EVALUATION OF GAS REBURNING AND LOW NO_X BURNERS ON A WALL-FIRED BOILER

Environmental Monitoring Report Public Service of Colorado's Cherokee Station Unit 3 Optimization Testing Period November 9, 1992 - April 23, 1993

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1.0 INTRODUCTION

An evaluation of Gas Reburning (GR) and Low NO_x Burners (LNB) has been completed at Public Service Company of Colorado's Cherokee Station Unit 3. The goal of the demonstration, which was carried out in a U.S. DOE Clean Coal Technology Round 3 Program, was to reduce NO_x emissions by 70%. The reduction was to be achieved from the pre-project level prior to LNB retrofit. The GR system was supplied by Energy and Environmental Research Corporation (EER) and the LNBs were supplied by the Foster Wheeler Energy Corporation. The project was carried out in three phases in which EER designed the GR system and obtained necessary permits (Phase 1), constructed the system and completed start-up tasks (Phase 2), and evaluated its performance with both Optimization Tests and a Long-Term Demonstration (Phase 3). As directed by the Cooperative Agreement, environmental monitoring was conducted in each phase. Measurements were taken by plant personnel and an EER Field Testing Team and were divided "Compliance Monitoring" was conducted by plant personnel to satisfy into two types. requirements of regulatory agencies, while "Supplemental Monitoring" was conducted by EER personnel to develop a database of environmental impacts of the technology and to ensure environmental acceptability of the project. This document presents environmental monitoring data obtained during the Optimization Testing period, November 11, 1992 to April 23, 1993. In addition to the DOE, program co-sponsors include the Gas Research Institute, Electric Power Research Institute, Public Service Company of Colorado, and the Colorado Interstate Gas Company.

Compliance Monitoring was conducted primarily in two areas, air emissions and aqueous discharges. The unit is required to meet an SO_2 limit of 1.2 lb/MBtu and an opacity limit of 20 percent (6 minute average). Therefore, the plant monitors flue gas SO_2 and opacity continuously and submits Excess Emissions Reports to the Colorado Air Pollution Control Division (AQCD) on a quarterly basis. These reports state the periods when emissions exceeded the standards and the reason for the emissions excursion. Discharge limits for the aqueous effluent from the plant and monitoring requirements are specified by a permit issued by the Colorado Water Quality Control Division (WQCD). The plant submits National Pollutant

Discharge Elimination System (NPDES) monitoring reports to the WQCD on a monthly basis. The aqueous stream discharged to the South Platte River has limits for total flow, pH, total suspended solids, oil and grease, temperature, total residual chlorine, total chromium, and total recoverable zinc. Plant personnel conduct daily to monthly monitoring to ensure compliance with limits stated in a subsequent section of this report.

Supplemental Monitoring was in the areas of gaseous emissions from the boiler, ambient Total Suspended Particulates (TSP) inside and outside of the plant, noise levels near GR equipment, and limited characterization of the ash waste. Boiler emissions were monitored continuously with EER's Continuous Emissions Monitoring System (CEMS). Flue gas samples were extracted from a 16 point stainless steel grid installed at the economizer outlet. Gas samples drawn from the duct cross-section were mixed, dried, then analyzed for concentration of NO_x, SO₂, CO, CO₂, HC, and O₂. These species were measured and logged continuously by the Boiler Performance Monitoring System (BPMS). In addition, limited measurements of nitrous oxide (N₂O) were made at the conclusion of the Optimization Testing period. This species was measured with a portable analyzer and not by collection of a grab sample and analysis by GC/EPC as originally planned. Ash analysis was limited to determination of carbon content used to evaluate combustion completion.

2.0 GAS REBURNING-LOW NO_X BURNERS

Gas Reburning and Low NO_x Burners are synergistic NO_x control technologies. In Gas Reburning, natural gas is injected into the furnace above the coal burners to create a fuel rich region in which NO_x is reduced to atmospheric nitrogen, N_2 . Overfire air is added higher up to burn out the primary and reburning fuels under a normal excess air level. The natural gas input is typically 15 to 25% of the total heat input, therefore there is a corresponding decrease in the coal fired by the burners. The reduced fuel input and limited burner excess air result in reduction in the level of "primary NO_x ." The natural gas addition produces a variety of hydrocarbons and free radicals which reduce NO_x to intermediates such as HCN and NH_2 then to N_2 . Overfire air is added higher up in the furnace to burn out the fuels under a normal

excess air level of 15 to 20%. The process reduces SO_2 emissions at a percentage equal to the gas heat input. Emissions of CO_2 also decrease since the fuels (natural gas and coal) have different hydrogen/carbon ratios. Also, reductions in fly ash and bottom ash result in lower disposal requirement of the solid waste and potentially lower stack particulate emissions.

At this site, Gas Reburning was applied with Low NO_x Burners (LNB). The LNBs selected are Foster Wheeler Controlled Flow/Split Flame Low NO_x Burners. Generally, LNBs reduce NO_x emissions by staging the mixing of coal with combustion air. LNBs have secondary (and in some cases tertiary) air zones in which the air split determines the mixing rate and hence the burner NO_x level. They produce longer flames with a lower peak flame temperature. LNBs typically reduce NO_x emissions by 30 to 50%. Therefore, the combined application of Gas Reburning and Low NO_x Burners was expected to achieve 70% NO_x reduction.

3.0 DESCRIPTION OF HOST UNIT

Cherokee Station Unit 3 is a front wall-fired steam generating unit supplied by Babcock and Wilcox which has a rated electric capacity of 172 MW_e (gross). At its capacity it produces steam at a rate of 1,140,000 lb/hr, at a pressure of 1925 psig and temperature of 1005°F. It is equipped with a reheat cycle which reheats steam to the same design temperature. It fires low sulfur western bituminous coal with a typical sulfur content of 0.4% and ash content of 10%. Coal is pulverized by four Riley Stoker No. 556 duplex drum pulverizers and is carried by 160°F primary air to a 4x4 array of burners on the front wall of the unit. The burners mix coal/primary air with 600°F secondary air and fire it into a radiant furnace. Flue gas flows up the furnace through a secondary superheater, reheater, primary superheater, economizer then to two Ljungstrom air heaters. The unit is equipped with a Baghouse Fabric Filter, which is designed to handle 825,000 acfm of flue gas at a temperature of 290°F. The Baghouse has a gross air/cloth ratio of 2.03 and was designed to limit particulate emissions to 0.007 gr/dscf.

4.0 **RESULTS**

The results of Environmental Monitoring conducted during the period November 9, 1992 through April 23, 1993 are presented in this section. During this period, GR-LNB was evaluated for 107 hours.

