Attachment A

Emission Calculations and TANKS Report

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-1. Pre-Project Emission Inventory

Unit ID	Unit Name	Fuel	Pollutant	Maximum Input (units/hr)		Emission Factor (lb/units)	(Ref.No.)	Emission Rate (lb/hr)	Emission Rate (g/s)	Operating Hours (hr/yr)	Controlled Potential to Emit (PTE) (ton/yr)
EU 001	Unit 1 Boiler	RDF	PM	11.7	tons	9.20E-02	4	1.1E+00	1.4E-01	8760	4.7
EU 001	Unit 1 Boiler	RDF	PM_{10}	11.7	tons	9.20E-02	4	1.1E+00	1.4E-01	8760	4.7
EU 001	Unit 1 Boiler	RDF	CO	11.7	tons	1.92E+00	3	2.2E+01	2.8E+00	8760	98.4
EU 001	Unit 1 Boiler	RDF	SO_2	11.7	tons	5.54E-01	1	6.5E+00	8.2E-01	8760	28.4
EU 001	Unit 1 Boiler	RDF	NOx	11.7	tons	2.47E+00	2	2.9E+01	3.6E+00	8760	126.6
EU 001	Unit 1 Boiler	RDF	Arsenic	11.7	tons	3.69E-05	4	4.3E-04	5.4E-05	8760	0.00189
EU 001	Unit 1 Boiler	RDF	Beryllium	11.7	tons	1.13E-05	4	1.3E-04	1.7E-05	8760	0.00058
EU 001	Unit 1 Boiler	RDF	Cadmium	11.7	tons	8.34E-06	4	9.8E-05	1.2E-05	8760	0.00043
EU 001	Unit 1 Boiler	RDF	Chromium	11.7	tons	6.54E-04	4	7.7E-03	9.6E-04	8760	0.034
EU 001	Unit 1 Boiler	RDF	Mercury	11.7	tons	8.19E-06	4	9.6E-05	1.2E-05	8760	0.00042
EU 001	Unit 1 Boiler	RDF	Nickel	11.7	tons	1.26E-04	4	1.5E-03	1.9E-04	8760	0.006
EU 001	Unit 1 Boiler	RDF	Lead	11.7	tons	1.86E-04	4	2.2E-03	2.7E-04	8760	0.010
EU 001	Unit 1 Boiler	RDF	Hydrochloric acid	11.7	tons	2.70E-02	4	3.2E-01	4.0E-02	8760	1.4
EU 001	Unit 1 Boiler	RDF	Selenium	11.7	tons	6.22E-05	4	7.3E-04	9.2E-05	8760	0.00319
EU 001	Unit 1 Boiler	RDF	Dioxins/Furans (as 2,3,7,8-TCDD equivalent)	11.7	tons	-	5	8.78E-08	1.1E-08	8760	0.0000004
EU 002	Unit 2 Boiler	RDF	PM	11.7	tons	9.20E-02	4	1.1E+00	1.4E-01	8760	4.7
EU 002	Unit 2 Boiler	RDF	PM_{10}	11.7	tons	9.20E-02	4	1.1E+00	1.4E-01	8760	4.7
EU 002	Unit 2 Boiler	RDF	CO	11.7	tons	1.92E+00	3	2.2E+01	2.8E+00	8760	98.4
EU 002	Unit 2 Boiler	RDF	SO_2	11.7	tons	5.54E-01	1	6.5E+00	8.2E-01	8760	28.4
EU 002	Unit 2 Boiler	RDF	NOx	11.7	tons	2.47E+00	2	2.9E+01	3.6E+00	8760	126.6
EU 002	Unit 2 Boiler	RDF	Arsenic	11.7	tons	3.69E-05	4	4.3E-04	5.4E-05	8760	0.00189
EU 002	Unit 2 Boiler	RDF	Beryllium	11.7	tons	1.13E-05	4	1.3E-04	1.7E-05	8760	0.00058
EU 002	Unit 2 Boiler	RDF	Cadmium	11.7	tons	8.34E-06	4	9.8E-05	1.2E-05	8760	0.00043
EU 002	Unit 2 Boiler	RDF	Chromium	11.7	tons	6.54E-04	4	7.7E-03	9.6E-04	8760	0.034
EU 002	Unit 2 Boiler	RDF	Mercury	11.7	tons	8.19E-06	4	9.6E-05	1.2E-05	8760	0.00042
EU 002	Unit 2 Boiler	RDF	Nickel	11.7	tons	1.26E-04	4	1.5E-03	1.9E-04	8760	0.006
EU 002	Unit 2 Boiler	RDF	Lead	11.7	tons	1.86E-04	4	2.2E-03	2.7E-04	8760	0.010
EU 002	Unit 2 Boiler	RDF	Hydrochloric acid	11.7	tons	2.70E-02	4	3.2E-01	4.0E-02	8760	1.4
EU 002	Unit 2 Boiler	RDF	Selenium	11.7	tons	6.22E-05	4	7.3E-04	9.2E-05	8760	0.00319
EU 002	Unit 2 Boiler	RDF	Dioxins/Furans (as 2,3,7,8-TCDD equivalent)	11.7	tons	-	5	8.78E-08	1.1E-08	8760	0.0000004
EU 003	Unit 3 Boiler	RDF	PM	24.4	tons	9.20E-02	4	2.2E+00	2.8E-01	8760	9.8
EU 003	Unit 3 Boiler	RDF	PM_{10}	24.4	tons	9.20E-02	4	2.2E+00	2.8E-01	8760	9.8
EU 003	Unit 3 Boiler	RDF	CO	24.4	tons	1.92E+00	3	4.7E+01	5.9E+00	8760	205.2
EU 003	Unit 3 Boiler	RDF	SO_2	24.4	tons	5.54E-01	1	1.4E+01	1.7E+00	8760	59.2
EU 003	Unit 3 Boiler	RDF	NOx	24.4	tons	2.47E+00	2	6.0E+01	7.6E+00	8760	264.0
EU 003	Unit 3 Boiler	RDF	Arsenic	24.4	tons	3.69E-05	4	9.0E-04	1.1E-04	8760	0.00394
EU 003	Unit 3 Boiler	RDF	Beryllium	24.4	tons	1.13E-05	4	2.8E-04	3.5E-05	8760	0.00121
EU 003	Unit 3 Boiler	RDF	Cadmium	24.4	tons	8.34E-06	4	2.0E-04	2.6E-05	8760	0.0009
EU 003	Unit 3 Boiler	RDF	Chromium	24.4	tons	6.54E-04	4	1.6E-02	2.0E-03	8760	0.070
EU 003	Unit 3 Boiler	RDF	Mercury	24.4	tons	8.19E-06	4	2.0E-04	2.5E-05	8760	0.0009
EU 003	Unit 3 Boiler	RDF	Nickel	24.4	tons	1.26E-04	4	3.1E-03	3.9E-04	8760	0.014
EU 003	Unit 3 Boiler	RDF	Lead	24.4	tons	1.86E-04	4	4.5E-03	5.7E-04	8760	0.020

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-1. Pre-Project Emission Inventory

Unit ID	Unit Name	Fuel	Pollutant	Maximum Input (units/hr)		Emission Factor (lb/units)	(Ref.No.)	Emission Rate (lb/hr)	Emission Rate (g/s)	Operating Hours (hr/yr)	Controlled Potential to Emit (PTE) (ton/yr)
EU 003	Unit 3 Boiler	RDF	Hydrochloric acid	24.4	tons	2.70E-02	4	6.6E-01	8.3E-02	8760	2.885
EU 003	Unit 3 Boiler	RDF	Selenium	24.4	tons	6.22E-05	4	1.5E-03	1.9E-04	8760	0.00665
EU 003	Unit 3 Boiler	RDF	Dioxins/Furans (as 2,3,7,8-TCDD equivalent)	24.4	tons	-	5	1.83E-07	2.3E-08	8760	0.0000008
EU 007	Ash Handling / Silo	N/A	Aluminum	2.1	lbs	1.4E-02	6	2.9E-02	3.6E-03	8760	1.3E-01
EU 007	Ash Handling / Silo	N/A	Arsenic	2.1	lbs	4.3E-05	6	8.8E-05	1.1E-05	8760	3.9E-04
EU 007	Ash Handling / Silo	N/A	Cadmium	2.1	lbs	3.9E-05	6	8.0E-05	1.0E-05	8760	3.5E-04
EU 007	Ash Handling / Silo	N/A	Lead	2.1	lbs	2.4E-03	6	4.9E-03	6.1E-04	8760	2.1E-02
EU 007	Ash Handling / Silo	N/A	Manganese	2.1	lbs	6.6E-04	6	1.4E-03	1.7E-04	8760	6.0E-03
EU 007	Ash Handling / Silo	N/A	Mercury	2.1	lbs	6.0E-06	6	1.2E-05	1.6E-06	8760	5.4E-05
EU 007	Ash Handling / Silo	N/A	Nickel	2.1	lbs	9.4E-05	6	1.9E-04	2.4E-05	8760	8.5E-04
EU 007	Ash Handling / Silo	N/A	Selenium	2.1	lbs	9.2E-06	6	1.9E-05	2.4E-06	8760	8.3E-05
EU 007	Ash Handling / Silo	N/A	Zinc	2.1	lbs	3.8E-03	6	7.9E-03	9.9E-04	8760	3.5E-02
EU 007	Ash Handling / Silo	N/A	Barium	2.1	lbs	4.1E-04	6	8.4E-04	1.1E-04	8760	3.7E-03
EU 007	Ash Handling / Silo	N/A	Boron	2.1	lbs	1.4E-04	6	2.9E-04	3.7E-05	8760	1.3E-03
EU 007	Ash Handling / Silo	N/A	Calcium	2.1	lbs	2.1E-01	6	4.4E-01	5.5E-02	8760	1.9E+00
EU 007	Ash Handling / Silo	N/A	Chromium	2.1	lbs	5.3E-05	6	1.1E-04	1.4E-05	8760	4.8E-04
EU 007	Ash Handling / Silo	N/A	Copper	2.1	lbs	5.3E-04	6	1.1E-03	1.4E-04	8760	4.8E-03
EU 007	Ash Handling / Silo	N/A	Iron	2.1	lbs	1.3E-02	6	2.7E-02	3.4E-03	8760	1.2E-01
EU 007	Ash Handling / Silo	N/A	Magnesium	2.1	lbs	8.3E-03	6	1.7E-02	2.2E-03	8760	7.5E-02
EU 007	Ash Handling / Silo	N/A	Silver	2.1	lbs	9.8E-06	6	2.0E-05	2.5E-06	8760	8.8E-05
EU 007	Ash Handling / Silo	N/A	Sodium	2.1	lbs	1.8E-02	6	3.6E-02	4.5E-03	8760	1.6E-01
EU 007	Ash Handling / Silo	N/A	Strontium	2.1	lbs	2.4E-04	6	4.9E-04	6.2E-05	8760	2.2E-03
EU 007	Ash Handling / Silo	N/A	Tin	2.1	lbs	1.2E-04	6	2.6E-04	3.2E-05	8760	1.1E-03
EU 007	Ash Handling / Silo	N/A	Chloride	2.1	lbs	5.1E-02	6	1.0E-01	1.3E-02	8760	4.6E-01
EU 007	Ash Handling / Silo	N/A	Sulfate	2.1	lbs	1.8E-03	6	3.7E-03	4.7E-04	8760	1.6E-02
IA	25,000 Gallon Fuel Oil Tank #1	N/A	Toluene	-	-	-	7	4.6E-06	5.8E-07	8760	2.0E-05
IA	25,000 Gallon Fuel Oil Tank #1	N/A	Xylenes	-	-	-	7	1.0E-05	1.3E-06	8760	4.5E-05
IA	25,000 Gallon Fuel Oil Tank #2	N/A	Toluene	-	-	-	7	4.6E-06	5.8E-07	8760	2.0E-05
IA	25,000 Gallon Fuel Oil Tank #2	N/A	Xylenes	-	-	-	7	1.0E-05	1.3E-06	8760	4.5E-05
TOTAL VOC EMISSIONS									0.0		0.0
TOTAL PM EMISSIONS									0.6		19.3
TOTAL PM_{10} EMISSIONS									0.6		19.3
TOTAL CO EMISSIONS									11.6		402.0
TOTAL SO_2 EMISSIONS									3.3		116.0
TOTAL NOx EMISSIONS									14.9		517.1
TOTAL HAP EMISSIONS									3.2		6.0
LARGEST SINGLE HAP EMISSIONS			**(Hydrochloric acid)**								5.7

Great River Energy

Elk River Station - Peaking Turbine Project

AERA Attachment A - Emission Calculations

Table A-1. Pre-Project Emission Inventory

Unit ID	Unit Name	Fuel	Pollutant	Maximum Input (units/hr)	Emission Factor (lb/units) (Ref.No.)	Emission Rate (lb/hr)	Emission Rate (g/s)	Operating Hours (hr/yr)	Controlled Potential to Emit (PTE) (ton/yr)

References

1 AP-42 Table 2.1-2 (English Units). PARTICULATE MATTER, METALS, AND ACID GAS EMISSION FACTORS FOR MASS BURN AND MODULAR EXCESS AIR COMBUSTORS
Using emission factors with Spray Dryer / Fabric Filter control

2 AP-42 Table 2.1-7 (Metric And English Units). ORGANIC, NITROGEN OXIDES, CARBON MONOXIDE, AND CARBON DIOXIDE EMISSION FACTORS FOR MODULAR EXCESS AIR
Using uncontrolled emission factor

3 AP-42 Table 2.1-8 (Metric And English Units). EMISSION FACTORS FOR REFUSE-DERIVED FUEL-FIRED COMBUSTORS
Using uncontrolled emission factor

4 Stack Test Data
Average of yearly stack test data from 2001-2004 plus one standard deviation.

5 Dioxin emission rate per 5/29 Barr internal memo, p. 6 from Marta Nelson / Tom Mattison. Total emission rate scaled to input rate of RDF to boilers.

