Criteria Air Pollutant Emissions
Boiler #1 (P106)

Combustion Source Characteristics

Boiler Manufacturer	Superior Boiler Works (or equivalent)
Burner Model	Super Seminole 4000 (or Equivalent)
Input Heat Capacity (BTU/hr) [e]	33,475,000
Fuel	Natural Gas
Heating Value (BTU/scf)	1,020
Max Hourly Fuel Consumption (scf/hr) [e]	32,819
Annual Fuel Consumption (scf/yr) [e]	287,491,176

Site Information

Jerome Barometric Pressure (mm Hg)	664.34

Stack Data [d]

Stack Height (ft)	39.5
Stack Diameter (ft)	4.083
Exit Gas Temperature (ºF)	350
Wet Actual Flow Rate (acfm)	10,389
Wet Standard Flow Rate (wscfm)	5,919
Dry Standard Flow Rate (dscfm)	4,859
Grain Loading Flow Rate (dscfm)	6,491
Stack Velocity (m/s)	4.03
Fd (dscf stack gas/BTU)	0.00871
Fw (wscf stack gas/BTU)	0.01061

Criteria Pollutants

Pollutant	Pollutant Source	Emission Factor[a]	Emission Factor Unit	Potential Emissions (lb/hr)	Potential Emissions (TPY)	Potential Emissions (g/s)
PM_{10}	NG Combustion	7.6	lb/10^6 scf	0.249	1.1	0.031
SO_2	NG Combustion	0.6	lb/10^6 scf	0.020	0.1	0.002
NO_x	NG Combustion	100	lb/10^6 scf	3.282	14.4	0.414
CO	NG Combustion	84	lb/10^6 scf	2.757	12.1	0.347
VOC	NG Combustion	5.5	lb/10^6 scf	0.181	0.8	0.023
Lead	NG Combustion	0.0005	lb/10^6 scf	1.64E-05	0.0	2.07E-06

Non-Criteria Pollutants with Significant Threshold

Pollutant	Pollutant Source	Emission Factor[a]	Emission Factor Unit	Potential Emissions (lb/hr)	Potential Emissions (TPY)	Potential Emissions (g/s)
PM	NG Combustion	See PM_{10}	See PM_{10}	0.249	1.092	3.14E-02
Beryllium	NG Combustion	<1.2E-5	lb/10^6 scf	3.94E-07	0.000	4.96E-08
Mercury	NG Combustion	2.60E-04	lb/10^6 scf	8.53E-06	0.000	1.08E-06

PM Grain Loading Standard[b]

Pollutant	Pollutant Source	Potential Emissions (lb/hr)	Grain Load @ 3% Oxygen (gr/dscf)	PM Grain Standard[b] (gr/dscf)	Meets Standard?
PM	NG Combustion	0.249	0.004	0.015	yes

Notes:
(a) Emission factors from AP-42 Chapter 1.4, "Natural Gas Combustion", unless otherwise noted.
(b) IDAPA 58.01.01.677
(c) Boiler #1 and #2 are fully redundant. Only one boiler will operate at any one time. Maximum natural gas combustion in boilers will be 287,491,176 scf/year based on maximum boiler firing rate.
(d) Stack parameters were determined as follows: discharge temperature = conservative assumption based on other similar projects, flowrate (wet actual) based on EPA Method 19 F_w factor (converted from standard conditions to actual conditions), stack height and diameter = actual (details provided on construction drawings).
(e) Heat input capacity from Superior Boiler spec sheet, this is the maximum rated heat input capcity. Max hourly fuel consumption calculated by dividing the heat input capcity by the fuel heating value. Annual fuel consumption assumes max firing throughout the year.

Toxic Air Pollutant Emissions
Boiler #1 (P106)

Combustion Source Characteristics

Boiler Manufacturer	Superior Boiler Works (or equivalent)
Burner Model	Super Seminole 4000 (or Equivalent)
Input Heat Capacity (BTU/hr)	33,475,000
Fuel	Natural Gas
Heating Value (BTU/scf)	1,020
Max Hourly Fuel Consumption (scf/hr)	32,819
Annual Fuel Consumption (scf/yr)	287,491,176

Site Information

Jerome Barometric Pressure (mm Hg)	664.34

Stack Data

Stack Height (ft)	39.5
Stack Diameter (ft)	4.08
Exit Gas Temperature (°F)	350
Wet Actual Flow Rate (acfm)	10,389
Wet Standard Flow Rate (wscfm)	5,919
Dry Standard Flow Rate (dscfm)	4,859
Grain Loading Flow Rate (dscfm)	6,491
Stack Velocity (m/s)	4.03
Fd (dscf stack gas/BTU)	0.00871
Fw (wscf stack gas/BTU)	0.01061

