Appendix 8.1-5

Operations Phase Emissions

Appendix 8.1-5a (emissions based on the use of GE combustion turbines)
Appendix 8.1-5b (emissions based on the use of Siemens combustion turbines)

APPENDIX 8.1-5a
KRCD CPP
MODELING PARAMETERS & EMISSIONS RATES – GE CASE

Note the text in bold is used to indicate where differences exist between the GE and Siemens cases.

A. STACK PARAMETERS

	North CT	**South CT**	**Cooling Tower**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
Stack Location[1]	N13296550..73' E885971.72'	N13296400.71' E885968.60'	See Note 1	N13296457.23' E885489.54'	N13296391.26' E886162.47'	N13296351.03' E885813.14'
Stack Height (feet)	150	150	80	45	45	100
Elevation at Base of Stack (FASL)[2]	327	327	327	327	327	327
Stack Exit Temperature (degrees F)[3]	**Scenario A -190** **Scenario B -190** **Scenario C -188** **Scenario D -187** **Scenario E -187** **Scenario F – 180**	**Scenario A -190** **Scenario B -190** **Scenario C -188** **Scenario D -187** **Scenario E -187** **Scenario F - 180**	81	986	900	325
Stack Exit Velocity (feet/min)[4]	**Scen. A – 4,198.6** **Scen. B – 4,004.8** **Scen. C– 3,907.3** **Scen. D – 4,000.9** **Scen. E – 3,538.4** **Scen. F – 2,590.0**	**Scen. A – 4,198.6** **Scen. B – 4,004.8** **Scen. C– 3,907.3** **Scen. D – 4,000.9** **Scen. E – 3,538.4** **Scen. F – 2,590.0**	2,967	6,703	8,959	2,030
Stack Cross-sectional Area (square feet)[5]	254.47	254.47	530.93 (per cell)	1.713	0.14	9.62

Notes

1. Given in UTM coordinates (feet). The approximate coordinates of the 8 cooling tower cells (centers) are:

Cell A – N13296742.00; E886210.17 (most NW cell)
Cell B – N13296700.85; E886249.64
Cell C – N13296659.71; E886289.10
Cell D – N13296618.57; E886328.57
Cell E – N13296577.41; E886368.04
Cell F – N13296536.27; E886407.51
Cell G – N13296495.12; E886446.97
Cell H – N13296453.99; E886486.45 (most SE cell)

2. The site FASL is given as 327.

3. The first 5 HRSG stack exit temperatures shown correlate to the 5 sets of ambient conditions, i.e., Scenarios A through E, used to envelope CT performance and represent the following performance cases, which were supplied on **10/25/06 by NCI as Rev. 2 of the GE** performance data:

Scenario A = Case 5 – 26F/60%RH, Fogger-Off, Stm Inj.-Off
Scenario B = Case 4 – 63F/40%RH, Fogger-On, Stm Inj.-Off
Scenario C = Case 13 – 63F/40%RH, Fogger-Off, Stm Inj.-Off

Scenario D = Case 2 – 103F/20.1%RH, Fogger-On, Stm Inj.-On
Scenario E = Case 12 – 103F/20.1%RH, Fogger-Off, Stm Inj.-Off

The stack exit temperature for the sixth scenario (F) comes from Case 14 of the CT performance data and is for partial load, startup/shutdown and commissioning operations.

Scenario F = Case 14 – 63F/40%RH, Fogger-Off, Stm Inj.-Off

The exit temperature for the cooling towers is assumed as the temperature of the air leaving the cooling towers, which is 80.97F for the 63F ambient annual average case.

4. The 5 HRSG stack exit velocities shown correlate to the 5 sets of ambient conditions, i.e., Scenarios A through E, used to envelope CT performance and represent the performance cases listed in Note 3 above. The 5 HRSG stack exit velocities are based on the stack diameter of 254.47 sq. feet (per Note 5 below) and the following **GE** performance data:

Scenario A = Case 5 – 1,068,414 acfm
Scenario B = Case 4 – 1,019,102 acfm
Scenario C = Case 13 – 994,289 acfm
Scenario D = Case 2 – 1,018,114 acfm
Scenario E = Case 12 – 900,404 acfm

The stack exit velocity for partial load operation, startup/shutdown and commissioning operations (Scenario F) is based on the stack diameter and the stack exhaust flow of **659,061 acfm, which is from Case 14 of the GE** performance data

The cooling tower number is based on a flow rate of 1,575,240 acfm per cell (CT Case 4, 63F ambient annual average). The emergency generator number is based on a flow rate of 11,484 acfm. The diesel fire pump number is based on a flow rate of 1,265 acfm. The aux. boiler number is based on a flow rate of 19,532 acfm.

5. Based on CT stack diameters of 18 feet each. Cooling tower cell cross sectional areas are based on each of the 8 cells having a diameter of 26 feet. The stack diameter of the emergency generator is 1.477 feet. The stack diameter of the diesel fire pump is 0.424 feet. The stack diameter of the aux. boiler is 3.5 feet.

B. FENCELINE

The KRCD CPP fence line is a rectangle, although it is not on a true N/S line. The coordinates (UTM in feet not meters) for the four fence line corners are given below:

NE Corner	N13296824.89, E887114.46
SE Corner	N13296170.20, E887092.76
SW Corner	N13296231.29, E885074.65
NW Corner	N13296885.87, E885093.31

C. MAJOR STRUCTURES

1. Inside the KRCD CPP Fence Line

The table below provides the dimensions for major structures inside the fence line as well as their identifying number from the General Arrangement drawing. UTM coordinate data for these structures in provided in Appendix 8-1.6.

Structure Description	Item # on GA Drawing	Dimensions – L x W x H (feet)
Switchyard Control Bldg.	2	70 x 60 x 20
Admin. Bldg.	6	100 x 60 x 24
Warehouse Maintenance Bldg.	8	100 x 80 x 24
CT1 Elec. Auxiliaries Structure	20.1	44 x 20 x 16
CT2 Elec. Auxiliaries Structure	20.1	44 x 20 x 16
CT1 Mech. Auxiliaries Structure	22.1	30 x 10 x 16
CT2 Mech. Auxiliaries Structure	22.1	30 x 10 x 16
CT1 Air Inlet Structure	24.1	70 x 50 x 62
CT2 Air Inlet Structure	24.2	70 x 50 x 62
CT1	26.1	116 x 44 x 20
CT2	26.2	116 x 44 x 20
Steam Turbine	29	121 x 36 x 34
Brine Holding Tank (north)	34	65 diam. x 34 high
Brine Holding Tank (south)	34	65 diam. x 34 high
Steam Condenser	36	34 x 50 x 35
HRSG1	40.1	165 x 62 x 95
HRSG2	40.2	165 x 62 x 95
Service/Firewater Storage Tank	47	40 diam. x 40 high
Aux. Boiler	50	30 x 22 x 12
Demin. Water Storage Tank	51	35 diam. x 32 high
Water Treatment Bldg.	52	100 x 85 x 22
Elec. Equip. Bldg.	56	118 x 44 x 20
ZLD/Cooling Tower Elec. Equip. Enclosure	58	58 x 18 x 12
Cooling Tower	59	460 x 76 x 80
ZLD Treatment Area	69	84 x 75 x 22
Recycle Water Holding Tank	73	80 diam. x 40 high

Other structures & equipment are not included, as they are either short or not solid.

2. Beyond the KRCD CPP Fence Line

Based on a review of an aerial photo of the project site and surrounding area, the terrain is relatively flat farmland and there are no significant structures in the vicinity.

D. OPERATING SCENARIOS

1. CTs in Full Load Operation (Steady-state)

Both CTs at full load

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator on (but only for 30 min./week & non simultaneous with the diesel fire pump)

Diesel Fire Pump on (but only for 30 min./week & non simultaneous with the emergency generator)

The following 5 ambient/operational scenarios will be assessed for CT steady-state operation:

Scenario A = Case 5 – Siemens/GE performance data – 26F/60%RH, Fogger-Off, Stm Inj.-Off
Scenario B = Case 4 – Siemens/GE performance data – 63F/40%RH, Fogger-On, Stm Inj.-Off
Scenario C = Case 13 – Siemens/GE performance data – 63F/40%RH, Fogger-Off, Stm Inj.-Off
Scenario D = Case 2 – Siemens/GE performance data – 103F/20.1%RH, Fogger-On, Stm Inj.-On
Scenario E = Case 12 – Siemens/GE performance data– 103F/20.1%RH, Fogger-Off, Stm Inj.-Off

This 5 case subset of the 20 cases of performance provided for the CTs should envelope the other 15 cases.

2. CT in Startup or Shutdown Mode

CT Startup

1 CT in startup mode for approximately **30 minutes** before the 2nd CT initiates startup

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator off

Diesel Fire Pump off

CT Shutdown

Both CTs in shutdowm mode simultaneously

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator off

Diesel Fire Pump off

3. CTs Not Operating

Both CTs off

Aux. Boiler on (at full load)

Cooling Tower on (at full load – This is conservative, but the cooling tower may need to operate at some load during this time.)

Emergency Generator on (but only for 30 min./week & non simultaneous with the diesel fire pump)

Diesel Fire Pump on (but only for 30 min./week & non simultaneous with the emergency generator)

4. CTs in Partial Load Operation

1 CT at partial load (apprx. **50.2% for GE)**

The other CT at full load

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator on (but only for 30 min./week & non simultaneous with the diesel fire pump)

Diesel Fire Pump on (but only for 30 min./week & non simultaneous with the emergency generator)

One ambient temperature/operational scenario is available for the assessment of CT partial load operation:

Scenario F = Case 14 – CT performance data – 63F/40%RH, Fogger-Off, Stm Inj.-Off

5. Hours of annual operation

CTs – 6,807 hpy of steady-state + 154 hot starts (@ **1 hr, 13 min./start**) + 27 warm starts (@ **1 hr, 57 min./start**) + 181 shutdowns (@ **60 min./shutdown**). Annual emissions from this annual CT operating scenario should be compared with those for the CTs operating at full load for 8,760 hpy and the highest emissions for each pollutant used for estimating max. annual emissions.

Aux. Boiler – 2,315 hpy (based on 8,760-6,807=1,953 hpy when the CTs are not in steady-state operation + 2 x 181=362 hpy for 1 hr overlap with CT steady-state before and after each start/stop cycle)

Cooling Tower – 8,760 hpy

Emergency Generator – 26 hpy (but not when diesel fire pump is on)

Diesel Fire Pump – 26 hpy (but not when emergency generator is on)

6. CT Commissioning

CTs – assume only 1 CT will operate during the commissioning period at any time.

Aux. boiler off

Cooling Tower on (at full load)

Emergency Generator off

Diesel Fire Pump off

E. EMISSIONS RATES

1. Steady-State

There are 5 sets of steady-state emissions rates. These 5 sets of CT emissions rates, which are associated with the five ambient temperature conditions noted in Section D (Operating Scenarios A through E), in essence govern all steady-state emissions scenarios.

The 5 sets of steady-state emissions rates are shown in Tables 1 through 5. Peak hourly emissions, based on the coldest (design) ambient temperature (Scenario A), are provided in Table 1. Annual average emissions are represented by the emissions rates in Tables 2 & 3 (Scenarios B & C). The

emissions rates at the maximum ambient (design) temperature are provided in Tables 4 & 5 (Scenarios D & E).

Note that the emissions rates for the cooling tower and aux. boiler are assumed to be constant across the range of operating conditions. Max. hourly emissions during steady-state assume operation of both CTs, the cooling tower, aux. boiler and emergency generator or the diesel fire pump (depending upon which of these two pieces of equipment has the higher emissions for a given scenario).

