD	2.0	IN
Tube Wall Thickness – Furnace Section	0.105	IN
Tube Wall Thickness – Convection Section	0.105	IN
Tube Material	SA178A	
Corrosion Allowance	NA	IN
Steam Drum:		**Units**
Inside Drum Diameter:	42 In	IN
Drum Length	25.33 Ft. Seam/Seam	FT
Drum Material:	SA516 Grade 70	
Corrosion Allowance:	NA	IN
Water Drum:		**Units**
Drum Diameter:	24 In	IN
Drum Length	25.33 Ft. Seam/Seam	FT
Drum Material:	SA106 Grade B	
Corrosion Allowance:	NA	IN
Standard Drum Connections:	**Quantity**	**Type**
Main Steam Outlet:	One	Flanged
Safety Valves:	Per ASME Code	Flanged
Feedwater Inlet:	One	Flanged
Bottom Drum Blowoff:	Two	Flanged
Water Column:	Two	Threaded (NPT)
Feedwater Regulator:	Two	Flanged
Vent:	One	NPT
Continuous Blowdown:	One	NPT
Chemical Feed:	One	NPT
Sootblower:	Two	Flanged
Auxiliary L.W. Cutouts:	One	NPT

**The above information is preliminary and shall be confirmed at time of engineering submittal.*

4.0 BOILER PERFORMANCE DATA

Fuel: Natural Gas

Boiler load - %	**100%**	**75%**	**50%**	**25%**	**Units**
Steam Flow - ¤	77,000	57,750	38,500	19,250	Lb/Hr
Steam Pressure – Operating - ¤	200.0	200.0	200.0	200.0	PSIG
Steam Temperature - ¤	387.0	387.0	387.0	387.0	°F
Fuel Input (HHV)	92.4	69.1	46.0	23.2	MMBTU/Hr
Ambient Air Temperature	80.0	80.0	80.0	80.0	°F
Relative Humidity	60	60	60	60	%
Excess Air	25	25	25	25	%
Flue Gas Recirculation	25	25	25	25	%
Steam Output Duty	77	58	39	19	MMBTU/hr
Heat Release Rate	67,012	50,097	33,366	16,805	BTU/FT3-Hr
Heat Release Rate	112,882	84,389	56,204	28,308	BTU/FT2-Hr
Deaerator Pegging Steam	-	-	-	-	Lb/Hr
Feed Water Temperature	227	227	227	227	°F
Water Temp. Leaving Economizer	321	309	297	288	±10°F
Blow Down	1.0	1.0	1.0	1.0	%
Boiler Gas Exit Temperature	543	498	451	409	±10°F
Economizer Gas Exit Temp.	299	282	266	251	±10°F
Air Flow	84,454	63,137	42,050	21,179	Lb/Hr
Flue Gas to Stack	88,692	66,305	44,160	22,241	Lb/Hr
Flue Gas Including FGR	110,865	82,881	55,200	27,802	Lb/Hr
Fuel Flow	4,237	3,167	2,109	1,062	Lb/Hr
Flue Gas Losses/Efficiency-%					
Dry Gas Loss	4.5	4.2	3.8	3.5	%
Air Moisture Loss	0.1	0.1	0.1	0.1	%
Fuel Moisture Loss	10.6	10.6	10.5	10.4	%
Casing Loss	0.5	0.7	1.0	2.0	%
Margin	0.5	0.5	0.5	0.5	%
Efficiency - LHV	92.8	93.1	93.2	92.5	%
Efficiency – HHV - ¤	83.7	84.0	84.1	83.5	%
Total Pressure Drop Including Economizer	9.46	5.30	2.35	0.56	IN WC
Products of Combustion - CO_2	7.7	7.7	7.7	7.7	%
- H_2O	16.9	16.9	16.9	16.9	%
-N_2	71.7	71.7	71.7	71.7	%
-O_2	3.8	3.8	3.8	3.8	%
-SO_2	-	-	-	-	%
GAS- % volume	**NG**				
methane	90.00				
ethane	5.00				
nitrogen	5.00				
LHV-Btu/lb	19,687				
HHV-Btu/lb	21,815				

**The above information is preliminary and shall be confirmed at time of engineering submittal.*

DIESEL GENERATOR SET

CATERPILLAR®

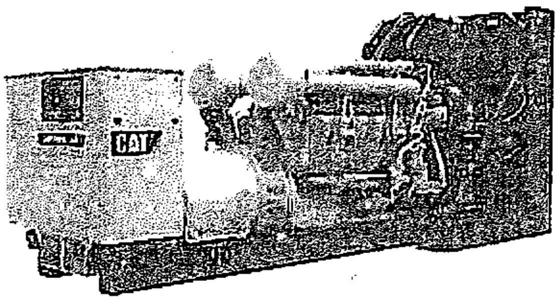


Image shown may not reflect actual package.

