APPENDIX A

Table A-1. Emission Controls Required for Combined-Cycle and Cogeneration Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
Island End Cogeneration /Cabot Power Corp. (350 MW) Everett, MA	MA Dept. of Envir. Protection	2,493 MMBtu/hr Siemens-Westinghouse 501G gas turbine with HRSG producing 230 MW and steam turbine producing 120 MW	SCR, oxidation catalyst	Permit: MBR-97-COM-014 (App. No.) Issued: 10/9/98 (Proposed Conditional Approval) Status: Construction not started	2.0 (1-hr avg.)	2.0 (1-hr avg.)	2.0 (1-hr avg.)	100% load 32.0 lb/hr; 0.012 lb/MMBtu 75% load 25.8 lb/hr; 0.012 lb/MMBtu	100% load 5.9 lb/hr; 0.0022 lb/MMBtu 75% load 4.7 lb/hr; 0.0022 lb/MMBtu	2 (1-hr avg.)
Limerick Partners LLC (550 MW) 3298 Sanatoga Rd., Limerick Township, Montgomery Co., PA	PA Dept. of Envir. Protection Bureau of Air Quality	(2) GE PG7241FA gas turbines with duct-fired HRSG and steam turbine	DLN + SCR, oxidation catalyst	Permit: PA-46-0203 (Plan Approval for Construction) Issued: 4/9/02 Status: NA	2.0 (1-hr block avg.)	8.1 (1-hr block avg.)	2.4 (1-hr block avg.)	19.75 lb/hr	0.8 (1-hr block avg.); 8.9 lb/hr	10 (1-hr block avg.)
Sithe Mystic Development LLC (1,550 MW) 39 Rover St., Everett, MA	MA Dept. of Envir. Protection	(2) 775 MW power blocks #8 and #9 each consisting of: (2) 2,699 MMBtu/hr Mitsubishi 501G gas turbines each with 253 MMBtu/hr duct-fired HRSG producing 250 MW each and steam turbine producing 275 MW	SCR, oxidation catalyst	Permit: MBR-99-COM-012 (App. No.) Issued: 9/29/99 (Proposed Conditional Approval) Status: Operating	2.0 (1-hr block avg.)	2.0 (1-hr block avg.)	w/ DB 1.7 (1-hr block avg.) w/o DB 1.0 (1-hr block avg.)	32.5 lb/hr; 0.011 lb/MMBtu	8.6 lb/hr; 0.0029 lb/MMBtu	2.0 (1-hr block avg.)[1]

[1] 14-month optimization program. Limit applies first five years. After, limit is 0.0 unless extended by the Agency.

Table A-1. Emission Controls Required for Combined-Cycle and Cogeneration Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
Rhode Island State Energy Partners L.P. (535 MW) Intersection of Shun Pike and Simmons Lake Dr., Johnston, RI	RI Dept. of Envir. Mangmnt., Office of Air Resources	(2) 2,009 MMBtu/hr Westinghouse 501F gas turbines with 306 MMBtu/hr duct-fired HRSG producing 186 MW each and steam turbine(s)	DLN + SCR	Permit: RI-PSD-6 Issued: 5/3/00 Status: Under construction, expected to complete late 2002	2.0 (1-hr avg.)	w/ DB 17.8 (1-hr avg.) w/o DB 15.9 (1-hr avg.)	w/ DB 2.9 (1-hr avg.) w/o DB 2.0 (1-hr avg.)	w/ DB 21.0 lb/hr; 0.009 lb/MMBtu w/o DB 18.3 lb/hr; 0.009 lb/MMBtu	w/ DB 11.8 lb/hr; 0.0054 lb/MMBtu w/o DB 10.85 lb/hr; 0.0054 lb/MMBtu	5 (1-hr avg.)
Turlock Irrigation District /Walnut Energy Center (250 MW) Near intersection of W. Main St. and Washington Rd., Turlock, CA	San Joaquin Valley APCD	(2) 1,047 MMBtu/hr GE Frame 7EA gas turbines producing 84 MW each and steam turbine producing 100 MW	DLN + SCR, oxidation catalyst	Permit: N-2246-3-0, N-2246-4-0 Issued: 6/30/03 Status: Expected commercial operation Mar.'06	2.0 (1-hr avg.)[2]	4.0 (3-hr rolling avg.)	1.4 (3-hr rolling avg.)	7.0 lb/hr; 0.0067 lb/MMBtu	0.0010 lb/MMBtu	10 (24-hr rolling avg.)
ANP Blackstone (550 MW) Elm St., Blackstone, MA	MA Dept. of Envir. Protection	(2) ABB GT-24 gas turbines with unfired HRSG producing 180 MW each (210 w/ steam aug.) and steam turbine producing 190 MW (170 MW w/ steam aug.)	SCR, oxidation catalyst	Permit: 118969 (Transmittal No.) Issued: 3/16/01 (Final Approval) Status: Operating since June '01 (Unit 1), July '01 (Unit 2)	2.0 (1-hr block avg.) steam aug. 3.5 (1-hr block avg.)	50% load 20.0 (1-hr block avg.) 75% load 4.0 (1-hr block avg.) 100% load + steam aug. 3.0 (1-hr block avg.)	50% load 2.5 (1-hr block avg.) 75% load 1.4 (1-hr block avg.) 100% load + steam aug. 3.5 (1-hr block avg.)	0.012 lb/MMBtu	0.0023 lb/MMBtu	2.0 (1-hr block avg.)

[2] Allowance for short-term excursions as a result of transient load conditions limited to 10 hours per rolling 12-month period. Maximum 1-hour NOx shall not exceed 30 ppmvd @ 15% O_2.

Table A-1. Emission Controls Required for Combined-Cycle and Cogeneration Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
ANP Bellingham Energy Company (550 MW) Bellingham, MA	MA Dept. of Envir. Protection	(2) 1,815 MMBtu/hr ABB GT-24 gas turbines with unfired HRSG producing 180 MW each (210 MW w/ steam aug.) and (2) steam turbines producing 190 MW (170 MW w/ steam aug.)	SCR, oxidation catalyst	Permit: 118970 (Transmittal No.) Issued: 4/10/02 (Final Approval) Status: Operating	2.0 (1-hr block avg.) steam aug. 3.5 (1-hr block avg.)	50% load 20.0 (1-hr block avg.) 75% load 4.0 (1-hr block avg.) 100% load + steam aug. 3.0 (1-hr block avg.)	50% load 2.5 (1-hr block avg.) 75% load 1.4 (1-hr block avg.) 100% load + steam aug. 3.5 (1-hr block avg.)	0.012 lb/MMBtu	0.002 lb/MMBtu	2.0 (1-hr block avg.)
AERA/Western Midway Sunset (510 MW) Crocker Springs Rd., Fellows, CA	San Joaquin Valley APCD	(2) GE Frame 7F or (2) Westinghouse 501F gas turbines with HRSG producing 170 MW each and steam turbine producing 170 MW	DLN + SCR, oxidation catalyst	Permit: S-1135-313-0, S-1135-4-0 Issued: Status: Construction on hold	w/ GE 2.0 (1-hr avg.) w/ Westng. 2.5 (1-hr avg.)	6 (1-hr avg.)	w/ GE 1.4 (3-hr avg.) w/ Westng. 1.5 (3-hr avg.)	9.4 lb/hr	w/ GE 3.8 lb/hr w/ Westng. 3.9 lb/hr	10 (24-hr avg.)
Lake Road Generating Company (840 MW) Lake Rd., Killingly, CT	CT Dept. of Envir. Protection	(3) 2,181 MMBtu/hr ABB GT-24 gas turbines and steam turbines	DLN + SCR, oxidation catalyst	Permit: 0068 Issued: 5/21/99 (Draft Permit) Status: Operating	2.0 (3-hr block avg.)	100% load 3.0 (1-hr block avg.) 75% load 4.0 (1-hr block avg.) 50% load 20.0 (1-hr block avg.)	0.0017 lb/MMBtu; 3.08 lb/hr	21.8 lb/hr; 0.0122 lb/MMBtu	4.73 lb/hr; 0.0026 lb/MMBtu	10.0 (3-hr block avg.)[3]

[3] After first year of operation, data to be reviewed and limit revised to reflect actual emissions.