2. Startup/Shutdown

CT cold startup, warm startup, hot startup and shutdown sequence emissions rates are shown in Tables 6 through 9, respectively.

The startup emissions rates do not directly account for multiple (failed) startup sequences. However, for warm and hot startups (and cold as well, although cold starts are not included in this project's operating scenarios because of the use of an aux. boiler), a failed start for either the 1st or 2nd CT in the start sequence would not alter the max. hourly emissions rates shown in Tables 6 through 8. Instead, a failed start of one of the CTs would extend the number of hours during which the max. emissions rates shown in Tables 6 through 8 would occur. To address the potential issue of failed start sequences, 2 failed start attempts, each of 30 minutes, are assumed. This has the effect of extending the hot, warm or cold startup period by 1 hour. **For GE the max. startup periods are: hot 73 + 60 = 133 min. & warm 117 + 60 = 177 min.**

(Note that the startup/shutdown emissions rates for the cooling tower and aux. boiler are assumed to be the same as those for steady-state.)

3. Partial Load

Table 10 provides emissions rates for CT partial load operation. **For GE partial load operation is at approximately 50.2% of full load output.** Partial load operation should be evaluated for short term impacts, but not for long term (i.e., annual), as full load operation produces greater emissions. Since it is likely that a) 1 CT would be in partial load operation and the other CT off or b) one CT would be in partial load operation and the other CT at full load, but unlikely that both CTs would operate at partial load, the partial load assessment will assume 1 CT at partial load and the other at full load (both at annual average ambient conditions).

4. Commissioning

CT commissioning emissions rates, which will occur within the first few months of project operation and are shown in Table 11, must be factored into the assessment of short-term impacts. Long-term (annual) impacts need not account for commissioning emissions, since in the 1st year of operation the allowable amount of normal operation is assumed to be reduced by and to the extent that commissioning operations occur.

(Note that the commissioning emissions rates for other equipment are assumed to be the same as those for steady-state.)

TABLE 1
MAXIMUM HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	Both CTs	Cooling Tower[2]	Emergency Generator	Diesel Fire Pump	Aux. Boiler
NOx[3]	**13.6**	**27.2**	NA	4.01	4.07	0.72
CO[4]	**6.9**	**13.8**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**9.0**	**18.0**	**0.52**	0.64	0.14	0.61
PM2.5[6]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5**[7]	**3.0**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:

1. Based on CT operation at an ambient temperature of 26 degrees F, Fogger-Off, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **57,366,384 lbs/hr (6,906,881 gal/hr**); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. CT PM2.5 emissions rate based on an emissions factor of 0.00028 lbs/MMBtu and **1,852 MMBtu/hr** fuel input per CT. Aux. bolier PM2.5 emissions rate based on an emissions factor of 0.00028 lbs/MMBtu and fuel input of 61.23 MMBtu/hr. Emergency generator PM2.5 emissions rate based on an emissions factor of 0.00028 lbs/MMBtu and fuel input of 13 MMBtu/hr. Diesel fire pump PM2.5 emissions factors based on an emissions factor of 0.004 lbs/MMBtu and fuel input of 3 MMBtu/hr. Cooling tower PM2.5 emissions rate assumes PM2.5 is 25% of the PM10 emissions rate.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 2
AVERAGE HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	Both CTs	Cooling Tower[2]	Emergency Generator	Diesel Fire Pump	Aux. Boiler
NOx[3]	**12.9**	**25.8**	NA	4.01	4.07	0.72
CO[4]	**6.4**	**12.8**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**9.0**	**18.0**	**0.52**	0.64	0.14	0.61
PM2.5[6]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5**[7]	**3.0**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:

1. Based on an ambient temperature of 63 degrees F, Fogger-On, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **57,366,384 lbs/hr (6,906,881 gal/hr**); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 3
AVERAGE HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**12.7**	**25.4**	NA	4.01	4.07	0.72
CO[4]	**6.4**	**12.8**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**9.0**	**18.0**	**0.52**	0.64	0.14	0.61
PM2.5[6]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[7]**	**3.0**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:
1. Based on an ambient temperature of 63 degrees F, Fogger-Off, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **57,366,384 lbs/hr (6,906,881** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 4
HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**12.8**	**25.6**	NA	4.01	4.07	0.72
CO[4]	**6.1**	**12.2**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**9.0**	**18.0**	**0.52**	0.64	0.14	0.61
PM2.5[6]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[7]**	**3.0**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:
1. Based on an ambient temperature of 103 degrees F, Fogger-On, STIG-On.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **57,366,384 lbs/hr (6,906,881** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 5 HOURLY EMISSIONS RATES (LBS/HR) STEADY-STATE OPERATION[1]						
	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**11.3**	**22.6**	NA	4.01	4.07	0.72
CO[4]	**5.8**	**11.6**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**9.0**	**18.0**	**0.52**	0.64	0.14	0.61
PM2.5[6]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[7]**	**3.0**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:

1. Based on an ambient temperature of 103 degrees F, Fogger-Off, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **57,366,384 lbs/hr (6,906,881** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 6 EMISSIONS RATES (LBS/HR) COLD STARTUP MODE[1]						
	One CT[2]	**Both CTs[2]**	**Cooling Tower[3]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[3]**
NOx	**89.6**	**179.2**	NA	4.01	4.07	0.72
CO	**166.6**	**333.2**	NA	10.43	0.31	2.27
VOCs	**13.4**	**26.8**	NA	2.65	0.19	0.37
PM10	**9.0[3]**	**18.0[3]**	**0.52**	0.64	0.14	0.61
PM2.5[4]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[5]**	**3.0**	NA	0.01	0.12	0.05

Notes:

1. For the CTs conventional, not fast or rapid, startup capability is assumed. The emissions rates in this cold startup mode table are not used for assessing impacts, as the warm and hot startup modes cover the various operating scenarios.
2. For a cold startup cycle the total time required is 231 minutes (3 hrs, 51 minutes) for both CTs. Since it is assumed that CT2 would start approximately 30 minutes after the start of CT1, the highest hourly emissions will occur not in the first hour of startup (when CT2 is off for the first 30 minutes), but in the 2nd, 3rd & 4th hours of the 3 hr, 51 minute sequence, as both CTs will be on and emitting at the cold startup rate for a full 60 minutes in the 2nd, 3rd & 4th hours.
3. The emissions rates are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 7 EMISSIONS RATES (LBS/HR) WARM STARTUP MODE[1]						
	One CT[2]	**Both CTs[2]**	**Cooling Tower[3]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[3]**
NOx	**83.9**	**167.8**	NA	4.01	4.07	0.72
CO	**502.2**	**1,004.4**	NA	10.43	0.31	2.27
VOCs	**30.0**	**60.0**	NA	2.65	0.19	0.37
PM10	**9.0[3]**	**18.0[3]**	**0.52**	0.64	0.14	0.61
PM2.5[4]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[5]**	**3.0**	NA	0.01	0.12	0.05

Notes:

1. For the CTs conventional, not fast or rapid, startup capability is assumed.
2. For a warm startup cycle the total time required is 117 minutes (1 hr, 57 min.) for both CTs. Since it is assumed that CT2 would start 30 minutes after the start of CT1, the highest hourly emissions will occur not in the first 30 minutes of startup (when CT2 is off), but immediately after this 30 minute period when both CTs will be on and emitting at the warm startup rate for a full 60 minutes.
3. The emissions rates are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 8 EMISSIONS RATES (LBS/HR) HOT STARTUP MODE[1]						
	One CT[2]	**Both CTs[2]**	**Cooling Tower[3]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[3]**
NOx	**87.2**	**174.4**	NA	4.01	4.07	0.72
CO	**208.6**	**417.2**	NA	10.43	0.31	2.27
VOCs	**17.5**	**35.0**	NA	2.65	0.19	0.37
PM10	**9.0[3]**	**18.0[3]**	**0.52**	0.64	0.14	0.61
PM2.5[4]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[5]**	**3.0**	NA	0.01	0.12	0.05

Notes:

1. For the CTs conventional, not fast or rapid, startup capability is assumed.
2. **For a hot startup cycle the total time required is 73 minutes (1 hr, 13 min.) for both CTs. It is assumed that CT2 would start 13 minutes after the start of CT1, & therefore the highest hourly emissions will occur in the last 60 minutes of the hot start cycle when both CTs will be on and emitting at the hot startup rate for a full 60 minutes.**
3. The emissions rates are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 9
EMISSIONS RATES (LBS/HR)
SHUTDOWN MODE[1]

	One CT[2]	**Both CTs[2]**	**Cooling Tower[3]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[3]**
NOx	**43.4**	**86.8**	NA	4.01	4.07	0.72
CO	**241.8**	**483.6**	NA	10.43	0.31	2.27
VOCs	**12.0**	**24.0**	NA	2.65	0.19	0.37
PM10	**9.0[3]**	**18.0[3]**	**0.52**	0.64	0.14	0.61
PM2.5[4]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[5]**	**3.0**	NA	0.01	0.12	0.05

Notes:
1. For the CTs, conventional, not fast or rapid, startup capability is assumed.
2. **For a shutdown cycle the total time required is assumed as 1.0 hr (60 minutes) for both CTs. Since it is assumed that both CTs can be in shutdown at the same time, the hourly emissions rates for the CTs are calculated as follows: 0 – 30 minutes both CTs in shutdown mode; minute 31 & beyond both CTs off.**
3. The emissions rates are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 10
EMISSIONS RATES (LBS/HR)
PARTIAL LOAD OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**8.0**	**16.0**	NA	4.01	4.07	0.72
CO[4]	**4.2**	**8.4**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**9.0**	**18.0**	**0.52**	0.64	0.14	0.61
PM2.5[6]	**0.52**	**1.04**	**0.13**	0.01	0.02	0.02
SO2	**1.5[7]**	**3.0**	NA	0.01	0.12[8]	0.05[7]

Notes:
1. Based on an ambient temperature of 63 degrees F, Fogger-Off, STIG-Off. Output is approximately **50.2% of full load.**
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **57,366,384 lbs/hr (6,906,881** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 11 EMISSIONS RATES COMMISSIONING MODE[1]							
	CT Commissioning Emissions Rates (lbs/hr) Per CT[2]						**Cooling Tower[3]**
	HRSG Cleanup, 0% Load	**ST Stm Checks/Stm Blows @ 50% Load; DLN Tuning @ 50% Load**	**DLN Tuning @ 20% Load**	**DLN Tuning @ 80% Load**	**NH3 Tuning @ 50% Load**	**NH3 Tuning & Stm Inj. Tuning @ 100% Load**	
NOx	**125.0**	**153.0**	**174.4**	**149.1**	**8.1**	**13.6**	NA
CO	**180.0**	**358.9**	**284.1**	**236.9**	**4.1**	**6.9**	NA
VOCs	**17.0**	**19.8**	**23.5**	**10.7**	**1.2**	**2.0**	NA
PM10[4]	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**9.0**	**0.52**
PM2.5[4]	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.52**	**0.13**
SO2[4]	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**	NA

Notes:

1. During commissioning it is assumed that the cooling tower will be in operation, but not the aux. boiler, emergency generator or diesel fire pump.
2. Each of the two CTs will be commissioned separately. Therefore, when comparing commissioning emissions rates with other scenarios, assume only one CT in commissioning mode as compared with two CTs in steady-state or startup/shutdown mode.
3. Emissions from this equipment are the same as for steady-state operation.
4. PM10, PM2.5 & SO2 emissions rates for the CTs are assumed as the same as for steady-state operation and based 26F ambient.

