NORTH COAST UNIFIED AIR QUALITY MANAGEMENT DISTRICT
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PRELIMINARY DETERMINATION OF COMPLIANCE
PERMIT TO CONSTRUCT EVALUATION

APPLICATION NO.:	ATC 440-1 (10 Wärtsilä, Diesel Black-start Generator, & Diesel Fire Pump)
EVALUATION DATE:	October 15, 2007
EVALUATION BY:	NCUAQMD Staff

A. FACILITY NAME
Pacific Gas & Electric Company, Humboldt Bay Repower Project (HBRP)

B. LOCATION OF EQUIPMENT
The project is located within a 143-acre site at 1000 King Salmon Ave, 3 miles southwest of the city of Eureka. It will be sited within the boundaries of PG&E's existing Humboldt Bay Power Plant complex.

C. PROPOSAL
Pacific Gas & Electric Company (PG&E) is proposing to install a 163 MW nominal power plant consisting of ten 16.3 MW nominal dual-fuel fired reciprocating engines.

D. INTRODUCTION
The plant will consist of ten Wärtsilä 18V50DF16.3 MW lean-burn reciprocating engines, equipped with selective catalytic reduction (SCR), oxidation catalyst, and associated support equipment including continuous emissions monitors. The applicant proposes installing an air radiator cooling system. The primary fuel will be natural gas with diesel pilot injection, and the backup fuel will be diesel. The applicant will also install a diesel-fired emergency back-up generator and a diesel-fired fire pump. PG&E has identified and will be providing offsets for the project.

The PG&E project is subject to approval by the California Energy Commission (CEC). The District will perform a Determination of Compliance review and will notice a preliminary Determination of Compliance (PDOC) for public comment. A Determination of Compliance, pursuant to District Rule 110 Section 9, is functionally equivalent to an Authority to Construct. The CEC is the lead agency for this project under the California Environmental Quality Act (CEQA). Additionally, PG&E must obtain Prevention of Significant Deterioration (PSD) approval from the NCUAQMD.

PG&E currently operates a natural gas and fuel oil power plant on the same property as the proposed repower project. The existing plant consists of 2 steam turbine-generators, 52 and 53 MW, respectively, primarily fueled by natural gas, with No. 6 fuel oil used as a secondary fuel; and 2 mobile emergency power plants (MEPPs), consisting of diesel-fueled turbines that operate as backup units and peaker units. A non-operating 63 MW nuclear power plant also exists at the facility. The 52 MW boiler began operating in 1956 and the 53 MW boiler began operating in 1953. (AFC Section 1.0, pg. 1-1)

PG&E proposes to decommission the existing power plant and replace it with the ten 16.3 MW Wärtsilä reciprocating engines described above. The new engines will be subject to Best Available Control Technology (BACT) requirements as well as Prevention of Significant Deterioration (PSD).

E. EQUIPMENT DESCRIPTION

The HBRP project will have the following equipment.

1. Ten Dual-fuel Reciprocating Engine-Generators (AFC Table 8.1-10)

Manufacturer:	Wärtsilä
Model:	18V50DF
Primary Fuel:	Natural Gas (Public Utilities Commission Pipeline Quality)
Backup Fuel:	CARB Diesel (ultra low sulfur, as defined in CCR Title 17, Section 93115)

2. Emergency Diesel Generator (AFC Table 8.1-12)

Manufacturer:	Caterpillar (or equivalent)
Model:	DM8149 (or equivalent)
Fuel:	CARB Diesel

3. Emergency Diesel Fire Pump (AFC Table 8.1-13 & Appendix 8.1A-5)

Manufacturer:	John Deere
Model:	JU6H-UF50
Fuel:	CARB Diesel

F. PROCESS RATE

1. Ten Dual-fuel Reciprocating Engine-Generators (AFC Table 8.1-10)

Nominal Heat Input Rate (HHV):	143.9 MMBtu/hr natural gas + 0.79 MMBtu/hr diesel pilot
(Higher Heating Value)	148.9 MMBtu/hr diesel
Nominal Power Generation Rate:	16 MW
Maximum Continuous Brake Horsepower:	22,931 bhp
Nominal Exhaust Temperature:	728 degrees F
Exhaust Flow Rate (natural gas):	121,502 acfm
Exhaust Flow Rate (natural gas):	45,533 dscfm
Exhaust Flow Rate (diesel):	135,556 acfm
Exhaust Flow Rate (diesel):	54,078 dscf

Exhaust O2 Concentration, dry volume: 11.58%
Exhaust CO_2 Concentration, dry volume: 5.32%
Exhaust Moisture Content, wet volume: 9.42%
Engine Efficiency (Natural Gas) 47.3%
Engine Efficiency (Diesel) 44.0%
Exhaust Stack Height: 30.48 m
Exhaust Stack Diameter: 1.620 m

2. Emergency Diesel Generator (AFC Table 8.1-12 & Appendix Table 8.1A-4)
Engine Output (kW): 350
Engine Output (bhp): 469
Heat Input, MMBtu/hr (HHV): 4.0
Fuel Consumption, Btu/bhp-hr (HHV): 8,491
Fuel Input (gal/hr): 29.1
Exhaust Flow (acfm): 3366
Stack Velocity (ft/sec): 285.67
Temperature (˚F) 925.9
Stack Diameter (inch) 6
Release Height (m) 3.048
Operating hours/year, maintenance & Testing: 50

3. Emergency Diesel Fire Pump (AFC Table 8.1-13 & Appendix 8.1A-5)

Engine Output (bhp): 210
Speed (rpm): 2100
Heat Input, MMBtu/hr (HHV): 8,019
Fuel Input (gal/hr) 12.3
Capacity (gpm): 2500
Exhaust Flow (acfm): 1204
Stack Velocity (ft/sec): 13.7
Temperature (˚F) 1050
Stack Diameter (inch) 5
Release Height (m) 12.192
Operating hours/year, maintenance & Testing: 50

G. OPERATING SCHEDULE (AFC Appendix Table 8.1A-7)

Table 1 – Hours of Operation

Equipment	Hrs/day	Hrs/yr
ICE, NG, Base load hrs/engine	21	6132
ICE, NG, Startups/engine (3 startups/day max)	3	315
TOTAL NG Mode/engine	**24**	**6447**
ICE, Diesel, Base load hrs/engine	21	50
ECE, Diesel, Startups/engine (3 startup/day max)	3	50
TOTAL DIESEL Mode /engine	**24**	**100**
Emergency Generator[a)]	1	50
Fire Pump[a)]	1	50

Note: a) Includes testing & maintenance.

In order to ensure that the Wärtsilä engines are not operated in excess of the proposed 70% capacity factor (6,497 full-load engine hours per year), the applicant proposes a permit condition limiting the combined heat input for all the Wärtsilä engines on an hourly, daily and annual basis (AFC 8.1.2.2.2, pg 8.1-24, and 8.1.2.3, pg 8.1-26).

To ensure enforceability of the capacity factor, it is recommended that, in addition to the heat input limitations, the Wärtsilä engines be limited to the following volumetric fuel consumption limits.

Table 2 – Combined Fuel Use Limitations for 10 Wärtsilä Engines

FUEL USE LIMITATIONS (gallons)[a, b]		
	Natural Gas Mode (Diesel Pilot)	Diesel Mode
Hourly (3-hr rolling average)	58	10,876
Daily (24-hr rolling average)	1,402	261,032
Annual (365-day rolling average)	376,734	544,181

a. Daily and annual heat rates for natural gas and diesel pilot injection are based on hours in AFC Appendix Table 8.1A-6 and higher heating value in AFC Table 8.1-11A

b. Daily and annual heat rates for backup diesel are based on hours in AFC Appendix Table 8.1A-7 and higher heating value in AFC Table 8.1-11B

H. CONTROL EQUIPMENT EVALUATION

WÄRTSILÄ ENGINES

The engines will use selective catalytic reduction (SCR) to control nitrogen oxide emissions to a level of 6.0 ppmvd when operating on natural gas, and 35.0 ppmvd when operating in diesel mode, both @ 15% O_2 for a three-hour average. The engines are proposed to control carbon monoxide emissions with oxidation catalysts to a level of 13.0 ppmvd when operating on natural gas, and 20.0 ppmvd when operating on diesel, both @ 15% O_2 for a three-hour average.

The nominal exhaust gas temperature is 728 degrees F (AFC Table 8.1-10 Design Specs). AFC Appendix Table 8.1B-3 identifies the max exhaust gas temp at approximately 795 F (697.4 K). The highest exhaust gas temperature at the catalyst is 840 degrees F.

I. EMISSIONS CALCULATIONS

The proposed project will replace the existing power plant, including 2 steam boilers (Units 1 and 2) and two Mobile Emergency Power Plants (MEPPs Units 2 and 3), permitted under NCUAQMD Permit No's NS-020 (Boiler #1), NS-021 (Boiler #2), and NS-057 (Gas Turbines). The units are also permitted under Title V Permit to Operate No. NCU-059-12.

1. **Proposed potential to emit for the emissions units:**

Table 3 – Emission Rates

WÄRTSILÄ ENGINES

Natural Gas Firing with Diesel Pilot Injection

NOX Rate Source

Base load, hourly	3.13	lb/hr	Calculation, based on manufacturer's guarantee of 6.0 ppmvd @ 15% O2 and 120,764 acfm (cold ambient temperature, base load)
Startup	23.6	lb/start	Provided by manufacturer, 30-min start + 30 min base load

Diesel Firing

NOX		Rate	Source
Base load, hourly	19.92	lb/hr	Calculation, based on manufacturer's guarantee of 35.0 ppmvd @ 15% O2 and 134,544 acfm hot ambient temperature, base load)
Startup	164	lb/start	Provided by manufacturer, 30-min start + 30 min base load

Natural Gas Firing with Diesel Pilot Injection

SO2		Rate	Source
Base load, hourly	0.40	lb/hr	Calculation, based on 1 gr sulfur/100 scf and 143.9 MMbtu/hr (cold ambient temperature, base load)
Startup	0.20	lb/start	30-min start, hourly emission rate = base load hourly emission
Hourly rate for annual emissions	0.13	lb/hr	Based on annual average sulfur content of 0.33 gr/100 scf ---> 0.066 lb/hr + diesel sulfur from pilot injection ---> 0.0012 lb/hr.

Diesel Firing

SO2		Rate	Source
Base load, hourly	0.22	lb/hr	Calculation, based on 15 ppmw sulfur content and 148.9 MMbtu/hr hot ambient temperature, base load)
Startup	0.11	lb/start	30-min start, hourly emission rate = base load hourly emission

Natural Gas Firing with Diesel Pilot Injection

CO		Rate	Source
Base load, hourly	4.13	lb/hr	Calculation, based on manufacturer's guarantee of 13.0 ppmvd @ 15% O2 and 120,764 acfm (cold ambient temperature, base load)
Startup	24	lb/start	Provided by manufacturer, 30-min start + 30 min base load

Diesel Firing

CO		Rate	Source
Base load, hourly	6.93	lb/hr	Calculation, based on manufacturer's guarantee of 20.0 ppmvd @ 15% O2 and 134,544 acfm hot ambient temperature, base load)
Startup	25.4	lb/start	Provided by manufacturer, 30-min start + 30 min base load

Natural Gas Firing with Diesel Pilot Injection

ROC		Rate	Source
Base load, hourly	5.10	lb/hr	Calculation, based on manufacturer's guarantee of 28 ppmvd @ 15% O2 and 120,764 acfm (cold ambient temperature, base load)
Startup	17.9	lb/start	Provided by manufacturer, 30-min start + 30 min base load

Diesel Firing

ROC		Rate	Source
Base load, hourly	7.94	lb/hr	Calculation, based on manufacturer's guarantee of 40 ppmvd @ 15% O2 and 134,544 acfm hot ambient temperature, base load)
Startup	17.2	lb/start	Provided by manufacturer, 30-min start + 30 min base

load

Natural Gas Firing with Diesel Pilot Injection

PM10		Rate	Source
Base load, hourly	3.60	lb/hr	Provided by manufacturer
Grain-loading	0.02	gr/dscf	Provided by manufacturer (hot ambient temperature, low load)
Startup	2.45	lb/start	30-min start, hourly emission rate = base load hourly emission

Diesel Firing

PM10	Rate		Source
Base load, hourly	10.8	lb/hr	Calculation, based on manufacturer's guarantee of 40 ppmvd @ 15% O2 and 134,544 acfm hot ambient temperature, base load)
Filterable PM10	0.15	g/bhp-hr	Provided by manufacturer, AFC pg 8.1-70, weighted average of emissions at 100%, 75%, and 50% loads
Startup	5.4	lb/start	30-min start, hourly emission rate = base load hourly emission

Natural Gas Firing with Diesel Pilot Injection

NH3	Rate		Source
Base load, hourly	1.93	lb/hr	Calculation, based on manufacturer's guarantee of 10.0 ppmvd @ 15% O2 and 120,764 acfm (cold ambient temperature, base load)

Diesel Firing

NH3	Rate		Source
Base load, hourly	2.11	lb/hr	Calculation, based on manufacturer's guarantee of 10.0 ppmvd @ 15% O2 and 134,544 acfm hot ambient temperature, base load)

BLACK-START GENERATOR

NOX	3.59	lb/hr	Provided by manufacturer
SO2	0.0061	lb/hr	Provided by manufacturer
CO	0.65	lb/hr	Provided by manufacturer
ROC	0.41	lb/hr	Provided by manufacturer
PM10	0.05	lb/hr	Provided by manufacturer

FIRE PUMP

NOX	2.27	lb/hr	Provided by manufacturer
SO2	0.0026	lb/hr	Provided by manufacturer
CO	0.27	lb/hr	Provided by manufacturer
ROC	0.23	lb/hr	Provided by manufacturer
PM10	0.06	lb/hr	Provided by manufacturer