STANDBY

1500 ekW 1875 kVA
60 Hz 1800 rpm 480 Volts

Caterpillar is leading the power generation marketplace with Power Solutions engineered to deliver unmatched flexibility, expandability, reliability, and cost-effectiveness.

FEATURES

FUEL/EMISSIONS STRATEGY
- EPA Certified for Stationary Emergency Application (EPA Tier 2 emissions levels)

DESIGN CRITERIA
- The generator set accepts 100% rated load in one step per NFPA 110 and meets ISO 8528-5 transient response.

UL 2200
- UL 2200 listed packages available. Certain restrictions may apply. Consult with your Cat® Dealer.

FULL RANGE OF ATTACHMENTS
- Wide range of bolt-on system expansion attachments, factory designed and tested
- Flexible packaging options for easy and cost effective installation

SINGLE-SOURCE SUPPLIER
- Fully prototype tested with certified torsional vibration analysis available

WORLDWIDE PRODUCT SUPPORT
- Cat dealers provide extensive post sale support including maintenance and repair agreements
- Cat dealers have over 1,800 dealer branch stores operating in 200 countries
- The Cat® S•O•S℠ program cost effectively detects internal engine component condition, even the presence of unwanted fluids and combustion by-products

CAT 3512C DIESEL ENGINE
- Reliable, rugged, durable design
- Four-stroke-cycle diesel engine combines consistent performance and excellent fuel economy with minimum weight

CAT GENERATOR
- Designed to match the performance and output characteristics of Cat diesel engines
- Single point access to accessory connections
- UL 1446 recognized Class H insulation

CAT EMCP 3 SERIES CONTROL PANELS
- Simple user friendly interface and navigation
- Scalable system to meet a wide range of customer needs
- Integrated Control System and Communications Gateway

SEISMIC CERTIFICATION
- Seismic Certification available
- Anchoring details are site specific, and are dependent on many factors such as generator set size, weight, and concrete strength.
  IBC Certification requires that the anchoring system used is reviewed and approved by a Professional Engineer
- Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007
- Pre-approved by OSHP and carries an OPA#(OSP-0084-01) for use in healthcare projects in California

CATERPILLAR

FACTORY INSTALLED STANDARD & OPTIONAL EQUIPMENT

System	Standard	Optional
Air Inlet	• Single element canister type air cleaner with service indicator	[ ] Dual element & heavy duty air cleaners (with pre-cleaners) [ ] Air inlet adapters & shutoff
Cooling	• Radiator fan and fan drive • Fan and belt guards • Coolant level sensors* • Cat Extended Life Coolant*	[ ] Coolant level switch gauge [ ] Heat exchanger and expansion tank
Exhaust	• Exhaust manifold - dry - dual - 8 in • 203 mm (8 in) ID round flanged outlet	[ ] Mufflers [ ] Stainless steel exhaust flex fittings [ ] Elbows, flanges, expanders & Y adapters
Fuel	• Secondary fuel filters • Fuel cooler* • Fuel priming pump • Flexible fuel lines-shipped loose	[ ] Duplex secondary fuel filter [ ] Primary fuel filter with fuel water separator
Generator	• Class H insulation • Cat digital voltage regulator (CDVR) with kVAR/PF control, 3-phase sensing • Winding temperature detectors • Anti-condensation heaters • Reactive Droop	[ ] Oversize & premium generators [ ] Bearing temperature detectors
Power Termination	• Bus bar (NEMA or IEC mechanical lug holes)- right side standard • Top and bottom cable entry	[ ] Circuit breakers, UL listed, 3 pole with shunt trip,100% rated, manual or electrically operated [ ] Circuit breakers, IEC compliant, 3 or 4 pole with shunt trip, manual or electrically operated [ ] Bottom cable entry [ ] Power terminations can be located on the right, left and/or rear as an option
Governor	• ADEM™ 3	[ ] Load share module
Control Panel	• EMCP 3.1 • User Interface panel (UIP) - rear mount • AC & DC customer wiring area (right side) • Emergency stop pushbutton	[ ] EMCP 3.2 ... [ ] EMCP 3.3 [ ] Option for right or left mount UIP [ ] Local & remote annunciator modules [ ] Digital I/O Module [ ] Generator temperature monitoring & protection [ ] Remote monitoring software
Lube	• Lubricating oil and filter • Oil drain line with valves • Fumes disposal • Gear type lube oil pump	[ ] Oil level regulator [ ] Deep sump oil pan [ ] Electric & air prelube pumps [ ] Manual prelube with sump pump [ ] Duplex oil filter
Mounting	• Rails - engine / generator / radiator mounting • Anti-vibration mounts (shipped loose)	[ ] Spring-type vibration isolator [ ] IBC Isolators
Starting/Charging	• 24 volt starting motor(s) • Batteries with rack and cables • Battery disconnect switch	[ ] Battery chargers (10 & 20 Amp) [ ] 45 amp charging alternator [ ] Oversize batteries [ ] Ether starting aids [ ] Heavy duty starting motors [ ] Barring device (manual) [ ] Air starting motor with control & silencer
Note	Standard and optional equipment may vary for UL 2200 Listed Packages. UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics.	
General	• Right hand service • Paint - Caterpillar Yellow (with high gloss black rails & radiator) • SAE standard rotation • Flywheel and flywheel housing - SAE No. 00	[ ] CSA certification [ ] CE Certificate of Conformance [ ] Seismic Certification per Applicable Building Codes: IBC 2000, IBC 2003, IBC 2006, IBC 2009, CBC 2007 * Not included with packages without radiators

