TETRA TECH EC, INC.

February 27, 2013

Mr. Eric Solorio
California Energy Commission
Docket No. 11-AFC-3
1516 9th St.
Sacramento, CA 95814

Cogentrix Quail Brush Generation Project - Docket Number 11-AFC-3, Quail Brush Generation Project Revised 1-Hour NO2 Modeling Assessment and Modeling Files

Docket Clerk:

Pursuant to the provisions of Title 20, California Code of Regulation, and on behalf of Quail Brush Genco, LLC, a wholly owned subsidiary of Cogentrix Energy, LLC, Tetra Tech hereby submits the *Quail Brush Generation Project Revised 1-Hour NO2 Modeling Assessment and Modeling Files* for the Quail Brush Power Project (11-AFC-3). The Quail Brush Generation Project is a 100 megawatt natural gas fired electric generation peaking facility to be located in the City of San Diego, California. As specific computer software is needed to open and run the modeling files, the Applicant is not serving each party with the CD but is filing with the Docket Unit and will provide a copy of the CD upon request.

If you have any questions regarding this submittal, please contact Rick Neff at (704) 525-3800 or me at (303) 980-3653.

Sincerely,

Constance C. Farmer

Constance E. Farmer
Project Manager/Tetra Tech

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION FOR THE QUAIL BRUSH GENERATION PROJECT

Docket No. **11**-AFC-03

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(Revised 02/12/2013)

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After docketing, the Docket Unit will provide a copy to the persons listed below. Do not send copies of documents to these persons unless specifically directed to do so.

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Adviser to Commissioner McAllister

Patrick Saxton
Adviser to Commissioner McAllister

Eileen Allen
Commissioners' Technical
Adviser for Facility Siting

* Indicates change

Declaration of Service

I, Constance Farmer, declare that on February 27, 2013, I served and filed copies of the attached Revised 1-Hour NO2 Modeling Assessment, Cogentrix Quail Brush Generation Project, City of San Diego, San Diego County, California (11-AFC-03). This document is accompanied by the most recent Proof of Service, which I copied from the web page for this project at: http://www.energy.ca.gov/sitingcases/quailbrush/index.html.

The document has been sent to the other persons on the Service List above in the following manner:

(C*heck one*)

For service to all other parties and filing with the Docket Unit at the Energy Commission:

_X_ I e-mailed the document to all e-mail addresses on the Service List above and personally delivered it or deposited it in the US mail with first class postage to those parties noted above as “hard copy required”; OR

__ Instead of e-mailing the document, I personally delivered it or deposited it in the US mail with first class postage to all of the persons on the Service List for whom a mailing address is given.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct, and that I am over the age of 18 years.

Dated: February 27, 2013

REVISED 1-HOUR NO_2 MODELING ASSESSMENT

For the:

QUAIL BRUSH GENERATION PROJECT

Prepared for:

Quail Brush Genco, LLC.
9405 Arrowpoint Boulevard
Charlotte, NC 28273

Prepared by:

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ATMOSPHERIC DYNAMICS, INC
Meteorological & Air Quality Modeling

February 2013

Revised Quail Brush Generation Project 1-Hour NO_2 Startup Air Quality Impact Assessment

This report describes the Quail Brush Generation Project (QBGP) air quality modeling results for the comparison to the Federal 1-hour standard of 188 ug/m^3. Potential air quality impacts were evaluated based on air quality dispersion modeling, as described herein. With the exception of the binary data files, all input and output modeling files are contained on a CD-ROM disk provided with this report. The modeling analyses were performed using the techniques and methods outlined by the EPA in the June 2010 "*Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program*" (EPA, June 2010).

DISPERSION MODELING

For modeling the potential impact of QBGP in terrain that is both below and above stack top (defined as simple terrain when the terrain is below stack top and complex terrain when it is above stack top), the USEPA guideline model AERMOD (version 12345) was used with the Plume Volume Molar Ratio Method for comparison with the Federal 1-hour NO_2 standard. The meteorological and receptor data sets used in this revised analysis were based on the data used in the October 2012 assessment.

The purpose of the revised AERMOD modeling analysis was to evaluate compliance with the federal 1-hour NO_2 air quality standard. As discussed with CEC Staff, the modeled 98th percentile daily average 1-hour NO_2 modeled concentration was added to the seasonal monitored background NO_2 concentrations in order to determine the total modeled impact.

Two operating profiles were assessed for compliance with the 1-hour NO_2 standard: (1) six engines starting up in the same hour with the other five engines nonoperational and (2) six engines starting up in the same hour with the other five engines at full operational load. In both cases, the heaters are fully operational. The stack parameters were those used in the October 2012 application.

