APPENDIX 5.1B

Calculation of Maximum Hourly, Daily, and Annual Emissions

APPENDIX 5.1B

Calculation of Maximum Hourly, Daily, and Annual Emissions

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-1
Commissioning Emission Scenarios

Number	Scenario	Turbine	Turbine Load Rate (%)	Scenario Modeled	Emission Rate per turbine (lb/hr)		
					1 Hr NOx	1-Hr CO	8-Hr CO
10	STG Load Testing	1	50		43.3	32.6	32.6
1	CTG Testing (Full Speed No Load, SNL)	1 or 2	50		58.7	86.1	86.1
2	Steam Blows	1 or 2	50		86.6	177.3	177.3
4	Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	1 or 2	50		160.48	245.68	245.68
3	Steam Blows	Both	50		81.0	167.9	167.9
6	Verify STG on Turning Gear; Establish Vauum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	Both	50	X	141.81	153.9	153.9
5	Restart CTGs and run HRSG in Bypass Mode Bypass Valve Tuning. HRSG Blow Down and Drum Tuning	1 or 2	100		40.8	70.0	70.00
8	CTG Base Load / Commissioning of Ammonia system	1 or 2	100		24.8	22.5	22.5
9	CT Tuning After Liner Change	1 or 2	100		59.5	38.6	38.6
11	STG Load Test	1 or 2	100		29.6	16.5	16.5
15	Emissions Tuning	1 or 2	100		34.7	37.5	37.5
7	Verify STG on Turning Gear; Establish Vauum in ACC Ext Bypass Blowdown to ACC (combined blows) commence tuning on ACC Controls; Finalize Bypass Valve Tuning	Both	100	X	40.8	70.0	70.0
12	Load Test STG / Combine Cycle (2X1)	Both	100	X	43.3	32.6	32.6
13	Combine Cycle testing	Both	100		7.2	5.4	5.4
19	Performance Testing	Both	100		11.6	13.4	13.4
21	CALISO Certification	Both	100		14.8	8.3	8.3
16	Emissions Tuning	1 or 2	100 DB		18.4	24.7	24.7
17	RATA / Pre-performance Testing/Source Testing	1 or 2	100 DB		18.4	24.7	24.7
18	Source Testing & Drift Test Day 1 - 6	1 or 2	100 DB	X	18.4	24.7	24.7
14	Commissioning Duct Burners	Both	100 DB	X	9.6	8.7	8.7
20	Performance Testing with Duct Burner	Both	100 DB		4.8	4.4	4.4
22	CALISO Certification with Duct Burner	Both	100 DB	X	9.2	12.35	12.35
			Max		160.5	245.7	245.7

All 100 % Load and 100% DB Load scenarios modeled at 59F and Evaporative Cooler On
For 50% Load, use the 60% normal operating turbine parameters. (no evaporative cooler on)

The scenarios modeled were chosen based on operating loads, turbine configurations, and the overall emission rates. For example, although Scenario #4 has a higher emission rate per turbine at 50% load than Scenario #6, Scenario #6 was modeled because both turbines would be operated simultaneously.
For scenarios with similar overall emission rates, operating loads, and turbine configurations, both scenarios were modeled. (e.g., CO for Scenario #18 and #22)

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-2
Start-Up Emission Rates - Event Data at 15°F

GWF - Tracy (15°F, 100% RH, 14.61psia)

2X1 GE 7EA STARTUP EMISSION ESTIMATES			
	HOT START	WARM START	COLD START
NOx, LBM	48	483	781
CO, LBM	202	698	1,125
UHC, LBM	17	65	103
VOC, LBM	3.4	13	21
SO2, LBM	2.5	5.0	8.2
PARTICULATES, LBM (FRONT HALF)	3.0	6.8	11
PARTICULATES, LBM (BACK HALF)	3.0	6.8	11
TOTAL PM, LBM	6.0	13.6	22.0
STARTUP DURATION, MIN	61	118	180

Client:	GWF
Project Name:	Tracy Combined Cycle Conversion
Project Number:	160129.0050
Date:	January 30, 2008

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-3
Start-Up Emission Rates - Event Data at 59°F

GWF - Tracy (59°F, 60% RH, 14.61psia)

2X1 GE 7EA STARTUP EMISSION ESTIMATES			
	HOT START	WARM START	COLD START
NOx, LBM	29	162	253
CO, LBM	93	320	286
UHC, LBM	8	19	31
VOC, LBM	1.5	3.8	6.1
SO2, LBM	2.2	4.7	7.5
PARTICULATES, LBM (FRONT HALF PM10)	3.4	6.8	11
PARTICULATES, LBM (BACK HALF PM10)	3.4	6.8	11
STARTUP DURATION, MIN	61	118	180