6 2006 Combined Ash Composition data

7 Emission rate calculated using EPA TANKS 4.0.9d.

Great River Energy

Elk River Station - Peaking Turbine Project

AERA Attachment A - Emission Calculations

Table A-2: Turbine 1 Project Emissions

										Limited Operation (80 tpy CO)			
Unit ID	Unit Name	Fuel	Pollutant	Maximum Heat Input (units/hr)		Emission Factor (lb/units)	(Ref.No.)	Emission Rate (lb/hr)	Maximum Potential to Emit (PTE) (ton/yr)	Actual Operating Hours (hr/yr)	Limited Potential to Emit (PTE) (ton/yr)	Max ton/yr	Limited Potential to Emit (PTE) (ton/yr)
EU010	Turbine 1	Natural Gas	VOC	1639	MMBtu	1.8E-02	1	28.8	126.2	8760	126.2	y	126.2
EU010	Turbine 1	Natural Gas	PM	1639	MMBtu	6.6E-03	2	10.8	47.4	8760	47.4	y	47.4
EU010	Turbine 1	Natural Gas	PM_{10}	1639	MMBtu	6.6E-03	2	10.8	47.4	8760	47.4	y	47.4
EU010	Turbine 1	Natural Gas	CO	1639	MMBtu	6.7E-02	1	110.0	481.9	8760	481.9	n	
EU010	Turbine 1	Natural Gas	SO_2	1639	MMBtu	9.1E-05	2	0.1	0.7	8760	0.7	n	
EU010	Turbine 1	Natural Gas	NOx	1639	MMBtu	9.2E-02	1	150.6	659.8	8760	659.8	n	
EU010	Turbine 1	Natural Gas	H_2SO_4 Mist	1639	MMBtu	1.8E-06	3	3.0E-03	1.3E-02	8760	1.3E-02	n	
EU010	Turbine 1	Natural Gas	1,3-Butadiene	1639	MMBtu	4.3E-07	4	7.0E-04	3.1E-03	8760	3.1E-03	n	
EU010	Turbine 1	Natural Gas	2,2,4-Trimethylpentane	1639	MMBtu	1.2E-06	7	2.0E-03	8.6E-03	8760	8.6E-03	-	8.6E-03
EU010	Turbine 1	Natural Gas	Acetaldehyde	1639	MMBtu	4.0E-05	4	6.6E-02	2.9E-01	8760	2.9E-01	y	2.9E-01
EU010	Turbine 1	Natural Gas	Acrolein	1639	MMBtu	6.4E-06	4	1.0E-02	4.6E-02	8760	4.6E-02	n	
EU010	Turbine 1	Natural Gas	Benzene	1639	MMBtu	1.2E-05	4	2.0E-02	8.6E-02	8760	8.6E-02	n	
EU010	Turbine 1	Natural Gas	Ethyl benzene	1639	MMBtu	3.2E-05	4	5.2E-02	2.3E-01	8760	2.3E-01	-	2.3E-01
EU010	Turbine 1	Natural Gas	Formaldehyde	1639	MMBtu	7.1E-04	4	1.2E+00	5.1E+00	8760	5.1E+00	y	5.1E+00
EU010	Turbine 1	Natural Gas	Hexane	1639	MMBtu	1.8E-05	7	3.0E-02	1.3E-01	8760	1.3E-01	-	1.3E-01
EU010	Turbine 1	Natural Gas	Naphthalene	1639	MMBtu	1.3E-06	4	2.1E-03	9.3E-03	8760	9.3E-03	n	
EU010	Turbine 1	Natural Gas	N-Nitrosodimethylamine (NDMA)	1639	MMBtu	2.3E-07	7	3.8E-04	1.7E-03	8760	1.7E-03	-	1.7E-03
EU010	Turbine 1	Natural Gas	N-Nitrosomorpholine (NMOR)	1639	MMBtu	1.6E-07	7	2.7E-04	1.2E-03	8760	1.2E-03	-	1.2E-03
EU010	Turbine 1	Natural Gas	PAH	1639	MMBtu	2.2E-06	4	3.6E-03	1.6E-02	8760	1.6E-02	n	
EU010	Turbine 1	Natural Gas	Propylene oxide	1639	MMBtu	2.9E-05	4	4.8E-02	2.1E-01	8760	2.1E-01	-	2.1E-01
EU010	Turbine 1	Natural Gas	Toluene	1639	MMBtu	1.3E-04	4	2.1E-01	9.3E-01	8760	9.3E-01	n	
EU010	Turbine 1	Natural Gas	Trimethoxyamphetamines (TMA)	1639	MMBtu	2.2E-07	7	3.6E-04	1.6E-03	8760	1.6E-03	-	1.6E-03
EU010	Turbine 1	Natural Gas	Xylenes	1639	MMBtu	6.4E-05	4	1.0E-01	4.6E-01	8760	4.6E-01	n	
EU010	Turbine 1	Natural Gas	Arsenic	1639	MMBtu	7.7E-08	7	1.3E-04	5.5E-04	8760	5.5E-04	n	
EU010	Turbine 1	Natural Gas	Cadmium	1639	MMBtu	2.7E-06	7	4.4E-03	1.9E-02	8760	1.9E-02	n	
EU010	Turbine 1	Natural Gas	Lead	1639	MMBtu	5.1E-05	7	8.4E-02	3.7E-01	8760	3.7E-01	y	3.7E-01
EU010	Turbine 1	Natural Gas	Manganese	1639	MMBtu	5.1E-06	7	8.4E-03	3.7E-02	8760	3.7E-02	n	
EU010	Turbine 1	Natural Gas	Mercury	1639	MMBtu	7.0E-07	7	1.1E-03	5.0E-03	8760	5.0E-03	n	
EU010	Turbine 1	Distillate Oil	VOC	2030	MMBtu	3.7E-03	1	7.5	33.0	8760	33.0	n	
EU010	Turbine 1	Distillate Oil	PM	2030	MMBtu	4.3E-03	2	8.7	38.2	8760	38.2	n	
EU010	Turbine 1	Distillate Oil	PM_{10}	2030	MMBtu	4.3E-03	2	8.7	38.2	8760	38.2	n	
EU010	Turbine 1	Distillate Oil	CO	2030	MMBtu	1.2E-01	1	239.7	1049.7	8760	1049.7	y	1049.7
EU010	Turbine 1	Distillate Oil	SO_2	2030	MMBtu	1.5E-03	2	3.1	13.5	8760	13.5	y	13.5
EU010	Turbine 1	Distillate Oil	NOx	2030	MMBtu	1.6E-01	1	330.7	1448.6	8760	1448.6	y	1448.6
EU010	Turbine 1	Distillate Oil	H_2SO_4 Mist	2030	MMBtu	3.0E-05	3	6.2E-02	2.7E-01	8760	2.7E-01	y	2.7E-01
EU010	Turbine 1	Distillate Oil	1,3-Butadiene	2030	MMBtu	1.6E-05	5	3.2E-02	1.4E-01	8760	1.4E-01	y	1.4E-01
EU010	Turbine 1	Distillate Oil	Acetaldehyde	2030	MMBtu	1.0E-05	7	2.1E-02	9.2E-02	8760	9.2E-02	n	
EU010	Turbine 1	Distillate Oil	Acrolein	2030	MMBtu	8.3E-05	7	1.7E-01	7.4E-01	8760	7.4E-01	y	7.4E-01
EU010	Turbine 1	Distillate Oil	Benzene	2030	MMBtu	5.5E-05	5	1.1E-01	4.9E-01	8760	4.9E-01	y	4.9E-01
EU010	Turbine 1	Distillate Oil	Carbon tetrachloride	2030	MMBtu	1.7E-05	7	3.5E-02	1.5E-01	8760	1.5E-01	-	1.5E-01
EU010	Turbine 1	Distillate Oil	Chlorobenzene	2030	MMBtu	1.3E-05	7	2.6E-02	1.1E-01	8760	1.1E-01	-	1.1E-01
EU010	Turbine 1	Distillate Oil	Chloroform	2030	MMBtu	1.4E-05	7	2.7E-02	1.2E-01	8760	1.2E-01	-	1.2E-01
EU010	Turbine 1	Distillate Oil	Dichlorobenzene	2030	MMBtu	1.7E-05	7	3.4E-02	1.5E-01	8760	1.5E-01	-	1.5E-01
EU010	Turbine 1	Distillate Oil	Dioxins/Furans (as 2,3,7,8-TCDD equiv.)	2030	MMBtu	7.1E-10	7	1.4E-06	6.3E-06	8760	6.3E-06	-	6.3E-06
EU010	Turbine 1	Distillate Oil	Ethylene dichloride	2030	MMBtu	1.1E-05	7	2.3E-02	1.0E-01	8760	1.0E-01	-	1.0E-01
EU010	Turbine 1	Distillate Oil	Formaldehyde	2030	MMBtu	2.8E-04	5	5.7E-01	2.5E+00	8760	2.5E+00	n	
EU010	Turbine 1	Distillate Oil	Methylene chloride	2030	MMBtu	9.6E-06	7	2.0E-02	8.5E-02	8760	8.5E-02	-	8.5E-02
EU010	Turbine 1	Distillate Oil	Naphthalene	2030	MMBtu	3.5E-05	5	7.1E-02	3.1E-01	8760	3.1E-01	y	3.1E-01
EU010	Turbine 1	Distillate Oil	PAH	2030	MMBtu	4.0E-05	5	8.1E-02	3.6E-01	8760	3.6E-01	y	3.6E-01

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-2: Turbine 1 Project Emissions