Table A-1. Emission Controls Required for Combined-Cycle and Cogeneration Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
Milford Power 1 Shelland St., Milford, CT	CT Dept. of Envir. Protection	(2) 1,965 MMBtu/hr ABB GT-24 gas turbines with HRSG and steam turbine	DLN + SCR, oxidation catalyst	Permit: 0068 Issued: 4/16/99 Status: Construction completed. Unit 1 tested on 12/30/03. Unit 2 not tested yet.	2.0 (3-hr block avg.)	<u>100% load</u> 13.0 lb/hr <u>50-99% load</u> 52.0 lb/hr	<u>100% load</u> @≥81°F 7.5 lb/hr, @71-80°F 3.7 lb/hr, @61-70°F 3.2 lb/hr, @≤60°F 3.0 lb/hr <u>75-99% load</u> 2.2 lb/hr <u>50-74% load</u> 3.0 lb/hr	19.9 lb/hr; 0.011 lb/MMBtu	4.4 lb/hr; 0.0022 lb/MMBtu	10 (3-hr block avg.)[4]
Redding Power Unit 5 (56 MW) 17120 Clear Creek Rd., Redding, CA	Shasta Co. AQMD	407 MMBtu/hr Alstom Power GTX 100 gas turbine with HRSG producing 43 MW and steam turbine producing 13 MW	SCONOx + SCOSOx	Permit: 00-PO-39 Issued: 3/30/01 Status: Operating since June '02	2.5 (1-hr rolling avg.)[5]	6.0 (1-hr rolling avg.)	1.4 (1-hr rolling avg.)	0.0012 gr/dscf @ 3% CO_2 (1-hr avg.)	0.2 (1-hr rolling avg.)	NA
Calpine Ontelaunee Energy Center (544 MW) Ontelaunee Township, Berks Co., PA	PA Dept. of Envir. Protection Bureau of Air Quality	(2) Siemens-Westinghouse 501F gas turbines with HRSG producing 182 MW each and steam turbine producing 180 MW	DLN + SCR	Permit: 06-5100 (Plan Approval for Construction) Issued: 10/10/00 Status: NA	2.5 (1-hr avg.), 2.0 (3-hr avg.)	10.0 (1-hr avg.); 0.0228 lb/MMBtu* *Install oxidation catalyst if fail to meet limits	1.8 (1-hr avg.); 0.0023 lb/MMBtu* *Install oxidation catalyst if fail to meet limits	0.0061 lb/MMBtu	0.0056 lb/MMBtu	10

[4] After first year of operation, data to be reviewed and limit revised to reflect actual emissions.
[5] Demonstration NOx limit of 2.0 (1-hr rolling average) to be evaluated over a three-year period.

Table A-1. Emission Controls Required for Combined-Cycle and Cogeneration Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
Cogen Technologies Linden Venture L.P. (180.6 MW) within Tosco Bayway Refinery, Railroad and Chemico Ave., Linden, NJ	NJ Dept. of Envir. Protection	1,954.6 MMBtu/hr GE PG7241 (FA) gas turbine with unfired HRSG producing 180.6 MW	DLN + SCR, oxidation catalyst	Permit: 000002, Facility ID 40955 Issued: 5/9/01 Status: NA	2.5 (1-hr avg.)	2 (1-hr avg.)	1.2 (1-hr avg.)	51.8 (1-hr avg.)	1.44 (1-hr avg.)	10 (3-hr rolling avg. based on a 1-hr block avg.)
University of California San Diego (26 MW) 9500 Gilman Dr., San Diego, CA	San Diego Co. APCD	(2) 148.64 MMBtu/hr Solar SoLoNOx Titan 130S gas turbines producing 12.894 MW each (aka Unit 100 and Unit 200)	SCONOx + SCOSOx	Permit: 974480, 974481 Issued: 4/16/02 Status: Operating since July '01	2.5 (3-hr rolling avg.)	5.0	-	-	-	NA
Wyeth Bio Pharma Unit 1 (6.2 MW) One Burtt Rd., Andover, MA	MA Dept. of Envir. Protection	76 MMBtu/hr Solar Taurus Model 60 gas turbine with 17.8 MMBtu/hr duct-fired HRSG producing 6.2 MW	DLN + SCONOx + SCOSOx	Permit: MBR-98-COM-001 (Final Approval) Issued: 9/4/02 Status: Operating since July 1999	nat. gas 2.5 (1-hr avg.) oil 15.0 (1-hr avg.)	5.0 (1-hr avg.)	-	0.010 lb/MMBtu	Fuel oil sulfur content ≤0.0015% S by weight	NA
Wyeth Bio Pharma Unit 2 (5.9 MW) One Burtt Rd., Andover, MA	MA Dept. of Envir. Protection	68.1 MMBtu/hr Solar Taurus Model 60 gas turbine with 18.8 MMBtu/hr duct-fired HRSG producing 5.9 MW	DLN + SCONOx + SCOSOx[6]	Permit: MBR-01-COM-053 (Conditional Approval) Issued: 2/28/02 Status: Operating	nat. gas 2.5 (1-hr avg.) oil 15.0 (1-hr avg.)	2.0 (1-hr avg.)	0.028 lb/MMBtu	nat. gas 0.020 lb/MMBtu oil 0.0360 lb/MMBtu	Fuel oil sulfur content ≤0.005% S by weight	NA

[6] Approval includes an 18-month optimization period to consistently maintain the NOx limits specified, with a goal of attaining 9 ppmvd NOx and 2.0 ppmvd CO at 15% O_2 while combusting fuel oil. If permit limits cannot be met, the applicant may replace with an SCR system and oxidation catalyst meeting: 2.5 (gas) and 9.0 (oil) ppmvd NOx; 2.0 ppmvd CO; 3.0 ppmvd NH_3 with a goal of 2.0 ppmvd; all at 15% O_2.

Table A-2. Emission Controls Required for Simple-Cycle Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
Lowell Power LLC (96 MW) 121 Maple St., Lowell, MA	MA Dept. of Envir. Protection	(2) 456.32 MMBtu/hr GE LM6000 gas turbines producing 48 MW each (aka Units 2 and 3)	Water injection + SCR, oxidation catalyst	Permit: MBR-00-COM-039 (App. No.) Issued: 6/6/01 (Proposed Conditional Approval) Status: Construction not started	2.0 (1-hr block avg.)	≥42°F 5.0 (1-hr block avg.) <42°F 10.0 (1-hr block avg.)	3.0 (1-hr block avg.)	3.0 lb/hr; 0.012 lb/MMBtu	1.0 lb/hr; 0.0029 lb/MMBtu	2.0 (1-hr block avg.)
Wallingford Energy (225 MW) 195 East St., Wallingford, CT	CT Dept. of Envir. Protection	(5) 461.2 MMBtu/hr GE LM6000 gas turbines producing 45 MW each	Water injection + SCR, oxidation catalyst	Permit: 189-114-0194 (Unit 1), '-0195 (Unit 2), '-0196 (Unit 3), '-0197 (Unit 4), '-0198 (Unit 5) Issued: 2/2/02 Status: Operating	2.5 (1-hr block avg.)	0.0364 lb/MMBtu	0.0107 lb/MMBtu	12.1 lb/hr; 0.026 lb/MMBtu	1.26 lb/hr; 0.0027 lb/MMBtu	6 (3-hr block avg.)
New York Power Authority /Hell Gate (94 MW) Bronx, NY	NY Dept. of Envir. Quality	(2) GE LM6000 Sprint gas turbines producing 47 MW each	Water injection + SCR, oxidation catalyst	Permit: 2-6007-00724/00001 (Air State Facility No.) Issued: Status: Operating	2.5 (1-hr avg.)	0.013 lb/MMBtu	1.2 lb/hr	3.0 lb/hr	-	10.0
Calpine /Creed Energy Center (49.9 MW) 6150 Creed Rd., Suisun City, CA	Bay Area AQMD	500 MMBtu/hr GE LM6000 PC Sprint gas turbine producing 49.9 MW	Water injection + SCR, oxidation catalyst	Permit: 4926 (ATC) Issued: 9/18/02 Status: Operating since Jan.'03	2.5 (3-hr rolling avg.)	6 (1-hr rolling avg.)	2 (1-hr rolling avg.)	3.0 lb/hr	1.38 lb/hr	10 (1-hr rolling avg.)
Calpine /Lambie Energy Center (49.9 MW) 5975 Lambie Rd., Suisun City, CA	Bay Area AQMD	500 MMBtu/hr GE LM6000 PC Sprint gas turbine producing 49.9 MW	Water injection + SCR, oxidation catalyst	Permit: 4881 (ATC) Issued: 9/11/02 Status: Operating since Jan.'03	2.5 (3-hr rolling avg.)	6 (1-hr rolling avg.)	2 (1-hr rolling avg.)	3.0 lb/hr	1.38 lb/hr	10 (1-hr rolling avg.)
Calpine /Goose Haven Energy Center (49.9 MW) 3853 Goose Haven Rd., Suisun City, CA	Bay Area AQMD	500 MMBtu/hr GE LM6000 PC Sprint gas turbine producing 49.9 MW	Water injection + SCR, oxidation catalyst	Permit: 4925 (ATC) Issued: 8/14/02 Status: Operating since Jan.'03	2.5 (3-hr rolling avg.)	6 (1-hr rolling avg.)	2 (1-hr rolling avg.)	3.0 lb/hr	1.38 lb/hr	10 (1-hr rolling avg.)