F. MODELING SCENARIOS

1. 1-hr Impacts (NOx, CO & SO2)

a. Based on maximum 1-hr emissions for normal operation (assess for Scenarios A through F)

CTs – 1 warm startup (both CTs in warm start mode for 60 min. simultaneously).

The warm start sequence, including 2 assumed failed start attempts of 30 min. each, is of long enough duration to provide for 60 min. of simultaneous warm startup mode emissions. One hr of warm startup produces greater emissions than hot start, steady-state or shutdown operation. (Emissions rates for all pollutants except NOx are highest in warm startup mode. Hot startup has a slightly higher NOx emissions rate, but the warm startup sequence, including on 2 x 30 min. failed starts, produces the highest NOx emissions.)

Aux. Boiler – 1 hr of operation at CT startup

Cooling Tower – 1 hr of operation

Emergency Generator (EG)– 30 min. of operation **OR** Diesel Fire Pump (DFP) – 30 min. of operation

Use Table 12 emissions rates and assess the 1-hr impacts from normal operation for Scenarios A through F. For NOx & SO2 worst case impacts the DFP operates; for CO worst case impacts the EG operates.

TABLE 12 EMISSIONS RATES (LBS/HR) FOR ASSESSING 1-HR IMPACTS FROM NORMAL OPERATIONS[1]						
	One CT	**Both CTs**	**Cooling Tower[3]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx	**83.9**	**167.8**	NA	2.01	2.04	0.72
CO	**502.2**	**1,004.4**	NA	5.22	0.16	2.27
VOCs	**30.0**	**60.0**	NA	1.33	0.10	0.37
PM10	**9.0**	**18.0**	**0.52**	0.32	0.07	0.61
PM2.5	**0.52**	**1.04**	**0.13**	0.005	0.01	0.02
SO2	**1.5**	**3.0**	NA	0.005	0.06	0.05

Notes:
1. Emissions rates are directly from Table 7 except for the Emergency Generator and Diesel Fire Pump, which are 50% of their Table 7 rates, since either of these pieces of equipment will only operate for 30 min. in an hour.

b. Based on CT commissioning (Use Scenarios A through F CT stack parameters)

Only 1 CT – Assume 1 hr of continuous commissioning. Use the highest commissioning emissions rates for each pollutant**.**

Aux.Boiler – off

Cooling Tower – 1 hr of operation

EG - off & DFP - off

Use the emissions rates in Table 13 along with Scenarios A through F CT stack parameters to assess the 1-hr impacts for the commissioning mode.

TABLE 13 MAXIMUM EMISSIONS RATES (LBS/HR) FOR COMMISSIONING MODE		
	One CT – Commissioning[1]	**Cooling Tower**
NOx	**174.4**	NA
CO	**358.9**	NA
VOCs	**23.5**	NA
PM10	**9.0**	**0.52**
PM2.5	**0.52**	**0.13**
SO2	**1.5**	NA

Notes:
1. Emissions rates are the highest for each pollutant from Table 11. Only one CT will operate in commissioning mode at a time.

c. Based on Partial Load Operation

CT1 – 1 hr in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 1-hr in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 1 hrs of operation (for conservatism)

Cooling Tower – 1 hr of operation

Emergency Generator (EG)– 30 min. of operation **OR** Diesel Fire Pump (DFP) – 30 min. of operation

Use Table 14 emissions rates to assess the 1-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters. For NOx & SO2 worst case impacts the DFP operates; for CO worst case impacts the EG operates.

TABLE 14
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 1-HR IMPACTS
FROM PARTIAL LOAD OPERATIONS

	CT1[1]	**CT2[2]**	**Cooling Tower[4]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**8.0**	**12.9**	NA	2.01	2.04	0.72
CO	**4.2**	**6.4**	NA	5.22	0.16	2.27
VOCs	**2.0**	**2.0**	NA	1.33	0.10	0.37
PM10	**9.0**	**9.0**	**0.52**	0.32	0.07	0.61
PM2.5	**0.52**	**0.52**	**0.13**	0.005	0.01	0.02
SO2	**1.5**	**1.5**	NA	0.005	0.06	0.05

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates are divided by 2, since this piece of equipment will only operate for 30 min. in an hour.
4. Normal emissions rates for this piece of equipment.

2. 3-hr Impacts (SO2)

a. Based on maximum 3-hr emissions for normal operation (assess for Scenarios A through E)

CTs – 1 warm startup, including 2 x 30 min. failed start attempts for 1 CT (87 min. both CTs in simultaneous warm start mode + 90 min. of 1 CT in warm start mode & the other CT in steady-state mode + 3 min. of 1 CT in warm start & the other CT off);

Aux. Boiler – 3 hrs of operation at CT startup

Cooling Tower – 3 hrs of operation

DFP – 30 min. of operation for worst case SO2 impacts

Use the emissions rates in Table 15 to assess the 3-hr impacts from normal operation for Scenarios A through E.

TABLE 15 EMISSIONS RATES (LBS/HR) FOR ASSESSING 3-HR IMPACTS FROM NORMAL OPERATIONS						
	CT1[1]	**CT2[1]**	**Cooling Tower[2]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**Scenario A -65.7** **Scenario B – 65.5** **Scenario C – 65.4** **Scenario D –65.5** **Scenario E – 65.1**	**Scenario A -65.7** **Scenario B – 65.5** **Scenario C – 65.4** **Scenario D –65.5** **Scenario E – 65.1**	NA	0.67	0.68	0.72
CO	**Scenario A -374.2** **Scenario B -374.1** **Scenario C -374.1** **Scenario D -374.0** **Scenario E -373.9**	**Scenario A -374.2** **Scenario B -374.1** **Scenario C -374.1** **Scenario D -374.0** **Scenario E -373.9**	NA	1.74	0.06	2.27
VOCs	**Scenario A -22.8** **Scenario B – 22.8** **Scenario C – 22.8** **Scenario D – 22.8** **Scenario E – 22.8**	**Scenario A -22.8** **Scenario B – 22.8** **Scenario C – 22.8** **Scenario D – 22.8** **Scenario E – 22.8**	NA	0.45	0.04	0.37
PM10	**Scenario A – 9.0** **Scenario B – 9.0** **Scenario C – 9.0** **Scenario D – 9.0** **Scenario E – 9.0**	**Scenario A – 9.0** **Scenario B – 9.0** **Scenario C – 9.0** **Scenario D – 9.0** **Scenario E – 9.0**	**0.52**	0.11	0.03	0.61
PM2.5	**All Scenarios - 0.52**	**All Scenarios - 0.52**	**0.13**	0.002	0.003	0.02
SO2	**All Scenarios - 1.5**	**All Scenarios - 1.5**	NA	0.002	0.02	0.05

Notes:
1. The emissions rates for the CTs are based on taking the total amount of emissions from both CTs for the 3-hr period and splitting these totals evenly between the two CTs.
2. Normal Cooling Tower emissions rates, since the cooling tower operates for 3 out of 3 hrs.
3. Normal EG & DFP emissions rates are divided by 6, since either the EG or DFP operates for only 30 min. of the 3 hrs.
4. Normal Aux. Boiler emissions rates, since the Aux. Boiler operates for 3 out of the 3 hrs.

b. Based on CT commissioning (Use only Scenario F CT stack parameters) *(Do not need to model this case because the results, which pertain to SO2 only, are covered by F.2.a & F.2.c.)*

Only 1 CT – Assume 3 hrs of continuous commissioning. Use the highest commissioning emissions rates for each pollutant**.**

Aux.Boiler – off

Cooling Tower – 3 hrs of operation

EG – off & DFP off

Use the emissions rates in Table 13 along with Scenario F CT stack parameters to assess 3-hr impacts for commissioning mode.

c. Based on Partial Load Operation

CT1 – 3 hrs in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 3-hrs in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 3 hrs of operation (for conservatism)

Cooling Tower – 3 hrs of operation

DFP – 30 min. of operation for worst case SO2 impacts

Use Table 16 emissions rates to assess the 3-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters.

TABLE 16
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 3-HR IMPACTS
FROM PARTIAL LOAD OPERATIONS

	CT1[1]	**CT2[2]**	**Cooling Tower[3]**	**Emergency Generator[4]**	**Diesel Fire Pump[4]**	**Aux. Boiler[3]**
NOx	**8.0**	**12.9**	NA	0.67	0.68	0.72
CO	**4.2**	**6.4**	NA	1.74	0.06	2.27
VOCs	**2.0**	**2.0**	NA	0.45	0.04	0.37
PM10	**9.0**	**9.0**	**0.52**	0.11	0.03	0.61
PM2.5	**0.52**	**0.52**	**0.13**	0.002	0.003	0.02
SO2	**1.5**	**1.5**	NA	0.002	0.02	0.05

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates for this piece of equipment.
4. Normal EG & DFP emissions rates are divided by 6, since either the EG or DFP operates for only 30 min. of the 3 hrs.

3. 8-hr Impacts (CO)

a. Based on maximum 8-hr emissions for normal operation (assess for Scenarios A through E)

CTs – 1 warm startup, including 2 x 30 min. failed start attempts for 1 CT (87 min. both CTs in simultaneous warm start mode + 90 min. of 1 CT in warm start mode & the other CT in steady-state mode + 30 min. of 1 CT in warm start mode and the other off + 273 min. of both CTs in steady-state mode)

Aux. Boiler – 3 hrs of operation at CT startup

Cooling Tower – 8 hrs of operation

EG– 30 min. of operation for worst case CO impacts

Use the emissions rates in Table 17 to assess the 8-hr impacts from normal operation for Scenarios A through E.

TABLE 17 EMISSIONS RATES (LBS/HR) FOR ASSESSING 8-HR IMPACTS FROM NORMAL OPERATIONS						
	CT1[1]	**CT2[1]**	**Cooling Tower[2]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**Scenario A -34.7** **Scenario B – 34.3** **Scenario C – 34.1** **Scenario D –34.2** **Scenario E – 33.2**	**Scenario A -34.7** **Scenario B – 34.3** **Scenario C – 34.1** **Scenario D –34.2** **Scenario E – 33.2**	NA	0.26	0.26	0.27
CO	**Scenario A -158.4** **Scenario B -158.1** **Scenario C -158.1** **Scenario D -157.9** **Scenario E -157.7**	**Scenario A -158.4** **Scenario B -158.1** **Scenario C -158.1** **Scenario D -157.9** **Scenario E -157.7**	NA	0.66	0.02	0.86
VOCs	**Scenario A -10.6** **Scenario B – 10.0** **Scenario C – 10.6** **Scenario D – 10.6** **Scenario E – 10.6**	**Scenario A -10.6** **Scenario B – 10.0** **Scenario C – 10.6** **Scenario D – 10.6** **Scenario E – 10.6**	NA	0.17	0.02	0.14
PM10	**Scenario A – 9.0** **Scenario B – 9.0** **Scenario C – 9.0** **Scenario D – 9.0** **Scenario E – 9.0**	**Scenario A – 9.0** **Scenario B – 9.0** **Scenario C – 9.0** **Scenario D – 9.0** **Scenario E – 9.0**	**0.52**	0.04	0.01	0.23
PM2.5	**All Scenarios - 0.52**	**All Scenarios - 0.52**	**0.13**	0.001	0.001	0.01
SO2	**All Scenarios - 1.5**	**All Scenarios - 1.5**	NA	0.001	0.008	0.02

Notes:
1. The emissions rates for the CTs are based on taking the total amount of emissions from both CTs for the 8-hr period and splitting these totals evenly between the two CTs.
2. Normal Cooling Tower emissions rates, since the cooling tower operates for 8 out of 8 hrs.
3. Normal EG & DFP emissions rates are divided by 16, since either the EG or DFP operates for only 30 min. of the 8 hrs.
4. Normal Aux. Boiler emissions rates multiplied by 3/8, since the Aux. Boiler operates for 3 out of the 8 hrs.

b. Based on CT commissioning (Use only Scenario F CT stack parameters)

Only 1 CT – Assume 8 hrs of continuous commissioning. Use the highest commissioning emissions rates for each pollutant**.**

Aux.Boiler – off

Cooling Tower – 8 hrs of operation

EG - off & DFP - off

Use the emissions rates in Table 13 along with Scenario F CT stack parameters to assess 8-hr impacts for commissioning mode.

c. Based on Partial Load Operation

CT1 – 8 hrs in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 8-hrs in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 3 hrs of operation at CT startup

Cooling Tower – 8 hrs of operation

EG– 30 min. of operation for worst case CO impacts

Use Table 18 emissions rates to assess the 8-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters.