Unit ID	Unit Name	Fuel	Pollutant	Maximum Heat Input (units/hr)		Emission Factor (lb/units)	(Ref.No.)	Emission Rate (lb/hr)	Maximum Potential to Emit (PTE) (ton/yr)	Limited Operation (80 tpy CO) Actual Operating Hours (hr/yr)	Limited Potential to Emit (PTE) (ton/yr)	Max ton/yr	Limited Potential to Emit (PTE) (ton/yr)
EU010	Turbine 1	Distillate Oil	Tetrachloroethylene	2030	MMBtu	1.9E-05	7	3.8E-02	1.7E-01	8760	1.7E-01	-	1.7E-01
EU010	Turbine 1	Distillate Oil	Toluene	2030	MMBtu	5.4E-04	7	1.1E+00	4.8E+00	8760	4.8E+00	y	4.8E+00
EU010	Turbine 1	Distillate Oil	Trichloroethylene	2030	MMBtu	1.5E-05	7	3.0E-02	1.3E-01	8760	1.3E-01	-	1.3E-01
EU010	Turbine 1	Distillate Oil	Vinyl chloride	2030	MMBtu	3.5E-05	7	7.2E-02	3.1E-01	8760	3.1E-01	-	
EU010	Turbine 1	Distillate Oil	Vinylidene chloride	2030	MMBtu	3.5E-05	7	7.2E-02	3.1E-01	8760	3.1E-01	-	
EU010	Turbine 1	Distillate Oil	Xylenes	2030	MMBtu	5.3E-04	7	1.1E+00	4.7E+00	8760	4.7E+00	y	4.7E+00
EU010	Turbine 1	Distillate Oil	Arsenic	2030	MMBtu	1.1E-05	6	2.2E-02	9.8E-02	8760	9.8E-02	y	9.8E-02
EU010	Turbine 1	Distillate Oil	Beryllium	2030	MMBtu	3.1E-07	6	6.3E-04	2.8E-03	8760	2.8E-03	-	2.8E-03
EU010	Turbine 1	Distillate Oil	Cadmium	2030	MMBtu	4.8E-06	6	9.7E-03	4.3E-02	8760	4.3E-02	y	4.3E-02
EU010	Turbine 1	Distillate Oil	Chromium	2030	MMBtu	1.1E-05	6	2.2E-02	9.8E-02	8760	9.8E-02	-	9.8E-02
EU010	Turbine 1	Distillate Oil	Lead	2030	MMBtu	1.4E-05	6	2.8E-02	1.2E-01	8760	1.2E-01	n	
EU010	Turbine 1	Distillate Oil	Manganese	2030	MMBtu	7.9E-04	6	1.6E+00	7.0E+00	8760	7.0E+00	y	7.0E+00
EU010	Turbine 1	Distillate Oil	Mercury	2030	MMBtu	1.2E-06	6	2.4E-03	1.1E-02	8760	1.1E-02	y	1.1E-02
EU010	Turbine 1	Distillate Oil	Nickel	2030	MMBtu	4.6E-06	6	9.3E-03	4.1E-02	8760	4.1E-02	-	4.1E-02
EU010	Turbine 1	Distillate Oil	Selenium	2030	MMBtu	2.5E-05	6	5.1E-02	2.2E-01	8760	2.2E-01	-	2.2E-01
ISA	Preheater	Natural Gas	VOC	2.75	MMBtu	5.4E-03	9	1.5E-02	6.5E-02	8760	0.065	-	0.065
ISA	Preheater	Natural Gas	PM	2.75	MMBtu	7.5E-03	9	2.0E-02	9.0E-02	8760	0.090	-	0.090
ISA	Preheater	Natural Gas	PM_{10}	2.75	MMBtu	7.5E-03	9	2.0E-02	9.0E-02	8760	0.090	-	0.090
ISA	Preheater	Natural Gas	CO	2.75	MMBtu	8.2E-02	8	2.3E-01	9.9E-01	8760	0.992	-	0.992
ISA	Preheater	Natural Gas	SO_2	2.75	MMBtu	5.9E-04	9	1.6E-03	7.1E-03	8760	0.007	-	0.007
ISA	Preheater	Natural Gas	H_2SO_4 Mist	2.75	MMBtu	1.2E-05	3	3.2E-05	1.4E-04	8760	1.4E-04	-	1.4E-04
ISA	Preheater	Natural Gas	NOx	2.75	MMBtu	4.9E-02	8	1.3E-01	5.9E-01	8760	0.590	-	0.590
ISA	Preheater	Natural Gas	Benzene	2.75	MMBtu	2.1E-06	10	5.7E-06	2.5E-05	8760	2.5E-05	-	2.5E-05
ISA	Preheater	Natural Gas	Dichlorobenzene	2.75	MMBtu	1.2E-06	10	3.2E-06	1.4E-05	8760	1.4E-05	-	1.4E-05
ISA	Preheater	Natural Gas	Formaldehyde	2.75	MMBtu	7.4E-05	10	2.0E-04	8.9E-04	8760	8.9E-04	-	8.9E-04
ISA	Preheater	Natural Gas	Hexane	2.75	MMBtu	1.8E-03	10	4.9E-03	2.1E-02	8760	2.1E-02	-	2.1E-02
ISA	Preheater	Natural Gas	Naphthalene	2.75	MMBtu	6.0E-07	10	1.6E-06	7.2E-06	8760	7.2E-06	-	7.2E-06
ISA	Preheater	Natural Gas	Toluene	2.75	MMBtu	3.3E-06	10	9.2E-06	4.0E-05	8760	4.0E-05	-	4.0E-05
ISA	Preheater	Natural Gas	PAH	2.75	MMBtu	8.6E-08	10	2.4E-07	1.0E-06	8760	1.0E-06	-	1.0E-06
ISA	Preheater	Natural Gas	Arsenic	2.75	MMBtu	2.0E-07	11	5.4E-07	2.4E-06	8760	2.4E-06	-	2.4E-06
ISA	Preheater	Natural Gas	Beryllium	2.75	MMBtu	1.2E-08	11	3.2E-08	1.4E-07	8760	1.4E-07	-	1.4E-07
ISA	Preheater	Natural Gas	Cadmium	2.75	MMBtu	1.1E-06	11	3.0E-06	1.3E-05	8760	1.3E-05	-	1.3E-05
ISA	Preheater	Natural Gas	Chromium	2.75	MMBtu	1.4E-06	11	3.8E-06	1.7E-05	8760	1.7E-05	-	1.7E-05
ISA	Preheater	Natural Gas	Cobalt	2.75	MMBtu	8.2E-08	11	2.3E-07	9.9E-07	8760	9.9E-07	-	9.9E-07
ISA	Preheater	Natural Gas	Lead	2.75	MMBtu	4.9E-07	11	1.3E-06	5.9E-06	8760	5.9E-06	-	5.9E-06
ISA	Preheater	Natural Gas	Manganese	2.75	MMBtu	3.7E-07	11	1.0E-06	4.5E-06	8760	4.5E-06	-	4.5E-06
ISA	Preheater	Natural Gas	Mercury	2.75	MMBtu	2.5E-07	11	7.0E-07	3.1E-06	8760	3.1E-06	-	3.1E-06
ISA	Preheater	Natural Gas	Molybdenum	2.75	MMBtu	1.1E-06	11	3.0E-06	1.3E-05	8760	1.3E-05	-	1.3E-05
ISA	Preheater	Natural Gas	Nickel	2.75	MMBtu	2.1E-06	11	5.7E-06	2.5E-05	8760	2.5E-05	-	2.5E-05
ISA	Preheater	Natural Gas	Selenium	2.75	MMBtu	2.4E-08	11	6.5E-08	2.8E-07	8760	2.8E-07	-	2.8E-07
ISA	846,000 Gallon CT Fuel Oil Tank	N/A	VOC	-	-	-	12	4.7E-02	2.1E-01	8760	2.1E-01	-	2.1E-01
ISA	846,000 Gallon CT Fuel Oil Tank	N/A	Benzene	-	-	-	12	1.1E-04	4.9E-04	8760	4.9E-04	-	4.9E-04
ISA	846,000 Gallon CT Fuel Oil Tank	N/A	Ethyl benzene	-	-	-	12	1.5E-04	6.5E-04	8760	6.5E-04	-	6.5E-04
ISA	846,000 Gallon CT Fuel Oil Tank	N/A	Hexane	-	-	-	12	2.3E-05	1.0E-04	8760	1.0E-04	-	1.0E-04
ISA	846,000 Gallon CT Fuel Oil Tank	N/A	Toluene	-	-	-	12	1.2E-03	5.1E-03	8760	5.1E-03	-	5.1E-03
ISA	846,000 Gallon CT Fuel Oil Tank	N/A	Xylenes	-	-	-	12	2.7E-03	1.2E-02	8760	1.2E-02	-	1.2E-02

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-2: Turbine 1 Project Emissions

Unit ID	Unit Name	Fuel	Pollutant	Maximum Heat Input (units/hr)	Emission Factor (lb/units) (Ref.No.)	Emission Rate (lb/hr)	Maximum Potential to Emit (PTE) (ton/yr)	Limited Operation (80 tpy CO) Actual Operating Hours (hr/yr)	Limited Potential to Emit (PTE) (ton/yr)	Max ton/yr	Limited Potential to Emit (PTE) (ton/yr)
TOTAL VOC EMISSIONS											126.5
TOTAL PM EMISSIONS											47.5
TOTAL PM_{10} EMISSIONS											47.5
TOTAL CO EMISSIONS											1,050.7
TOTAL SO_2 EMISSIONS											13.48
TOTAL H_2SO_4 Mist EMISSIONS											0.27
TOTAL NOx EMISSIONS											1,449.2
TOTAL HAP EMISSIONS											26.4
LARGEST SINGLE HAP EMISSIONS			**(Manganese compounds)**								#N/A

REFERENCES:

1 Information provided by Siemens Westinghouse for Estimated V84.3A(2) Gas Turbine Performance
2 AP-42 Table 3.1-2a. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM STATIONARY GAS TURBINES
NNG Data:

Sulfur content = < 0.032 grains/100 scf
Heat Content (gross) = 999.500 Btu/scf

$$s\% = \frac{0.032 \text{ grains S}}{100 \text{ scf}} \cdot \frac{1 \text{ lb}}{7000 \text{ grains}} \cdot \frac{\text{cf}}{999.5 \text{ Btu}} \cdot \frac{1000000 \text{ Btu}}{\text{MMBtu}} \cdot \frac{2 \text{ lb SO2}}{\text{lb S}} = 9.15\text{E-}05 \frac{\text{lb SO2}}{\text{MMBtu}}$$

Fuel Oil Data:

Sulfur content (given): 0.0015 %S

3 Assumes a 1-2% conversion of SO2 to SO3 and, conservatively, 100% conversion of SO3 to H2SO4. (ref: Reising, B.; Siemens-Westinghouse; Review of Air Toxics from Combustion Sources; Power Gen 2003 - Las Vegas; December 2003
4 AP-42 Table 3.1-3. EMISSION FACTORS FOR HAZARDOUS AIR POLLUTANTS FROM NATURAL GAS-FIRED STATIONARY GAS TURBINES
5 AP-42 Table 3.1-4. EMISSION FACTORS FOR HAZARDOUS AIR POLLUTANTS FROM DISTILLATE OIL-FIRED STATIONARY GAS TURBINES
6 AP-42 Table 3.1-5. EMISSION FACTORS FOR METALLIC HAZARDOUS AIR POLLUTANTS FROM DISTILLATE OIL-FIRED STATIONARY GAS TURBINES
7 EPA. Technology Transfer Network Air Toxics Website, Stationary Combustion Turbines NESHAP, Combustion Turbine Emissions Database v.5, 10/15/02. http://www.epa.gov/ttn/atw/turbine/turbinepg.html#TECH
8 AP-42 Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NOx) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION
9 AP-42 TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION
10 AP-42 TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION
11 AP-42 TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION
12 Emission rate calculated using EPA TANKS 4.0.9d.