Toxic Air Pollutants

Pollutant	Emission Factor[a]	Emission Factor Unit	Potential Emissions (lb/hr)	Potential Emissions (g/s)	Emission Limit[b] (lb/hr)
Arsenic	2.00E-04	lb/10^6 scf	6.56E-06	8.27E-07	1.50E-06
Barium	4.40E-03	lb/10^6 scf	1.44E-04	1.82E-05	3.30E-02
Benzene	2.10E-03	lb/10^6 scf	6.89E-05	8.68E-06	8.00E-04
Beryllium	<1.2E-5	lb/10^6 scf	3.94E-07	4.96E-08	2.80E-05
Benzo(a)pyrene	<1.2E-6	lb/10^6 scf	3.94E-08	4.96E-09	2.00E-06
Bis (2-ethylhexyl)phthalate	FNA	lb/10^6 scf	FNA	FNA	2.80E-02
Cadmium	1.10E-03	lb/10^6 scf	3.61E-05	4.55E-06	3.70E-06
Chromium	1.40E-03	lb/10^6 scf	4.59E-05	5.79E-06	3.30E-02
Cobalt	8.40E-05	lb/10^6 scf	2.76E-06	3.47E-07	3.30E-03
Copper	8.50E-04	lb/10^6 scf	2.79E-05	3.51E-06	3.33E-01
Dibutylphthalate	FNA	lb/10^6 scf	FNA	FNA	6.70E-02
Dichlorobenzene	1.20E-03	lb/10^6 scf	3.94E-05	4.96E-06	2.00E+01
Ethylbenzene	FNA	lb/10^6 scf	FNA	FNA	2.90E+01
Fluorene	2.80E-06	lb/10^6 scf	9.19E-08	1.16E-08	1.33E-01
Formaldehyde	7.50E-02	lb/10^6 scf	2.46E-03	3.10E-04	5.10E-04
Hexane	1.80E+00	lb/10^6 scf	5.91E-02	7.44E-03	1.20E+01
Manganese	3.80E-04	lb/10^6 scf	1.25E-05	1.57E-06	3.33E-01
Mercury	2.60E-04	lb/10^6 scf	8.53E-06	1.08E-06	3.00E-03
Molybdenum	1.10E-03	lb/10^6 scf	3.61E-05	4.55E-06	3.33E-01
Napthalene	6.10E-04	lb/10^6 scf	2.00E-05	2.52E-06	3.33E+00
Nickel	2.10E-03	lb/10^6 scf	6.89E-05	8.68E-06	2.70E-05
Pentane	2.60E+00	lb/10^6 scf	8.53E-02	1.08E-02	1.18E+02
Phenol	FNA	lb/10^6 scf	FNA	FNA	1.27E+00
Selenium	<2.4E-5	lb/10^6 scf	7.88E-07	9.92E-08	1.30E-02
Toluene	3.40E-03	lb/10^6 scf	1.12E-04	1.41E-05	2.50E+01
Vanadium	2.30E-03	lb/10^6 scf	7.55E-05	9.51E-06	3.00E-03
o-Xylene	FNA	lb/10^6 scf	FNA	FNA	2.90E+01
Zinc	2.90E-02	lb/10^6 scf	9.52E-04	1.20E-04	6.67E-01

Notes:
(a) Emission Factors from AP-42 Chapter 1.4, "Natural Gas Combustion".
(b) IDAPA 58.01.01.585 and 586
* FNA - Factor Not Available

SUPERIOR BOILER WORKS, Inc

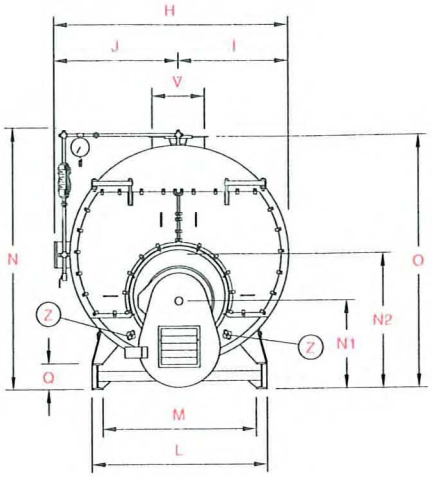
SUPER SEMINOLE

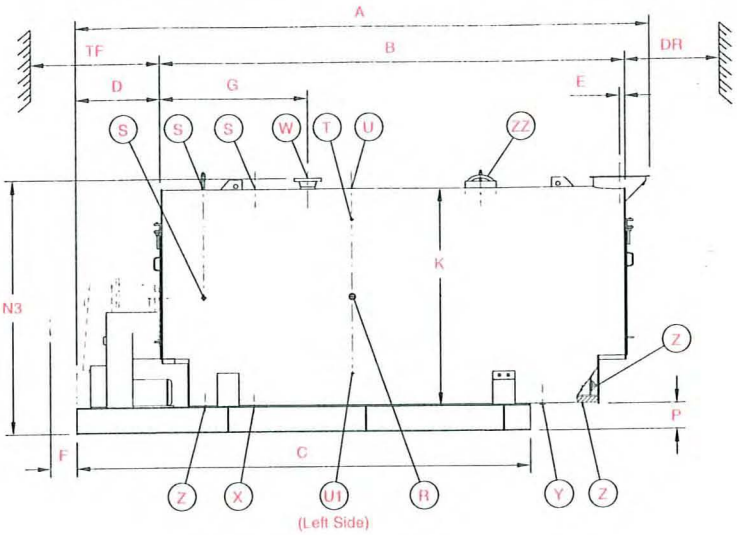
DIMENSIONAL DATA
STEAM BOILERS
15 AND 150 PSIG

