INTEGRATED DRY NO_x / SO_2 EMISSIONS CONTROL SYSTEM

ENVIRONMENTAL MONITORING REPORT

Calcium-Based Dry Sorbent Injection System Test Period:

April 30, 1993 through November 2, 1993

Calcium DSI Air Toxics Test October 19-20, 1993

Dioxins/Furans Air Toxics Text October 11-13, 1993

DOE Contract Number DE-FC22-91PC90550

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ABBREVIATIONS

ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
CARB	California Air Resources Board
CDH	Colorado Department of Health
CEM	Continuous emissions monitor
CO	Carbon monoxide
CO_2	Carbon dioxide
CVAA	Cold vapor atomic absorptions
EMP	Environmental Monitoring Plan
EPA	Environmental Protection Agency
FC/VM	Fixed carbon/volatile matter
FFDC	Fabric filter dust collector
GC/MS	Gas chromatography/mass spectroscopy
GFAA	Graphite furnace atomic absorption
HF	Hydrofluoric acid
HHV	Higher heating value
IC	Ion chromatography
ICP	Inductively coupled plasma
ICP-AES	Inductively coupled plasma-atomic emission spectroscopy
INAA	Instrumental Neutron Activation Analysis
ISE	Ion specific electrode
MS	Mass spectrometry
NO	Nitric oxide
NO_x	Oxides of nitrogen
O_2	Molecular oxygen
PAH	Polycyclic aromatic hydrocarbons
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans

PID	Photoionization detector
PM_{10}	Particulate matter less than 10 microns
PSCC	Public Service Company of Colorado
PTC	Power test code
QA	Quality assurance
SO_2	Sulfur dioxide
SO_3	Sulfur trioxide
VOC	Volatile organic compounds

UNITS

Btu	British Thermal Unit
°F	degree Fahrenheit
DSCFM	dry standard cubic feet per minute
DSCF	dry standard cubic feet, 68°F and 1 atm
gpm	gallons per minute
gr	grains
kg	kilogram
lb	pound (mass)
lb/10^{12} Btu	pound per trillion British thermal units
lb/MMBtu	pounds per million British thermal units
m^3	cubic meter
mg	milligram (10^{-3} gram)
μg	microgram (10^{-6} gram)
$\mu g/Nm^3$	microgram per normal cubic meter (0°F, 1 atm)
MMBtu	Million Btu
MWe	Megawatt-electric
ng	nanogram (10^{-9} gram)
ng/Nm^3	nanogram per normal cubic meter (0°F, 1 atm)
pCi	pico-Curie
ppm	parts per million
ppmc	parts per million corrected to 3% O_2, dry
ppmd	parts per million, dry
ppmw	parts per million by weight

I. Project Status

A. Test Summary

The dry sorbent injection (DSI) system was tested with calcium-based sorbents from April 30, 1993 through November 2, 1993 at Public Service Company of Colorado's (PSCC) Arapahoe Unit 4 Steam Electric Generating Station.

The test consisted of two phases: (1) Optimization of the operating parameters and (2) Parametric tests on the optimized system to assess the performance as various boiler operating parameters were modified. Nearly 200 different tests were completed over this period. Calcium was injected both into the boiler at a temperature range of approximately 1000°F and into the inlet to the fabric filter dust collector (FFDC). Testing was conducted both with and without flue-gas humidification. After these two phases were completed, a series of air toxics tests were conducted. These tests measured air toxics during the injection of calcium-based reagents before the FFDC and during humidification. In addition, baseline air toxics tests for dioxins and furans were repeated.

B. Summary of Environmental Monitoring

The purpose of this report is to document the environmental monitoring that was completed as part of the calcium injection test series. Monitoring was completed according to the *Environmental Monitoring Plan for the Integrated Dry NO_x/SO_2 Emissions Control System*, dated February 1992 and its addendum dated July 1993.

Generally, the testing went well and there were no significant environmental events during the test period and there were no excursions of any compliance requirements during testing. A significant amount of supplemental monitoring was completed to determine the emissions while operating and testing the DSI system with calcium-based reagents. The test series report *Calcium-Based Dry*

Sorbent Injection, dated December 1994 contains a complete discussion of the calcium test program.

Additional supplemental monitoring to collect data for 21 potential air toxics was completed during the calcium injection testing. Sampling for this testing was conducted October 19 and 20, 1994. Additional baseline testing to determine a number of dioxins and furans was also conducted without the calcium injection system in operation. This baseline sampling was conducted October 11, 12, and 13, 1993.

II. Summary of Compliance Monitoring Results

A. Sulfur Dioxide Monitoring

Regulation 1, VI.A.3.a.(ii) of the State of Colorado states that the maximum emission of sulfur dioxide (SO_2) is 1.2 lb/MMBtu. An Altech 180 continuous emission monitoring (CEM) system was installed at Arapahoe Unit 4 in June 1992. This monitor was used to collect emissions data during this test program. However, the monitor was not used for compliance monitoring during this test series.

SO_2 emissions for compliance monitoring were calculated from the amount of sulfur in the fuel. Table 1 summarizes this data. Emissions calculated to be above the regulatory limit of 1.2 lb/MMBtu are provided to the state quarterly. The test period covered most of the second, all of the third, and part of the fourth quarters of 1993. Appendix A contains copies of the reports documenting this information to the Colorado Department of Health (CDH).

Quarter (1993)	Avg. SO_2 Content (lb/MMBtu)	SO_2 Violations
2nd	0.844	None
3rd	0.861	None
4th	0.850	None

Table 1: Arapahoe 4 SO_2 Emissions

B. Opacity Monitoring

According to Regulation 1, II.A.1., PSCC must report to the CDH anytime Arapahoe Unit 4 exceeds 20% opacity due to any air pollutant. The unit uses a Lear Siegler RM41 continuous opacity monitor to measure and record opacity.

During the test period, the average daily opacity ranged from 0.7 to 6.8%. Arapahoe Unit 4 had thirty one 6-minute opacity excursions exceeding the 20%

opacity limit for a 99.93% compliance percentage over the test period. None of these excursions occurred, however, while testing the calcium-based DSI system and all were related to the startup and shutdown of the unit. Appendix A provides copies of the reports documenting this information to the CDH and the compliance rate calculation.

C. Aqueous Stream Monitoring

Colorado Wastewater Discharge Permit No. CO-0001091 requires that Arapahoe Unit 4 must sample and report on various aqueous discharges. Appendix B contains copies of the reports provided to the CDH during the combustion test period for April through November of 1993. Note that there were no violations and that the station was in compliance 100.0% of the test period.

III. Summary of Supplemental Monitoring Results

A. Gaseous Species Monitoring

Significant gas monitoring was done to determine the environmental effects of the Integrated Dry NO_x/SO_2 Emissions Control System and, specifically, the DSI system using calcium-based sorbents. Appendix C contains a summary of all test data obtained during the calcium-based DSI testing conducted April 30 through November 2, 1993. The test summary contains average emissions by test for the following gases:

- Nitric oxide (NO)
- Carbon monoxide (CO)
- Carbon dioxide (CO_2)
- Oxygen (O_2)
- Sulfur dioxide (SO_2)

B. Particulate Monitoring

Three particulate tests were conducted during the air toxics testing. Environmental Protection Agency (EPA) Method 5 was used to conduct these tests at the FFDC inlet and outlet. The inlet particulate levels ranged from 2.437 to 1.873 gr/DSCF and averaged 2.207 gr/DSCF. The outlet particulate levels were 0.0019, 0.0007, and 0.0006 gr/DSCF and averaged 0.0012 gr/DSCF. The high outlet value (0.0019 gr/DSCF) could be the result of rust and other materials not associated with combustion. The efficiency of the FFDC averaged 99.952%.