TABLE 18
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 8-HR IMPACTS
FROM PARTIAL LOAD OPERATIONS

	CT1[1]	**CT2[2]**	**Cooling Tower[3]**	**Emergency Generator[4]**	**Diesel Fire Pump[4]**	**Aux. Boiler[5]**
NOx	**8.0**	**12.9**	NA	0.26	0.26	0.27
CO	**4.2**	**6.4**	NA	0.66	0.02	0.86
VOCs	**2.0**	**2.0**	NA	0.17	0.02	0.14
PM10	**9.0**	**9.0**	**0.52**	0.04	0.01	0.23
PM2.5	**0.52**	**0.52**	**0.13**	0.001	0.001	0.01
SO2	**1.5**	**1.5**	NA	0.001	0.008	0.02

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates for this piece of equipment.
4. Normal EG & DFP emissions rates are divided by 16, since either the EG or DFP operates for only 30 min. of the 8 hrs.
5. Normal AB emissions rates are multiplied by 3/8, since the AB operates for only 3 of the 8 hrs.

d. Based on Aux. Boiler only Operation

Both CTs – off

Aux. Boiler – 8 hrs of operation

Cooling Tower – off

Emergency Generator – off & DFP - off

Use full aux. boiler emissions rates (e.g., from Table 1)

4. 24-hr Impacts (NOx – for Class I, PM10, PM2.5, SO2)

a. Based on maximum 24-hr emissions for normal operation (assess for Scenarios A through E)

CTs – 1 warm startup, including 2 x 30 min. failed start attempts for 1 CT, & 1 shutdown (87 min. both CTs in simultaneous warm start mode + 90 min. of 1 CT in warm start mode & the other CT in steady-state mode + 30 min. of 1 CT in warm start mode and the other off + 1,173 min. of both CTs in steady-state mode + 60 min. of both CTs in shutdown mode).

Aux. Boiler – 2 hrs of operation at CT startup, and 2 hrs at CT shutdown (1 hr during shutdown & 1 hr post-shutdown) = 4 hrs total

Cooling Tower – 24 hrs of operation

DFP – 30 min. of operation for worst case PM10, PM2.5 & SO2 impacts

Use the emissions rates in Table 19 to assess the 24-hr impacts from normal operation for Scenarios A through E.

TABLE 19
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 24-HR IMPACTS
FROM NORMAL OPERATIONS

	CT1[1]	**CT2[1]**	**Cooling Tower[2]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**Scenario A -21.9** **Scenario B – 21.3** **Scenario C – 21.1** **Scenario D –21.2** **Scenario E – 20.0**	**Scenario A -21.9** **Scenario B – 21.3** **Scenario C – 21.1** **Scenario D –21.2** **Scenario E – 20.0**	NA	0.09	0.09	0.12
CO	**Scenario A -67.2** **Scenario B -66.8** **Scenario C -66.8** **Scenario D -66.5** **Scenario E -66.3**	**Scenario A -67.2** **Scenario B -66.8** **Scenario C -66.8** **Scenario D -66.5** **Scenario E -66.3**	NA	0.22	0.006	0.38
VOCs	**Scenario A -5.3** **Scenario B – 5.3** **Scenario C – 5.3** **Scenario D – 5.3** **Scenario E – 5.3**	**Scenario A -5.3** **Scenario B – 5.3** **Scenario C – 5.3** **Scenario D – 5.3** **Scenario E – 5.3**	NA	0.06	0.004	0.07
PM10	**Scenario A – 9.0** **Scenario B – 9.0** **Scenario C – 9.0** **Scenario D – 9.0** **Scenario E – 9.0**	**Scenario A – 9.0** **Scenario B – 9.0** **Scenario C – 9.0** **Scenario D – 9.0** **Scenario E – 9.0**	**0.52**	0.013	0.003	0.11
PM2.5	**All Scenarios - 0.52**	**All Scenarios - 0.52**	**0.13**	0.0003	0.0005	0.01
SO2	**All Scenarios - 1.5**	**All Scenarios - 1.5**	NA	0.0003	0.003	0.01

Notes:
1. The emissions rates for the CTs are based on taking the total amount of emissions from both CTs for the 24-hr period and splitting these totals evenly between the two CTs.
2. Normal Cooling Tower emissions rates, since the cooling tower operates for 24 out of 24 hrs.
3. Normal EG & DFP emissions rates are divided by 48, since either the EG or DFP operates for only 30 min. of the 24 hrs.
4. Normal Aux. Boiler emissions rates divided by 6, since the Aux. Boiler operates for 4 out of the 24 hrs.

b. Based on CT commissioning (Use only Scenario F CT stack parameters)

Only 1 CT –Assume 24 hrs of continuous commissioning. Do not use the highest commissioning emissions rates for each pollutant, as these do not necessarily apply for the 24 hours of continuous commissioning operation, which is assumed to take place only for HRSG cleanup (0% load) commissioning.

Aux.Boiler – off

Cooling Tower – 24 hrs of operation

EG – off & DFP - off

Use the emissions rates in Table 20 along with Scenario F CT stack parameters to assess 24-hr impacts for commissioning mode.

TABLE 20 EMISSIONS RATES (LBS/HR) FOR 24-HR COMMISSIONING MODE[1]		
	One CT - Commissioning	**Cooling Tower**
NOx	**125.0**	NA
CO	**180.0**	NA
VOCs	**17.0**	NA
PM10	**9.0**	**0.52**
PM2.5	**0.52**	**0.13**
SO2	**1.5**	NA

Notes:
1. CT emissions rates are from Table 11 for the 0% load case.

c. Based on Partial Load Operation

CT1 – 24 hrs in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 24-hrs in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 2 hrs of operation at CT startup, and 2 hrs at CT shutdown (1 hr during shutdown & 1 hr post-shutdown) = 4 hrs total

Cooling Tower – 24 hrs of operation

DFP – 30 min. of operation for worst case PM10, PM2.5 & SO2 impacts

Use Table 21 emissions rates to assess the 24-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters.

TABLE 21 EMISSIONS RATES (LBS/HR) FOR ASSESSING 24-HR IMPACTS FROM PARTIAL LOAD OPERATIONS						
	CT1[1]	**CT2[2]**	**Cooling Tower[3]**	**Emergency Generator[4]**	**Diesel Fire Pump[4]**	**Aux. Boiler[5]**
NOx	**8.0**	**12.9**	NA	0.09	0.09	0.12
CO	**4.2**	**6.4**	NA	0.22	0.006	0.38
VOCs	**2.0**	**2.0**	NA	0.06	0.004	0.07
PM10	**9.0**	**9.0**	**0.52**	0.013	0.003	0.11
PM2.5	**0.52**	**0.52**	**0.13**	0.0003	0.0005	0.01
SO2	**1.5**	**1.5**	NA	0.0003	0.003	0.01

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates for this piece of equipment.
4. Normal EG & DFP emissions rates are divided by 48, since either the EG or DFP operates for only 30 min. of the 24 hrs.
5. Normal AB emissions rates are multiplied by 1/6, since the AB operates for only 4 of the 24 hrs.

d. Based on Aux. Boiler only Operation

Both CTs – off

Aux. Boiler – 24 hrs of operation

Cooling Tower – off

Emergency Generator – off & DFP - off

Use full aux. boiler emissions rates (e.g., from Table 1)

5. Annual Impacts

a. Based on 6,807 hpy of CT operation & 181 startups/shutdowns *(5.a is not a modeling case per se, but is used along with 5.b to determine maximum emissions rates on a pollutant by pollutant basis.)*

Each CT - 6,807 hpy of steady-state operation (Use Table 2 CT emissions rates and Scenario B CT stack parameters)

Each CT – 154 hot starts (use Table 8 emissions rates x **1.22 hrs/start** x 154 starts) + 27 warm starts (use Table 7 emissions rates x **1.95 hrs/start** x 27 starts) + 181 shutdowns (use Table 9 emissions rates x **1 hr/shutdown** x 181 shutdowns) (Use Scenario B CT stack parameters.)

Aux. Boiler – 2,315 hpy (Use Table 2 emissions rates)

Cooling Tower 8,760 hpy (Use Table 2 emissions rates)

Emergency Generator – 26 hpy (Use Table 2 emissions rates)

Diesel Fire Pump – 26 hpy (Use Table 2 emissions rates)

b. Based on 8,760 hpy of CT operation (Use Table 2 emissions rates) *(5.b is not a modeling case per se, but is used along with 5.a to determine maximum emissions rates on a pollutant by pollutant basis.)*

Each CT - 8,760 hpy of steady-state operation (Use Scenario B CT stack parameters.)

Aux. Boiler – 2,315 hpy

Cooling Tower 8,760 hpy

Emergency Generator – 26 hpy

Diesel Fire Pump – 26 hpy

Since maximum annual emissions for some CT pollutants (e.g., NOx, CO & VOCs) may occur in 5.a and maximum annual emissions for other CT pollutants (e.g., PM10) may occur in 5.b, use the Table 22 emissions rates, which are the maximum for each pollutant, to assess annual impacts. Use the Scenario B CT stack parameters.

TABLE 22
EMISSIONS RATES (TONS/YR)
FOR
ASSESSING ANNUAL IMPACTS

	One CT	**Both CTs**	**Cooling Tower[1]**	**Emergency Generator[2]**	**Diesel Fire Pump[2]**	**Aux. Boiler[3]**
NOx	**58.233[4]**	**116.466**	NA	0.052	0.053	0.833
CO	**76.482[4]**	**152.964**	NA	0.136	0.004	2.628
VOCs	**10.327[4]**	**20.654**	NA	0.034	0.002	0.428
PM10	**39.420[1]**	**78.840**	**2.278**	0.008	0.002	0.706
PM2.5	**2.278[1]**	**4.556**	**0.569**	0.0002	0.0003	0.023
SO2	**6.570[1]**	**13.140**	NA	0.0002	0.002	0.058

Notes:
1. Based on 8,760 hpy of operation.
2. Based on 52 half-hour periods = 26 hpy of operation.
3. Based on 2,315 hpy of operation.
4. Based on 6,807 hpy of steady-state operation + 181 startup/shutdowns.

APPENDIX 8.1-5b
KRCD CPP
MODELING PARAMETERS & EMISSIONS RATES – SIEMENS CASE

Note the text in bold is used to indicate where differences exist between the GE and Siemens cases.