The worst case cold startup emissions along with the assumptions on the NO_2/NO_x ratios were modified with this submittal and are based upon the following procedures:

1. Only six (6) engines may start-up at any one-time (1-hour time frame).
2. Per the most recent analysis of applicable NO_2/NO_x ratios, QBGP has proposed to use the following ratios for the following time periods:
   a. 25% for the cold startup period of 25 minutes for each engine.
   b. 18.5% for the remaining 35 minutes in the startup hour for each engine.
   c. These changes result in a weighted start-up hour NO_2/NO_x ratio of 21.2%.
3. QBGP has reduced, per item 3 above, the cold start-up time from 30 to 25 minutes. This reduction amounts to a 17% reduction in the cold start-up time.
4. QBGP has approved a reduction in the cold start-up NOx emissions of 10%, which decreases the pound/event value from 8.82 lbs to 7.94 lbs of NO_x.

5. The pound per hour NOx emission rate used in the assessment becomes 8.7091 lb/hr or 1.09735 g/s per engine for a startup hour. Thus, each engine in startup represents 25 minutes in startup mode and 35 minutes at 100 percent base load.
6. For all other operations hours, including warm start hours, the previously established NO_2/NO_x ratio of 18.5% will apply.

The previous worst-case hour included a shutdown, but this case was removed from the analysis as the engines will not startup, run and then shut down during any one-hour period. The updated emissions for all engines are provided as an attachment at the end of this document.

The worst case NO_2 facility configuration, eleven engines at 100% load for 70°F ambient temperatures (Case I), was modeled with AERMOD. The modeling options and inputs were the same as the previous modeled, namely:

- Seasonal NO_2 background data for 2008-2010 (third-highest seasonal value for each hour, with the NO_2 data first processed in accordance with the guidance contained in the CAPCOA Guidance Document "Modeling Compliance of The Federal 1-Hour NO_2 NAAQS" dated October 27, 2011) from the Kearny Mesa site were used to assess compliance with the NAAQS based on the 5-year average of the annual 8th highest daily 1-hour maxima.

Receptor and source base elevations were determined from the USGS National Elevation Dataset (NED) data in the GeoTIFF format at a horizontal resolution of 1/3 arc-second (approximate 10 meter spacing). Because of the format of the NED data, all coordinates (both sources and receptors) were referenced to UTM North American Datum 1983 (NAD83, Zone 11). Elevation locations in the NED dataset were interpolated by AERMAP to the UTM locations appropriate for the receptor grid spacings shown below.

The receptor grids used in the modeling analysis are presented in Figure 1.