3 PASS WET BACK

70 THRU 1000 BoHP

5 SQ. FT. / BoHP





FORM CATX6SSF
ISSUED: 3-31-03

NOMINAL BOILER HORSEPOWER		70	80	100	125	150	200	250	300	350	400	500	600	700	750	800	900	1000
UNIT MODEL NUMBER		350	400	500	625	750	1000	1250	1500	1750	2000	2500	3000	3500	3750	4000	4500	5000
LENGTHS: Overall	A	158	171	197	183	205	210	241	270	278	263	305	301	297	305	319	324	343
Shell	B	124	137	163	148	170	160	191	220	226	211	253	248 1/2	244	252	266	262	281
Base	C	115	128	154	136 1/2	158 1/2	160	191	220	224	208	250	247 1/2	236	244	258	263	282
Front Plate To Front Skid Extension	D	26	26	26	26	26	40	40	40	40	40	40	40	40	40	40	49	49
Rear Plate To Center Line Of Stack	E	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Front Of Base To End Of Burner	F																	
(GP)		-	-	-	9	9	5	5	-	-	-	-	-	-	-	-	13	12
(IC)		12	15	15	15	15	11	11	12	12	15	20	23	23				
Front Plate To Nozzle	G	43	43	47	47	47	52	52	52	63	63	67	74	64	64	64	64	64
WIDTHS: Overall	H	73	73	73	80	80	90	90	90	96	107	107	113	124	124	124	130	130
Centerline To Lagging	I	33	33	33	36 1/2	36 1/2	41 1/2	41 1/2	41 1/2	44 1/2	50	50	53	57	57	57	61	61
Water Column/Panel	J	40	40	40	43 1/2	43 1/2	48 1/2	48 1/2	48 1/2	51 1/2	57	57	60	67	67	67	69	69
Over Jacket	K	66	66	66	73	73	83	83	83	89	100	100	106	114	114	114	122	122
Base Width Outside	L	50	50	50	50 1/2	50 1/2	65 1/2	65 1/2	65 1/2	70 1/2	80	80	87	87	87	87	87	87
Base Width Inside	M	42	42	42	42 1/2	42 1/2	57 1/2	57 1/2	57 1/2	62 1/2	70	70	77	77	77	77	77	77
HEIGHTS: Overall	N	85	85	85	92	92	102	102	102	108	119	119	125	133	133	133	141	141
Centerline of Burner	N1	34	34	34	35 1/2	35 1/2	39	39	39	40	43	43	45	46	46	46	50	50
Centerline of Boiler	N2	45	45	45	48 1/2	48 1/2	53 1/2	53 1/2	53 1/2	56 1/2	62	62	65	69	69	69	75	75
Top of Steam Nozzle	N3	78 1/2	78 1/2	80 1/2	89 3/8	89 3/8	99 1/2	99 1/2	99 1/2	105 1/2	116 1/2	116 1/2	122 1/2	130 5/8	130 5/8	130 5/8	140 5/8	140 5/8
Base to Stack Outlet	O	81 1/2	81 1/2	81 1/2	89	89	99	99	99	105	116	116	122	130	130	130	140	140
Base To Lagging	P	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	14	14
Height Of Runner	Q	6	6	6	6	6	8	8	8	8	12	12	12	12	12	12	12	12
CONNECTIONS:																		
Feedwater-Right/Left	R	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	2	2	2	2	2	2	2	2	2	2	2	2
Auxillary Conn-Right/Top	S	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Blowoff-Right	T	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auxillary Conn-Top	U	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Low Fire Hold(Left Side)	U1	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Flanged Stack Conn I.D.	V	15 7/8	15 7/8	15 7/8	17 7/8	17 7/8	19 7/8	19 7/8	19 7/8	23 7/8	23 7/8	23 7/8	25 7/8	25 7/8	25 7/8	25 7/8	25 7/8	25 7/8
HIGH PRESSURE																		
Steam Nozzle	W	3	3	4†	4†	4†	6†	6†	6†	6†	6†	8†	8†	8†	8†	8†	8†	8†
Blowdown Front	X	-	-	-	-	-	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2
Rear	Y	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/4	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2
LOW PRESSURE																		
Steam Nozzle	W	6*	6*	6*	6*	6*	8*	8*	10*	10*	12*	12*	12*	12*	12*	12*	12*	12*
Blowdown Front	X	-	-	-	-	-	2	2	2	2	2	2	2	2	2	2	2	2
Rear	Y	1 1/2	1 1/2	1 1/2	1 1/2	2	2	2	2	2	2	2	2	2	2	2	2	2
ACCESS OPENINGS:																		
Handholes 3" x 4"	Z	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Manway 12" x 16"	ZZ	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MINIMUM CLEARANCES**																		
Tube Removal Front	TF	90 1/2	103 1/2	129 1/2	114 1/2	136 1/2	123 1/2	154 1/2	183 1/2	183 1/2	168 1/2	210 1/2	203	198 1/2	206 1/2	220 1/2	216 1/2	235 1/2
Rear Door Swing Rear	DR	14	14	14	18	18	16	16	16	20	22	22	24	28	28	28	39	39

NOTE: * 150 PSIG RF FLANGE
† 300 PSIG RF FLANGE

NOTE: All Dimensions Are Approximate And May Be Used For Layout Only. SUPERIOR BOILER WORKS, Inc Reserves The Right To Change Dimensions Due To Product Revisions Or Job Requirements.
** Check Local, State And Federal Code.

