20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	1	2	3
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	115	115	115
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Ambient Temperature, F	115.0	115.0	115.0
Ambient Relative Humidity, %	30.0	30.0	30.0
Atmospheric Pressure, psia	14.640	14.640	14.640
CTG Inlet Air Conditioning Effectiveness, %	0	0	0
CTG Compressor Inlet Dry Bulb Temperature, F	115.0	115.0	115.0
CTG Compr. Inlet Relative Humidity, %	30.1	30.1	30.1
Inlet Loss, in. H2O	4.5	4.5	4.5
Exhaust Loss, in. H2O	10.0	10.0	10.0
CTG Performance Reference	GTPE	GTPE	GTPE
CTG Load Level (percent of Base Load)	100%	80%	60%
Gross CTG Output, kW	66,536	53,229	39,922
Gross CTG Heat Rate, Btu/kWh (LHV)	11,180	12,080	13,850
Gross CTG Heat Rate, Btu/kWh (HHV)	12,405	13,404	15,368
CTG Heat Input, MBtu/h (LHV)	743.9	643.0	552.9
CTG Heat Input, MBtu/h (HHV)	825.4	713.5	613.5
CTG Water Injection Flow, lb/h	0	0	0
CTG Steam Injection Flow, lb/h	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	2,052,939	1,705,795	1,519,255
CTG Exhaust Temperature, F	1,041	1,095	1,100
Total CTG Fuel Flow, lb/h	35,890	31,020	26,670
CTG Fuel Temperature, F	80	80	80
CTG Fuel LHV, Btu/lb	20,728	20,728	20,728
CTG Fuel HHV, Btu/lb	23,000	23,000	23,000
HHV/LHV Ratio	1.1096	1.1096	1.1096
CTG Fuel Composition (Ultimate Analysis by Weight)			
Ar	0.00%	0.00%	0.00%
C	73.19%	73.19%	73.19%
H2	23.97%	23.97%	23.97%
N2	1.55%	1.55%	1.55%
O2	1.29%	1.29%	1.29%
S	0.00064%	0.00064%	0.00064%
Total	100.00%	100.00%	100.00%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	1	2	3
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	115	115	115
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions			
CTG Exhaust Analysis (Volume Basis - Wet)			
Ar	0.92%	0.92%	0.92%
CO2	3.01%	3.13%	3.02%
H2O	8.81%	9.04%	8.84%
N2	73.44%	73.35%	73.43%
O2	13.82%	13.56%	13.79%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	9.00	9.00	9.00
NOx, ppmvd	8.77	9.14	8.81
NOx, ppmvw (wet - uncorrected exhaust gas)	8.00	8.32	8.03
NOx, lb/h as NO2	27.7	24.1	20.9
NOx, lb/MBtu (LHV)	0.0373	0.0375	0.0377
NOx, lb/MBtu (HHV)	0.0336	0.0338	0.0340
CO, ppmvd @ 15% O2	25.64	24.60	29.62
CO, ppmvd	25.00	25.00	29.00
CO, ppmvw (wet - uncorrected exhaust gas)	22.80	22.74	26.44
CO, lb/h	46.4	38.4	39.8
CO, lb/MBtu (LHV)	0.0623	0.0598	0.0720
CO, lb/MBtu (HHV)	0.0562	0.0539	0.0649
NOTE: SO2 estimate does not include the effects of SO2 oxidation			
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvd (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	0.10	0.10	0.10
SO2, lb/h (with no SO2 oxidation)	0.46	0.40	0.34
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	1	2	3
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	115	115	115
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions - continued			
UHC, ppmvd @ 15% O2	7.87	7.57	8.96
UHC, ppmvd	7.68	7.70	8.78
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	8.00
UHC, lb/h as CH4	8.2	6.8	6.9
UHC, lb/MBtu as CH4 (LHV)	0.0110	0.0105	0.0125
UHC, lb/MBtu as CH4 (HHV)	0.0099	0.0095	0.0112
VOC percentage of UHC	20%	20%	20%
VOC, ppmvd @ 15% O2	1.6	1.5	1.8
VOC, ppmvd	1.54	1.54	1.76
VOC, ppmvw (wet - uncorrected exhaust flow)	1.40	1.40	1.60
VOC, lb/h as CH4	1.6	1.4	1.4
VOC, lb/MBtu as CH4 (LHV)	0.0022	0.0021	0.0025
VOC, lb/MBtu as CH4 (HHV)	0.0020	0.0019	0.0022
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (LHV) (front half catch only)	0.0067	0.0078	0.0090
Particulates, lb/MBtu (HHV) (front half catch only)	0.0061	0.0070	0.0081
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (LHV) (front and back half catch)	0.0134	0.0156	0.0181
PM10, lb/MBtu (HHV) (front and back half catch)	0.0121	0.0140	0.0163
CTG Wet (Total) Exhaust Gas Analysis			
Molecular Wt, lb/mol	28.28	28.26	28.28
Gas Constant, ft-lbf/lbm-R	54.640	54.670	54.640
Specific Volume, ft^3/lb	37.96	39.34	39.45
Exhaust Gas Flow, acfm	1,298,826	1,118,433	998,910
Specific Volume, scf/lb	13.42	13.42	13.42
Exhaust Gas Flow, scfm	459,174	381,530	339,807

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	1	2	3
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	115	115	115
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions			
NOTE: Exhaust Analysis does not include the effects of post combustion control			
Stack Exhaust Analysis (Volume Basis - Wet)			
Ar	0.93%	0.93%	0.93%
CO2	2.43%	2.42%	2.22%
H2O	7.70%	7.68%	7.29%
N2	73.87%	73.88%	74.03%
O2	15.07%	15.09%	15.53%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
Stack Emissions			
NOx, ppmvd @15% O2 w/o SCR (does not account for added margin	9.00	9.00	9.00
NOx, ppmvd w/o SCR	7.01	6.97	6.37
NOx, ppmvw w/o SCR	6.47	6.44	5.90
NOx, lb/h as NO2 w/o SCR (includes correction adder)	27.72	24.10	20.86
NOx, lb/MBtu (LHV) as NO2 w/o SCR	0.0373	0.0375	0.0377
NOx, lb/MBtu (HHV) as NO2 w/o SCR	0.0336	0.0338	0.0340
NOx, ppmvd @15% O2 w/ SCR	5.00	5.00	5.00
NOx, ppmvd w SCR	3.89	3.87	3.54
NOx, ppmvw w SCR	3.59	3.58	3.28
NOx, lb/h as NO2 w/ SCR (includes NOx margin applied to CTG)	15.40	13.39	11.59
NOx, lb/MBtu (LHV) as NO2 w SCR	0.0207	0.0208	0.0210
NOx, lb/MBtu (HHV) as NO2 w SCR	0.0187	0.0188	0.0189
SCR NH3 slip, ppmvd @15% O2	10.00	10.00	10.00
SCR NH3 slip, lb/h	10.99	9.50	8.17
CO, ppmvd @ 15% O2 w/o Catalyst	25.64	24.60	29.62
CO, ppmvd w/o Catalyst	19.96	19.06	20.95
CO, ppmvw w/o Catalyst	18.42	17.60	19.42
CO, lb/h w/o Catalyst (includes CO correction as applied to CTG and margin)	46.36	38.44	39.79
CO, lb/MBtu (LHV) w/o SCR	0.0623	0.0598	0.0720
CO, lb/MBtu (HHV) w/o SCR	0.0562	0.0539	0.0649
CO Reduction % w/ Catalyst	86%	86%	86%
CO, ppmvd @ 15% O2 w/ Catalyst	3.59	3.44	4.15
CO, ppmvd w/ Catalyst	2.79	2.67	2.93
CO, ppmvw w/ Catalyst	2.58	2.46	2.72
CO, lb/h w/ Catalyst (includes CO margin applied to CTG)	6.49	5.38	5.57
CO, lb/MBtu (LHV) w SCR	0.0087	0.0084	0.0101
CO, lb/MBtu (HHV) w SCR	0.0079	0.0075	0.0091
SO2, ppmvd@15% O2 w/o scrubber (with no SO2 oxidation)	0.111	0.111	0.111
SO2, ppmvd w/o scrubber (with no SO2 oxidation)	0.09	0.09	0.08
SO2, ppmvw w/o scrubber (with no SO2 oxidation)	0.08	0.08	0.07
SO2, lb/h w/o scrubber (with no SO2 oxidation)	0.46	0.40	0.34
SO2, lb/MBtu (LHV) w/o scrubber	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) w/o scrubber	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	1	2	3
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	115	115	115
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions - continued			
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.			
UHC, ppmvd @ 15% O2	7.87	7.57	8.96
UHC, ppmvd	6.13	5.87	6.34
UHC, ppmvw	5.66	5.42	5.88
UHC, lb/h as CH4	8.15	6.78	6.90
UHC, lb/MBtu (LHV)	0.0110	0.0105	0.0125
UHC, lb/MBtu (HHV)	0.0099	0.0095	0.0112
VOC, ppmvd @ 15% O2 w/o Catalyst	1.57	1.51	1.79
VOC, ppmvd w/o Calatyst	1.23	1.17	1.27
VOC, ppmvw w/o Catalyst	1.13	1.08	1.18
VOC, lb/h as CH4 w/o Catalyst (includes correction adder)	1.63	1.36	1.38
VOC, lb/MBtu (LHV) w/o CO catalyst	0.0022	0.0021	0.0025
VOC, lb/MBtu (HHV) w/o CO catalyst	0.0020	0.0019	0.0022
VOC Reduction % w/ Catalyst	16%	16%	16%
VOC, ppmvd @ 15% O2 w/ Catalyst	1.32	1.27	1.51
VOC, ppmvd w/ Calatyst	1.03	0.99	1.07
VOC, ppmvw w/ Catalyst	0.95	0.91	0.99
VOC, lb/h as CH4 w/ Catalyst (includes VOC correction as applied to CTG)	1.37	1.14	1.16
VOC, lb/MBtu (LHV) w CO catalyst	0.0018	0.0018	0.0021
VOC, lb/MBtu (HHV) w CO catalyst	0.0017	0.0016	0.0019
Particulate without the effect of SO2 oxidation and SCR catalysts			
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/MBtu (front half catch only)	0.0067	0.0078	0.0090
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (front and back half catch)	0.0134	0.0156	0.0181
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/MBtu (front half catch only)	0.0067	0.0078	0.0090
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (front and back half catch)	0.0134	0.0156	0.0181
Particulate including the effect of SO2 oxidation and SCR catalysts [includes (NH4)2-(SO4)]			
Particulates, lb/h (front half catch only)	5.3	5.3	5.2
Particulates, lb/MBtu(front half catch only)	0.0071	0.0082	0.0094
Particulates, lb/h (front and back half catch)	10.3	10.3	10.2
Particulates, lb/MBtu(front and back half catch)	0.0138	0.0159	0.0185
PM10, lb/h (front half catch only)	5.3	5.3	5.2
PM10, lb/MBtu(front half catch only)	0.0071	0.0082	0.0094
PM10, lb/h (front and back half catch)	10.3	10.3	10.2
PM10, lb/MBtu(front and back half catch)	0.0138	0.0159	0.0185
NOTE: SO2 to SO3 conversion rate (assumed), wt%	30.0%	30.0%	30.0%
Remaining SO2 in Exhaust Gas, lb/h	0.32	0.28	0.24
Amount of SO2 converted to SO3, lb/h	0.14	0.12	0.10
Maximum Exhaust Gas ammonium sulfate [(NH4)2-(SO4)] (assuming 100% conversion from SO3), lb/h	0.29	0.25	0.21
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	0.21	0.18	0.16