Table A-2. Emission Controls Required for Simple-Cycle Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
Modesto Irrigation District (95 MW) S. Stockton Ave. and Doak Blvd., Ripon, CA	San Joaquin Valley APCD	(2) 500 MMBtu/hr GE LM6000 Sprint gas turbines producing 47.5 MW each	Water injection + SCR, oxidation catalyst	Permit: N-4940-1-0, N-4940-2-0 (ATC) Issued: 3/8/04 Status: Construction not started	2.5 (3-hr rolling avg.)	6.0 (3-hr rolling avg.)	2.0 (3-hr rolling avg.)	3.00 lb/hr	0.51 lb/hr	10.0 (24-hr rolling avg.)
CalPeak Power Midway /Lodi Electric Energy Facility (49 MW) 1215 Thurman Rd., Lodi, CA	San Joaquin Valley APCD	464.7 MMBtu/hr Pratt & Whitney FT8-2 "Twin Pac" gas turbines with common generator and exhaust stack producing 49 MW	DLN + SCR, oxidation catalyst[7]	Permit: N-4834-1-0 Issued: NA Status: NA	3.0 (3-hr rolling avg.)	5 (3-hr rolling avg.)	2.0 (3-hr rolling avg.)	144 lb/day	32.4 lb/day	10.0 (24-hr rolling avg.)
Lodi Energy Center LLC (49.6 MW) 610 S. Guild Ave., Lodi, CA	San Joaquin Valley APCD	GE LM6000 Sprint gas turbine producing 49.6 MW	Water injection + SCR, oxidation catalyst	Permit: N-4857-1-0 (ATC) Issued: 6/18/03 Status: Construction not started	3.0 (3-hr rolling avg.)	6.0 (3-hr rolling avg.)	2.0 (3-hr rolling avg.)	3.00 lb/hr	1.43 lb/hr	10.0 (24-hr rolling avg.)
Herndon Energy Center (49.6 MW) Fresno, CA	San Joaquin Valley APCD	500 MMBtu/hr GE LM6000 Sprint gas turbine producing 49.6 MW	Water injection + SCR, oxidation catalyst	Permit: N-4030-1-0 (ATC) Issued: 7/8/02 Status:	3.0 (3-hr rolling avg.)	6.0 (3-hr rolling avg.)	2.0 (3-hr rolling avg.)	3.00 lb/hr	0.36 lb/hr	10 (24-hr rolling avg.)
Northern California Power (49 MW) 12751 Thornton Rd., Lodi, CA	San Joaquin Valley APCD	417 MMBtu/hr GE LM5000 gas turbine producing 49 MW	Water injection + SCR, oxidation catalyst	Permit: N-2697-1-1 Issued: NA Status: Operating	3.0 (3-hr rolling avg.)	200 (3-hr rolling avg.)	142 lb/day	48 lb/day	-	25
CalPeak Power Border LLC (49.5 MW) Harvest Rd. and Hwy 905, San Diego, CA	San Diego Co. APCD	500 MMBtu/hr Pratt & Whitney FT8 "Twin Pac" gas turbines with common generator and exhaust producing 49.5 MW	DLN + SCR, oxidation catalyst	Permit: 976502 (ATC) Issued: NA Status: Operating since 10/26/01	3 (3-hr rolling avg.); 2.5 (24-hr rolling avg.)	50 (3-hr rolling avg.)	2	-	-	10

[7] Turbine exhaust temperature (~950°F) is too high for a standard SCR system catalyst. Applicant proposes to introduce fresh air in exhaust upstream of SCR system to reduce exhaust to ~730°F.

Table A-2. Emission Controls Required for Simple-Cycle Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
CalPeak Power Panoche (49.4 MW) 43699 W. Panoche Rd., Firebaugh, CA	San Joaquin Valley APCD	Pratt & Whitney FT8 "Twin Pac" gas turbines with common generator and exhaust producing 49.4 MW	DLN + SCR, oxidation catalyst	Permit: C-3811-1-0, C-3811-2-0 (ATC) Issued: 4/26/01 Status: Operating since Dec.'01	3.4 (3-hr rolling avg.)	6.8 (3-hr rolling avg.)	2.0 (3-hr rolling avg.)	1.62 lb/hr (3-hr rolling avg.)	0.71 lb/hr (3-hr rolling avg.)	10 (3-hr rolling avg.)
West Springfield Redevelopment Project (84 MW) existing West Springfield Station, West Springfield, MA	MA Dept. of Envir. Protection	(2) 462.6 MMBtu/hr GE LM6000 gas turbines producing 42 MW each	Water injection + SCR, oxidation catalyst	Permit: 1-B00-038 (App. No.) Issued: 4/11/01 (Conditional Approval), 6/23/03 (Final Approval) Status: Operating	3.5 (1-hr block avg.)[8]	≥42°F 5.0 (1-hr block avg.) <42°F 10.0 (1-hr block avg.)	3.0 (1-hr block avg.)	3.0 lb/hr; 0.008 lb/MMBtu	1.0 lb/hr; 0.0029 lb/MMBtu	7.0 (1-hr block avg.)
Wellhead Power Gates LLC (45.4 MW) Huron, CA	San Joaquin Valley APCD	436 MMBtu/hr GE LM6000 gas turbine producing 45.4 MW	Water or steam injection + SCR, oxidation catalyst	Permit: C-3843-1-0 (ATC) Issued: 8/30/01 Status: Operating	3.5 (3-hr rolling avg.)	6.0 (1-hr rolling avg.)	2.0 (1-hr rolling avg.)	2.88 lb/hr	1.26 lb/hr	10 (1-hr rolling avg.)
E.I. Colton LLC (48 MW) 2040 Aqua Mansa Rd., Colton, CA	South Coast AQMD	456.5 MMBtu/hr GE LM6000 Sprint gas turbine producing 48 MW	Water injection + SCR, oxidation catalyst	Permit: 406065 Issued: 11/26/02 Status: NA	3.5 (3-hr rolling avg.)	6 (3-hr rolling avg.)	2 (3-hr rolling avg.)	3.33 lb/hr	0.162 lb/hr	5 (3-hr rolling avg.)
Gilroy Energy Center Phase I (135 MW) at the Calpine Gilroy Power Plant, Gilroy, CA	Bay Area AQMD	(3) 467.6 MMBtu/hr GE LM6000PC gas turbines producing 45 MW each	Water injection or DLN + SCR, oxidation catalyst	Permit: NA Issued: 5/21/01 Status: Operating	5 (1-hr rolling avg.)	6 (3-hr rolling avg.)	2 (3-hr rolling avg.)	2.5 lb/hr	0.33 lb/hr	10 (3-hr rolling avg.)
Wildflower Energy /Indigo (135 MW) 19th Ave., Palm Springs, CA	South Coast AQMD	(3) 450 MMBtu/hr GE LM6000 Enhanced Sprint gas turbines producing 45 MW each	Steam or water injection + SCR, oxidation catalyst	Permit: 127299 (ATC) Issued: 7/13/01 Status: Operating since 7/26/01	5 (1-hr rolling avg.)	6 (1-hr rolling avg.)	2	6.8 lb/MMscf	0.32 lb/MMscf	5 (1-hr rolling avg.)

[8] Conditional Approval stated that system was to be designed to achieve 2 ppm limits for NOx and ammonia, but that upon completion of an optimization program, new limits may need to be established if consistent compliance cannot be maintained. The levels listed herein are the final established emission limits for NOx and ammonia.

Table A-2. Emission Controls Required for Simple-Cycle Power Plant Gas-Fired Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Permit Status	Emission Limit, per turbine (ppmvd @ 15% O_2 unless otherwise noted)					
					NOx	CO	VOC	PM10	SOx	NH_3
Sacramento Municipal Utility District (77 MW) McClellan Air Force Base, Sacramento, CA	Sac Metro AQMD	927 MMBtu/hr GE Frame 7E PG7931 gas turbine producing 77 MW	Water injection + SCR	Permit: 14332, 14333 (ATC) Issued: 3/24/00 Status: Operating	5 (3-hr rolling avg.)	46.98 lb/hr (3-hr avg.)	2.36 lb/hr (3-hr avg.)	7.00 lb/hr (3-hr avg.)	0.56 lb/hr (3-hr avg.)	10 (3-hr avg.)
GWF Energy LLC /Tracy Peaker Power Plant (169 MW) Tracy, CA	San Joaquin Valley APCD	(2) 990.6 MMBtu/hr GE PG7121 EA gas turbines producing 84.5 MW each	DLN + SCR, oxidation catalyst	Permit: N-4597-1-0, N-4597-2-0 Issued: 10/5/01 (ATC) Status: Operating since 6/1/03	5.0 (3-hr rolling avg.)	6.0 (3-hr rolling avg.)	2.0 (3-hr rolling avg.)	10.3 lb/hr	0.70 lb/hr	10 (24-hr rolling avg.)
PG&E Dispersed Generating Company /Chula Vista (44 MW) 3497 Main St., Chula Vista, CA	San Diego Co. APCD	688 MMBtu/hr Pratt & Whitney FT4/GG4 "Twin Pac" gas turbines producing 44 MW	DLN + SCR, oxidation catalyst	Permit: 976039 (ATC) Issued: 7/5/01 Status: Operating	9 (1-hr avg.); 5 (3-hr rolling avg.)	50 (1-hr avg.)	2	-	-	10
Wildflower Energy /Larkspur (135 MW) Harvest Rd., Otay Mesa area, San Diego, CA	San Diego Co. APCD	(2) 395 MMBtu/hr GE LM6000 PC Sprint gas turbines producing 45 MW each	Water injection + SCR, oxidation catalyst	Permit: 976094 (ATC) Issued: 4/24/01 Status: Operating since 7/16/01	9 (1-hr avg.); 5 (3-hr rolling avg.)	50 (1-hr avg.)	2	-	-	10
Dynegy /Bluegrass Generation Company LLC (624 MW) 3200 W. Hwy 146, LaGrange, KY	KY Dept. of Air Quality	(3) 2,076 MMBtu/hr Siemens-Westinghouse 501FD gas turbines producing 208 MW each	DLN + SCR* *SCR install on two units only)[9]	Permit: V-00-052 (Title V) Issued: 6/5/01 Status: Operating since 2nd quarter '02	111 (3-hr rolling avg.)* *Target 5-6 ppm w/ SCR	50 (3-hr avg.0	-	-	-	-