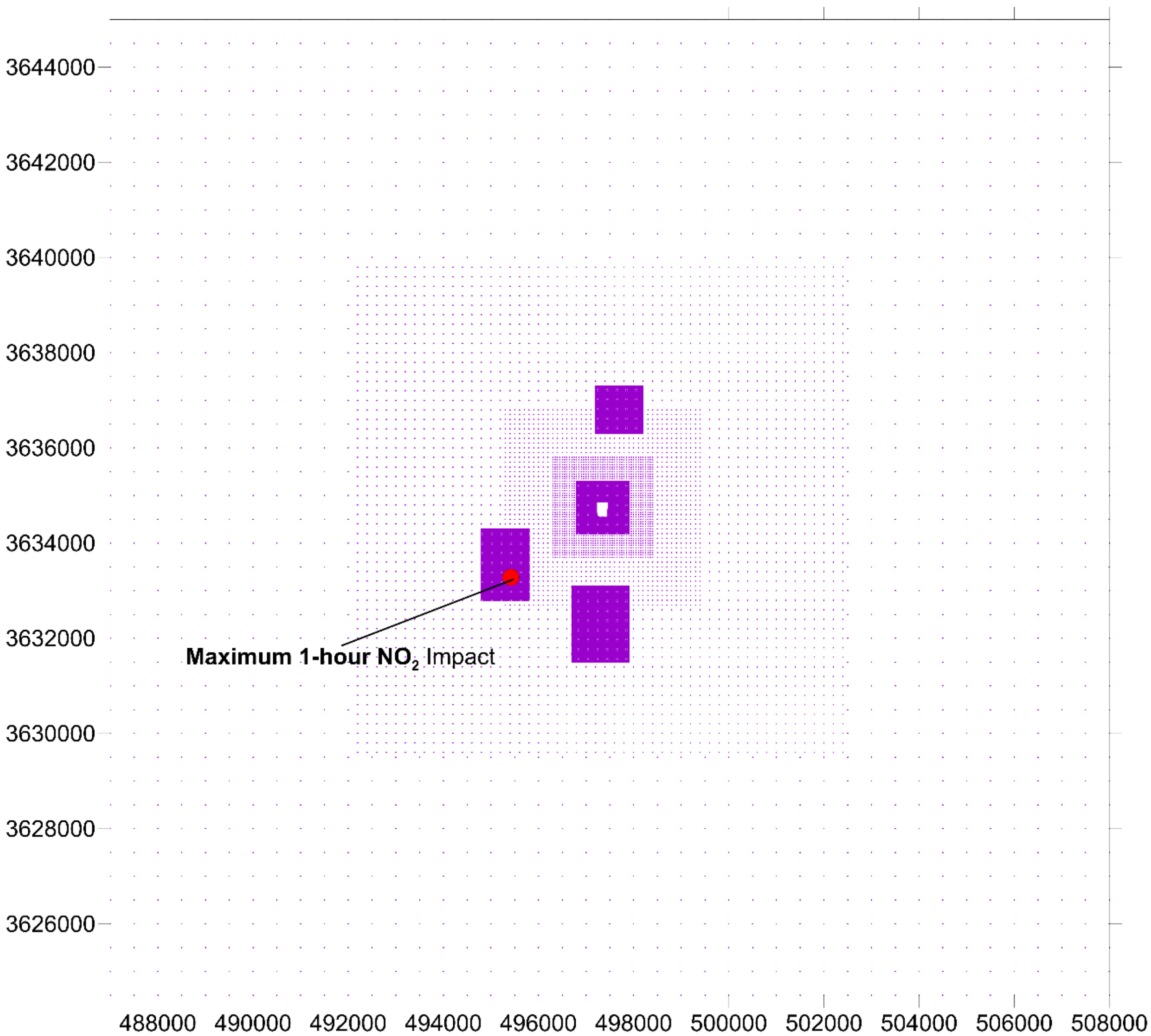
PLUME VOLUME MOLAR RATIO METHOD

As with one of the existing techniques called the Ozone Limiting Method (OLM), the Plume Volume Molar Ratio Method (PVMRM) approach limits the conversion of NO to NO_2 based on the amount of ambient ozone available. The OLM involves an initial comparison of the estimated maximum NO_x concentration and the ambient ozone concentration to determine which is the limiting factor to NO_2 formation. If the ozone concentration is greater than the maximum NO_x concentration, total conversion is assumed. If the NO_x concentration is greater than the ozone concentration, the formation of NO_2 is limited by the ambient ozone concentration. In this case, the NO_2 concentration is set equal to the ozone concentration plus a correction factor that accounts for in-stack and near-stack thermal conversion. However, the PVMRM approach limits the conversion based on the amount of ozone within the volume of the plume. With PVMRM, the NO_2/NO_x conversion ratio is coupled with the dispersion of the plume. The PVMRM approach also incorporates a technique for merging plumes from nearby sources for purposes of calculating the NO_2/NO_x ratios.

The PVMRM was used with concurrent hourly 1-hour ozone concentrations to calculate the 1-hour NO_2 concentrations using the AERMOD PVMRM subroutine. Ozone data from the Overland Avenue Monitoring Station for the same period as the meteorological data (2003-2007) were used for the PVMRM analyses. Missing ozone data for periods of 1 hour were interpolated from the monitoring data before/after the missing period. Missing data for longer periods were replaced with data from nearest ozone monitoring station.

As stated above, seasonal background NO_2 data was added to the modeled concentrations to produce a combined impact for comparison with the Federal 1-hour NO_2 standard.

Figure 1 Receptor Grids used in AERMOD for the Revised 1-hour NO_2 Analysis



AERMOD MODELING RESULTS

In order to determine which of the six (6) engines in startup mode would produce the largest impact, a series of screening runs were performed with various combinations of engines in startup and in base load operation. It was determined that the worst-case impacts would occur for the case where five (5) of the engines were at 100 percent load and the remaining six (6) were in startup. The engines are clustered into two groups, with one of the groups of six (6) engines on the western side and five (5) engines in the eastern side. Six engine startups of beginning on the western side and rotating towards the east were assessed. It became apparent that the eastern engines always produce the largest impacts for the 1-hour NO_2 standard. Thus, the worst case 1-hour NO_2 results are based on the five (5) engines starting up on the eastern cluster with one (1) engine starting up in the western grouping. The remaining five (5) engines are at 100 percent load.

The revised 1-hour NO_2 impacts are compared below to the AAQS. Maximum impacts for both NAAQS/CAAQS occurred on the high resolution receptor grids, so no additional refined receptor grids were necessary. Figure 1 identifies the location of the maximum 1-hour NO_2 impact. As can be seen in Table 1, the facility will comply with applicable state/California and Federal/ National NO_2 standards.