Table 4 – Hourly Emission Rates

MAXIMUM HOURLY EMISSION RATES							
	(lb/hr)						g/s
	NOX	**CO**	**ROC**	**SO2[f]**	**PM10**	**NH3**	**NH3**
Wärtsilä NG							
Base load	3.13	4.13	5.10	0.40	3.6	1.93	
Startup[a]	22.0	22.00	15.4	0.40	3.6	1.93	
Startup for all 10 engines[b]	**830.0**	**220.00**	**154.00**	**4.00**	**36.00**	**19.30**	
Wärtsilä Diesel							
Base load[c]	19.92	6.93	7.94	0.22	10.8	2.11	2.659E-01
Startup[a]	154.0	22	17.2	0.22	10.8	2.11	
Startup for all 10 engines[b]	**830.0**	**220**	**172**	**2.2**	**108.0**	**21.1**	
Black-Start Generator[d]	3.47	0.63	0.4	0.0061	0.05	0	
Fire Pump[e]	2.27	0.27	0.23	0.0026	0.06	0	

a - AFC Appendix Table 8.1A-6

b - for NOX, applicant-proposed limit - not the mathematical equivalent of the total for all ten engines starting up at the same time

c - front& back half (AFC Table 8.1-15)

d - AFC Appendix Table 8.1A-4

e - AFC Appendix Table 8.1A-5

f - SOX emissions are the same during startup and base load operations (AFC pg 8.1-29)

AFC Table 8.1-17 shows ROC Startup emissions of 171.7 lb/hr for all 10 Wärtsilä engines, however Table 8.16 shows ROC startup emission rate of 17.9 lb/hr per engine for natural gas (179 lb/hr total)

Table 5 – Daily Emission Rates

MAXIMUM DAILY EMISSION RATES PER ENGINE[a)] (lb/day)							
	hours/day	NOX	CO	ROC	SO2	PM10	NH3
Wärtsilä NG							
Base load	21				8.4		
Startup	3				1.2		
Wärtsilä Diesel							
Base load	21	418.32	145.53	166.74		226.8	44.31
Startup	3	492	76.38	51.6		32.4	0
TOTAL FOR EACH WÄRTSILÄ ENGINE		**910.3**	**221.91**	**218.34**	**9.6**	**259.2**	**44.31**
TOTAL FOR ALL WÄRTSILÄ ENGINES	24	**9103**	**2219.1**	**2183.4**	**96.0**	**2592.0**	**443.1**
Black-Start Generator	1	4.5	0.56	0.06	0.005	0.05	0
Fire Pump	1	2.27	0.27	0.23	0.0026	0.06	0

Note: a) Diesel emission rates were used for daily maximum emission rates for all criteria pollutants except SO2. This is because SO2 emissions are greater when operating on natural gas than they are when using the secondary diesel fuel.

Table 6 – Toxics Emission Rates

TOXICS - emission rates used for HRA

	Natural Gas Mode						
	Natural Gas		Diesel Pilot		Gas + Diesel[e)]		
	lb/MMscf[a]	lb/hr[b]	lb/Mgal[c]	lb/hr[d]	max hourly g/s	annual avg (g/s/engine	g/s for 10 engines
Acetaldehyde	5.29E-01	7.46E-02	3.47E-03	2.03E-08	9.393E-03	6.91E-04	**6.91E-03**
Acrolein	5.90E-02	8.31E-03	1.07E-03	6.25E-09	1.048E-03	7.71E-05	**7.71E-04**
Ammonia					2.659E-01	8.57E-01	**1.70E-01**
Benzene	2.18E-01	3.07E-02	1.01E-01	5.90E-07	3.871E-03	2.85E-04	**2.85E-03**
1,3 Butadiene	3.67E-01	5.17E-02	0.00E+00	0.00E+00	6.517E-03	4.79E-04	**4.79E-03**
Ethylbenzene	7.11E-02	1.00E-02	0.00E+00	0.00E+00	1.262E-03	9.29E-05	**9.29E-04**
Formaldehyde	2.36E+00	3.33E-01	1.32E-02	7.71E-08	4.191E-02	3.08E-03	**3.08E-02**
Hexane	1.13E+00	1.59E-01	0.00E+00	0.00E+00	2.006E-02	1.48E-03	**1.48E-02**
Napthalene	2.51E-02	3.54E-03	1.63E-02	9.52E-08	4.457E-04	3.28E-05	**3.28E-04**
PAHs							
Anthracene	1.19E-04	1.68E-05	1.79E-04	1.05E-09	2.113E-06	1.55E-07	**1.55E-06**
Benzo(a)anthracene	5.88E-05	8.29E-06	5.03E-05	2.94E-10	1.044E-06	7.68E-08	**7.68E-07**
Benzo(a)pyrene	2.70E-06	3.81E-07	1.81E-05	1.06E-10	4.796E-08	3.53E-09	**3.53E-08**
Benzo(b)fluoranthene	4.09E-05	5.76E-06	7.96E-05	4.65E-10	7.263E-07	5.34E-08	**5.34E-07**
Benzo(k)fluoranthene	7.83E-06	1.10E-06	1.56E-05	9.12E-11	1.390E-07	1.02E-08	**1.02E-07**
Chrysene	1.43E-05	2.02E-06	1.06E-04	6.19E-10	2.540E-07	1.87E-08	**1.87E-07**
Dibenz(a,h)anthracene	2.70E-06	3.81E-07	2.43E-05	1.42E-10	4.796E-08	3.53E-09	**3.53E-08**
Indeno(1,2,3-cd)pyrene	7.17E-06	1.01E-06	2.89E-05	1.69E-10	1.273E-07	9.37E-09	**9.37E-08**
Propylene	5.38E+00	7.58E-01	3.85E-01	2.25E-06	9.553E-02	7.03E-03	**7.03E-02**
Toluene	2.39E-01	3.37E-02	3.74E-02	2.19E-07	4.244E-03	3.12E-04	**3.12E-03**
Xylene	6.46E-01	9.10E-02	2.68E-02	1.57E-07	1.147E-02	8.44E-04	**8.44E-03**

a - Emission factors from OEHHA's CATEF Natural Gas ICE, SCC 20200202 (4S/Lean burn > 650 hp, no pollution control device), Mean Values (options are Max, Mean and Median), except Formaldehyde and Hexane

Natural gas formaldehyde emission rate provided by vendor - no test data available

Natural gas hexane emission rate is from AP42; not listed in CATEF

b - based on 6147 hr/yr, 143.9 MMBtu/hr, and 1021.1 Btu/scf

c - Emission factors from OEHHA's CATEF Diesel ICE, SCC 20200102 (lean burn, no pollution control device, industrial engine), Mean values

d - based on 0.8 MMBtu/hr, 136903 Btu/gal diesel

e - based on 6447 hours/yr

Natural gas & diesel toxic emission factors not included in risk assessment but available on CATEF

Acenapthene
Acenaphthylene
Benzo(g,h,i)perylene
Fluoranthene
Fluorene
Phenanthrene
Pyrene

Toxic emission rates from the Wärtsilä engines, when running on diesel, are quantified as Diesel Particulate Matter (DPM). The same is true for the Black-start Generator and the Fire Pump.

The applicant has stated that the Wärtsilä engine will meet a DPM emission limit of 0.15 grams/kw-hr and 0.11 grams/bhp-hr.
DPM consists solely of filterable particulate and does not include the condensable particulate matter.

Diesel Particulate Emissions per Engine

	Emission Rate (g/bhp-hr)	Horsepower	lb/hr	Max g/s	Hours/yr[a]	Tons/yr	g/s
Wärtsilä	0.11	22931	5.560962	7.01E-01	100	2.8E-01	8.00E-03
Black-start Generator[b]		469	0.05	6.30E-03	50	1.25E-03	3.60E-05
Fire Pump[b]		210	0.06	7.56E-03	50	1.50E-03	4.31E-05

a - hours used for HRA submitted with the AFC; a subsequent HRA calculation was submitted upon request, showing the risk from operating the Wärtsilä diesel engines at 100 hr/yr/engine on secondary diesel fuel, with an annual emission rate of 2.78 E-01 tons for all 10 engines

b - lb/hr emission rates as submitted by applicant.

Table 7 – Quarterly Emission Rates

	MAXIMUM QUARTERLY EMISSIONS QUARTER 1																	
			NOX			CO			ROC			SOX			PM10/2.5			
	hr/day	hr/qtr[a]	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr
Wärtsilä NG																	
Base load * 10 engines	21	1512	3.13	47325.6	23.7	4.13	62445.6	31.2	5.10	77112	38.6	0.40	6048	3.0	4.9	74088	37.0
Startup[b] * 10 engines	3	78	23.6	18408	9.2	24.07	18774.6	9.4	17.9	13962	7.0	0.40	312	0.2	4.9	3822	1.9
Wärtsilä Diesel																	
Base load * 10 engines	21	13	19.92	258.96	0.1	6.93	90.09	0.0	7.94	103.22	0.1	0.22	2.86	0.0	10.8	140.4	0.1
Startup[b] * 10 engines	3	12	164.0	19680	9.8	25.46	3055.2	1.5	17.2	2064	1.0	0.22	26.4	0.0	10.8	1296	0.6
SUBTOTAL				**85672.56**	**42.8**		**84365.49**	**42.2**		**93241.22**	**46.6**		**6389.26**	**3.2**		**79346.4**	**39.7**
Emergency Generator	1	12	4.50	54	2.7E-02	0.56	6.72	3.4E-03	0.06	0.72	3.6E-04	0.0050	0.06	3.0E-05	0.05	0.6	3.0E-04
Fire Pump	1	12	2.27	27.24	1.4E-02	0.27	3.24	1.6E-03	0.23	2.76	1.4E-03	0.0026	0.0312	1.6E-05	0.06	0.72	3.6E-04
TOTAL				**85753.8**	**42.9**		**84375.45**	**42.2**		**93244.7**	**46.6**		**6389.35**	**3.2**		**79347.7**	**39.7**

Assumptions: All startups are diesel (worst case emissions)
50 hr/yr testing & maintenance and 50 hrs base load for all diesel operations
all diesel testing/maintenance covered under 3 hr/day startup
90 days in quarter

a - provided by applicant (AFC Appendix Table 8.1A-6)

b - applicant proposes 830 lb/hr NOX limit during startup for all Wärtsilä engines combined

MAXIMUM QUARTERLY EMISSIONS QUARTER 2			NOX			CO			ROC			SOX			PM10/2.5		
	hr/day	hr/qtr[a]	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr
Wärtsilä NG																	
Base load * 10 engines	21	1528	3.13	47826.4	23.9	4.13	63106.4	31.6	5.10	77928	39.0	0.40	6112	3.1	4.9	74872	37.4
Startup[b] * 10 engines	3	79	23.6	18644	9.3	24.07	19015.3	9.5	17.9	14141	7.1	0.40	316	0.2	4.9	3871	1.9
Wärtsilä Diesel							0	0.0		0	0.0		0	0.0		0	0.0
Base load * 10 engines		13	19.92	258.96	0.1	6.93	90.09	0.0	7.94	103.22	0.1	0.22	2.86	0.0	10.8	140.4	0.1
Startup[b] * 10 engines	3	12	164.0	19680	9.8	25.46	3055.2	1.5	17.2	2064	1.0	0.22	26.4	0.0	10.8	1296	0.6
SUBTOTAL				**86409.36**	**43.2**		**85266.99**	**42.6**		**94236.22**	**47.1**		**6457.26**	**3.2**		**80179.4**	**40.1**
Emergency Generator	1	12	3.47	41.64	2.1E-02	0.63	7.56	3.8E-03	0.4	4.8	2.4E-03	0.0050	0.06	3.0E-05	0.05	0.6	3.0E-04
Fire Pump	1	12	2.27	27.24	1.4E-02	0.27	3.24	1.6E-03	0.23	2.76	1.4E-03	0.0026	0.0312	1.6E-05	0.06	0.72	3.6E-04
TOTAL				**86478.2**	**43.2**		**85277.79**	**42.6**		**94243.78**	**47.1**		**6457.35**	**3.2**		**80180.7**	**40.1**

Assumptions: All startups are diesel (worst case emissions)
50 hr/yr testing & maintenance & 50 hrs base load for all diesel operations
all diesel testing/maintenance covered under 3 hr/day startup
90 days in quarter

a - provided by applicant (AFC Appendix Table 8.1A-6)

b - applicant proposes 830 lb/hr NOX limit during startup for all Wärtsilä engines combined

MAXIMUM QUARTERLY EMISSIONS QUARTER 3			NOX			CO			ROC			SOX			PM10/2.5		
	hr/day	hr/qtr[a]	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr
Wärtsilä NG																	
Base load * 10 engines	21	1546	3.13	48389.8	24.2	4.13	63849.8	31.9	5.10	78846	39.4	0.40	6184	3.1	4.9	75754	37.9
Startup[b] * 10 engines	3	79	23.6	18644	9.3	24.07	19015.3	9.5	17.9	14141	7.1	0.40	316	0.2	4.9	3871	1.9
Wärtsilä Diesel																	
Base load * 10 engines		12	19.92	239.04	0.1	6.93	83.16	0.0	7.94	95.28	0.0	0.22	2.64	0.0	10.8	129.6	0.1
Startup[b] * 10 engines	3	13	164.0	21320	10.7	25.46	3309.8	1.7	17.2	2236	1.1	0.22	28.6	0.0	10.8	1404	0.7
SUBTOTAL				**88592.84**	**44.3**		**86258.06**	**43.1**		**95318.28**	**47.7**		**6531.24**	**3.3**		**81158.6**	**40.6**
Emergency Generator	1	12	3.47	41.64	2.1E-02	0.63	7.56	3.8E-03	0.4	4.8	2.4E-03	0.0050	0.06	3.0E-05	0.05	0.6	3.0E-04
Fire Pump	1	12	2.27	27.24	1.4E-02	0.27	3.24	1.6E-03	0.23	2.76	1.4E-03	0.0026	0.0312	1.6E-05	0.06	0.72	3.6E-04
TOTAL				**88661.7**	**44.3**		**86268.86**	**43.1**		**95325.84**	**47.7**		**6531.33**	**3.3**		**81159.9**	**40.6**