Great River Energy

Elk River Station - Peaking Turbine Project

AERA Attachment A - Emission Calculations

Table A-3. Post-Project Emission Inventory

										Unlimited Operation		Limited Operation (80 tpy CO)		Startup/Shutdown	
Unit ID	Unit Name	Fuel	Pollutant	Maximum Input (units/hr)		Emission Factor (lb/units)	(Ref.No.)	Maximum Emission Rate (lb/hr)	Maximum Emission Rate (g/s)	Unlimited Operating Hours (hr/yr)	Uncontrolled Potential to Emit (PTE) (ton/yr)	Limited Operating Hours (hr/yr)	Max. Limited Potential to Emit (PTE) (ton/yr)	Operating Hours (hr/yr)	Uncontrolled Potential to Emit (PTE) (ton/yr)
EU 001	Unit 1 Boiler	RDF	PM	11.7	tons	9.20E-02	15	1.1E+00	1.4E-01	8760	4.7	8760	4.7	NA	NA
EU 001	Unit 1 Boiler	RDF	PM_{10}	11.7	tons	9.20E-02	15	1.1E+00	1.4E-01	8760	4.7	8760	4.7	NA	NA
EU 001	Unit 1 Boiler	RDF	CO	11.7	tons	1.92E+00	14	2.2E+01	2.8E+00	8760	98.4	8760	98.4	NA	NA
EU 001	Unit 1 Boiler	RDF	SO_2	11.7	tons	5.54E-01	12	6.5E+00	8.2E-01	8760	28.4	8760	28.4	NA	NA
EU 001	Unit 1 Boiler	RDF	NOx	11.7	tons	2.47E+00	13	2.9E+01	3.6E+00	8760	126.6	8760	126.6	NA	NA
EU 001	Unit 1 Boiler	RDF	Arsenic	11.7	tons	3.69E-05	15	4.3E-04	5.4E-05	8760	1.9E-03	8760	1.9E-03	NA	NA
EU 001	Unit 1 Boiler	RDF	Beryllium	11.7	tons	1.13E-05	15	1.3E-04	1.7E-05	8760	5.8E-04	8760	5.8E-04	NA	NA
EU 001	Unit 1 Boiler	RDF	Cadmium	11.7	tons	8.34E-06	15	9.8E-05	1.2E-05	8760	4.3E-04	8760	4.3E-04	NA	NA
EU 001	Unit 1 Boiler	RDF	Chromium	11.7	tons	6.54E-04	15	7.7E-03	9.6E-04	8760	3.4E-02	8760	3.4E-02	NA	NA
EU 001	Unit 1 Boiler	RDF	Mercury	11.7	tons	8.19E-06	15	9.6E-05	1.2E-05	8760	4.2E-04	8760	4.2E-04	NA	NA
EU 001	Unit 1 Boiler	RDF	Nickel	11.7	tons	1.26E-04	15	1.5E-03	1.9E-04	8760	6.5E-03	8760	6.5E-03	NA	NA
EU 001	Unit 1 Boiler	RDF	Lead	11.7	tons	1.86E-04	15	2.2E-03	2.7E-04	8760	9.5E-03	8760	9.5E-03	NA	NA
EU 001	Unit 1 Boiler	RDF	Hydrochloric acid	11.7	tons	2.70E-02	15	3.2E-01	4.0E-02	8760	1.4E+00	8760	1.4E+00	NA	NA
EU 001	Unit 1 Boiler	RDF	Selenium	11.7	tons	6.22E-05	15	7.3E-04	9.2E-05	8760	3.2E-03	8760	3.2E-03	NA	NA
EU 001	Unit 1 Boiler	RDF	Dioxins/Furans (as 2,3,7,8-TCDD equivalent)	11.7	tons	-	16	8.78E-08	1.1E-08	8760	3.8E-07	8760	3.8E-07	NA	NA
EU 002	Unit 2 Boiler	RDF	PM	11.7	tons	9.20E-02	15	1.1E+00	1.4E-01	8760	4.7	8760	4.7	NA	NA
EU 002	Unit 2 Boiler	RDF	PM_{10}	11.7	tons	9.20E-02	15	1.1E+00	1.4E-01	8760	4.7	8760	4.7	NA	NA
EU 002	Unit 2 Boiler	RDF	CO	11.7	tons	1.92E+00	14	2.2E+01	2.8E+00	8760	98.4	8760	98.4	NA	NA
EU 002	Unit 2 Boiler	RDF	SO_2	11.7	tons	5.54E-01	12	6.5E+00	8.2E-01	8760	28.4	8760	28.4	NA	NA
EU 002	Unit 2 Boiler	RDF	NOx	11.7	tons	2.47E+00	13	2.9E+01	3.6E+00	8760	126.6	8760	126.6	NA	NA
EU 002	Unit 2 Boiler	RDF	Arsenic	11.7	tons	3.69E-05	15	4.3E-04	5.4E-05	8760	1.9E-03	8760	1.9E-03	NA	NA
EU 002	Unit 2 Boiler	RDF	Beryllium	11.7	tons	1.13E-05	15	1.3E-04	1.7E-05	8760	5.8E-04	8760	5.8E-04	NA	NA
EU 002	Unit 2 Boiler	RDF	Cadmium	11.7	tons	8.34E-06	15	9.8E-05	1.2E-05	8760	4.3E-04	8760	4.3E-04	NA	NA
EU 002	Unit 2 Boiler	RDF	Chromium	11.7	tons	6.54E-04	15	7.7E-03	9.6E-04	8760	3.4E-02	8760	3.4E-02	NA	NA
EU 002	Unit 2 Boiler	RDF	Mercury	11.7	tons	8.19E-06	15	9.6E-05	1.2E-05	8760	4.2E-04	8760	4.2E-04	NA	NA
EU 002	Unit 2 Boiler	RDF	Nickel	11.7	tons	1.26E-04	15	1.5E-03	1.9E-04	8760	6.5E-03	8760	6.5E-03	NA	NA
EU 002	Unit 2 Boiler	RDF	Lead	11.7	tons	1.86E-04	15	2.2E-03	2.7E-04	8760	9.5E-03	8760	9.5E-03	NA	NA
EU 002	Unit 2 Boiler	RDF	Hydrochloric acid	11.7	tons	2.70E-02	15	3.2E-01	4.0E-02	8760	1.4E+00	8760	1.4E+00	NA	NA
EU 002	Unit 2 Boiler	RDF	Selenium	11.7	tons	6.22E-05	15	7.3E-04	9.2E-05	8760	3.2E-03	8760	3.2E-03	NA	NA
EU 002	Unit 2 Boiler	RDF	Dioxins/Furans (as 2,3,7,8-TCDD equivalent)	11.7	tons	-	16	8.78E-08	1.1E-08	8760	3.8E-07	8760	3.8E-07	NA	NA
EU 003	Unit 3 Boiler	RDF	PM	24.4	tons	9.20E-02	15	2.2E+00	2.8E-01	8760	9.8	8760	9.8	NA	NA
EU 003	Unit 3 Boiler	RDF	PM_{10}	24.4	tons	9.20E-02	15	2.2E+00	2.8E-01	8760	9.8	8760	9.8	NA	NA
EU 003	Unit 3 Boiler	RDF	CO	24.4	tons	1.92E+00	14	4.7E+01	5.9E+00	8760	205.2	8760	205.2	NA	NA
EU 003	Unit 3 Boiler	RDF	SO_2	24.4	tons	5.54E-01	12	1.4E+01	1.7E+00	8760	59.2	8760	59.2	NA	NA
EU 003	Unit 3 Boiler	RDF	NOx	24.4	tons	2.47E+00	13	6.0E+01	7.6E+00	8760	264.0	8760	264.0	NA	NA
EU 003	Unit 3 Boiler	RDF	Arsenic	24.4	tons	3.69E-05	15	9.0E-04	1.1E-04	8760	3.9E-03	8760	3.9E-03	NA	NA
EU 003	Unit 3 Boiler	RDF	Beryllium	24.4	tons	1.13E-05	15	2.8E-04	3.5E-05	8760	1.2E-03	8760	1.2E-03	NA	NA
EU 003	Unit 3 Boiler	RDF	Cadmium	24.4	tons	8.34E-06	15	2.0E-04	2.6E-05	8760	8.9E-04	8760	8.9E-04	NA	NA
EU 003	Unit 3 Boiler	RDF	Chromium	24.4	tons	6.54E-04	15	1.6E-02	2.0E-03	8760	7.0E-02	8760	7.0E-02	NA	NA
EU 003	Unit 3 Boiler	RDF	Mercury	24.4	tons	8.19E-06	15	2.0E-04	2.5E-05	8760	8.8E-04	8760	8.8E-04	NA	NA
EU 003	Unit 3 Boiler	RDF	Nickel	24.4	tons	1.26E-04	15	3.1E-03	3.9E-04	8760	1.4E-02	8760	1.4E-02	NA	NA
EU 003	Unit 3 Boiler	RDF	Lead	24.4	tons	1.86E-04	15	4.5E-03	5.7E-04	8760	2.0E-02	8760	2.0E-02	NA	NA
EU 003	Unit 3 Boiler	RDF	Hydrochloric acid	24.4	tons	2.70E-02	15	6.6E-01	8.3E-02	8760	2.9E+00	8760	2.9E+00	NA	NA
EU 003	Unit 3 Boiler	RDF	Selenium	24.4	tons	6.22E-05	15	1.5E-03	1.9E-04	8760	6.6E-03	8760	6.6E-03	NA	NA
EU 003	Unit 3 Boiler	RDF	Dioxins/Furans (as 2,3,7,8-TCDD equivalent)	24.4	tons	-	16	1.83E-07	2.3E-08	8760	8.0E-07	8760	8.0E-07	NA	NA
EU 007	Ash Handling / Silo	N/A	Aluminum	2.1	lbs	1.4E-02	17	2.9E-02	3.6E-03	8760	1.3E-01	8760	1.3E-01	NA	NA
EU 007	Ash Handling / Silo	N/A	Arsenic	2.1	lbs	4.3E-05	17	8.8E-05	1.1E-05	8760	3.9E-04	8760	3.9E-04	NA	NA
EU 007	Ash Handling / Silo	N/A	Cadmium	2.1	lbs	3.9E-05	17	8.0E-05	1.0E-05	8760	3.5E-04	8760	3.5E-04	NA	NA
EU 007	Ash Handling / Silo	N/A	Lead	2.1	lbs	2.4E-03	17	4.9E-03	6.1E-04	8760	2.1E-02	8760	2.1E-02	NA	NA
EU 007	Ash Handling / Silo	N/A	Manganese	2.1	lbs	6.6E-04	17	1.4E-03	1.7E-04	8760	6.0E-03	8760	6.0E-03	NA	NA
EU 007	Ash Handling / Silo	N/A	Mercury	2.1	lbs	6.0E-06	17	1.2E-05	1.6E-06	8760	5.4E-05	8760	5.4E-05	NA	NA
EU 007	Ash Handling / Silo	N/A	Nickel	2.1	lbs	9.4E-05	17	1.9E-04	2.4E-05	8760	8.5E-04	8760	8.5E-04	NA	NA
EU 007	Ash Handling / Silo	N/A	Selenium	2.1	lbs	9.2E-06	17	1.9E-05	2.4E-06	8760	8.3E-05	8760	8.3E-05	NA	NA
EU 007	Ash Handling / Silo	N/A	Zinc	2.1	lbs	3.8E-03	17	7.9E-03	9.9E-04	8760	3.5E-02	8760	3.5E-02	NA	NA
EU 007	Ash Handling / Silo	N/A	Barium	2.1	lbs	4.1E-04	17	8.4E-04	1.1E-04	8760	3.7E-03	8760	3.7E-03	NA	NA
EU 007	Ash Handling / Silo	N/A	Boron	2.1	lbs	1.4E-04	17	2.9E-04	3.7E-05	8760	1.3E-03	8760	1.3E-03	NA	NA
EU 007	Ash Handling / Silo	N/A	Calcium	2.1	lbs	2.1E-01	17	4.4E-01	5.5E-02	8760	1.9E+00	8760	1.9E+00	NA	NA
EU 007	Ash Handling / Silo	N/A	Chromium	2.1	lbs	5.3E-05	17	1.1E-04	1.4E-05	8760	4.8E-04	8760	4.8E-04	NA	NA
EU 007	Ash Handling / Silo	N/A	Copper	2.1	lbs	5.3E-04	17	1.1E-03	1.4E-04	8760	4.8E-03	8760	4.8E-03	NA	NA
EU 007	Ash Handling / Silo	N/A	Iron	2.1	lbs	1.3E-02	17	2.7E-02	3.4E-03	8760	1.2E-01	8760	1.2E-01	NA	NA
EU 007	Ash Handling / Silo	N/A	Magnesium	2.1	lbs	8.3E-03	17	1.7E-02	2.2E-03	8760	7.5E-02	8760	7.5E-02	NA	NA
EU 007	Ash Handling / Silo	N/A	Silver	2.1	lbs	9.8E-06	17	2.0E-05	2.5E-06	8760	8.8E-05	8760	8.8E-05	NA	NA
EU 007	Ash Handling / Silo	N/A	Sodium	2.1	lbs	1.8E-02	17	3.6E-02	4.5E-03	8760	1.6E-01	8760	1.6E-01	NA	NA
EU 007	Ash Handling / Silo	N/A	Strontium	2.1	lbs	2.4E-04	17	4.9E-04	6.2E-05	8760	2.2E-03	8760	2.2E-03	NA	NA