Table 1 Comparison of NO_2 Air Quality Impacts to the AAQS

Pollutant	Avg. Period	Maximum Concentration ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	Ambient Air Quality CAAQS/NAAQS	
					($\mu g/m^3$)	($\mu g/m^3$)
STARTUP QBGP CONDITIONS:						
NO_2	1-hour Federal	180.232	-	180.23	-	188
	1-hour State	314.044	-	314.04	339	-

Notes: Background concentrations included by AERMOD for 1-hour NO_2 impacts.

CONCLUSION

The results of the revised startup modeling analysis for NO_2 demonstrates that the proposed project will safely comply with the federal 1-hour ambient air quality standard for NO_2.

Table F.1-1 (Revised 02-26-13)

Maximum Hourly, Daily, and Annual Emissions Calculations

Number of Identical Engines: 11

Full Load Case

Input data per unit:

Operation hrs/day	Annual Op hrs	Avg # of Cold Startups day	Avg # of Warm Startups day	Cold Startup Time hrs	Warm Startup Time hrs	Shutdown Time hrs	Cold Starts yr	Warm Starts yr	Estimated Shutdowns yr	Max Estimated Shutdowns day
24	4032	1	1	0.416	0.25	0.1417	300	100	400	2

	Cold Startup Emissions lbs/event	Warm Startup Emissions lbs/event	Shutdown Emissions lbs/event	Steady State Emissions lbs/hr *(100% Load)*	Total Cold Start hrs/yr	Total Warm Start hrs/yr	Total Shutdown hrs/yr	Annual Steady State Non SU/SD hrs/yr	Total Annual Emissions Cold Starts lbs/yr	Total Annual Emissions Warm Starts lbs/yr	Total Annual Emissions Shutdowns lbs/yr
NOx	7.94	2.43	0.2	1.317	124.8	25	56.68	3825.52	2382.0	243.0	80.0
CO	12.57	1.322	0.31	1.564					3771.0	132.2	124.0
VOC	6.614	1.764	0.34	1.584					1984.2	176.4	136.0
SOx	0.137	0.07	0.05	0.256					41.1	7.0	20.0
PM10	1.54	1.54	0.35	1.379					462.0	154.0	140.0
PM2.5	1.54	1.54	0.35	1.379					462.0	154.0	140.0

1. SU/SD emissions data and times derived from: Wartsila Emissions Data Sheet, DBAB715360, 2-27-11.
2. Cold start (CS): engine will reach steady state in 10 minutes and controls (SCR and CO Cat) will be fully operational in 30 minutes.
3. Warm start (WS): engine will reach steady state in 10 minutes and controls (SCR and CO Cat) will be fully operational in 15 minutes.
4. A warm start is defined as a start initiated within 2-6 hours after the engine has been shutdown, or when the emissions control system is at a temperature of no less than 270 C (518 F).
5. Shutdown time is optimally 8.5 minutes per Wartsila.
6. Cold start w/o shutdown = 0.416 hrs steady state = 0.584 hrs
7. Warm start w/o shutdown = 0.25 hrs steady state = 0.75 hrs
8. Shut down = 0.1417 hrs steady state = 0.8583 hrs
9. Steady state (SS) emissions values derived from Cogentrix/Wartsila.
10. SO2 emissions include S to SO2 from lube oil burn-off from cylinder sleeves.

Maximum Estimated Hourly Emissions **1 Hour Period**		NOx lbs/hr	CO lbs/hr	VOC lbs/hr	SOx lbs/hr	PM10 lbs/hr	PM2.5 lbs/hr	
Scenario 1		8.71	13.48	7.54	0.29	2.35	2.35	*1 Engine*
Cold Start w/Steady State (5 Engines)		43.55	67.42	37.70	1.43	11.73	11.73	5 Engines
Cold Start w/Steady State (6 Engines)		52.25	80.90	45.23	1.72	14.07	14.07	6 Engines
Scenario 2		3.42	2.50	2.95	0.26	2.57	2.57	*1 Engine*
Warm Start w/Steady State		37.60	27.45	32.47	2.88	28.32	28.32	All Engines
Scenario 3		8.91	13.79	7.88	0.34	2.70	2.70	*1 Engine*
Cold Start, Steady State, Shutdown	***	98.00	151.73	86.67	3.70	29.65	29.65	All Engines
Scenario 4		3.62	2.81	3.29	0.31	2.92	2.92	*1 Engine*
Warm Start, Steady State, Shutdown	***	39.80	30.86	36.21	3.43	32.17	32.17	All Engines
Scenario 5		1.33	1.65	1.70	0.27	1.53	1.53	*1 Engine*
Steady State w/Shutdown		14.63	18.18	18.70	2.97	16.87	16.87	All Engines
Scenario 6		1.32	1.56	1.58	0.26	1.38	1.38	*1 Engine*
Steady State		14.49	17.20	17.42	2.82	15.17	15.17	All Engines