Client:	GWF
Project Name:	Tracy Combined Cycle Conversion
Project Number:	160129.0050
Date:	January 30, 2008

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-4
Start-Up Emission Rates - Event Data at 115°F

GWF - Tracy (115°F, 30% RH, 14.61psia)

2X1 GE 7EA STARTUP EMISSIONS ESTIMATES			
	HOT START	WARM START	COLD START
NOx, LBM	48	449	735
CO, LBM	143	663	1,063
UHC, LBM	11	51	80
VOC, LBM	2.1	10	16
SO2, LBM	1.8	3.6	6.5
PARTICULATES, LBM (FRONT HALF)	3.8	10	11
PARTICULATES, LBM (BACK HALF)	3.8	10	11
STARTUP DURATION, MIN	61	118	180

Client:	GWF
Project Name:	Tracy Combined Cycle Conversion
Project Number:	160129.0050
Date:	January 30, 2008

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-5
Start-Up Emission Rates - Worst Case 1-Hour Emissions

GWF - Tracy

2X1 GE 7EA WORST EMISSIONS ESTIMATES IN 1 HOUR DURING STARTUP	
	WORST PERIOD EMISSIONS DURING STARTUP
NOx, LBM	399
CO, LBM	375
UHC, LBM	53
VOC, LBM	11
SO2, LBM	4.9
PARTICULATES, LBM (FRONT HALF)	4.7
PARTICULATES, LBM (BACK HALF)	4.7
TOTAL PM, LBM	9.4
DURATION, MIN	60

Client:	GWF
Project Name:	Tracy 2X1 GE 7EA
Project Number:	160129.0050
Date:	January 30, 2008

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-6
Shutdown Emission Rates - Event Data at 15°F

GWF - Tracy (15°F, 100% RH, 14.61psia)

2X1 GE 7EA SHUTDOWN EMISSIONS ESTIMATES	
	SHUTDOWN
NOx, LBM	208
CO, LBM	296
UHC, LBM	26
VOC, LBM	5.2
SO2, LBM	1.7
PARTICULATES, LBM (FRONT HALF)	3.0
PARTICULATES, LBM (BACK HALF)	3.0
TOTAL PM, LBM	6.0
SHUTDOWN DURATION,	39

Client:	GWF
Project Name:	Tracy Combined Cycle Conversion
Project Number:	160129.0050
Date:	January 30, 2008

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-7
Shutdown Emission Rates - Event Data at 59°F

GWF - Tracy (59°F, 60% RH, 14.61psia)

2X1 GE 7EA SHUTDOWN EMISSIONS ESTIMATES	
	SHUTDOWN
NOx, LBM	77
CO, LBM	99
UHC, LBM	8.2
VOC, LBM	1.7
SO2, LBM	2.1
PARTICULATES, LBM (FRONT HALF)	3.0
PARTICULATES, LBM (BACK HALF)	3.0
SHUTDOWN DURATION,	39

Client:	GWF
Project Name:	Tracy Combined Cycle Conversion
Project Number:	160129.0050
Date:	January 30, 2008

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-8
Shutdown Emission Rates - Event Data at 115°F

GWF - Tracy (115°F, 30% RH, 14.61psia)

2X1 GE 7EA SHUTDOWN EMISSIONS ESTIMATES	
	SHUTDOWN
NOx, LBM	200
CO, LBM	282
UHC, LBM	21
VOC, LBM	4.2
SO2, LBM	1.8
PARTICULATES, LBM (FRONT HALF)	3.0
PARTICULATES, LBM (BACK HALF)	3.0
SHUTDOWN DURATION,	39

Client:	GWF
Project Name:	Tracy Combined Cycle Conversion
Project Number:	160129.0050
Date:	January 30, 2008

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GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-9
Shutdown Emission Rates - Worst Case 1-Hour Emissions

2X1 GE 7EA WORST EMISSIONS ESTIMATES IN 1 HOUR DURING SHUTDOWN	
	WORST PERIOD EMISSIONS DURING SHUTDOWN
NOx, LBM	212
CO, LBM	298
VOC, LBM	6.3
SO2, LBM	2.5
PARTICULATES, LBM (FRONT HALF)	3.8
PARTICULATES, LBM (BACK HALF)	3.8
TOTAL PM, LBM	7.5
DURATION, MIN	60

Notes
Shutdown takes 39 minutes. Balance of hour filled with 21 minutes of 15F baseload emissions.