[9] Permittee has the option of installing high temperature SCR. Targeting NOx emissions out the turbine are 15 ppmvd @ 15% O_2.

APPENDIX B

Table B-1. Emission Source Test Results for Combined-Cycle and Cogeneration Power Plant Gas Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Date Tested	Average Measured Emissions, per turbine (ppmvd @ 15% O_2 unless otherwise noted)				
					NOx	CO	VOC	PM10 (lb/hr)	NH_3
ANP Blackstone (550 MW) Elm St., Blackstone, MA	MA Dept. of Envir. Protection	(2) ABB GT-24 gas turbines with unfired HRSG producing 180 MW each (210 MW w/ steam aug.) and steam turbine producing 190 MW (170 MW w/ steam aug.)	SCR, oxidation catalyst	**CTG1** 6/5-7/2001 82% load	1.5	<0.1	0.4	0.767	0.07
				75% load	1.6	<0.1	0.2	0.433	0.06
				50% load	1.4	0.5	0.2	0.800	0.08
				CTG2 7/11-12/2001 82% load	1.6	<0.1	0.4	2.83	<0.02
				75% load	1.5	<0.1	0.4	3.30	0.02
				50% load	1.7	0.8	0.4	19.2	0.2
				CTG2 12/5-6/2001 82% load	1.4	<0.1	0.1	-	0.05
				50% load (retest for PM10)	-	-	-	2.50 (front half only)	-
				CTG1 2/11-12/2002 87% load	1.6	0.3	0.1	-	0.1
				5/15/2002 87% load	1.6 (CTG1) 1.6 (CTG2)	0.3 (CTG1) 0.0 (CTG2)	0.1 (CTG1) 0.1 (CTG2)	-	0.1 (CTG1) 0.1 (CTG2)
Elk Hills Power LLC (500 MW) 4026 Skyline Rd., Tupman, CA	San Joaquin Valley APCD			5/20/2003 100% load w/o DB	2.29 (CTG1) 2.40 (CTG2)	0.47 (CTG1) 0.05 (CTG2)	<0.80 (CTG1) <0.80 (CTG2)	9.56 (CTG1) 11.45 (CTG2)	0.07 (CTG1) 0.10 (CTG2)
				5/21/2003 100% load w/ DB	1.56 (CTG1) 1.89 (CTG2)	0.57 (CTG1) 0.00 (CTG2)	<0.65 (CTG1) <0.67 (CTG2)	8.22 (CTG1) 10.99 (CTG2)	0.28 (CTG1) 0.58 (CTG2)
High Desert Power Project LLC (830 MW) Victorville, CA	Mojave Desert AQMD	(3) Siemens-Westinghouse 501F gas turbines with HRSG producing 190 MW each and steam turbine producing 330 MW		4/5/2003	2.39 (CTG1) 2.99 (CTG3)	0.17 (CTG1) 0.25 (CTG3)	0.38 (CTG1) 1.06 (CTG3)	16.50 (CTG1) 16.43 (CTG3)	5.38 (CTG1) 0.95 (CTG3)
				CTG2 4/7/2003	2.38	0.0629	0.57	9.15	6.54
				CTG3 4/30/2003 (retest)	2.41	-	-	-	-
Los Medanos Energy Center (555 MW) Pittsburg, CA	Bay Area AQMD	(2) 1,929 MMBtu/hr GE Frame 7FA PG7241 gas turbines with 333 MMBtu/hr duct-fired HRSG producing 170 MW each and (2) steam turbines producing 90 MW each	DLN + SCR, oxidation catalyst	7/19-8/24/2001 full load w/ DB	2.115 (CTG1) 1.648 (CTG2)	0.046 (CTG1) 0.043 (CTG2)	10.12 (CTG1) 1.714 (CTG2)	3.53; 0.00232 lb/MMBtu (CTG1) 2.31; 0.00150 lb/MMBtu (CTG2)	0.09 (CTG1) 0.13 (CTG2)
				60% load	-	0.045 (CTG1) 0.042 (CTG2)	2.64 (CTG1) 0.74 (CTG2)	-	-

Table B-1. Emission Source Test Results for Combined-Cycle and Cogeneration Power Plant Gas Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Date Tested	Average Measured Emissions, per turbine (ppmvd @ 15% O_2 unless otherwise noted)				
					NOx	CO	VOC	PM10 (lb/hr)	NH_3
University of California San Diego (26 MW) 9500 Gilman Dr., San Diego, CA	San Diego Co. APCD	(2) 148.64 MMBtu/hr Solar SoLoNOx Titan 130S gas turbines producing 12.894 MW each (aka Unit 100 and Unit 200)	SCONOx + SCOSOx	**CTG1** 12/19-20/2001	0.68	<0.04	-	-	NA
				CTG2 12/23/2001	1.01	<0.04	-	-	NA
Wyeth Bio Pharma #1 /Genetics Institute (5 MW) Andover, MA	MA Dept. of Envir. Protection	Solar Taurus 60 gas turbine with duct-fired HRSG producing 5 MW	SCONOx + SCOSOx	2/14-17/2000					
Sutter Power Plant (540 MW) 5029 S. Township Rd., Yuba City, CA	Feather River AQMD	(2) 1,900 MMBtu/hr Westinghouse 501F gas turbines with 170 MMBtu/hr duct-fired HRSG producing 170 MW each and steam turbine producing 160 MW	DLN + SCR, oxidation catalyst	6/25-29/2001 full load w/ DB	2.36 (CTG1) 2.20 (CTG2)	0.12 (CTG1) 0.04 (CTG2)	1.51 (CTG1) 1.23 (CTG2)	2.661 (CTG1) 2.242 (CTG2)	7.93 (CTG1) 12.77 (CTG2)
				90% load w/o DB	2.447 (CTG2)	0.343 (CTG2)	4.66 (CTG2)	-	-
				80% load w/o DB	2.233 (CTG2)	0.143 (CTG2)	2.74 (CTG2)	-	-
				70% load w/o DB	2.228 (CTG2)	0.125 (CTG2)	1.81 (CTG2)	-	-
				8/30-31/2001 full load w/ DB (retest for VOC and NH_3)	-	-	0.44 (CTG1) 0.32 (CTG2)	-	<0.05 (CTG1) 7.92 (CTG2)
				10/15-16/2001 100% load w/o DB (retest for VOC)	-	-	0.21 (CTG1) 0.14 (CTG2)	-	-
				90% load w/o DB	-	-	0.19 (CTG1) 0.55 (CTG2)	-	-
				80% load w/o DB	-	-	0.21 (CTG1) 0.26 (CTG2)	-	-
				70% load w/o DB	-	-	0.18 (CTG1) 0.25 (CTG2)		