4.1 AIR EMISSIONS

Boiler emissions data are presented in Table 1. Under GR-LNB operation, NO_x emissions averaged 0.261 lb/MBtu, which is a reduction of 64% from the pre-project baseline of 0.73 lb/MBtu. CO emissions varied widely, with the highest emissions recorded under low gas inputs. This resulted from relatively low overfire air flows and velocities in this "off-design" condition (design gas heat input equal to 18%). On average, CO emissions were 149 ppm (@ $3\% O_2$). SO₂ emissions averaged 0.554 lb/MBtu, with a high of 0.720 lb/MBtu and a low of 0.473 lb/MBtu. A typical coal composition indicating a sulfur level of 0.44% and higher heating value of 11,015 Btu/lb theoretically forms SO₂ at a rate of 0.80 lb/MBtu. Therefore the measured SO₂ values are somewhat lower than expected based on fuel composition.

Table 2 shows the emissions of nitrous oxide (N_2O) from the boiler under LNB and GR-LNB operation. N_2O is believed to be a major contributor to depletion of stratospheric ozone. The measurements indicate that N_2O varied from 1 to 5 ppm under LNB and GR-LNB. These levels were below the limit of 10 ppm, above which more extensive measurements were planned. Currently there exists no federal standard for N_2O emissions from utility boilers.

4.2 AMBIENT AIR MONITORING

Measurement of ambient Total Suspended Particulates (TSP) under 10 microns in diameter, PM_{10} , were made at the boundary of the facility at both upwind and downwind locations. High volume air samplers supplied by General Metal Works Inc. were used. The purpose of the measurements was to quantify the plant contribution to ambient PM_{10} levels. Table 3 summarize

the data which show great variability. The plant is situated in a heavily industrialized area with many other contributors to ambient dust levels. On average, the plant appears to contribute to ambient dust levels but there is no consistent correlation to LNB or GR-LNB operation.

Work area dust levels were measured at various locations in the boiler house. Table 4 summarizes the results. The samplers used were manufactured by Gilian Instrument Corp. Sampling was conducted under LNB and GR-LNB operation to verify that dust levels are below the Labor Department's Occupational Safety and Health Administration (OSHA) standard of 15 mg/m³. Very low levels were measured, typically below 0.1 mg/m³, with one unusually high reading of 1.72 mg/m³ outside of the CEM trailer.

Noise levels were measured at various locations in the boiler house, near to GR equipment in some cases. The measurements presented in Table 5 indicate noise levels were slightly higher when the GR equipment was in operation. In some cases the noise levels were above OSHA's action limit of 85 decibels, which is applicable over an eight hour period. Therefore, workers exposed to these noise levels over extended periods would be required to wear audiometric protective devices.

4.3 ASH ANALYSIS

Ash samples were taken from the unit with a high volume SLM sampler for analysis of carbon content. The unburned carbon level indicates the extent of fuel burnout. Table 6 lists the unburned carbon in ash measured under LNB and GR-LNB operation. Wide variations are evident, with higher excess air levels achieving enhanced fuel burnout. On average, LNB and GR-LNB data are comparable, i.e. neither condition results in higher carbon-in-ash levels.

4.4 AQUEOUS DISCHARGE

GR-LNB operation was not expected to change either the quantity or makeup of the aqueous discharge from the facility. Plant personnel monitor the aqueous discharge as required by the

Colorado Water Quality Control Division. Monitoring frequency and discharge limits are listed in Table 7. Appendix A contains discharge monitoring reports covering the Optimization Testing period. These show that all limits for the aqueous discharge were met during the monitoring period.

4.5 OPACITY AND PLANT SO₂ MONITORING

The plant measured opacity of the flue gas from each unit with Lear Siegler Model Number RM-41 monitors. Periods of excess opacity (20 percent, six minute average) were reported with the likely cause. Appendix B contains the Excess Emissions Reports for the three quarters covering the Optimization Testing period. Periods of excess opacity were typically due to unit start-up or baghouse bypass during gas firing. Also reported are periods of SO₂ emissions exceeding the 1.2 lb/MBtu standard and maximum theoretical SO₂ emissions based on coal analyses. The plant employed Rosemount Model Number EC960 and Altech Model Number MCS100 SO₂ monitors. The SO₂ monitors did not measure excursions above the limit and, on average, coal sampling results were also below the limit.

5.0 CONCLUSIONS

Environmental monitoring was conducted to evaluate the impacts of Gas Reburning and Low NO_x Burners on gaseous emissions, ambient air particulate matter inside and outside of the plant, worker area noise levels, unburned carbon-in-fly ash, and aqueous effluent pollutant levels. GR-LNB operation resulted in a NO_x reduction of 64% from the original baseline, CO emissions at an acceptable level (below 200 ppm), and SO₂ emissions well below the 1.2 lb/MBtu standard. Nitrous oxide emissions were low under LNB and GR-LNB, with a maximum of 5 ppm. The plant contribution to PM_{10} at its boundary is small relative to the contribution of surrounding industry and there was no direct relationship with GR operation. Worker area dust levels were well below the standard of 15 mg/m³. Noise levels near GR equipment and the boiler were higher than the standard of 85 decibels (averaged over 8 hours) in some cases, therefore workers exposed to these noise levels over extended periods would be

required to wear audiometric protection. Carbon-in-fly ash, measured under many conditions (GR and GR-LNB), was generally acceptable (under 10%) with no change due to GR operation determined. The aqueous effluent met its discharge standard in each case.