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-10
Summary of Turbine Emissions - Criteria Pollutants

March 20, 2008
2x1 7EA Combined Cycle
Peak, Base and Part Load Emission Estimates, Revision 3

Case Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CTG Model	7EA	7EA	7EA	7EA	7EA	7EA	7EA	7EA	7EA	7EA	7EA	7EA	7EA	7EA
CTG Fuel Type	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
CTG Load	100%	100%	100%	80%	60%	100%	100%	100%	80%	60%	100%	100%	80%	60%
CTG Inlet Air Cooling	Evap. Cooler	Off	Evap. Cooler	Off	Off	Evap. Cooler	Off	Evap. Cooler	Off	Off	Off	Off	Off	Off
CTG Steam/Water Injection	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Ambient Temperature, F	59	59	59	59	59	115	115	115	115	115	15	15	15	15
HRSG Duct Firing	Fired	Unfired	Unfired	Unfired	Unfired	Fired	Unfired	Unfired	Unfired	Unfired	Fired	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
CTG Heat Input, MBtu/h (LHV)	893	877	893	735	633	806	744	806	643	553	983	983	809	690
CTG Heat Input, MBtu/h (HHV)	991	974	991	816	702	895	826	895	714	614	1091	1091	899	766
Duct Burner Heat Input, MBtu/h (LHV)	292	0	0	0	0	292	0	0	0	0	292	0	0	0
Duct Burner Heat Input, MBtu/h (HHV)	324	0	0	0	0	324	0	0	0	0	324	0	0	0
NOx, ppmvd (dry, 15% O2)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
NOx, ppmvd (dry)	2.7	2	2	2	2	2.8	1.9	2	2	2	2.6	2	2	2
NOx, ppmvw (wet)	2.4	1.8	1.8	1.9	1.9	2.4	1.8	1.8	1.8	1.8	2.4	1.9	1.9	1.9
NOx, lb/h as NO2	9.6	7.2	7.3	6.1	5.3	8.9	6.2	6.7	5.4	4.6	10.3	8.1	6.7	5.7
NOx, lb/MBtu (LHV) as NO2 (incl. duct burner fuel)	0.0081	0.0082	0.0082	0.0083	0.0083	0.0081	0.0083	0.0083	0.0083	0.0084	0.0081	0.0082	0.0083	0.0083
NOx, lb/MBtu (HHV) as NO2 (incl. duct burner fuel)	0.0073	0.0074	0.0074	0.0075	0.0075	0.0073	0.0075	0.0074	0.0075	0.0076	0.0073	0.0074	0.0074	0.0075
SCR NH3 slip, ppmvd (dry, 15% O2)	5	5	5	5	5	5	5	5	5	5	5	5	5	5
SCR NH3 slip, lb/h	8.75	6.45	6.6	5.4	4.65	8.1	5.5	5.95	4.75	4.1	9.4	7.25	5.95	5.1
CO, ppmvd (dry, 15% O2)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CO, ppmvd (dry)	2.6	1.6	1.6	1.6	1.6	2.8	1.6	1.6	1.6	1.9	2.6	1.6	2	2
CO, ppmvw (wet)	2.4	1.5	1.5	1.5	1.5	2.4	1.5	1.5	1.5	1.7	2.3	1.5	1.8	1.9
CO, lb/h	5.7	3.5	3.6	2.9	2.5	5.3	3	3.2	2.5	2.6	6	3.9	3.8	3.3
CO, lb/MBtu (LHV) (incl. duct burner fuel)	0.0048	0.004	0.004	0.0039	0.0039	0.0048	0.0041	0.004	0.0039	0.0047	0.0047	0.004	0.0047	0.0048
CO, lb/MBtu (HHV) (incl. duct burner fuel)	0.0043	0.0036	0.0036	0.0036	0.0035	0.0044	0.0037	0.0036	0.0035	0.0042	0.0043	0.0036	0.0042	0.0043