A. STACK PARAMETERS

	North CT	**South CT**	**Cooling Tower**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
Stack Location[1]	N13296550..73' E885971.72'	N13296400.71' E885968.60'	See Note 1	N13296457.23' E885489.54'	N13296391.26' E886162.47'	N13296351.03' E885813.14'
Stack Height (feet)	150	150	80	45	45	100
Elevation at Base of Stack (FASL)[2]	327	327	327	327	327	327
Stack Exit Temperature (degrees F)[3]	**Scenario A -195** **Scenario B -192** **Scenario C -190** **Scenario D -188** **Scenario E -189** **Scenario F - 186**	**Scenario A -195** **Scenario B -192** **Scenario C -190** **Scenario D -188** **Scenario E -189** **Scenario F - 186**	81	986	900	325
Stack Exit Velocity (feet/min)[4]	**Scen. A - 4,666.1** **Scen. B – 4,432.1** **Scen. C– 4,325.3** **Scen. D – 4,386.1** **Scen. E – 3,892.8** **Scen. F – 3,099.0**	**Scen. A - 4,666.1** **Scen. B – 4,432.1** **Scen. C– 4,325.3** **Scen. D – 4,386.1** **Scen. E – 3,892.8** **Scen. F – 3,099.0**	2,967	6,703	8,959	2,030
Stack Cross-sectional Area (square feet)[5]	254.47	254.47	530.93 (per cell)	1.713	0.14	9.62

Notes

1. Given in UTM coordinates (feet). The approximate coordinates of the 8 cooling tower cells (centers) are:

Cell A – N13296742.00; E886210.17 (most NW cell)
Cell B – N13296700.85; E886249.64
Cell C – N13296659.71; E886289.10
Cell D – N13296618.57; E886328.57
Cell E – N13296577.41; E886368.04
Cell F – N13296536.27; E886407.51
Cell G – N13296495.12; E886446.97
Cell H – N13296453.99; E886486.45 (most SE cell)

2. The site FASL is given as 327.

3. The first 5 HRSG stack exit temperatures shown correlate to the 5 sets of ambient conditions, i.e., Scenarios A through E, used to envelope CT performance and represent the following performance cases, which were supplied on **10/25/06 by NCI as Rev. 3 of the Siemens** performance data:

Scenario A = Case 5 – 26F/60%RH, Fogger-Off, Stm Inj.-Off
Scenario B = Case 4 – 63F/40%RH, Fogger-On, Stm Inj.-Off
Scenario C = Case 13 – 63F/40%RH, Fogger-Off, Stm Inj.-Off
Scenario D = Case 2 – 103F/20.1%RH, Fogger-On, Stm Inj.-On
Scenario E = Case 12 – 103F/20.1%RH, Fogger-Off, Stm Inj.-Off

The stack exit temperature for the sixth scenario (F) comes from Case 14 of the CT performance data and is for partial load, startup/shutdown and commissioning operations.

Scenario F = Case 14 – 63F/40%RH, Fogger-Off, Stm Inj.-Off

The exit temperature for the cooling towers is assumed as the temperature of the air leaving the cooling towers, which is 80.97F for the 63F ambient annual average case.

4. The 5 HRSG stack exit velocities shown correlate to the 5 sets of ambient conditions, i.e., Scenarios A through E, used to envelope CT performance and represent the performance cases listed in Note 3 above. The 5 HRSG stack exit velocities are based on the stack diameter of 254.47 sq. feet (per Note 5 below) and the following **Siemens** performance data:

Scenario A = Case 5 – 1,187,377 acfm
Scenario B = Case 4 – 1,127,830 acfm
Scenario C = Case 13 – 1,100,652 acfm
Scenario D = Case 2 – 1,116,135 acfm
Scenario E = Case 12 – 990,595 acfm

The stack exit velocity for partial load operation, startup/shutdown and commissioning operations (Scenario F) is based on the stack diameter and the stack exhaust flow of **788,591 acfm, which is from Case 14 of the Siemens** performance data

The cooling tower number is based on a flow rate of 1,575,240 acfm per cell (CT Case 4, 63F ambient annual average). The emergency generator number is based on a flow rate of 11,484 acfm. The diesel fire pump number is based on a flow rate of 1,265 acfm. The aux. boiler number is based on a flow rate of 19,532 acfm.

5. Based on CT stack diameters of 18 feet each. Cooling tower cell cross sectional areas are based on each of the 8 cells having a diameter of 26 feet. The stack diameter of the emergency generator is 1.477 feet. The stack diameter of the diesel fire pump is 0.424 feet. The stack diameter of the aux. boiler is 3.5 feet.

B. FENCELINE

The KRCD CPP fence line is a rectangle, although it is not on a true N/S line. The coordinates (UTM in feet not meters) for the four fence line corners are given below:

NE Corner N13296824.89, E887114.46
SE Corner N13296170.20, E887092.76
SW Corner N13296231.29, E885074.65
NW Corner N13296885.87, E885093.31

C. MAJOR STRUCTURES

3. Inside the KRCD CPP Fence Line

The table below provides the dimensions for major structures inside the fence line as well as their identifying number from the General Arrangement drawing. UTM coordinate data for these structures in provided in Appendix 8-1.6.

Structure Description	**Item # on GA Drawing**	**Dimensions – L x W x H (feet)**
Switchyard Control Bldg.	2	70 x 60 x 20
Admin. Bldg.	6	100 x 60 x 24
Warehouse Maintenance Bldg.	8	100 x 80 x 24
CT1 Elec. Auxiliaries Structure	20.1	44 x 20 x 16
CT2 Elec. Auxiliaries Structure	20.1	44 x 20 x 16
CT1 Mech. Auxiliaries Structure	22.1	30 x 10 x 16
CT2 Mech. Auxiliaries Structure	22.1	30 x 10 x 16
CT1 Air Inlet Structure	24.1	70 x 50 x 62
CT2 Air Inlet Structure	24.2	70 x 50 x 62
CT1	26.1	116 x 44 x 20
CT2	26.2	116 x 44 x 20
Steam Turbine	29	121 x 36 x 34
Brine Holding Tank (north)	34	65 diam. x 34 high
Brine Holding Tank (south)	34	65 diam. x 34 high
Steam Condenser	36	34 x 50 x 35
HRSG1	40.1	165 x 62 x 95
HRSG2	40.2	165 x 62 x 95
Service/Firewater Storage Tank	47	40 diam. x 40 high
Aux. Boiler	50	30 x 22 x 12
Demin. Water Storage Tank	51	35 diam. x 32 high
Water Treatment Bldg.	52	100 x 85 x 22
Elec. Equip. Bldg.	56	118 x 44 x 20
ZLD/Cooling Tower Elec. Equip. Enclosure	58	58 x 18 x 12
Cooling Tower	59	460 x 76 x 80
ZLD Treatment Area	69	84 x 75 x 22
Recycle Water Holding Tank	73	80 diam. x 40 high

Other structures & equipment are not included, as they are either short or not solid.

4. Beyond the KRCD CPP Fence Line

Based on a review of an aerial photo of the project site and surrounding area, the terrain is relatively flat farmland and there are no significant structures in the vicinity.

D. OPERATING SCENARIOS

1. CTs in Full Load Operation (Steady-state)

Both CTs at full load

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator on (but only for 30 min./week & non simultaneous with the diesel fire pump)

Diesel Fire Pump on (but only for 30 min./week & non simultaneous with the emergency generator)

The following 5 ambient/operational scenarios will be assessed for CT steady-state operation:

Scenario A = Case 5 – Siemens/GE performance data – 26F/60%RH, Fogger-Off, Stm Inj.-Off
Scenario B = Case 4 – Siemens/GE performance data – 63F/40%RH, Fogger-On, Stm Inj.-Off
Scenario C = Case 13 – Siemens/GE performance data – 63F/40%RH, Fogger-Off, Stm Inj.-Off
Scenario D = Case 2 – Siemens/GE performance data – 103F/20.1%RH, Fogger-On, Stm Inj.-On
Scenario E = Case 12 – Siemens/GE performance data– 103F/20.1%RH, Fogger-Off, Stm Inj.-Off

This 5 case subset of the 20 cases of performance provided for the CTs should envelope the other 15 cases.

2. CT in Startup or Shutdown Mode

CT Startup

1 CT in startup mode for **30 minutes** before the 2nd CT initiates startup

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator off

Diesel Fire Pump off

CT Shutdown

Both CTs in shutdowm mode simultaneously

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator off

Diesel Fire Pump off

3. CTs Not Operating

Both CTs off

Aux. Boiler on (at full load)

Cooling Tower on (at full load – This is conservative, but the cooling tower may need to operate at some load during this time.)

Emergency Generator on (but only for 30 min./week & non simultaneous with the diesel fire pump)

Diesel Fire Pump on (but only for 30 min./week & non simultaneous with the emergency generator)

4. CTs in Partial Load Operation

1 CT at partial load (apprx. **60.5% for Siemens)**

The other CT at full load

Aux. Boiler on (at full load)

Cooling Tower on (at full load)

Emergency Generator on (but only for 30 min./week & non simultaneous with the diesel fire pump)

Diesel Fire Pump on (but only for 30 min./week & non simultaneous with the emergency generator)

One ambient temperature/operational scenario is available for the assessment of CT partial load operation:

Scenario F = Case 14 – CT performance data – 63F/40%RH, Fogger-Off, Stm Inj.-Off

5. Hours of annual operation

CTs – 6,807 hpy of steady-state + 154 hot starts (@ **2 hrs, 27 min./start**) + 27 warm starts (@ **2hrs, 52 min./start**) + 181 shutdowns (@ **1hr, 2 min./shutdown**). Annual emissions from this annual CT operating scenario should be compared with those for the CTs operating at full load for 8,760 hpy and the highest emissions for each pollutant used for estimating max. annual emissions.

Aux. Boiler – 2,315 hpy (based on 8,760-6,807=1,953 hpy when the CTs are not in steady-state operation + 2 x 181=362 hpy for 1 hr overlap with CT steady-state before and after each start/stop cycle)

Cooling Tower – 8,760 hpy

Emergency Generator – 26 hpy (but not when diesel fire pump is on)

Diesel Fire Pump – 26 hpy (but not when emergency generator is on)

6. CT Commissioning

CTs – assume only 1 CT will operate during the commissioning period at any time.

Aux. boiler off

Cooling Tower on (at full load)

Emergency Generator off

Diesel Fire Pump off

E. EMISSIONS RATES

1. Steady-State

There are 5 sets of steady-state emissions rates. These 5 sets of CT emissions rates, which are associated with the five ambient temperature conditions noted in Section D (Operating Scenarios A through E), in essence govern all steady-state emissions scenarios.

The 5 sets of steady-state emissions rates are shown in Tables 1 through 5. Peak hourly emissions, based on the coldest (design) ambient temperature (Scenario A), are provided in Table 1. Annual average emissions are represented by the emissions rates in Tables 2 & 3 (Scenarios B & C). The emissions rates at the maximum ambient (design) temperature are provided in Tables 4 & 5 (Scenarios D & E).

Note that the emissions rates for the cooling tower and aux. boiler are assumed to be constant across the range of operating conditions. Max. hourly emissions during steady-state assume operation of both CTs, the cooling tower, aux. boiler and emergency generator or the diesel fire pump (depending upon which of these two pieces of equipment has the higher emissions for a given scenario).

2. Startup/Shutdown

CT cold startup, warm startup, hot startup and shutdown sequence emissions rates are shown in Tables 6 through 9, respectively.

The startup emissions rates do not directly account for multiple (failed) startup sequences. However, for warm and hot startups (and cold as well, although cold starts are not included in this project's operating scenarios because of the use of an aux. boiler), a failed start for either the 1st or 2nd CT in the start sequence would not alter the max. hourly emissions rates shown in Tables 6 through 8. Instead, a failed start of one of the CTs would extend the number of hours during which the max. emissions rates shown in Tables 6 through 8 would occur. To address the potential issue of failed start sequences, 2 failed start attempts, each of 30 minutes, are assumed. This has the effect of extending the hot, warm or cold startup period by 1 hour. **For Siemens the max. startup periods are: hot 147 + 60 = 207 min. & warm 172 + 60 = 232 min.**

(Note that the startup/shutdown emissions rates for the cooling tower and aux. boiler are assumed to be the same as those for steady-state.)