CATERPILLAR

SPECIFICATIONS

CAT GENERATOR

SR4B Generator
Frame Size....697
Excitation....Permanent Magnet
Pitch....0.7333
Number of poles....4
Number of bearings....1
Number of Leads....006
Insulation.... UL 1446 Recognized Class H with tropicalization and antiabrasion
IP Rating....Drip Proof IP22
Alignment....Pilot Shaft
Overspeed capability- % of rated....150
Wave form....003.00
Paralleling kit/Droop transformer....Standard
Voltage Regulator3 Phase sensing with selectible volts/Hz
Telephone influence factor....Less than 50

CAT DIESEL ENGINE

3512C ATAAC, V-12, 4 stroke, water-cooled diesel
Bore....170.00 mm (6.69 in)
Stroke....190.00 mm (7.48 in)
Displacement....51.80 L (3161.03 in³)
Compression Ratio....14.7:1
Aspiration....TA
Fuel System.... Electronic unit injection
Governor Type....ADEM3

CAT EMCP SERIES CONTROLS

- EMCP 3.1 (Standard)
- EMCP 3.2 / EMCP 3.3 (Option)
- Single location customer connector point
- True RMS AC metering, 3-phase
- Controls
  - Run / Auto / Stop control
  - Speed Adjust
  - Voltage Adjust
  - Emergency Stop Pushbutton
  - Engine cycle crank
- Digital Indication for:
  - RPM
  - Operating hours
  - Oil pressure
  - Coolant temperature
  - System DC volts
  - L-L volts, L-N volts, phase amps, Hz
  - ekW, kVA, kVAR, kW-hr, %kW, PF (EMCP 3.2 / 3.3)
- Shutdowns with common indicating light for:
  - Low oil pressure
  - High coolant temperature
  - Low coolant level
  - Overspeed
  - Emergency stop
  - Failure to start (overcrank)
- Programmable protective relaying functions: (EMCP 3.2 & 3.3)
  - Under and over voltage
  - Under and over frequency
  - Overcurrent (time and inverse time)
  - Reverse power (EMCP 3.3)
- MODBUS isolated data link, RS-485 half-duplex (EMCP 3.2 & 3.3)
- Options
  - Vandal door
  - Local annunciator module
  - Remote annunciator module
  - Input / Output module
  - RTD / Thermocouple modules
  - Monitoring software