SEMINOLE 3 PASS STEAM BOILER

SUPERIOR BOILER WORKS, Inc.
3524 EAST FOURTH ST. HUTCHINSON, KANSAS 67501 (316) 662-6693

FORM CAT6SB
Reviewed 12-2002

RATINGS: STEAM 15/150 PSIG — Sea Level To 2000' — 5 sq.ft./BoHP

NOMINAL BOILER HORSEPOWER	70	80	100	125	150	200	250	300	350	400	500	600	700	750	800	900	1000
UNIT MODEL NUMBER	350	400	500	625	750	1000	1250	1500	1750	2000	2500	3000	3500	3750	4000	4500	5000
OUTPUT MBH	2343	2678	3348	4184	5021	6695	8369	10043	11716	13390	16738	20085	23432	25106	26780	30128	33475
STEAM LBS/HR (#2)	2415	2760	3450	4312	5175	6900	8625	10350	12075	13800	17250	20700	24150	25875	27600	31050	34500
INPUT GAS (1,000 BTU) CU. FT.	2928	3347	4185	5230	6276	8368	10461	12553	14645	16737	20922	25106	29290	31382	33475	37660	41843
OIL (140,000 BTU) GAL.	20.91	23.91	29.88	37.35	44.83	59.77	74.72	89.66	104.60	119.55	149.44	179.33	209.21	224.16	239.10	269.00	298.88
OIL (150,000 BTU) GAL.	19.52	22.31	27.89	34.86	41.53	55.78	69.73	83.68	97.62	111.57	139.47	167.37	195.26	209.21	223.16	251.06	278.95

DATA:

HEATING SURFACE SQ. FT.	354	410	503	626	752	1022	1270	1536	1775	2005	2505	3039	3502	3767	4014	4520	5015
FURNACE VOLUME CU.FT. (#3)	17.25	20.99	27.21	37.16	46.45	52.44	68.57	83.44	98.90	107.57	139.77	170.71	153.99	167.19	179.51	202.11	227.24
STEAM STORAGE VOL. CU.FT.	14.03	16.25	19.94	21.98	26.28	31.36	38.54	49.04	56.35	72.91	90.11	111.47	126.45	135.30	143.55	154.08	169.99
DISENGAGING AREA SQ. FT.	29.93	34.65	42.52	41.77	49.93	53.81	66.31	76.57	87.99	87.79	108.50	119.45	120.41	128.83	136.69	139.18	153.54
WATER CAPACITY NWL GAL.	784	921	1150	1140	1381	1619	2035	2575	2991	2918	3674	4014	4267	4590	4892	5357	5948
WATER WEIGHT NWL LBS.	6522	7662	9563	9481	11485	13469	16926	21417	24878	24271	30559	33385	35489	38180	40691	44556	49472
WATER CAPACITY FULL GAL.	889	1043	1299	1304	1577	1854	2323	2942	3413	3463	4348	4848	5213	5602	5966	6509	7220
WATER WEIGHT FULL LBS.	7395	8673	10804	10849	13121	15420	19324	24469	28384	28807	36166	40320	43357	46598	49623	54143	60049
SHIPPING WEIGHT 15 PSIG (#4)	8300	9100	10400	12100	13600	17600	20200	25500	28200	30700	36500	41700	45500	48400	50600	55500	59900
SHIPPING WEIGHT 150 PSIG (#4)	9200	10100	11500	13000	14600	20500	23500	28200	31000	35600	40300	46400	51800	54800	57300	62100	66900

STANDARD FEATURES:

1. Units Designed And Fabricated To ASME Boiler And Pressure Vessel Code Requirements. Section IV–15 psig. Section I–150 psig Thru 250 psig.
2. Insulated With 2"–8 Lb. Density Mineral Fiber Insulation.
3. Jacket Material 22 Gauge Galvanized–Phosphate Coated Steel.
4. Davited Doors: Front / Rear–All Units.
5. Rear Access Plug: 17" Dia.–All Units.
6. Handholes: 3" x 4" (5) All Units.
7. Manway: 12" x 16" (1) All Units.
8. Surface Blowdown Connections.

STANDARD TRIM (BOILER)

1. ASME Safety Valve(s).
2. Water Column w/Water Level Gauge Glass, Try Cocks (As Req'd), Low Water Cutoff/Pump Control, Blowdown Valve.
3. Operating Pressure Control
4. High Limit Pressure Control (Manual Reset).
5. Firing Rate Control (Hi–Lo–Off Or Modulating Firing Only).
6. Pressure Gauge w/Shutoff And Inspectors Gauge Cocks.
7. Control Circuit Terminal Strips.
8. Auxiliary Low Water Cutoff, Probe in Shell.

Notes:

1. All Units Manufactured To UL Listing Procedures.
2. Steam Output–Based On Steam From And At 212°F.
3. Furnace Volume Is Furnace Only (Wet Backed Turnaround Not Included).
4. Shipping Weights Are Based On Units With Natural Gas Burners–Weights Of Units For Air Atomized Oil Or Combination Gas/Oil Firing Will Be Higher.