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	1	2	3
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	115	115	115
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack			
Stack Exit Temperature, F	850	850	850
Stack Diameter, ft (estimated)	17.0	17.0	17.0
Stack Flow, lb/h	2,546,348	2,210,577	2,074,782
Stack Flow, scfm	567,836	492,959	462,331
Stack Flow, acfm	1,436,989	1,247,502	1,169,831
Stack Exit Velocity, ft/s	106.0	92.0	86.0
Post Combustion Emissions Control			
CO Catalyst			
CO removed in CO Catalyst, %wt	86%	86%	86%
CO removed in CO Catalyst, lb/h (includes CO correction as applied to CTG)	39.87	33.06	34.22
Selective Catalytic Reduction (SCR)			
NOx Removed, lb/h as NO2	12.32	10.71	9.27
NOx Removed, percent	44.4%	44.4%	44.4%
NH3 Slip, lb/h	11.0	9.5	8.2
Stack Exhaust Gas Analysis (Wet)			
Molecular Wt, lb/mol	28.3	28.3	28.4
Specific Volume, ft^3/lb	33.9	33.9	33.8
Specific Volume, scf/lb	13.4	13.4	13.4

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The dry air composition used is 0.98% Ar, 78.03% N2 and 20.99%O2
3. Standard conditions are defined as 60 F, 14.696 psia, Norm conditions are defined as 0 C, 1.103 bar
4. The CTG performance is a General Electric GTPE estimate.
5. The VOC oxidation rates are Black & Veatch estimates based on typical data.
6. UHC calculations do not include the effects of oxidation in the CO catalyst. The VOC/UHC ratio is assumed to be 20% for natural gas firing (typical for GE turbines).
7. The front half catch of particulate emissions is assumed to be half the amount of the front and back half catch.
8. Ammonium sulfates created downstream of the SCR are included in front half particulates and front&back half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
9. The SO2 oxidation rate was assumed to be 30%.

SR4/2 Preparer: J.Arthur Filepath: c:_project\patrick\tracy\[emission2-8ne.xls]input Reviewer: P.Elrod

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	4	5	6
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	98	98	98
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Ambient Temperature, F	98.0	98.0	98.0
Ambient Relative Humidity, %	24.0	24.0	24.0
Atmospheric Pressure, psia	14.640	14.640	14.640
CTG Inlet Air Conditioning Effectiveness, %	0	0	0
CTG Compressor Inlet Dry Bulb Temperature, F	98.0	98.0	98.0
CTG Compr. Inlet Relative Humidity, %	24.2	24.2	24.2
Inlet Loss, in. H2O	4.5	4.5	4.5
Exhaust Loss, in. H2O	10.0	10.0	10.0
CTG Performance Reference	GTPE	GTPE	GTPE
CTG Load Level (percent of Base Load)	100%	80%	60%
Gross CTG Output, kW	71,554	57,249	42,934
Gross CTG Heat Rate, Btu/kWh (LHV)	10,930	11,710	13,430
Gross CTG Heat Rate, Btu/kWh (HHV)	12,128	12,993	14,902
CTG Heat Input, MBtu/h (LHV)	782.1	670.4	576.6
CTG Heat Input, MBtu/h (HHV)	867.8	743.9	639.8
CTG Water Injection Flow, lb/h	0	0	0
CTG Steam Injection Flow, lb/h	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	2,150,698	1,775,623	1,558,159
CTG Exhaust Temperature, F	1,027	1,080	1,100
Total CTG Fuel Flow, lb/h	37,730	32,340	27,820
CTG Fuel Temperature, F	80	80	80
CTG Fuel LHV, Btu/lb	20,728	20,728	20,728
CTG Fuel HHV, Btu/lb	23,000	23,000	23,000
HHV/LHV Ratio	1.1096	1.1096	1.1096
CTG Fuel Composition (Ultimate Analysis by Weight)			
Ar	0.00%	0.00%	0.00%
C	73.19%	73.19%	73.19%
H2	23.97%	23.97%	23.97%
N2	1.55%	1.55%	1.55%
O2	1.29%	1.29%	1.29%
S	0.00064%	0.00064%	0.00064%
Total	100.00%	100.00%	100.00%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	4	5	6
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	98	98	98
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions			
CTG Exhaust Analysis (Volume Basis - Wet)			
Ar	0.94%	0.94%	0.94%
CO2	3.04%	3.15%	3.09%
H2O	7.36%	7.58%	7.46%
N2	74.59%	74.50%	74.55%
O2	14.07%	13.82%	13.96%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	9.00	9.00	9.00
NOx, ppmvd	8.72	9.07	8.88
NOx, ppmvw (wet - uncorrected exhaust gas)	8.07	8.38	8.22
NOx, lb/h as NO2	29.1	25.1	21.7
NOx, lb/MBtu (LHV)	0.0372	0.0374	0.0377
NOx, lb/MBtu (HHV)	0.0335	0.0337	0.0339
CO, ppmvd @ 15% O2	25.81	24.82	25.34
CO, ppmvd	25.00	25.00	25.00
CO, ppmvw (wet - uncorrected exhaust gas)	23.16	23.10	23.13
CO, lb/h	49.1	40.4	35.5
CO, lb/MBtu (LHV)	0.0627	0.0603	0.0616
CO, lb/MBtu (HHV)	0.0565	0.0543	0.0555
NOTE: SO2 estimate does not include the effects of SO2 oxidation			
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvd (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	0.10	0.10	0.10
SO2, lb/h (with no SO2 oxidation)	0.48	0.41	0.36
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	4	5	6
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	98	98	98
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions - continued			
UHC, ppmvd @ 15% O2	7.80	7.52	12.05
UHC, ppmvd	7.56	7.57	11.89
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	11.00
UHC, lb/h as CH4	8.5	7.0	9.7
UHC, lb/MBtu as CH4 (LHV)	0.0109	0.0105	0.0168
UHC, lb/MBtu as CH4 (HHV)	0.0098	0.0094	0.0151
VOC percentage of UHC	20%	20%	13%
VOC, ppmvd @ 15% O2	1.6	1.5	1.5
VOC, ppmvd	1.51	1.51	1.51
VOC, ppmvw (wet - uncorrected exhaust flow)	1.40	1.40	1.40
VOC, lb/h as CH4	1.7	1.4	1.2
VOC, lb/MBtu as CH4 (LHV)	0.0022	0.0021	0.0021
VOC, lb/MBtu as CH4 (HHV)	0.0020	0.0019	0.0019
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (LHV) (front half catch only)	0.0064	0.0075	0.0087
Particulates, lb/MBtu (HHV) (front half catch only)	0.0058	0.0067	0.0078
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (LHV) (front and back half catch)	0.0128	0.0149	0.0173
PM10, lb/MBtu (HHV) (front and back half catch)	0.0115	0.0134	0.0156
CTG Wet (Total) Exhaust Gas Analysis			
Molecular Wt, lb/mol	28.44	28.42	28.43
Gas Constant, ft-lbf/lbm-R	54.330	54.360	54.340
Specific Volume, ft^3/lb	37.39	38.74	39.23
Exhaust Gas Flow, acfm	1,340,244	1,146,461	1,018,776
Specific Volume, scf/lb	13.34	13.35	13.34
Exhaust Gas Flow, scfm	478,172	395,076	346,431