Great River Energy

Elk River Station - Peaking Turbine Project

AERA Attachment A - Emission Calculations

Table A-3. Post-Project Emission Inventory

										Unlimited Operation		Limited Operation (80 tpy CO)		Startup/Shutdown	
Unit ID	Unit Name	Fuel	Pollutant	Maximum Input (units/hr)		Emission Factor (lb/units)	(Ref.No.)	Maximum Emission Rate (lb/hr)	Maximum Emission Rate (g/s)	Unlimited Operating Hours (hr/yr)	Uncontrolled Potential to Emit (PTE) (ton/yr)	Limited Operating Hours (hr/yr)	Max. Limited Potential to Emit (PTE) (ton/yr)	Operating Hours (hr/yr)	Uncontrolled Potential to Emit (PTE) (ton/yr)
EU 007	Ash Handling / Silo	N/A	Tin	2.1	lbs	1.2E-04	17	2.6E-04	3.2E-05	8760	1.1E-03	8760	1.1E-03	NA	NA
EU 007	Ash Handling / Silo	N/A	Chloride	2.1	lbs	5.1E-02	17	1.0E-01	1.3E-02	8760	4.6E-01	8760	4.6E-01	NA	NA
EU 007	Ash Handling / Silo	N/A	Sulfate	2.1	lbs	1.8E-03	17	3.7E-03	4.7E-04	8760	1.6E-02	8760	1.6E-02	NA	NA
IA	25,000 Gallon Fuel Oil Tank #1	N/A	Toluene	-	-	-	18	4.6E-06	5.8E-07	8760	2.0E-05	8760	2.0E-05	NA	NA
IA	25,000 Gallon Fuel Oil Tank #1	N/A	Xylenes	-	-	-	18	1.0E-05	1.3E-06	8760	4.5E-05	8760	4.5E-05	NA	NA
IA	25,000 Gallon Fuel Oil Tank #2	N/A	Toluene	-	-	-	18	4.6E-06	5.8E-07	8760	2.0E-05	8760	2.0E-05	NA	NA
IA	25,000 Gallon Fuel Oil Tank #2	N/A	Xylenes	-	-	-	18	1.0E-05	1.3E-06	8760	4.5E-05	8760	4.5E-05	NA	NA
IA	846,000 Gallon CT Fuel Oil Tank	N/A	VOC	-	-	-	18	4.7E-02	2.1E-01	8760	2.1E-01	8760	2.1E-01	NA	NA
IA	846,000 Gallon CT Fuel Oil Tank	N/A	Benzene	-	-	-	18	1.1E-04	1.4E-05	8760	4.9E-04	8760	4.9E-04	NA	NA
IA	846,000 Gallon CT Fuel Oil Tank	N/A	Ethyl benzene	-	-	-	18	1.5E-04	1.9E-05	8760	6.5E-04	8760	6.5E-04	NA	NA
IA	846,000 Gallon CT Fuel Oil Tank	N/A	Hexane	-	-	-	18	2.3E-05	2.9E-06	8760	1.0E-04	8760	1.0E-04	NA	NA
IA	846,000 Gallon CT Fuel Oil Tank	N/A	Toluene	-	-	-	18	1.2E-03	1.5E-04	8760	5.1E-03	8760	5.1E-03	NA	NA
IA	846,000 Gallon CT Fuel Oil Tank	N/A	Xylenes	-	-	-	18	2.7E-03	3.4E-04	8760	1.2E-02	8760	1.2E-02	NA	NA
EU010	Turbine 1	Natural Gas / Dist. Oil	VOC	1639	MMBtu	1.8E-02	1	28.8	3.6E+00	8760	126.2	8760	126.2	876	12.62
EU010	Turbine 1	Natural Gas / Dist. Oil	PM	1639	MMBtu	6.6E-03	2	10.8	1.4E+00	8760	47.4	8760	47.4	876	4.74
EU010	Turbine 1	Natural Gas / Dist. Oil	PM10	1639	MMBtu	6.6E-03	2	10.8	1.4E+00	8760	47.4	8760	47.4	876	4.74
EU010	Turbine 1	Natural Gas / Dist. Oil	CO	2030	MMBtu	1.2E-01	1	239.7	3.0E+01	8760	1049.7	8760	1049.7	876	104.97
EU010	Turbine 1	Natural Gas / Dist. Oil	SO2	2030	MMBtu	1.5E-03	2	3.1	3.9E-01	8760	13.5	8760	13.5	876	1.35
EU010	Turbine 1	Natural Gas / Dist. Oil	NOx	2030	MMBtu	1.6E-01	1	330.7	4.2E+01	8760	1448.6	8760	1448.6	876	144.86
EU010	Turbine 1	Natural Gas / Dist. Oil	H2SO4 Mist	2030	MMBtu	3.0E-05	3	6.2E-02	7.8E-03	8760	2.7E-01	8760	2.7E-01	876	2.7E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	1,3-Butadiene	2030	MMBtu	1.6E-05	5	3.2E-02	4.1E-03	8760	1.4E-01	8760	1.4E-01	876	1.4E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	2,2,4-Trimethylpentane	1639	MMBtu	1.2E-06	7	2.0E-03	2.5E-04	8760	8.6E-03	8760	8.6E-03	876	8.6E-04
EU010	Turbine 1	Natural Gas / Dist. Oil	Acetaldehyde	1639	MMBtu	4.0E-05	4	6.6E-02	8.3E-03	8760	2.9E-01	8760	2.9E-01	876	2.9E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Acrolein	2030	MMBtu	8.3E-05	7	1.7E-01	2.1E-02	8760	7.4E-01	8760	7.4E-01	876	7.4E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Benzene	2030	MMBtu	5.5E-05	5	1.1E-01	1.4E-02	8760	4.9E-01	8760	4.9E-01	876	4.9E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Carbon tetrachloride	2030	MMBtu	1.7E-05	7	3.5E-02	4.5E-03	8760	1.5E-01	8760	1.5E-01	876	1.5E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Chlorobenzene	2030	MMBtu	1.3E-05	7	2.6E-02	3.3E-03	8760	1.1E-01	8760	1.1E-01	876	1.1E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Chloroform	2030	MMBtu	1.4E-05	7	2.7E-02	3.5E-03	8760	1.2E-01	8760	1.2E-01	876	1.2E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Dichlorobenzene	2030	MMBtu	1.7E-05	7	3.4E-02	4.3E-03	8760	1.5E-01	8760	1.5E-01	876	1.5E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Dioxins/Furans (as 2,3,7,8-TCDD equivalent)	2030	MMBtu	7.1E-10	7	1.4E-06	1.8E-07	8760	6.3E-06	8760	6.3E-06	876	6.3E-07
EU010	Turbine 1	Natural Gas / Dist. Oil	Ethyl benzene	1639	MMBtu	3.2E-05	4	5.2E-02	6.6E-03	8760	2.3E-01	8760	2.3E-01	876	2.3E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Ethylene dichloride	2030	MMBtu	1.1E-05	7	2.3E-02	2.9E-03	8760	1.0E-01	8760	1.0E-01	876	1.0E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Formaldehyde	1639	MMBtu	7.1E-04	4	1.2E+00	1.5E-01	8760	5.1E+00	8760	5.1E+00	876	5.1E-01
EU010	Turbine 1	Natural Gas / Dist. Oil	Hexane	1639	MMBtu	1.8E-05	7	3.0E-02	3.7E-03	8760	1.3E-01	8760	1.3E-01	876	1.3E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Methylene chloride	2030	MMBtu	9.6E-06	7	2.0E-02	2.5E-03	8760	8.5E-02	8760	8.5E-02	876	8.5E-03
EU010	Turbine 1	Natural Gas / Dist. Oil	Naphthalene	2030	MMBtu	3.5E-05	5	7.1E-02	9.0E-03	8760	3.1E-01	8760	3.1E-01	876	3.1E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	N-Nitrosodimethylamine (NDMA)	1639	MMBtu	2.3E-07	7	3.8E-04	4.8E-05	8760	1.7E-03	8760	1.7E-03	876	1.7E-04
EU010	Turbine 1	Natural Gas / Dist. Oil	N-Nitrosomorpholine (NMOR)	1639	MMBtu	1.6E-07	7	2.7E-04	3.4E-05	8760	1.2E-03	8760	1.2E-03	876	1.2E-04
EU010	Turbine 1	Natural Gas / Dist. Oil	PAH	2030	MMBtu	4.0E-05	5	8.1E-02	1.0E-02	8760	3.6E-01	8760	3.6E-01	876	3.6E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Propylene oxide	1639	MMBtu	2.9E-05	4	4.8E-02	6.0E-03	8760	2.1E-01	8760	2.1E-01	876	2.1E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Tetrachloroethylene	2030	MMBtu	1.9E-05	7	3.8E-02	4.8E-03	8760	1.7E-01	8760	1.7E-01	876	1.7E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Toluene	2030	MMBtu	5.4E-04	7	1.1E+00	1.4E-01	8760	4.8E+00	8760	4.8E+00	876	4.8E-01
EU010	Turbine 1	Natural Gas / Dist. Oil	Trichloroethylene	2030	MMBtu	1.5E-05	7	3.0E-02	3.8E-03	8760	1.3E-01	8760	1.3E-01	876	1.3E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Trimethoxyamphetamines (TMA)	1639	MMBtu	2.2E-07	7	3.6E-04	4.5E-05	8760	1.6E-03	8760	1.6E-03	876	1.6E-04
EU010	Turbine 1	Natural Gas / Dist. Oil	Vinyl chloride	2030	MMBtu	3.5E-05	7	7.2E-02	9.0E-03	8760	3.1E-01	8760	3.1E-01	876	3.1E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Vinylidene chloride	2030	MMBtu	3.5E-05	7	7.2E-02	9.0E-03	8760	3.1E-01	8760	3.1E-01	876	3.1E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Xylenes	2030	MMBtu	5.3E-04	7	1.1E+00	1.3E-01	8760	4.7E+00	8760	4.7E+00	876	4.7E-01
EU010	Turbine 1	Natural Gas / Dist. Oil	Arsenic	2030	MMBtu	1.1E-05	6	2.2E-02	2.8E-03	8760	9.8E-02	8760	9.8E-02	876	9.8E-03
EU010	Turbine 1	Natural Gas / Dist. Oil	Beryllium	2030	MMBtu	3.1E-07	6	6.3E-04	7.9E-05	8760	2.8E-03	8760	2.8E-03	876	2.8E-04
EU010	Turbine 1	Natural Gas / Dist. Oil	Cadmium	2030	MMBtu	4.8E-06	6	9.7E-03	1.2E-03	8760	4.3E-02	8760	4.3E-02	876	4.3E-03
EU010	Turbine 1	Natural Gas / Dist. Oil	Chromium	2030	MMBtu	1.1E-05	6	2.2E-02	2.8E-03	8760	9.8E-02	8760	9.8E-02	876	9.8E-03
EU010	Turbine 1	Natural Gas / Dist. Oil	Lead	1639	MMBtu	5.1E-05	7	8.4E-02	1.1E-02	8760	3.7E-01	8760	3.7E-01	876	3.7E-02
EU010	Turbine 1	Natural Gas / Dist. Oil	Manganese	2030	MMBtu	7.9E-04	6	1.6E+00	2.0E-01	8760	7.0E+00	8760	7.0E+00	876	7.0E-01
EU010	Turbine 1	Natural Gas / Dist. Oil	Mercury	2030	MMBtu	1.2E-06	6	2.4E-03	3.1E-04	8760	1.1E-02	8760	1.1E-02	876	1.1E-03
EU010	Turbine 1	Natural Gas / Dist. Oil	Nickel	2030	MMBtu	4.6E-06	6	9.3E-03	1.2E-03	8760	4.1E-02	8760	4.1E-02	876	4.1E-03
EU010	Turbine 1	Natural Gas / Dist. Oil	Selenium	2030	MMBtu	2.5E-05	6	5.1E-02	6.4E-03	8760	2.2E-01	8760	2.2E-01	876	2.2E-02
ISA	Turbine Fuel Preheater	Natural Gas	VOC	2.75	MMBtu	5.4E-03	9	1.5E-02	1.9E-03	8760	0.065	8760	0.06	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	PM	2.75	MMBtu	7.5E-03	9	2.0E-02	2.6E-03	8760	0.090	8760	0.09	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	PM_{10}	2.75	MMBtu	7.5E-03	9	2.0E-02	2.6E-03	8760	0.090	8760	0.09	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	CO	2.75	MMBtu	8.2E-02	8	2.3E-01	2.9E-02	8760	0.992	8760	0.99	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	SO_2	2.75	MMBtu	3.4E-03	9	9.4E-03	1.2E-03	8760	0.041	8760	0.04	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	H_2SO_4 Mist	2.75	MMBtu	6.8E-05	3	1.9E-04	2.4E-05	8760	0.001	8760	8.2E-04	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	NOx	2.75	MMBtu	4.9E-02	8	1.3E-01	1.7E-02	8760	0.590	8760	0.59	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Benzene	2.75	MMBtu	2.1E-06	10	5.7E-06	7.1E-07	8760	2.5E-05	8760	2.5E-05	NA	NA