Assumptions: All startups are diesel (worst case emissions)
50 hr/yr testing & maintenance and 50 hrs base load for all diesel operations
all diesel testing/maintenance covered under 3 hr/day startup
90 days in quarter

a - provided by applicant (AFC Appendix Table 8.1A-6)

b - applicant proposes 830 lb/hr NOX limit during startup for all Wärtsilä engines combined

	MAXIMUM QUARTERLY EMISSIONS QUARTER 4																
			NOX			CO			ROC			SOX			PM10/2.5		
	hr/day	hr/qtr[a]	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr	lb/hr	lb/qtr	ton/qtr
Wärtsilä NG																	
Base load * 10 engines	21	1546	3.13	48389.8	24.2	4.13	63849.8	31.9	5.10	78846	39.4	0.40	6184	3.1	4.9	75754	37.9
Startup[b] * 10 engines	3	79	23.6	18644	9.3	24.07	19015.3	9.5	17.9	14141	7.1	0.40	316	0.2	4.9	3871	1.9
Wärtsilä Diesel																	
Base load * 10 engines		12	19.92	239.04	0.1	6.93	83.16	0.0	7.94	95.28	0.0	0.22	2.64	0.0	10.8	129.6	0.1
Startup[b] * 10 engines	3	13	164.0	21320	10.7	25.46	3309.8	1.7	17.2	2236	1.1	0.22	28.6	0.0	10.8	1404	0.7
SUBTOTAL				**88592.84**	**44.3**		**86258.06**	**43.1**		**95318.28**	**47.7**		**6531.24**	**3.3**		**81158.6**	**40.6**
Emergency Generator	1	12	3.47	41.64	2.1E-02	0.63	7.56	3.8E-03	0.4	4.8	2.4E-03	0.0050	0.06	3.0E-05	0.05	0.6	3.0E-04
Fire Pump	1	12	2.27	27.24	1.4E-02	0.27	3.24	1.6E-03	0.23	2.76	1.4E-03	0.0026	0.0312	1.6E-05	0.06	0.72	3.6E-04
TOTAL				**88661.7**	**44.3**		**86268.86**	**43.1**		**95325.84**	**47.7**		**6531.33**	**3.3**		**81159.9**	**40.6**

Table 8 – Quarterly Emissions Summary

QUARTERLY EMISSIONS SUMMARY			
	tons/qtr		
	NOX	ROC	PM10/2.5
Quarter 1	42.9	46.6	39.7
Quarter 2	43.2	47.1	40.1
Quarter 3	44.3	47.7	40.6
Quarter 4	44.3	47.7	40.6

Table 9 – Annual Emission Rates

MAXIMUM ANNUAL EMISSIONS	NOX		CO		ROC		SO2		PM10		NH3	
	lb/yr	ton/yr	lb/yr	ton/yr	lb/yr	ton/yr	lb/yr	ton/yr	lb/yr	ton/yr	lb/yr	ton/yr
Wärtsilä NG												
Base load per engine	19,193.2	96.0	25,325.2	12.7	31,273.2	15.6	797.2	0.4	22,075.2	11.0	11,834.8	59.2
Startup per engine	6,930.0	34.7	6,930.0	3.5	4,851.0	2.4	41.0	0.0	1,134.0	0.6	608.0	3.0
Base load * 10 engines	191,931.6	96.0	253,251.6	126.6	312,732.0	156.4	7,971.6	4.0	220,752.0	110.4	118,347.6	591.7
Startup * 10 engines	69,300.0	34.7	69,300.0	34.7	48,510.0	24.3	409.5	0.2	11,340.0	5.7	6,079.5	30.4
Wärtsilä Diesel												
Base load per engine	996.0	0.5	346.5	0.2	397.0	0.2	11.0	0.0	540.0	0.3	105.5	0.1
Startup per engine	7,700.0	3.9	1,100.0	0.6	860.0	0.4	11.0	0.0	540.0	0.3	105.5	0.1
Base load * 10 engines	9,960.0	5.0	3,465.0	1.7	3,970.0	2.0	110.0	0.1	5,400.0	2.7	1,055.0	0.5
Startup * 10 engines	77,000.0	38.5	11,000.0	5.5	8,600.0	4.3	110.0	0.1	5,400.0	2.7	1,055.0	0.5
SUBTOTAL	**348,191.6**	**174.1**	**337,016.6**	**168.5**	**373,812.0**	**186.9**	**8,601.1**	**4.3**	**233,172.0**	**116.6**	**126,537.1**	**63.3**
Black-Start Generator	173.5	0.1	31.5	0.0	20.0	0.0	0.3	0.0	2.5	0.0	0.0	0.0
Fire Pump	113.5	0.1	13.5	0.0	11.5	0.0	0.1	0.0	3.0	0.0	0.0	0.0
TOTAL	**348,478.6**	**174.2**	**337,061.6**	**168.5**	**373,843.5**	**186.9**	**8,601.5**	**4.3**	**233,177.5**	**116.6**	**126,537.1**	**63.3**

applicant proposes 830 lb/hr NOX limit for all Wärtsilä engines combined, regardless of fuel type
based on 100 hr/yr/engine diesel firing total
10 engines at 24 hr/day, 7 days/week
6,132 Wärtsilä engine hours at base load, natural gas firing (70% capacity factor)
315 hours of natural gas startup emissions
50 hours of diesel startup emissions
Black-Start Generator & Fire Pump = 50 hr/yr/engine

The applicant has stated that NOX emissions will be limited to a combined maximum of 830 lb/hr for all Wärtsilä engines. At a startup rate of 164 lb/hr during secondary diesel fuel startups, this equates to five engines starting up in the same hour. It is recommended that a condition be included in the permit, if the project is approved, to limit startups to a maximum of 5 engines per 60 minute period.

Annual and quarterly emissions are based on 6,497 hours of operation per engine, as presented by the applicant. According to the application, each engine may have up to 3 startups per day, but are limited to 365 hours per year of startup and shut-down activity, with 1 hour per event (AFC 8.1.2.3.3, pg 8.1-29, 30). It is recommended that a condition be included in the permit, if the project is approved, to limit each Wärtsilä engine to a maximum of 3 startups per 24-hour period.

Table 10 - DISPERSION MODEL EMISSION RATES

2 Operating Scenarios were Modeled

1. Secondary diesel firing scenario
2. Primary natural gas firing scenario (normal)
3. The applicant did not model $PM_{2.5}$ separately from PM_{10}; rather it was assumed that all the PM_{10} is $PM_{2.5}$. $PM_{2.5}$ is presented here for clarity of analysis.

DIESEL 1-HOUR AVERAGE (g/s)					
Units	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	2.50987778	0.8731653	2.77E-02	-	-
Black-Start Generator	-	-	-	-	-
Fire Pump	-	-	-	-	-

Wärtsilä emission rates are based on diesel, base load rates.
Since the black-start generator and the fire pump emissions were not modeled in this scenario, it is recommended that, if the project is approved, a condition be included in the permit that prohibits these two engines from operating for testing and maintenance when the Wärtsilä engines are operating on secondary diesel fuel.

NATURAL GAS 1-HOUR AVERAGE (g/s)					
	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	0.39437337	0.5203712	5.04E-02	-	-
Black-Start Generator	0.43721265	7.94E-02	7.69E-04	-	-
Fire Pump	0.28601519	3.40E-02	3.28E-04	-	-

Wärtsilä emission rates are based on natural gas, base load rates.
Derived from AFC Appendix Table 8.1A-4

NATURAL GAS 3-HOUR AVERAGE (g/s)					
	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	-	-	5.04E-02	-	-
Black-Start Generator	-	-	2.56E-04	-	-
Fire Pump	-	-	1.09E-04	-	-

Wärtsilä emission rates are based on natural gas, base load rates.
. Derived from AFC Appendix Table 8.1A-4

DIESEL 8-HOUR AVERAGE (g/s)					
	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	-	1.1105138	-	-	-
Black-Start Generator	-	9.92E-03	-	-	-
Fire Pump	-	4.25E-03	-	-	-

Wärtsilä emission rates are based on 7 hours diesel base load and 1 hour diesel startup.
Derived from AFC Appendix Table 8.1A-4

NATURAL GAS 24-HOUR AVERAGE (g/s)

	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	-	-	5.04E-02	4.54E-01	4.54E-01
Black-Start Generator	-	-	3.20245E-05	2.62E-04	2.62E-04
Fire Pump	-	-	1.36498E-05	3.15E-04	3.15E-04

Wärtsilä emission rates are based on 21 hours natural gas base load and 3 hours natural gas startup.

DIESEL 24-HOUR AVERAGE (g/s)					
	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	-	-	-	1.3607771	1.3607771
Black-Start Generator	-	-	-	2.62E-04	2.62E-04
Fire Pump	-	-	-	3.15E-04	3.15E-04

Wärtsilä emission rates are based on 21 hours diesel base load and 3 hours diesel startup.

NATURAL GAS ANNUAL AVERAGE[a]					
	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	5.01E-01	-	1.24E-02	3.35E-01	3.35E-01
Black-Start Generator	2.50E-03	-	4.39E-06	3.60E-05	3.60E-05
Fire Pump	1.63E-03	-	1.87E-06	4.31E-05	4.31E-05

a. The annual average emission rates are based on:

1. 50 hr/yr/engine diesel firing
2. 10 engines at 24 hr/day, 7 days/week
3. 6,132 Wärtsilä engine hours at base load, natural gas firing (70% capacity factor)
4. 315 hours of natural gas startup emissions
5. 50 hours of diesel startup emissions
6. Black-Start Generator & Fire Pump = 50 hr/yr/engine

PSD ANNUAL AVERAGE

	NOX	CO	SO2	PM10	PM2.5
Wärtsilä	7.37E-01	-	3.53E-02	4.19E-01	2.10E-04
Black-Start Generator	9.98E-03	-	1.75E-05	1.44E-04	7.19E-08
Fire Pump	6.53E-03	-	7.48E-06	1.73E-04	8.63E-08

10 engines at 24 hr/day, 7 days/week

6,132 Wärtsilä engine hours at base load, natural gas firing (70% capacity factor)

315 hours of natural gas startup emissions

750 hours per year diesel base load operations

50 hours of diesel startup emissions

Black-Start Generator & Fire Pump = 200 hr/yr/engine

The operating hours used in the dispersion modeling and health risk assessment to estimate maximum potential impacts from the proposed project should be reflected in the permit, it the project is approved. Refer to Table 11 below for recommended hourly limits.

Table 11 – Hourly Operational Limits

CUMULATIVE HOURS OF OPERATION[a]						
	Daily	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual Average**
Wärtsilä Natural Gas						
Base load	-	15,120	15,280	15,460	15,460	61,320
Startup	-	780	790	790	790	3,150
Wärtsilä Diesel						
Base load	210	13	13	12	12	50
Startup	30	12	12	13	13	50
Emergency Generator	1	12	12	13	13	50
Fire Pump	1	12	12	13	13	50

Note: a) The Wärtsilä hours are combined for all ten engines

AFC Table 8.1-17 indicates that only one of the two emergency units (black start generator and fire pump) will be started during the same hour. It is recommended that, if the project is approved, a permit condition is included that prohibits the startup of both emergency engines in the same 60-minutre period, for testing and maintenance purposes.

AFC Table 8.1-24 indicates that the black start generator's hourly emissions are based on 45-minutes of operation in any 1 hour. It is recommended that, if the project is approved, a permit condition is included that prohibits the black start generator from operating more than 45 minutes in any 60-minute period.

2. Calculation of BACT triggers (NCUAQMD Regulation I, Rule 101 & Rule 110):

The HBRP meets the local and federal definition of a reconstructed source (NCUAQMD Regulation 1, Rule 110, Section 4.22; 40 CFR 60.15). According to Rule 110 Section 4.15, a reconstructed source shall be treated as a new source rather than a modified source; therefore the historical potential to emit is zero.

Table 12 - Each Wärtsilä Engine (uncontrolled)

Pollutant	Max Daily (lb/day)	BACT Trigger Levels (lb/day)	Max Annual (ton/yr)	BACT Trigger Levels (ton/yr)	Is BACT Required?
NOX	3,561.0	>50.0	3,184	≥ 40	Yes
CO	2,456.0	>500.0	3,511.7	≥ 100	Yes
ROC	782.6	>50.0	1,053.9	≥ 40	Yes
SOX	9.1	>80.0	12.8975.0	≥ 40	No
PM10/2.5	135.3	>80.0	158.2	≥ 15	Yes

Uncontrolled emissions are based on data provided by the applicant. The applicant has stated that the emissions are indicative, but not guaranteed. Startup emissions are not identified. The worst case operating scenario was selected for each pollutant. Emission rates reflect 50 hours per year per engine of diesel fuel firing.

Table 13 - Emergency Black-Start Generator BACT Determination

Pollutant	Max Daily (lb/day)	BACT Trigger Levels (lb/day)	Max Annual (ton/yr)	BACT Trigger Levels (ton/yr)	Is BACT Required?
NOX	3.6	>50.0	0.1	≥ 40	No
CO	0.65	>500.0	0.01	≥ 100	No
ROC	0.41	>50.0	0.001	≥ 40	No
SOX	0.006	>80.0	0.0001	≥ 40	No
PM10/2.5	0.05	>80.0	0.001	≥10	No

Reflects 50 hr/yr testing and maintenance; does not include hours of operation during emergencies.