TABLE 1. SUMMARY OF GR-LNB EMISSIONS AT CHEROKEE UNIT 3

Test	Test	Net	Gas	CEMS	COc	CO2c	NOxc	NOx	SÖ2c	SO2	HCc
Date	Dur.	Power	Heat	02				-			
		(MWe)	(%, totl)	(%, dry)	(ppm)	(%)	(ppm)	(lb/MBtu)	(ppm)	(lb/MBtu)	(ppm)
11/11/92	1:01	157	20.60	3.38	256	15.5	208	0.278	276	0.515	7.2
11/12/92	1:05	156	19.50	3.85	29	15.5	227	0.303	269	0.503	1.2
11/17/92	1:00	150	20.86	3.52	86	15.5	206	0.274	280	0.521	3.0
11/17/92	1:00	150	21.08	3.57	13	15.5	200	0.266	278	0.517	0.3
11/18/92	1:04	151	20.94	3.67	14	15.4	201	0.268	281	0.523	0.0
11/18/92	1:05	149	15.96	3.79	31	15.7	203	0.272	306	0.573	0.1
11/19/92	1:00	149	5.27	3.12	986	16.3	208	0.282	338	0.641	7.0
11/19/92	1:00	152	10.33	2.64	955	16.0	176	0.238	326	0.614	58.2
11/19/92	1:00	150	23.41	2.83	92	15.2	175	0.232	275	0.511	0.8
11/20/92	0:58	150	18.61	2.66	530	15.7	164	0.219	285	0.532	34.1
11/20/92	1:00	160	18.69	3.25	43	15.7	186	0.248	291	0.544	1.5
11/20/92	1:00	150	20.51	3.60	32	15.5	189	0.251	281	0.525	1.2
12/1/92	1:06	120	21.03	4.07	34	15.4	168	0.224	271	0.504	1.2
12/1/92	0:50	116	8.24	5.26	11	16.0	208	0.281	310	0.585	0.5
12/2/92	1:35	153	17.97	3.69	172	15.4	196	0.262	334	0.623	13. 9
12/7/92	1:05	119	11.40	4.12	671	16.0	175	0.236	320	0,602	9.2
12/7/92	1:00	119	15.70	4.03	23	15.8	173	0.231	302	0.566	0.0
12/7/92	1:00	119	20.85	3.90	8	15.5	163	0.217	281	0.524	
12/8/92	1:00	90	21.01	3.87	202	15.4	158	0.210	281	0.523	5.1
12/8/92	1:23	88	21.24	5.10	8	15.1	183	0.242	275	0.512	0.2
12/8/92	1:00	91	11.13	4.17	240	15.9	168	0.227	304	0.573	1.6
12/9/92	1:00	89	20.87	4.68	17	15.3	171	0.226	262	0.489	0.5
12/9/92	0:56	92	20.99	4.19	13	15.3	146	0.194	265	0.494	0.2
12/14/92	1:02	150	5.42	3.87	326	16.0	237 -	0.322	309	0.586	1.2
12/14/92	0:17	150	2.65	4.12	54	16.2	235	0.319	314	0.597	0.9
12/15/92	0:36	152	19.62	3,54	53	15.5	194	0.258	263	0.490	1.7
12/16/92	2:19	152	10.38	3.76	74	16.0	214	0.288	288	0.542	1.3
1/15/93	1:00	150	7.53	4.02	31	16.3	242	0.328	292	0.553	2.4
1/15/93	1:00	151	12.25	3.89	17	16.0	212	0.285	282	0.531	1.6
1/15/93	0:58	151	17.05	3.67	13	15,7	185	0.248	275	0.514	1.1
1/15/93	0:БО	152	21.76	3.38	77	15.5	175	0.233	262	0.488	1.1
1/18/93	0:15	150	18.86	2.48	343	15.8	180	0.240	290	0.541	6.6
1/18/93	0:17	150	18.81	2.69	360	15.8	196	0.262	283	0.528	9.5
1/19/93	1:00	149	5.10	4.56	20	16.4	256	0.348	310	0.589	0.9
1/19/93	1:00	149	18.54	3.42	33	15.7	185	0.247	269	0.503	0.9
1/20/93	1:10	152	18.08	3.50	28	15.8	199	0.266	277	0.518	2.2
1/20/93	1:05	151	15.17	3.81	12	15.9	204	0.274	283	0.532	1.7
1/20/93	0:59	150	9.84	3.52	57	16.2	216	0.292	312	0,589	0.9
1/21/93	1:05	162	22.48	3.15	54	15.6	185	0.246	269	0.500	1.8
1/21/93	1:00	122	24.62	3.47	13	15.5	160	0.213	255	0.473	1.7
1/25/93	5:10	144	17.60	4.42	8	15.6	218	0.291	278	0.520	2.4
1/26/93		141	16.61	3.95	22	15.8	197	0.263	283	0.530	1.0
1/27/93	5:66	151	16,15	4.03	31	15.7	220	0.295	276	0.517	2.0
2/2/93	1:12	152	19.43	2.32	688	15.8	162	0.216	0		5.2
2/2/93		152	19.32	2.44	642	15.8	166	0.222	0		5.8
3/22/93	1:02	147	20.22	2.53	158	15.6	150	0.200	280	0.523	4.2
3/22/93	1:03	147	20.34	2.27	144	15.6	150	0.200	272	0.507	3.4
3/22/93	0:59	148	20.26	2.87	16	15.5	181	0.241	271	0.504	1.2

Subscript c denotes correction to 3% O2

Test	Test	Net	Gas	CEMS	COc	CO2c	NOxc	NOx	SO2c	SO2	HCc
Date	Dur.	Power	Heat	02							
		(MWe)	(%, totl)	(%, dry)	(ppm)	(%)	(ppm)	(Ib/MBtu)	(ppm)	(ib/MBtu)	(ppm
4/19/93	0:56	151	19.50	3.69	69	15.7	220	0.293	386	0.720	
4/19/93	0:52	151	19.51	3.68	58	15.7	219	0.292	385	0.720	
4/19/93	2:29	150	19.73	4.18	9	15.7	236	0.315	371	0.693	
4/19/93	1:10	161	19.72	4.27	9	15.8	246	0.329	383	0.716	
4/19/93	Б:42	150	19.71	4.10	12	15.8	235	0.313	376	0.702	
Average		141	17.03	3.63	149	15.7	195	0.261	285	0.554	4.5
Maximum		157	24.62	5.26	986	16.4	256	0.348	386	0.720	58.2
Minimum		88	2.65	2.27	8	15.1	146	0.194	0	0.473	0.0
St. Dev.		20	5.28	0.67	239	0.3	27	0.037	66	0.064	9.7

TABLE 1. SUMMARY OF GR-LNB EMISSIONS AT CHEROKEE UNIT 3 (CON.)

Subscript c denotes correction to 3% O2

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TABLE 2. MEASUREMENT OF NITROUS OXIDE UNDER LNB AND GR-LNB OPERATION

Nitrous Oxide	4.37	5.14	3.33	1.04	1.01
Boiler O2	3.38	4.05	4.19	3.31	4.51
Gas Heat Input	0	0	20	0	0
Load (MWA net)	150 ISO	150	150	130	120
Operating	LNB	TNB	GR-LNB	LNB	LNB
Test Duration	2.1	6.0	5.7	3.3	2.8
Test	4/15/93	4/16/93	4/19/93	4/20/93	4/20/93

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Sampling Date	g Date	Sampling Time	g Time	Filter	Test I.D.	Sampling	TSP < PM10	Plant Contribution
Start	Finish	Start	Finish	Number		Location	micrograms/cubic meter	micrograms/cubic meter
1/25/93	1/25/93	9:00	15:02	2000	GR REP 1	Upwind	[10.1	
1/25/93	1/25/93	9:00	15:12	2001		Downwind	148.2	38.1
1/25/93	1/26/93	15:05	8:00	2003	Baseline REP 1	Upwind	100.7	
1/25/93	1/26/93	15:15	7:53	2002		Downwind	118.6	17.9
1/26/93	1/26/93	8:16	14:45	2004	GR REP 2	Upwind	61.8	
1/26/93	1/26/93	8:15	14:55	2005		Downwind	77.2	15.4
1/26/93	1/27/93	14:52	8:25	2006	Baseline REP 2	Upwind	70.7	
1/26/93	1/27/93	15:00	8:15	2007		Downwind	71.2	6.5
1/27/93	1/27/93	9:28	15:28	2009	GR REP 3	Upwind	77.5	
1/27/93	1/27/93	9:23	15:23	2008		Downwind	93.1	15.6
1/27/93	1/28/93	15:40	7:56	2010	Baseline REP 3	Upwind	94.6	
1/27/93	1/28/93	15:30	7:46	2011		Downwind	105.6	11
1/28/93	1/28/93	8:01	14:38	2013	Baseline REP 4	Upwind	35	
1/28/93	1/28/93	8:05	14:45	2012		Downwind	24.7	-10.3
1/28/93	1/29/93	14:41	10:00	2015	Baseline REP 5	Upwind	21.3	
1/28/93	1/29/93	14:51	10:00	2014		Downwind	23.3	2