C. Aqueous Stream Monitoring

No supplemental monitoring of aqueous streams was planned or required during the calcium-based DSI test program but, the consumptive water use of the flue-gas humidification system and urea injection system was recorded for informational purposes. Table 2 shows water use by month.

Month	Gallons	Acre-feet
May 1993	254,185	0.78
June 1993	490,849	1.51
July 1993	339,858	1.04
August 1993	0	0
September 1993	90,503	0.28
October 1993	260,359	0.80
November 1993	0	0
Total	1,435,754	4.41

Table 2: Water Use by Flue-Gas Humidification System

D. Solids Stream Monitoring

Coal

Coal sampling and analysis was conducted during the air toxics sampling period. Two sets of coal samples were obtained. The first set of samples were obtained during baseline testing for dioxins and furans. The second set of samples were obtained during the air toxics testing with the calcium-based DSI system.

Table 3 lists the proximate analysis and Table 4 lists the ultimate analysis of the coal burned during the repeat of the baseline dioxin and furan sampling. Originally dioxin and furan sampling was completed under baseline conditions during the selective non-catalytic reduction air toxics test period completed March 8, 1993 through March 11, 1993. Due to contamination of native isomers in the method blanks, samples, and archived resin a valid measurement could not be obtained and the testing was repeated during the current air toxics test period. Except for the percent ash values which are slightly higher than normal, the results show good agreement and are typical for the bituminous coal fired at Arapahoe Unit 4.

Property	Test 1		Test 2		Test 3		Average	
	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis
%Moisture	10.34	--	10.10	--	10.22	--	10.22	--
%Ash	9.62	10.73	11.58	12.88	11.78	13.12	10.99	12.24
%Volatile	34.46	38.43	33.87	37.68	33.60	37.42	33.98	37.84
%Fixed Carbon	45.58	50.84	44.45	49.44	44.40	49.46	44.81	49.91
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Btu/lb	11,197	12,488	10,962	12,193	10,933	12,177	11,051	11,030
FC/VM	1.32	1.32	1.31	1.31	1.32	1.32	1.32	1.32
lb SO_2/MMBTu @ (100%)	0.79		0.86		0.84		0.83	

Table 3: Proximate Analysis for Baseline Air Toxics Testing

Property	Test 1		Test 2		Test 3		Average	
	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis
%Moisture	10.34	--	10.10	--	10.22	--	10.22	--
%Carbon	64.42	71.85	62.77	69.82	61.97	69.02	63.05	70.23
%Hydrogen	4.43	4.94	4.35	4.84	4.51	5.02	4.43	4.93
%Nitrogen	1.57	1.75	1.51	1.68	1.56	1.74	1.55	1.72
%Sulfur	0.44	0.49	0.47	0.52	0.46	0.51	0.46	0.51
%Ash	9.62	10.73	11.58	12.88	11.78	13.12	10.99	12.24
%Oxygen (diff)	9.18	10.24	9.22	10.26	9.50	10.59	9.30	10.36
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 4: Ultimate Analysis for Baseline Air Toxics Testing

Table 5 lists the proximate analysis and Table 6 lists the ultimate analysis of the coal burned during the air toxics testing during the calcium-based DSI system. Generally, Arapahoe Unit 4 burns Colorado coal from the Yampa mine, but PSCC occasionally purchases spot market Colorado coal from the Edna mine.

The higher sulfur levels in the analyses indicate that Arapahoe Unit 4 fired its alternate coal both days of air toxics testing for the calcium-based DSI system.

Property	Test 1		Test 2		Test 3		Average	
	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis
%Moisture	11.33	--	12.15	--	11.60	--	11.69	--
%Ash	8.49	9.58	7.96	9.06	7.80	8.82	8.08	9.15
%Volatile	34.92	39.38	34.96	39.79	35.01	39.60	34.96	39.59
%Fixed Carbon	45.26	51.04	44.93	51.15	45.59	51.58	45.26	51.26
Total	100.00	100.00	100.00	100.00	100.00	100.00	99.99	100.00
FC/VM	1.30	1.30	1.29	1.29	1.30	1.30	1.30	1.30
Btu/lb	11,034	12,444	10,959	12,475	11,076	12,529	11,023	12,482
lb SO_2/ MMBtu	1.05		1.09		1.03		1.06	

Table 5: Proximate Analysis for Calcium-Based DSI System Air Toxics Testing

Property	Test 1		Test 2		Test 3		Average	
	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis	As Received	Dry Basis
%Moisture	11.33	--	12.15	--	11.60	--	11.69	--
%Carbon	62.71	70.72	62.29	70.91	63.14	71.42	62.71	70.95
%Hydrogen	4.38	4.94	4.30	4.90	4.36	4.93	4.35	4.92
%Nitrogen	1.59	1.79	1.61	1.83	1.64	1.85	1.61	1.82
%Sulfur	0.58	0.65	0.60	0.68	0.57	0.65	0.58	0.66
%Ash	8.49	9.58	7.96	9.06	7.80	8.82	8.08	9.15
%Oxygen (diff)	10.92	12.32	11.09	12.62	10.89	12.33	97	12.59
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 6: Ultimate Analysis for Calcium-Based DSI System Air Toxics Testing

Fly ash

Supplemental monitoring of fly ash and bottom ash was also completed during the calcium injection testing. The samples were obtained in order to perform mineralogical, elemental, anion, and leachate analyses. These analyses take a significant amount of time to perform. These results will be reported in the environmental monitoring section of the *Final Report, Volume 2: Project Performance and Economics.*

IV. Summary of Air Toxics Monitoring Results

A total of 21 potential air toxics was measured at Arapahoe 4 with the calcium-based DSI system operating. Table 7 lists the air toxics that were sampled during the calcium-based DSI testing. Table 8 compares the target air toxics measured during each of the four test series. This report presents baseline dioxin data and air toxics data for the calcium-based DSI system. Refer to the other three environmental monitoring reports for more information on the other tests conducted.

Trace Metals	Arsenic	Lead
	Cadmium	Molybdenum
	Copper	Phosphorous
	Mercury	Beryllium
	Selenium	Cobalt
	Calcium	Manganese
	Barium	Nickel
	Chromium	Vanadium
	Calcium	Sodium
Anions [1]	Chloride	Sulfate
	Fluoride	

1. Elemental precursors of these anions measured in the fuel (Cl, F, S).

Table 7: Target Compounds for Calcium-Based DSI System

Sampling of the baseline dioxins was conducted on October 11, 12, and 13, 1993. The air toxics tests for the calcium-based DSI system were conducted on October 19 and 20, 1993. No sampling occurred during sootblowing operations.

Target Compounds		Test Period					
		Low-NOx Combustion	SNCR		Calcium-Based DSI		Sodium-Based DSI
			Baseline [3]	SNCR	Baseline	Sodium	
Trace Metals		X		X		X	X
Acid-Forming Anions		X		X		X	X
Volatile Organic Compounds	Benzene/toluene	X	X				
	Formaldehyde	X					
Semi-Volatile Organic Compounds	PAH	X					
	PCDD/PCDF [1]		X[2]		X		
Solid Particulate		X		X		X	X
Radio Nuclides		X					
Trace Metals Speciation	Total/hexavalent chromium		X				
	Mercury		X				
Nitrogen Compounds		X		X			
HHV, Ultimate/ Proximate Analysis		X	X	X	X	X	X
Loss-On-Ignition		X		X		X	X

1. Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF).
2. Due to anomalous contamination of native 2,3,7,8,PCDD/PCDF isomers in the method blanks, samples, and archived resin, the results of these tests are invalid and were repeated during the calcium-based DSI test period.
3. Some baseline tests were repeated in the SNCR test period.

Table 8: Target Compounds

PSCC contracted with Carnot, Inc. of Tustin, California to complete the air toxics work at Arapahoe Unit 4. Fossil Energy Research Corp. of Laguna Hills, California provided some assistance at the site and with data collection. Table 9 lists the laboratories used to analyze the collected samples.