Table 14 - Emergency Fire Pump Generator BACT Determination

Pollutant	Max Daily (lb/day)	BACT Trigger Levels (lb/day)	Max Annual (ton/yr)	BACT Trigger Levels (ton/yr)	Is BACT Required?
NOX	2.3	>50.0	0.06	≥ 40	No
CO	0.3	>500.0	0.008	≥ 100	No
ROC	0.2	>50.0	0.005	≥ 40	No
SOX	0.003	>80.0	7.5 E-05	≥ 40	No
PM10/2.5	0.06	>80.0	0.0015	≥10	No

Reflects 50 hr/yr testing and maintenance; does not include hours of operation during emergencies.

3. Calculation of offset trigger for NOX, ROC, SO2 and PM10/2.5 (Rule 110, Section 5.2.1): Annual emissions depicted below reflect the worst case scenario, not including operations under natural gas curtailment.

Table 15 – Calculation of Offset Trigger

CALCULATION OF OFFSET TRIGGER FOR NOX, ROC AND PM10/2.5 (tons/yr)				
	NOX	**ROC**	**SO2**	**PM10**
Facility Wide Emissions	174.2	186.9	4.3	116.6
Offset Trigger	≥ 25	≥ 25	≥ 25	≥ 25

4. Calculation of emission offsets for NOX, ROC, SOX and PM10/2.5 (Section 415 and 416):

NOX:
Since the cumulative emissions for the HBRP is in excess of the 25 tons/year offset trigger limit, emission offsets will be required for NOX.

ROC:
Since the cumulative emissions for the HBRP is in excess of the 25 tons/year offset trigger limit, emission offsets will be required for ROC.

SO2:
Since the cumulative emissions for the HBRP is less than the 25 tons/year offset trigger limit, emission offsets will not be required for SOX.

PM10/2.5:
Since the cumulative emissions for the HBRP is in excess of the 25 tons/year offset trigger limit, emission offsets will be required for PM0/2.5.

J. COMPLIANCE WITH RULES AND REGULATIONS:

1. CALIFORNIA HEALTH AND SAFETY CODE SECTION 42301.6 COMPLIANCE:

The property boundary is approximately 600 feet from South Bay Union School; however, exhaust stacks for the proposed equipment are located 1,651 feet from South Bay Union School. Therefore, it is recommended that the requirements of California Health and Safety Code Section 42301.6 not be implemented. When evaluating compliance with this provision, considerable weight was given to that fact that the project had undergone extensive public notice, review by several governmental agencies, that a detailed health risk assessment had been performed, and that the public has had substantial opportunity to provide comment and input into the permitting process.

NEW SOURCE REVIEW AND PREVENTION OF SIGNIFICANT DETERIORATION COMPLIANCE (NCUAQMD Rule 110):

i. Offsets Requirements (NCUAQMD Rule 110, Sections 1.2 & 5.2)

NCUAQMD Regulation I, Rule 110, Section 1.2: *No net increase in emissions…from new or modified stationary sources which emit, or have the potential to emit, 25 tons per year or more of any non-attainment pollutant or its precursors.*

The NCUAQMD is in non-attainment for the state PM10 standard. The precursors to PM10 include NOX, ROC, and SO2.

In addition to Regulation I, Rule 110, the NCUAQMD has a SIP-approved rule, and therefore permitting authority for federal New Source Review (NSR) and Prevention of Significant Deterioration (PSD). The NCUAQMD is in attainment of the federal Ambient Air Quality Standards. Consequently, PSD review is required for the proposed project.

The applicant has proposed offsets for the above pollutants as described below.

Table 16 – Offset Package

OFFSET PACKAGE AS SUBMITTED BY APPLICANT

(tons/quarter)

NOX	Tons			
	Q1	Q2	Q3	Q4
Emissions subject to offsets	36.8	37.2	37.6	37.6
Onsite Reductions	36.8	37.2	37.6	37.6
Surplus Reduction Credits	157	176	184	231

ROC	Tons			
	Q1	Q2	Q3	Q4
Emissions subject to offsets	40.4	40.9	41.3	41.3
Onsite ROC:ROC offsets	5.3	5.4	6.1	6.6
Offsite ROC:ROC offsets	0.41	0.39	0.39	0.39
Onsite NOX:ROC offsets	34.7	35.1	34.9	34.3
Balance	0	0	0	0

Onsite NOX credits remainder	122	141	149	197

PM10	Tons			
	Q1	Q2	Q3	Q4
Emissions subject to offsets	33.4	33.8	34.2	34.2
Onsite PM:PM offsets	4.7	7.1	6.4	6.7
Offsite PM:PM2.5 offsets	1.6	1.6	1.6	1.6
Onsite NOX:PM2.5 offsets	27.1	25.1	26.2	25.9
Balance	0	0	0	0

Onsite NOX credits remainder	94.8	116	123	171

ASSUMPTIONS
Onsite reductions are result of planned decommissioning of existing power plant
Existing power plant = 2 natural gas boilers & 2 diesel turbine peakers, all uncontrolled
allowed 25 tons per year emissions, as source meets definitions of "reconstruction"
all PM is PM2.5

Offset ratios

NOX:NOX	1:1
NOX:ROC	1:1
NOX:PM2.5	3.58:1

ERCs tons/yr	
NOX	5.4
ROC	2.4
PM10	9.5

Offsite Adjustment Factor 1.5:1
Offsite PM source consists of 7.2 tons/yr from a wood-fired boiler and 2.3 tons/yr from a sawmill.

ii) BEST AVAILABLE CONTROL TECHNOLOGY (BACT) (NCUAQMD Rule 110.5.1)

Regulation I, Rule 110.5.1 requires that the applicant apply BACT to any new emissions unit which results in a potential to emit for the emissions unit which exceeds the BACT thresholds set forth in Section 5.1 of the regulation and identified in Tables 12 through 14 of this document.

Regulation 110, Section 4.5 defines BACT as the more stringent of:

a. the most effective emission control device, emission limit, or technique which has been required or used for the type of equipment comprising such emissions unit unless the applicant demonstrates to the satisfaction of the APCO that such limitations are not achievable; or

b. any other emission control device or technique, alternative basic equipment, different fuel or process, determined to be technologically feasible and cost-effective by the APCO.

An evaluation of emissions control requirements is completed through a "top-down" BACT determination. The top-down approach to the BACT review process involves identifying all demonstrated and potentially applicable control technology alternatives. After broadly identifying potential control technology alternatives, the permitting authority can eliminate any control alternatives that are not technically feasible because the alternative is either not available or not applicable. Next, the permitting authority ranks each technically feasible control alternative to establish a hierarchy. In the next step, the process either validates the suitability of the top control option in the listing for selection as BACT, or provides clear justification why the top candidate is inappropriate as BACT. If the applicant accepts the top (most stringent) control technology alternative as BACT, and that control alternative is not eliminated based on collateral environmental impacts, then the BACT analysis is complete and the top control technology alternative is selected. The top-down BACT analysis is a case-by-case exercise for the particular source under evaluation. In summary, the five steps involved in a top-down BACT evaluation are:

a. Identify all available control options with practical potential for application to the specific emission unit for the regulated pollutant under evaluation;
b. Eliminate technically infeasible technology options;
c. Rank remaining control technologies by control effectiveness;
d. Evaluate the most effective control alternative and document results; if top option is not selected as BACT, evaluate next most effective control option; and
e. Select BACT, which will be the most effective practical option not rejected based on energy, environmental, and economic impacts.

The applicant provided BACT analyses for NOX, ROC, CO, and PM10. The permitting authority independently evaluated the information submitted. The analysis and evaluation for each pollutant is presented below.

The proposed project consists of engines of a size and fuel firing technologies that are not directly comparable to other permitted emission units in the state. During the regulatory evaluation of the proposed project, a number of internal combustion engine units were evaluated. The in-state units evaluated were all single fuel engines, either diesel fuel fired or natural gas fired. Two out-of-state dual fuel plants were evaluated; one is located in Denver, CO and the other is in Chambersburg, PA. The out-of-state engines do not run on ultralow sulfur diesel. The engines in Colorado are 10% diesel fuel injection, whereas the proposed Wärtsilä engines use 0.7% diesel fuel injection. Additionally, a natural gas Wärtsilä engine power plant, located in Red Bluff, CA, was evaluated.

Nitrogen Oxides (NOX)

NOX is formed during the combustion of fossil fuels and is generally classified as either thermal NOX or fuel NOX. Thermal NOX is formed when elemental nitrogen reacts with oxygen in the combustion air. The rate of formation of thermal NOX is a function of residence time, temperature and free oxygen. Fuel NOX is generated when nitrogen contained in the fuel itself is oxidized. The rate of formation of fuel NOX is primarily a function of fuel-bound nitrogen content of the fuel, but is also affected by fuel air mixing.

NOX emissions can be reduced using three different strategies: controlling fuel nitrogen, using combustion controls, and exhaust gas treatment.

Emissions from fuel-bound nitrogen can be reduced by restricting the type of fuel burned and the nitrogen content of the fuel. Natural gas typically has no fuel-bound nitrogen. CARB ultra low sulfur diesel fuel is a low-nitrogen fuel. Diesel fuel emulsions are also known to reduce NOX emissions.

Combustion control options include after cooling, electronic fuel injection timing retard, exhaust gas recirculation, pre-chamber combustion ignition (clean burn combustion or pre-stratified charge combustion), turbo charging, water/steam injection and air-to-fuel ratio adjustment (lean burn/rich burn combustion).

Exhaust gas treatments include diesel particulate filters, non-selective catalytic reduction, selective catalytic reduction and selective non-catalytic reduction.

Wärtsilä Engines

<u>**Fuel restrictions**</u>

The applicant proposes to use utility-grade natural gas as the primary fuel and CARB ultra-low sulfur diesel as a back-up fuel, for periods of natural gas curtailment or and emergency operations.

<u>**Combustion Controls**</u>

After cooling: After cooling can result in NOX reductions from3% to 35%. The applicant states that after cooling is technically infeasible. An independent review found no evidence to the contrary.

Exhaust Gas Recirculation (EGR): The applicant states that EGR would result in increased fouling of the air intake systems, combustion chamber deposits, and engine wear rates due to the chemical and physical properties of the exhaust gas. Additionally, the applicant states, this control technique is not commercially available from manufacturers of stationary internal combustion engines.

According to the 1997 publication by the Manufacturers of Emission Controls Association (MECA), *Emission Control Technology for Stationary Internal Combustion Engines*, "employing EGR to diesel engines introduces abrasive diesel particulate into the air intake which could result in increased engine wear and fouling. Using EGR after a diesel particulate filter would supply clean EGR and effectively eliminate this concern."

The New Jersey *State of the Art Manual for Reciprocating Internal Combustion Engines*, 2003, states that EGR results in a 48% to 80% reduction in NOX emissions in stationary diesel engines.

According to a 2005 presentation by Caterpillar, Inc., "Concerns with EGR systems include how suppressing combustion by limiting oxygen concentrations affects engine performance and fuel efficiency, and whether combustion products in exhaust gases affect operation/maintenance costs and the service life of components. In some markets, such as standby power generation, these issues may not be critical."

Independent research confirmed that EGR is not commonly used on stationary internal combustion engines; however, with the use of diesel particulate filters and ultra-low sulfur diesel, low-pressure EGR technology is being developed that could reduce NOX emissions by up to 80%, according to MECA testimony to the EPA, 2005.

Pre-chamber combustion: The applicant states that pre-chamber combustion is technically infeasible because it cannot be used in conjunction with diesel fuel firing. Pre-chamber combustion can reduce NOX emissions by 80%.

In pre-chamber combustion, fuel is delivered into a chamber off the combustion chamber, called a pre-chamber, where combustion begins and then spreads into the main chamber. This is also known as indirect injection. The pre-chamber is carefully designed to ensure adequate mixing of the atomized fuel with the compression-heated air. The addition of a pre-chamber can increase heat loss to the cooling system and subsequently lower engine efficiency.

Early diesel engines often used indirect injection. According to a major manufacturer of stationary diesel engines, indirect injection (IDI) fuel systems are available for diesel engines.

Rich burn combustion: EPA estimates that rich burn combustion can reduce NOX by 90% to 98%. According to the applicant, "the ability to fire on gas or oil is a project requirement. There are no dual-fuel rich-burn engines available." An independent review found no evidence to the contrary.

Water/steam injection: According to the applicant, "steam injection techniques, applicable to boilers and turbines, reduce peak combustion temperatures, and for these applications realize a decrease in NOX emissions. However, water or steam would corrode the interior of internal combustion engines and downstream components, and increase engine wear; therefore these techniques are considered to be technically infeasible for this application." A Wärtsilä publication indicates that water injection is a valid method of NOX control "only on liquid-fuel-fired diesel engines." Water/steam injection can reduce NOX emissions by 50% to 60%.

Lean combustion: Lean combustion decreases the fuel/air ratio in the zones where NOX is formed. Thus the peak temperature is lower and therefore thermal NOX formation is suppressed. The applicant has selected this technology for NOX reduction.

Exhaust Gas Treatment

Non-Selective Catalytic Reduction (NSCR)

This technology uses three-way catalysts to promote the reduction of NOX to nitrogen and water. CO and hydrocarbons are simultaneously oxidized to carbon dioxide and water. NSCR is applicable only to rich burn engines and is therefore not technically feasible for the proposed lean burn engines.

Selective Catalytic Reduction (SCR)

SCR is a process that involves post-combustion removal of NOX from exhaust gas with a catalytic reactor. In the SCR process, ammonia injected into the exhaust gas reacts with nitrogen oxides and oxygen to form nitrogen and water. The reactions take place on the surface of a catalyst. The function of the catalyst is to effectively lower the activation energy of the NOX decomposition reaction. Technical factors related to this technology include the catalyst reactor design, optimum operating temperature, sulfur content of the fuel, catalyst de-activation due to aging or poisoning, ammonia slip emissions, and design of the ammonia injection system.