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	4	5	6
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	98	98	98
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions			
NOTE: Exhaust Analysis does not include the effects of post combustion control			
Stack Exhaust Analysis (Volume Basis - Wet)			
Ar	0.94%	0.94%	0.94%
CO2	2.52%	2.51%	2.33%
H2O	6.35%	6.34%	5.99%
N2	74.98%	74.99%	75.13%
O2	15.20%	15.22%	15.61%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
Stack Emissions			
NOx, ppmvd @15% O2 w/o SCR (does not account for added margin	9.00	9.00	9.00
NOx, ppmvd w/o SCR	7.15	7.12	6.59
NOx, ppmvw w/o SCR	6.69	6.67	6.19
NOx, lb/h as NO2 w/o SCR (includes correction adder)	29.09	25.08	21.71
NOx, lb/MBtu (LHV) as NO2 w/o SCR	0.0372	0.0374	0.0377
NOx, lb/MBtu (HHV) as NO2 w/o SCR	0.0335	0.0337	0.0339
NOx, ppmvd @15% O2 w/ SCR	5.00	5.00	5.00
NOx, ppmvd w SCR	3.97	3.96	3.66
NOx, ppmvw w SCR	3.72	3.71	3.44
NOx, lb/h as NO2 w/ SCR (includes NOx margin applied to CTG)	16.16	13.93	12.06
NOx, lb/MBtu (LHV) as NO2 w SCR	0.0207	0.0208	0.0209
NOx, lb/MBtu (HHV) as NO2 w SCR	0.0186	0.0187	0.0189
SCR NH3 slip, ppmvd @15% O2	10.00	10.00	10.00
SCR NH3 slip, lb/h	11.56	9.90	8.52
CO, ppmvd @ 15% O2 w/o Catalyst	25.81	24.82	25.34
CO, ppmvd w/o Catalyst	20.50	19.64	18.55
CO, ppmvw w/o Catalyst	19.20	18.40	17.44
CO, lb/h w/o Catalyst (includes CO correction as applied to CTG and margin)	49.06	40.43	35.51
CO, lb/MBtu (LHV) w/o SCR	0.0627	0.0603	0.0616
CO, lb/MBtu (HHV) w/o SCR	0.0565	0.0543	0.0555
CO Reduction % w/ Catalyst	86%	86%	86%
CO, ppmvd @ 15% O2 w/ Catalyst	3.61	3.47	3.55
CO, ppmvd w/ Catalyst	2.87	2.75	2.60
CO, ppmvw w/ Catalyst	2.69	2.58	2.44
CO, lb/h w/ Catalyst (includes CO margin applied to CTG)	6.87	5.66	4.97
CO, lb/MBtu (LHV) w SCR	0.0088	0.0084	0.0086
CO, lb/MBtu (HHV) w SCR	0.0079	0.0076	0.0078
SO2, ppmvd@15% O2 w/o scrubber (with no SO2 oxidation)	0.111	0.111	0.111
SO2, ppmvd w/o scrubber (with no SO2 oxidation)	0.09	0.09	0.08
SO2, ppmvw w/o scrubber (with no SO2 oxidation)	0.08	0.08	0.08
SO2, lb/h w/o scrubber (with no SO2 oxidation)	0.48	0.41	0.36
SO2, lb/MBtu (LHV) w/o scrubber	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) w/o scrubber	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	4	5	6
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	98	98	98
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions - continued			
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.			
UHC, ppmvd @ 15% O2	7.80	7.52	12.05
UHC, ppmvd	6.20	5.95	8.82
UHC, ppmvw	5.80	5.57	8.29
UHC, lb/h as CH4	8.49	7.01	9.67
UHC, lb/MBtu (LHV)	0.0109	0.0105	0.0168
UHC, lb/MBtu (HHV)	0.0098	0.0094	0.0151
VOC, ppmvd @ 15% O2 w/o Catalyst	1.56	1.50	1.53
VOC, ppmvd w/o Calatyst	1.24	1.19	1.12
VOC, ppmvw w/o Catalyst	1.16	1.11	1.06
VOC, lb/h as CH4 w/o Catalyst (includes correction adder)	1.70	1.40	1.23
VOC, lb/MBtu (LHV) w/o CO catalyst	0.0022	0.0021	0.0021
VOC, lb/MBtu (HHV) w/o CO catalyst	0.0020	0.0019	0.0019
VOC Reduction % w/ Catalyst	16%	16%	16%
VOC, ppmvd @ 15% O2 w/ Catalyst	1.31	1.26	1.29
VOC, ppmvd w/ Calatyst	1.04	1.00	0.94
VOC, ppmvw w/ Catalyst	0.97	0.94	0.89
VOC, lb/h as CH4 w/ Catalyst (includes VOC correction as applied to CTG)	1.43	1.18	1.03
VOC, lb/MBtu (LHV) w CO catalyst	0.0018	0.0018	0.0018
VOC, lb/MBtu (HHV) w CO catalyst	0.0016	0.0016	0.0016
Particulate without the effect of SO2 oxidation and SCR catalysts			
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/MBtu (front half catch only)	0.0064	0.0075	0.0087
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (front and back half catch)	0.0128	0.0149	0.0173
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/MBtu (front half catch only)	0.0064	0.0075	0.0087
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (front and back half catch)	0.0128	0.0149	0.0173
Particulate including the effect of SO2 oxidation and SCR catalysts [includes (NH4)2-(SO4)]			
Particulates, lb/h (front half catch only)	5.3	5.3	5.2
Particulates, lb/MBtu(front half catch only)	0.0068	0.0078	0.0091
Particulates, lb/h (front and back half catch)	10.3	10.3	10.2
Particulates, lb/MBtu(front and back half catch)	0.0132	0.0153	0.0177
PM10, lb/h (front half catch only)	5.3	5.3	5.2
PM10, lb/MBtu(front half catch only)	0.0068	0.0078	0.0091
PM10, lb/h (front and back half catch)	10.3	10.3	10.2
PM10, lb/MBtu(front and back half catch)	0.0132	0.0153	0.0177
NOTE: SO2 to SO3 conversion rate (assumed), wt%	30.0%	30.0%	30.0%
Remaining SO2 in Exhaust Gas, lb/h	0.34	0.29	0.25
Amount of SO2 converted to SO3, lb/h	0.15	0.12	0.11
Maximum Exhaust Gas ammonium sulfate [(NH4)2-(SO4)] (assuming 100% conversion from SO3), lb/h	0.30	0.26	0.22
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	0.22	0.19	0.16

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	4	5	6
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	98	98	98
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack			
Stack Exit Temperature, F	850	850	850
Stack Diameter, ft (estimated)	17.0	17.0	17.0
Stack Flow, lb/h	2,600,328	2,236,095	2,074,016
Stack Flow, scfm	576,839	496,040	459,740
Stack Flow, acfm	1,459,651	1,254,822	1,163,177
Stack Exit Velocity, ft/s	107.0	92.0	85.0
Post Combustion Emissions Control			
CO Catalyst			
CO removed in CO Catalyst, %wt	86%	86%	86%
CO removed in CO Catalyst, lb/h (includes CO correction as applied to CTG)	42.19	34.77	30.54
Selective Catalytic Reduction (SCR)			
NOx Removed, lb/h as NO2	12.93	11.15	9.65
NOx Removed, percent	44.4%	44.4%	44.4%
NH3 Slip, lb/h	11.6	9.9	8.5
Stack Exhaust Gas Analysis (Wet)			
Molecular Wt, lb/mol	28.5	28.5	28.5
Specific Volume, ft^3/lb	33.7	33.7	33.7
Specific Volume, scf/lb	13.3	13.3	13.3

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The dry air composition used is 0.98% Ar, 78.03% N2 and 20.99%O2
3. Standard conditions are defined as 60 F, 14.696 psia, Norm conditions are defined as 0 C, 1.103 bar
4. The CTG performance is a General Electric GTPE estimate.
5. The VOC oxidation rates are Black & Veatch estimates based on typical data.
6. UHC calculations do not include the effects of oxidation in the CO catalyst. The VOC/UHC ratio is assumed to be 20% for natural gas firing (typical for GE turbines).
7. The front half catch of particulate emissions is assumed to be half the amount of the front and back half catch.
8. Ammonium sulfates created downstream of the SCR are included in front half particulates and front&back half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
9. The SO2 oxidation rate was assumed to be 30%.