Table B-1. Emission Source Test Results for Combined-Cycle and Cogeneration Power Plant Gas Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Date Tested	Average Measured Emissions, per turbine (ppmvd @ 15% O_2 unless otherwise noted)				
					NOx	CO	VOC	PM10 (lb/hr)	NH_3
Mirant Kendall LLC (170 MW) existing Mirant Kendall site, Cambridge, MA	MA Dept. of Envir. Protection	1,766 MMBtu/hr GE 7241 FA gas turbine with 350 MMBtu/hr duct-fired HRSG producing 170 MW with steam routed to (3) existing steam turbines producing 64 MW	DLN + SCR, oxidation catalyst	Date Unknown 100% load w/ DB	1.9	0.0	0.0	2.51; 0.0023 lb/MMBtu	0.2
				100% load	2.0	0.0	0.0	-	0.1
				75% load	1.9	0.0	0.0	-	0.1
				50% load	1.9	0.0	0.0	-	0.1
Mystic Station (1,550 MW)	MA Dept. of Envir. Protection	(4) Mitsubishi 501G gas turbines with HRSG producing 250 MW each and (2) steam turbines (aka Units 81, 82, 93, 94)	DLN + SCR. oxidation catalyst	Date Unknown 100% load w/ DB	1.9 (CTG81) 1.6 (CTG82) 1.5 (CTG93) 1.7 (CTG94)	0.0 (CTG81) 0.0 (CTG82) 0.0 (CTG93) 0.0 (CTG94)	0.3 (CTG81) 0.5 (CTG82) 0.3 (CTG93) 0.2 (CTG94)	32.1; 0.010 lb/MMBtu (CTG81) 16.8; 0.005 lb/MMBtu (CTG82) 22.4; 0.007 lb/MMBtu (CTG93) 14.5; 0.005 lb/MMBtu (CTG94)	0.6 (CTG81) <0.5 (CTG82) 0.8 (CTG93) 0.3 (CTG94)
				100% load	1.6 (CTG81) 1.2 (CTG82) 1.6 (CTG93) 1.7 (CTG94)	0.0 (CTG81) 0.0 (CTG82) 0.0 (CTG93) 0.0 (CTG94)	0.2 (CTG81) 0.7 (CTG82) 0.3 (CTG93) 0.0 (CTG94)	- - - -	0.6 (CTG81) 0.2 (CTG82) 0.6 (CTG93) 0.5 (CTG94)
				87.5% load	1.7 (CTG81) 1.6 (CTG82) 1.6 (CTG93) 1.7 (CTG94)	0.0 (CTG81) 0.0 (CTG82) 0.0 (CTG93) 0.0 (CTG94)	0.2 (CTG81) 0.2 (CTG82) 0.1 (CTG93) 0.1 (CTG94)	- - - -	0.5 (CTG81) <0.3 (CTG82) 0.6 (CTG93) 0.4 (CTG94)
				75% load	1.6 (CTG81) 1.3 (CTG82) 1.4 (CTG93) 1.6 (CTG94)	0.2 (CTG81) 0.2 (CTG82) 0.0 (CTG93) 0.0 (CTG94)	0.0 (CTG81) 0.5 (CTG82) 0.1 (CTG93) 0.1 (CTG94)	- - - -	0.7 (CTG81) 0.3 (CTG82) 0.6 (CTG93) 0.2 (CTG94)

Table B-1. Emission Source Test Results for Combined-Cycle and Cogeneration Power Plant Gas Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Date Tested	Average Measured Emissions, per turbine (ppmvd @ 15% O_2 unless otherwise noted)				
					NOx	CO	VOC	PM10 (lb/hr)	NH_3
Lake Road Generating Company (840 MW) Lake R., Killingly, CT	CT Dept. of Envir. Protection	(3) 2,181 MMBtu/hr ABB GT-24 gas turbines and steam turbines	DLN + SCR, oxidation catalyst	1/24/2002 >90% load	1.3 (CTG1) 0.8 (CTG2)	<0.4 (CTG1) <0.4 (CTG2)	0.85 (CTG1) <0.4 (CTG2)	20.39; 0.0046 lb/MMBtu (CTG1) <6.65; <0.0038 lb/MMBtu (CTG2)	0.21 (CTG1)
				CTG2 1/25/2002 75% load	0.7	<0.4	<0.4	-	-
				60% load	0.7	1.3	<0.4	-	-
				50% load	1.1	4.7	<0.4	-	-
				CTG3 4/23/2002 >90% load	1.2	<0.4	<0.4	<5.36; <0.0029 lb/MMBtu	0.16
				CTG2 4/24/2002 75% load	1.1	<0.4	<0.4	-	-
				60% load	1.3	1.4	<0.4	-	-
				50% load	1.6	3.1	0.5	-	-

Table B-2. Emission Source Test Results for Simple-Cycle Power Plant Gas Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Date Tested	Average Measured Emissions, per turbine (ppmvd @ 15% O_2 unless otherwise noted)				
					NOx	CO	VOC	PM10 (lb/hr)	NH_3
New York Power Authority /Hell Gate (94 MW) Bronx, NY	NY Dept. of Envir. Quality	(2) GE LM6000 Sprint gas turbines producing 47 MW each	Water injection + SCR, oxidation catalyst	10/3-4/2001 100% load	2.2 (CTG1) 2.1 (CTG2)	0.1 (CTG1) 0.1 (CTG2)	-	-	9.6 (CTG1) 13.5 (CTG2)
				90% load	2.1 (CTG1) 1.9 (CTG2)	0.1 (CTG1) 0.0 (CTG2)	-	-	-
				80% load	2.0 (CTG1) 1.7 (CTG2)	0.1 (CTG1) 0.0 (CTG2)	-	-	-
				65% load	2.0 (CTG1) 2.0 (CTG2)	0.1 (CTG1) 0.0 (CTG2)	-	-	-
				11/27/2001 (retest for NH_3)	2.3 (CTG2)	0.2 (CTG2)	-	-	3.4 (CTG2)
Calpine /Lambie Energy Center (49.9 MW) 5975 Lambie Rd., Suisun City, CA	Bay Area AQMD	500 MMBtu/hr GE LM6000 PC Sprint gas turbine producing 49.9 MW	Water injection + SCR, oxidation catalyst	1/15-17/2003	2.45	1.71	0.61	1.90	1.50
Calpine /Creed Energy Center (49.9 MW) 6150 Creed Rd., Suisun City, CA	Bay Area AQMD	500 MMBtu/hr GE LM6000 PC Sprint gas turbine producing 49.9 MW	Water injection + SCR, oxidation catalyst	1/29-2/1/2003	1.53	1.28	0.14	2.18	0.76
Calpine /Goose Haven Energy Center (49.9 MW) 3853 Goose Haven Rd., Suisun City, CA	Bay Area AQMD	500 MMBtu/hr GE LM6000 PC Sprint gas turbine producing 49.9 MW	Water injection + SCR, oxidation catalyst	1/22-24/2003	2.41	1.59	0.84	1.97	0.42
Northern California Power (49 MW) 12751 Thornton Rd., Lodi, CA	San Joaquin Valley APCD	417 MMBtu/hr GE LM5000 gas turbine producing 49 MW	Steam injection + SCR, oxidation catalyst	July 2000	2.75	11.5	-	0.629	24.49
CalPeak Power Border LLC (49.5 MW) Harvest Rd., San Diego, CA	San Diego Co. APCD	500 MMBtu/hr Pratt & Whitney FT8 "Twin Pac" gas turbines with common generator and exhaust producing 49.5 MW	DLN + SCR, oxidation catalyst	11/9/2001	1.88	6.3	2.28	-	3.36

Table B-2. Emission Source Test Results for Simple-Cycle Power Plant Gas Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Date Tested	Average Measured Emissions, per turbine (ppmvd @ 15% O_2 unless otherwise noted)				
					NOx	CO	VOC	PM10 (lb/hr)	NH_3
CalPeak Power /Panoche (49.4 MW) 43699 W. Panoche Rd., Firebaugh, CA	San Joaquin Valley APCD	(2) Pratt & Whitney FT8 "Twin Pac" gas turbines with common generator and exhaust producing 24.7 MW each	DLN + SCR, oxidation catalyst	2/19/2002	2.47	1.53	<1.24	2.11 (total)	11.7
				5/13/2002 (retest for NH_3)	2.31	-	-	-	6.01
Wellhead Power Gates LLC (45.4 MW) Huron, CA	San Joaquin Valley APCD	436 MMBtu/hr GE LM6000 gas turbine producing 45.4 MW	Water or steam injection + SCR, oxidation catalyst	3/20/2002	2.7	0.7	0.0	2.620	0.4
Wildflower Energy /Indigo (135 MW) 19th Ave., Palm Springs, CA	South Coast AQMD	(3) 450 MMBtu/hr GE LM6000 Enhanced Sprint gas turbines producing 45 MW each	Steam or water injection + SCR, oxidation catalyst	11/30/2001 and 12/2&6/2001	4.47 (CTG1) 3.80 (CTG2) 3.96 (CTG3)	1.46 (CTG1) 1.47 (CTG2) 1.74 (CTG3)	-	-	4.24 (CTG1) 2.19 (CTG2) 3.46 (CTG3)
GWF Energy LLC /Tracy Peaker Power Plant (169 MW) Tracy, CA	San Joaquin Valley APCD	(2) 990.6 MMBtu/hr GE PG7121 EA gas turbines producing 84.5 MW each	DLN + SCR, oxidation catalyst	5/21/2003 100% load	4.82 (CTG1) 4.76 (CTG2)	0.42 (CTG1) 0.16 (CTG2)	0.39 (CTG1) 0.38 (CTG2)	1.960 (CTG1) 2.034 (CTG2)	7.711 (CTG1) 4.962 (CTG2)
				75% load	4.95 (CTG1) 4.73 (CTG2)	0.38 (CTG1) 0.01 (CTG2)	-	-	-
				50% load	3.49 (CTG1) 4.71 (CTG2)	0.23 (CTG1) 0.00 (CTG2)	-	-	-
				25% load	3.07 (CTG1) 4.41 (CTG2)	0.22 (CTG1) 0.00 (CTG2)	-	-	-
Sacramento Municipal Utility District (77 MW) McClellan Air Force Base, Sacramento, CA	Sac Metro AQMD	927 MMBtu/hr GE Frame 7E PG7931 gas turbine producing 77 MW	Water injection + SCR	1/22-23/2001 Full load	3.99	1.54	7.24	4.826	2.41
				Part load	-	33.97	7.24	-	-
				March 2001 Full load	-	-	1.03; 1.21 lb/hr	-	-
				Part load	-	20.7; 30.38 lb/hr	0.83; 0.70 lb/hr	-	-
PG&E Dispersed Generating Company /Chula Vista (44 MW) 3497 Main St., Chula Vista, CA	San Diego Co. APCD	688 MMBtu/hr Pratt & Whitney FT4/GG4 "Twin Pac" gas turbines producing 44 MW	DLN + SCR, oxidation catalyst	6/26/2001	3.16	56.8	2.1	-	8