Example Calculations – Boiler Emission Estimates

1. Wet Standard Stack Flow Rate = (Q_{ws}) = (F_w) (Input Heat Capacity of Boiler)

$$F_{w(Natural\ Gas)} = 0.01061\, wscf\ stack\ gas / BTU \quad (40\,CFR\,60, App\ A, Meth.19, Table\,19-1)$$

For Boiler:

$$Q_{ws} = (0.01061\, wscf\ stack\ gas / BTU)\left(33{,}475{,}000 \frac{BTU}{hr}\right)\left(\frac{1hr}{60\,\min}\right) = 5{,}919\,\text{wscf/min}$$

2. Dry Standard Stack Flow Rate = (Q_{ds}) = (F_d) (Input Heat Capacity of Boiler)

$$F_d = (0.00871\, dscf / BTU) \quad (40\,CFR, App\ A, Meth19, Table\,19-1)$$

For Boiler:

$$Q_{ds} = (0.00871\ dscf / BTU)\left(33{,}475{,}000 \frac{BTU}{hr}\right)\left(\frac{1hr}{60\,\min}\right) = 4{,}859\ \text{dscf/min}$$

3. Dry Standard Stack Flow Rate Corrected for 3% O_2 and Altitude = $(Q_{ds,O_2,AL}) = (Q_{ds})\left(\frac{20.9}{20.9-3}\right)\left(\frac{P_S}{P_A}\right)$

P_S = Standard Barometric Pressure = 760 mm Hg
P_A = Actual Barometric Pressure = 664.34 mm Hg (approximate barometric pressure for site)

For Boiler:

$$Q_{ds,O_2,AL} = (4{,}859\, dscf / \min)\left(\frac{20.9}{20.9-3}\right)\left(\frac{760\, mm\ Hg}{664.34\, mm\ Hg}\right) = 6{,}491\ \text{dscf/min}$$

4. Wet Actual Stack Flow Rate = (Q_{wa}) = $\left(Q_{WS}\right)\left(\frac{P_S}{P_A}\right)\left(\frac{T_A}{T_S}\right)$

T_S=Standard Temperature= 273.15 K
T_A=Actual Temperature= 449.82 K (Boiler stack gas)

For Boiler:

$$Q_{wa} = (5{,}919 wscf/\min)\left(\frac{760\,mm\,Hg}{664.34\,mm\,Hg}\right)\left(\frac{449.82K}{293.15K}\right) = 10{,}389\,\text{wscf/min}$$

5. Volume Fuel Combusted = (V_c) = (Product Consumption Rate)(Hours of Operation)

For Boiler:

$$V_C = \left(32{,}819\,\frac{scf}{hr}\right)(8{,}760\,hour) = 287.5\,x10^6\,scf$$

6. Potential Emissions

Potential Emission Rate of Contaminant = (M_x) = (EF)(fuel consumption rate)
EF = Emission Factor, provided by equipment vendor or from AP-42.

For Boiler:

$$M_{PM_{10}} = \left(7.6\,\frac{lb}{10^6\,scf}\right)\left(32{,}475{,}000\,\frac{BTU}{hr}\right)\left(\frac{1scf}{1{,}020BTU}\right) = 0.249\frac{lb}{hr} = 0.0314\frac{g}{s}$$

$$= \frac{\left(0.249\frac{lb}{hr}\right)\left(24\frac{hr}{day}\right)\left(365\frac{day}{yr}\right)}{2000\frac{lb}{ton}} = 1.1\frac{ton}{yr}$$

7. Particulate Matter Grain Emission Rate =

$$\left(PM_g\right) = \left(M_{pm}\left[\frac{g}{s}\right]\right)\left(\frac{15.43grain}{1g}\right)\left(\frac{60S}{1\min}\right)$$

For Boiler:

$$PM_g\left(0.0314\,\frac{g}{s}\right)\left(\frac{15.43grain}{1g}\right)\left(\frac{60s}{1\min}\right) = 29.07\frac{grain}{\min}$$

8. Grain Loading Concentration Corrected to 3% O_2 and Altitude (C_{pm}) = $\frac{PM_g}{Q_{ds,O_2,AL}}$

For Boiler:

$$C_{PM} = \frac{29.07 \frac{grain}{\min}}{6{,}491 \frac{dscf}{\min}} = 4 \; x \; 10^{-3} \frac{grain}{dscf}$$

Criteria Air Pollutant Emissions
Boiler #2 (P107)

Combustion Source Characteristics

Boiler Manufacturer	Superior Boiler Works (or equivalent)
Burner Model	Super Seminole 4000 (or Equivalent)
Input Heat Capacity (BTU/hr) [e]	33,475,000
Fuel	Natural Gas
Heating Value (BTU/scf)	1,020
Max Hourly Fuel Consumption (scf/hr) [e]	32,819
Annual Fuel Consumption (scf/yr) [e]	287,491,176

Site Information

Jerome Barometric Pressure (mm Hg)	664.34

Stack Data [d]

Stack Height (ft)	39.5
Stack Diameter (ft)	4.083
Exit Gas Temperature (°F)	350
Wet Actual Flow Rate (acfm)	10,389
Wet Standard Flow Rate (wscfm)	5,919
Dry Standard Flow Rate (dscfm)	4,859
Grain Loading Flow Rate (dscfm)	6,491
Stack Velocity (m/s)	4.03
Fd (dscf stack gas/BTU)	0.00871
Fw (wscf stack gas/BTU)	0.01061