SR4/2 Preparer: J.Arthur Filepath: c:_project\patrick\tracy\[emission2-8ne.xls]input Reviewer: P.Elrod

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	7	8	9
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	59	59	59
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Ambient Temperature, F	59.0	59.0	59.0
Ambient Relative Humidity, %	60.0	60.0	60.0
Atmospheric Pressure, psia	14.640	14.640	14.640
CTG Inlet Air Conditioning Effectiveness, %	0	0	0
CTG Compressor Inlet Dry Bulb Temperature, F	59.0	59.0	59.0
CTG Compr. Inlet Relative Humidity, %	60.2	60.2	60.2
Inlet Loss, in. H2O	4.5	4.5	4.5
Exhaust Loss, in. H2O	10.0	10.0	10.0
CTG Performance Reference	GTPE	GTPE	GTPE
CTG Load Level (percent of Base Load)	100%	80%	60%
Gross CTG Output, kW	83,155	66,526	49,897
Gross CTG Heat Rate, Btu/kWh (LHV)	10,550	11,050	12,680
Gross CTG Heat Rate, Btu/kWh (HHV)	11,706	12,261	14,070
CTG Heat Input, MBtu/h (LHV)	877.3	735.1	632.7
CTG Heat Input, MBtu/h (HHV)	973.4	815.7	702.0
CTG Water Injection Flow, lb/h	0	0	0
CTG Steam Injection Flow, lb/h	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	2,359,184	1,939,220	1,647,938
CTG Exhaust Temperature, F	1,001	1,038	1,090
Total CTG Fuel Flow, lb/h	42,320	35,460	30,520
CTG Fuel Temperature, F	80	80	80
CTG Fuel LHV, Btu/lb	20,728	20,728	20,728
CTG Fuel HHV, Btu/lb	23,000	23,000	23,000
HHV/LHV Ratio	1.1096	1.1096	1.1096
CTG Fuel Composition (Ultimate Analysis by Weight)			
Ar	0.00%	0.00%	0.00%
C	73.19%	73.19%	73.19%
H2	23.97%	23.97%	23.97%
N2	1.55%	1.55%	1.55%
O2	1.29%	1.29%	1.29%
S	0.00064%	0.00064%	0.00064%
Total	100.00%	100.00%	100.00%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	7	8	9
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	59	59	59
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions			
CTG Exhaust Analysis (Volume Basis - Wet)			
Ar	0.94%	0.94%	0.94%
CO2	3.11%	3.17%	3.21%
H2O	7.06%	7.18%	7.26%
N2	74.88%	74.83%	74.80%
O2	14.01%	13.88%	13.79%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	9.00	9.00	9.00
NOx, ppmvd	8.90	9.08	9.20
NOx, ppmvw (wet - uncorrected exhaust gas)	8.27	8.43	8.53
NOx, lb/h as NO2	32.5	27.4	23.7
NOx, lb/MBtu (LHV)	0.0371	0.0373	0.0375
NOx, lb/MBtu (HHV)	0.0334	0.0336	0.0338
CO, ppmvd @ 15% O2	25.29	24.79	24.46
CO, ppmvd	25.00	25.00	25.00
CO, ppmvw (wet - uncorrected exhaust gas)	23.23	23.21	23.19
CO, lb/h	53.9	44.3	37.6
CO, lb/MBtu (LHV)	0.0615	0.0602	0.0594
CO, lb/MBtu (HHV)	0.0554	0.0543	0.0536
NOTE: SO2 estimate does not include the effects of SO2 oxidation			
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvd (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	0.10	0.10	0.11
SO2, lb/h (with no SO2 oxidation)	0.54	0.45	0.39
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	7	8	9
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	59	59	59
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions - continued			
UHC, ppmvd @ 15% O2	7.62	7.48	7.38
UHC, ppmvd	7.53	7.54	7.55
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	7.00
UHC, lb/h as CH4	9.3	7.7	6.5
UHC, lb/MBtu as CH4 (LHV)	0.0106	0.0104	0.0103
UHC, lb/MBtu as CH4 (HHV)	0.0096	0.0094	0.0093
VOC percentage of UHC	20%	20%	20%
VOC, ppmvd @ 15% O2	1.5	1.5	1.5
VOC, ppmvd	1.51	1.51	1.51
VOC, ppmvw (wet - uncorrected exhaust flow)	1.40	1.40	1.40
VOC, lb/h as CH4	1.9	1.5	1.3
VOC, lb/MBtu as CH4 (LHV)	0.0021	0.0021	0.0021
VOC, lb/MBtu as CH4 (HHV)	0.0019	0.0019	0.0019
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (LHV) (front half catch only)	0.0057	0.0068	0.0079
Particulates, lb/MBtu (HHV) (front half catch only)	0.0051	0.0061	0.0071
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (LHV) (front and back half catch)	0.0114	0.0136	0.0158
PM10, lb/MBtu (HHV) (front and back half catch)	0.0103	0.0123	0.0142
CTG Wet (Total) Exhaust Gas Analysis			
Molecular Wt, lb/mol	28.48	28.47	28.47
Gas Constant, ft-lbf/lbm-R	54.250	54.270	54.280
Specific Volume, ft^3/lb	36.68	37.62	38.94
Exhaust Gas Flow, acfm	1,442,248	1,215,891	1,069,512
Specific Volume, scf/lb	13.32	13.33	13.33
Exhaust Gas Flow, scfm	523,739	430,830	366,117