Table B-2. Emission Source Test Results for Simple-Cycle Power Plant Gas Turbines

Facility Name	Permitting Agency	Basic Equipment	Method of Control	Date Tested	Average Measured Emissions, per turbine (ppmvd @ 15% O_2 unless otherwise noted)				
					NOx	CO	VOC	PM10 (lb/hr)	NH_3
Gilroy Energy Center Phase I (135 MW) at the Calpine Gilroy Power Plant, Gilroy, CA	Bay Area AQMD	(3) 467.6 MMBtu/hr GE LM6000PC gas turbines producing 45 MW each	Water injection or DLN + SCR, oxidation catalyst	**CTG1** 2/1,4,5/2002	3.46	0.62	0.37	-	1.45
				CTG2 2/7-8/2002	3.27	0.70	0.79	-	1.33
				CTG3 3/14-15/2002	3.62	0.49	0.24	-	0.87
Wildflower Energy /Larkspur (135 MW) Harvest Rd., Otay Mesa area, San Diego, CA	San Diego Co. APCD	(2) 395 MMBtu/hr GE LM6000 PC Sprint gas turbines producing 45 MW each	Water injection + SCR, oxidation catalyst	8/28/2001	4.49 (CTG1) 4.56 (CTG2)	38.24 (CTG1) 47.81 (CTG2)	<0.96 (CTG1) <0.96 (CTG2)	-	37.4 (CTG1) 36.6 (CTG2)
				CTG1 1/18/2002	4.16	12.8	<1.00	-	1.33
				CTG2 12/20/2001	3.39	14.6	<0.96	-	1.4
Tampa Electric Company /Polk Power Station (165 MW) Mulberry, Polk Co., FL	FL Dept. of Envir. Protection	1,600 MMBtu/hr GE PG7241FA gas turbine producing 165 MW	DLN	10/7/2000 100% load	7.58	0.24	0.11	-	NA
				85% load	6.18	0.31	0.17	-	NA
				70% load	6.34	0.42	0.33	-	NA
				50% load	5.30	1.31	0.41	-	NA
Sunrise Power Company Phase I (320 MW) Kern Co., CA	San Joaquin Valley APCD	(2) GE Frame 7FA gas turbines producing 165 MW each	DLN	**CTG1** 7/9/2001	6.79	0.49	<0.81	3.52	NA
				CTG2 7/12/2001	6.38	0.47	<0.76	1.91	NA

APPENDIX C

Table C-1. Area Designations for State PM2.5 Ambient Air Quality Standard

Air Basin	Area Included	Designation
Mojave Desert	Central San Bernardino County (portion of San Bernardino County within the federal Modified AQMA for ozone)	N
Mountain Counties	Plumas County	N
Sacramento Valley	Butte and Sacramento counties, portion of Placer County within air basin	N
Salton Sea	Imperial County	N
San Diego	Entire air basin	N
San Francisco Bay Area	Entire air basin	N
San Joaquin Valley	Entire air basin	N
South Central Coast	Ventura County (including Anacapa and San Nicolas islands)	N
South Coast	Entire air basin (including San Clemente and Santa Catalina islands)	N
Lake County	Entire air basin	A
Great Basin Valleys	Entire air basin	U
Lake Tahoe	Entire air basin	U
Mojave Desert (remainder)	Portion of Kern County, portion of Los Angeles County, portion of Riverside County within air basin	U
Mountain Counties (remainder)	Amador, Calaveras, Mariposa, Nevada, Sierra, and Tuolumne counties; portion of El Dorado County; portion of Placer County within air basin	U
North Central Coast	Entire air basin	U
North Coast	Entire air basin	U
Northeast Plateau	Entire air basin	U
Sacramento Valley (remainder)	Colusa, Glenn, Shasta, Sutter, Tehama, Yolo, and Yuba counties; portion of Solano County within air basin	U
Salton Sea (remainder)	Portion of Riverside County within air basin	U
South Central Cost (remainder)	San Luis Obispo and Santa Barbara counties (including San Miguel, Santa Barbara, Santa Cruz, and Santa Rosa islands)	U

A = Attainment; indicates no violations of the State standard in the area during the previous three years.
N = Nonattainment; indicates at least one violation of the State standard in the area during the previous three years.
U = Unclassified; indicates data are not sufficient for determining attainment or nonattainment.

APPENDIX D

Comment Letter 1 from Mitsubishi Power Systems, Inc.

Subject: RE: noxlegrpt Draft Report Available for Comment
Date: Wed, 31 Mar 2004 14:25:23 -0800
From: "Fusato Dana" <fdana@mhia.com>
To: <mbueto@arb.ca.gov>
CC: <ahattori@mhia.com>

Merrin,

Thank you for sending us the draft copy of the report.
I have read the copy and have only one comment.

Page 23 of the draft, 2nd sentence. Please correct the sentence to read:
"Ammonia is injected into the combustion turbine exhaust through the ammonia injection grid (AIG)."

Thanks
Fusato Dana
Sr Sales & Marketing Administrator
Mitsubishi Power Systems, Inc.
100 Bayview Circle, Suite 4000
Newport Beach, CA 92660

Comment Letter 2 from Lindh & Associates

Subject: noxlegrpt Draft Report
Date: Thu, 25 Mar 2004 08:49:04 -0800
From: "Chuck Solt" <chuck@csolt.net>
To: <mbueto@arb.ca.gov>
CC: "Stephanie Kato" <skato@arb.ca.gov>,
"Michael Tollstrup" <mtollstr@arb.ca.gov>

I would like to make 2 comments on the report:

Under "Findings" (Page 3), I suggest changing as shown:

The Xonon Cool Combustion system has shown to be an effective pollution prevention device that can achieve NOx emission levels required as BACT in California for simple-cycle gas turbine power plants without the associated environmental impacts from ammonia use; however, the technology has limited applications at this time.

My understanding was that the primary issue of the document is to examine the environmental benefits of using a NOx control technology that does not use ammonia. To that end, I suggest you compare the total ammonia emissions in California with the ammonia slip from SCR.

Thank you for your consideration.

Chuck Solt
J C Solt Lindh & Associates

Comment Letter 3 from Power Systems Mfg., LLC

Jeff Benoit
Director - Combustion Engineering
Power Systems MFG., LLC
A Calpine Company
1440 West Indiantown Rd.
Suite 200
Jupiter, FL 33432

3. Low Emissions Combustor (LEC-III™) System

Power Systems Mfg. LLC, a subsidiary of San Jose, CA based Calpine Corporation, has developed its proprietary Low Emissions Combustor III (LEC-III™) system that produces low single-digit NOx and CO emissions on natural gas without post-combustion controls.

a. Technology Description

The LEC-III™ is a patented aftermarket system designed to be a "drop-in" replacement for existing GE frame gas turbine combustors outfitted with either diffusion or DLN combustors. Power System's lean, premixed combustion design involves premixing of fuel and air in the combustion system through innovative fuel gas injection methods and liner design. A forward-cooling flow venturi (the flame holder) in the combustion liner injects spent cooling air directly into the liner's head end premixing chamber—reducing CO spikes at machine part load conditions. In addition, efficient cooling of the combustion liner is achieved through effusion cooling, where over 5,000 dimensionally controlled holes arrayed around the head end of the liner eliminate the need for thermal barrier coating. This improves cooling air requirements, aides in fuel/air mixing and provides a more uniform thermal environment. The liner design allows for excellent heat transfer performance, low metal temperatures, and reduced NOx and CO emissions.

b. Emission Performance

The LEC-III™ liner system was first installed in an existing 70-MW GE Frame 7EA gas turbine at TransAlta Cogeneration in Alberta, Canada, in 2001. Prior to the retrofit, the lowest emission levels from the turbine were reported at 17 ppmvd NOx and 14 ppmvd CO at 15% O_2. After installation of the LEC system, emission levels of 6 ppmvd NOx and 2.5 ppmvd CO (average) at 15% O_2 were measured. The turbine has since undergone a 24,000-hour major overhaul, which included removal and return of the hardware to the manufacturer for refurbishment. Reinstallation is planned for September 2004.