3. Partial Load

Table 10 provides emissions rates for CT partial load operation. **For Siemens partial load operation is at approximately 60.5% of full load output.** Partial load operation should be evaluated for short term impacts, but not for long term (i.e., annual), as full load operation produces greater emissions. Since it is likely that a) 1 CT would be in partial load operation and the other CT off or b) one CT would be in partial load operation and the other CT at full load, but unlikely that both CTs would operate at partial load, the partial load assessment will assume 1 CT at partial load and the other at full load (both at annual average ambient conditions).

4. Commissioning

CT commissioning emissions rates, which will occur within the first few months of project operation and are shown in Table 11, must be factored into the assessment of short-term impacts. Long-term (annual) impacts need not account for commissioning emissions, since in the 1st year of operation the allowable amount of normal operation is assumed to be reduced by and to the extent that commissioning operations occur.

(Note that the commissioning emissions rates for other equipment are assumed to be the same as those for steady-state.)

TABLE 1
MAXIMUM HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**15.1**	**30.2**	NA	4.01	4.07	0.72
CO[4]	**9.2**	**18.4**	NA	10.43	0.31	2.27
VOCs[5]	**3.0**	**6.0**	NA	2.65	0.19	0.37
PM10	**10.0**	**20.0**	**0.56**	0.64	0.14	0.61
PM2.5[6]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[7]**	**3.32**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:

1. Based on CT operation at an ambient temperature of 26 degrees F, Fogger-Off, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **62,342,384 lbs/hr (7,505,989 gal/hr**); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. CT PM2.5 emissions rate based on an emissions factor of 0.00028 lbs/MMBtu and **2,087.5 MMBtu/hr** fuel input per CT. Aux. bolier PM2.5 emissions rate based on an emissions factor of 0.00028 lbs/MMBtu and fuel input of 61.23 MMBtu/hr. Emergency generator PM2.5 emissions rate based on an emissions factor of 0.00028 lbs/MMBtu and fuel input of 13 MMBtu/hr. Diesel fire pump PM2.5 emissions factors based on an emissions factor of 0.004 lbs/MMBtu and fuel input of 3 MMBtu/hr. Cooling tower PM2.5 emissions rate assumes PM2.5 is 25% of the PM10 emissions rate.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 2
AVERAGE HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**14.2**	**28.4**	NA	4.01	4.07	0.72
CO[4]	**8.8**	**17.6**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**10.0**	**20.0**	**0.56**	0.64	0.14	0.61
PM2.5[6]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[7]**	**3.32**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:

1. Based on an ambient temperature of 63 degrees F, Fogger-On, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **62,342,384 lbs/hr (7,505,989 gal/hr**); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 3
AVERAGE HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**14.0**	**28.0**	NA	4.01	4.07	0.72
CO[4]	**8.4**	**16.8**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**10.0**	**20.0**	**0.56**	0.64	0.14	0.61
PM2.5[6]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[7]**	**3.32**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:
1. Based on an ambient temperature of 63 degrees F, Fogger-Off, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **62,342,384 lbs/hr (7,505,989** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 4
HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**14.4**	**28.8**	NA	4.01	4.07	0.72
CO[4]	**8.8**	**17.6**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**10.0**	**20.0**	**0.56**	0.64	0.14	0.61
PM2.5[6]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[7]**	**3.32**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:
1. Based on an ambient temperature of 103 degrees F, Fogger-On, STIG-On.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **62,342,384 lbs/hr (7,505,989** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 5
HOURLY EMISSIONS RATES (LBS/HR)
STEADY-STATE OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**12.2**	**24.4**	NA	4.01	4.07	0.72
CO[4]	**7.4**	**14.8**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**10.0**	**20.0**	**0.56**	0.64	0.14	0.61
PM2.5[6]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[7]**	**3.32**	NA	0.01[7]	0.12[8]	0.05[7]

Notes:

1. Based on an ambient temperature of 103 degrees F, Fogger-Off, STIG-Off.
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **62,342,384 lbs/hr (7,505,989** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 6
EMISSIONS RATES (LBS/HR)
COLD STARTUP MODE[1]

	One CT[2]	Both CTs[2]	Cooling Tower[3]	Emergency Generator[3]	Diesel Fire Pump[3]	Aux. Boiler[3]
NOx	**41.7**	**83.4**	NA	4.01	4.07	0.72
CO	**233.9**	**467.8**	NA	10.43	0.31	2.27
VOCs	**20.2**	**40.4**	NA	2.65	0.19	0.37
PM10	**8.8**	**17.6**	**0.56**	0.64	0.14	0.61
PM2.5[4]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[5]**	**3.32**	NA	0.01	0.12	0.05

Notes:

1. For the CTs conventional, not fast or rapid, startup capability is assumed. The emissions rates in this cold startup mode table are not used for assessing impacts, as the warm and hot startup modes cover the various operating scenarios.
2. **For a cold startup cycle the total time required is 262 minutes (4 hrs, 22 minutes) per CT. Since it is assumed that CT2 would start 30 minutes after the start of CT1, the highest hourly emissions will occur not in the first hour of startup (when CT2 is off for the first 30 minutes), but in the 2nd, 3rd & 4th hours of the 4 hr, 22 minute sequence, as both CTs will be on and emitting at the cold startup rate for a full 60 minutes in the 2nd, 3rd & 4th hours.**
3. The emissions rates for these pieces of equipment are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 7
EMISSIONS RATES (LBS/HR)
WARM STARTUP MODE[1]

	One CT[2]	**Both CTs[2]**	**Cooling Tower[3]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[3]**
NOx	**57.6**	**115.2**	NA	4.01	4.07	0.72
CO	**362.5**	**725.0**	NA	10.43	0.31	2.27
VOCs	**30.7**	**61.4**	NA	2.65	0.19	0.37
PM10	**9.1**	**18.2**	**0.56**	0.64	0.14	0.61
PM2.5[4]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[5]**	**3.32**	NA	0.01	0.12	0.05

Notes:

1. For the CTs conventional, not fast or rapid, startup capability is assumed.
2. **For a warm startup cycle the total time required is 172 minutes (2 hrs, 52 min.) per CT. Since it is assumed that CT2 would start 30 minutes after the start of CT1, the highest hourly emissions will occur not in the first hour of startup (when CT2 is off for the first 30 minutes), but in the 2nd hour, as both CTs will be on and emitting at the warm startup rate for a full 60 minutes in the 2nd hour.**
3. The emissions rates for these pieces of equipment are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 8
EMISSIONS RATES (LBS/HR)
HOT STARTUP MODE[1]

	One CT[2]	**Both CTs[2]**	**Cooling Tower[3]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[3]**
NOx	**65.4**	**130.8**	NA	4.01	4.07	0.72
CO	**423.7**	**847.4**	NA	10.43	0.31	2.27
VOCs	**35.6**	**71.2**	NA	2.65	0.19	0.37
PM10	**9.0**	**18.0**	**0.56**	0.64	0.14	0.61
PM2.5[4]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[5]**	**3.32**	NA	0.01	0.12	0.05

Notes:

1. For the CTs conventional, not fast or rapid, startup capability is assumed.
2. **For a hot startup cycle the total time required is 147 minutes (2 hrs, 27 min.) per CT. Since it is assumed that CT2 would start 30 minutes after the start of CT1, the highest hourly emissions will occur not in the first hour of startup (when CT2 is off for the first 30 minutes), but in the 2nd hour, as both CTs will be on and emitting at the hot startup rate for a full 60 minutes in the 2nd hour.**
3. The emissions rates for these pieces of equipment are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 9
EMISSIONS RATES (LBS/HR)
SHUTDOWN MODE[1]

	One CT[2]	**Both CTs[2]**	**Cooling Tower[3]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[3]**
NOx	**50.0**	**100.0**	NA	4.01	4.07	0.72
CO	**336.0**	**672.0**	NA	10.43	0.31	2.27
VOCs	**27.0**	**54.0**	NA	2.65	0.19	0.37
PM10	**8.3**	**16.6**	**0.56**	0.64	0.14	0.61
PM2.5[4]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[5]**	**3.32**	NA	0.01	0.12	0.05

Notes:

1. For the CTs, conventional, not fast or rapid, startup capability is assumed.
2. **For a shutdown cycle the total time required is approximately 1 hr (62 minutes) per CT. Since it is assumed that both CTs can be in shutdown at the same time, the hourly emissions rates for the CTs are calculated as follows: 0 – 60 minutes both CTs in shutdown mode; minute 61 & beyond both CTs off.**
3. The emissions rates for these pieces of equipment are the same as for steady-state operation.
4. PM2.5 emissions rates assume those used for the 26F ambient case.
5. This emissions rate is assumed as the same as for steady-state operation in the 26 degree F ambient case.

TABLE 10
EMISSIONS RATES (LBS/HR)
PARTIAL LOAD OPERATION[1]

	One CT	**Both CTs**	**Cooling Tower[2]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx[3]	**9.6**	**19.2**	NA	4.01	4.07	0.72
CO[4]	**5.8**	**11.6**	NA	10.43	0.31	2.27
VOCs[5]	**2.0**	**4.0**	NA	2.65	0.19	0.37
PM10	**10.0**	**20.0**	**0.56**	0.64	0.14	0.61
PM2.5[6]	**0.59**	**1.17**	**0.14**	0.01	0.02	0.02
SO2	**1.66[7]**	**3.32**	NA	0.01	0.12[8]	0.05[7]

Notes:

1. Based on an ambient temperature of 63 degrees F, Fogger-Off, STIG-Off. Output is approximately **60.5% of full load.**
2. PM10 is the only emission from this equipment. Cooling tower PM 10 emissions are based on: a circ. water rate of **62,342,384 lbs/hr (7,505,989** gal/hr); a TDS conc. of 1,800 mg/l; and a drift rate of 0.0005%.
3. CT NOx emissions are based on SCR to 2 ppmdv @ 15% O2; aux. boiler emissions are based on 9 ppmdv @ 3% O2.
4. CT CO emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
5. CT VOC emissions are based on an oxidation catalyst to 2 ppmdv @ 15% O2.
6. PM2.5 emissions rates assume those used for the 26F ambient case.
7. Based on 0.3 grains S/100 scf.
8. Based on 0.05% fuel sulfur content.

TABLE 11 EMISSIONS RATES COMMISSIONING MODE[1]							
CT Commissioning Emissions Rates (lbs/hr) Per CT[2]							**Cooling Tower[3]**
	HRSG Cleanup, 0% Load	**ST Stm Checks/Stm Blows @ 50% Load; DLN Tuning @ 50% Load**	**DLN Tuning @ 20% Load**	**DLN Tuning @ 80% Load**	**NH3 Tuning @ 50% Load**	**NH3 Tuning & Stm Inj. Tuning @ 100% Load**	
NOx	**140.9**	**172.5**	**196.6**	**168.1**	**9.0**	**15.1**	NA
CO	**202.9**	**404.4**	**320.1**	**267.0**	**5.5**	**9.2**	NA
VOCs	**19.2**	**22.3**	**26.5**	**12.1**	**1.8**	**3.0**	NA
PM10[4]	**10.0**	**10.0**	**10.0**	**10.0**	**10.0**	**10.0**	**0.56**
PM2.5[4]	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.59**	**0.14**
SO2[4]	**1.66**	**1.66**	**1.66**	**1.66**	**1.66**	**1.66**	NA

Notes:

1. During commissioning it is assumed that the cooling tower will be in operation, but not the aux. boiler, emergency generator or diesel fire pump.
2. Each of the two CTs will be commissioned separately. Therefore, when comparing commissioning emissions rates with other scenarios, assume only one CT in commissioning mode as compared with two CTs in steady-state or startup/shutdown mode.
3. Emissions from this equipment is the same as for steady-state operation.
4. PM10, PM2.5 & SO2 emissions rates for the CTs are assumed as the same as for steady-state operation and based 26F ambient.