Analysis	Laboratory	Location
Solid particulate	Carnot, Inc	Tustin, CA
Chloride and sulfate (as necessary for confirmation)	Carnot, Inc	Tustin, CA
Acid-forming anions	Curtis and Tompkins	Berkeley, CA
Trace metals	Curtis and Tompkins	Berkeley, CA
Semi-volatile organic compounds	Zenon Environmental Laboratories	Burlington, Ontario, Canada
LOI for ash	Commercial Testing and Engineering	Denver, CO
Trace metals and anions analysis of fuel and ash	Curtis and Tompkins	Berkeley, CA
Coal preparation and ultimate analysis, including anions	Commercial Testing and Engineering	Denver, CO
Neutron activation analysis	Massachusetts Institute of Technology	Cambridge, MA
Coal preparation	A. J. Edmonds	Long Beach, CA
Ash preparation and anion analysis	Commercial Testing and Engineering	Denver, CO
Ash preparation	Carnot	Tustin, CA

Table 9: Laboratories for Air Toxics Analyses

The Environmental Monitoring Plan (EMP) addendum for air toxics includes details on the method used to determine the total mass flow of the air toxics. In addition to the measured concentrations of the air toxics in the sample, mass flows of the solid and gas are required. Table 10 lists the mass flowrates for the flue gas and the solids used to determine the mass flow of the toxics. The actual flue-gas flowrate is used for each of the trace metal, particulate matter, and anion tests. The flue-gas flowrates for the VOC and cyanide tests were from the major test conducted concurrently. The existing plant equipment was used to measure the coal flow. The measured particulate loading and flue-gas flowrate was used to calculate the flowrate of the fly ash and the stack ash. The coal input and the fly ash flowrates were used to calculate the bottom ash flowrate.

Stream	Test	Location	Test 1	Test 2	Test 3
Flue Gas Flow Rate (DSCFM)	Trace Metals	Inlet	271,100	279,700	276,300
		Outlet	279,200	288,700	279,700
	Particulate Matter	Inlet	252,500	263,000	272,700
		Outlet	260,000	268,900	275,900
	Anions	Inlet	252,500	263,000	272,700
		Outlet	260,000	268,900	275,900
	Dioxins and Furans	Inlet	232,600	199,100	225,200
		Outlet	234,900	204,700	206,900
Coal Flow (lb/h)			101,800	105,400	104,300
Fly Ash Flow (lb/h)			8,359	8,351	7,474
Bottom Ash Flow (lb/h)			3,638	3,889	4,593
Total Ash Flow (lb/h)			11,997	12,240	12,067
Stack Ash Flow (lb/h)			4.2	1.6	1.4

Table 10: Stream Mass Flow Data

Table 11 lists the average operating conditions of Arapahoe Unit 4 during the calcium and baseline air toxics testing. All three baseline dioxin tests were conducted at 75 Mwe. A problem occurred on the first day of testing that limited load to 75MWe. The problem was corrected the following day but the remaining tests were conducted at the same load to provide three replicate tests. Figure 1 shows a simplified diagram of the unit and shows the five different sample locations. Gaseous samples were obtained at the inlet and the outlet of the FFDC. Solid samples of unpulverized coal, bottom ash, and fly ash were also obtained. This section lists the results of the air toxics testing. For details on the methods used for sampling, analysis, and quality assurance, see the *Environmental Monitoring Plan Addendum for Air Toxics Monitoring*, dated July 1993.

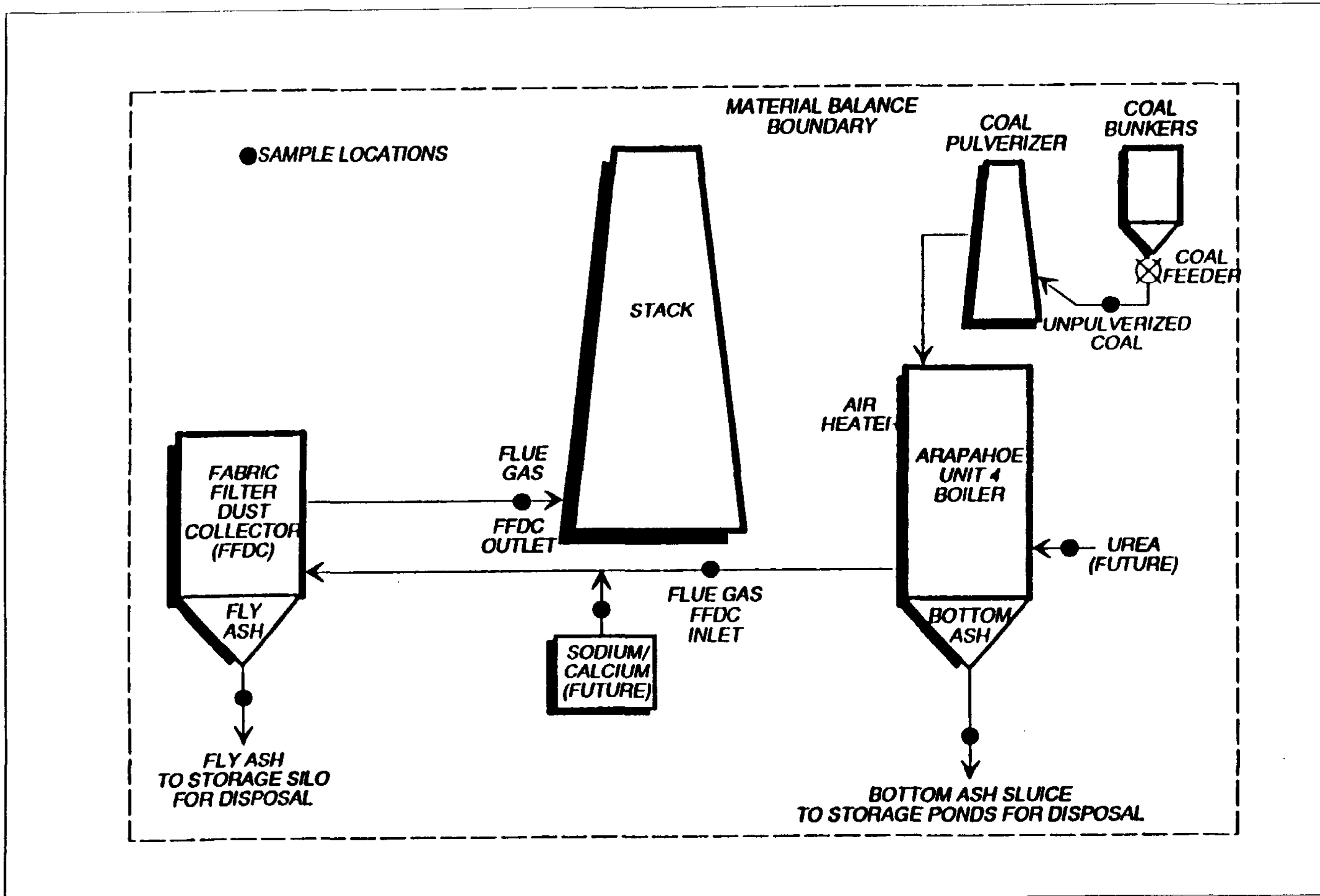

Figure 1: Sampling Locations

Property		Baseline Dioxins			Calcium-Based DSI Air Toxics		
		1	2	3	1	2	3
Unit load (MW, net) [3]		76	75	75	112	112	112
Input	Air (lb/h)	753,000	705,000	716,000	976,000	995,000	1,028,000
	Coal (lb/h)	67,600	68,900	72,200	101,800	105,400	104,300
Steam flow (lb/h)		638,000	632,000	630,000	959,000	966,000	966,000
DSI	Injection rate (lb/min)	--	--	--	51.5	52.4	51.7
	Ca/S	--	--	--	2.06	2.07	2.10
	Sorbent feeder output (A/B) [4]	--	--	--	56%/68%	57%/69%	56%/68%
	Humidification water (gpm)	--	--	--	70.9	66.8	72.8
FFDC outlet	$\%O_2$[1], dry	7.70%	7.24%	7.34%	6.11%	6.25%	6.32%
	CO (ppmd) [2]	14.0	19.2	13.2	71.7	231	212
	NO (ppmd) [2]	216	194	196	225	221	225
	SO_2 (ppmd) [2]	308	308	307	280	283	262

1. From Carnot's portable O_2 that sampled at each sample point.
2. From a single point Altech CEM system located in the FFDC outlet duct.
3. The "B" ID fan was off line for the first baseline test. To maintain consistent operating conditions, the remaining tests were operated at 75 MW.
4. Indicates level of operation of "A" and "B" DSI feed systems.