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Test I.D.	Sampling	Date	Dust Collected	Time	Flow Rate, Avg.	Concentration
	Location		(mg)	(min)	(1/min)	milligram/cubic meter
Baseline REP 1	Siemans Fan on	1/26/93	0.00	240	2.223	0.000
Baseline REP 2	Ground Level	1/29/93	0.09	184	2.464	0.198
GR REP 1		1/27/93	0.01	180	2.219	0.025
Baseline REP 1	4th Floor, at	1/26/93	0.00	240	2.367	0.000
Baseline REP 2	Gas Header	1/29/93	0.01	180	2.219	0.025
GR REP 1		1/27/93	0.02	180	2.406	0.046
Baseline REP 1	5th Floor, Back	1/27/93	0.00	240	2.425	0.000
Baseline REP 2	Part of Injection	1/28/93	0.02	180	2.404	0.046
GR REP 1	Area (left of Elev.)	1/27/93	0.11	213	2.397	0.215
Baseline REP 1	5th Floor, Front	1/27/93	0.00	240	2.214	0.000
Baseline REP 2	Part of Injection	1/28/93	0.04	180	2.247	0.099
GR REP 1	Area (Right of Elev.)	1/27/93	0.05	214	2.226	0.105
Baseline REP 1	5.5 Floor, Nozzle	1/28/93	0.00	061	2.248	0.000
Baseline REP 2	Cooling Fans	1/29/93	0.00	180	2.450	0.000
Baseline REP 1	6th Floor, Above	1/28/93	0.00	190	2.430	0.000
Baseline REP 2	FGR Inlet	1/29/93	0.20	180	2.248	0.494
Baseline REP 1	CEM Trailer Inside	1/28/93	0.05	247	2.413	0.084
Baseline REP 1	CEM Trailer Outside	1/28/93	0.96	247	2.256	1.720
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Measurements Listed Are in Order of Elevation (Ground Level First)

Test I.D.	Measurement	Date	Noise Level
	Location		(db)
Baseline REP 1	Siemans Fan on	1/26/93	92
Baseline REP 2	Ground Level	1/27/93	90.4
Baseline REP 3		1/28/93	89.4
Baseline REP 4		1/29/93	92.4
GR REP 1		1/25/93	91.4
GR REP 2		1/26/93	91
GR REP 3		1/27/93	91.9
Baseline REP 1	4th Floor, at	1/26/93	78.4
Baseline REP 2	Gas Header	1/27/93	78.4
Baseline REP 3		1/28/93	79.9
Baseline REP 4		1/29/93	77.9
GR REP 1		1/25/93	90.6
GR REP 2		1/26/93	84.9
GR REP 3		1/27/93	89.4
Baseline REP 1	5th Floor, Scanner	1/26/93	81.9
Baseline REP 2	Cooling Fan (Maxon)	1/27/93	83.9
Baseline REP 3		1/28/93	84.4
Baseline REP 4		1/29/93	82.9
GR REP 1		1/25/93	95.4
GR REP 2		1/26/93	93
GR REP 3		1/27/93	94.4
Baseline REP 1	5th Floor, Back Part	1/26/93	75.9
Baseline REP 2	of Injection Area	1/27/93	76.4
Baseline REP 3	(Left of Elevator)	1/28/93	78.4
Baseline REP 4		1/29/93	75.9
GR REP 1		1/25/93	94.4
GR REP 2		1/26/93	92.9
GR REP 3		1/27/93	92.9
Baseline REP 1	Sth Floor, Front Part	1/26/93	79.4
Baseline REP 2	of Injection Area	1/27/93	79.9
Baseline REP 3	(Right of Elevator)	1/28/93	79.9
Baseline REP 4		1/29/93	79.1
GR REP 1		1/25/93	97.9
GR REP 2		1/26/93	93.9
GR REP 3		1/27/93	95.4

TABLE 5. NOISE LEVELS IN BOILER HOUSE.

TABLE 5. NOISE LEVELS IN BOILER HOUSE (Con.)

Test I.D.	Measurement Location	Date	Noise Level (db)
Baseline REP 1	5.5 Floor, Nozzle	1/26/93	80
Baseline REP 2	Cooling Fans	1/27/93	80.8
Baseline REP 3		1/28/93	83.4
Baseline REP 4		1/29/93	80.4
GR REP 1		1/25/93	89.9
GR REP 2		1/26/93	89.9
GR REP 3		1/27/93	90.4
Baseline REP 1	6th Floor, Above	1/26/93	81.9
Baseline REP 2	FGR Inlet	1/27/93	78.9
Baseline REP 3		1/28/93	81
Baseline REP 4		1/29/93	79.5
GR REP 1		1/25/93	81.5
GR REP 2		1/26/93	80.5
GR REP 3		1/27/93	80.4

Measurements Listed Are in Order of Elevation (Ground Level First)