*** cannot occur, once SU is finalized, the unit(s) must run for 2 hours prior to a SD

Maximum Estimated Daily Emissions **24 Hr Period Run Day**	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
Scenario 1	39.20	49.77	44.31	6.22	34.41	34.41	*1 Engine*
Cold Start, Steady State, Shutdown	431.20	547.42	487.42	68.47	378.54	378.54	All Engines
Scenario 2	33.91	38.78	39.72	6.20	34.64	34.64	*1 Engine*
Warm Start, Steady State, Shutdown	373.00	426.55	436.96	68.20	381.05	381.05	All Engines
Scenario 3	31.61	37.54	38.02	6.14	33.10	33.10	*1 Engine*
Steady State	347.69	412.90	418.18	67.58	364.06	364.06	All Engines
Scenario 4							*1 Engine*
******							All Engines

Maximum Estimated Daily Emissions **16 Hr Period Run Day**	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
Scenario 1	28.66	37.25	31.64	4.18	23.38	23.38	*1 Engine*
Cold Start, Steady State, Shutdown	315.31	409.79	348.03	45.94	257.18	257.18	All Engines
Scenario 2	23.37	26.27	27.05	4.15	23.61	23.61	*1 Engine*
Warm Start, Steady State, Shutdown	257.10	288.92	297.57	45.67	259.70	259.70	All Engines
Scenario 3	21.07	25.02	25.34	4.10	22.06	22.06	*1 Engine*
Steady State	231.79	275.26	278.78	45.06	242.70	242.70	All Engines
Scenario 4							*1 Engine*
******							All Engines

Maximum Estimated Daily Emissions **8 Hr Period Run Day**	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
Scenario 1	18.13	24.74	18.97	2.13	12.35	12.35	*1 Engine*
Cold Start, Steady State, Shutdown	199.41	272.16	208.64	23.41	135.83	135.83	All Engines
Scenario 2	12.84	13.75	14.38	2.10	12.58	12.58	*1 Engine*
Warm Start, Steady State, Shutdown	141.20	151.28	158.18	23.14	138.35	138.35	All Engines
Scenario 3	10.54	12.51	12.67	2.05	11.03	11.03	*1 Engine*
Steady State	115.90	137.63	139.39	22.53	121.35	121.35	All Engines
Scenario 4							*1 Engine*
******							All Engines

Other Misc Scenarios -based on run hour type

(CS-cold start hour, WS-warm start hour, SD-shutdown hour, SS-steady state hour)

	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
a - CS, SS, SD, WS, SS, SD (total ops period 12 hrs)							
	25.32	31.80	26.56	3.14	19.02	19.02	*1 Engine*
	278.56	349.75	292.18	34.50	209.21	209.21	All Engines
b - 3 CSs, 1 WS, 4 SDs, SS (total ops period 24 hrs)							
	55.94	74.58	57.71	6.30	37.81	37.81	*1 Engine*
	615.33	820.37	634.82	69.26	415.90	415.90	All Engines

Maximum Estimated Annual Emissions		NOx lbs/yr	CO lbs/yr	VOC lbs/yr	SOx lbs/yr	PM10 lbs/yr	PM2.5 lbs/yr
Ops Scenario							
Cold Startups		2382.0	3771.0	1984.2	41.1	462.0	462.0
Warm Startups		243.0	132.2	176.4	7.0	154.0	154.0
Shutdowns		80.0	124.0	136.0	20.0	140.0	140.0
Steady State		5038.2	5983.1	6059.6	979.3	5275.4	5275.4
	1 Engine Totals, lbs/yr:	*7743.2*	*10010.3*	*8356.2*	*1047.4*	*6031.4*	*6031.4*
	1 Engine Totals, tons/yr:	3.87	5.01	4.18	0.52	3.02	3.02
		NOx tpy	CO tpy	VOC tpy	SOx tpy	PM10 tpy	PM2.5 tpy
	Total Tons/Yr All Engines:	**42.59**	**55.06**	**45.96**	**5.76**	**33.17**	**33.17**
EPA	PSD Significant Emissions Rates, TPY:	40	100	40	40	15	10
SDAPCD	Air Agency Offset Trigger Levels, TPY:	50	100	50	100	100	100

GHG Emissions Estimates

CCAR, General Reporting Protocol, Version 3.1, January 2009, Table C.6.

1 short ton = 2000 lbs, 1 metric ton = 2200 lbs.