CATERPILLAR®

TECHNICAL DATA

Open Generator Set - - 1800 rpm/60 Hz/480 Volts	DM8260	
EPA Certified for Stationary Emergency Application (EPA Tier 2 emissions levels)		
Generator Set Package Performance		
Genset Power rating @ 0.8 pf	1875 kVA	
Genset Power rating with fan	1500 ekW	
Coolant to aftercooler		
Coolant to aftercooler temp max	50 ° C	122 ° F
Fuel Consumption		
100% load with fan	396.9 L/hr	104.8 Gal/hr
75% load with fan	310.9 L/hr	82.1 Gal/hr
50% load with fan	219.8 L/hr	58.1 Gal/hr
Cooling System[1]		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Air flow (max @ rated speed for radiator arrangement)	2075 m³/min	73278 cfm
Engine Coolant capacity with radiator/exp. tank	390.8 L	103.2 gal
Engine coolant capacity	156.8 L	41.4 gal
Radiator coolant capacity	234.0 L	61.8 gal
Inlet Air		
Combustion air inlet flow rate	129.5 m³/min	4573.3 cfm
Exhaust System		
Exhaust stack gas temperature	406.4 ° C	763.5 ° F
Exhaust gas flow rate	313.2 m³/min	11060.6 cfm
Exhaust flange size (internal diameter)	203.2 mm	8.0 in
Exhaust system backpressure (maximum allowable)	6.7 kPa	26.9 in. water
Heat Rejection		
Heat rejection to coolant (total)	616 kW	35032 Btu/min
Heat rejection to exhaust (total)	1327 kW	75466 Btu/min
Heat rejection to aftercooler	482 kW	27411 Btu/min
Heat rejection to atmosphere from engine	124 kW	7052 Btu/min
Heat rejection to atmosphere from generator	64.1 kW	3645.4 Btu/min
Alternator[2]		
Motor starting capability @ 30% voltage dip	2670 skVA	
Frame	697	
Temperature Rise	130 ° C	234 ° F
Lube System		
Sump refill with filter	310.4 L	82.0 gal
Emissions (Nominal)[3]		
NOx g/hp-hr	4.97 g/hp-hr	
CO g/hp-hr	.45 g/hp-hr	
HC g/hp-hr	.11 g/hp-hr	
PM g/hp-hr	.03 g/hp-hr	

[1] For ambient and altitude capabilities consult your Cat dealer. Air flow restriction (system) is added to existing restriction from factory.
[2] UL 2200 Listed packages may have oversized generators with a different temperature rise and motor starting characteristics. Generator temperature rise is based on a 40 degree C ambient per NEMA MG1-32.
[3] Emissions data measurement procedures are consistent with those described in EPA CFR 40 Part 89, Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77°F, 28.42 in HG and number 2 diesel fuel with 35° API and LHV of 18,390 btu/lb. The nominal emissions data shown is subject to instrumentation, measurement, facility and engine to engine variations. Emissions data is based on 100% load and thus cannot be used to compare to EPA regulations which use values based on a weighted cycle.

RATING DEFINITIONS AND CONDITIONS

Meets or Exceeds International Specifications: AS1359, CSA, IEC60034-1, ISO3046, ISO8528, NEMA MG 1-22, NEMA MG 1-33, UL508A, 72/23/EEC, 98/37/EC, 2004/108/EC

Standby - Output available with varying load for the duration of the interruption of the normal source power. Average power output is 70% of the standby power rating. Typical operation is 200 hours per year, with maximum expected usage of 500 hours per year. Standby power in accordance with ISO8528. Fuel stop power in accordance with ISO3046. Standby ambients shown indicate ambient temperature at 100% load which results in a coolant top tank temperature just below the shutdown temperature.

Ratings are based on SAE J1349 standard conditions. These ratings also apply at ISO3046 standard conditions.

Fuel rates are based on fuel oil of 35° API [16° C (60° F)] gravity having an LHV of 42 780 kJ/kg (18,390 Btu/lb) when used at 29° C (85° F) and weighing 838.9 g/liter (7.001 lbs/U.S. gal.). Additional ratings may be available for specific customer requirements, contact your Cat representative for details. For information regarding Low Sulfur fuel and Biodiesel capability, please consult your Cat dealer.

CATERPILLAR®

DIMENSIONS

Package Dimensions		
Length	5895.0 mm	232.09 in
Width	2537.5 mm	99.9 in
Height	2749.5 mm	108.25 in
Weight	14 035 kg	30,942 lb

NOTE: For reference only - do not use for installation design. Please contact your local dealer for exact weight and dimensions. (General Dimension Drawing #2846048).

Performance No.: DM8260

Feature Code: 512DE6C

Gen. Arr. Number: 2628100

Source: U.S. Sourced

www.CAT-ElectricPower.com

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The International System of Units (SI) is used in this publication.