TABLE 6. C	CARBON-IN-FLY	ASH DATA.
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Test	Date	Gross	Net	CEMS	Gas	Coal	Reburn	Exit	OFA	Carbon
Condition		Power	Power	O2	Heat	Zone	Zone	Zone		In-Ash
		(MWe)	(MWe)	(%, dry)	(%, totl)	Stoich	Stoich	Stoich		(%, As Rcvd)
LNB	11/13/92	166	155	4.41	0.00	1.259	1.259	1.259	0%	3.54
LNB	11/13/92	162	151	4.18	0.00	1.182	1.184	1.242	5%	7.47
LNB	11/13/92	162	151	3.75	0.00	1.098	1.100	1.212	9%	11.43
GR-LNB	11/17/92	162	150	3.52	20.86	1.201	0.965	1.194	20%	4.18
GR-LNB	11/17/92	161	150	3.57	21.08	1.162	0.932	1.197	23%	2.71
GR-LNB	11/18/92	162	151	3.67	20.94	1.161	0.933	1.204	24%	2.85
GR-LNB	11/18/92	161	149	3.79	15.96	1.117	0.953	1.213	23%	3.27
GR-LNB	11/19/92	160	149	3.12	5.27	1.074	1.025	1.170	13%	10.24
GR-LNB	11/19/92	163	152	2.64	10.33	1.071	0.969	1.139	15%	7.82
GR-LNB	11/19/92	161	150	2.83	23.41	1.127	0.879	1.150	24%	2.77
GR-LNB	11/20/92	161	150	2.66	18.61	1.091	0.897	1.140	22%	4.34
GR-LNB	11/20/92	161	150	3.60	20.51	1.156	0.933	1.199	24%	4.93
GR-LNB	12/1/92	129	120	4.07	21.03	1.165	0.937	1.231	25%	2.75
GR-LNB	12/1/92	126	116	5.26	8.24	1.129	1.052	1.324	22%	6.77
GR-LNB	12/7/92	130	119	4.12	11.40	1.110	0.999	1.236	20%	3.95
GR-LNB	12/7/92	129	119	4.03	15.70	1.100	0.942	1.229	24%	2.47
GR-LNB	12/7/92	130	119	3.90	20.85	1.119	0.903	1.219	27%	1.62
GR-LNB	12/8/92	100	90	3.87	21.01	1.227	0.990	1.217	20%	3.98
GR-LNB	12/8/92	98	88	5.10	21.24	1.164	0.941	1.308	30%	1.22
GR-LNB	12/8/92	101	91	4.17	11.13	1.128	1.021	1.240	19%	3.84
GR-LNB	12/9/92	99	89	4.68	20.87	1.097	0.891	1.275	32%	1.77
GR-LNB	12/9/92	102	92	4.19	20.99	1.106	0.896	1.239	29%	10.29
GR-LNB	12/14/92	159	150	3.87	5.42	1.085	1.035	1.219	16%	8.75
GR-LNB	12/16/92	161	152	3.75	10.38	1.096	0.994	1.210	19%	6.68
GR-LNB	1/15/93	163	152	3.38	21.76	1.155	0.920	1.184	23%	4.69
GR-LNB	1/21/93	163	152	3.15	22.48	1.137	0.896	1.168	24%	3.51
GR-LNB	2/2/93	163	152	2.44	19.32	1.067	0.872	1.125	23%	11.47
LNB	3/8/93	126	117	3.92	0.00	1.223	1.225	1.223	0%	11.23
LNB	3/8/93	126	118	3.75	0.00	1.212	1.214	1.212	0%	8.63
LNB	3/9/93	161	151	4.11	0.00	1.238	1.239	1.238	0%	4.87
LNB	3/9/93	157	147	3.58	0.00	1.201	1.202	1.201	0%	6.09
LNB	3/10/93	97	89	5.04	0.00	1.308	1.308	1.308	0%	4.13
LNB	3/10/93	98	90	4.61	0.00	1.274	1.274	1.274	0%	4.81
LNB	3/11/93	159	149	3.75	0.00	1.212	1.212	1.212	0%	5.99
LNB	3/11/93	160	150	3.36	0.00	1.186	1.186	1.186	0%	7.20
LNB	4/23/93	160	149	3.58	0.00	1.201	1.203	1.201	0%	9.81
LNB	4/23/93	<u>157</u>	147	2.93	0.00	1.158	1.160	1.158	0%	8.00

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TABLE 7. AQUEOUS DISCHARGE LIMITS AND MONITORING FREQUENCY
TINOM GUA S
SCHARGE LIMIT
AQUEOUS DIS
TABLE 7.

Effluent Discharge Li Parameter 30-Day Avg. D			
30-Day Avg.	Discharge Limitations	Sampling	Sample
ļ	Daily Maximum	Frequency	Type
Flow 5.6 MGD	N/A	Daily	Instantaneous or Continuous
Total Suspended Solids 30 mg/l	100 mg/l	Weekly	Composite
Oil and Grease 15 mg/l	20 mg/l	Contingent	Grab (5 x Weekly - Visual)
Temperature N/A	86 F	5 x Weekly	In Situ
Total Residual Chlorine 0.007 mg/l	0.015 mg/l	Weekly	Grab
Total Chromium 0.11 mg/l	0.11 mg/l	Monthly	Composite
Total Recoverable Copper Report	Report	Monthly	Composite
Total Recoverable Zinc 0.23 mg/l	0.46 mg/l	Monthly	Composite
0.23 mg/l 6.5 Minimum	6	Monthly 5 x Weekly	Composite Grab or Continuous

APPENDIX A

DISCHARGE MONITORING REPORTS

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OCATION			FROM YEAR	1 () MO	ę	°₽ ₽					
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PARAMETER		(J Caril Unity) QUA (46-53)	QUANTITY OR LOADING (54-61)		14 Card (2845) (3845)	44ALITY UR CU	CUNCENTHATION (54-61)		ů. Š	FREQUENCY	SAMPLE TYPE
(32-37)		AVERAGE	MUMIXAM	UNITS	MINIMUM	AVERAGE	MAXIMUM	UNITS		(NA LA)	(44.70)
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GREASE TR-GRAV	8AMPLE Measurement				CONTINGE			(19)	0	127 3	
FFLUENT_GROSS_VALUE	PERMIT REQUIREMENT					15.000 3-day avg.	20.000 Daily Max.	NG/L		177	GR
	SAMPLE MEASUREMENT					0.007	20010	(61)	0	1.221	
DIG34 1 0 0	PERMIT REQUIREMENT					0.110 30-day ave	0.110 Daily Max.	HG.L		02/1	COMP
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i al	PERMIT REQUIREMENT					0.230	0.460	16.1.		0274	COMP
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APPENDIX B

EXCESS EMISSIONS AND OPACITY REPORTS



Public Service Company of Colorado P.O. Box 840 Denver, CO 80201- 0840

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January 29, 1993

Mr. Roy Doyle Air Pollution Control Division Colorado Department of Health 4300 Cherry Creek Drive South Denver, CO 80222-1530

RE: Fourth Quarter, 1992 Excess Emissions Report, Cherokee S.E.G.S., Units #1-4

Dear Roy:

Attached is the fourth quarter, 1992 excess emissions report for the Public Service Company of Colorado Cherokee Station Units #1-4.

Unit #1 operated 2,144 hours, Unit #2 operated 1,727 hours, Unit #3 operated 2,066 hours and Unit #4 operated 1,809 hours.

Feel free to contact me at 294-2810 with any questions in this regard.

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Sincerely,

S. J. Cohlmia

Peter J. Cohlmia Chief Environmental Scientist

PJC:tc

Attachment

QUARTERLY EXCESS EMISSIONS REPORT (EER)

for

Fossil Fuel-Fired Steam Generators, Subpart D

Suggested Format for Sources in Region VIII*

Minimum Requirements Under Section 60.7 (See instructions)

Part 1. This report includes all the required information under section 60.7 for:

a.	Quarterly emission reporting perio	d ending: (circle one)
	March 31 June 30 Se	pt. 30 <u>Dec. 31</u>
ь.	Reporting year:	1992
c.	Reporting date:	January 12, 1993
d.	Person completing report:	Thomas M. Kennedy
e.	Station name:	Cherokee SEGS Units 1-4
f.	Plant location:	Denver, CO 80216
g.	Person responsible for review and integrity of report:	<u>Peter J. Cohlmia</u>
h.	Mailing address for person in 1-g a	above:
	Public Service Company of Colorado	P.O. Box 840
	Denver CO 80201-0840	
i.	Phone number for 1-g above:	294-2810

irt 2. Instrument Information, complete for each instrument.