Table 11: Average Operating Conditions and Continuous Emissions Data

Table 12 lists the methods used during this sampling program that differ from the EMP.

A. Uncertainty Analysis

In the tables that follow, a value for uncertainty expressed as a percentage is provided for all data. The calculation method used is based upon ANSI/ASME PTC 19.1-1985, "Measurement of Uncertainty." The uncertainty is based on a 95% confidence interval for the mass emissions for the target species but is expressed as a percentage so that it may be applied to other units. A very important part of the method is assigning an estimated bias error for the major

Species		EMP Specified Method	Method Used
FFDC Inlet	Arsenic	EPA SW 846-7060 (GFAA)	EPA SW 846-6010 (ICP)
	Cadmium	EPA SW 846-7131 (ICP)	EPA SW 846-6010 (ICP)
	Chromium	EPA SW 846-7191 (GFAA)	EPA SW 846-6010 (ICP)
FFDC Outlet	Arsenic	EPA SW 846-7060 (GFAA)	EPA SW 846-6010 (ICP)
	Cadmium	EPA SW 846-7131 (ICP)	EPA SW 846-6010 (ICP)
	Chromium	EPA SW 846-7191 (GFAA)	EPA SW 846-6010 (ICP)
Fuel	Arsenic	EPA SW 846-7060 (GFAA)	INAA
	Barium	EPA SW 846-6010 (ICP)	EPA SW 846-6010 (ICP with EPA3050 digestion)
	Chlorine	ASTM D-4208 & ISP	INAA
	Sulfate	EPA SW 846-300-IC	ASTM D4239 & LECO SC-132
	Cadmium	EPA SW 846-7131 (ICP)	INAA
	Mercury	EPA SW 846-7470 (CVAA)	INAA
	Selenium	EPA SW 846-7740 (GFAA)	INAA
	Chromium	EPA SW 846-7191 (GFAA)	EPA SW846-6010 (ICP-AES)
	Lead	EPA SW 846-7421 (GFAA)	EPA SW846-7420 (GFAA)
	Calcium	EPA SW 846-6010 (ICP)	EPA SW 846-6010 (ICP with EPA3050 digestion)
	Sodium	EPA SW 846-6010 (ICP)	EPA SW 846-6010 (ICP with EPA3050 digestion)
	Manganese	EPA SW 846-6010 (ICP)	INAA
	Vanadium	EPA SW 846-6010 (ICP)	INAA
Flyash/ Bottom Ash	Barium	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Beryllium	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Cadmium	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Chromium	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Cobalt	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Copper	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Manganese	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Mercury	EPA SW 846-7470 CVAA	EPA SW 846-7471 ICP-AES
	Molybdenum	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Nickel	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Phosphorus	EPA SW 846-6010 (ICP)	EPA SW 846-7060 ICP-AES
	Vanadium	EPA SW 846-6010 (ICP)	EPA SW 846-7060
	Calcium	EPA SW 846-6010 (ICP)	EPA SW 846-7060 (ICP with EPA3050 digestion)
	Sodium	EPA SW 846-6010 (ICP)	EPA SW 846-7471 (ICP with EPA3050 digestion)
	Fluoride	EPA 300.0(IC)	EPA 340.2 (ISE)
	Sulfate	EPA 300.0(IC)	ASTM D4239 & LECO SC-132

Table 12: Test Methods Different from EMP (TBD)

variables. The value presented represents only an approximation of the uncertainty as not all bias errors may be estimated. The uncertainty is also not a measure of long-term trace-species emissions for this boiler, but only the uncertainty for the specific test period. It was assumed that the samples are a normal population distribution. Table 13 summarizes the bias values used to determine uncertainties.

Location	Particle Collection [1]	Flowrate [2]	Fuel Flowrate [3]	Fly Ash Flowrate [4]	Bottom Ash Flow Rate [4]
Inlet	15%	0%	0%	15%	15%
Outlet	0%	0%	N/A	N/A	N/A

1. Bias based on difference between pitot and heat rate flowrates.
2. No bias estimated as measured inlet, measured outlet, and calculated flow agreed within +-5%
3. No bias estimated as calculated flue gas flow agreed with measured outlet flow.
4. Bias equals the inlet particle collection bias.

Table 13: Summary of Bias Values Used for Uncertainty Calculations

B. Treatment of Non-Detectable Measurements

Many of the target species for which a measurement was attempted were not found using the specified sampling and analytical techniques. If a measurement for a target species was not found, the value that could have been measured (i.e. the detection limit) if the trace emissions were present are reported. The "non-detects" are shown as less than the detection limit. The difficulty occurs when averaging various samples of which some or all of the measurements are below the detection limit. The following summarizes the two cases:

- **All values below detection limit:** The arithmetic average of the detection limit is shown with a "<" sign to indicate that the trace species is less than the reported average detection limit. For example, if a species was not found and the method provided a detection limit of 0.45, the values is reported as <0.45.

- **Some, but not all, values below detection limit:** The value of all measurements above the detection limit are averaged with one-half of the detection limit. For example, if three measurements of 10, 8, and <6 are found, the average would be (10+8+6/2)/3 or 7. Note that no "<" sign is used in these reported averages even though some of the values are below the detection limit. If the average calculated with this method is less than the greatest detection limit; the largest detection limit is reported and a "<" symbol is used. For example, if values of 6, <4, and <2 were reported, the average would be reported as <4 and not (6+4/2+2/2)/3 or 3.

C. Treatment of Blank Values

Three different types of blanks were used as part of the air toxics testing quality assurance (QA) program. The QA program included field blanks, reagent blanks, and laboratory preparation blanks.

Field blanks are samples obtained by assembling a complete sample train at the test site using the same procedures as when obtaining the actual sample. The sample train is then leak checked and disassembled to recover and analyze the sample. Field blanks are not used to "correct" the data generally but are used to provide an indication of the quality of the sample.

Reagent blanks consist of samples of the reagent and/or filters that are collected at the site. Analysis of these samples show if any of the results were caused by existing levels of the trace species in the material used to collect or recover the sample. If measurable values of the trace species are found, the data is usually corrected by subtracting the value measured in the reagent.

Laboratory reagent blanks consist of samples of the chemicals used during the measurement analysis. If measurable values of the trace species are found, the data is usually corrected by subtracting the value measured in the reagent. Any measurable values in the laboratory reagent may be caused by initial trace species in the chemicals or by the analytical procedures.