F. MODELING SCENARIOS

1. 1-hr Impacts (NOx, CO & SO2)

a. Based on maximum 1-hr emissions for normal operation (assess for Scenarios A through F)

CTs – 1 hot startup (both CTs in hot start mode for 60 min. simultaneously); 1 hr of hot startup produces greater emissions than either steady-state, warm start or shutdown operation.

Aux. Boiler – 1 hr of operation at CT startup

Cooling Tower – 1 hr of operation

Emergency Generator (EG)– 30 min. of operation **OR** Diesel Fire Pump (DFP) – 30 min. of operation

Use Table 12 emissions rates and assess the 1-hr impacts from normal operation for Scenarios A through F. For NOx & SO2 worst case impacts the DFP operates; for CO worst case impacts the EG operates.

TABLE 12 EMISSIONS RATES (LBS/HR) FOR ASSESSING 1-HR IMPACTS FROM NORMAL OPERATIONS[1]						
	One CT	**Both CTs**	**Cooling Tower[3]**	**Emergency Generator**	**Diesel Fire Pump**	**Aux. Boiler**
NOx	**65.4**	**130.8**	NA	2.01	2.04	0.72
CO	**423.7**	**847.4**	NA	5.22	0.16	2.27
VOCs	**35.6**	**71.2**	NA	1.33	0.10	0.37
PM10	**9.0**	**18.0**	**0.56**	0.32	0.07	0.61
PM2.5	**0.59**	**1.17**	**0.14**	0.005	0.01	0.02
SO2	**1.66**	**3.32**	NA	0.005	0.06	0.05

Notes:
1. Emissions rates are directly from Table 8 except for the Emergency Generator and Diesel Fire Pump, which are 50% of their Table 8 rates, since either of these pieces of equipment will only operate for 30 min. in an hour.

b. Based on CT commissioning (Use Scenarios A through F CT stack parameters)

Only 1 CT – Assume 1 hr of continuous commissioning. Use the highest commissioning emissions rates for each pollutant**.**

Aux.Boiler – off

Cooling Tower – 1 hr of operation

EG - off & DFP - off

Use the emissions rates in Table 13 along with Scenarios A through F CT stack parameters to assess the 1-hr impacts for the commissioning mode.

TABLE 13 MAXIMUM EMISSIONS RATES (LBS/HR) FOR COMMISSIONING MODE		
	One CT – Commissioning[1]	**Cooling Tower**
NOx	**196.6**	NA
CO	**404.4**	NA
VOCs	**26.5**	NA
PM10	**10.0**	**0.56**
PM2.5	**0.59**	**0.14**
SO2	**1.66**	NA

Notes:
1. Emissions rates are the highest for each pollutant from Table 11. Only one CT will operate in commissioning mode at a time.

c. Based on Partial Load Operation

CT1 – 1 hr in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 1-hr in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 1 hrs of operation (for conservatism)

Cooling Tower – 1 hr of operation

Emergency Generator (EG)– 30 min. of operation **OR** Diesel Fire Pump (DFP) – 30 min. of operation

Use Table 14 emissions rates to assess the 1-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters. For NOx & SO2 worst case impacts the DFP operates; for CO worst case impacts the EG operates.

TABLE 14
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 1-HR IMPACTS
FROM PARTIAL LOAD OPERATIONS

	CT1[1]	**CT2[2]**	**Cooling Tower[4]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**9.6**	**14.2**	NA	2.01	2.04	0.72
CO	**5.8**	**8.8**	NA	5.22	0.16	2.27
VOCs	**2.0**	**2.0**	NA	1.33	0.10	0.37
PM10	**10.0**	**10.0**	**0.56**	0.32	0.07	0.61
PM2.5	**0.59**	**0.59**	**0.14**	0.005	0.01	0.02
SO2	**1.66**	**1.66**	NA	0.005	0.06	0.05

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates are divided by 2, since this piece of equipment will only operate for 30 min. in an hour.
4. Normal emissions rates for this piece of equipment.

2. 3-hr Impacts (SO2)

a. Based on maximum 3-hr emissions for normal operation (assess for Scenarios A through E)

CTs – 1 hot startup, including 2 x 30 min. failed start attempts for 1 CT (117 min. both CTs in simultaneous hot start mode + 63 min. of 1 CT in hot start mode & the other CT in steady-state mode);

Aux. Boiler – 3 hrs of operation at CT startup

Cooling Tower – 3 hrs of operation

DFP – 30 min. of operation for worst case SO2 impacts

Use the emissions rates in Table 15 to assess the 3-hr impacts from normal operation for Scenarios A through E.

TABLE 15 EMISSIONS RATES (LBS/HR) FOR ASSESSING 3-HR IMPACTS FROM NORMAL OPERATIONS						
	CT1[1]	**CT2[1]**	**Cooling Tower[2]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**Scenario A -56.6 Scenario B – 56.45 Scenario C – 56.41 Scenario D –56.48 Scenario E – 56.1**	**Scenario A -56.6 Scenario B – 56.45 Scenario C – 56.41 Scenario D –56.48 Scenario E – 56.1**	NA	0.67	0.68	0.72
CO	**Scenario A -351.17 Scenario B -351.1 Scenario C -351.03 Scenario D -351.1 Scenario E -350.85**	**Scenario A -351.17 Scenario B -351.1 Scenario C -351.03 Scenario D -351.1 Scenario E -350.85**	NA	1.74	0.06	2.27
VOCs	**Scenario A -29.90 Scenario B – 29.72 Scenario C – 29.72 Scenario D – 29.72 Scenario E – 29.72**	**Scenario A -29.90 Scenario B – 29.72 Scenario C – 29.72 Scenario D – 29.72 Scenario E – 29.72**	NA	0.45	0.04	0.37
PM10	**Scenario A – 9.18 Scenario B – 9.18 Scenario C – 9.18 Scenario D – 9.18 Scenario E – 9.18**	**Scenario A – 9.18 Scenario B – 9.18 Scenario C – 9.18 Scenario D – 9.18 Scenario E – 9.18**	**0.56**	0.11	0.03	0.61
PM2.5	**All Scenarios - 0.59**	**All Scenarios - 0.59**	**0.14**	0.002	0.003	0.02
SO2	**All Scenarios - 1.66**	**All Scenarios - 1.66**	NA	0.002	0.02	0.05

Notes:
1. The emissions rates for the CTs are based on taking the total amount of emissions from both CTs for the 3-hr period and splitting these totals evenly between the two CTs.
2. Normal Cooling Tower emissions rates, since the cooling tower operates for 3 out of 3 hrs.
3. Normal EG & DFP emissions rates are divided by 6, since either the EG or DFP operates for only 30 min. of the 3 hrs.
4. Normal Aux. Boiler emissions rates, since the Aux. Boiler operates for 3 out of the 3 hrs.

b. Based on CT commissioning (Use only Scenario F CT stack parameters) *(Do not need to model this case because the results, which pertain to SO2 only, are covered by F.2.a & F.2.c.)*

Only 1 CT – Assume 3 hrs of continuous commissioning. Use the highest commissioning emissions rates for each pollutant**.**

Aux.Boiler – off

Cooling Tower – 3 hrs of operation

EG – off & DFP off

Use the emissions rates in Table 13 along with Scenario F CT stack parameters to assess 3-hr impacts for commissioning mode.

c. Based on Partial Load Operation

CT1 – 3 hrs in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 3-hrs in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 3 hrs of operation (for conservatism)

Cooling Tower – 3 hrs of operation

DFP – 30 min. of operation for worst case SO2 impacts

Use Table 16 emissions rates to assess the 3-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters.

TABLE 16
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 3-HR IMPACTS
FROM PARTIAL LOAD OPERATIONS

	CT1[1]	**CT2[2]**	**Cooling Tower[3]**	**Emergency Generator[4]**	**Diesel Fire Pump[4]**	**Aux. Boiler[3]**
NOx	**9.6**	**14.2**	NA	0.67	0.68	0.72
CO	**5.8**	**8.8**	NA	1.74	0.06	2.27
VOCs	**2.0**	**2.0**	NA	0.45	0.04	0.37
PM10	**10.0**	**10.0**	**0.56**	0.11	0.03	0.61
PM2.5	**0.59**	**0.59**	**0.14**	0.002	0.003	0.02
SO2	**1.66**	**1.66**	NA	0.002	0.02	0.05

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates for this piece of equipment.
4. Normal EG & DFP emissions rates are divided by 6, since either the EG or DFP operates for only 30 min. of the 3 hrs.

3. 8-hr Impacts (CO)

a. Based on maximum 8-hr emissions for normal operation (assess for Scenarios A through E)

CTs – 1 hot startup, including 2 x 30 min. failed start attempts for 1 CT (117 min. both CTs in simultaneous hot start mode + 90 min. of 1 CT in hot start mode & the other CT in steady-state mode + 30 min. of 1 CT in start mode and the other off + 243 min. of both CTs in steady-state mode)

Aux. Boiler – 3 hrs of operation at CT startup

Cooling Tower – 8 hrs of operation

EG– 30 min. of operation for worst case CO impacts

Use the emissions rates in Table 17 to assess the 8-hr impacts from normal operation for Scenarios A through E.

TABLE 17 EMISSIONS RATES (LBS/HR) FOR ASSESSING 8-HR IMPACTS FROM NORMAL OPERATIONS						
	CT1[1]	**CT2[1]**	**Cooling Tower[2]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**Scenario A -33.18** **Scenario B – 32.64** **Scenario C – 32.52** **Scenario D –32.76** **Scenario E – 31.44**	**Scenario A -33.18** **Scenario B – 32.64** **Scenario C – 32.52** **Scenario D –32.76** **Scenario E – 31.44**	NA	0.26	0.26	0.27
CO	**Scenario A -161.76** **Scenario B -161.52** **Scenario C -161.28** **Scenario D -161.52** **Scenario E -160.68**	**Scenario A -161.76** **Scenario B -161.52** **Scenario C -161.28** **Scenario D -161.52** **Scenario E -160.68**	NA	0.66	0.02	0.86
VOCs	**Scenario A -14.93** **Scenario B – 14.33** **Scenario C – 14.33** **Scenario D – 14.33** **Scenario E – 14.33**	**Scenario A -14.93** **Scenario B – 14.33** **Scenario C – 14.33** **Scenario D – 14.33** **Scenario E – 14.33**	NA	0.17	0.02	0.14
PM10	**Scenario A – 9.32** **Scenario B – 9.32** **Scenario C – 9.32** **Scenario D – 9.32** **Scenario E – 9.32**	**Scenario A – 9.32** **Scenario B – 9.32** **Scenario C – 9.32** **Scenario D – 9.32** **Scenario E – 9.32**	**0.56**	0.04	0.01	0.23
PM2.5	**All Scenarios - 0.59**	**All Scenarios - 0.59**	**0.14**	0.001	0.001	0.01
SO2	**All Scenarios - 1.66**	**All Scenarios - 1.66**	NA	0.001	0.008	0.02

Notes:
1. The emissions rates for the CTs are based on taking the total amount of emissions from both CTs for the 8-hr period and splitting these totals evenly between the two CTs.
2. Normal Cooling Tower emissions rates, since the cooling tower operates for 8 out of 8 hrs.
3. Normal EG & DFP emissions rates are divided by 16, since either the EG or DFP operates for only 30 min. of the 8 hrs.
4. Normal Aux. Boiler emissions rates multiplied by 3/8, since the Aux. Boiler operates for 3 out of the 8 hrs.

b. Based on CT commissioning (Use only Scenario F CT stack parameters)

Only 1 CT – Assume 8 hrs of continuous commissioning. Use the highest commissioning emissions rates for each pollutant**.**

Aux.Boiler – off

Cooling Tower – 8 hrs of operation

EG - off & DFP - off

Use the emissions rates in Table 13 along with Scenario F CT stack parameters to assess 8-hr impacts for commissioning mode.

c. Based on Partial Load Operation

CT1 – 8 hrs in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 8-hrs in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 3 hrs of operation at CT startup

Cooling Tower – 8 hrs of operation

EG– 30 min. of operation for worst case CO impacts

Use Table 18 emissions rates to assess the 8-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters.