The applicant proposes to use SCR for NOX emissions control. The applicant provided the following information regarding the SCR system: "The SCR equipment will include a reactor chamber, catalyst modules, ammonia storage system, ammonia injection and mixing system and monitoring equipment and sensors."

The SCR process is subject to catalyst deactivation over time. Catalyst deactivation occurs through two primary mechanisms: physical deactivation and chemical poisoning. Physical deactivation is generally the result either of prolonged exposure to excessive temperatures or masking of the catalyst due to entrainment of particulate from ambient air or internal contaminants. Chemical poisoning is caused by the irreversible reaction of the catalyst with a contaminant in the gas stream and is a permanent condition. Catalyst suppliers typically only guarantee a limited lifetime to very low emission level, high performance catalyst systems. It is recommended that a permit condition be included requiring the applicant to prepare an inspection and maintenance plan wherein replacement intervals for equipment are identified.

SCR manufacturers typically estimate 10 ppmvd of un-reacted ammonia emissions (ammonia slip) when making guarantees at very high efficiency levels. To achieve high NOX reduction rates, SCR vendors suggest a higher ammonia injection rate than stoichiometrically required, which conversely results in ammonia slip. Thus an emissions trade-off between NOX and ammonia may occur in high NOX reduction applications.

The potential environmental impacts associated with the use of SCR include:

i. Un-reacted ammonia would be emitted to the atmosphere (ammonia slip).

ii. Ammonium particulate may be formed and potentially clog the catalyst.

iii. Safety issues and Risk Management Planning may be required relative to the transportation, handling, and storage of ammonia.

According to the 1997 publication by the Manufacturers of Emission Controls Association (MECA), *Emission Control Technology for Stationary Internal Combustion Engines*, SCR technologies can provide greater than 90% reduction in NOX.

Selective Non-Catalytic Reduction (SNCR)

SNCR is applicable to both lean burn natural gas and diesel engines. SNCR involves injecting ammonia or urea into regions of the exhaust with temperatures greater than 1400 – 1500 degrees Fahrenheit. The nitrogen oxides in the exhaust are reduced to nitrogen and water vapor. Additional fuel is required to heat the engine exhaust to the correct operating temperature. Heat recovery from the engine exhaust can limit the additional fuel requirement and concurrent additional emissions from heating exhaust gases. Ten parts per million ammonia (slip) is considered reasonable for SNCR. Temperature is the operational parameter affecting the reaction - as well as degree of contaminant mixing with reagent and residence time. Additional control of particulate matter (up to 85% diesel particulate matter), volatile organic compounds (up to 90 percent) and carbon monoxide (up to 70 percent) may be realized by the afterburning effect of this technology.

Given that the Wärtsilä engine design exhaust temperature is rated at 728 degrees Fahrenheit, this technology would not be technically feasible.

The following information sources were consulted to identify possible NOX BACT limits for similar sizes and types of equipment:

a. CARB "Guidance for the Permitting of Electrical Generation Technologies"
b. NEO California Power LLC, Red Bluff, Tehama County Air Pollution Control District 2006 Source Test of natural gas-fired Wärtsilä engines at average operating rate of 2.80 MW
c. Chambersburg, PA Orchard Park Generating Station; Wärtsilä dual-fuel, 5.6 MW engines permitted October 28, 2004.
d. South Coast Air Quality Management District BACT Guidelines Manual

e. Bay Area Air Quality Management District BACT Guidelines
f. CARB RACT/BACT/LAER Clearinghouse
g. Colorado La Junta Municipal Utilities

NEO California Power

NOX (natural gas-fired reciprocating engines (3,871 bhp-hr) – achieved in practice	Engine 11: 4.86 ppmvd @ 15% O_2 Engine 9: 3.83 ppmvd @ 15% O_2 No other engines were tested

Bay Area Air Quality Management District BACT Guidelines

Natural Gas Lean Burn (NEO, Red Bluff; permitted limit)	0.07 g/bhp-hr (6 ppmvd @ 15% oxygen)
Diesel CI Engine >= 175 hp	107 ppmvd @ 15% O_2 (1.5 g/bhp-hr)

CARB "Guidance for Power plant Siting and Best Available Control Technology"

NOX (natural gas-fired reciprocating engines)	9.0 ppmvd @ 15% O_2
NOX (diesel-fired reciprocating engines)	No data available

South Coast Air Quality Management District BACT Guidelines Manual

Orange County Flood Control District – Natural Gas – 750 bhp	0.15 g/bhp-hr
Snow Summit – Diesel - 2,835 bhp with SCR	50 ppmvd @ 15% O_2 permit limit 45 ppmvd @ 15% O2 achieved in practice

CARB RACT/BACT/LAER Clearinghouse

Natural Gas	1.5 g/bhp-hr
Diesel	4.17 g/bhp-hr

Orchard Park

Natural gas with diesel pilot injection	24 ppmv (4.5 lb/hr)
Diesel	130 ppmv (26.7 lb/hr)

La Junta

Natural gas with 10% diesel pilot injection	0.03 lb/MMBtu (2683 ppmvd @ 15% O_2)
Diesel	3.4 lb/MMbtu (25 ppmvd @ 15% O_2)

Eliminate Technically Infeasible Options
After cooling
Rich Burn Combustion
Water Steam Injection
Non-Selective Catalytic Reduction
Selective Non-Catalytic Reduction

Remaining Technologies Ranked by % Control Efficiency
Selective Catalytic Reduction (>90%)
Exhaust Gas Recirculation (80%)
Pre-Chamber Combustion (80%)
Fuel Restrictions (35%)
Lean Burn Technology

Through the application of selective catalytic reduction (SCR) and lean burn technology, the applicant proposes to meet the NOX concentration limit of 6.0 ppmvd @15% O2 (0.06 g/bhp-hr) during natural gas operation. During diesel operation, the applicant proposed to meet a limit 35.0 ppmvd @ 15% O2 (0.39 g/bhp-hr). The applicant expects to be able to achieve an emission control efficiency of 97.3% when operating on natural gas, and 96.4% when firing diesel fuel.

b. Carbon Monoxide

Combustion Control

Carbon monoxide is formed as a result of incomplete combustion of a hydrocarbon fuel. Control of CO is accomplished by providing adequate fuel residence time, excess oxygen and high temperature in the combustion chamber to ensure complete combustion. These control factors, however, also tend to result in increased emissions of NOX. Conversely, a low NOX emission rate achieved through combustion modification techniques can result in higher levels of CO formation. Thus, a compromise is established to achieve the lowest NOX formation rate possible while keeping CO emission rates at acceptable levels.

Exhaust Gas Treatment

Oxidation Catalyst

CO emissions can also be controlled by exhaust gas treatment. According to MECA, oxidation catalysts have been used on off-road mobile source lean-burn engines for almost 30 years. In the U.S., over 500 stationary lean-burn IC engines have been outfitted with oxidation catalysts. Oxidation catalysts contain precious metals impregnated onto a high geometric surface area carrier and are placed in the exhaust stream. With the use of oxidation catalyst, CO emissions can be reduced by up to 90%.

The applicant proposes to install oxidation catalysts on all the Wärtsilä engines.

The following information sources were consulted to identify possible CO BACT limits for similar sizes and types of equipment:

a. CARB "Guidance for the Permitting of Electrical Generation

Technologies"

b. NEO California Power LLC, Red Bluff, Tehama County Air Pollution Control District 2006 Source Test of natural gas-fired Wärtsilä engines at average operating rate of 2.80 MW
c. Chambersburg, PA Orchard Park Generating Station; Wärtsilä dual-fuel, 5.6 MW engines permitted October 28, 2004.
d. South Coast Air Quality Management District BACT Guidelines Manual
e. Bay Area Air Quality Management District BACT Guidelines
f. CARB RACT/BACT/LAER Clearinghouse
g. Colorado La Junta Municipal Utilities

NEO California Power

Natural gas-fired reciprocating engines (3,871 bhp-hr) achieved in practice	Engine 11: 5.45 ppmvd @ 15% O_2 (0.03 g/bhp-hr) Engine 9: 42.26 ppmvd @ 15% O_2 (0.20 g/bhp-hr) No other engines were tested

South Coast Air Quality Management District BACT Guidelines Manual

Orange County Flood Control District – Natural Gas – 750 bhp	0.6 g/bhp-hr
Kings County – Diesel – 2848 bhp	.035 g/bhp-hr – 97% removal efficiency achieved
Snow Summit – Diesel - 2,835 bhp with SCR	89 ppmvd @ 15% O_2 permit limit 5 ppmvd @ 15% O_2 achieved

CARB RACT/BACT/LAER Clearinghouse

Natural Gas	0.6 g/bhp-hr
Diesel	89 ppmvd @ 15% O_2

Bay Area Air Quality Management District BACT Guidelines

Natural Gas Lean Burn (NEO, Red Bluff; permitted limit)	12 ppmvd @ 15% oxygen (0.10 g/bhp-hr)
Diesel CI Engine >= 175 hp	319 ppmvd @ 15% O2 (2.75 g/bhp-hr)

CARB "Guidance for Power plant Siting and Best Available Control Technology"

Natural gas-fired reciprocating engines	56 ppmvd @ 15% O_2 (0.6 g/bhp-hr)
Diesel-fired reciprocating engines	No data available

Orchard Park

Natural gas with diesel pilot injection	No data available
Diesel	1.5 g/bhp-hr

Eliminate Technically Infeasible Options

Remaining Technologies Ranked by % Control Efficiency
Oxidation Catalyst (90%)
Combustion controls

Through the application of combustion controls and oxidation catalyst, the applicant proposes to meet a CO concentration limit of 13.0 ppmvd @15% O2 (0.08 g/bhp-hr) during natural gas operation. During diesel operation, the applicant proposed to meet a limit of 20.0 ppmvd @ 15% O2 (0.14 g/bhp-hr). The applicant expects to be able to achieve an emission control efficiency of 96.8% when operating on natural gas, and 88.9% when firing diesel fuel.

The applicant's proposed CO emission limits, based on vendor guarantee, are within range of the majority of the other emission units evaluated, with the diesel concentration of 13 ppmvd being one part per million greater than the Bay Area BACT limit of 12 and the NEO engine's best achieved of 5.45. Additionally, the proposed limit of 0.08 g/bhp-hr is greater than the NEO achieved rate of 0.03.
The diesel fuel emission limit of 20 ppmvd is greater than the Snow Summit achieved rate of 5 ppmvd; and the rate of 0.14 g/bhp-hr is greater than the King's County diesel engine BACT rate of 0.035.

c. Reactive Organic Compounds

According to the US EPA, ROCs are discharged into the atmosphere from internal combustion engines when some of the fuel remains unburned or is only partially burned during the combustion process. Most ROC emissions result from fuel droplets that were transported or injected into the quench layer during combustion. This is the region immediately adjacent to the combustion chamber surfaces, where heat transfer outward through the cylinder walls causes the mixture temperatures to be too low to support combustion. In the case of natural gas, some organics are carryover, un-reacted, trace constituents of the gas, while others may be pyrolysis products of the heavier hydrocarbon constituents.

ROC emissions can be controlled by combustion controls and exhaust gas treatment.

Combustion Control

Combustion control refers to controlling emissions of ROC through the design and operation of the engine in a manner so as to limit VOC formation. In general, a combustion control system seeks to maintain the proper conditions to ensure complete combustion. The applicant stated that combustion control will be optimized for NOX reduction, but they will additionally have the affect of reducing ROC emissions.

Exhaust Gas Treatment

Oxidation Catalyst

Oxidation catalysts generally are precious metal compounds that promote oxidation of CO and VOCs to CO_2 and H2O in the presence of excess O2. According to a report prepared for the EPA in 2002, CO and NMHC conversion levels of 98% to 99% are achievable. Methane conversion may approach 60 to 70%. The report also states that oxidation catalysts are now widely used with all types of engines, including diesel engines. They are being used increasingly with lean burn gas engines to reduce their relatively high CO and VOC emissions.

The applicant proposes to install oxidation catalysts on all the Wärtsilä engines.

The following information sources were consulted to identify possible ROC BACT limits for similar sizes and types of equipment:

a. CARB "Guidance for the Permitting of Electrical Generation Technologies"
b. NEO California Power LLC, Red Bluff, Tehama County Air Pollution Control District 2006 Source Test of natural gas-fired Wärtsilä engines at average operating rate of 2.80 MW
c. Chambersburg, PA Orchard Park Generating Station; Wärtsilä dual-fuel, 5.6 MW engines permitted October 28, 2004.
d. South Coast Air Quality Management District BACT Guidelines Manual
e. Bay Area Air Quality Management District BACT Guidelines
f. CARB RACT/BACT/LAER Clearinghouse
g. Colorado La Junta Municipal Utilities

NEO California Power

NMOC (natural gas-fired reciprocating engines (3,871 bhp-hr) achieved in practice	Engine 11: 7.49 ppmvd @ 15% O_2 (0.02 g/bhp-hr) Engine 9: 6.82 ppmvd @ 15% O_2 (0.02 g/bhp-hr) No other engines were tested

CARB "Guidance for Power plant Siting and Best Available Control Technology"

VOC (natural gas-fired reciprocating engines)	25 ppmvd @ 15% O_2 (0.15 g/bhp-hr)
VOC (diesel-fired reciprocating engines)	No data available

Bay Area Air Quality Management District BACT Guidelines

Natural Gas Lean Burn (NEO, Red Bluff; permitted limit)	32 ppmvd @ 15% oxygen (0.15 g/bhp-hr)
Diesel CI Engine >= 175 hp	62 ppmvd @ 15% O_2 (0.30 g/bhp-hr) 309 ppmvd @ 15% O_2 (1.5 g/bhp-hr) achieved

South Coast Air Quality Management District BACT Guidelines Manual

Orange County Flood Control District – Natural Gas – 750 bhp	0.15 g/bhp-hr
Kings County – Diesel – 2848 bhp	.0026 g/bhp-hr – 95% removal efficiency achieved
Snow Summit – Diesel - 2,835 bhp with SCR	39 ppmvd @ 15% O_2 (0.15 g/bhp-hr) permit limit 49 (NMHC) ppmvd @ 15% O_2 (0.21 g/bhp-hr) achieved 25% hydrocarbon removal guarantee

CARB RACT/BACT/LAER Clearinghouse

Natural Gas	0.15 g/bhp-hr
Diesel	39 ppmvd @ 15% O_2

Orchard Park

Natural gas with diesel pilot injection	No data available
Diesel	0.75 g/bhp-hr

Eliminate Technically Infeasible Options

Remaining Technologies
Oxidation Catalyst
Combustion controls

Through the application of combustion controls and oxidation catalyst, the applicant proposes to meet a ROC concentration limit of 28 ppmvd @15% O2 (0.1 g/bhp-hr) during natural gas operation. During diesel operation, the applicant proposed to meet a limit of 40.0 ppmvd @ 15% O2 (0.16 g/bhp-hr). The applicant expects to be able to achieve an emission control efficiency of 86.7% when operating on natural gas, and 77.8% when firing diesel fuel.