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	7	8	9
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	59	59	59
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions			
NOTE: Exhaust Analysis does not include the effects of post combustion control			
Stack Exhaust Analysis (Volume Basis - Wet)			
Ar	0.95%	0.95%	0.95%
CO2	2.53%	2.44%	2.43%
H2O	5.93%	5.75%	5.74%
N2	75.32%	75.39%	75.40%
O2	15.28%	15.47%	15.49%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
Stack Emissions			
NOx, ppmvd @15% O2 w/o SCR (does not account for added margin	9.00	9.00	9.00
NOx, ppmvd w/o SCR	7.14	6.87	6.85
NOx, ppmvw w/o SCR	6.71	6.47	6.45
NOx, lb/h as NO2 w/o SCR (includes correction adder)	32.51	27.40	23.73
NOx, lb/MBtu (LHV) as NO2 w/o SCR	0.0371	0.0373	0.0375
NOx, lb/MBtu (HHV) as NO2 w/o SCR	0.0334	0.0336	0.0338
NOx, ppmvd @15% O2 w/ SCR	5.00	5.00	5.00
NOx, ppmvd w SCR	3.97	3.82	3.80
NOx, ppmvw w SCR	3.73	3.60	3.59
NOx, lb/h as NO2 w/ SCR (includes NOx margin applied to CTG)	18.06	15.22	13.18
NOx, lb/MBtu (LHV) as NO2 w SCR	0.0206	0.0207	0.0208
NOx, lb/MBtu (HHV) as NO2 w SCR	0.0186	0.0187	0.0188
SCR NH3 slip, ppmvd @15% O2	10.00	10.00	10.00
SCR NH3 slip, lb/h	12.96	10.86	9.35
CO, ppmvd @ 15% O2 w/o Catalyst	25.29	24.79	24.46
CO, ppmvd w/o Catalyst	20.06	18.92	18.61
CO, ppmvw w/o Catalyst	18.87	17.83	17.54
CO, lb/h w/o Catalyst (includes CO correction as applied to CTG and margin)	53.91	44.27	37.60
CO, lb/MBtu (LHV) w/o SCR	0.0615	0.0602	0.0594
CO, lb/MBtu (HHV) w/o SCR	0.0554	0.0543	0.0536
CO Reduction % w/ Catalyst	86%	86%	86%
CO, ppmvd @ 15% O2 w/ Catalyst	3.54	3.47	3.42
CO, ppmvd w/ Catalyst	2.81	2.65	2.61
CO, ppmvw w/ Catalyst	2.64	2.50	2.46
CO, lb/h w/ Catalyst (includes CO margin applied to CTG)	7.55	6.20	5.26
CO, lb/MBtu (LHV) w SCR	0.0086	0.0084	0.0083
CO, lb/MBtu (HHV) w SCR	0.0078	0.0076	0.0075
SO2, ppmvd@15% O2 w/o scrubber (with no SO2 oxidation)	0.111	0.111	0.111
SO2, ppmvd w/o scrubber (with no SO2 oxidation)	0.09	0.09	0.08
SO2, ppmvw w/o scrubber (with no SO2 oxidation)	0.08	0.08	0.08
SO2, lb/h w/o scrubber (with no SO2 oxidation)	0.54	0.45	0.39
SO2, lb/MBtu (LHV) w/o scrubber	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) w/o scrubber	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	7	8	9
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	59	59	59
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions - continued			
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.			
UHC, ppmvd @ 15% O2	7.62	7.48	7.38
UHC, ppmvd	6.04	5.71	5.62
UHC, ppmvw	5.68	5.38	5.30
UHC, lb/h as CH4	9.30	7.65	6.50
UHC, lb/MBtu (LHV)	0.0106	0.0104	0.0103
UHC, lb/MBtu (HHV)	0.0096	0.0094	0.0093
VOC, ppmvd @ 15% O2 w/o Catalyst	1.52	1.50	1.48
VOC, ppmvd w/o Calatyst	1.21	1.14	1.12
VOC, ppmvw w/o Catalyst	1.14	1.08	1.06
VOC, lb/h as CH4 w/o Catalyst (includes correction adder)	1.86	1.53	1.30
VOC, lb/MBtu (LHV) w/o CO catalyst	0.0021	0.0021	0.0021
VOC, lb/MBtu (HHV) w/o CO catalyst	0.0019	0.0019	0.0019
VOC Reduction % w/ Catalyst	16%	16%	16%
VOC, ppmvd @ 15% O2 w/ Catalyst	1.28	1.26	1.24
VOC, ppmvd w/ Calatyst	1.02	0.96	0.94
VOC, ppmvw w/ Catalyst	0.96	0.90	0.89
VOC, lb/h as CH4 w/ Catalyst (includes VOC correction as applied to CTG)	1.56	1.29	1.09
VOC, lb/MBtu (LHV) w CO catalyst	0.0018	0.0017	0.0017
VOC, lb/MBtu (HHV) w CO catalyst	0.0016	0.0016	0.0016
Particulate without the effect of SO2 oxidation and SCR catalysts			
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/MBtu (front half catch only)	0.0057	0.0068	0.0079
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (front and back half catch)	0.0114	0.0136	0.0158
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/MBtu (front half catch only)	0.0057	0.0068	0.0079
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (front and back half catch)	0.0114	0.0136	0.0158
Particulate including the effect of SO2 oxidation and SCR catalysts [includes (NH4)2-(SO4)]			
Particulates, lb/h (front half catch only)	5.3	5.3	5.2
Particulates, lb/MBtu(front half catch only)	0.0061	0.0072	0.0083
Particulates, lb/h (front and back half catch)	10.3	10.3	10.2
Particulates, lb/MBtu(front and back half catch)	0.0118	0.0140	0.0162
PM10, lb/h (front half catch only)	5.3	5.3	5.2
PM10, lb/MBtu(front half catch only)	0.0061	0.0072	0.0083
PM10, lb/h (front and back half catch)	10.3	10.3	10.2
PM10, lb/MBtu(front and back half catch)	0.0118	0.0140	0.0162
NOTE: SO2 to SO3 conversion rate (assumed), wt%	30.0%	30.0%	30.0%
Remaining SO2 in Exhaust Gas, lb/h	0.38	0.32	0.27
Amount of SO2 converted to SO3, lb/h	0.16	0.14	0.12
Maximum Exhaust Gas ammonium sulfate [(NH4)2-(SO4)] (assuming 100% conversion from SO3), lb/h	0.34	0.28	0.24
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	0.25	0.21	0.18

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	7	8	9
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	59	59	59
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack			
Stack Exit Temperature, F	850	850	850
Stack Diameter, ft (estimated)	17.0	17.0	17.0
Stack Flow, lb/h	2,912,339	2,531,396	2,185,528
Stack Flow, scfm	645,083	560,282	483,730
Stack Flow, acfm	1,631,881	1,418,004	1,224,260
Stack Exit Velocity, ft/s	120.0	104.0	90.0
Post Combustion Emissions Control			
CO Catalyst			
CO removed in CO Catalyst, %wt	86%	86%	86%
CO removed in CO Catalyst, lb/h (includes CO correction as applied to CTG)	46.37	38.07	32.33
Selective Catalytic Reduction (SCR)			
NOx Removed, lb/h as NO2	14.45	12.18	10.54
NOx Removed, percent	44.4%	44.4%	44.4%
NH3 Slip, lb/h	13.0	10.9	9.3
Stack Exhaust Gas Analysis (Wet)			
Molecular Wt, lb/mol	28.5	28.6	28.6
Specific Volume, ft^3/lb	33.6	33.6	33.6
Specific Volume, scf/lb	13.3	13.3	13.3

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The dry air composition used is 0.98% Ar, 78.03% N2 and 20.99%O2
3. Standard conditions are defined as 60 F, 14.696 psia, Norm conditions are defined as 0 C, 1.103 bar
4. The CTG performance is a General Electric GTPE estimate.
5. The VOC oxidation rates are Black & Veatch estimates based on typical data.
6. UHC calculations do not include the effects of oxidation in the CO catalyst. The VOC/UHC ratio is assumed to be 20% for natural gas firing (typical for GE turbines).
7. The front half catch of particulate emissions is assumed to be half the amount of the front and back half catch.
8. Ammonium sulfates created downstream of the SCR are included in front half particulates and front&back half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
9. The SO2 oxidation rate was assumed to be 30%.

SR4/2 Preparer: J.Arthur Filepath: c:_project\patrick\tracy\[emission2-8ne.xls]input Reviewer: P.Elrod

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	10	11	12
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	36	36	36
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Ambient Temperature, F	36.0	36.0	36.0
Ambient Relative Humidity, %	86.0	86.0	86.0
Atmospheric Pressure, psia	14.640	14.640	14.640
CTG Inlet Air Conditioning Effectiveness, %	0	0	0
CTG Compressor Inlet Dry Bulb Temperature, F	36.0	36.0	36.0
CTG Compr. Inlet Relative Humidity, %	86.1	86.1	86.1
Inlet Loss, in. H2O	4.5	4.5	4.5
Exhaust Loss, in. H2O	10.0	10.0	10.0
CTG Performance Reference	GTPE	GTPE	GTPE
CTG Load Level (percent of Base Load)	100%	80%	60%
Gross CTG Output, kW	89,829	71,863	53,897
Gross CTG Heat Rate, Btu/kWh (LHV)	10,370	10,760	12,290
Gross CTG Heat Rate, Btu/kWh (HHV)	11,507	11,939	13,637
CTG Heat Input, MBtu/h (LHV)	931.5	773.2	662.4
CTG Heat Input, MBtu/h (HHV)	1,033.6	858.0	735.0
CTG Water Injection Flow, lb/h	0	0	0
CTG Steam Injection Flow, lb/h	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	2,484,875	2,029,996	1,717,766
CTG Exhaust Temperature, F	984	1,018	1,068
Total CTG Fuel Flow, lb/h	44,940	37,300	31,960
CTG Fuel Temperature, F	80	80	80
CTG Fuel LHV, Btu/lb	20,728	20,728	20,728
CTG Fuel HHV, Btu/lb	23,000	23,000	23,000
HHV/LHV Ratio	1.1096	1.1096	1.1096
CTG Fuel Composition (Ultimate Analysis by Weight)			
Ar	0.00%	0.00%	0.00%
C	73.19%	73.19%	73.19%
H2	23.97%	23.97%	23.97%
N2	1.55%	1.55%	1.55%
O2	1.29%	1.29%	1.29%
S	0.00064%	0.00064%	0.00064%
Total	100.00%	100.00%	100.00%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	10	11	12
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	36	36	36
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions			
CTG Exhaust Analysis (Volume Basis - Wet)			
Ar	0.94%	0.94%	0.94%
CO2	3.14%	3.19%	3.23%
H2O	6.72%	6.82%	6.90%
N2	75.17%	75.13%	75.10%
O2	14.02%	13.92%	13.83%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	9.00	9.00	9.00
NOx, ppmvd	8.95	9.10	9.22
NOx, ppmvw (wet - uncorrected exhaust gas)	8.35	8.48	8.58
NOx, lb/h as NO2	34.5	28.8	24.8
NOx, lb/MBtu (LHV)	0.0370	0.0372	0.0374
NOx, lb/MBtu (HHV)	0.0333	0.0335	0.0337
CO, ppmvd @ 15% O2	25.14	24.73	24.40
CO, ppmvd	25.00	25.00	25.00
CO, ppmvw (wet - uncorrected exhaust gas)	23.32	23.30	23.28
CO, lb/h	56.9	46.5	39.3
CO, lb/MBtu (LHV)	0.0611	0.0601	0.0593
CO, lb/MBtu (HHV)	0.0551	0.0541	0.0535
NOTE: SO2 estimate does not include the effects of SO2 oxidation			
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvd (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	0.10	0.10	0.11
SO2, lb/h (with no SO2 oxidation)	0.58	0.48	0.41
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	10	11	12
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	36	36	36
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions - continued			
UHC, ppmvd @ 15% O2	7.55	7.43	7.34
UHC, ppmvd	7.50	7.51	7.52
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	7.00	7.00
UHC, lb/h as CH4	9.8	8.0	6.8
UHC, lb/MBtu as CH4 (LHV)	0.0105	0.0103	0.0102
UHC, lb/MBtu as CH4 (HHV)	0.0095	0.0093	0.0092
VOC percentage of UHC	20%	20%	20%
VOC, ppmvd @ 15% O2	1.5	1.5	1.5
VOC, ppmvd	1.50	1.50	1.50
VOC, ppmvw (wet - uncorrected exhaust flow)	1.40	1.40	1.40
VOC, lb/h as CH4	2.0	1.6	1.4
VOC, lb/MBtu as CH4 (LHV)	0.0021	0.0021	0.0020
VOC, lb/MBtu as CH4 (HHV)	0.0019	0.0019	0.0018
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (LHV) (front half catch only)	0.0054	0.0065	0.0075
Particulates, lb/MBtu (HHV) (front half catch only)	0.0048	0.0058	0.0068
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (LHV) (front and back half catch)	0.0107	0.0129	0.0151
PM10, lb/MBtu (HHV) (front and back half catch)	0.0097	0.0117	0.0136
CTG Wet (Total) Exhaust Gas Analysis			
Molecular Wt, lb/mol	28.52	28.51	28.51
Gas Constant, ft-lbf/lbm-R	54.180	54.190	54.200
Specific Volume, ft^3/lb	36.21	37.07	38.33
Exhaust Gas Flow, acfm	1,499,622	1,254,199	1,097,366
Specific Volume, scf/lb	13.30	13.31	13.31
Exhaust Gas Flow, scfm	550,814	450,321	381,058