SO2, ppmvd (dry, 15% O2)	0.14	0.1407	0.1407	0.1407	0.1407	0.14	0.1407	0.1407	0.1407	0.1407	0.14	0.1407	0.1407	0.1407
SO2, ppmvd (dry)	0.19	0.1389	0.1397	0.1417	0.1436	0.19	0.137	0.1409	0.1428	0.1376	0.18	0.1406	0.1422	0.144
SO2, ppmvw (wet)	0.17	0.129	0.1294	0.1315	0.1332	0.17	0.1248	0.127	0.1298	0.1254	0.17	0.1314	0.1328	0.1344
SO2, lb/h	0.92	0.6848	0.6969	0.5739	0.494	0.86	0.5807	0.6289	0.5019	0.4316	1	0.7673	0.6319	0.5385
SO2, lb/MBtu (LHV) (incl. duct burner fuel)	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
SO2, lb/MBtu (HHV) (incl. duct burner fuel)	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007
VOC, ppmvd (dry, 15% O2)	2	1	1	1	1	2	1	1	1	1	2	1	1	1
VOC, ppmvd (dry)	2.5	0.8	0.8	0.8	0.8	2.8	0.8	0.9	0.8	1	2.4	0.8	0.9	0.9
VOC, ppmvw (wet)	2.3	0.8	0.8	0.8	0.8	2.4	0.8	0.8	0.8	0.9	2.2	0.8	0.9	0.9
VOC, lb/h as CH4	3.13	1.02	1.04	0.84	0.72	3.05	0.9	0.95	0.75	0.76	3.22	1.13	1.05	0.88
VOC, lb/MBtu (LHV) (incl. duct burner fuel)	0.0026	0.0012	0.0012	0.0011	0.0011	0.0028	0.0012	0.0012	0.0012	0.0014	0.0025	0.0011	0.0013	0.0013
VOC, lb/MBtu (HHV) (incl. duct burner fuel)	0.0024	0.0011	0.001	0.001	0.001	0.0025	0.0011	0.0011	0.001	0.0012	0.0023	0.001	0.0012	0.0012
PM10, lb/h	4.4	3.3	3.3	3.2	3.2	4.3	3.3	3.3	3.2	3.1	4.4	3.4	3.3	3.2
PM10, lb/MBtu (LHV) (incl. duct burner fuel)	0.0037	0.0038	0.0037	0.0044	0.005	0.0039	0.0044	0.0041	0.005	0.0057	0.0035	0.0035	0.0041	0.0047
PM10, lb/MBtu (HHV) (incl. duct burner fuel)	0.0033	0.0034	0.0034	0.004	0.0045	0.0035	0.0039	0.0037	0.0045	0.0051	0.0031	0.0031	0.0037	0.0042
PM2.5, lb/h	4.4	3.3	3.3	3.2	3.2	4.3	3.3	3.3	3.2	3.1	4.4	3.4	3.3	3.2
PM2.5, lb/MBtu (LHV) (incl. duct burner fuel)	0.0037	0.0038	0.0037	0.0044	0.005	0.0039	0.0044	0.0041	0.005	0.0057	0.0035	0.0035	0.0041	0.0047
PM2.5, lb/MBtu (HHV) (incl. duct burner fuel)	0.0033	0.0034	0.0034	0.004	0.0045	0.0035	0.0039	0.0037	0.0045	0.0051	0.0031	0.0031	0.0037	0.0042
Stack Exit Temperature, F	188	211	213	200	189	203	216	221	204	198	194	222	210	195
Stack Diameter, ft	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Stack Flow, lb/h	2405176	2359184	2391106	1939220	1647938	2190704	2052939	2176634	1705795	1519255	2615657	2601587	2118777	1784601
Stack Flow, scfm	535953	522952	530427	429860	365568	493274	458490	487566	380961	339300	580676	575384	468603	394694
Stack Flow, acfm	673048	680231	692225	550092	459775	633844	600485	643921	490416	432734	736307	760531	608442	501175
Stack Exit Velocity, ft/s	49	50	51	40	34	47	44	47	36	32	54	56	45	37
Stack Exhaust Moisture Content Percent Wet	9.25	7.10	7.34	7.22	7.30	11.90	8.88	9.86	9.11	8.90	8.27	6.51	6.57	6.65