Fuel:	Natural Gas								
Btu/scf:	1019	HHV							
Heat Rate:	80.18	mmbtu/hr							
Fuel Rate:	0.0787	mmscf/hr						CO2e	
						short	IPCC SAR	short	
Emissions Factors			*Emissions*	lbs/hr	lbs/year	tons/yr	Values	tons/yr	
CO2	116.954	lbs/mmbtu		9.38E+03	3.78E+07	1.89E+04	1	1.89E+04	
CH4	0.01301	lbs/mmbtu		1.04E+00	4.21E+03	2.10E+00	21	4.42E+01	
N2O	0.0002205	lbs/mmbtu		1.77E-02	7.13E+01	3.56E-02	310	1.10E+01	

Total CO2e:	18960	short TPY	1 Engine
Total CO2e:	208560	short TPY	All Engines
Total CO2e:	17236	metric TPY	1 Engine
Total CO2e:	**189600**	**metric TPY**	All Engines

PSD Triggered for GHGs: Yes

75% Load Evaluation
Maximum Hourly, Daily Emissions Calculations

Number of Identical Engines: 11

Input data per unit:

Operation hrs/day	Annual Op hrs	Avg # of Cold Startups day	Avg # of Warm Startups day	Cold Startup Time hrs	Warm Startup Time hrs	Shutdown Time hrs	Cold Starts yr	Warm Starts yr	Estimated Shutdowns yr	Max Estimated Shutdowns day
24	4032	1	1	0.416	0.25	0.1417	300	100	400	2

	Cold Startup Emissions lbs/event	Warm Startup Emissions lbs/event	Shutdown Emissions lbs/event	Steady State Emissions lbs/hr ***(75% Load)***
NOx	7.94	2.43	0.2	1.11
CO	12.57	1.322	0.31	1.48
VOC	6.614	1.764	0.34	1.541
SOx	0.137	0.07	0.05	0.256
PM10	1.54	1.54	0.35	1.372
PM2.5	1.54	1.54	0.35	1.372

1. SU/SD emissions data and times derived from: Wartsila Emissions Data Sheet, DBAB715360, 2-27-11.
2. Cold start (CS): engine will reach steady state in 10 minutes and controls (SCR and CO Cat) will be fully operational in 25 minutes.
3. Warm start (WS): engine will reach steady state in 10 minutes and controls (SCR and CO Cat) will be fully operational in 15 minutes.
4. A warm start is defined as a start initiated within 2-6 hours after the engine has been shutdown, or when the emissions control system is at a temperature of no less than 270 C (518 F).
5. Shutdown time is optimally 8.5 minutes per Wartsila.
6. Cold start w/o shutdown = 0.416 hrs steady state = 0.584 hrs
7. Warm start w/o shutdown = 0.25 hrs steady state = 0.75 hrs
8. Shut down = 0.1417 hrs steady state = 0.8583 hrs
9. Steady state (SS) emissions values derived from Cogentrix/Wartsila.
10. SO2 emissions include S to SO2 from lube oil burn-off from cylinder sleeves.

Maximum Estimated Hourly Emissions 1 Hour Period		NOx lbs/hr	CO lbs/hr	VOC lbs/hr	SOx lbs/hr	PM10 lbs/hr	PM2.5 lbs/hr	
Scenario 1		8.59	13.43	7.51	0.29	2.34	2.34	*1 Engine*
Cold Start w/Steady State (5 Engines)		42.94	67.17	37.57	1.43	11.71	11.71	5 Engines
Cold Start w/Steady State (6 Engines)		51.53	80.61	45.08	1.72	14.05	14.05	6 Engines
Scenario 2		3.26	2.43	2.92	0.26	2.57	2.57	*1 Engine*
Warm Start w/Steady State		35.89	26.75	32.12	2.88	28.26	28.26	All Engines
Scenario 3		8.79	13.74	7.85	0.34	2.69	2.69	*1 Engine*
Cold Start, Steady State, Shutdown	***	96.67	151.19	86.39	3.70	29.60	29.60	All Engines
Scenario 4		3.46	2.74	3.26	0.31	2.92	2.92	*1 Engine*
Warm Start, Steady State, Shutdown	***	38.09	30.16	35.86	3.43	32.11	32.11	All Engines
Scenario 5		1.15	1.58	1.66	0.27	1.53	1.53	*1 Engine*
Steady State w/Shutdown		12.68	17.38	18.29	2.97	16.80	16.80	All Engines
Scenario 6		1.11	1.48	1.54	0.26	1.37	1.37	*1 Engine*
Steady State		12.21	16.28	16.95	2.82	15.09	15.09	All Engines

*** cannot occur, once SU is finalized, the unit(s) must run for 2 hours prior to a SD

Maximum Estimated Daily Emissions **24 Hr Period Run Day**	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
Scenario 1	34.32	47.78	43.30	6.22	34.25	34.25	*1 Engine*
Cold Start, Steady State, Shutdown	377.50	525.63	476.27	68.47	376.72	376.72	All Engines
Scenario 2	28.99	36.78	38.70	6.20	34.48	34.48	*1 Engine*
Warm Start, Steady State, Shutdown	318.92	404.60	425.73	68.20	379.23	379.23	All Engines
Scenario 3	26.64	35.52	36.98	6.14	32.93	32.93	*1 Engine*
Steady State	293.04	390.72	406.82	67.58	362.21	362.21	All Engines
Scenario 4							*1 Engine*
******							All Engines