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	10	11	12
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	36	36	36
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions			
NOTE: Exhaust Analysis does not include the effects of post combustion control			
Stack Exhaust Analysis (Volume Basis - Wet)			
Ar	0.95%	0.95%	0.95%
CO2	2.61%	2.51%	2.48%
H2O	5.68%	5.49%	5.42%
N2	75.58%	75.65%	75.68%
O2	15.19%	15.40%	15.48%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
Stack Emissions			
NOx, ppmvd @15% O2 w/o SCR (does not account for added margin	9.00	9.00	9.00
NOx, ppmvd w/o SCR	7.34	7.06	6.95
NOx, ppmvw w/o SCR	6.92	6.67	6.57
NOx, lb/h as NO2 w/o SCR (includes correction adder)	34.46	28.77	24.80
NOx, lb/MBtu (LHV) as NO2 w/o SCR	0.0370	0.0372	0.0374
NOx, lb/MBtu (HHV) as NO2 w/o SCR	0.0333	0.0335	0.0337
NOx, ppmvd @15% O2 w/ SCR	5.00	5.00	5.00
NOx, ppmvd w SCR	4.08	3.92	3.86
NOx, ppmvw w SCR	3.85	3.71	3.65
NOx, lb/h as NO2 w/ SCR (includes NOx margin applied to CTG)	19.15	15.99	13.78
NOx, lb/MBtu (LHV) as NO2 w SCR	0.0206	0.0207	0.0208
NOx, lb/MBtu (HHV) as NO2 w SCR	0.0185	0.0186	0.0187
SCR NH3 slip, ppmvd @15% O2	10.00	10.00	10.00
SCR NH3 slip, lb/h	13.76	11.42	9.79
CO, ppmvd @ 15% O2 w/o Catalyst	25.14	24.73	24.40
CO, ppmvd w/o Catalyst	20.50	19.39	18.85
CO, ppmvw w/o Catalyst	19.34	18.33	17.83
CO, lb/h w/o Catalyst (includes CO correction as applied to CTG and margin)	56.91	46.46	39.29
CO, lb/MBtu (LHV) w/o SCR	0.0611	0.0601	0.0593
CO, lb/MBtu (HHV) w/o SCR	0.0551	0.0541	0.0535
CO Reduction % w/ Catalyst	86%	86%	86%
CO, ppmvd @ 15% O2 w/ Catalyst	3.52	3.46	3.42
CO, ppmvd w/ Catalyst	2.87	2.71	2.64
CO, ppmvw w/ Catalyst	2.71	2.57	2.50
CO, lb/h w/ Catalyst (includes CO margin applied to CTG)	7.97	6.50	5.50
CO, lb/MBtu (LHV) w SCR	0.0086	0.0084	0.0083
CO, lb/MBtu (HHV) w SCR	0.0077	0.0076	0.0075
SO2, ppmvd@15% O2 w/o scrubber (with no SO2 oxidation)	0.111	0.111	0.111
SO2, ppmvd w/o scrubber (with no SO2 oxidation)	0.09	0.09	0.09
SO2, ppmvw w/o scrubber (with no SO2 oxidation)	0.09	0.08	0.08
SO2, lb/h w/o scrubber (with no SO2 oxidation)	0.58	0.48	0.41
SO2, lb/MBtu (LHV) w/o scrubber	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) w/o scrubber	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	10	11	12
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	36	36	36
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions - continued			
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.			
UHC, ppmvd @ 15% O2	7.55	7.43	7.34
UHC, ppmvd	6.15	5.83	5.67
UHC, ppmvw	5.81	5.51	5.36
UHC, lb/h as CH4	9.78	8.00	6.77
UHC, lb/MBtu (LHV)	0.0105	0.0103	0.0102
UHC, lb/MBtu (HHV)	0.0095	0.0093	0.0092
VOC, ppmvd @ 15% O2 w/o Catalyst	1.51	1.49	1.47
VOC, ppmvd w/o Calatyst	1.23	1.17	1.13
VOC, ppmvw w/o Catalyst	1.16	1.10	1.07
VOC, lb/h as CH4 w/o Catalyst (includes correction adder)	1.96	1.60	1.35
VOC, lb/MBtu (LHV) w/o CO catalyst	0.0021	0.0021	0.0020
VOC, lb/MBtu (HHV) w/o CO catalyst	0.0019	0.0019	0.0018
VOC Reduction % w/ Catalyst	16%	16%	16%
VOC, ppmvd @ 15% O2 w/ Catalyst	1.27	1.25	1.23
VOC, ppmvd w/ Calatyst	1.03	0.98	0.95
VOC, ppmvw w/ Catalyst	0.98	0.93	0.90
VOC, lb/h as CH4 w/ Catalyst (includes VOC correction as applied to CTG)	1.64	1.34	1.14
VOC, lb/MBtu (LHV) w CO catalyst	0.0018	0.0017	0.0017
VOC, lb/MBtu (HHV) w CO catalyst	0.0016	0.0016	0.0015
Particulate without the effect of SO2 oxidation and SCR catalysts			
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/MBtu (front half catch only)	0.0054	0.0065	0.0075
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (front and back half catch)	0.0107	0.0129	0.0151
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/MBtu (front half catch only)	0.0054	0.0065	0.0075
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (front and back half catch)	0.0107	0.0129	0.0151
Particulate including the effect of SO2 oxidation and SCR catalysts [includes (NH4)2-(SO4)]			
Particulates, lb/h (front half catch only)	5.4	5.3	5.3
Particulates, lb/MBtu(front half catch only)	0.0058	0.0068	0.0079
Particulates, lb/h (front and back half catch)	10.4	10.3	10.3
Particulates, lb/MBtu(front and back half catch)	0.0111	0.0133	0.0155
PM10, lb/h (front half catch only)	5.4	5.3	5.3
PM10, lb/MBtu(front half catch only)	0.0058	0.0068	0.0079
PM10, lb/h (front and back half catch)	10.4	10.3	10.3
PM10, lb/MBtu(front and back half catch)	0.0111	0.0133	0.0155
NOTE: SO2 to SO3 conversion rate (assumed), wt%	30.0%	30.0%	30.0%
Remaining SO2 in Exhaust Gas, lb/h	0.40	0.34	0.29
Amount of SO2 converted to SO3, lb/h	0.17	0.14	0.12
Maximum Exhaust Gas ammonium sulfate [(NH4)2-(SO4)] (assuming 100% conversion from SO3), lb/h	0.36	0.30	0.25
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	0.27	0.22	0.19