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-11
Summary of Turbine Emissions - Ammonia and HAPs

Assume:

Maximum Daily Heat Input Case: Operating Conditions at 15F baseload for hourly emission estimate (1).

Unfired Operations Hours/Year	4900	Hours/Year
Fired Operations Hours/Year	3100	Hours/Year
Start/Shutdown Hours/Year	639	Hours/Year

Gas Heat Content =		1020 MMBtu/MMSCF	1 CTG+DB		1 CTG+DB	
	Hourly		Hourly		Annual	
CTG Heat Input	1,091	MMBtu/Hr HHV	1.070	MMCF/Hr	9243	MMCF/Yr
DB Heat Input	324	MMBtu/Hr HHV	0.318	MMCF/Hr	984	MMCF/Yr
Total Heat Input	1415	MMBtu/Hr HHV	1.387	MMCF/Hr	10227	MMCF/Yr

				Turbine Emissions					
Compound	Emission Factor (Lb/MMCF)[a]	Maximum CTG and DB Heat Input (mmBtu/hr)	Gas Input (MMCF/hr)	lb/hr/CT	lb/hr/2-CT	lb/yr/CT	TPY/CT	lb/yr/2-CT	TPY/2-CT
Ammonia[b]	5 ppm	1,415	1.387	9.6	19.3	47200	23.6	94401	47.2
Acetaldehyde	0.137	1,415	1.387	0.19	0.380	1401	0.7	2802	1.4
Acrolein	0.0189	1,415	1.387	0.026	0.052	193.3	0.10	387	0.19
Benzene	0.0133	1,415	1.387	0.018	0.037	136	0.07	272	0.14
1,3-Butadiene	0.000127	1,415	1.387	0.00018	0.0004	1.3	0.0006	3	0.0013
Ethylbenzene	0.0179	1,415	1.387	0.025	0.050	183	0.09	366	0.18
Formaldehyde	0.917	1,415	1.387	1.3	2.5	9378	4.7	18757	9.4
Hexane	0.259	1,415	1.387	0.36	0.72	2649	1.3	5298	2.6
Naphthalene	0.00166	1,415	1.387	0.0023	0.005	17.0	0.008	34	0.017
PAHs[c]	0.000014	1,415	1.387	0.00002	0.000	0.14	0.00007	0.3	0.00014
Propylene	0.771	1,415	1.387	1.07	2.14	7885.2	3.9	15770	7.9
Propylene Oxide	0.0478	1,415	1.387	0.066	0.13	489	0.24	978	0.49
Toluene	0.071	1,415	1.387	0.099	0.20	726	0.4	1452	0.7
Xylene	0.0261	1,415	1.387	0.036	0.072	267	0.13	534	0.3
TOTAL HAPs						23326	11.7	46653	23.3

Notes:

(1) Source - GWF Spreadsheet dated March 20, 2008

[a] Obtained from the California Air Toxics Emission Factors (CATEF) database.

[b] Based on an exhaust NH_3 limit of 5 ppmv @ 15% O_2 and a F-factor of 8710.

[c] Carcinogenic PAHs only; naphthalene considered separately. Emission Factor based on two separate source tests (2002 and 2004) from the Delta Energy Center located in Pittsburg, CA.

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-12
Summary of Turbine Emissions - Greenhouse Gas Pollutants

Turbine Natural Gas Use: 20,863,661 MMBtu/yr

	Emission Factor (kg/MMBtu)	Emissions (metric tons/year)
CO2	53.06	1,107,026
CH4	0.0059	123
N2O	0.0001	2

CO2 emission factor from CCAR General Reporting Protocol (version 3.0, April 2008) Table C.6.
CH4 and N2O emission factors from CCAR General Reporting Protocol (version 3.0, April 2008) Table C.7.

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-13
Summary of Auxiliary Boiler Emissions - Criteria, HAPS, and Greenhouse Gas Pollutants

Operating Data

Annual Operating Hours	4000	
Daily Operating Hours	24	
Fuel Heat content (HHV)	1,005	Btu/scf
Fuel Heat content (LHV)	906	Btu/scf
Fuel S Content	0.25	gr/100dscf
Heat Input	85.0	MMBTU/hr
Fuel Input	0.0938	MMscf/hr

Emissions Data

	Emission Factor (lb/MMBtu)	Hourly Emissions (lb/hr)	g/s	Daily g/s	Annual g/s	Annual (ton/yr)
NOx (lb/MMBTU)	0.0073	0.62	0.078	0.078	0.036	1.24
CO (lb/MMBTU)	0.03697	3.14	0.396	0.396	0.181	6.28
VOC (lb/MMBTU)	0.005	0.43	0.054	0.054	0.024	0.85
SOx (as SO2) (lb/MMBTU)	0.0006	0.051	0.0064	0.0064	0.0029	0.10
PM10 (lb/MMBTU)	0.01	0.60	0.075	0.075	0.034	1.19

Note: Emission factors from vendor. GWF email dated 3-27-08.

			Annual (metric ton/yr)
CO2 (kg/MMBtu)	53.06	29.24	18040.4
CH4 (kg/MMBtu)	0.0059	1.11	2.006
N2O (kg/MMBtu)	0.0001	0.02	0.034

CO2 emission factor from CCAR General Reporting Protocol (version 3.0, April 2008) Table C.6

CH4 and N2O emission factors from CCAR General Reporting Protocol (version 3.0, April 2008) Table C.7.

Auxiliary Boiler HAP Emission Calculations

Daily Operating Hours	24	
Annual Operating Hours	4,000	
Fuel Usage	0.0938	MMscf/hr

HAP

	Emission Factor Lb/MMSCF	Lb/Hr	Lb/Day	TPY
benzene (1)	0.00431	0.0004	0.010	0.0008
formaldehyde (1)	0.0221	0.0021	0.050	0.004
acetaldehyde (1)	0.00887	0.0008	0.020	0.002
toluene (2)	0.0034	0.0003	0.008	0.0006
Copper (2)	0.00085	0.0001	0.002	0.00016
Nickel (2)	0.0021	0.0002	0.005	0.0004
			Total (ton/yr)	0.0078

(1) Source - CATEF, Emission Factors for Natural Gas Fired Boiler, Website Accessed May 19, 2008
(2) Source - AP-42, Tables 1.4-3 and 1.4-4, revised 7/98. Use of only C or better emission factors.