TABLE 18
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 8-HR IMPACTS
FROM PARTIAL LOAD OPERATIONS

	CT1[1]	**CT2[2]**	**Cooling Tower[3]**	**Emergency Generator[4]**	**Diesel Fire Pump[4]**	**Aux. Boiler[5]**
NOx	**9.6**	**14.2**	NA	0.26	0.26	0.27
CO	**5.8**	**8.8**	NA	0.66	0.02	0.86
VOCs	**2.0**	**2.0**	NA	0.17	0.02	0.14
PM10	**10.0**	**10.0**	**0.56**	0.04	0.01	0.23
PM2.5	**0.59**	**0.59**	**0.14**	0.001	0.001	0.01
SO2	**1.66**	**1.66**	NA	0.001	0.008	0.02

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates for this piece of equipment.
4. Normal EG & DFP emissions rates are divided by 16, since either the EG or DFP operates for only 30 min. of the 8 hrs.
5. Normal AB emissions rates are multiplied by 3/8, since the AB operates for only 3 of the 8 hrs.

d. Based on Aux. Boiler only Operation

Both CTs – off

Aux. Boiler – 8 hrs of operation

Cooling Tower – off

Emergency Generator – off & DFP - off

Use full aux. boiler emissions rates (e.g., from Table 1)

4. 24-hr Impacts (NOx – for Class I, PM10, PM2.5, SO2)

a. Based on maximum 24-hr emissions for normal operation (assess for Scenarios A through E)

CTs – 1 hot startup, including 2 x 30 min. failed start attempts for 1 CT, & 1 shutdown (117 min. both CTs in simultaneous hot start mode + 90 min. of 1 CT in hot start mode & the other CT in steady-state mode + 30 min. of 1 CT in start mode and the other off + 1,143 min. of both CTs in steady-state mode + 60 min. of both CTs in shutdown mode).

Aux. Boiler – 2 hrs of operation at CT startup, and 2 hrs at CT shutdown (1 hr during shutdown & 1 hr post-shutdown) = 4 hrs total

Cooling Tower – 24 hrs of operation

DFP – 30 min. of operation for worst case PM10, PM2.5 & SO2 impacts

Use the emissions rates in Table 19 to assess the 24-hr impacts from normal operation for Scenarios A through E.

TABLE 19
EMISSIONS RATES (LBS/HR)
FOR
ASSESSING 24-HR IMPACTS
FROM NORMAL OPERATIONS

	CT1[1]	**CT2[1]**	**Cooling Tower[2]**	**Emergency Generator[3]**	**Diesel Fire Pump[3]**	**Aux. Boiler[4]**
NOx	**Scenario A -22.58** **Scenario B – 21.84** **Scenario C – 21.68** **Scenario D –22.0** **Scenario E – 20.19**	**Scenario A -22.58** **Scenario B – 21.84** **Scenario C – 21.68** **Scenario D –22.0** **Scenario E – 20.19**	NA	0.09	0.09	0.12
CO	**Scenario A -73.67** **Scenario B -73.34** **Scenario C -73.01** **Scenario D -73.34** **Scenario E -72.19**	**Scenario A -73.67** **Scenario B -73.34** **Scenario C -73.01** **Scenario D -73.34** **Scenario E -72.19**	NA	0.22	0.006	0.38
VOCs	**Scenario A -7.98** **Scenario B – 7.15** **Scenario C – 7.15** **Scenario D – 7.15** **Scenario E – 7.15**	**Scenario A -7.98** **Scenario B – 7.15** **Scenario C – 7.15** **Scenario D – 7.15** **Scenario E – 7.15**	NA	0.06	0.004	0.07
PM10	**Scenario A – 9.71** **Scenario B – 9.71** **Scenario C – 9.71** **Scenario D – 9.71** **Scenario E – 9.71**	**Scenario A – 9.71** **Scenario B – 9.71** **Scenario C – 9.71** **Scenario D – 9.71** **Scenario E – 9.71**	**0.56**	0.013	0.003	0.11
PM2.5	**All Scenarios - 0.59**	**All Scenarios - 0.59**	**0.14**	0.0003	0.0005	0.01
SO2	**All Scenarios - 1.66**	**All Scenarios - 1.66**	NA	0.0003	0.003	0.01

Notes:
1. The emissions rates for the CTs are based on taking the total amount of emissions from both CTs for the 24-hr period and splitting these totals evenly between the two CTs.
2. Normal Cooling Tower emissions rates, since the cooling tower operates for 24 out of 24 hrs.
3. Normal EG & DFP emissions rates are divided by 48, since either the EG or DFP operates for only 30 min. of the 24 hrs.
4. Normal Aux. Boiler emissions rates divided by 6, since the Aux. Boiler operates for 4 out of the 24 hrs.

b. Based on CT commissioning (Use only Scenario F CT stack parameters)

Only 1 CT –Assume 24 hrs of continuous commissioning. Do not use the highest commissioning emissions rates for each pollutant, as these do not necessarily apply for the 24 hours of continuous commissioning operation, which is assumed to take place only for HRSG cleanup (0% load) commissioning.

Aux.Boiler – off

Cooling Tower – 24 hrs of operation

EG – off & DFP - off

Use the emissions rates in Table 20 along with Scenario F CT stack parameters to assess 24-hr impacts for commissioning mode.

TABLE 20 EMISSIONS RATES (LBS/HR) FOR 24-HR COMMISSIONING MODE[1]		
	One CT - Commissioning	**Cooling Tower**
NOx	**140.9**	NA
CO	**202.9**	NA
VOCs	**19.2**	NA
PM10	**10.0**	**0.56**
PM2.5	**0.59**	**0.14**
SO2	**1.66**	NA
Notes: 1. CT emissions rates are from Table 11 for the 0% load case.		

c. Based on Partial Load Operation

CT1 – 24 hrs in steady-state (partial load) mode. (Use Scenario F CT stack parameters & Table 10 emissions rates.)

CT2 – 24-hrs in steady-state mode (full load) mode. (Use Scenario B CT stack parameters & Table 2 emissions rates.)

Aux. Boiler – 2 hrs of operation at CT startup, and 2 hrs at CT shutdown (1 hr during shutdown & 1 hr post-shutdown) = 4 hrs total

Cooling Tower – 24 hrs of operation

DFP – 30 min. of operation for worst case PM10, PM2.5 & SO2 impacts

Use Table 21 emissions rates to assess the 24-hr impacts from partial load operation. For CT1 use Scenario F CT stack parameters, and for CT2 use Scenario B CT stack parameters.

TABLE 21 EMISSIONS RATES (LBS/HR) FOR ASSESSING 24-HR IMPACTS FROM PARTIAL LOAD OPERATIONS						
`	**CT1[1]**	**CT2[2]**	**Cooling Tower[3]**	**Emergency Generator[4]**	**Diesel Fire Pump[4]**	**Aux. Boiler[5]**
NOx	**9.6**	**14.2**	NA	0.09	0.09	0.12
CO	**5.8**	**8.8**	NA	0.22	0.006	0.38
VOCs	**2.0**	**2.0**	NA	0.06	0.004	0.07
PM10	**10.0**	**10.0**	**0.56**	0.013	0.003	0.11
PM2.5	**0.59**	**0.59**	**0.14**	0.0003	0.0005	0.01
SO2	**1.66**	**1.66**	NA	0.0003	0.003	0.01

Notes:
1. CT1 in partial load operation; emissions rates from Table 10.
2. CT2 in full load operation; emissions rates from Table 2.
3. Normal emissions rates for this piece of equipment.
4. Normal EG & DFP emissions rates are divided by 48, since either the EG or DFP operates for only 30 min. of the 24 hrs.
5. Normal AB emissions rates are multiplied by 1/6, since the AB operates for only 4 of the 24 hrs.

d. Based on Aux. Boiler only Operation

Both CTs – off

Aux. Boiler – 24 hrs of operation

Cooling Tower – off

Emergency Generator – off & DFP - off

Use full aux. boiler emissions rates (e.g., from Table 1)

5. Annual Impacts

a. Based on 6,807 hpy of CT operation & 181 startups/shutdowns *(5.a is not a modeling case per se, but is used along with 5.b to determine maximum emissions rates on a pollutant by pollutant basis.)*

Each CT - 6,807 hpy of steady-state operation (Use Table 2 CT emissions rates and Scenario B CT stack parameters)

Each CT – 154 hot starts (use Table 8 emissions rates x **2.45 hrs/start** x 154 starts) + 27 warm starts (use Table 7 emissions rates x **2.87 hrs/start** x 27 starts) + 181 shutdowns (use Table 9 emissions rates x **1 hr/shutdown** x 181 shutdowns) (Use Scenario B CT stack parameters.)

Aux. Boiler – 2,315 hpy (Use Table 2 emissions rates)

Cooling Tower 8,760 hpy (Use Table 2 emissions rates)

Emergency Generator – 26 hpy (Use Table 2 emissions rates)

Diesel Fire Pump – 26 hpy (Use Table 2 emissions rates)

b. Based on 8,760 hpy of CT operation (Use Table 2 emissions rates) *(5.b is not a modeling case per se, but is used along with 5.a to determine maximum emissions rates on a pollutant by pollutant basis.)*

Each CT - 8,760 hpy of steady-state operation (Use Scenario B CT stack parameters.)

Aux. Boiler – 2,315 hpy

Cooling Tower 8,760 hpy

Emergency Generator – 26 hpy

Diesel Fire Pump – 26 hpy

Since maximum annual emissions for some CT pollutants (e.g., NOx, CO & VOCs) occur in 5.a and maximum annual emissions for other CT pollutants (e.g., PM10) occur in 5.b, use the Table 22 emissions rates, which are the maximum for each pollutant, to assess annual impacts. Use the Scenario B CT stack parameters.

TABLE 22
EMISSIONS RATES (TONS/YR)
FOR
ASSESSING ANNUAL IMPACTS

	One CT	**Both CTs**	**Cooling Tower[1]**	**Emergency Generator[2]**	**Diesel Fire Pump[2]**	**Aux. Boiler[3]**
NOx	**67.424[4]**	**134.848**	NA	0.052	0.053	0.833
CO	**154.334[4]**	**308.668**	NA	0.136	0.004	2.628
VOCs	**17.155[4]**	**34.31**	NA	0.034	0.002	0.428
PM10	**43.8[1]**	**87.6**	**2.453**	0.008	0.002	0.706
PM2.5	**2.584[1]**	**5.168**	**0.613**	0.0002	0.0003	0.023
SO2	**7.271[1]**	**14.542**	NA	0.0002	0.002	0.058

Notes:
1. Based on 8,760 hpy of operation.
2. Based on 52 half-hour periods = 26 hpy of operation.
3. Based on 2,315 hpy of operation.
4. Based on 6,807 hpy of steady-state operation + 181 startup/shutdowns.