Maximum Estimated Daily Emissions **16 Hr Period Run Day**	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
Scenario 1	25.44	35.94	30.97	4.18	23.27	23.27	*1 Engine*
Cold Start, Steady State, Shutdown	279.82	395.39	340.66	45.94	255.98	255.98	All Engines
Scenario 2	20.11	24.94	26.37	4.15	23.50	23.50	*1 Engine*
Warm Start, Steady State, Shutdown	221.24	274.36	290.12	45.67	258.49	258.49	All Engines
Scenario 3	17.76	23.68	24.66	4.10	21.95	21.95	*1 Engine*
Steady State	195.36	260.48	271.22	45.06	241.47	241.47	All Engines
Scenario 4							*1 Engine*
******							All Engines

Maximum Estimated Daily Emissions **8 Hr Period Run Day**	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
Scenario 1	16.56	24.10	18.64	2.13	12.30	12.30	*1 Engine*
Cold Start, Steady State, Shutdown	182.14	265.15	205.05	23.41	135.25	135.25	All Engines
Scenario 2	11.23	13.10	14.05	2.10	12.52	12.52	*1 Engine*
Warm Start, Steady State, Shutdown	123.56	144.12	154.51	23.14	137.75	137.75	All Engines
Scenario 3	8.88	11.84	12.33	2.05	10.98	10.98	*1 Engine*
Steady State	97.68	130.24	135.61	22.53	120.74	120.74	All Engines
Scenario 4							*1 Engine*
******							All Engines

Other Misc Scenarios -based on run hour type

(CS-cold start hour, WS-warm start hour, SD-shutdown hour, SS-steady state hour)

	NOx lbs/day	CO lbs/day	VOC lbs/day	SOx lbs/day	PM10 lbs/day	PM2.5 lbs/day	
a - CS, SS, SD, WS, SS, SD (total ops period 12 hrs)							
	23.04	30.87	26.09	3.14	18.94	18.94	*1 Engine*
	253.40	339.54	286.96	34.50	208.36	208.36	All Engines
b - 3 CSs, 1 WS, 4 SDs, SS (total ops period 24 hrs)							
	51.40	72.74	56.77	6.30	37.66	37.66	*1 Engine*
	565.38	800.10	624.45	69.26	414.21	414.21	All Engines

50% Load Evaluation
Maximum Hourly, Daily Emissions Calculations

Number of Identical Engines: 11

Input data per unit:

Operation hrs/day	Annual Op hrs	Avg # of Cold Startups day	Avg # of Warm Startups day	Cold Startup Time hrs	Warm Startup Time hrs	Shutdown Time hrs	Cold Starts yr	Warm Starts yr	Estimated Shutdowns yr	Max Estimated Shutdowns day
24	4032	1	1	0.416	0.25	0.1417	300	100	400	2

	Cold Startup Emissions lbs/event	Warm Startup Emissions lbs/event	Shutdown Emissions lbs/event	Steady State Emissions lbs/hr ***(50% Load)***
NOx	7.94	2.43	0.2	0.921
CO	12.57	1.322	0.31	1.494
VOC	6.614	1.764	0.34	1.504
SOx	0.137	0.07	0.05	0.256
PM10	1.54	1.54	0.35	1.361
PM2.5	1.54	1.54	0.35	1.361

1. SU/SD emissions data and times derived from: Wartsila Emissions Data Sheet, DBAB715360, 2-27-11.
2. Cold start (CS): engine will reach steady state in 10 minutes and controls (SCR and CO Cat) will be fully operational in 30 minutes.
3. Warm start (WS): engine will reach steady state in 10 minutes and controls (SCR and CO Cat) will be fully operational in 15 minutes.
4. A warm start is defined as a start initiated within 2-6 hours after the engine has been shutdown, or
   when the emissions control system is at a temperature of no less than 270 C (518 F).
5. Shutdown time is optimally 8.5 minutes per Wartsila.
6. Cold start w/o shutdown = 0.416 hrs steady state = 0.584 hrs
7. Warm start w/o shutdown = 0.25 hrs steady state = 0.75 hrs
8. Shut down = 0.1417 hrs steady state = 0.8583 hrs
9. Steady state (SS) emissions values derived from Cogentrix/Wartsila.
10. SO2 emissions include S to SO2 from lube oil burn-off from cylinder sleeves.