In the tables that follow the value of the field blank is shown for reference, but none of the data has been changed due to these measurements. If a measurement has a value near the field blank measurement, there may be some question as to the accuracy of the data and the reported value may NOT be source related. A separate column lists a blank correction percentage for all trace species that were corrected due to either a reagent or laboratory reagent blank. This is an average percentage calculated as follows:

$$\%blank\ correct = \frac{\sum\left(\frac{blank\ value}{sample\ value}\right)}{number\ of\ samples}\ \text{æ}\ 100$$

For example, if three samples contained 10, 5, and 4 mg/kg of a trace species and the reagent blank was 2 mg/kg, the blank correction would be:

$$blank\ correction = \left(\frac{2}{10} + \frac{2}{5} + \frac{2}{4}\right)\ \text{æ}\ \frac{100}{3} = 37\%$$

Thus, on average, the actual value measured was 37% higher than the value reported in the table. If the blank correction is reported as 0%, no blank correction was calculated and the reported value was the measured value. Note that in most cases a high blank correction value does not mean that the data is inaccurate. If a sample was contaminated with a trace species due to a filter, and the filter was analyzed and the data corrected, it is likely that the data is meaningful.

D. Gaseous Species Monitoring

This section reports the trace metal, acid-forming anion, and FFDC efficiency from the air toxics testing of the calcium-based DSI system. In addition, it reports the furan and dioxin data from the baseline tests.

Trace Metals

Table 14 lists the gaseous trace metal emissions for the calcium-based DSI test period. Although calcium and sodium are neither trace metals or air toxics, Table 14 also lists their results. At the FFDC inlet, all 15 trace metals, calcium, and sodium were reported above their detection limits.

Previous air toxics test series at Arapahoe reported a wide unexplained variation of barium, calcium, and sodium in various solid streams between different test methods. Curtis and Tompkins, the laboratory completing the analysis, investigated and discovered a problem with the ASTM D3683 ashing/acid digestion method of sample preparation. Coal samples were prepared according to ASTM D3683 and also EPA method 3050. The EPA method does not require ashing or digestion using HF acid. A comparison of the data with the two different digestion methods for both the calcium and sodium injection program compared to INAA is shown in Table 15. This data suggests that ASTM D3683 (that uses HF acid digestion) may have a significant low bias. The EPA 3050 method provides better precision between replicates and better accuracy when compared to INAA which does not require sample digestion.

Trace Metals	FFDC Inlet							FFDC Outlet						
	Test 1	Test 2	Test 3	Avg.	Uncert.	Field Blank	Blank Correct [1]	Test 1	Test 2	Test 3	Avg.	Uncert.	Field Blank	Blank Correct [1]
	$\mu g/Nm^3$				%	$\mu g/Nm^3$	%	$\mu g/Nm^3$				%	$\mu g/Nm^3$	%
Arsenic [3]	27	28	19	25	50	0.14	1.4L	0.070	0.24	<0.070	0.12	239	0.074	39L
Barium [2,3,6]	16	353	730	542	443	0.80	0.3R	1.7	1.7	0.14	1.2	190	0.14	50R
Beryllium	10	15	11	12	52	<0.035	0.0	<0.027	<0.027	<0.028	<0.027	29	<0.027	0.0
Cadmium	5.0	4.8	5.2	5.0	17	<0.089	0.0	<0.070	0.48	<0.070	0.18	349	<0.069	0.0
Chromium [3]	62	95	81	80	55	0.26	1.5R	0.14	0.14	0.68	0.32	244	0.14	75R
Cobalt	43	90	70	68	88	<0.35	0.0	<0.27	<0.27	<0.28	<0.27	29	<0.27	0.0
Copper	632	322	234	396	132	1.0	0.2R	0.70	0.53	0.33	0.52	89	0.12	47R
Lead	27	103	79	70	139	0.083	0.4R	0.29	1.1	0.05	0.48	288	0.079	42R
Manganese	146	125	140	137	25	0.18	0.2R	1.2	0.21	0.84	0.74	163	0.14	26R
Mercury	4.4	5.0	3.4	4.3	50	0.12	0.0	0.33	0.19	0.27	0.26	63	0.31	0.0
Molybdenum [3]	21	43	34	33	83	3.2	15.9R	0.27	0.27	0.28	0.27	4.2	0.27	79R
Nickel [3]	36	22	17	25	100	0.77	4.1R	0.27	0.27	0.28	0.27	4.2	0.27	42R
Selenium [4]	50	103	64	72	96	<0.89	0.0	<0.070	0.11	<0.070	<0.070	88	<0.069	0.0
Phosphorus	20,300	16,100	12,500	16,300	62	<8.9	0.02L	<1.4	<1.4	<1.4	<1.4	29	3.6	0.0
Vanadium	190	319	232	247	68	<0.18	0.0	<0.14	<0.14	<0.14	<0.14	29	<0.14	0.0
Calcium [2,5,6]	1,170	<90	1,960	1,560	320	8.9	2R	143	151	102	132	50	8.9	14R
Sodium [3,5,6]	4,920	2,570	2,380	3,290	108	8.9	2R	7.5	34	7.0	16	237	27	75R

Note: "<" indicates that the quantity measured was less than the detection limit thus the detection limit is shown

1. "R" indicates reagent blank correction. "L" indicates laboratory blank correction.
2. Tests Ba #1-Out and Ca #2-In not included in averages.
3. Subtracting reagent blank lowered result below the detection for Ar #1-Out; Ba #3-Out; Cr #1-, 2-Out; Mb #1-, 2-, 3-Out; Ni #1-, 2-, 3-Out; and Na 3-Out.
4. Average calculated by dividing non-detects in half was less than highest non-detect, so highest non-detect used for average.
5. Results included, even though neither trace metals nor air toxics.
6. Values for these metals at the FFDC inlet are reported but believed to be invalid due to a problem with sample preparation (see text).

Table 14: Trace Metal Emission Results for Calcium-Based DSI System

	Reagent	D3683 mg/Kg	E3050 mg/Kg	INAA mg/Kg
Barium	sodium	5,976	24,390	33,122
	calcium	6,670	17,447	28,925
Calcium	sodium	122,740	213,404	NP
	calcium	78,917	204,879	NP
Sodium	sodium	14,843	64,322	105,096
	calcium	31,849	27,423	46,099

Table 15: Comparison of Alternate Digestion Methods with INAA

EPA method 29, multi-metals method, also uses HF acid for digestion of solid matter collected in the sample train. Due to the potential negative bias that may be caused with HF acid, all data collected for barium, calcium, and sodium from the solid samples using Method 29 are believed invalid and are presented for information only. Table 16 compares the inlet fuel levels to the values measured at the FFDC inlet determined from the Method 29 test using HF digestion. Note the very large discrepancy in the inlet values. It is believed that the fuel values are more accurate and that the FFDC inlet values for the three elements presented are invalid. They are shown in this table only to note the large variation that was believed due to the HF digestion techniques. Note that the inlet values are based on a large amount of particulate matter that is present at the FFDC inlet. Due to the very low particulate at the FFDC outlet, the possible interference with HF digestion is not believed to significantly affect the outlet data. While the fly ash and coal samples could be re-analyzed after the discovery of the possible HF interference, it was not possible to re-analyze the Method 29 train.

	Fuel lb/10^{12} Btu	FFDC Inlet lb/10^{12} Btu	Percent Difference
barium	17,400	431	3,937%
calcium	205,000	1,240	16,432%
sodium	27,400	2,580	962%

Table 16: Comparison of fuel vs FFDC Inlet Measurements

Uncertainties for copper, lead, and nickel were 100% and greater. The wide spread between the replicate tests caused the high uncertainty for these three elements. A review of the data logs and sample methods did not reveal any errors that could explain the differences.

The FFDC outlet trace metal emissions were very low with many at or near their detection limit. The high uncertainty values are due mainly to a wide variation of replicate tests. Due to the very low measured emissions, the reagent or laboratory blank corrections were also relatively high for many elements.

Anions

Anions were measured from both the front (solid/liquid phase) and the back-half (gaseous phase) of each particulate train. As expected, the majority of all anions occur in the gaseous phase. Results of the testing are presented in Table 17.