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-14
Summary of Emergency Backup Generator Emissions - Criteria, HAPS, and Greenhouse Gas Pollutants

Given: Existing 300 kW electric generator powered by a 471 HP Caterpiller Model 3456 DI TA AA diesel-fired emergency generator (Assume Tier 2)

Assume: Engine operates a maximum of 24 hours per day/50 hours per year for maintenance and reliability testing.

Fraction of Hour Operated:	1		(hourly emission rate assumes a maximum of 60 minutes of operation per hour)
Max Hours/Day	24		
Total Hours/Year	50		
Rated Horsepower	471		
Max Hourly Fuel usage:	22.3	Gal/hr	(engine manufacturer data)
Hourly Fuel Use:	22.3	Gal/hr	(assumes engine is operated for one hour)
	535.2	Gal/day	(assumes engine is operated 24 hours per day)
	1115	Gal/yr	(assumes 200 hours per year)

Engine Data Source - existing SJVAPCD operating permit (expiration date: 6/30/2009)
Maximum fuel usage based on the engine cut sheet on file with GWF
(phone conversation with Peter Lai on 05/28/2008 - 100% Load = 22.3 gph; 75% Load = 17.3 gph; 50% Load = 12.7 gph)

Pollutant	Emission Factor[1]	Emissions		
	Grams/Brake-Horsepower-Hour	lb/hr	lb/day	lb/yr
Hydrocarbons	0.04	0.042	1.0	2.1
Oxides of Nitrogen	4.69	4.9	117	243
Carbon Monoxide	0.12	0.12	3.0	6.2
Particulates	0.029	0.030	0.72	1.5
Sulfur Dioxide[2]	-	0.0047	0.11	0.24
	kg/gal	**lb/hr**	**lb/day**	**metric tons/yr**
Carbon Dioxide[3]	10.15	499	11976	11
Methane[4]	0.0003	0.015	0.35	0.0003
Nitrous Oxide[4]	0.0001	0.005	0.12	0.00011

1. Emission factors from the SJVAPCD operating permit. (Expiration Date: 6/30/2009).
2. Calculated from fuel use of 22.3 gal/hr, fuel density of 7.05 lb/gal, fraction of hour operated, and 15 ppmw of sulfur.
3. Based on CCAR General Reporting Protocol (version 3.0, April 2008) Table C.6 emission factor for distallate oil of 10.15 kg/gal.
4. Based on CCAR General Reporting Protocol (version 3.0, April 2008) Table C.7 emission factor for distallate oil of 0.0003 kg CH4 /gal and 0.0001 kg N2O/gal.

Hourly Fuel Use:	22.3	Gal/hr	0.0223	1000 Gal/hr
	22.3	Gal/day	0.0223	1000 Gal/day
	1115	Gal/yr	1.115	1000 Gal/yr

Pollutant	Emission Factor lb/1000 gallons	Emissions		
		lb/hr	lb/day	lb/yr
Benzene	0.1863	0.0042	0.0042	0.21
Formaldehyde	1.7261	0.038	0.038	1.9
PAHs - Naphthalene	0.0559	0.0012	0.0012	0.062
Naphthalene	0.0197	0.00044	0.00044	0.022
Acetaldehyde	0.7833	0.017	0.017	0.87
Acrolein	0.0339	0.0008	0.0008	0.038
1,3 Butadiene	0.2174	0.0048	0.0048	0.24
Chlorobenzene	0.0002	0.0000045	0.0000045	0.00022
Dioxins	ND	ND	ND	ND
Furans	ND	ND	ND	ND
Propylene	0.467	0.010	0.010	0.52
Hexane	0.0269	0.00060	0.00060	0.030
Toluene	0.1054	0.0024	0.0024	0.12
Xylenes	0.0424	0.0009	0.0009	0.047
Ethyl Benzene	0.0109	0.0002	0.0002	0.012
Hydrogen Chloride	0.1863	0.0042	0.0042	0.21
Arsenic	0.0016	0.000036	0.000036	0.0018
Beryllium	ND	ND	ND	ND
Cadmium	0.0015	0.000033	0.000033	0.0017
Total Chromium	0.0006	0.000013	0.000013	0.00067
Hexavalent Chromium	0.0001	0.0000022	0.0000022	0.00011
Copper	0.0041	0.000091	0.000091	0.0046
Lead	0.0083	0.00019	0.00019	0.0093
Manganese	0.0031	0.000069	0.000069	0.0035
Mercury	0.002	0.000045	0.000045	0.0022
Nickel	0.0039	0.000087	0.000087	0.0043
Selenium	0.0022	0.000049	0.000049	0.0025
Zinc	0.0224	0.00050	0.00050	0.0250
			Total (lb/yr)	4.4

