APPENDIX 8.1F

Best Available Control Technology Support Data

APPENDIX 8.1F

Evaluation of Best Available Control Technology

To evaluate BACT for the proposed turbine, the guidelines for large simple cycle gas turbines (> 50 MW) as delineated in the District, state, and federal BACT listings were reviewed. The relevant BACT determinations for this analysis are shown in Tables 8.1F-1 through 8.1F-4.

TABLE 8.1F-1
SCAQMD BACT Data for Simple Cycle Gas Turbines

Pollutant	BACT	Typical Technology
Nitrogen oxides (NO_x)	5 ppm dry @ 15% O_2 , 1 or 3 hr avg	1. SCR + DLN, or, 2. SCR + water or steam injection
Sulfur dioxide (SO_2)	Natural gas fuel	PUC regulated gas
Carbon monoxide (CO)	6 ppm dry @ 15% O_2, 1 or 3 hr avg	Catalytic oxidation
VOC	2 ppm dry @ 15% O_2	Catalytic oxidation
PM_{10}	Natural gas fuel	PUC regulated gas

Achieved in practice, from website August 2005.

TABLE 8.1F-2
SCAQMD Recent BACT Decisions for Simple Cycle Gas Turbines (achieved in practice)

Facility	NO_x	CO	VOC	PM_{10}/SO_x
Colton	3.5*	6	2	Natural gas
Indigo	5	6	2	Natural gas
LADWP-Valley	5	6	2	Natural gas

Ammonia slip BACT is 5 ppmv for all listings. SCR for NO_x all listings. CO catalyst for CO and VOC all listings.

From SCAQMD website, August 2005.

* Dated 2-17-04, applicant proposed 3.5 ppm NO_x, while AQMD states 5 ppm NO_x is BACT/LAER.

TABLE 8.1F-3
Summary of BACT Recommendations from ARB-CEC BACT Guidance (SImple Cycle)*

NO_X	CO	VOC	SO_X	PM_{10}
5 ppm dry @15% O_2, 3 hr avg 5 ppm NH_3 slip @ 15% O_2	6 ppm dry @15% O_2, 3 hr avg	2 ppm dry @ 15% O_2, 3 hr avg	Natural gas fuel Fuel S < 1gr/100 scf	Natural gas fuel

* CARB, July 1999.

TABLE 8.1F-4
Recent Facility BACT Determinations for Large Simple Cycle Gas Turbines

Facility/Location	NO_x (ppm)	CO (ppm)	VOC (ppm)	PM_{10}/SO_x
GWF Tracy	5	6	2	Natural gas
Enpower Corp. CPA Peaker Analysis*	5-8	6-10	2-3	Natural gas
Henrietta Peakers	3.6	6	2	Natural gas
Los Esteros	5	6	2	Natural gas
Calpeak-Enterprise	5	6	2	Natural gas
Calpeak-Border	5	6	2	Natural gas
RAMCO	5	6	2	Natural gas

* Not a public domain document.

The USEPA RACT-BACT-LAER Clearinghouse (RBLC) was also consulted to review recent USEPA BACT decisions for simple cycle gas-fired gas turbines. These recent BACT decisions are summarized in Table 8.1F-5.

TABLE 8.1F-5
Simple Cycle Turbine RBLC BACT Determinations (Natural Gas)

RBLC ID	Unit Size (MMBtu/hr)	NO_x (ppm)	CO (ppm)	VOC (ppm)
CA0997	1,611	2	4	1.4
VA0263	1,624	10.5	9	
VA0266	1,624	9	9	
VA0262	866	9	51	2.6
VA0261	2,132		2	1.7
IA0060		3	5	
SC0064	1,751	2.5	14	
OK0072	1,832	3.5	17.2	
VA0250	1,887	2.5		
FL0232	1,591	25	10	
IN0095	469	25	25	
MI0327	1,679	15		
CA0593	412	5	6	2
MI0296	855	9	25	
IN0096	1,146	9	25	
FL0227	1,803	9	7.4	1.4
FL0229	1,910	9	9	1.4
MI0321	849	9	25	

TABLE 8.1F-5
Simple Cycle Turbine RBLC BACT Determinations (Natural Gas)

RBLC ID	Unit Size (MMBtu/hr)	NO_x (ppm)	CO (ppm)	VOC (ppm)
CA0951	464	5	6	2
SC0058	3,296	3.5	11.7	3.5
AR0042	6,077	3.5	7	
NM0043	1,500	9	9	7
Average	-	**8.5**	**13.9**	**2.55**
Range	**412 - 6,077**	**2 - 25**	**2 - 51**	**1.4 - 7**

BA recent compilation of BACT determinations is presented in AWMA Paper #42752 (June 2002), "Comparison of the Most Recent BACT Determinations for Combustion Turbines by State Air Pollution Control Agencies". Data presented in this paper was derived from surveys conducted nationwide. Simple cycle BACT data is summarized as follows:

- NO_x 5-12 ppm
- CO 9-25 ppm
- VOC No Data
- PM_{10} Nat gas fuel
- SO_2 Nat gas fuel

Based on the above data, it would seem that the most appropriate and current range for BACT for simple cycle combustion turbines (achieved in practice) is as follows:

- NO_x 5 ppm (DLN, DLN+SCR, SCR + water/steam injection)
- CO 6 ppm (good combustion practices [GCP], GCP + CO catalyst)
- VOC 2 ppm (GCP, GCP + CO catalyst)
- PM_{10} Nat gas fuel (clean fuel)
- SO_x Nat gas fuel (clean fuel)

Cooling Tower BACT

BACT for the cooling tower is the use of high efficiency drift eliminators at a rating of 0.0005%.