Great River Energy

Elk River Station - Peaking Turbine Project

AERA Attachment A - Emission Calculations

Table A-3. Post-Project Emission Inventory

										Unlimited Operation		Limited Operation (80 tpy CO)		Startup/Shutdown	
Unit ID	Unit Name	Fuel	Pollutant	Maximum Input (units/hr)		Emission Factor (lb/units)	(Ref.No.)	Maximum Emission Rate (lb/hr)	Maximum Emission Rate (g/s)	Unlimited Operating Hours (hr/yr)	Uncontrolled Potential to Emit (PTE) (ton/yr)	Limited Operating Hours (hr/yr)	Max. Limited Potential to Emit (PTE) (ton/yr)	Operating Hours (hr/yr)	Uncontrolled Potential to Emit (PTE) (ton/yr)
ISA	Turbine Fuel Preheater	Natural Gas	Dichlorobenzene	2.75	MMBtu	1.2E-06	10	3.2E-06	4.1E-07	8760	1.4E-05	8760	1.4E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Formaldehyde	2.75	MMBtu	7.4E-05	10	2.0E-04	2.5E-05	8760	8.9E-04	8760	8.9E-04	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Hexane	2.75	MMBtu	1.8E-03	10	4.9E-03	6.1E-04	8760	2.1E-02	8760	2.1E-02	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Naphthalene	2.75	MMBtu	6.0E-07	10	1.6E-06	2.1E-07	8760	7.2E-06	8760	7.2E-06	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Toluene	2.75	MMBtu	3.3E-06	10	9.2E-06	1.2E-06	8760	4.0E-05	8760	4.0E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	PAH	2.75	MMBtu	8.6E-08	10	2.4E-07	3.0E-08	8760	1.0E-06	8760	1.0E-06	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Arsenic	2.75	MMBtu	2.0E-07	11	5.4E-07	6.8E-08	8760	2.4E-06	8760	2.4E-06	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Barium	2.75	MMBtu	4.3E-06	11	1.2E-05	1.5E-06	8760	5.2E-05	8760	5.2E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Beryllium	2.75	MMBtu	1.2E-08	11	3.2E-08	4.1E-09	8760	1.4E-07	8760	1.4E-07	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Cadmium	2.75	MMBtu	1.1E-06	11	3.0E-06	3.7E-07	8760	1.3E-05	8760	1.3E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Chromium	2.75	MMBtu	1.4E-06	11	3.8E-06	4.8E-07	8760	1.7E-05	8760	1.7E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Cobalt	2.75	MMBtu	8.2E-08	11	2.3E-07	2.9E-08	8760	9.9E-07	8760	9.9E-07	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Copper	2.75	MMBtu	8.3E-07	11	2.3E-06	2.9E-07	8760	1.0E-05	8760	1.0E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Lead	2.75	MMBtu	4.9E-07	11	1.3E-06	1.7E-07	8760	5.9E-06	8760	5.9E-06	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Manganese	2.75	MMBtu	3.7E-07	11	1.0E-06	1.3E-07	8760	4.5E-06	8760	4.5E-06	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Mercury	2.75	MMBtu	2.5E-07	11	7.0E-07	8.8E-08	8760	3.1E-06	8760	3.1E-06	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Molybdenum	2.75	MMBtu	1.1E-06	11	3.0E-06	3.7E-07	8760	1.3E-05	8760	1.3E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Nickel	2.75	MMBtu	2.1E-06	11	5.7E-06	7.1E-07	8760	2.5E-05	8760	2.5E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Selenium	2.75	MMBtu	2.4E-08	11	6.5E-08	8.2E-09	8760	2.8E-07	8760	2.8E-07	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Vanadium	2.75	MMBtu	2.3E-06	11	6.2E-06	7.8E-07	8760	2.7E-05	8760	2.7E-05	NA	NA
ISA	Turbine Fuel Preheater	Natural Gas	Zinc	2.75	MMBtu	2.8E-05	11	7.8E-05	9.9E-06	8760	3.4E-04	8760	3.4E-04	NA	NA
TOTAL VOC EMISSIONS											126.5		126.5		12.6
TOTAL PM EMISSIONS											66.7		66.7		4.7
TOTAL PM_{10} EMISSIONS											66.7		66.7		4.7
TOTAL CO EMISSIONS											1,452.7		1,452.7		105.0
TOTAL SO_2 EMISSIONS											129.5		129.5		1.3
TOTAL H_2SO_4 Mist EMISSIONS											2.7E-01		2.7E-01		2.7E-02
TOTAL NOx EMISSIONS											1,966.4		1,966.4		144.9
TOTAL HAP EMISSIONS											33.0		33.4		2.7
LARGEST SINGLE HAP EMISSIONS			**(Manganese compounds)**								7.0		7.03		0.51

REFERENCES:

1 Information provided by Siemens Westinghouse for Estimated V84.3A(2) Gas Turbine Performance
2 AP-42 Table 3.1-2a. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM STATIONARY GAS TURBINES
NNG Data:

Sulfur content = < 0.032 grains/100 scf
Heat Content (gross) = 999.500 Btu/scf

$$s\% = \frac{0.032 \text{ grains S}}{100 \text{ scf}} \cdot \frac{1 \text{ lb}}{7000 \text{ grains}} \cdot \frac{\text{cf}}{999.5 \text{ Btu}} \cdot \frac{1000000 \text{ Btu}}{\text{MMBtu}} \cdot \frac{2 \text{ lb SO2}}{\text{lb S}} = 9.15\text{E-}05 \frac{\text{lb SO2}}{\text{MMBtu}}$$

Fuel Oil Data:

Sulfur content (given): 0.0015 %S

3 Assumes a 1-2% conversion of SO2 to SO3 and, conservatively, 100% conversion of SO3 to H2SO4. (ref: Reising, B.; Siemens-Westinghouse; Review of Air Toxics from Combustion Sources; Power Gen 2003 - Las Vegas; December 2003
4 AP-42 Table 3.1-3. EMISSION FACTORS FOR HAZARDOUS AIR POLLUTANTS FROM NATURAL GAS-FIRED STATIONARY GAS TURBINES
5 AP-42 Table 3.1-4. EMISSION FACTORS FOR HAZARDOUS AIR POLLUTANTS FROM DISTILLATE OIL-FIRED STATIONARY GAS TURBINES
6 AP-42 Table 3.1-5. EMISSION FACTORS FOR METALLIC HAZARDOUS AIR POLLUTANTS FROM DISTILLATE OIL-FIRED STATIONARY GAS TURBINES
7 EPA. Technology Transfer Network Air Toxics Website, Stationary Combustion Turbines NESHAP, Combustion Turbine Emissions Database v.5, 10/15/02. http://www.epa.gov/ttn/atw/turbine/turbinepg.html
8 AP-42 Table 1.4-1. EMISSION FACTORS FOR NITROGEN OXIDES (NOx) AND CARBON MONOXIDE (CO) FROM NATURAL GAS COMBUSTION
9 AP-42 TABLE 1.4-2. EMISSION FACTORS FOR CRITERIA POLLUTANTS AND GREENHOUSE GASES FROM NATURAL GAS COMBUSTION
10 AP-42 TABLE 1.4-3. EMISSION FACTORS FOR SPECIATED ORGANIC COMPOUNDS FROM NATURAL GAS COMBUSTION
11 AP-42 TABLE 1.4-4. EMISSION FACTORS FOR METALS FROM NATURAL GAS COMBUSTION

12 AP-42 Table 2.1-2 (English Units). PARTICULATE MATTER, METALS, AND ACID GAS EMISSION FACTORS FOR MASS BURN AND MODULAR EXCESS AIR COMBUSTORS
Using emission factors with Spray Dryer / Fabric Filter control
13 AP-42 Table 2.1-7 (Metric And English Units). ORGANIC, NITROGEN OXIDES, CARBON MONOXIDE, AND CARBON DIOXIDE EMISSION FACTORS FOR MODULAR EXCESS AIR COMBUSTORS
Using uncontrolled emission factor
14 AP-42 Table 2.1-8 (Metric And English Units). EMISSION FACTORS FOR REFUSE-DERIVED FUEL-FIRED COMBUSTORS
Using uncontrolled emission factor
15 Stack Test Data
Average of yearly stack test data from 2001-2004 plus one standard deviation.
16 Dioxin emission rate per 5/29 Barr internal memo, p. 6 from Marta Nelson / Tom Mattison. Total emission rate scaled to input rate of RDF to boilers.
17 2006 Combined Ash Composition data
18 Emission rate calculated using EPA TANKS 4.0.9d.

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-4. RDF Boiler Stack Test Results, 2001-2004

Date / Method	Pollutant	Measured Concentration	Concentration Units	Measured emission factor (lb/hr-ton RDF)	
Barr Determination	.Dioxins/Furans as 2,3,7,8-TCDD equivalent	0.54	ng/dscm	3.59E-07	(lb/hr)
5/26-6/2, 2004	PM	0.0015	gr/dscf	0.0419	
5/26-6/2, 2004	HCl	1.40	ppm,d	0.025	
5/26-6/2, 2004	As	0.531	ug/dscm	7.84E-06	
5/26-6/2, 2004	Be	0.212	ug/dscm	3.13E-06	
5/26-6/2, 2004	Cd	0.069	ug/dscm	1.03E-06	
5/26-6/2, 2004	Cr	2.044	ug/dscm	3.02E-05	
5/26-6/2, 2004	Pb	0.472	ug/dscm	6.97E-06	
5/26-6/2, 2004	Hg	0.139	ug/dscm	2.05E-06	
5/26-6/2, 2004	Ni	1.389	ug/dscm	2.05E-05	
5/26-6/2, 2004	Se	0.531	ug/dscm	7.84E-06	
6/3-6/6, 2003	PM	0.0023	gr/dscf	0.0582	
6/3-6/6, 2003	HCl	0.55	ppm,d	0.011	
6/3-6/6, 2003	As	0.482	ug/dscm	6.59E-06	
6/3-6/6, 2003	Be	0.241	ug/dscm	3.30E-06	
6/3-6/6, 2003	Cd	0.258	ug/dscm	3.52E-06	
6/3-6/6, 2003	Cr	1.285	ug/dscm	1.76E-05	
6/3-6/6, 2003	Pb	13.23	ug/dscm	1.81E-04	
6/3-6/6, 2003	Hg	0.24	ug/dscm	3.30E-06	
6/3-6/6, 2003	Ni	1.28	ug/dscm	1.76E-05	
6/3-6/6, 2003	Se	0.48	ug/dscm	6.59E-06	
5/28-6/5, 2002	PM	0.0052	gr/dscf	0.105	
5/28-6/5, 2002	HCl	1.60	ppm,d	0.0257	
5/28-6/5, 2002	As	3.40	ug/dscm	4.700E-05	
5/28-6/5, 2002	Be	0.97	ug/dscm	1.340E-05	
5/28-6/5, 2002	Cd	0.65	ug/dscm	8.93E-06	
5/28-6/5, 2002	Cr	3.23	ug/dscm	4.46E-05	
5/28-6/5, 2002	Pb	1.78	ug/dscm	2.46E-05	
5/28-6/5, 2002	Hg	0.54	ug/dscm	7.41E-06	
5/28-6/5, 2002	Ni	6.46	ug/dscm	8.900E-05	
5/28-6/5, 2002	Se	4.37	ug/dscm	0.0000604	
5/15-5/18, 2001	PM	0.00086	gr/dscf	0.024	
5/15-5/18, 2001	HCl	1.1	ppm,d	0.019	
5/15-5/18, 2001	As	3.78	ug/dscm	4.360E-06	
5/15-5/18, 2001	Be	0.54	ug/dscm	6.240E-06	
5/15-5/18, 2001	Cd	0.54	ug/dscm	6.24E-06	
5/15-5/18, 2001	Cr	74.6	ug/dscm	8.62E-04	
5/15-5/18, 2001	Pb	14.04	ug/dscm	1.66E-04	
5/15-5/18, 2001	Hg	0.70	ug/dscm	8.08E-06	
5/15-5/18, 2001	Ni	12.2	ug/dscm	1.41E-04	
5/15-5/18, 2001	Se	4.85	ug/dscm	0.000056	

Pollutant	Average Emission Factor	Standard Deviation	**Emission Factor (lb/ton-hr RDF)**
PM	5.73E-02	3.47E-02	9.20E-02
HCl	2.02E-02	6.82E-03	2.70E-02
As	1.64E-05	2.04E-05	3.69E-05
Be	6.52E-06	4.81E-06	1.13E-05
Cd	4.93E-06	3.41E-06	8.34E-06
Cr	2.39E-04	4.16E-04	6.54E-04
Pb	9.46E-05	9.15E-05	1.86E-04
Hg	5.21E-06	2.98E-06	8.19E-06
Ni	6.70E-05	5.93E-05	1.26E-04
Se	3.27E-05	2.95E-05	6.22E-05

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-5: Turbine 1 Manufacturer Data

Siemens Emissions Guarantees

Fuel	Gas	Gas	Gas	Oil	Oil	Oil
Temp	-30 to 102	-30 to 102	-30 to 102	-30 to 102	-30 to 102	-30 to 102
Load (%)	≥70	60 to <70	50 to <60	≥90	80 to <90	70 to <80
NOx (ppmv @ 15% O2)	9	9	25	42	42	42
CO (ppmv @ 15% O2)	4	4	30	10	40	50
VOC (ppmv @ 15% O2)	1	5	5	1	1	1
PM (mg/Nm^3)	3	3	3	16	19	22
Calculated Equivalent lb/mmBtu						
F Factor dry (dscf/mmBtu)	8710	8710	8710	9190	9190	9190
Actual O2%	15	15	15	15	15	15
NOx (lb/mmBtu)	0.0331	0.0331	0.0919	0.1629	0.1629	0.1629
CO (lb/mmBtu)	0.0090	0.0090	0.0671	0.0236	0.0944	0.1180
VOC (lb/mmBtu)	0.0035	0.0176	0.0176	0.0037	0.0037	0.0037
PM (lb/mmBtu)	0.0016	0.0016	0.0016	0.0092	0.0109	0.0126