Maximum Estimated Hourly Emissions **1 Hour Period**		NOx lbs/hr	CO lbs/hr	VOC lbs/hr	SOx lbs/hr	PM10 lbs/hr	PM2.5 lbs/hr	
Scenario 1		8.48	13.44	7.49	0.29	2.33	2.33	*1 Engine*
Cold Start w/Steady State (5 Engines)		42.39	67.21	37.46	1.43	11.67	11.67	5 Engines
Cold Start w/Steady State (6 Engines)		50.87	80.65	44.95	1.72	14.01	14.01	6 Engines
Scenario 2		3.12	2.44	2.89	0.26	2.56	2.56	*1 Engine*
Warm Start w/Steady State		34.33	26.87	31.81	2.88	28.17	28.17	All Engines
Scenario 3		8.68	13.75	7.83	0.34	2.68	2.68	*1 Engine*
Cold Start, Steady State, Shutdown	***	95.46	151.28	86.16	3.70	29.53	29.53	All Engines
Scenario 4		3.32	2.75	3.23	0.31	2.91	2.91	*1 Engine*
Warm Start, Steady State, Shutdown	***	36.53	30.28	35.55	3.43	32.02	32.02	All Engines
Scenario 5		0.99	1.59	1.63	0.27	1.52	1.52	*1 Engine*
Steady State w/Shutdown		10.90	17.52	17.94	2.97	16.70	16.70	All Engines
Scenario 6		0.92	1.49	1.50	0.26	1.36	1.36	*1 Engine*
Steady State		10.13	16.43	16.54	2.82	14.97	14.97	All Engines

*** cannot occur, once SU is finalized, the unit(s) must run for 2 hours prior to a SD

Maximum Estimated Daily Emissions	NOx	CO	VOC	SOx	PM10	PM2.5	
24 Hr Period Run Day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	
Scenario 1	29.86	48.11	42.42	6.22	33.99	33.99	*1 Engine*
Cold Start, Steady State, Shutdown	328.47	529.26	466.67	68.47	373.87	373.87	All Engines
Scenario 2	24.50	37.11	37.82	6.20	34.21	34.21	*1 Engine*
Warm Start, Steady State, Shutdown	269.54	408.26	416.06	68.20	376.35	376.35	All Engines
Scenario 3	22.10	35.86	36.10	6.14	32.66	32.66	*1 Engine*
Steady State	243.14	394.42	397.06	67.58	359.30	359.30	All Engines
Scenario 4							*1 Engine*
******							All Engines

Maximum Estimated Daily Emissions	NOx	CO	VOC	SOx	PM10	PM2.5	
16 Hr Period Run Day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	
Scenario 1	22.49	36.16	30.39	4.18	23.10	23.10	*1 Engine*
Cold Start, Steady State, Shutdown	247.42	397.79	334.32	45.94	254.10	254.10	All Engines
Scenario 2	17.14	25.16	25.79	4.15	23.33	23.33	*1 Engine*
Warm Start, Steady State, Shutdown	188.49	276.79	283.71	45.67	256.58	256.58	All Engines
Scenario 3	14.74	23.90	24.06	4.10	21.78	21.78	*1 Engine*
Steady State	162.10	262.94	264.70	45.06	239.54	239.54	All Engines
Scenario 4							*1 Engine*
******							All Engines

Maximum Estimated Daily Emissions	NOx	CO	VOC	SOx	PM10	PM2.5	
8 Hr Period Run Day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	
Scenario 1	15.12	24.21	18.36	2.13	12.21	12.21	*1 Engine*
Cold Start, Steady State, Shutdown	166.37	266.32	201.96	23.41	134.33	134.33	All Engines
Scenario 2	9.77	13.21	13.76	2.10	12.44	12.44	*1 Engine*
Warm Start, Steady State, Shutdown	107.45	145.32	151.36	23.14	136.82	136.82	All Engines
Scenario 3	7.37	11.95	12.03	2.05	10.89	10.89	*1 Engine*
Steady State	81.05	131.47	132.35	22.53	119.77	119.77	All Engines
Scenario 4							*1 Engine*
******							All Engines

Other Misc Scenarios -based on run hour type

(CS-cold start hour, WS-warm start hour, SD-shutdown hour, SS-steady state hour)

	NOx	CO	VOC	SOx	PM10	PM2.5	
	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	lbs/day	
a - CS, SS, SD, WS, SS, SD (total ops period 12 hrs)							
	20.95	31.02	25.68	3.14	18.82	18.82	*1 Engine*
	230.42	341.24	282.46	34.50	207.02	207.02	All Engines
b - 3 CSs, 1 WS, 4 SDs, SS (total ops period 24 hrs)							
	47.25	73.04	55.96	6.30	37.41	37.41	*1 Engine*
	519.78	803.48	615.52	69.26	411.55	411.55	All Engines