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CLARKE

Fire Protection Products, Inc.

Engine Selection / De-rate Calculator / Speed Interpolator

USA Purchased, USA Installed, 2011 Models, UL/FM Approved, Heat Exchanger Cooled

DATE: 2/18/2011

PUMP REQUIREMENTS:
Pump Max Power: 315 BHP
RPM(s): 1800

DERATE PARAMETERS:
Altitude: 185 (feet)
Ambient Temperature: 77 (°F)
Right Angle Gear Loss: 0%
Derate Percent: .0

APPLICATION INFO:
Customer:
Job Name:
Job Number:
Run By:

RESULTS:

Model	RPM	Rated HP (KW)	Derate HP (KW)	Emissions Tier	Interpolation Data (RPM, HP)
JU6H-UFAD98	1800	315 (235)		T3-Certified	Not used

NOTE:
Derated HP takes into account all the input derates for altitude, temperature and Right Angle Gearbox. When no derates are input, this column will be blank and engine selection(s) will be based upon Rated HP When the Derated HP column is filled in, then the engine selection(s) are based upon this value

DEFINITIONS:

- UL/FM - Engine that is Underwriters Laboratories Listed and Factory Mutual Approved
- LPCB - Engine that is Loss Prevention Council Board Approved
- NL - Non-Listed Engine has no private agency certification, like UL, or insurance company certification, like FM It applies to any engine that is not UL Listed or FM Approved, and is built to meet individual European country specifications

North American Offices, 3133 East Kemper Road * Cincinnati, Ohio * 45241 * USA * Tel: +1 (513) 475-3473 * Fax. +1 (513) 771-0726
European Office Grange Works * Lomond Road * Coatbridge, Scotland * ML5 2NN * Tel: +44 (0)1236 429 946 * Fax: +44 (0)1236 427 274

CLARKE

Fire Protection Products, Inc.

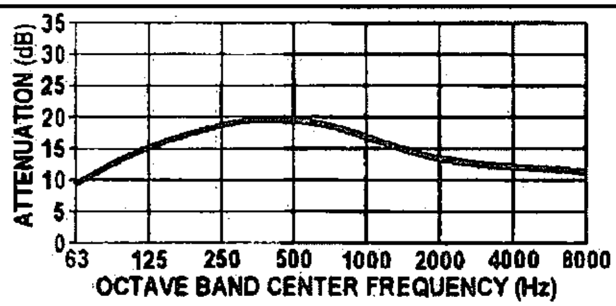
Exhaust Backpressure Calculator - Results
Calculations made 2/18/2011

Data input by:

Input Data:		
Customer:	Job Name:	Job Number:
Engine Data:	**Piping Data:**	**Silencer Data:**
Manufacturer: Clarke	Pipe Size: 5"	Manufacturer: Clarke USA
Model: JU6H-UFAD98	#90° elbow or Y:	Pipe Size (in): 5
RPM: 1760	Number 45° elbows:	Model: C06545
HP:315	Number Tees:	Application: Industrial
	Straight Pipe (Feet): 30	Connection: 150# Flange

Output Data:

Exh Flow (CFM): 1400	
Temperature (° F): 961	
Max Backpressure (inches water): 30	
Min Backpressure (inches water): 0	
Std. Exhaust Dia (in): 5	



Exhaust Pipe Recommendation:

BACKPRESSURE CALCULATIONS (inches water)		
	6.5	Pipe
	+ 8.0	Silencer (see note 1)
	14.5	Total
	30.0	Maximum Allowable Backpressure
	Result: Total Backpressure is lower than minimum	

1) CAUTION Silencer Backpressure is based upon a Clarke USA provided Silencer Actual Silencer Backpressure will vary depending upon the actual Silencer used (manufacturer, size, type and model). If the total Backpressure from the pipe, Silencer and orifice plate (if required) is close to the engine Maximum Allowed Backpressure, it is highly recommended you obtain the actual Backpressure (for the engine exhaust flow given above) on the Silencer being used and then confirm that the total Backpressure is still under the Maximum Allowed Backpressure
2) Schedule 40 pipe used in calculations
3) All pipe sizes and lengths are in inches and feet.
4) WARNING: The total Backpressure is less than the engine permissible Backpressure In order to get the maximum Backpressure above the engine permissible limit, you must change one or more of the following: pipe size; pipe length; Silencer size, Silencer type.

North American Offices:
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