Calculated lb/hr Emission Rates

Case ID	**5b**	**6**	**1**				**7b**	**8**		**3**			
Season	**Summer**	**Summer**	**Summer**	**Summer**	**Min**	**Max**	**Winter**	**Winter**	**Winter**	**Winter**	**Summer**	**Min**	**Max**
Fuel	**Gas**	**Gas**	**Gas**	**Gas**			**Oil**	**Oil**	**Oil**	**Oil**	**Oil**		
Evap Cooler	On	On	On	Off			Off	Off	Off	Off	Off		
Water Injection	Off	Off	Off	Off			On	On	On	On	On		
Dry Bulb (F)	81	88	102	88			10	0	0	-30	88		
RH (%)	55	60	80	68			68	68	68	80	60		
Load (%)	75	100	100	57			75	100	82	100	100		
Net Power (MW)	129.3	174.7	171.6	96.1			154.65	211.7	178.3	224	158.4		
Heat Rate (Btu/kWh)	10069	9383	9438	12455			9691	9117	10294	9064	9860		
Heat Input (MMBtu/hr)	1302	1639	1620	1197	1197	**1639**	1499	1930	1836	2030	1562	1499	**2030**
NOx (lb/mmBtu)	0.0331	0.0331	0.0331	0.0919	0.0331	**0.0919**	0.1629	0.1629	0.1629	0.1629	0.1629	0.1629	**0.1629**
CO (lb/mmBtu)	0.0090	0.0090	0.0090	0.0671	0.0090	**0.0671**	0.1180	0.0236	0.0944	0.0236	0.0236	0.0236	**0.1180**
VOC (lb/mmBtu)	0.0035	0.0035	0.0035	0.0176	0.0035	**0.0176**	0.0037	0.0037	0.0037	0.0037	0.0037	0.0037	**0.0037**
PM (lb/mmBtu)	0.0016	0.0016	0.0016	0.0016	0.0016	**0.0016**	0.0126	0.0092	0.0109	0.0092	0.0092	0.0092	**0.0126**
NOx (lb/hr)	43.07	54.23	53.58	110.00	43	110	244.14	314.41	299.00	330.74	254.42	244	331
CO (lb/hr)	11.65	14.67	14.50	80.00	12	80	176.91	45.57	43.00	47.93	36.87	37	177
VOC (lb/hr)	4.58	5.76	5.69	7.70	4.6	7.7	5.56	7.16	2.50	7.53	5.79	2.5	7.5
PM (lb/hr)	2.12	2.67	2.64	1.95	2.0	2.7	18.92	17.72	20.01	18.64	14.34	14.3	20.0
CO Synthetic Minor (Hours to 80 ton CO/yr)	NA	NA	NA	2000	**1454**	2000	904	3511	3721	3338	4339	**668**	4339

NOTES:
Bolded values are used in potential emission calculations.
The hour limits are found conservatively by dividing the limit of 80 tons of CO by the product of the maximum heat input and the maximum emission factor.
For example, for fuel oil:

$$\frac{80 \text{ tons CO}}{\text{year}} \cdot \frac{2000 \text{ lb CO}}{\text{ton CO}} \cdot \frac{\text{MMBtu}}{0.1180 \text{ lb CO}} \cdot \frac{\text{hr}}{2030 \text{ MMBtu}} = 668 \text{ hours / year}$$

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-6. Turbine Emissions Test Data (Obtained from EPA Combustion Turbine Emissions Database)

Fuel	Pollutant	Measured Conc.(1)	Conc. Units(1)	Stack Flow Rate (dscfm)(1)	Test Source(2)	Molecular Weight	Calculated Emission Rate (lb/hr)	Turbine Rating (MW)(1)	Assumed Heating Rate (Btu/kWh)(3)	Turbine Rating (MMBtu/hr)	Calculated Emission Factor (lb/MMBtu)	Max EF (lb/MMBtu)
Natural Gas	TMA	0.082	µg/dscm	236,770	10	225.3	7.27E-05	37	9000	333	2.18E-07	2.18E-07
Natural Gas	NDMA	0.088	µg/dscm	236,770	10	74.1	7.80E-05	37	9000	333	2.34E-07	2.34E-07
Natural Gas	NMOR	0.061	µg/dscm	236,770	10	116.1	5.41E-05	37	9000	333	1.62E-07	1.62E-07
Natural Gas	Arsenic	0.029	µg/dscm	236,770	10	74.9	2.57E-05	37	9000	333	7.72E-08	7.72E-08
Natural Gas	Mercury	0.262	µg/dscm	236,770	10	200.6	2.32E-04	37	9000	333	6.97E-07	6.97E-07
Natural Gas	Cadmium	1.00	µg/dscm	236,770	10	112.4	8.87E-04	37	9000	333	2.66E-06	2.66E-06
Natural Gas	Manganese	1.93	µg/dscm	236,770	10	54.9	1.71E-03	37	9000	333	5.14E-06	5.14E-06
Natural Gas	Lead	19.3	µg/dscm	236,770	10	207.2	1.71E-02	37	9000	333	5.14E-05	5.14E-05
Natural Gas	2,2,4-Trimethylpentane	2	ppb	23,311	29	114.2	8.29E-04	77	9000	693	1.20E-06	1.20E-06
Natural Gas	n-Hexane	40	ppb	23,311	29	86.2	1.25E-02	77	9000	693	1.81E-05	1.81E-05
#2 Fuel Oil	1,4 - Dichlorobenzene	3	ppb	44,438	300	147.0	3.05E-03	20.83	9000	187.47	1.63E-05	
#2 Fuel Oil	1,4 - Dichlorobenzene	3	ppb	45,426	300	147.0	3.12E-03	20.83	9000	187.47	1.66E-05	
#2 Fuel Oil	1,4 - Dichlorobenzene	0.84	ppb	41,691	301	147.0	8.02E-04	20.83	9000	187.47	4.28E-06	1.66E-05
#2 Fuel Oil	Acetaldehyde	3.7	ppb	44,438	300	44.1	1.13E-03	20.83	9000	187.47	6.02E-06	
#2 Fuel Oil	Acetaldehyde	6.2	ppb	45,426	300	44.1	1.93E-03	20.83	9000	187.47	1.03E-05	1.03E-05
#2 Fuel Oil	Acrolein(4)	-	-	-	14	56.1	.056	75	9000	675	8.30E-05	8.30E-05
#2 Fuel Oil	Carbon Tetrachloride	3	ppb	44,438	300	153.8	3.19E-03	20.83	9000	187.47	1.70E-05	
#2 Fuel Oil	Carbon Tetrachloride	3	ppb	45,426	300	153.8	3.26E-03	20.83	9000	187.47	1.74E-05	
#2 Fuel Oil	Carbon Tetrachloride	0.8	ppb	41,691	301	153.8	7.99E-04	20.83	9000	187.47	4.26E-06	1.74E-05
#2 Fuel Oil	Chlorobenzene	3	ppb	44,438	300	112.6	2.34E-03	20.83	9000	187.47	1.25E-05	
#2 Fuel Oil	Chlorobenzene	3	ppb	45,426	300	112.6	2.39E-03	20.83	9000	187.47	1.27E-05	
#2 Fuel Oil	Chlorobenzene	1.1	ppb	41,691	301	112.6	8.04E-04	20.83	9000	187.47	4.29E-06	1.27E-05
#2 Fuel Oil	Chloroform	3	ppb	44,438	300	119.4	2.48E-03	20.83	9000	187.47	1.32E-05	
#2 Fuel Oil	Chloroform	3	ppb	45,426	300	119.4	2.53E-03	20.83	9000	187.47	1.35E-05	
#2 Fuel Oil	Chloroform	1.0	ppb	41,691	301	119.4	7.75E-04	20.83	9000	187.47	4.13E-06	1.35E-05
#2 Fuel Oil	Dioxins(5)	1.84E-04	ug/dscm	384,000	14	-	2.65E-07	75	9000	675	3.93E-10	3.93E-10
#2 Fuel Oil	Furans(5)	4.97E-04	ug/dscm	384,000	14	-	7.14E-07	75	9000	675	3.17E-10	3.17E-10
#2 Fuel Oil	Total Dioxins + Furans(6)	-	-	-	-	-	-	-	-	-	7.10E-10	7.10E-10
#2 Fuel Oil	Ethylene Dichloride	3	ppb	44,438	300	99.0	2.05E-03	20.83	9000	187.47	1.10E-05	
#2 Fuel Oil	Ethylene Dichloride	3	ppb	45,426	300	99.0	2.10E-03	20.83	9000	187.47	1.12E-05	1.12E-05
#2 Fuel Oil	Methylene Chloride	3	ppb	44,438	300	84.9	1.76E-03	20.83	9000	187.47	9.40E-06	
#2 Fuel Oil	Methylene Chloride	3	ppb	45,426	300	84.9	1.80E-03	20.83	9000	187.47	9.61E-06	
#2 Fuel Oil	Methylene Chloride	1.5	ppb	41,691	301	84.9	8.27E-04	20.83	9000	187.47	4.41E-06	9.61E-06
#2 Fuel Oil	Tetrachloroethylene	3	ppb	44,438	300	165.8	3.44E-03	20.83	9000	187.47	1.84E-05	
#2 Fuel Oil	Tetrachloroethylene	3	ppb	45,426	300	165.8	3.52E-03	20.83	9000	187.47	1.88E-05	
#2 Fuel Oil	Tetrachloroethylene	0.75	ppb	41,691	301	165.8	8.07E-04	20.83	9000	187.47	4.31E-06	1.88E-05
#2 Fuel Oil	Toluene	66	ppb	384,000	14	92.1	3.64E-01	75	9000	675	5.39E-04	5.39E-04
#2 Fuel Oil	Trichloroethylene	3	ppb	44,438	300	131.4	2.73E-03	20.83	9000	187.47	1.45E-05	
#2 Fuel Oil	Trichloroethylene	0.94	ppb	41,691	301	131.4	8.02E-04	20.83	9000	187.47	4.28E-06	

Great River Energy
Elk River Station - Peaking Turbine Project
AERA Attachment A - Emission Calculations
Table A-6. Turbine Emissions Test Data (Obtained from EPA Combustion Turbine Emissions Database)

Fuel	Pollutant	Measured Conc.(1)	Conc. Units(1)	Stack Flow Rate (dscfm)(1)	Test Source(2)	Molecular Weight	Calculated Emission Rate (lb/hr)	Turbine Rating (MW)(1)	Assumed Heating Rate (Btu/kWh)(3)	Turbine Rating (MMBtu/hr)	Calculated Emission Factor (lb/MMBtu)	Max EF (lb/MMBtu)
#2 Fuel Oil	Trichloroethylene	3	ppb	45,426	300	131.4	2.79E-03	20.83	9000	187.47	1.49E-05	1.49E-05
#2 Fuel Oil	Vinyl Chloride	15	ppb	44,438	300	62.5	6.49E-03	20.83	9000	187.47	3.46E-05	
#2 Fuel Oil	Vinyl Chloride	15	ppb	45,426	300	62.5	6.63E-03	20.83	9000	187.47	3.54E-05	
#2 Fuel Oil	Vinyl Chloride	2.0	ppb	41,691	301	62.5	8.11E-04	20.83	9000	187.47	4.33E-06	3.54E-05
#2 Fuel Oil	Vinylidene Chloride	3	ppb	44,438	300	96.9	2.01E-03	20.83	9000	187.47	1.07E-05	
#2 Fuel Oil	Vinylidene Chloride	3	ppb	45,426	300	96.9	2.06E-03	20.83	9000	187.47	1.10E-05	1.10E-05
#2 Fuel Oil	Xylenes	56	ppb	384,000	14	106.2	3.56E-01	75	9000	675	5.27E-04	5.27E-04

Notes:

(1) Data from EPA Combustion Turbine Emissions Database v.5. <http://www.epa.gov/ttn/atw/turbine/turbinepg.html>

(2) Test Sources:

10. State of California Air Resources Board, Engineering Evaluation Branch Monitoring and Laboratory Division, Project # C-88-014. Evaluation Test on a Natural Gas Fired Turbine Cogeneration Facility, University Technical Services Inc., Taft, California. January 1989.

14. Report of Air Pollution Source Testing For California AB 2588 at the Kern River Cogen Company, Bakersfield, California. Prepared by Engineering-Science, Inc., Pasadena, California for Kern River Cogen Company, Bakersfield, California. March 28, 1990.

29. Shareef, G., Ferry, K., Gundappa, M., Leatherwood, C., Ogle, L., and Campbell, L. Measurement of Air Toxic Emissions from Natural Gas-Fired Internal Combustion Engines at Natural Gas Transmission and Storage Facilities. Prepared by Radian Corporation, RTP, NC for Gas Research Institute, Chicago, Illinois. February, 1996.