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	10	11	12
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	36	36	36
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack			
Stack Exit Temperature, F	850	850	850
Stack Diameter, ft (estimated)	17.0	17.0	17.0
Stack Flow, lb/h	3,003,074	2,588,134	2,250,327
Stack Flow, scfm	664,180	572,409	497,697
Stack Flow, acfm	1,680,720	1,448,061	1,258,683
Stack Exit Velocity, ft/s	123.0	106.0	92.0
Post Combustion Emissions Control			
CO Catalyst			
CO removed in CO Catalyst, %wt	86%	86%	86%
CO removed in CO Catalyst, lb/h (includes CO correction as applied to CTG)	48.95	39.95	33.79
Selective Catalytic Reduction (SCR)			
NOx Removed, lb/h as NO2	15.32	12.79	11.02
NOx Removed, percent	44.4%	44.4%	44.4%
NH3 Slip, lb/h	13.8	11.4	9.8
Stack Exhaust Gas Analysis (Wet)			
Molecular Wt, lb/mol	28.6	28.6	28.6
Specific Volume, ft^3/lb	33.6	33.6	33.6
Specific Volume, scf/lb	13.3	13.3	13.3

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The dry air composition used is 0.98% Ar, 78.03% N2 and 20.99%O2
3. Standard conditions are defined as 60 F, 14.696 psia, Norm conditions are defined as 0 C, 1.103 bar
4. The CTG performance is a General Electric GTPE estimate.
5. The VOC oxidation rates are Black & Veatch estimates based on typical data.
6. UHC calculations do not include the effects of oxidation in the CO catalyst. The VOC/UHC ratio is assumed to be 20% for natural gas firing (typical for GE turbines).
7. The front half catch of particulate emissions is assumed to be half the amount of the front and back half catch.
8. Ammonium sulfates created downstream of the SCR are included in front half particulates and front&back half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
9. The SO2 oxidation rate was assumed to be 30%.

SR4/2 Preparer: J.Arthur Filepath: c:_project\patrick\tracy\[emission2-8ne.xls]input Reviewer: P.Elrod

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	13	14	15
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	15	15	15
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Ambient Temperature, F	15.0	15.0	15.0
Ambient Relative Humidity, %	100.0	100.0	100.0
Atmospheric Pressure, psia	14.640	14.640	14.640
CTG Inlet Air Conditioning Effectiveness, %	0	0	0
CTG Compressor Inlet Dry Bulb Temperature, F	15.0	15.0	15.0
CTG Compr. Inlet Relative Humidity, %	100.0	100.0	100.0
Inlet Loss, in. H2O	4.5	4.5	4.5
Exhaust Loss, in. H2O	10.0	10.0	10.0
CTG Performance Reference	GTPE	GTPE	GTPE
CTG Load Level (percent of Base Load)	100%	80%	60%
Gross CTG Output, kW	95,904	76,721	57,538
Gross CTG Heat Rate, Btu/kWh (LHV)	10,250	10,550	11,990
Gross CTG Heat Rate, Btu/kWh (HHV)	11,373	11,706	13,304
CTG Heat Input, MBtu/h (LHV)	983.0	809.4	689.9
CTG Heat Input, MBtu/h (HHV)	1,090.8	898.1	765.5
CTG Water Injection Flow, lb/h	0	0	0
CTG Steam Injection Flow, lb/h	0	0	0
Injection Fluid/Fuel Ratio	0.0	0.0	0.0
CTG Exhaust Flow, lb/h	2,601,587	2,118,777	1,784,601
CTG Exhaust Temperature, F	968	999	1,048
Total CTG Fuel Flow, lb/h	47,420	39,050	33,280
CTG Fuel Temperature, F	80	80	80
CTG Fuel LHV, Btu/lb	20,728	20,728	20,728
CTG Fuel HHV, Btu/lb	23,000	23,000	23,000
HHV/LHV Ratio	1.1096	1.1096	1.1096
CTG Fuel Composition (Ultimate Analysis by Weight)			
Ar	0.00%	0.00%	0.00%
C	73.19%	73.19%	73.19%
H2	23.97%	23.97%	23.97%
N2	1.55%	1.55%	1.55%
O2	1.29%	1.29%	1.29%
S	0.00064%	0.00064%	0.00064%
Total	100.00%	100.00%	100.00%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	13	14	15
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	15	15	15
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions			
CTG Exhaust Analysis (Volume Basis - Wet)			
Ar	0.95%	0.95%	0.95%
CO2	3.17%	3.21%	3.24%
H2O	6.45%	6.52%	6.59%
N2	75.40%	75.37%	75.34%
O2	14.03%	13.95%	13.87%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
NOx, ppmvd @15% O2	9.00	9.00	9.00
NOx, ppmvd	9.00	9.11	9.22
NOx, ppmvw (wet - uncorrected exhaust gas)	8.42	8.51	8.61
NOx, lb/h as NO2	36.3	30.1	25.8
NOx, lb/MBtu (LHV)	0.0369	0.0372	0.0374
NOx, lb/MBtu (HHV)	0.0333	0.0335	0.0337
CO, ppmvd @ 15% O2	24.99	29.64	30.25
CO, ppmvd	25.00	30.00	31.00
CO, ppmvw (wet - uncorrected exhaust gas)	23.39	28.04	28.96
CO, lb/h	59.7	58.3	50.7
CO, lb/MBtu (LHV)	0.0607	0.0720	0.0735
CO, lb/MBtu (HHV)	0.0547	0.0649	0.0663
NOTE: SO2 estimate does not include the effects of SO2 oxidation			
SO2, ppmvd @ 15% O2 (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvd (with no SO2 oxidation)	0.11	0.11	0.11
SO2, ppmvw (with no SO2 oxidation)(wet - uncorrected exhaust gas)	0.10	0.11	0.11
SO2, lb/h (with no SO2 oxidation)	0.61	0.50	0.43
SO2, lb/MBtu (LHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) (with no SO2 oxidation)	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	13	14	15
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	15	15	15
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Combustion Turbine Exhaust Emissions - continued			
UHC, ppmvd @ 15% O2	7.48	8.46	8.36
UHC, ppmvd	7.48	8.56	8.56
UHC, ppmvw (wet - uncorrected exhaust gas)	7.00	8.00	8.00
UHC, lb/h as CH4	10.2	9.5	8.0
UHC, lb/MBtu as CH4 (LHV)	0.0104	0.0118	0.0116
UHC, lb/MBtu as CH4 (HHV)	0.0094	0.0106	0.0105
VOC percentage of UHC	20%	20%	20%
VOC, ppmvd @ 15% O2	1.5	1.7	1.7
VOC, ppmvd	1.50	1.71	1.71
VOC, ppmvw (wet - uncorrected exhaust flow)	1.40	1.60	1.60
VOC, lb/h as CH4	2.0	1.9	1.6
VOC, lb/MBtu as CH4 (LHV)	0.0021	0.0024	0.0023
VOC, lb/MBtu as CH4 (HHV)	0.0019	0.0021	0.0021
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (LHV) (front half catch only)	0.0051	0.0062	0.0072
Particulates, lb/MBtu (HHV) (front half catch only)	0.0046	0.0056	0.0065
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (LHV) (front and back half catch)	0.0102	0.0124	0.0145
PM10, lb/MBtu (HHV) (front and back half catch)	0.0092	0.0111	0.0131
CTG Wet (Total) Exhaust Gas Analysis			
Molecular Wt, lb/mol	28.55	28.55	28.54
Gas Constant, ft-lbf/lbm-R	54.120	54.120	54.130
Specific Volume, ft^3/lb	35.77	36.55	37.78
Exhaust Gas Flow, acfm	1,550,979	1,290,688	1,123,704
Specific Volume, scf/lb	13.29	13.29	13.29
Exhaust Gas Flow, scfm	576,251	469,309	395,289