Emission Factor Source - Ventura County APCD AB-2588 Combustion Emission Factors, dated May 17, 2001

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-15
Summary of Emergency Fire Pump Emissions - Criteria, HAPS, and Greenhouse Gas Pollutants

Given: Cummins Model CFP83-F40 (or equivalent) fire pump to be driven by 288 bHp diesel engine

Assume: Tier 3 engine
Engine operates a maximum of 24 hours per day/50 hours per year for maintenance and reliability testing

Rated Horsepower	288	
Max Hours/Day	24	
Hours/Year	50	
Fuel usage is	14.5	Gal/hr
	348	Gal/day
	725	Gal/yr

Based on 14.5 gallons per hour fuel consumption.
Engine Data Source - Email from Dave Odham dated 1/17/2008. Annual Operating data from Paul Kieffer dated 4-16-08

Pollutant	Emission Factor[1] Grams/Brake-Horsepower-Hour	Emissions lb/hr	lb/day	lb/yr
Hydrocarbons	0.16	0.10	2.4	5.1
Oxides of Nitrogen	2.67	1.7	41	85
Carbon Monoxide	2.39	1.5	36	76
Particulates	0.12	0.076	1.8	3.8
Sulfur Dioxide[2]	-	0.0031	0.0736	0.15
	kg/gal	**lb/hr**	**lb/day**	**metric tons/yr**
Carbon Dioxide[3]	10.15	324	7787	7
Methane[4]	0.0003	0.0096	0.23	0.0002
Nitrous Oxide[4]	0.0001	0.0032	0.077	0.0001

1. Emission factors from SCAQMD ICE Certified List for a Cummins Model QSL9-G2, dated 7/12/07
2. Calculated from fuel use of 14.5 gal/hr, fuel density of 7.05 lb/gal and 15 ppmw of sulfur.
3. Based on CCAR General Reporting Protocol (version 3.0, April 2008) Table C.6 emission factor for distallate oil of 10.15 kg/gal
4. Based on CCAR General Reporting Protocol (version 3.0, April 2008) Table C.7 emission factor for distallate oil of 0.0003 kg CH4 /gal and 0.0001 kg N2O/gal

Fuel usage is	14.5	Gal/hr	0.0145	1000 Gal/hr
	348	Gal/day	0.348	1000 Gal/day
	725	Gal/yr	0.725	1000 Gal/yr

Pollutant	Emission Factor lb/1000 gallons	Emissions lb/hr	lb/day	lb/yr
Benzene	0.1863	0.0027	0.065	0.14
Formaldehyde	1.7261	0.025	0.60	1.3
PAHs - Naphthalene	0.0559	0.00081	0.019	0.041
Naphthalene	0.0197	0.00029	0.0069	0.014
Acetaldehyde	0.7833	0.011	0.27	0.57
Acrolein	0.0339	0.00049	0.012	0.025
1,3 Butadiene	0.2174	0.0032	0.076	0.16
Chlorobenzene	0.0002	0.0000029	0.000070	0.00015
Dioxins	ND	ND	ND	ND
Furans	ND	ND	ND	ND
Propylene	0.467	0.0068	0.16	0.34
Hexane	0.0269	0.00039	0.0094	0.020
Toluene	0.1054	0.0015	0.037	0.076
Xylenes	0.0424	0.00061	0.015	0.031
Ethyl Benzene	0.0109	0.00016	0.0038	0.0079
Hydrogen Chloride	0.1863	0.0027	0.065	0.14
Arsenic	0.0016	0.000023	0.00056	0.0012
Beryllium	ND	ND	ND	ND
Cadmium	0.0015	0.000022	0.00052	0.0011
Total Chromium	0.0006	0.0000087	0.00021	0.00044
Hexavalent Chromium	0.0001	0.0000015	0.000035	0.000073
Copper	0.0041	0.000059	0.0014	0.0030
Lead	0.0083	0.00012	0.0029	0.0060
Manganese	0.0031	0.000045	0.00108	0.0022
Mercury	0.002	0.000029	0.00070	0.0015
Nickel	0.0039	0.000057	0.0014	0.0028
Selenium	0.0022	0.000032	0.00077	0.0016
Zinc	0.0224	0.00032	0.0078	0.016
			Total (lb/yr)	2.8

Emission Factor Source - Ventura County APCD AB-2588 Combustion Emission Factors, dated May 17, 2001

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-16
WSAC Cooling Tower Emissions