a.	Opacity Monitor:	Unit 1 Lear	Unit 2 Lear	Unit 3 Lear	Unit 4 Lear
b.	Manufacturer:	<u>Siegler</u>	<u>Siegler</u>	<u>Siegler</u>	<u>Siegler</u>
c.	Model No.:	<u>RM-41</u>	<u>RM-41</u>	<u>RM-41</u>	<u>RM-41</u>
d.	Serial No.:	<u>985</u>	<u>989</u>	<u>982</u>	14824993
e.	Installation date:	<u>10/27/78</u>	<u>10/27/78</u>	10/27/78	06/07/85

f. SO2	Monitor:	Unit 1	Unit 2	Unit 3	Unit 4		
g. Manu	facturer:	Rosemount	Rosemount	Rosemount	Altech		
h. Mode	1 No.:	<u>EC960</u>	<u>EC960</u>	EC960	MCS100		
i. Seri	al No.:	<u>133</u>	<u>130</u>	<u>129</u>	ACS132		
j. Inst	allation date:	<u>12/19/88</u>	04/25/88	04/28/88	<u>06/09/91</u>		
Use Tab	emissions (by) le I: attach ; ion factors (no	separate na	-		ns.		
	ent measured:			<u> </u>	UNIT 4)		
i. P	ctor value used ublished or dev F, Fc, or <u>Fw</u>				540		
c. Basi:	s for gas measu	y) <u>wet/dry</u>	<u>(unit 4)</u>				
d. Zero	and Cal values						
	Unit 1	L	Unit 2				
	Opacity(%) S	50 ₂ (ppm)	Opacity(%) SO ₂ (ppm))		
Zero	0.0	300	0.0	300			
Cal		750	60.0		<u> </u>		
-	Unit 3	1	Unit 4				
	Opacity(%)	SO ₂ (ppm)	Opacity	(%) SO ₂ (pr))		
Zero	0.0		0.0	0			

____750____

45.0 450

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66.0

Part 5. Continuous Monitoring System operation failures

See Table II: Complete one sheet for <u>each</u> monitor; attach separate narrative per instructions.

Part 6. Certification of report integrity by person in 1-g above:

THIS IS TO CERTIFY THAT, TO THE BEST OF MY KNOWLEDGE, THE INFORMATION PROVIDED IN THE ABOVE REPORT IS COMPLETE AND ACCURATE.

NAME	Peter J. Cohlmia
SIGNATURE	hts Cohimia
TITLE	Chief Environmental Scientist
DATE	
	1

* Suggested Format for Subpart D sources in: Colorado, Montana,

North Dakota, South Dakota, Utah, Wyoming

EXCESS EMISSIONS (SULFUR DIOXIDE)

DATE POLLUTANT

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MAGNITUDE*
LB./10° BTU
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There were no excess SO, emissions

Narrative of Maximum Theoretical SO, Emissions:

Calculated maximum hypothetical SO₂ emissions from the sample with the highest sulfur content taken on 10/19/92 was 3.20 lbs. SO₂/MMBtu. This value was obtained using modified procedures specified in the "Coal Sampling and Analysis Certification Protocol". This sample analysis shows significant deviation from the monthly average for the analyses on Cherokee coal and is considered atypical. Because the CSA Protocol has no provision to compensate for SO₂ removal by processes within the power plant system, this value represents maximum hypothetical SO₂ emissions. Actual stack en isions would be lower than those calculated from coal samples. The average maximum theoretical SO₂ emissions for the quarter was 0.97 lbs. SO₂/MMBtu, which is below the 1.2 lbs. SO₂/MMBtu standard.

* Narrative of causes attached.

NARRATIVE OF OPACITY EXCESSES

UNIT #4

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<u>date</u>	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
10/11/92	Unspecified	2
11/22/92	Baghouse bypassed, unit off line	10
11/24/92	Unspecified	6
11/27/92	Unspecified	7
12/05/92	Unspecified	1
12/28/92	Unspecified	1
12/31/92	Baghouse bypassed, unit off line	27

NARRATIVE OF OPACITY EXCESSES

UNIT #3

DATE	<u>NARRATIVE</u>	NUMBER OF SIX MIN. EXCESSES
10/15/92	Calibration & audit	3
10/16/92	Unspecified	1
10/29/92	Unspecified	1
10/30/92	Unspecified	1
11/01/92	Baghouse bypassed, unit on 100% gas	36
12/06/92	Unspecified	1
12/13/92	Unspecified	1
12/22/92	Routine preventative maintenance	5
12/24/92	Unspecified	1
12/30/92	Baghouse bypassed, unit on 100% gas	7
12/31/92	Same as above	37

NARRATIVE OF OPACITY EXCESSES

UNIT #2

DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
11/12/92	Calibration & audit	4
11/14/92	Unspecified	l

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NARRATIVE OF OPACITY EXCESSES

<u>UNIT #1</u>

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DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
11/14/92	Calibration & audit	2
11/23/92	Unspecified	1
11/29/92	Unspecified	to a second a second and a se
12/01/92	Baghouse bypassed, unit on 100% gas	3
12/06/92	Unspecified	1
12/10/92	Calibration & audit	2
12/11/92	Unspecified	1
12/23/92	Calibration & audit	3
12/30/92	Unspecified	4
12/31/92	Unspecified	5

502 Continuous Monitoring System Operation Failures

<u>Date</u>	Time From - To	Unit	<u>Instrument</u>	Effect on Instrument Output
10/29	02:56 - 06:00	4	MCS100	Data held at last good reading
11/01 11/02	07:38 - 06:00	4	MCS100	Data held at last good reading
11/19	06:34 - 13:16	4	MCS100	Data held at last good reading
11/19 11/20	22.45 - 12:27	4	MCS100	Data held at last good reading
11/25	01:36 - 12:44	4	MCS100	Data held at last good reading
12/06 12/07	06:22 - 09:10	4	MCS100	Data held at last good reading
12/16	06:21 - 07:18	4	MCS100	Data held at last good reading
12/23	06:21 - 08:58	4	MCS100	Data held at last good reading
12/25 12/26	06:21 - 16:51	4	MCS100	Data held at last good reading

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Continuous Monitoring System Operation Failures

Date	Time* <u>From - To</u>	Unit	Instrument	Effect on Instrument Output
10/02/92 10/15/92	02:25 - 19:10	3	RM41	No Output - Monitor out of service due to asbestos abatement
10/18/92	00:22-09:13	3	RM41	Incorrect Output
10/19/92	01:14-09:39	3	RM41	Incorrect Output
10/20/92	04:20-07:36	3	RM41	Incorrect Output
10/29/92 11/01/92	14:17 - 14:26	l	RM41	No Output
11/02/92 11/04/92	14:28 - 08:49	1	RM41	No Output
11/04/92 11/05/92	14:34 - 11:13	1	RM41	No Output
11/06/92 11/07/92	11:13 - 11:16	1	RM41	No Output
11/08/92 11/13/92	11:19 - 15:18	1	RM41	No Output
11/09/92 11/11/92	08:47 - 12:52	2	RM41	Incorrect Output
11/12/92	07:26-21:22	2	RM41	Incorrect Output
11/13/92 11/14/92	13:07 - 16:52	2	RM41	Incorrect Output
11/14/92	06:42-11:09	1	RM41	Incorrect Output
.12/10/92	09:14-16:22	1	RM41	No Output
.12/18/92	11:04-15:28	2	RM41	No Output
12/20/92 12/22/92	07:40 - 07:46	3	RM4 1	No Output
12/22/92	11:24-13:49	1	RM41	No Output
12/23/92	07:19-12:26	1	RM41	Incorrect Output



Public Service Company of Colorado

Governmental and Environmental Affairs P. O. Box 840 Denver, CO 80201 - 0840

April 29, 1993

Mr. Roy Doyle Air Pollution Control Division Colorado Department of Health 4300 Cherry Creek Drive South Denver, CO 80222-1530

RE: First Quarter, 1993 Excess Emissions Report, Cherokee S.E.G.S., Units #1-4

Dear Roy:

Attached is the first quarter, 1993 excess emissions report for the Public Service Company of Colorado Cherokee Station Units #1-4.