The second installation of the LEC-III™ liner system occurred in March 2003 at Dow Chemical's Power 8 facility in Freeport, Texas, on a 83-MW GE Frame 7EA gas turbine. The manufacturer offered an 8-ppmvd NOx guarantee with a design target of 5 ppmvd at 15% O2. Testing was conducted in April 2003 and emission levels of 4.75 ppmvd NOx at 15% O_2 were reported while the turbine was operated without duct burners. During duct burner firing, NOx emissions were between 6.75 to 9.09 ppmvd at 15% O_2, all with CO emissions below 1 ppmvd at 15% O_2. NOx emissions over the entire premixed operation gas turbine load range were below 5 ppmvd at 15% O2.

Two additional units will go into service in Texas in 2004.

c. Commercial Availability

The product is offered commercially for the GE Frame 7E/EA (85.4 MW) and GE 6B (42.1 MW) turbines. The guaranteed NOx and CO emission concentrations in the exhaust are 5 ppmvd at 15% O_2 for both pollutants. The system is under development for the Siemens Westinghouse 501D5 gas turbine (173 MW), Additional development programs in 2004 involve the use of hydrogen-fuel blending to help drive emissions down to 2ppm NOx as well as continued work on LEC systems for the GE 7FA (170 MW) and Siemens Westinghouse 501FD2 (283 MW) machines.

Comment Letter 4 from Sacramento Municipal Utility District

Subject: Gas-Fired Power Plant NOx Emissions - Draft Report to the Legislature (March 2004)
Date: Wed, 7 Apr 2004 14:18:31 -0700
From: "Stu Husband" <SHusban@smud.org>
To: <mbueto@arb.ca.gov>
CC: "Ross Gould" <RGould@CORPORATE.smud.org>

Ms. Bueto:

Thank you for the opportunity to comment on the referenced draft report. SMUD owns and controls approximately 500 MW of gas-fired generation capacity in the greater Sacramento area. Our comments focus primarily on pages A-9 and B-6 of the draft report. On those pages, information is presented for SMUD's 77 MW gas turbine generator located at McClellan Park (formerly McClellan Air Force Base). Please note that this is an industrial frame natural gas-fired gas turbine in simple cycle configuration with water injection NOx control technology, and was originally installed in 1986. In 2000, SMUD retrofit the unit with SCR to reduce NOx emissions and increase permitted operational flexibility. Due to performance problems with the original SCR installation, the unit's SCR system is currently being rebuilt including catalyst replacement. Hence, this facility does not meet the intended scope of the report stated on page 2 as being "new" power plant installations. From that perspective, SMUD believes that it may not be appropriate to include information for the McClellan turbine facility in this report.

However, in lieu of deleting the McClellan turbine facility from the report, the following comments pertain to the table columns presenting CO and VOC information. On Table A-2 (page A-9), emission limits for CO and VOC are listed as 23 ppm and 2 ppm, respectively. This is not correct. Our air permit does not contain CO or VOC concentration emission limits. For CO and VOC, our air permit contains mass emission limits only. These are 46.98 lb/hr CO and 2.36 lb/hr VOC, both on a 3-hr average basis.

On Table B-2 (page B-6), CO and VOC source test results are presented in concentration units. Although not specified in the table, the first set of CO/VOC values (1.54 ppm CO / 7.24 ppm VOC) was at full load operation and the second set of values (33.97 ppm CO / 19.24 ppm VOC) was at part load operation. Due to problems with the initial source testing conducted on 1/22-23/2001, SMUD did not believe these results were representative and the unit was retested in March 2001 with the following results:

* CO part load - 20.7 ppm corrected and 30.38 lb/hr
* VOC part load - 0.83 ppm corrected and 0.70 lb/hr
* VOC full load - 1.03 ppm corrected and 1.21 lb/hr

Other comments for your consideration are as follows:

* Pages 31-32, Catalyst Washing - The report presumes disposal of catalyst wash wastewater in a public sewer system. Many power plants do not have ready access on site to a public sewer system. In this case, options could include disposal of wastewater to land or surface water if allowed by applicable water quality regulations. This option may be constrained due to stringent water quality release criteria, particularly where NPDES surface water discharge permits are involved. Another option could be to transport the wastewater to an off-site disposal facility or public sewer system that will accept the wastewater.

Please do not hesitate to contact me if there are any questions on these comments.

Stu Husband
Regulatory Compliance Coordinator, Power Generation
Sacramento Municipal Utility District
6201 S Street, MS-B355
Sacramento, CA 95817-1899

Comment Letter 5 from South Coast Air Quality Management District

Subject: NOx Controls Report
Date: Wed, 7 Apr 2004 13:41:47 -0700
From: "Howard Lange" <HLange@aqmd.gov>
To: <mbueto@arb.ca.gov>

In the discussion of ammonia impacts, it would be useful to explain what is included in the various non-agricultural categories depicted in Figure IV-1, i.e., mobile, industrial, soil, waste, domestic. If ammonia inventory from NOx controls is such a tiny fraction of total ammonia inventory even in non-agricultural areas, as this figure suggests, it would seem that we should not be placing much emphasis on ammonia limits on sources that use ammonia for NOx control. In the permits reflected in Appendix A, the trend seems to be toward increasingly more stringent ammonia limits. Is this really productive in most cases? Perhaps the report could provide a little more guidance on this.

Howard B. Lange, Air Quality Engineer
South Coast Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4182

Comment Letter 6 from Catalytica Energy Systems

Subject: [Fwd: FW: Leg Report]
Date: Tue, 13 Apr 2004 16:03:30 -0700
From: Beverly Werner <bwerner@arb.ca.gov>
To: Merrin Bueto <mbueto@arb.ca.gov>

Subject: RE: FW: Leg Report
Date: Tue, 13 Apr 2004 13:57:29 -0700
From: DHatfield@CatalyticaEnergy.com
To: bwerner@arb.ca.gov
CC: mtollstr@arb.ca.gov

- The Xonon Cool Combustion system has shown to be an effective pollution prevention device that can achieve NOx emission levels required as BACT in California for both simple-cycle and combined cycle gas turbine power plants without the associated environmental impacts from ammonia use; however, the technology has limited applications at this time.

Each Xonon combustor is customized to the particular turbine model and application and is defined through a collaborative effort with the turbine original equipment manufacturer (OEM) to integrate the hardware into the design. Xonon is currently only commercially available from Kawasaki Gas Turbines-Americas on a small 1.4 MW gas turbine.

The Xonon system was first designed into the combustor of a 1.4 MW Kawasaki Model M1A-13A gas turbine and began operating at Silicon Valley Power ~~Coporation~~ in Santa Clara, California, in 1999. Since its installation, the turbine has operated as a demonstration of Xonon's performance and as a development and test unit in support of commercial program initiatives for customers. More than 18,000 hours of Xonon performance data has been accumulated on the demonstration unit.

As a result of a collaborative agreement announced in December 2000, Kawasaki Gas Turbines-Americas markets and sells a GPB15X generator package including a 1.4-MW M1A-13X gas turbine equipped with Xonon. Kawasaki will provide a performance guarantee for NOx of 3.0 ppmvd and 10.0 ppmvd at 15% O_2 on a continuous basis over a 70-100 percent turbine operating load.

Comment Letter 7 from California Council for Environmental and Economic Balance (CCEEB)

CALIFORNIA COUNCIL FOR ENVIRONMENTAL AND ECONOMIC BALANCE

COMMENTS REGARDING ARB'S DRAFT REPORT TO THE LEGISLATURE: GAS-FIRED POWER PLANT NOx EMISSION CONTROLS AND RELATED ENVIRONMENTAL IMPACTS

(March 2004 ARB Draft)

(Comments Submitted April 13, 2004)

The California Council for Environmental and Economic Balance ("CCEEB") is a nonprofit, nonpartisan coalition of business, labor and public leaders that works to advance policies that protect public health and the environment while also allowing for economic growth. Some of CCEEB's members own and operate power plants in California. Following are CCEEB's comments regarding the March 2004 draft of the Air Resources Board's ("ARB's") Report to the Legislature: Gas-Fired Power Plant NOx Emission Controls and Related Environmental Impacts.

1. General Comment

The draft report is a well-written and well-organized document.

2. Caveats

ARB indicates (at Pages 2 and 3 of the draft) that the report:

a. "is not intended to establish new BACT emission levels or certify or validate any emission levels purported to be achieved at various facilities."

b. "does not include conclusions or recommendations."

c. "provides information that can be used as a starting point in conducting more detailed site-specific analyses of the environmental advantages and disadvantages of control technologies that reduce NOx emissions from natural gas-fired power plants."