The applicant's proposed VOC emission limits, based on vendor guarantee, are within range of the other emission units evaluated, with the diesel concentration of 40.0 ppmvd being one part per million greater than the CARB BACT limit of 39.

d. Particulate Matter

Particulate matter emissions from internal combustion engines are considered to be 2.5 microns or smaller in diameter (PM2.5). Natural gas is considered an insignificant source of PM emissions. The majority of PM emissions from the project will be due to diesel pilot injection and the potential diesel fuel firing of the engines.

The California Air Resources Board regulates diesel particulate matter (DPM) as a toxic air contaminant. DPM consists of the filterable portion of total particulate emitted from diesel combustion sources.

Particulate emissions from internal combustion engines can be controlled by exhaust gas treatment methods.

Diesel Particulate Filters (DPF)

Historically, stationary diesel engines used for both primary and back-up power generation have been installed with DPF systems to control particulate emissions. Information on the application of DPFs to stationary diesel engines can be found in the California Air Resources Board staff report issued in September 2003 to support ARB's air toxic control measure aimed at reducing particulate emissions from these engines (ARB staff report available at: www.arb.ca.gov/regact/statde/statde.htm). This report includes lists of DPF applications and reports on operating experience on stationary engines, for example, Caterpillar 3516 engines, rated in the 1490-2120 kW range. ARB did not identify operating experience with engines of the size range proposed for this project (approximately 16,000 kW); however, ARB did not indicate that the technology is not transferable to the larger engines.

DPFs can be passive or active. When ultra-low sulfur diesel fuel (<15 ppm sulfur) is used, precious metal catalyst-based diesel particulate filters (CB-DPFs) have demonstrated the capability to reduce PM emissions on a mass basis by up to 90 percent or more. CB-DPF technology has also demonstrated the capability to reduce a wide range of toxic hydrocarbon compounds by up to 80 percent or more.

Electrostatic Precipitators (ESP)

An ESP is a particulate control device that uses electrical forces to move particles entrained within an exhaust stream onto collection surfaces. In dry ESPs, the collectors are knocked, or "rapped", by various mechanical means to dislodge the particulate, which slides downward into a hopper where it is collected.

Collection efficiency is affected by dust resistivity, gas temperature, chemical composition (of the dust and the gas), and particle size distribution. Typical inlet PM concentrations are 0.5 to 5 gr/scf. Exhaust flows with concentrations below 0.5 gr/scf are also sometimes controlled with ESPs (USEPA). ESPs generally operate most efficiently with dust resistivities between 5 x 103 and 2 x 1010 ohm-cm. According to the EPA, the most difficult particles to collect are those with aerodynamic diameters between 0.1 and 1.0 μm. Particles between 0.2 and 0.4 μm usually show the most penetration. This is most likely a result of the transition region between field and diffusion charging.

ESPs have been applied to Wärtsilä engines operating on diesel and heavy fuel oils. Ultra low sulfur diesel fuel may not be collected as effectively, due to the decrease in available sulfur particles.

Baghouses

Baghouse filtration products (BFPs) are filtration fabrics used throughout industry to collect particulate matter. The fabrics are sewn into bags used in fabric filters (baghouses) that are efficient for collecting particles across a wide size range. The fabric filters are not designed to handle exhaust gas temperatures in the range identified for this project.

The following information sources were consulted to identify possible PM10 BACT limits for similar sizes and types of equipment:

a. CARB "Guidance for the Permitting of Electrical Generation Technologies"
b. NEO California Power LLC, Red Bluff, Tehama County Air Pollution Control District 2006 Source Test of natural gas-fired Wärtsilä engines at average operating rate of 2.80 MW
c. Chambersburg, PA Orchard Park Generating Station; Wärtsilä dual-fuel, 5.6 MW engines permitted October 28, 2004.
d. South Coast Air Quality Management District BACT Guidelines Manual
e. Bay Area Air Quality Management District BACT Guidelines
f. CARB RACT/BACT/LAER Clearinghouse
g. Colorado La Junta Municipal Utilities – Natural gas ICE with 10% diesel pilot injection

South Coast Air Quality Management District BACT Guidelines Manual

Kings County – Diesel – 2848 bhp	0.0116 g/bhp-hr – 85% removal efficiency achieved (DPF)
Snow Summit – Diesel - 2,835 bhp with SCR	0.045 g/bhp-hr) permit limit 0.009 g/bhp-hr achieved (including condensables)

CARB "Guidance for Power plant Siting and Best Available Control Technology"

Natural gas-fired reciprocating engines	0.02 g/bhp-hr
Diesel-fired reciprocating engines	No data available

NEO California Power

Natural gas-fired reciprocating engines (3,871 bhp-hr)	Engines 9 & 11: 0.02 g/bhp-hr (permit limit and achieved) No other engines were tested

CARB RACT/BACT/LAER Clearinghouse

Diesel	0.045 g/bhp-hr

Bay Area Air Quality Management District BACT Guidelines

Diesel CI Engine >= 175 hp (TBACT)	0.1 g/bhp-hr achieved in practice

Colorado La Junta Municipal Utilities – Dual Fuel

Natural Gas w/ 10% Diesel Pilot Injection, 4,945 bhp; 8,724 Btu/bhp-hr	0.074 g/bhp-hr
Natural Gas w/ 10% Diesel Pilot Injection, 7,131 bhp; 5,072 Btu/bhp-hr	0.13 g/bhp-hr
Diesel, 4,945 bhp; 6,718 Btu/bhp-hr	7.8 lb/hr
Diesel, 7,131 bhp; 5,731 Btu/bhp-hr	9.6 lb/hr

Orchard Park

Natural gas with diesel pilot injection	No data available
Diesel	1.5 g/bhp-hr

The most comparable engines are the Orchard Park and La Junta dual fuel engines. The Wärtsilä PM emission rates are lower than Orchard Park's and higher than La Junta. La Junta and Wärtsilä emission rates are compared below.

Humboldt NG w/ 0.7% Diesel Injection	0.1g/bhp-hr full load; 0.2 g/bhp-hr low load
CO NG w/ 10% Diesel Injection, 4,945 bhp; 8,724 Btu/bhp-hr	0.07 g/bhp-hr
CO NG w/ 10% Diesel Injection, 7,131 bhp; 5,072 Btu/bhp-hr	0.1 gbhp-hr

PM10	
Humboldt Diesel	10.8 lb/gal
Diesel, 4,945 bhp; 6,718 Btu/bhp-hr	7.8 lb/hr
Diesel, 7,131 bhp; 5,731 Btu/bhp-hr	9.6 lb/hr

Eliminate Technically Infeasible Options
ESP
Baghouse

Remaining Technologies
DPF

The applicant proposes to meet a PM10 emission limit of 3.6 lb/hr (0.14 g/bhp-hr) during natural gas operation. During diesel operation, the applicant proposes to meet a limit of 10.8 lb/hr (0.20 g/bhp-hr).

The PM limit of 0.14 g/bhp-hr for the natural gas engine identified above is based on the use of an oxidation catalyst and PUC pipeline quality natural gas. The Wärtsilä engines will be equipped oxidation catalysts. When operating on natural gas, the engines will maintain a continuous injection of <1% diesel fuel. Recently, in the Bay Area East Shore project, it was determined that oxidation catalysts are also capable of achieving particulate matter reductions. EPA recognizes the acceptable control range of 20% to 40%.

The Colorado dual fuel engines are permitted at a level that is equivalent to 0.074 g/bhp-hr for the 4,945 hp engine, and 0.13 g/bhp-hr for the 7,131 hp engine. These engines are not required to use ultra low sulfur diesel and do not use DPFs.

The PM limit of 0.0116 g/bhp-hr in the Kings County engine identified above is for an engine that has installed a DPF. The applicant asserts that DPFs are not a feasible option for the Wärtsilä engines. It is likely that the installation of DPFs would be cost-prohibitive; and it appears that the actual emissions may be significantly lower than the manufacturer's guarantee.

Comparison of Emission Rates for Internal Combustion Engines (Natural Gas)

Pollutant	Wärtsilä Emission Factors	Lowest Emission Rates
NOX	6 ppmvd @ 15% O2 0.06 g/bhp-hr	6 ppmvd @ 15% O2 0.07 g/bhp-hr
CO	13 ppmvd @ 15% O2 0.08 g/bhp-hr	12 ppmvd @ 15% O2 0.1 g/bhp-hr
VOC	28 ppmvd @ 15% O2 0.1 g/bhp-hr	25 ppmvd @ 15% O2 0.15 g/bhp-hr
PM10	0.1 g/bhp-hr	0.02 g/bhp-hr

Comparison of Emission Rates for Internal Combustion Engines (Diesel)

Pollutant	Wärtsilä Emission Factors	Lowest Emission Rates
NOX	35 ppmvd @ 15% O2 0.0.39 g/bhp-hr	50 ppmvd @ 15% O2 1.5 g/bhp-hr (different sources)
CO	20 ppmvd @ 15% O2 0.14 g/bhp-hr	89 ppmvd @ 15% O2 0.035 g/bhp-hr (different sources)
VOC	40 ppmvd @ 15% O2 0.16 g/bhp-hr	39 ppmvd @ 15% O2 0.0026 g/bhp-hr
PM10	0.21 g/bhp-hr	0.0116 g/bhp-hr

As identified in the beginning of this section, the District BACT Requirements are:

a. the most effective emission control device, emission limit, or technique which has been required or used for the type of equipment comprising such emissions unit unless the applicant demonstrates to the satisfaction of the APCO that such limitations are not achievable; or

b. any other emission control device or technique, alternative basic equipment, different fuel or process, determined to be technologically feasible and cost-effective by the APCO.

As discussed earlier, engines of this size have not previously been permitted in California. Additionally, natural gas engines with diesel pilot ignition have not previously been permitted in California. However, diesel engines up to over 2,000 horsepower have been permitted in California and have demonstrated the ability to meet BACT standards. The District has determined that the control equipment proposed to be installed by the applicant represents BACT for the project.

Section 110.5.5 Ambient Air Quality Standards

According to the ambient air quality impact analysis submitted by the applicant, the combined PM impacts exceed the state 24-hr and annual PM10 standards for both operating scenarios.

The applicant conducted an ambient air quality impact analysis using AERMOD for flat terrain and CTSCREENPLUS for complex and intermediate terrain (terrain at elevations above the stack base elevation. The California Energy Commission and ARB determined that AERMOD should have been used for intermediate terrain (terrain at elevation between the stack base and stack top).

The applicant ran a model that reflected operations based on 100 hours/year/Wärtsilä engine on diesel and each of the emergency generators operating at 100 hours/year. The proposed project's emissions were evaluated in combination with background ambient air concentrations to determine the project's impacts. Table 16 below indicates the results of the analysis.

Table 16 - Ambient Air Quality Impact Analysis (micrograms/cubic meter)

Pollutant	Averaging Time	50 hours/yr Impact	Maximum Operating Impact (including background data)	State Standard	Federal Standard
NO2	1-hour	209.1	284	338	-
	Annual	2.5	20	56	100
SO2	1-hour	25.4	140	650	-
	3-hour	18.3	88	-	1,300
	24-hour	3.7	25	109	365
	Annual	0.1	5.9	-	80
CO	1-hour	492.2	3,742	23,000	40,000
	8-hour	242.2	2,220	10,000	10,000
PM10	24-hour	34.1	106	50	150
	Annual	3.1	24.2	20	50
PM2.5	24-hour	-	33.8	-	35
	Annual	-	-	12	15

The PM impacts for the facility without considering the background ambient air concentrations are identified below.

Pollutant	Averaging Time	100 hours/yr Impact	Maximum Operating Impact	State Standard	Federal Standard
PM10	24-hour	21.7	28.9	50	150
	Annual	1.2	1.4	20	50
PM2.5	24-hour	21.7	28.9	-	35

The data provided indicate that the proposed facility alone would not cause an ambient air quality standard violation. It also indicates that state PM10 standards are exceeded by background concentrations alone. Finally, the applicant has demonstrated that the $PM_{2.5}$ impacts from the proposed project, when combined with the background pollutant concentration, will not exceed the federal $PM_{2.5}$ twenty-four (24) hour standard.

Background Concentrations Prior to the Proposed Project

Pollutant	Averaging Time	Background Concentration	State Standard	Federal Standard
PM10	24-hour	71 (2006)	50	150
	Annual	20.7 (2004)	20	50
PM2.5	24-hour	32 (2005)		35

Rule 110.5.5 requires that the APCO take into account emissions mitigation provided by offsets obtained pursuant to the regulation. Since state PM10 standards will be worsened, offsets will be provided for all PM10 emissions above 25 tons per year.