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	13	14	15
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	15	15	15
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions			
NOTE: Exhaust Analysis does not include the effects of post combustion control			
Stack Exhaust Analysis (Volume Basis - Wet)			
Ar	0.95%	0.95%	0.95%
CO2	2.75%	2.69%	2.58%
H2O	5.63%	5.51%	5.29%
N2	75.72%	75.77%	75.85%
O2	14.95%	15.09%	15.32%
SO2	0.00001%	0.00001%	0.00001%
Total	100.0%	100.0%	100.0%
Stack Emissions			
NOx, ppmvd @15% O2 w/o SCR (does not account for added margin	9.00	9.00	9.00
NOx, ppmvd w/o SCR	7.74	7.55	7.23
NOx, ppmvw w/o SCR	7.30	7.13	6.84
NOx, lb/h as NO2 w/o SCR (includes correction adder)	36.31	30.08	25.78
NOx, lb/MBtu (LHV) as NO2 w/o SCR	0.0369	0.0372	0.0374
NOx, lb/MBtu (HHV) as NO2 w/o SCR	0.0333	0.0335	0.0337
NOx, ppmvd @15% O2 w/ SCR	5.00	5.00	5.00
NOx, ppmvd w SCR	4.30	4.19	4.02
NOx, ppmvw w SCR	4.06	3.96	3.80
NOx, lb/h as NO2 w/ SCR (includes NOx margin applied to CTG)	20.17	16.71	14.32
NOx, lb/MBtu (LHV) as NO2 w SCR	0.0205	0.0206	0.0208
NOx, lb/MBtu (HHV) as NO2 w SCR	0.0185	0.0186	0.0187
SCR NH3 slip, ppmvd @15% O2	10.00	10.00	10.00
SCR NH3 slip, lb/h	14.52	11.96	10.19
CO, ppmvd @ 15% O2 w/o Catalyst	24.99	29.64	30.25
CO, ppmvd w/o Catalyst	21.49	24.86	24.29
CO, ppmvw w/o Catalyst	20.28	23.49	23.01
CO, lb/h w/o Catalyst (includes CO correction as applied to CTG and margin)	59.69	58.30	50.71
CO, lb/MBtu (LHV) w/o SCR	0.0607	0.0720	0.0735
CO, lb/MBtu (HHV) w/o SCR	0.0547	0.0649	0.0663
CO Reduction % w/ Catalyst	86%	86%	86%
CO, ppmvd @ 15% O2 w/ Catalyst	3.50	4.15	4.24
CO, ppmvd w/ Catalyst	3.01	3.48	3.40
CO, ppmvw w/ Catalyst	2.84	3.29	3.22
CO, lb/h w/ Catalyst (includes CO margin applied to CTG)	8.36	8.16	7.10
CO, lb/MBtu (LHV) w SCR	0.0085	0.0101	0.0103
CO, lb/MBtu (HHV) w SCR	0.0077	0.0091	0.0093
SO2, ppmvd@15% O2 w/o scrubber (with no SO2 oxidation)	0.111	0.111	0.111
SO2, ppmvd w/o scrubber (with no SO2 oxidation)	0.10	0.09	0.09
SO2, ppmvw w/o scrubber (with no SO2 oxidation)	0.09	0.09	0.08
SO2, lb/h w/o scrubber (with no SO2 oxidation)	0.61	0.50	0.43
SO2, lb/MBtu (LHV) w/o scrubber	0.0006	0.0006	0.0006
SO2, lb/MBtu (HHV) w/o scrubber	0.0006	0.0006	0.0006

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	13	14	15
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	15	15	15
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack Emissions - continued			
NOTE: UHC calculations do NOT include the effect of any oxidation in the CO catalyst.			
UHC, ppmvd @ 15% O2	7.48	8.46	8.36
UHC, ppmvd	6.43	7.09	6.71
UHC, ppmvw	6.07	6.70	6.36
UHC, lb/h as CH4	10.23	9.53	8.02
UHC, lb/MBtu (LHV)	0.0104	0.0118	0.0116
UHC, lb/MBtu (HHV)	0.0094	0.0106	0.0105
VOC, ppmvd @ 15% O2 w/o Catalyst	1.50	1.69	1.67
VOC, ppmvd w/o Calatyst	1.29	1.42	1.34
VOC, ppmvw w/o Catalyst	1.21	1.34	1.27
VOC, lb/h as CH4 w/o Catalyst (includes correction adder)	2.05	1.91	1.60
VOC, lb/MBtu (LHV) w/o CO catalyst	0.0021	0.0024	0.0023
VOC, lb/MBtu (HHV) w/o CO catalyst	0.0019	0.0021	0.0021
VOC Reduction % w/ Catalyst	16%	16%	16%
VOC, ppmvd @ 15% O2 w/ Catalyst	1.26	1.42	1.40
VOC, ppmvd w/ Calatyst	1.08	1.19	1.13
VOC, ppmvw w/ Catalyst	1.02	1.13	1.07
VOC, lb/h as CH4 w/ Catalyst (includes VOC correction as applied to CTG)	1.72	1.60	1.35
VOC, lb/MBtu (LHV) w CO catalyst	0.0017	0.0020	0.0020
VOC, lb/MBtu (HHV) w CO catalyst	0.0016	0.0018	0.0018
Particulate without the effect of SO2 oxidation and SCR catalysts			
Particulates, lb/h (front half catch only)	5.0	5.0	5.0
Particulates, lb/MBtu (front half catch only)	0.0051	0.0062	0.0072
Particulates, lb/h (front and back half catch)	10.0	10.0	10.0
Particulates, lb/MBtu (front and back half catch)	0.0102	0.0124	0.0145
PM10, lb/h (front half catch only)	5.0	5.0	5.0
PM10, lb/MBtu (front half catch only)	0.0051	0.0062	0.0072
PM10, lb/h (front and back half catch)	10.0	10.0	10.0
PM10, lb/MBtu (front and back half catch)	0.0102	0.0124	0.0145
Particulate including the effect of SO2 oxidation and SCR catalysts [includes (NH4)2-(SO4)]			
Particulates, lb/h (front half catch only)	5.4	5.3	5.3
Particulates, lb/MBtu(front half catch only)	0.0055	0.0066	0.0076
Particulates, lb/h (front and back half catch)	10.4	10.3	10.3
Particulates, lb/MBtu(front and back half catch)	0.0106	0.0127	0.0149
PM10, lb/h (front half catch only)	5.4	5.3	5.3
PM10, lb/MBtu(front half catch only)	0.0055	0.0066	0.0076
PM10, lb/h (front and back half catch)	10.4	10.3	10.3
PM10, lb/MBtu(front and back half catch)	0.0106	0.0127	0.0149
NOTE: SO2 to SO3 conversion rate (assumed), wt%	30.0%	30.0%	30.0%
Remaining SO2 in Exhaust Gas, lb/h	0.43	0.35	0.30
Amount of SO2 converted to SO3, lb/h	0.18	0.15	0.13
Maximum Exhaust Gas ammonium sulfate [(NH4)2-(SO4)] (assuming 100% conversion from SO3), lb/h	0.38	0.31	0.26
Maximum H2SO4 (assuming 100% conversion from SO3 to H2SO4), lb/hr	0.28	0.23	0.20

20-Jul-01
CED
GWF Tracy
69389
Simple Cycle Plant Emissions Estimate, Revision 3

Case Number	13	14	15
CTG Model	GE 7EA	GE 7EA	GE 7EA
Diluent	DN 9/42	DN 9/42	DN 9/42
CTG Fuel Type	Cust Gas	Cust Gas	Cust Gas
CTG Load	100%	80%	60%
CTG Inlet Air Conditioning In Operation?	No	No	No
Ambient Temperature, F	15	15	15
HRSG Firing	Unfired	Unfired	Unfired
Fuel Sulfur Content (grains/100 standard cubic feet)	0.20	0.20	0.20
Stack			
Stack Exit Temperature, F	850	850	850
Stack Diameter, ft (estimated)	17.0	17.0	17.0
Stack Flow, lb/h	3,005,673	2,535,307	2,252,364
Stack Flow, scfm	664,254	560,303	497,772
Stack Flow, acfm	1,681,173	1,417,659	1,258,696
Stack Exit Velocity, ft/s	123.0	104.0	92.0
Post Combustion Emissions Control			
CO Catalyst			
CO removed in CO Catalyst, %wt	86%	86%	86%
CO removed in CO Catalyst, lb/h (includes CO correction as applied to CTG)	51.34	50.14	43.61
Selective Catalytic Reduction (SCR)			
NOx Removed, lb/h as NO2	16.14	13.37	11.46
NOx Removed, percent	44.4%	44.4%	44.4%
NH3 Slip, lb/h	14.5	12.0	10.2
Stack Exhaust Gas Analysis (Wet)			
Molecular Wt, lb/mol	28.6	28.6	28.6
Specific Volume, ft^3/lb	33.6	33.6	33.5
Specific Volume, scf/lb	13.3	13.3	13.3

Notes:

1. The emissions estimates shown in the table above are per stack.
2. The dry air composition used is 0.98% Ar, 78.03% N2 and 20.99%O2
3. Standard conditions are defined as 60 F, 14.696 psia, Norm conditions are defined as 0 C, 1.103 bar
4. The CTG performance is a General Electric GTPE estimate.
5. The VOC oxidation rates are Black & Veatch estimates based on typical data.
6. UHC calculations do not include the effects of oxidation in the CO catalyst. The VOC/UHC ratio is assumed to be 20% for natural gas firing (typical for GE turbines).
7. The front half catch of particulate emissions is assumed to be half the amount of the front and back half catch.
8. Ammonium sulfates created downstream of the SCR are included in front half particulates and front&back half particulates. The assumption that 100% SO3 is converted to ammonium sulfates results in "worst case" particulate emissions.
9. The SO2 oxidation rate was assumed to be 30%.

SR4/2 Preparer: J.Arthur Filepath: c:_project\patrick\tracy\[emission2-8ne.xls]input Reviewer: P.Elrod