CCEEB supports the inclusion of these important caveats in the report.

3. Proposed Finding regarding SCONOx

A. BACT Emission Levels

As explained below, CCEEB has strong concerns regarding how the draft report characterizes the ability of SCONOx to meet Best Available Control Technology ("BACT") emission limitations for power plants. As context for this section, we emphasize that a key element of whether a technology meets a BACT limit is the "achieved in practice" element. This element ensures that a technology will reliably meet the BACT emission limitation for the application in question so that the high compliance costs will not be wasted.

At the first bullet on Page 3, ARB proposes to state that:

> "The SCONOx catalytic absorption system produces beneficial NOx, carbon monoxide (CO), and volatile organize compound (VOC) emission reductions without the associated environmental impacts from ammonia use and **can achieve emissions levels required as BACT in California."**

Similarly, at Page 9, ARB proposes to state:

> "(...) the control technologies described in this chapter are those that **have the ability to meet or that facilitate meeting** the ARB's recommended BACT emission levels for power plant gas turbines."

Our concern is that these statements could mislead a reader (including Legislators and staff of the State Legislature) into believing that SCONOx will work reliably in meeting BACT and in its operation for **all** power plant situations – which is not the case. We appreciated that this is not ARB's intent, but **it is critical that a report to the Legislature be transparent as to what is really the current status of the technology for meeting BACT limits**.

Table III-3 on Page 16 and the text on Pages 16 and 17 include useful information regarding SCONOx. They note that the "SCONOx system is installed at a total of seven sites in the United States." The use of SCONOx at these plants involves the generation of from 43 MW down to 5.2 MW (i.e., smaller applications). At Pages 16 and 17, ARB includes a discussion of the installation experience at these plants. What is missing from the Executive Summary finding and the related text of the report is a discussion of the lack of experience (and BACT determinations) for use of SCONOx in larger applications. In the CEC's power plant licensing process, significant issues have arisen as to the reliability and scope of vendor guarantees for SCONOx for larger utility-grade operations.

CCEEB urges ARB to clarify in both the Executive Summary and the supporting text of the report that SCONOx has been demonstrated to meet BACT for some applications but has not been shown to meet BACT for all power plant applications including larger applications. On a related note, we support ARB's inclusion of the statement on Page 33 that the "SCONOx system is not available for use in simple-cycle configurations because the turbine exhaust temperatures are outside the effective range of the control technology."

Please note that our comments in this area are not intended as a criticism of SCONOx. CCEEB recognizes the benefits of SCONOx for the commercial applications for which it has been demonstrated to meet BACT levels (and for which a vendor will provide a guarantee to that

effect). Our concern is that future legislative and regulatory requirements for controls for new power plants must tied to emission levels that have been "achieved in practice" for the application in question. This is necessary to assure that large environmental compliance investments made during the construction of new power plants are not wasted. It is critical that the Legislature understand the complete picture in this area.

B. Environmental Impacts

As noted above, at the first bullet on Page 3, ARB proposes to state that:

> "The SCONOx catalytic absorption system produces beneficial NOx, carbon monoxide (CO), and volatile organize compound (VOC) emission reductions without the associated environmental impacts from ammonia use and can achieve emissions levels required as BACT in California."

In addition to the concerns raised above, we are concerned that from reading this proposed finding and the other proposed findings in the Executive Summary, a person might conclude that there are no environmental impact issues associated with SCONOx. With regard to both the findings and the text regarding environmental issues associated with SCONOx at Pages 31-32, we suggest that ARB may want to add information regarding the handling of hydrogen and potential emissions of H_2S and SO_2.

4. The Differences in Cost of Controls

In the last bullet on Page 4, ARB proposed to state that:

> "Available cost data indicates that SCR used in conjunction with an oxidation catalyst costs less than SCONOx for the same level of emission reduction."

In the supporting text on Page 33, ARB proposes to state that:

> "Cost figures show that the SCR/oxidation catalyst package is less than the SCONOx system."

First, CCEEB supports inclusions of such statements in the report. It is important that the Legislature be aware of the cost differences. Second, we note that the two statements are accurate, but they do not convey that the estimated cost differences are substantial. In Table V-1, the data indicates that for a 500-MW combined-cycle gas turbine power plant, the capital cost for SCONOx may be over three times as much as SCR/CO (i.e., $20,747,637 for SCONOx and $6,259,857 for SCR/CO). The table indicates that the annual operation and maintenance costs for SCONOx may be over double same costs for SCR/CO (i.e., $3,027,653 per year for SCONOx and $1,355,253 per year for SCR/CO).

We suggest that ARB be more explicit regarding the cost differences. One way to accomplish this would be to insert the word "significantly" before the word "less" in the two above-quoted sentences.

Also, with regarding to Table V-1, the table is labeled as "Estimated Average Cost of Post-Combustion Control Technology for a 500-MW Combined-Cycle Gas Turbine Power Plant meeting BACT." As noted previously, the text and Table III-3 on Page 16 indicates that the "SCONOx system is installed at a total of seven sites in the United States." The seven plants are plants with 43 MW or less (i.e., plants that are much smaller than 500 MW plants). Based on that information, we expect that the "estimated average cost of post-combustion control technology for a 500-MW Combined-Cycle Gas Turbine" is based on a scaling up of costs for SCONOx for smaller plants – and there are no real cost numbers for installed SCONOx for a 500-MW power plant. Assuming this is the case, we recommend that ARB note this clearly and note that the estimates are hypothetical numbers based on scaled-up data, and that inclusion of the table does **not** imply that a 500-MW combined cycle gas turbine power plant meeting BACT limits with SCONOx exists.

5. Stratospheric Ozone Depletion

In the second paragraph on Page 6, the draft report states that NOx emissions are of particular concern due to their contribution to "ground-level ozone formation, stratospheric ozone depletion, and acid rain." Our understanding is that NOx is **not** a compound that is regulated as a stratospheric ozone-depleting compound. (Please see http://www.epa.gov/ozone/ods.html.) Further, the issue of stratospheric ozone depletion is beyond the scope of the requested report. CCEEB suggests that ARB delete the reference to stratospheric ozone depletion from this sentence.

CCEEB appreciates ARB's consideration of these comments. If you have any questions, please contact Cindy Tuck at (916) 442-4249.

Comment Letter 8 from Florida Power & Light Group

Subject: Gas Fired NOx emissions controls draft report.
Date: Tue, 13 Apr 2004 13:52:29 -0400
From: Kyle_Boudreaux@fpl.com
To: mbueto@arb.ca.gov

My name is Kyle Boudreaux and I work for FPL Group, Juno Beach, FL. A subsidiary of our company, FPL Energy, owns a gas fired power plant in Blythe, CA. In addition, our corporation has developed numerous gas fired power plants in several states outside of Florida and have re-powered several of our Florida facilities to run on natural gas. We have been recognized by Innovest for the past three years as the top performer in environmental excellence among electric utilities in the US. Everyone of our environmental experts that I showed your draft document to agreed with the majority of the information in your report. The individuals who prepared this report for the California Air Resources Board did an excellent job. The document is obviously the result of a well designed plan to research and gather information on NOx controls for gas fired power plants. The only suggestion I received for a possible improvement is related to SCONOX technology and large combustion turbines. The report seems to indicate that SCONOX is a commercially viable and technically feasible technology. We have not found this to be the case for large combustion turbines in our fleet. Typically, the reaction chambers are complex, the maintenance costs are high and we are not aware of the technology being proven to work on larger units. We know that the technology is being developed and there is a permit application in process for one of these units in San Joaquin County, but we do not feel SCONOX has reached the level of reliability and economic feasibility as other technologies for these larger turbines.

Thank You,

Kyle Boudreaux
Sr Environmental Specialist
Environmental Services

Comment Letter 9 from Cormetech

Subject: Comments on ARB Draft Report to Legislature
Date: Tue, 13 Apr 2004 18:04:21 -0400
From: "Hastings, Thomas W." <HastingsTW@Cormetech.com>
To: <mbueto@arb.ca.gov>
CC: <skato@arb.ca.gov>

Comments on Section III.D.2 - Zero-Slip(TM) Ammonia Reduction Technology, Emission Performance

The Zero-Slip(TM) technology is described well in the first paragraph. After the description, there is a focus on VOC issues and no direct mention of emission performance for NOx, CO, and NH3. The NOx and CO emissions have been below the permit levels. The NH3 emission level was measured as 0.1 ppmvd or less which is well below the permit level of 5 ppmvd.

On the VOC issues, the Zero-Slip(TM) technology installed at the Paramount Petroleum site in SCAQMD was designed for zero VOC. If a design requirement for VOC had been indicated, the CO catalyst would have been formulated to handle both CO and VOC.

Thanks and best regards . . . Tom.

Thomas W. Hastings, Sc.D.
New Business Development Manager
Cormetech, Inc.
5000 International Drive
Durham, NC 27712