At the FFDC inlet, the sample-train measured 465 ppm of gaseous sulfate and the CEM measured 460 ppm of SO_2. The gaseous fraction represents SO_2 plus any SO_3 in the vapor phase. The sample-train measured 3 ppm of solid-phase sulfate at the FFDC inlet, representing sulfuric acid mist and solid-phase sulfate present at the 250°F filter temperature. At the FFDC outlet, the sample-train measured 287 ppm of gaseous sulfate and the CEM measured 275 ppm of SO_2.

Acid Forming Anions		FFDC Inlet Test 1	Test 2	Test 3	Avg.	Uncert.	Field Blank	Blank Correct	FFDC Outlet Test 1	Test 2	Test 3	Avg.	Uncert.	Field Blank	Blank Correct
		ppmw				%	ppmw	%	ppmw				%	ppmw	%
Chlorine (Cl^-)	Total	0.59	0.75	0.64	0.66	36	N/A		0.25	0.32	0.30	0.29	33	N/A	
	Gaseous	0.56	0.72	0.61	0.63				0.24	0.30	0.29	0.28			
	Solid	0.035	0.034	0.031	0.033			0	<0.017	0.020	0.012	<0.017			0
Fluorine (F^-)	Total	8.5	11	11	10	38	N/A		0.12	0.58	<0.06	0.24	293	N/A	
	Gaseous	8.2	10	11	9.6				0.09	0.54	<0.06	0.22			
	Solid	0.23	0.50	0.35	0.36			0	0.034	0.039	0.019	0.031			0
Sulfate (SO_4^{-2})	Total	455	477	474	469	17	N/A		302	297	262	287	15	N/A	
	Gaseous	452	474	470	465				302	297	262	287			
	Solid	2.9	3.1	3.3	3.1			1R	0.068	0.015	0.019	0.034			32R

1. "<"indicates that the quantity measured was less than the detection limit thus the detection limit is shown.
2. "R" indicates reagent blank correction. "L" indicates laboratory blank correction.
3. Solid fraction consists of filter and front-half rinse.
4. Gaseous fraction consists of bicarbonate/carbonate and 3% peroxide rinses.

Table 17: Acid-Forming Anion Emission Results for Calcium-Based DSI System

Baseline Dioxin and Furan Emissions

Table 18 lists the gaseous polychlorinated dibenzo-P-dioxin (PCDD) and polychlorinated dibenzofuran (PCDF) emissions at the FFDC inlet and outlet. Note that sampling and analysis techniques were optimized to lower detection limits to an average 10 times lower than that of normal dioxin and furan tests.

All dioxins and furans were measured near or below their detection limits. At the FFDC outlet, OCDD and 23478 PeCDF were the only individual isomers detected in all three samples. However, these isomers were also detected in the field blank, so their detected levels may not be entirely source related.

In Table 18, the column headed by "EPA Equiv." lists the EPA toxic equivalent for each specie. These values can be used for comparing risk and are used in the establishment of emission limits for municipal solid waste (MSW) incinerators. These equivalent values were calculated by multiplying the average actual emission of a specie by its EPA risk factor.

The total emissions of EPA equivalent toxics at the FFDC inlet was 0.0015 ng/Nm^3 and consisted of 0.0008 ng/Nm^3 of detected species and 0.0007 ng/Nm^3 of nondetects. Thus, 47% of the total EPA equivalent at the inlet of the FFDC was due to nondetects. The total emissions of EPA equivalent toxics at the FFDC outlet was 0.0014 ng/Nm^3 and consisted of 0.0003 ng/Nm^3 of detected species and 0.0012 ng/Nm^3 of nondetects. Thus, the nondetects at the outlet relate to 86% of the total EPA equivalent toxics. For comparison, well controlled MSW incinerators typically have on the order of 1 ng/Nm^3 of equivalent toxic emissions, three orders of magnitude higher than Arapahoe Unit 4.

PCDD/PCDF	FFDC Inlet							FFDC Outlet						
	Test 1	Test 2	Test 3	Avg.	Uncert.	Field Blank	EPA Equiv.	Test 1	Test 2	Test 3	Avg.	Uncert.	Field Blank	EPA Equiv.
	ng/Nm^3				%	ng/Nm^3		ng/Nm^3				%	ng/Nm^3	
2378-TCDD [1,2]	<0.0006	0.0006	0.0006	0.0005	95	<0.0006	0.0005	0.0006	<0.0004	<0.0005	<0.0005	74	<0.0005	0.0005
12378 PeCDD [1]	<0.0006	0.0002	<0.0004	<0.0006	78	<0.0006	0.0003	<0.0007	<0.0005	<0.0005	<0.0005	48	<0.0005	0.0003
123478 HxCDD [2]	<0.0007	0.0007	0.0007	0.0006	88	<0.0008	0.0001	0.0007	<0.0007	0.0006	0.0006	90	<0.0012	0.0001
123678 HxCDD [1]	<0.0004	0.0002	<0.0003	<0.0004	48	<0.0005	0.0000	<0.0004	<0.0004	<0.0002	<0.0003	83	<0.0007	0.0000
123789 HxCDD	<0.0006	<0.0002	<0.0004	<0.0004	108	<0.0007	0.0000	<0.0006	<0.0006	<0.0003	<0.0005	88	<0.0010	0.0000
1234678 HpCDD [1,2]	<0.0008	0.0004	0.0004	0.0004	43	<0.0008	0.0000	0.0010	<0.0006	<0.0004	<0.0006	136	<0.0005	0.0000
OCDD	<0.0011	0.0037	0.0020	0.0021	191	0.0036	0.0000	0.0042	0.0012	0.0008	0.0021	225	0.0010	0.0000
2378 TCDF	<0.0020	<0.0011	<0.0013	<0.0014	91	<0.0018	0.0001	<0.0022	<0.0018	<0.0018	<0.0020	36	<0.0011	0.0002
12378 PeCDF [1]	<0.0005	<0.0002	0.0002	<0.0005	92	<0.0005	0.0000	<0.0004	<0.0002	<0.0001	<0.0002	127	<0.0003	0.0000
23478 PeCDF	0.0005	0.0004	0.0004	0.0004	42	<0.0005	0.0002	0.0005	0.0004	0.0004	0.0004	62	0.0004	0.0002
123478 HxCDF [1]	<0.0006	<0.0002	<0.0004	<0.0004	126	<0.0004	0.0000	0.0004	<0.0004	<0.0002	<0.0004	75	<0.0004	0.0000
123678 HxCDF	<0.0004	<0.0002	<0.0003	<0.0003	89	<0.0002	0.0000	<0.0003	<0.0003	<0.0001	<0.0002	104	<0.0004	0.0000
234678 HxCDF	<0.0007	<0.0003	<0.0004	<0.0005	101	<0.0004	0.0000	<0.0004	<0.0004	<0.0002	<0.0003	96	<0.0004	0.0000
123789 HxCDF	<0.0007	<0.0004	<0.0004	<0.0005	107	<0.0004	0.0001	<0.0004	<0.0005	<0.0002	<0.0004	95	<0.0005	0.0000
1234678 HpCDF	<0.0004	<0.0003	<0.0003	<0.0004	45	<0.0007	0.0000	<0.0005	<0.0003	<0.0002	<0.0004	106	<0.0004	0.0000
1234789 HpCDF	<0.0006	<0.0005	<0.0005	<0.0005	44	<0.0010	0.0000	<0.0008	<0.0005	<0.0004	<0.0005	103	<0.0006	0.0000
OCDF	<0.0006	<0.0004	<0.0006	<0.0005	51	<0.0010	0.0000	<0.0006	<0.0008	<0.0005	<0.0006	67	<0.0006	0.0000
Total TCDD [1,2]	<0.0006	0.0006	0.0006	0.0005	95	<0.0006	--	0.0006	<0.0004	<0.0005	<0.0005	74	<0.0005	--
Total PeCDD [1]	<0.0006	0.0002	<0.0005	<0.0006	79	<0.0006	--	<0.0007	<0.0005	<0.0005	<0.0006	50	<0.0005	--
Total HxCDD	<0.0005	0.0008	0.0005	0.0005	132	<0.0006	--	0.0009	<0.0005	0.0004	0.0005	167	<0.0009	--
Total HpCDD [1,2]	<0.0008	0.0004	0.0004	0.0004	43	<0.0008	--	0.0010	<0.0006	<0.0005	<0.0006	119	<0.0005	--
Total TCDF	0.0019	0.0023	0.0028	0.0023	41	0.0019	--	0.0019	0.0016	0.0015	0.0017	26	0.0014	--
Total PeCDF	0.0011	0.0007	0.0014	0.0011	80	<0.0005	--	0.0011	0.0007	0.0007	0.0008	68	0.0004	--
Total HxCDF [1]	<0.0006	0.0003	<0.0004	<0.0006	69	<0.0006	--	0.0004	<0.0004	<0.0004	<0.0004	28	<0.0004	--
Total HpCDF	<0.0005	<0.0004	<0.0004	<0.0004	41	<0.0008	--	<0.0006	<0.0004	<0.0004	<0.0005	73	<0.0005	--
Total	0.0119	0.0144	0.0137	0.0133	27	--	0.0015 [3]	0.0185	0.0104	0.0093	0.0127	100	--	0.0014 [3]