Calculation of Wet SAC Emissions

		Source
Water Flow Rate, lbm/hr	1,921,536	Calculated
Water Flow Rate, gal/min	3840	GWF email dated 5/2/08
Drift Rate, % of Recirculation Rate	0.005	GWF email dated 5/7/08
Drift, lbm water/hr	96.1	Calculated
TDS level, ppm (based on 5 COC)	2083	TPP Supplement Table 8.14-3.
Annual Hours of Operation (hrs/yr)	550	
PM10, lb/hr	0.20	Calculated
PM10, lb/day	4.8039	Calculated
PM10, tpy	0.0550	Calculated
Exhaust Gas Temperature (F)	85	GWF email dated 5/7/08
Exhaust Gas Mass Flow Rate (lb/hr)	1,267,000	GWF email dated 5/7/08
Design Heat Load (Btu/hr)	31,675,000	GWF email dated 5/7/08
Liquid to Gas Mass Flow Ratio	0.0243	Calculated
TDS Level from Supplement TTP AFC, Section 8.14, Table 8.14-3		

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-17
Facility Wide Greenhouse Gas Emission Summary

Source	Emissions (Metric tons per year)			
	CO_2	CH_4	N_2O	CO_2e
Turbines	1,107,026	123	2	1,110,258
Auxiliary Boiler	18,040	2.01	0.034	18,093
Fire Pump	7	0.00022	0.00007	7
Emergency Generator	11	0.000335	0.000112	11
Total	1,125,085	125	2	1,128,369

CO_2 Equivalent Emissions (metric tons/year) =[CO_2 Emissions (metric tons/year)] + [CH_4 Emissions (metric tons/year) x CH_4 GWP] + [NO_2 Emissions (metric tons/year) x NO_2 GWP]

Global Warming Potential

CH_4	21
N_2O	310

Reference: Intergovernmental Panel on Climate Change, Second Assessment Report (SAR) (IPCC, 1996).

GWF Tracy Combined Cycle Power Plant Project
Table 5.1B-18
Facility Wide Maximum Natural Gas Fuel Use

Total annual heat input per unit			
	Auxiliary Boiler	85	MMBtu/Hr
	Turbine	1091	MMBtu/Hr
	Duct Burner	324	MMBtu/Hr
Hours/Year			
	Turbine	8639	(includes startup and shutdowns)
	Duct Burner	3100	
	Auxiliary Boiler	4000	

Max Fuel Use	**Turbine**	**Duct Burner**	**Auxiliary Boiler**	**Total All Units**
Per Hour	1,091	324	85	2,915
Per Day	26,191	7,774	2,040	69,970
Per Year	9,427,741	1,004,090	340,000	21,203,661

Maximum daily fuel use is based on the maximum rated heat capacity multiplied by 24 hours/day

San Joaquin Valley
Air Pollution Control District

Northern Regional Office • 4230 Kiernan Avenue, Suite 130 • Modesto, CA 95356-9322

Emission Reduction Credit Certificate
N-320-3

ISSUED TO: HANFORD, L.P.

ISSUED DATE: March 5, 2003

LOCATION OF REDUCTION: 18800 S SPRECKELS RD
MANTECA, CA

For CO Reduction In The Amount Of:

Quarter 1	Quarter 2	Quarter 3	Quarter 4
4,941 lbs	72,468 lbs	72,385 lbs	64,622 lbs

[ ] Conditions Attached

Method Of Reduction

[ ] Shutdown of Entire Stationary Source
[ ] Shutdown of Emissions Units
[X] Other

BURNER RETROFIT ON TWO BOILERS (OLD#S 91-177&178)

Use of these credits outside the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) is not allowed without express written authorization by the SJVUAPCD.

David L. Crow, Executive Director / APCO

Seyed Sadredin, Director of Permit Services

Apr 14 2003 9:20AM -- POLLASTC

San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

Northern Regional Office • 4800 Enterprise Way • Modesto, CA 95356-8718

Emission Reduction Credit Certificate
N-575-5

ISSUED TO: GWF ENERGY, LLC

ISSUED DATE: January 29, 2007

LOCATION OF REDUCTION: 800 W CHURCH STREET
STOCKTON, CA

For SOx Reduction In The Amount Of:

Quarter 1	Quarter 2	Quarter 3	Quarter 4
50,000 lbs	50,000 lbs	50,000 lbs	50,000 lbs

[ ] Conditions Attached

Method Of Reduction

[ ] Shutdown of Entire Stationary Source
[ ] Shutdown of Emissions Units
[X] Other

Retrofit of two boilers with Low-NOx burners and reducing the fuel oil usage of those boilers.

Use of these credits outside the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) is not allowed without express written authorization by the SJVUAPCD.

Seyed Sadredin, Executive Director / APCO

David Warner, Director of Permit Services

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