Section 110.5.7 Compliance by Other Owned, Operated, or Controlled Sources:

The applicant is required to certify that other sources in California that are owned by the same applicant and that have a potential to emit greater than 25 tons per year, are in compliance, or on a schedule for compliance, with all applicable emission limitations and standards.

This certification was submitted to the NUCAQMD along with the District application.

Section 110.11 Prevention of Significant Deterioration (PSD)

The applicant is required to conduct an air quality analysis to demonstrate that the potential new emission emissions from the proposed source, in conjunction with other applicable emissions from existing sources (including secondary emission from growth associated with the new project), will not cause or contribute to a violation of any PSD increment. This analysis is required for each pollutant with a potential to emit that exceeds the significance threshold.
The significance threshold are defined in Regulation I, Rule 101.1.266 and identified in Table 18 below.

Table 18 – PSD Applicability

Pollutant	Proposed Net Emissions Changes Tons/Year (Reduction)	Significant Emissions Rate Threshold (A) tons/year
NO2 (NOX)	**(762.5)**	40
O3 (VOC)	164.4	40
SO2	**(25.6)**	40
PM10	91.3	15
CO	57.8	100

VOC and PM10 emissions increases exceed the Significant Emissions Rate. Increment consumption analysis is not required for VOC emissions; however, it is required for PM10 emissions.

The applicant submitted Class I and Class II increment consumption analyses. Class I increment consumption was estimated to be 5% of the allowable increment.

For the Class II increment consumption analysis, the applicant modeled the ambient impact of major PM10 sources within 50 km of the impact area. The results of the modeling analysis are identified in Table 19 below.

Table 19 Modeled Impacts and PSD Class II Increments

Pollutant	Averaging Time	Modeled Impacts	Class II Increment (ug/m3)
PM_{10}	24 – hour Natural Gas Mode	15.5	30
	24 Hour Diesel Mode	28.1	30
	Annual	3.1	17

Federal Land Managers

The Federal Land Managers (US Department of the Interior and the Department of Agriculture) performed an independent review of the proposed project and provided the following comments.

- The VISCREEN plume analysis results suggest that there will not be any perceptible visibility impacts associated with the emissions from the plant at Redwood National Park, nor the Marble or Yolla Bolla wilderness areas.

- The applicant originally proposed a limit of 0.21 g/bhp-hr when operating in Diesel Mode, which given the NCUAQMD's attainment status, was not sufficient to qualify as BACT. The applicant has since revised the limit to 0.15 g/bhp-hr.

- Future modeling conducted to predict regional haze should be performed with CALPUFF rather than CALPUFF-Lite.

- Encourage the applicant to consider voluntary green house gas emission offsets

4. PROHIBITORY RULES COMPLIANCE

NCUAQMD Rule 104.2 – Visible Emissions
Visible emissions from the engines are expected to comply with the 40% opacity requirement of this rule.

NCUAQMD Rule 104.3.4.1 Particulate Matter Emissions from General Combustion Sources
The proposed project is expected to comply with the particulate matter emission limit of 0.20grains/ standard cubic foot. Based on the data reported in the AFC, Table 8.1A-3, the maximum PM10 emission rate would be 0.04 grains/dscf.

NCUAQMD Rule 104.5 – Sulfur Oxide Emissions
SO2 emissions from the proposed project are expected to comply with the 1,000 ppm SO2 limitation.

5. NSPS COMPLIANCE (NCUAQMD Rule 104.11):

Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII)

Subpart IIII applies specifically to manufacturers, owners and operators of stationary compression ignition (CI) internal combustion engines. The Subpart defines CI engines as any engines that are not spark ignition engines.

The Subpart's definition for spark ignition engines includes the following:
"*Dual-fuel engines in which a liquid fuel...is used for CI and gaseous fuel...is used as the primary fuel at an annual average ratio of less than 2 parts diesel fuel to 100 parts total fuel on an energy equivalent basis are spark ignition* engines".

Based on the tables below, the maximum potential annual average ratio of diesel to natural gas, calculated as described above, is 1.6%. There is the possibility that the engines could be operated for additional periods in Diese Mode (natural disaster i.e. earthquake). As such, for the purposes of this Subpart, the Wärtsilä engines should be considered Compression Ignition (CI) Engines and accordingly, the Subpart applies to them.

	Natural Gas	
	MMBtu	scf
Hourly	144	1,409,403
Daily	3,454	33,825,661
Annual	927,723	9,086,418,217

Diesel Pilot		
	MMBtu	**Gallons**
Hourly	0.8	58
Daily	19	1,402
Annual	5,158	376,734

Diesel Mode		
	MMBtu	**Gallons**
Hourly	148.9	1,088
Daily	3,574	26,106
Annual	14,890	108,836

The Wärtsilä engines are classified, for the purposes of compliance with the NSPS as "non-emergency stationary CI Internal Combustion Engines with a displacement of greater than or equal to 30 liters per cylinder" and therefore must meet the following requirements.

a. Reduce NOX emissions by 90% or more, OR limit NOX emissions to 1.6 g/KW-hr (1.2 g/bhp-hr).
b. Reduce PM emissions by 60% or more, OR limit PM emissions to 0.15 g/KW-hr (0.11 g/bhp-hr).

The Wärtsilä engines are guaranteed by the manufacturer to emit a maximum of 0.56 g/KW-hr (0.39 g/bhp-hr), less than the maximum allowed by the NSPS. The manufacturer also guarantees a diesel PM maximum emission rate of 0.15 g/KW-hr.

The black-start generator and fire pump engine are not required to meet the NSPS standards, because they are emergency engines.

6. NESHAP COMPLIANCE:

National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40 CFR 63 Subpart ZZZZ)

When operating in diesel mode, the Wärtsilä engines qualify as Compression Ignition (CI) Engines under the definition in the NESHAP. The facility is a major source for hazardous air pollutants (HAPs), having the potential to emit 10 tons or more per year of one HAP, and 25 tons or more per year of more than one HAP. There are multiple types of Reciprocating Internal Combustion Engines (RICE) regulated by this NESHAP. The Wärtsilä engines qualify, by definition, as CI engines.

"Compression ignition engine *means any stationary RICE in which a high boiling point liquid fuel injected into the combustion chamber ignites when the air charge has been compressed to a temperature sufficiently high for auto-ignition, including diesel engines, dual-fuel engines, and engines that are not spark ignition."*

NESHAP requirements include:

a. Reduce CO emissions by 70% or more; or
b. Limit concentration of formaldehyde in the exhaust to 50 ppbvd or less @ 15% O2.

The applicant has proposed emission limits that reduce CO emissions by 96.8% when operating on natural gas, and 88.9% when firing diesel fuel. The NESHAP exempts startups, shutdowns and malfunctions.

The black-start generator and fire pump engine are both less than 500 bhp and are therefore exempt from the NESHAP.

7. California Airborne Toxic Control Measure for Stationary Compression Ignition Engines (93115, Title 17, California Code of Regulations)

The ATCM defines a compression ignition engine by the following: "Compression Ignition (CI) Engine means an internal combustion engine with operating characteristics significantly similar to the theoretical diesel combustion cycle. The regulation of power by controlling fuel supply in lieu of a throttle is indicative of a compression ignition engine."

According to the applicant, the Wärtsilä engines, when operating in natural gas firing mode, do not meet this definition, as their operation is different than the theoretical diesel combustion cycle. The applicant asserts that the natural gas operating mode is more similar to the Otto cycle of a spark ignition engine.

The Wärtsilä engines, when operating in the diesel firing mode meet the definition of CI Engine; therefore, the engines must comply with the ATCM when running on diesel fuel.

The ATCM sets forth diesel particulate matter (DPM) emission limits for new engines, which are categorized, by definition, as either Emergency Standby Engines or Prime CI Engines. Prime CI Engines are defined as any engine that is not an Emergency Standby Engine.

The definition for Emergency Standby Engine includes a stationary engine that: (A) is installed for the primary purpose of providing electrical power or mechanical work during an emergency use and is not the source of primary power at the facility; and (B) is operated to provide electrical power or mechanical work during an emergency use; and (C) is operated under limited circumstances for maintenance and testing, emissions testing, or initial start-up testing.

The definition of Emergency Use includes providing electrical power or mechanical work in the event of the failure or loss of all or part of the normal natural gas supply to the facility: (A) which is caused by any reason other than the enforcement of a contractual obligation the owner or operator has with a third party or any other party; and (B) which is demonstrated by the owner or operator to the District APCO's satisfaction, to have been beyond the reasonable control of the owner or operator.

The applicant, PG&E, is the primary electricity provider for the County of Humboldt. PG&E obtains its natural gas fuel supply from PG&E's gas operations. PG&E, as a gas supplier, operates under Gas Rules, or Tariffs, that define the company's relationship with its customers. Rule 14 provides that, "when operational conditions exist such that supply is insufficient to meet demand and deliveries to Core End-Use Customers are threatened…PG&E may divert gas supply in its system from Noncore End-Use Customers to Core End-Use Customers. If a Noncore End-Use Customer's supply is diverted…that Customer must stop or reduce its use of natural gas."

The applicant is defined as a Noncore End-Use Customer in Rule 1: "Noncore End-Use Customers are typically large commercial, industrial, cogeneration, wholesale or electric generation Customers who meet the usage requirements for service under a noncore rate schedule and who have executed a Natural Gas Service Agreement. Electric Generation, Enhanced Oil Recovery, Cogeneration, and Refinery Customers with historical or potential annual use exceeding 250,000 therms per year or rated generation capacity of five hundred kilowatts (500 kW) or larger, are permanently classified as Noncore End-Use Customers." As a Noncore End-Use Customer, the applicant is required to curtail its natural gas use during shortfalls. In Humboldt County, such shortfalls typically occur during the winter months, when overall customer gas use increases.

Under the ATCM's Emergency Use definition, CARB determined, in correspondence dated March 10th 2006, that an engine would be an Emergency Standby Engine if the emergency use were the result of the enforcement of a contractual obligation the owner or operator has with another party. The purpose for this provision was to not allow engines that were part of an interruptible service contract to be considered emergency standby engines.

The black-start generator and fire pump are also emergency back-up generators and subject to the requirements of the ATCM for New Emergency Backup Engines.

All engines will operate only on CARB Diesel or Alternative Fuel, as defined in the ATCM. The engines will operate for a maximum of 50 hours per year per engine for testing and maintenance purposes. There is no limit in the ATCM on the amount of hours allowed for emergency operations; however, engine hours will be limited to no more than 100 for the combined purpose of maintenance and testing and during periods of natural gas curtailment. All engines will meet the ATCM emission standard of 0.15 g/hp-hr will operating in Diesel Mode.

It should be pointed out that the Stationary Diesel Engine ATCM was designed to address diesel emergency backup engines and prime engines where the access to grid power was not readily available or reliable. In developing the ATCM, duel-fueled, multi-engine power generating stations were not even envisioned. As a result, CARB believes that the ATCM should be viewed as a minimum level control of compliance in this situation and the required level of control should be based on a source specific analysis of best available control technology.

K. Discussion

The installation and operation of the permitted units described in this evaluation should comply with all local, state, and federal emission requirements when operated in accordance with the Authority to Construct Temporary Permit Operate #440-1. Further, staff has evaluated the information presented by the applicant and applicable rules and regulations, and believes sufficient evidence exists for the APCO to make the determinations required under Rule 102 §1.2 and Rule 103 §7.0 and issue a Preliminary Determination of Compliance.

It should be noted, that the recommendations contained herein are in fact preliminary. The District continues to receive comments from the public, additional information from regulatory agencies, and information as a result of data requests being satisfied by the applicant. The District will continue to evaluate data and consider all comments prior to the issuance of a final determination of compliance.

EVALUATED BY: ______________________________ **DATE:** ________________

Jason L. Davis, Division Manager

ATTACHMENTS

- Stationary Diesel ATCM Applicability Determination – CARB
- Comments on Air Quality Analysis – National Park Service
- Comments on Air Quality Analysis – US Forest Service

Alan C. Lloyd, Ph.D.
Agency Secretary

Air Resources Board

Robert F. Sawyer, Ph.D., Chair
1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov

Arnold Schwarzenegger
Governor

RECEIVED
AUG 23 2006
By________

March 10, 2006

Mr. Kent L. Fickett
Co-CEO and President
Ramco Generating Two, Inc.
61 Avenida De Orinda, Suite 35
Orinda, California 94563

Dear Mr. Fickett:

In response to the request in your letter of February 24, 2006, the Air Resources Board staff conducted a regulatory analysis to determine if your dual-fueled diesel pilot ignition engine technology was subject to the requirements of the Stationary Compression Ignition Engine Airborne Toxic Control Measure (ATCM). Based on our analysis of the data you supplied, we concur that:

1. The requirements in the Stationary Diesel Engine ATCM do not apply to the dual-fuel diesel pilot ignition engines when operating in the natural gas/diesel pilot mode.

2. The requirements in the Stationary Diesel Engine ATCM for Emergency Standby Engines do apply to the dual-fuel diesel pilot ignition engines when operating in the diesel-only mode.

If you have further questions regarding this matter, please contact Mr. Dan Donohoue, Chief of the Emissions Assessment Branch, Stationary Source Division at (916) 322-6023.

Sincerely,

Michael H. Scheible
Michael H. Scheible
Deputy Executive Officer

cc: Dan Donohoue, Chief
Emissions Assessment Branch

S:\Diesel\Stationary ATCM\dual fuel response letter.doc

Draft February 17, 2006
Applicability of the Stationary Diesel Engine ATCM
To Humboldt Power Plant Project
[Contains information that was requested to be held "Confidential"]

Issue: Does the Stationary Diesel Engine ATCM apply to the duel-fueled engines proposed for use in the Humboldt Power Plant Project?