"<"indicates detection limit and that species was not detected.

1. By convention, the calculated mean cannot be smaller than the largest detection limit value. When this happens, the mean is reported as not detected below highest detection limit.
2. Detection limits varied by sample, a straight average with non-detects divided by two was taken, highest non-detect rule was deemed inappropriate.
3. Total EPA toxic equivalent (2, 3, 7, 8, TCDD Equivalent)

Table 18: Baseline Polychlorinated Dibenzo-P-Dioxin (PCDD) and Polychlorinated Dibenzofuran (PCDF) Emissions

FFDC Efficiency

Table 19 shows the FFDC removal efficiency for trace metals, anions, calcium, and sodium. The FFDC did not affect flue gas concentrations of PCDDs or PCDFs. The FFDC averaged 98.6% removal efficiency for trace metals and 99.95% for particulates.

The FFDC's removal efficiency for mercury was 93.7%, significantly higher than was obtained in previous testing without calcium injection with humidification. Fly ash unburned carbon during this testing averaged 11.21%. Water was also injected into the flue gas to improve calcium utilization. The water injection cooled the flue gas to approximately 150°F. It is believed that the combination of low flue gas temperature and high unburned carbon in the fly ash allowed the higher than expected mercury removal.

As was discussed in the trace metals section, sodium, calcium, and barium are believed to be severely biased low. Thus the data for these three elements is presented for informational purposes but the relative numbers are considered invalid.

The combination of the FFDC with calcium injection with humidification obtained significant removal of the acid-forming anions. Removal of both chloride and fluoride were 55.1% and 97.5% respectively. The removals are comparable to previous testing with urea injection but are significantly higher than the original baseline which were 10% for chloride and 20% for fluorides. SO_2 removal during the test was approximately 37% due to the calcium and humidification system.

Species		Inlet	Outlet	FFDC Removal
Trace Metals		$lb/10^{12}$ Btu	$lb/10^{12}$ Btu	%
Arsenic		20	0.09	99.5
Barium [2]		431	0.94	99.8
Beryllium		9.5	<0.02	>99.8
Cadmium		3.9	0.15	96.2
Chromium		63	0.26	99.6
Cobalt		53	<0.22	>99.6
Copper		310	0.42	99.9
Lead		55	0.38	99.3
Manganese		108	0.59	99.4
Mercury		3.4	0.21	93.7
Molybdenum		26	0.22	99.1
Nickel		19	0.22	98.9
Selenium		57	<0.06	>99.9
Phosphorus		12,800	<1.1	>99.99
Vanadium		194	<0.11	>99.9
Calcium [1,2]		1,240	106	91.4
Sodium [1,2]		2,580	13	99.5
Average		--	--	**98.6**
Total Particulate		4.27 lb/MMBtu	0.0021 lb/MMBtu	99.95%
Acid-Forming Anions		$lb/10^{12}$ Btu	$lb/10^{12}$ Btu	%
Chloride (Cl)	Solid	41	<21	>48.9
	Gas	784	353	54.9
	Total	825	371	55.1
Fluoride (F)	Solid	241	21	91.3
	Gas	6,460	150	97.7
	Total	6,700	167	97.5
Sulfate	Solid	10,600	115	98.9
	Gas	$1.57(10^6)$	$9.89(10^5)$	37.1
	Total	$1.58(10^6)$	$9.90(10^5)$	37.5

NOTES:

"<" indicates that the quantity measured was less than the detection limit; thus the detection limit is shown.

">" indicates that the percentage removal is based on a detection limit so the expected minimum removal rate.

1. Included even though neither trace metals or air toxics.
2. Values for these metals are reported but are believed invalid due to a problem with sample preparation. (see text)

Table 19: FFDC Removal Efficiency (Calcium-Based DSI Test Period)

E. Solids Stream Monitoring

Calcium-Based Sorbent Analysis

Table 20 lists the trace metal and anion analysis results for the calcium-based sorbent (calcium hydroxide) and humidification water. Although calcium and sodium are neither trace metals nor air toxics, Table 20 also lists them.

The humidification water contained negligible amounts of trace metals but significant amounts of calcium, sodium, and acid-forming anions. The total mass input of air toxics due to the sorbent and water added to the process was insignificant in comparison to the amounts in the coal. Notable exceptions were molybdenum and chloride. The sorbent water contained 41% of the total mass input of molybdenum and 46% of the input chlorides. Other air toxics that were input due to the sorbent and water were much lower and ranged from 0 to 10% of those input from other sources on a mass basis.

Element	Calcium Sorbent		Sorbent H_2O
	Test 22	Blank Correct	
	mg/kg	%	µg/L
Arsenic	<1.2	0	<5.0
Barium	9.0	0	34
Beryllium	<0.49	0	<2.0
Cadmium	<1.2	0	<5.0
Chromium [1]	5.1	0	<10
Cobalt	<4.9	0	<20
Copper	5.3	0	<5.0
Lead	<0.73	0	<3.0
Manganese [1]	45	22.4	<10
Mercury	<0.091	0	<0.20
Molybdenum	6.2	0	25
Nickel [1]	5.3	0	<20
Selenium	<61	0	<250
Phosphorous	195	0	<100
Vanadium	7.9	0	<10
Calcium	NP	0	27,000
Sodium	NP	0	17,000
Chloride	<5.0	0	22,973
Fluoride	34	0	960
Sulfate	170	0	104,350

1. Prep blank levels were higher than the sample values, so the samples were not blank corrected.

Table 20: AirToxics Analysis of Hydrated Lime

Coal Analysis

Previous air toxics testing at Arapahoe has shown the importance of obtaining representative solid samples. This is a difficult task due to the scale and current equipment. Coal sample procedures were modified and the ASTM D2234 collection method was followed more closely during the sodium- and calcium-based DSI test periods than during the low-NO_x combustion and SNCR test periods. In addition, the ASTM D2013 preparation method was followed during the sodium- and calcium-based DSI test periods. For barium, lead, calcium, and sodium, EPA Method 3050 was used for coal digestion instead of ASTM D3683.

For many trace metal data points, there were two or three sets of results. On average, there were three sets of data with some having as many as six sets. For example, one point had results from:

- Curtis & Tompkins analysis using conventional digestion.
- Curtis & Tompkins analysis using EPA 3050 digestion.
- Standard Laboratory's analysis.
- Curtis & Tompkins triplicate analysis using conventional digestion.
- Curtis & Tompkins triplicate analysis using EPA 3050 digestion.
- INAA.