Criteria Pollutants

Pollutant	Pollutant Source	Emission Factor[a]	Emission Factor Unit	Potential Emissions (lb/hr)	Potential Emissions (TPY)	Potential Emissions (g/s)
PM_{10}	NG Combustion	7.6	lb/10^6 scf	0.249	1.1	0.031
SO_2	NG Combustion	0.6	lb/10^6 scf	0.020	0.1	0.002
NO_x	NG Combustion	100	lb/10^6 scf	3.282	14.4	0.414
CO	NG Combustion	84	lb/10^6 scf	2.757	12.1	0.347
VOC	NG Combustion	5.5	lb/10^6 scf	0.181	0.8	0.023
Lead	NG Combustion	0.0005	lb/10^6 scf	1.64E-05	0.0	2.07E-06

Non-Criteria Pollutants with Significant Threshold

Pollutant	Pollutant Source	Emission Factor[a]	Emission Factor Unit	Potential Emissions (lb/hr)	Potential Emissions (TPY)	Potential Emissions (g/s)
PM	NG Combustion	See PM_{10}	See PM_{10}	0.249	1.092	3.14E-02
Beryllium	NG Combustion	<1.2E-5	lb/10^6 scf	3.94E-07	0.000	4.96E-08
Mercury	NG Combustion	2.60E-04	lb/10^6 scf	8.53E-06	0.000	1.08E-06

PM Grain Loading Standard[b]

Pollutant	Pollutant Source	Potential Emissions (lb/hr)	Grain Load @ 3% Oxygen (gr/dscf)	PM Grain Standard[b] (gr/dscf)	Meets Standard?
PM	NG Combustion	0.249	0.004	0.015	yes

Notes:
(a) Emission factors from AP-42 Chapter 1.4, "Natural Gas Combustion", unless otherwise noted.
(b) IDAPA 58.01.01.677
(c) Boiler #1 and #2 are fully redundant. Only one boiler will operate at any one time. Maximum natural gas combustion in boilers will be 287,491,176 scf/year based on maximum boiler firing rate.
(d) Stack parameters were determined as follows: discharge temperature = conservative assumption based on other similar projects, flowrate (wet actual) based on EPA Method 19 F_w factor (converted from standard conditions to actual conditions), stack height and diameter = actual (details provided on construction drawings).
(e) Heat input capacity from Superior Boiler spec sheet, this is the maximum rated heat input capcity. Max hourly fuel consumption calculated by dividing the heat input capcity by the fuel heating value. Annual fuel consumption assumes max firing throughout the year.

Toxic Air Pollutant Emissions
Boiler #2 (P107)

Combustion Source Characteristics

Boiler Manufacturer	Superior Boiler Works (or equivalent)
Burner Model	Super Seminole 4000 (or Equivalent)
Input Heat Capacity (BTU/hr)	33,475,000
Fuel	Natural Gas
Heating Value (BTU/scf)	1,020
Max Hourly Fuel Consumption (scf/hr)	32,819
Annual Fuel Consumption (scf/yr)	287,491,176

Site Information

Jerome Barometric Pressure (mm Hg)	664.34

Stack Data

Stack Height (ft)	39.5
Stack Diameter (ft)	4.08
Exit Gas Temperature (°F)	350
Wet Actual Flow Rate (acfm)	10,389
Wet Standard Flow Rate (wscfm)	5,919
Dry Standard Flow Rate (dscfm)	4,859
Grain Loading Flow Rate (dscfm)	6,491
Stack Velocity (m/s)	4.03
Fd (dscf stack gas/BTU)	0.00871
Fw (wscf stack gas/BTU)	0.01061

Toxic Air Pollutants

Pollutant	Emission Factor[a]	Emission Factor Unit	Potential Emissions (lb/hr)	Potential Emissions (g/s)	Emission Limit[b] (lb/hr)
Arsenic	2.00E-04	lb/10^6 scf	6.56E-06	8.27E-07	1.50E-06
Barium	4.40E-03	lb/10^6 scf	1.44E-04	1.82E-05	3.30E-02
Benzene	2.10E-03	lb/10^6 scf	6.89E-05	8.68E-06	8.00E-04
Beryllium	<1.2E-5	lb/10^6 scf	3.94E-07	4.96E-08	2.80E-05
Benzo(a)pyrene	<1.2E-6	lb/10^6 scf	3.94E-08	4.96E-09	2.00E-06
Bis (2-ethylhexyl)phthalate	FNA	lb/10^6 scf	FNA	FNA	2.80E-02
Cadmium	1.10E-03	lb/10^6 scf	3.61E-05	4.55E-06	3.70E-06
Chromium	1.40E-03	lb/10^6 scf	4.59E-05	5.79E-06	3.30E-02
Cobalt	8.40E-05	lb/10^6 scf	2.76E-06	3.47E-07	3.30E-03
Copper	8.50E-04	lb/10^6 scf	2.79E-05	3.51E-06	3.33E-01
Dibutylphthalate	FNA	lb/10^6 scf	FNA	FNA	6.70E-02
Dichlorobenzene	1.20E-03	lb/10^6 scf	3.94E-05	4.96E-06	2.00E+01
Ethylbenzene	FNA	lb/10^6 scf	FNA	FNA	2.90E+01
Fluorene	2.80E-06	lb/10^6 scf	9.19E-08	1.16E-08	1.33E-01
Formaldehyde	7.50E-02	lb/10^6 scf	2.46E-03	3.10E-04	5.10E-04
Hexane	1.80E+00	lb/10^6 scf	5.91E-02	7.44E-03	1.20E+01
Manganese	3.80E-04	lb/10^6 scf	1.25E-05	1.57E-06	3.33E-01
Mercury	2.60E-04	lb/10^6 scf	8.53E-06	1.08E-06	3.00E-03
Molybdenum	1.10E-03	lb/10^6 scf	3.61E-05	4.55E-06	3.33E-01
Napthalene	6.10E-04	lb/10^6 scf	2.00E-05	2.52E-06	3.33E+00
Nickel	2.10E-03	lb/10^6 scf	6.89E-05	8.68E-06	2.70E-05
Pentane	2.60E+00	lb/10^6 scf	8.53E-02	1.08E-02	1.18E+02
Phenol	FNA	lb/10^6 scf	FNA	FNA	1.27E+00
Selenium	<2.4E-5	lb/10^6 scf	7.88E-07	9.92E-08	1.30E-02
Toluene	3.40E-03	lb/10^6 scf	1.12E-04	1.41E-05	2.50E+01
Vanadium	2.30E-03	lb/10^6 scf	7.55E-05	9.51E-06	3.00E-03
o-Xylene	FNA	lb/10^6 scf	FNA	FNA	2.90E+01
Zinc	2.90E-02	lb/10^6 scf	9.52E-04	1.20E-04	6.67E-01