Conclusions:
1. The requirements in the Stationary Diesel Engine ATCM do not apply to the dual-fuel diesel pilot engines when operating in the natural gas/diesel pilot mode.

2. The requirements in the Stationary Diesel Engine ATCM for Emergency Standby Engines do apply to the dual-fuel diesel pilot engines when operating in the diesel-only mode.

Background:

On February 2, 2006, ARB staff met with representative from Ramco, Black Hills, Sierra Research, and PG&E to discuss the applicability of the Stationary Diesel Engine ATCM to a potential Humboldt Power Plant Project. The proposal is to install 10 Wartsila 50DF dual-fueled engines (combined power 165 MW) to replace PG&E Humboldt Power Plant (two 52 MW boilers and two combustion turbines). The Wartsila 50DF engines would use natural gas as the primary fuel. A small quantity of diesel fuel is injected into the combustion chambers as pilot fuel. The diesel fuel ignites by compression ignition and serves as the ignition source for the natural gas and air mixture. The pilot fuel amounts to about 1% of the full-load fuel consumption. When gas supply is interrupted the engine would switch to 100% diesel fuel.

The key issue was whether or not these engines would be subject to the requirements of the Stationary Diesel Engine ATCM, and if so, what standards would the engines have to meet.

Finding 1: Under the current project design and when operating on natural gas with diesel pilot injection, the Wartsila 50DF engine would not be subject to the requirements in the Stationary Diesel Engine ATCM.

The Stationary Diesel Engine ATCM applies to stationary compression ignition engines. Under this regulation, *"'Compression Ignition Engine' means an internal combustion engine with operating characteristics significantly similar to the theoretical diesel combustion cycle. The regulation of power by controlling fuel supply in lieu of a throttle is indicative of a compression ignition engine."*

The Wartsila 50DF engine, when operating in the natural gas/diesel pilot mode, has operating characteristics more closely related to an Otto cycle engine than a

United States Department of the Interior
NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225

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IN REPLY REFER TO:

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By Scanned

August 29, 2007

N3615 (2350)

Rick Martin, Air Pollution Control Officer
North Coast Unified Air Quality Management District
2300 Myrtle Avenue
Eureka, California 95501

Dear Mr. Martin:

We have reviewed the Class I Impact Analysis report prepared by Sierra Research for the Humboldt Bay Repowering Project (HBRP) located near Eureka, California. We have also reviewed the California Air Resources Board draft engineering evaluation which contains the Best Available Control Technology (BACT) analysis for HBRP. The HBRP facility is located approximately 42 kilometers (km) south of Redwood National Park, a Class I air quality area administered by the National Park Service (NPS). The HBRP is a major modification and will include the installation of 10 new Wartsila Model 18V50DF engine/generator sets, with a total capacity of about 163 MW. The new equipment replaces two natural gas-fired steam boilers (50 MW each) and two distillate oil peaking combustion turbines (15 MW each). The new engines are intended to operate primarily on natural gas, but have the capability of using ultra-low sulfur diesel fuel when natural gas delivery is disrupted. It is estimated that diesel fuel could be used for up to 50 hours per year of operation (down from original estimate of 800 hours per year). The HBRP replacement of the existing boilers and turbines will cause an emission reduction of approximately 573 tons per year (TPY) of nitrogen oxide (NO_x), and an increase in emissions of sulfur dioxide (SO_2) of 0.8 TPY, and 158 TPY of particulate matter less than 10 microns (PM_{10})/particulate matter less than 2.5 microns ($PM_{2.5}$).

We have the following comments concerning the Sierra Research Class I Impact Analysis and the proposed BACT analysis.

Air Quality Analysis
The Sierra Research report assessed plume impacts at Redwood National Park using VISCREEN modeling analysis and Class I increment, visibility and acid deposition impacts using CALPUFF modeling analysis.

Upon our review of the VISCREEN plume analysis performed for HBRP and its potential plume impacts to Redwood National Park we find that the analysis incorrectly subtracted the **impacts** of the existing sources that are to be retired from the **impacts** of the proposed new sources. The addition or subtraction of impacts is inappropriate for discrete plume analyses and does not allow us to properly determine potential plume impacts of the new sources emissions at Redwood National Park.

Based on new information we received on August 1, 2007, from Sierra Research and further review of computer files of the modeling analysis, we re-modeled the plume impacts of the new sources alone. We applied the emission rates (56.92 lb/hr of NOx, 4.03 lb/hr of SOx, and 42.75 lb/hr of speciated PM) for the ten new engines provided by Sierra Research. We based our modeling on the Level 2 VISCREEN file named HUMNEWG2.SUM (natural gas firing scenario) which was used by Sierra Research in their analysis. In their modeling they conducted a VISCREEN Level 2 analysis where the 1% worst-case meteorological data were applied as per the recommendations found in the EPA Workbook for Plume Visual Impact Screening and Analysis (EPA-450/4-88-015 September 1988). The 1% worst case meteorological data were determined to be "F" atmospheric stability and a wind speed of 3 meters per second. The impact under these meteorological conditions was calculated to be a Delta E (change in color) against a terrain background of 3.675 which is above the impact threshold (Delta E of 2.0). The plume contrast impact under these meteorological conditions is (-0.038) which is below the contrast impact threshold (an absolute value of 0.05). We followed additional guidance found in the EPA VISCREEN Workbook, specifically the section "ACCOUNTING FOR COMPLEX TERRAIN", where in complex terrain "the worst-case" stability class should be shifted one category to a less stable atmospheric condition. Therefore, considering the intervening terrain between the HBRP site and Redwood National Park, we ran the analysis applying "E" atmospheric stability at a wind speed of 3 meters per second. The results of this analysis indicate impacts below the VISCREEN Delta E and contrast thresholds with a Delta E of 1.986 and a contrast of 0.015. We therefore do not anticipate any perceptible plume impacts at Redwood National Park. Our VISCREEN analysis is enclosed. Please note that we only consider plume impacts **inside** the Class I area and not **outside** the Class I area. Because the North Coast Unified Air Quality Management District will limit oil firing to only 50 hours per year, we do not request that Sierra Research conduct a VISCREEN analysis for emissions from oil firing.

Considering the emission reductions associated with the units being shut down, the total amount of annual emissions of NO_x, SO_2 and $PM_{10}/PM_{2.5}$ from the new engines, and the distance to Redwood National Park, we will not ask Sierra Research to conduct a re-analysis with the EPA CALPUFF refined model. However, for future uniform haze modeling analyses, the use of the CALPUFF-Lite model, used by Sierra Research in this case, is no longer an accepted modeling method. CALPUFF-Lite is currently not listed as an approved modeling procedure in the EPA Air Quality Modeling Guidelines (40 CFR 51, Appendix W).

BACT Analysis

According to the ambient air quality impact analysis submitted by the applicant, the HBRP combined PM impacts exceed the state 24-hr and annual PM_{10} standards and the federal 24-hr $PM_{2.5}$ standard. Because of the poor local air quality and in consideration of projected impacts which would exacerbate the non-attainment problem as well as impact visibility at Redwood National Park, it seems that a more rigorous BACT analysis is warranted. The HBRP draft permit proposes to limit PM_{10} to 0.21 g/bhp-hr when burning diesel fuel. The North Coast Unified Air Quality Management District (NCUAQMD) has identified other internal combustion engines burning diesel fuel and using Diesel Particulate Filters (DPF) to reduce PM_{10} emissions to as low as 0.0116 g/bhp-hr (Kings County). Please consider that when addressing non-attainment issues and potential visibility impacts at Redwood National Park, the assertion by the applicant that DPFs "could be cost-prohibitive" is not an adequate justification to eliminate that proven technology in this case. If NCUAQMD does allow economic factors to be considered in this case, then it should require DPFs as BACT, unless HBRP demonstrates that this control technology is not feasible at Humboldt Bay.

Please note that our comments pertain to the HBRP Class I air quality impact analysis and BACT analysis. It is possible that additional emission reductions may be required at the Humboldt Bay facility in the future under the Reasonable Progress requirement of the Regional Haze Rule.

Thank you for involving us in the review of HBRP Class I impact analysis and BACT analysis. Please contact me at (303) 969-2817 if you have any questions regarding our comments concerning HBRP.

Sincerely,

Darwin W. Morse
Environmental Protection Specialist

Enclosure

cc:
Nancy Matthews
Sierra Research
1801 J Street
Sacramento, California 95814

Visual Effects Screening Analysis for
Source: HUMBOLT
Class I Area: REWO

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	4.38	G	/S
NOx (as NO2)	7.17	G	/S
Primary NO2	.00	G	/S
Soot	1.54	G	/S
Primary SO4	.25	G	/S

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	230.00 km
Source-Observer Distance:	44.00 km
Min. Source-Class I Distance:	44.00 km
Max. Source-Class I Distance:	50.00 km
Plume-Source-Observer Angle:	11.25 degrees
Stability: 5	
Wind Speed: 3.00 m/s	

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	117.	50.0	51.	2.00	.304	.05	-.001
SKY	140.	117.	50.0	51.	2.00	.591	.05	-.020
TERRAIN	10.	84.	44.0	84.	2.00	1.986	.05	.015
TERRAIN	140.	84.	44.0	84.	2.00	.226	.05	.003

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	0.	1.0	168.	2.00	3.082*	.05	-.003
SKY	140.	0.	1.0	168.	2.00	8.621*	.05	-.230*
TERRAIN	10.	0.	1.0	168.	2.00	21.501*	.05	.245*
TERRAIN	140.	0.	1.0	168.	2.00	8.241*	.05	.177*

USDA United States Department of Agriculture | Forest Service | Pacific Southwest Region | Regional Office, R5
1323 Club Drive
Vallejo, CA 94592
(707) 562-8737 Voice
(707) 562-9130 Text (TDD)

File Code: 2580
Date: OCT 16 2007

Rick Martin Air Pollution Control Officer
North Coast Unified Air Quality Management District
2300 Myrtle Ave
Eureka, CA 95501

RECEIVED
OCT 20 2007
By OM

Dear Mr. Martin:

Thank you for the opportunity to review and comment on the proposed Humboldt Bay Repowering Project (HBRP) Class I Impact Analysis. The applicant is Pacific Gas & Electric Company. The analysis was prepared by Sierra Research (Sacramento, CA office). The following comments reflect the Forest Service review of the analysis.

The nearest Class I PSD area (Redwood National Park) is 42 kms from the project. Table 1 below shows the distance to Class I areas that the applicant has analyzed.

Table 1
Class 1 Area Distances from the Project Site

Class 1 Area	Distance km	Distance miles
Redwood NP	42	26
Marble	100	62
Yolla Bolly	114	71

The Humboldt Bay Repowering Project consists of ten new Wartsila Model 18V50DF engine/generator sets (total capacity approximately 163 MW) at the Humboldt Bay Power Plant near Eureka, CA. This new equipment will replace two natural gas-fired steam boilers (rated at 50 MW each) and two distillate-fired peaking turbines (rated at 15 MW each), so there is a small net capacity increase associated with the project. The new engines are intended to operate primarily on natural gas, but have the capability of using ultra-low sulfur diesel fuel when natural gas delivery is disrupted. It is estimated that diesel fuel could be used for up to 50 hours per year of operation (down from an original estimate of 800 hours per year). The replacement of the equipment will cause an emission reduction of approximately 573 tons per year (TPY) of nitrogen oxide (NO_x), and an increase in emissions of sulfur dioxide (SO_2) of 0.8 TPY, and 158 TPY of $PM_{10}/PM_{2.5}$.

The proposed modeling analysis was conducted at all three Class I areas using the CALPUFF model in the screening mode. Since Redwood National Park also lies less than 50 km from the project site, a plume analysis with VISCREEN was also employed. However, PSD increment, visibility and acid deposition impacts were still calculated using CALPUFF at Redwood National Park

The National Park Service re-modeled the plume impacts of the new sources alone for Redwood National Park. The results of this analysis indicate impacts below the VISCREEN Delta E and contrast thresholds with a Delta E of 1.986 and a contrast of 0.015. We therefore do not anticipate any perceptible plume impacts at Marble and Yolla Bolly wilderness Class I areas that are farther than Redwood National Park.

Because the North Coast Unified Air Quality Management District will limit oil firing to only 50 hours per year, we do not request that Sierra Research conduct a VISCREEN analysis for emissions from oil firing.

Considering the emission reductions associated with the units being shut down, the total amount of annual emissions of NO_x, SO_2 and $PM_{10}/PM_{2.5}$ from the new engines, and the distance to Marble and Yola Bolly, we will not ask Sierra Research to conduct a re-analysis with the EPA CALPUFF refined model. We agree with comments from National Park Service that for future uniform haze modeling analyses, the use of the CALPUFF-Lite model, used by Sierra Research in this case, is no longer an accepted modeling method. CALPUFF-Lite is currently not listed as an approved modeling procedure in the EPA Air Quality Modeling Guidelines (40 CFR 51, Appendix W).

The Forest Service encourages use of clean technology whenever possible and feasible. We hope the facility follows its policy of applying new technology in the future as it becomes available to maintain the air quality at healthy levels and conducive to the environment. Forest Service Region 5 (Pacific Southwest Region) is also deeply concerned about increased green house gas emissions. We would like information about green house gases that are being emitted at the facility and if the company is considering any offsets on a volunteer basis. This information will not be considered in the permit review.

Thanks again for the opportunity to be involved in an early review process. If you have any questions, please contact Trent Procter of my staff at 559-784-1500, x1114 / tprocter@fs.fed.us or Dr. Suraj Ahuja at 530-521-7394 / sahuja@fs.fed.us.

Sincerely,

Beth G. Pendleton, for

VICKI A. JACKSON
Acting Regional Forester