Diesel Fired IC Engine BACT

BACT levels for the diesel fired fire pump engine are shown in Table 8.1F-6.

TABLE 8.1F-6
Summary of BACT Recommendations from SCAQMD Guidance for Diesel Fired Fire Pump Engines

	NO_x, g/bhp	CO, g/bhp	VOC, g/bhp	SO_x, %S wt.	PM_{10}, g/bhp
Fire Pump Engines	3.9 - 6.9	0.45 - 8.5	0.09 - 1.0	≤ 0.05	0.14 - 0.38

The proposed diesel engine will also comply with the EPA Tier II and/or Tier III standards as applicable based upon engine size and year of manufacture.

The proposed diesel engine will comply with the CARB proposed Air Toxic Control Measure (ACTM) for Stationary Compression Ignition Engines (upon adoption by the South Coast AQMD). Since the fire pump engine is classified as emergency standby, with a rating greater than 50 hp, and operational hours less than 100 hours per year, the performance standard to be met will be 0.1g/hp-hr using CARB certified diesel fuel. Add-on controls would not be required, and a HRA would also not be required. In addition the engine will comply with AQMD Rule 1470 and the Tier standards as delineated in Title 13 CCR Section 2423, based upon engine size and year of manufacture.

Table 8.1F-7 SCR Design Data

Table 8.1F-8 CO Catalyst Design Data

Table 8.1F-7 SCR Design Data

SCR CATALYST SYSTEM SPECIFICATIONS FOR GE AERO ENERGY PRODUCTS

Please Specify	Description	Units
Lead Time Required	< 4 months / must confirm manufacturing availability	
Guaranteed Life	Earliest of 20,000 hours from first gas-in or 51 months from Contracted Delivery	op. hours
Expected Life @ 800 °F	> 20,000 hours	op. hours
Catalyst Module Dimensions	133.5"W x 81.5"H x 24"D	feet
Total Catalyst Dimensions	22.25'W x 34'H x 2.5'D	feet
Module Weight and Total Weight	4,600 / 46,000 total	pounds
Catalyst Volume	Approx. 27 m3	ft^3
Space Velocity	23,580	1/hr *
Max. Operating Temperature	870°F - Continuous 930°F – limited to 500hrs total or 1020 °F limited to 4 hrs total.	°F
Pressure Drop (guar/exp)	4.8/4.3	in H_2O
Percent Open Area to Flow	> 78	%
Catalyst Pitch	2.1	mm
Geometric Surface Area	> 1670	m^2/m^3
BET Surface Area	Proprietary	m^2/g
Cell Density and Geometry	70 cell product (approx 144cpsi)	cpsi
SO_2 to SO_3 Conversion	< 2.5%	%
Major Contaminants and Maximum Contaminant Levels	See Catalyst Degradation Chart	

GHSV in ft^3/hr gas @ STP / ft^3 catalyst

ENGELHARD

Engelhard Corporation
101 Wood Avenue, P.O. Box 770
Iselin, NJ 08830-0770
732-205-5000

Table 8.1F-8 CO Catalyst Design Data

Engelhard Corporation
2205 Chequers Court
Bel Air, MD 21015
410-569-0297
e-mail: fred_booth@engelhard.com

DATE: August 11, 2005 **NO. PAGES** 1

TO: EXPRESS INTEGRATED TECHNOLOGIES via e-mail
ATTN: Phil Childers

FROM: Fred Booth Ph 410-569-0297 // FAX 410-569-1841

RE: EIT C05-115
GE – LMS100 // SoCalEd Project
CO Catalyst – Engelhard Proposal EPB00262-Rev. 1a - Data Sheet

Design and Construction Details	CO
Catalyst material	Pt on ALUMINA
Catalyst manufactured by	ENGELHARD
Number of catalyst layers	1
Total number of modules	LATER
Catalyst Module length x width x height (ft)	Nom. 2 ft x 2 ft x 2.5 in.
Include room for a spare layer	YES
Catalyst module cells per sq in.	140
Catalyst space volume {ratio of gas volume (ft3/hr) and catalyst volume in service (ft3)}	Nom. 120,000 Max.
a) Catalyst conversion efficiency %	See Proposal –
b) Catalyst efficiency after 10000 hours of operation	See Proposal –
Catalyst washing requirements	DE-ION WATER
The maximum temp. catalyst can withstand 0F	1250
Minimum operating catalyst temperature 0F	500
Over temperature protection for catalyst	
Differential pressure protection	
Exhaust gas face velocity through catalyst housing, fps	Nom. 24
Ammonia Injection Grid (AIG)	N/A
Number of headers	N/A
Branches per header	N/A
AIG pipes total	N/A
Ammonia Flow Control Skid	N/A
Number of blowers / fans provided	N/A
Atomizing air requirements (CFM)	N/A
How is the ammonia injection skid controls interfaced with plant controls?	N/A
Catalyst support frame / structure	
Number of test elements provided for each layer of catalyst	8
List of catalyst poisons and operating conditions that may reduce the life of catalyst.	SEE WARRANTY
Catalyst life, (operating hours)	20,000
Pressure drop, (In of WC)	1.9"wg Max.
Lifting equipment and tools	N / R
At design operating conditions, estimated ammonia consumption, lb/hr	N/A
Will the catalyst supplier accept spent catalyst for disposal?	YES
Type of gaskets used	Zetex Rope