Unit #1 operated 2,057 hours, Unit #2 operated 1,816 hours, Unit #3 operated 1,499 hours and Unit #4 operated 1,870 hours.

Feel free to contact me at 294-2810 with any questions in this regard.

Sincerely,

et J. Cohlmia

Peter J. Cohlmia Chief Environmental Scientist

PJC:tc

Attachment

OUARTERLY EXCESS EMISSIONS REPORT (EER)

for

Fossil Fuel-Fired Steam Generators, Subpart D

Suggested Format for Sources in Region VIII*

Minimum Requirements Under Section 60.7 (See instructions)

Part 1. This report includes all the required information under section 60.7 for:

	a.	Quarterly emission	reporting]	period	endin	g: (circ	le one)
		March 31 Ju	ne 30	Sept	. 30	D	ec. 31
	b.	Reporting year:		1	.993		
	c.	Reporting date:		<u>A</u>	pril	7, 1993	
	d.	Person completing :	report:	I	<u>'homas</u>	M. Kenned	<u>y</u>
	e.	Station name:		<u>c</u>	herok	ee SEGS Un	<u>its 1-4</u>
	f.	Plant location:		D	enver	. CO 80216	
	g.	Person responsible and integrity of re			<u>eter</u>	J. Cohlmia	
	h.	Mailing address for	r person in	1-g ab	ove:		
		Public Service Company of Colorado P.O. Box 840 Denver CO 80201-0840					
	i.	Phone number for 1	-g above:		<u>294-2</u>	810	
Part 2.	In	strument Informatio	n, complete	for ea	ich in	strument.	
	a.	Opacity Monitor:	Unit 1 Lear	Unit 2 Lear		Unit 3 Lear	Unit 4 Lear
	b.	Manufacturer:	Siegler	Siegle		Siegler	Siegler
	c.	Model No.:	<u>RM-41</u>	<u>RM-41</u>		<u>RM-41</u>	<u>RM-41</u>
	d.	Serial No.:	<u>985</u>	<u>989</u>		<u>982</u>	<u>14824993</u>
	e.	Installation date:	<u>10/27/78</u>	<u>10/27/</u>	78	<u>10/27/78</u>	<u>06/07/85</u>

	f. SO2 M	onitor:	Unit 1	Unit 2	Unit 3	Unit 4	
	g. Manufa		Rosemount	<u>Rosemount</u>	Rosemount	Altech	
	h. Model	No.:	<u>EC960</u>	<u>EC960</u>	EC960	<u>MCS100</u>	
	i. Seria	l No.:	<u>133</u>	<u>130</u>	<u>129</u>	<u>ACS132</u>	
	j. Insta	llation date:	<u>12/19/88</u>	04/25/88	04/28/88	<u>06/09/91</u>	
Part 3.	Excess e	missions (by)	pollutant)				
	Use Tabl	e I: attach	separate na	rrative per	instructio	ons.	
Part 4.	Conversi	on factors (n	ot for dilu	ent monitor	report)		
		nt measured:				(UNIT 4)	
	b. F-Fac	tor value use	d:				
		blished or de , Fc, or <u>Fw</u>	veloped		10	640	
	c. Basis for gas measurement data: (wet or dry) wet/dry(unit 4)						
	d. Zero and Cal values used, by instrument:						
	a. Zero		- -		Jnit 2		
		Unit					
		Opacity(%)	SO ₂ (ppm)	Opacity(\$) SO ₂ (pp)	m)	
	Zero	0.0	300	0.0			
	Cal	57.0	750	60.0			
		Unit	3	τ	Jnit 4		
		Opacity(%)	SO _z (ppm)	Opacit	y(%) SO ₂ (ppm)	
	Zero	0.0		0	.0	0	
	Cal	64.0		47	.54	50	
						•	

Part 5. Continuous Monitoring System operation failures

See Table II: Complete one sheet for <u>each</u> monitor; attach separate narrative per instructions.

Part 6. Certification of report integrity by person in 1-g above:

THIS IS TO CERTIFY THAT, TO THE BEST OF MY KNOWLEDGE, THE INFORMATION PROVIDED IN THE ABOVE REPORT IS COMPLETE AND ACCURATE.

NAME	<u>Peter J. Cohlmia</u>
SIGNATURE	Peter J. Cohlmia
TITLE	<u>Chief Environmental Scientist</u>
DATE	4/29/93

* Suggested Format for Subpart D sources in: Colorado, Montana,

Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming

EXCESS EMISSIONS (SULFUR DIOXIDE)

DATE

POLLUTANT

MAGNITUDE* LB./10° BTU

There were no excess SO, emissions for the first quarter, 1993.

Narrative of Maximum Theoretical SO₂ Emissions:

Calculated maximum hypothetical SO₂ emissions from the sample with the highest sulfur content taken on 3/14/93 was 0.612 lb/MMBtu. This value was obtained using modified procedures specified in the "Coal Sampling and Analysis Certification Protocol". Because the CSA Protocol has no provision to compensate for SO₂ removal by processes within the power plant system, this value represents maximum hypothetical SO₂ emissions. Actual stack emissions would be lower than those calculated from coal samples. The average maximum theoretical SO₂ emissions for the quarter was 0.71 lb/MMBtu, which is well below the 1.2 lb/MMBtu standard.

* Narrative of causes attached.