Notes:
(a) Emission Factors from AP-42 Chapter 1.4, "Natural Gas Combustion".
(b) IDAPA 58.01.01.585 and 586
* FNA - Factor Not Available

Air Pollutant Emissions
Emergency Generator (P108)

Combustion Source Characteristics

Generator Manufacturer	Cummins
Model	1000DQFAD or equivalent
Input Heat Capacity (MMBTU/hr) [d]	9.24
Break Horsepower (bhp)	1,490
Power Generation (ekW)	1,000
Fuel	Diesel
Heating Value (BTU/gal)	128,000
Max Hourly Fuel Consumption (gal/hr) [d]	72
Unlimited Annual Fuel Consumption (gal/yr)	632,472

Stack Data [c]

Stack Height (ft)	13.8
Stack Diameter (ft)	2.67
Exit Gas Temperature (°F)	500
Wet Actual Flow Rate (acfm)	3,399
Wet Standard Flow Rate (wscfm)	1,590
Dry Standard Flow Rate (dscfm)	1,416
Grain Loading Flow Rate (dscfm)	1,891
Stack Velocity (m/s)	3.08
Fd (dscf stack gas/BTU)	0.00919
Fw (wscf stack gas/BTU)	0.01032

Miscellaneous Support Data

Pressure at Standard Conditions (atm)	1
Temperature at Standard Conditions (K)	293
Ideal Gas Constant (atm-ft^3/mol-K)	1.314
Jerome Barometric Pressure (atm)	0.87

Criteria Pollutants

Pollutant	Emission Factor[a]	Emission Factor Unit	Potential Emissions (lb/hr)	Limited Potential Emissions (TPY)[b]
PM_{10} (assume = PM)	0.19	g/bhp-hr	6.24E-01	0.16
SO_2	0.11	g/bhp-hr	3.61E-01	0.09
NO_x	5.2	g/bhp-hr	17.08	4.27
CO	0.66	g/bhp-hr	2.17	0.54

Notes:

(a) Emission factors for PM, SOx, CO, and NOx supplied by the equipment manufacturer (Cummins).
Assumed worst-case exhaust emission data from equipment manufacturer.

(b) Limited to 500 hours of operation per year.

(c) Stack parameters were determined as follows: discharge temperature = conservatively assumed rated exhaust temp was reduced from 873°F down to 500°F to account for heat losses from the exhaust manifold, flowrate (wet actual) based on EPA Method 19 F_w facto (converted from standard conditions to actual conditions) this is conservative since the manufacturer claims that the flowrate will be 15,385 cfm, stack height = actual (details provided on construction drawings), and stack diameter = assumed large diameter of 2.67 to be conservative, actual is 10 inches.

(d) Maximum fuel consumption from Cummins spec sheet (full standby), heat input capacity calculated by multiplying fuel heating value times the maximum fuel consumption rate.

Air Pollutant Emissions
Emergency Generator (P108)

Combustion Source Characteristics

Genset Manufacturer	Cummins
Genset Model	QSX15-G9 Nonroad 2 (or equivalent)
Engine Manufacturer	1,490
Engine Model	1,000
Break Horsepower (bhp)	Diesel
Power Generation (kW - prime)	72.2
Fuel	36,100.0
Max Hourly Fuel Consumption (gal/hr)	128,000
Controlled Fuel Consumption (gal/yr)	9,241,600
Heating Value (BTU/gal)	
Heat Input Capacity (BTU/hr)	

Toxic Air Pollutants

Pollutant	Emission Factor[a] (lb/MMBtu)	Uncontrolled Emissions (lb/hr)	Controlled Emissions (ton/yr)[b]	Emissions Limit (lb/hr)
Benzene	7.76E-04	7.17E-03	1.79E-03	8.0E-04
Toluene	2.81E-04	2.60E-03	6.49E-04	2.5E+01
Xylenes	1.93E-04	1.78E-03	4.46E-04	2.9E+01
Formadehyde	7.89E-05	7.29E-04	1.82E-04	5.1E-04
Acetaldehyde	2.52E-05	2.33E-04	5.82E-05	3.0E-03
Acrolein	7.88E-06	7.28E-05	1.82E-05	1.7E-02
Naphthalene	1.30E-04	1.20E-03	3.00E-04	3.3E+00
Fluorene	1.28E-05	1.18E-04	2.96E-05	1.3E-01
Benzo(a)pyrene	2.57E-07	2.38E-06	5.94E-07	2.0E-06
Total PAH	2.12E-04	1.96E-03	4.90E-04	9.1E-05

Notes:
(a) Emission factors from AP-42 Chapter 3.4, "Large Stationary Diesel and All Stationary Duel-fuel Engines
(b) Emission rates were reduced due to limited hours of operation of 500 hrs.