300. Measurement of Emissions, Total Energy Facility Gas Turbine at Joint Water Pollution Control Plant, Carson California. Prepared by Calscience Environmental Laboratories, Inc., Cypress, California for County Sanitation Districts of Los Angeles County, Whittier, California. August 17, 1992.

301. Measurement of Emissions, Total Energy Facility Gas Turbine No. 1, Digester Gas Inlet at Joint Water Pollution Control Plant, Carson California. Prepared by Calscience Environmental Laboratories, Inc., Stanton, California for County Sanitation Districts of Los Angeles County, Whittier, California. March 19, 1993.

(3) Assumed value - to be conservative, assumed low.

(4) Emission rate determined by stack tester (see Combustion Turbine Emissions Database v.5)

(5) Dioxin and furan concentrations from Combustion Turbine Emissions Database expressed as 2,3,7,8-TCDD equivalent in calculated emission factor by mutliplying by the following TEFs:

Dioxins: 1
Furans: 0.3

TEF Source: Van den Berg, et al., The World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. ToxSci Advance Access published July 7, 2006.

(6) Total Dioxin + Furan factor is sum of separate dioxin and furan equivalent factors. Thus the factor is expressed as 2,3,7,8-TCDD equivalent.

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	25,000 Gallon Fuel Oil Tank #1
City:	Elk River
State:	Minnesota
Company:	Great River Energy
Type of Tank:	Vertical Fixed Roof Tank
Description:	25,000 gallon fuel oil storage tank

Tank Dimensions

Shell Height (ft):		30.00
Diameter (ft):		12.00
Liquid Height (ft) :		29.55
Avg. Liquid Height (ft):		25.00
Volume (gallons):		25,000.00
Turnovers:		2.50
Net Throughput(gal/yr):		62,500.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome	
Height (ft)		0.00
Radius (ft) (Dome Roof)		12.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: St. Cloud, Minnesota (Avg Atmospheric Pressure = 14.18 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

25,000 Gallon Fuel Oil Tank #1 - Vertical Fixed Roof Tank
Elk River, Minnesota

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	43.16	37.69	48.64	41.54	0.0035	0.0031	0.0043	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045
1,2,4-Trimethylbenzene						0.0101	0.0079	0.0128	120.1900	0.0100	0.0413	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						0.7182	0.6079	0.8449	78.1100	0.0000	0.0023	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Ethylbenzene						0.0589	0.0477	0.0723	106.1700	0.0001	0.0031	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Hexane (-n)						1.2130	1.0376	1.4124	86.1700	0.0000	0.0005	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Toluene						0.1912	0.1586	0.2295	92.1300	0.0003	0.0250	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Unidentified Components						0.0030	0.0028	0.0029	134.4987	0.9866	0.8701	189.60	
Xylene (-m)						0.0488	0.0395	0.0599	106.1700	0.0029	0.0577	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

25,000 Gallon Fuel Oil Tank #1 - Vertical Fixed Roof Tank
Elk River, Minnesota

Annual Emission Calcaulations	
Standing Losses (lb):	0.8074
Vapor Space Volume (cu ft):	658.5754
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0394
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	658.5754
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	5.8231
Tank Shell Height (ft):	30.0000
Average Liquid Height (ft):	25.0000
Roof Outage (ft):	0.8231
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.8231
Dome Radius (ft):	12.0000
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Daily Avg. Liquid Surface Temp. (deg. R):	502.8346
Daily Average Ambient Temp. (deg. F):	41.5167
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	501.2067
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,218.7134
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0394
Daily Vapor Temperature Range (deg. R):	21.8931
Daily Vapor Pressure Range (psia):	0.0012
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0031
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0043
Daily Avg. Liquid Surface Temp. (deg R):	502.8346
Daily Min. Liquid Surface Temp. (deg R):	497.3613
Daily Max. Liquid Surface Temp. (deg R):	508.3079
Daily Ambient Temp. Range (deg. R):	22.3500
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0035
Vapor Space Outage (ft):	5.8231

Working Losses (lb):	0.6854
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Annual Net Throughput (gal/yr.):	62,500.0000
Annual Turnovers:	2.5000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	25,000.0000
Maximum Liquid Height (ft):	29.5498
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1.4928

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

25,000 Gallon Fuel Oil Tank #1 - Vertical Fixed Roof Tank
Elk River, Minnesota

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.69	0.81	1.49
Hexane (-n)	0.00	0.00	0.00
Benzene	0.00	0.00	0.00
Toluene	0.02	0.02	0.04
Ethylbenzene	0.00	0.00	0.00
Xylene (-m)	0.04	0.05	0.09
1,2,4-Trimethylbenzene	0.03	0.03	0.06
Unidentified Components	0.60	0.70	1.30

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	25,000 Gallon Fuel Oil Tank #2
City:	Elk River
State:	Minnesota
Company:	Great River Energy
Type of Tank:	Vertical Fixed Roof Tank
Description:	25,000 gallon fuel oil storage tank

Tank Dimensions

Shell Height (ft):		30.00
Diameter (ft):		12.00
Liquid Height (ft) :		29.55
Avg. Liquid Height (ft):		25.00
Volume (gallons):		25,000.00
Turnovers:		2.50
Net Throughput(gal/yr):		62,500.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome	
Height (ft)		0.00
Radius (ft) (Dome Roof)		12.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: St. Cloud, Minnesota (Avg Atmospheric Pressure = 14.18 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

25,000 Gallon Fuel Oil Tank #2 - Vertical Fixed Roof Tank
Elk River, Minnesota

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	43.16	37.69	48.64	41.54	0.0035	0.0031	0.0043	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045
1,2,4-Trimethylbenzene						0.0101	0.0079	0.0128	120.1900	0.0100	0.0413	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						0.7182	0.6079	0.8449	78.1100	0.0000	0.0023	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Ethylbenzene						0.0589	0.0477	0.0723	106.1700	0.0001	0.0031	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Hexane (-n)						1.2130	1.0376	1.4124	86.1700	0.0000	0.0005	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Toluene						0.1912	0.1586	0.2295	92.1300	0.0003	0.0250	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Unidentified Components						0.0030	0.0028	0.0029	134.4987	0.9866	0.8701	189.60	
Xylene (-m)						0.0488	0.0395	0.0599	106.1700	0.0029	0.0577	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

25,000 Gallon Fuel Oil Tank #2 - Vertical Fixed Roof Tank
Elk River, Minnesota

Annual Emission Calcaulations	
Standing Losses (lb):	0.8074
Vapor Space Volume (cu ft):	658.5754
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0394
Vented Vapor Saturation Factor:	0.9989
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	658.5754
Tank Diameter (ft):	12.0000
Vapor Space Outage (ft):	5.8231
Tank Shell Height (ft):	30.0000
Average Liquid Height (ft):	25.0000
Roof Outage (ft):	0.8231
Roof Outage (Dome Roof)	
Roof Outage (ft):	0.8231
Dome Radius (ft):	12.0000
Shell Radius (ft):	6.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Daily Avg. Liquid Surface Temp. (deg. R):	502.8346
Daily Average Ambient Temp. (deg. F):	41.5167
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	501.2067
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,218.7134
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0394
Daily Vapor Temperature Range (deg. R):	21.8931
Daily Vapor Pressure Range (psia):	0.0012
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0031
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0043
Daily Avg. Liquid Surface Temp. (deg R):	502.8346
Daily Min. Liquid Surface Temp. (deg R):	497.3613
Daily Max. Liquid Surface Temp. (deg R):	508.3079
Daily Ambient Temp. Range (deg. R):	22.3500
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9989
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0035
Vapor Space Outage (ft):	5.8231

Working Losses (lb):	0.6854
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Annual Net Throughput (gal/yr.):	62,500.0000
Annual Turnovers:	2.5000
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	25,000.0000
Maximum Liquid Height (ft):	29.5498
Tank Diameter (ft):	12.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	1.4928

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

25,000 Gallon Fuel Oil Tank #2 - Vertical Fixed Roof Tank
Elk River, Minnesota

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	0.69	0.81	1.49
Hexane (-n)	0.00	0.00	0.00
Benzene	0.00	0.00	0.00
Toluene	0.02	0.02	0.04
Ethylbenzene	0.00	0.00	0.00
Xylene (-m)	0.04	0.05	0.09
1,2,4-Trimethylbenzene	0.03	0.03	0.06
Unidentified Components	0.60	0.70	1.30

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	846,000 Gallon Fuel Oil Storage Tank
City:	Elk River
State:	Minnesota
Company:	Great River Energy
Type of Tank:	Vertical Fixed Roof Tank
Description:	846,000 gallon fuel oil storage tank for combustion turbine

Tank Dimensions

Shell Height (ft):		40.00
Diameter (ft):		60.00
Liquid Height (ft) :		38.00
Avg. Liquid Height (ft):		35.00
Volume (gallons):		846,000.00
Turnovers:		75.00
Net Throughput(gal/yr):		63,450,000.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		0.00
Slope (ft/ft) (Cone Roof)		0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: St. Cloud, Minnesota (Avg Atmospheric Pressure = 14.18 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

846,000 Gallon Fuel Oil Storage Tank - Vertical Fixed Roof Tank
Elk River, Minnesota

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	43.16	37.69	48.64	41.54	0.0035	0.0031	0.0043	130.0000			188.00	Option 1: VP40 = .0031 VP50 = .0045
1,2,4-Trimethylbenzene						0.0101	0.0079	0.0128	120.1900	0.0100	0.0413	120.19	Option 2: A=7.04383, B=1573.267, C=208.56
Benzene						0.7182	0.6079	0.8449	78.1100	0.0000	0.0023	78.11	Option 2: A=6.905, B=1211.033, C=220.79
Ethylbenzene						0.0589	0.0477	0.0723	106.1700	0.0001	0.0031	106.17	Option 2: A=6.975, B=1424.255, C=213.21
Hexane (-n)						1.2130	1.0376	1.4124	86.1700	0.0000	0.0005	86.17	Option 2: A=6.876, B=1171.17, C=224.41
Toluene						0.1912	0.1586	0.2295	92.1300	0.0003	0.0250	92.13	Option 2: A=6.954, B=1344.8, C=219.48
Unidentified Components						0.0030	0.0028	0.0029	134.4987	0.9866	0.8701	189.60	
Xylene (-m)						0.0488	0.0395	0.0599	106.1700	0.0029	0.0577	106.17	Option 2: A=7.009, B=1462.266, C=215.11

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

846,000 Gallon Fuel Oil Storage Tank - Vertical Fixed Roof Tank
Elk River, Minnesota

Annual Emission Calcaulations	
Standing Losses (lb):	17.3347
Vapor Space Volume (cu ft):	14,137.1669
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0394
Vented Vapor Saturation Factor:	0.9991
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	14,137.1669
Tank Diameter (ft):	60.0000
Vapor Space Outage (ft):	5.0000
Tank Shell Height (ft):	40.0000
Average Liquid Height (ft):	35.0000
Roof Outage (ft):	0.0000
Roof Outage (Cone Roof)	
Roof Outage (ft):	0.0000
Roof Height (ft):	0.0000
Roof Slope (ft/ft):	0.0000
Shell Radius (ft):	30.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Daily Avg. Liquid Surface Temp. (deg. R):	502.8346
Daily Average Ambient Temp. (deg. F):	41.5167
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	501.2067
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,218.7134
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0394
Daily Vapor Temperature Range (deg. R):	21.8931
Daily Vapor Pressure Range (psia):	0.0012
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0031
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0043
Daily Avg. Liquid Surface Temp. (deg R):	502.8346
Daily Min. Liquid Surface Temp. (deg R):	497.3613
Daily Max. Liquid Surface Temp. (deg R):	508.3079
Daily Ambient Temp. Range (deg. R):	22.3500
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9991
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0035

Vapor Space Outage (ft):	5.0000
Working Losses (lb):	394.3028
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0035
Annual Net Throughput (gal/yr.):	63,450,000.0000
Annual Turnovers:	75.0000
Turnover Factor:	0.5667
Maximum Liquid Volume (gal):	846,000.0000
Maximum Liquid Height (ft):	38.0000
Tank Diameter (ft):	60.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	411.6375

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

846,000 Gallon Fuel Oil Storage Tank - Vertical Fixed Roof Tank
Elk River, Minnesota

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	394.30	17.33	411.64
Hexane (-n)	0.20	0.01	0.20
Benzene	0.92	0.04	0.97
Toluene	9.85	0.43	10.28
Ethylbenzene	1.23	0.05	1.29
Xylene (-m)	22.76	1.00	23.76
1,2,4-Trimethylbenzene	16.27	0.72	16.98
Unidentified Components	343.07	15.08	358.16