SO2 Continuous Monitoring System Operation Failures

Date	Time From - To	<u>Unit</u>	Instrument	Effect on Instrument Output
1/4	08:09 - 08:22	4	MCS100	Data held at last good reading
1/9 1/10	17:43 - 13:23	4	MCS100	Data held at last good reading
1/13	04:48 - 06:51	4	MCS100	Data held at last good reading
1/31	05.17 - 05:19	4	MCS100	Data held at last good reading
1/31	05:36 - 05:41	4	MCS100	Data held at last good reading
2/15 2/16	16:23 - 07:14	4	MCS100	Data held at last good reading
2/17	18:43 - 18:47	4	MCS100	Data held at last good reading
2/17	19:31 - 23:35	4	MCS100	Data held at last good reading
3/7 3/8	14:20 - 05:54	4	MCS100	Data held at last good reading
3/8	13:39 - 15:33	4	MCS100	Data held at last good reading

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TABLE	<u></u>
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Continuous Monitoring System Operation Failures

Date	Time* From - To	<u>Unit</u>	Instrument	Effect on Instrument Output
01/01/93	09:06-09:51	4	RM41	No Output
01/03/ 93	12:36-13:00	4	RM41	No Output
01/07/93	08:03-08:25	4	RM41	No Output
01/15/93	12:24-14:54	4	RM41	No Output
01/20/93	00:51-07:49	4	RM41	No Output
01/23/93	06:50-06:58	4	RM41	No Output
01/23/93	08:23-08:50	4	RM41	No Output
01/23/93	10:37-23:59	4	RM41	No Output
01/24/93	00:00-23:59	4	RM41	No Output
01/27/93	13:12-15:49	4	RM41	No Output
02/01/93	07:36-11:54	3	RM41	No Output
02/01/93	13:04-13:24	3	RM41	Incorrect Output
02/01/93	14:26-14:41	3	RM41	Incorrect Output
02/12/93	02:00-04:32	4	RM41	No Output
02/13/93	10:21-11:40	4	RM4 1	Incorrect Output
02/13/93	10:48-12:50	1	RM41	No Output
02/13/93	10:48-12:50	2	RM41	No Output
02/13/93	10:48-12:50	3	RM41	No Output
03/03/93	11:43-12:07	4	RM41	No Output
03/11/93	07:37-14:41	4	RM41	No Output
03/23/93	07:42-11:16	2	RM41	No Output
03/24/93	13:10-14:06	2	RM41	No Output

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NARRATIVE OF OPACITY EXCESSES

UNIT #1

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DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
01/05/93	Cleaned optics	2
01/07/93	Unspecified	2
01/08/93	Baghouse problems	l
01/24/93	Unspecified	2
01/29/93	Unspecified	1
02/05/93	Unspecified	l
02/28/93	Unspecified	1
03/21/93	Unspecified	1
03/27/93	Unit off line	5

NARRATIVE OF OPACITY EXCESSES

UNIT #2

DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
01/05/93	Unit off line	2
03/24/93	Calibration & audit	1

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NARRATIVE OF OPACITY EXCESSES

UNIT #3

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DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
01/01/93	Unspecified	2
02/01/93	Unit off line	10
02/11/93	Baghouse out of servi unit on 100% gas	ce, 76
02/12/93	Unit off line	11
02/14/93	Unit off line	45
02/16/93	Unit off line	1
02/22/93	Unit off line	8
02/27/93	Unit startup	8
02/28/93	Unspecified	2
03/01/93	Unit off line	67
03/02/93	Unit off line	33
03/05/93	Unit startup	10
03/26/93	Unit startup	11
03/13/93	Unit off line	l
03/14/93	Unit startup	30
03/16/93	Unit startup	5
03/17/93	Unit startup	6
03/22/93	Unspecified	4
03/23/93	Unspecified	12
03/25/93	Unit off line	27
03/26/93	Unspecified	4

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NARRATIVE OF OPACITY EXCESSES

<u>UNIT #4</u>

<u>date</u>	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
01/01/93	Unspecified	1
01/07/93	Unspecified	6
02/11/93	Unspecified	11
02/12/93	Unspecified	3
02/27/93	Unit off line	2
02/28/93	Unspecified	2
03/03/93	Unspecified	6

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EXCESS EMISSIONS (SULFUR DIOXIDE)

<u>DATE</u>

<u>POLLUTANT</u>

MAGNITUDE* LB./10° BTU

There were no excess SO₂ emissions for the second quarter, 1993.

Narrative of Maximum Theoretical SO, Emissions:

Calculated maximum possible SO₂ emissions from the sample with the highest sulfur content taken on 5/3/93 was 1.004 lb/MMBtu. This value was obtained using modified procedures specified in the "Coal Sampling and Analysis Certification Protocol". Because the CSA Protocol has no provision to compensate for SO₂ removal by processes within the power plant system, this value represents maximum hypothetical SO₂ emissions. Actual stack emissions would be lower than those calculated from coal samples. The average maximum theoretical SO₂ emissions for the quarter was 0.90 lb/MMBtu, which is well below the 1.2 lb/MMBtu standard.

* Narrative of causes attached.

NARRATIVE OF OPACITY EXCESSES

<u>UNIT #1</u>

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DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
04/02/93	Unspecified	1
04/22/93	Unspecified	1
04/24/93	Unspecified	1
04/29/93	Black start - Lear Seiglers powered down	18
04/30/93	Unit off line	6
05/03/93	Unspecified	1
05/05/93	Unit off line	11
05/21/93	Unspecified	5
06/04/93	Unspecified	1
06/26/92	Unit off line	22
06/29/93	Unit startup	22

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<u>TABLE I</u>

NARRATIVE OF OPACITY EXCESSES

<u>UNIT #2</u>

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DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
05/06/93	Unspecified	1
05/21/93	Unspecified	1

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NARRATIVE OF OPACITY EXCESSES

<u>UNIT #3</u>

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DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
04/03/93	Unit startup	15
04/18/93	Unspecified	1
04/22/93	Unspecified	2
04/29/93	Unspecified	1
04/30/93	Unit startup	24
05/05/93	Unit startup	12
05/06/93	Unspecified	2
05/09/93	Unit startup	44
05/10/93	Unit startup	14
05/31/93	Unspecified	1
06/05/93	Unspecified	1
06/17/93	Unit startup	52
06/21/93	Unspecified	21

SO2 Continuous Emissions Monitor Failures

Unit 4 Altech MCS 100

From Date Time	To Date Time	Reason	Corrective Action
05/13 18:22	05/14 11:26	Pump failure	Replaced diaphragms
06/11 22:00	06/12 23:14	Inlet sample line plug	Self-corrected

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Continuous Monitoring System Operation Failures

From	L	То	•			Effect on
Date	Time	Date	<u>Time</u>	<u>Unit</u>	<u>Instrument</u>	<u>Instrument Output</u>
04/17/93	10:02	04/17/93	21:16	4	RM41	Incorrect Output
04/29/93	11:25	04/29/93	15:10	3	RM41	No Output
04/29/93	11:25	04/29/93	15:10	4	RM41	No Output
04/29/93	11:25	04/29/93	15:36	1	RM41	No Output
04/29/93	11:25	04/29/93	16:14	2	RM41	No Output
05/07/93	16:44	05/07/93	17:46	1	RM41	No Output
05/07/93	16:44	05/07/93	17:46	2	RM41	No Output
05/12/93	17:59	05/19/93	15:09	1	RM41	No Output
06/17/93	23:05	06/18/93	00:22	2	RM41	No Output
06/28/93	12:39	06/28/93	13:14	4	RM41	No Output

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NARRATIVE OF OPACITY EXCESSES

<u>UNIT #4</u>

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DATE	NARRATIVE	NUMBER OF SIX MIN. EXCESSES
04/25/93	Unspecified	1
04/26/93	Unspecified	3
06/10/93	Unspecified	5