Power Generation

Exhaust Emission Data Sheet
1000DQFAD
60 Hz Diesel Generator Set

Engine Information:

Model:	Cummins Inc. QST30-G5 NR2	Bore:	5.51 in. (139 mm)
Type:	4 Cycle, 50°V, 12 Cylinder Diesel	Stroke:	6.5 in. (165 mm)
Aspiration:	Turbocharged and Low Temperature aftercooled	Displacement:	1860 cu. in. (30.4 liters)
Compression Ratio:	14.7:1		
Emission Control Device:	Aftercooled (Air-to-Air)		

	1/4 Standby	1/2 Standby	3/4 Standby	Full Standby	Full Prime
PERFORMANCE DATA					
BHP @ 1800 RPM (60 Hz)	371	741	1112	1482	1322
Fuel Consumption (gal/Hr)	19.1	35.8	54.1	72.2	63.9
Exhaust Gas Flow (CFM)	2780	4500	6370	7540	6950
Exhaust Gas Temperature (°F)	620	760	814	890	873
EXHAUST EMISSION DATA					
HC (Total Unburned Hydrocarbons)	0.12	0.10	0.08	0.07	0.08
NOx (Oxides of Nitrogen as NO2)	4.17	5.20	3.87	3.95	4.00
CO (carbon Monoxide)	0.66	0.36	0.48	0.66	0.58
PM (Particular Matter)	0.19	0.15	0.12	0.11	0.11
SO2 (Sulfur Dioxide)	0.11	0.10	0.10	0.11	0.10
Smoke (Bosch)	0.88	0.80	0.79	0.73	0.75

All Values are Grams/HP-Hour, Smoke is Bosch #

TEST CONDITIONS

Data was recorded during steady-state rated engine speed (± 25 RPM) with full load (±2%). Pressures, temperatures, and emission rates were stabilized.

Fuel Specification:	46.5 Cetane Number, 0.035 Wt.% Sulfur; Reference ISO8178-5, 40CFR86.1313-98 Type 2-D and ASTM D975 No. 2-D.
Fuel Temperature:	99 ± 9 °F (at fuel pump inlet)
Intake Air Temperature:	77 ± 9 °F
Barometric Pressure:	29.6 ± 1 in. Hg
Humidity:	NOx measurement corrected to 75 grains H2O/lb dry air
Reference Standard:	ISO 8178

The NOx, HC, CO and PM emission data tabulated here were taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.

Power Generation

EPA Tier 2 Exhaust Emission Compliance Statement 1000DQFAD

60 Hz Diesel Generator Set

Compliance Information:
The engine used in this generator set complies with U.S. EPA and California emission regulations under the provisions of 40 CFR 89, Nonroad (Mobile Off Highway) Tier 2 emissions limits when tested per ISO 8178 D2.

Engine Manufacturer:	Cummins Inc
EPA Certificate Number:	CEX-NRCI-07-07
Effective Date:	09/15/2006
Date Issued:	09/18/2006
EPA Nonroad Diesel Engine Family:	7CEXL030.AAD
CARB Executive Order:	U-R-002-0368

Engine Information:

Model:	Cummins Inc QST30-G5 NR2	Bore:	5.51 in. (140 mm)
Engine Nameplate HP:	1490	Stroke:	6.5 in. (165 mm)
Type:	4 Cycle, 50°V, 12 Cylinder Diesel	Displacement:	1860 cu. in. (30.5 liters)
Aspiration:	Turbocharged and Low Temperature Aftercooled (Air-to-Air)		

Compression Ratio: 14.7:1
Emission Control Device: Tirbocharged and Low Temperature Aftercooled(Air-to-Air)

U.S. Environmental Protection Agency Nonroad Tier 2 Limits

(All values are Grams per HP-Hour)

COMPONENT	
NOx + HC (Oxides of Nitrogen as NO2 + Total Unburned Hydrocarbons)	4.77
CO (Carbon Monoxide)	2.61
PM (Particulate Matter)	0.15

Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may result in elevated emission levels.

Cummins Rocky Mountain LLC
Power Generation Branch
1030 South 300 West
Salt Lake City, UT 84101
801.524.1326 office 801.524.1359 fax

Date: 11/5/07

To: Big D Construction

Fax:

Attn.: Aaron Baker

From: Ken Wormington

Ref.: Jayhawk Dairy

Number of pages including cover sheet: 1

Mr. Baker,

John Taft contacted me this morning and asked me to provide you with some additional information on the exhaust system of the standby generator for this project.

Please see below:

Exhaust outlet diameter…10"

Exhaust gas flow at rated load…15,385 CFM

Exhaust gas temperature…900 degrees, F