Except for a few cases, the results from these different sources did not agree. Ideally, if the data for one element from one set was consistent with expected levels and other process streams, then the data for elements within the same data set processed by the same lab and method would also be consistent. Unfortunately, a common bias for a data set could not be found. Therefore, the use of a particular data set depended solely on its agreement with levels determined in other input and output streams from the same test program.

For the low-NO_x combustion and SNCR test periods, INAA was selected as the analytical technique most likely to produce representative data sets for arsenic, barium, mercury, selenium, and chloride because INAA:

- Could achieve lower detection limits for arsenic, mercury, selenium, and chloride.
- Results for barium agreed with USGS and Cyprus Yampa Valley coal data. ICP-AES results were biased low.

Since INAA is not a proven analytical technique for trace metal analysis of coal, it was not chosen to analyze an element unless there was a clear technical justification to discard the conventional data.

For the coal samples from the sodium- and calcium-based DSI test periods, INAA was the only technique used to analyze arsenic, mercury, selenium, and chloride. With the use of EPA 3050 digestion technique for barium, the ICP-AES analysis results for barium are no longer severely biased and are now consistent with expected levels. For sodium-based DSI test, the conventional analytical results for cadmium, chromium, manganese, and vanadium were considered as qualitative and discarded.

Table 21 lists the analysis of the coal for trace metals and acid-forming anions. Although calcium and sodium are neither trace metals nor air toxics, Table 21 also lists them. All trace metals were detected in each replicate. Most elements show relatively good precision (uncertainty less than 100%). A single high nickel reading caused uncertainty of 120%. While high the nickel readings are in the range expected for this coal.

Trace Metals	Base Test Method						INAA					
	Test 1	Test 2	Test 3	Avg.	Uncert.	Blank Correct	Test 1	Test 2	Test 3	Avg.	Uncert.	Blank Correct
	mg/kg				%		mg/kg				%	
Arsenic [2]	NP	NP	NP	NP	NP	0	0.54	0.48	0.51	0.51	14	0
Barium [1]	30	173	174	192	42	0	285	347	325	319	25	0
Beryllium	0.37	0.28	0.41	0.35	46	0						
Cadmium [2,3]	0.12	<0.10	<0.12	<0.11	--	0	0.05	0.08	0.047	0.048	86	0
Chromium	2.6	1.9	2.9	2.5	52	0	1.7	1.6	2.1	1.8	39	0
Cobalt	1.3	0.8	1.0	1.0	60	0	0.81	0.91	0.82	0.85	17	0
Copper	5.2	3.4	4.5	4.4	53	0						
Lead [1]	3.4	3.1	3.8	3.4	24	0						
Manganese	14	11	23	16	104	0	6.7	7.8	8.4	7.6	28	
Mercury [2]	NP	NP	NP	NP	NP	0	0.024	0.035	0.030	0.030	46	0
Molybdenum	0.52	0.32	0.42	0.42	60	0	0.9	0.8	0.9	0.9	14	0
Nickel	2.4	0.9	1.4	1.6	120	0						
Selenium [2]	NP	NP	NP	NP	NP	0	1.29	1.37	1.14	1.27	22	0
Phosphorus	450	338	376	388	37	0						
Vanadium	7.5	4.5	6.7	6.2	63	0	5.9	4.7	7.2	5.9	51	
Calcium [1,4]	2,390	2,280	2,110	2,260	16	0						
Sodium [1,4]	432	265	211	302	95	0	496	475	554	508	20	0
Anions	mg/kg				%		mg/kg				%	
Chloride (Cl⁻)[2]	--	--	--	--	--	0	13	25	19	19	78	0
Fluorine (F⁻)	80	70	70	73	20	0						
Sulfate	17,400	18,000	17,100	17,500	16	0						

"<" indicates that the quantity measured was less than the detection limit thus the detection limit is shown.

"NP" indicates not performed.

All values are reported on an as-received basis for the coal.

1. Analysis performed after an EPA 3050 digestion (acid only).
2. INAA results were used for these trace species rather than the base method.
3. Cadmium average less than highest nondetect and reported as such.
4. Included even though neither are trace metals or air toxics.

Table 21: Trace Metals Analysis of Coal

Fly Ash

Table 22 lists the results for the fly ash and bottom ash from the calcium-based DSI test period. Although calcium and sodium are neither trace metals nor air toxics, Table 22 also lists them. Cadmium is the only element reported below its detection limit. The results for barium, calcium, and sodium from Test-1 were not used in the average. The combination of EPA 3050 digestion and ICP-AES analysis is used only for these three elements, therefore a problem with the digestion or ICP analysis may have affected these results. The conventional digestion of the sodium sample for Test-1 also yielded a value an order of magnitude higher than the other samples. This suggests that EPA 3050 digestion failed to dissolve the entire samples of barium and calcium and that the sodium sample was contaminated. Test-3 for sodium appears to be negatively biased when compared with output stream levels.

Matrix effects and certain digestion techniques make the analysis of selenium very difficult. Selenium is by far the most problematic of potential air toxics elements to analyze. With the discovery that hydrofluoric (HF) acid was interfering with GFAA, ash samples were re-analyzed using EPA 3050 digestion. This method eliminated the need for diluting the ash samples to minimize interference as well as most of the questionable results and high detection limits. However, the ash results for selenium obtained with EPA 3050 digestion from the sodium- and calcium-based DSI test periods are not consistent with expected levels. Despite high detection limits and poor precision, the conventional ash results for selenium agree, on average, with expected values and are used in the mass balance.

Bottom Ash

Overall, sample preparation does not appear to have biased the results of the bottom ash. The average results for arsenic, cadmium, mercury, and molybdenum were below the detection limit. Except for selenium and sodium, the replicates show good agreement. As with the fly ash, the conventional digestion methods used to analyze selenium often produce spurious data points. Also, since bottom ash levels of sulfate contribute less than 1% of the total sulfate stream, the spread in the sulfate results is considered negligible.

	Bottom Ash/Sluice Water [7]						Fly Ash					
	Test 1	Test 2	Test 3	Avg.	Uncert.	Blank Correct	Test 1	Test 2	Test 3	Avg.	Uncert.	Blank Correct
Trace Metals	mg/kg				%		mg/kg				%	
Arsenic	<1.2	<1.3	<1.2	<1.2	40	0	5.9	3.7	3.3	4.3	84	0
Barium [1]	900	1,100	1,000	1,000	29	0	580	1,100	990	1,045	31	0
Beryllium	3.9	3.6	3.8	3.8	27	0	3.7	2.9	2.7	3.1	37	0
Cadmium [4]	<1.1	<1.1	<1.1	<1.1	40	0	<1.1	<1.3	<1.4	<1.3	41	0
Chromium	23	20	23	22	27	0	27	20	20	22	50	0
Cobalt	15	14	16	15	29	0	16	14	13	14	27	0
Copper [5]	120	47	49	72	91	0	42	47	43	44	20	0
Lead	23	22	21	22	28	0	45	29	30	35	68	0
Manganese	100	83	180	121	111	0	150	96	100	115	68	0
Mercury	<0.020	<0.020	<0.020	<0.020	44	0	0.15	0.32	0.27	0.25	91	0
Molybdenum [4]	4.5	<4.3	<3.9	<4.3	37	0	4.6	7.8	7.5	6.6	70	0
Nickel	15	13	19	16	44	0	17	16	10	14	69	0
Selenium [3]	<11	23	<9.7	11	233	0	18	<13	7.8	11	148	0
Phosphorus	5,100	5,900	5,900	5,630	27	0	3,900	4,600	4,300	4,270	22	0
Vanadium	49	50	54	51	28	0	57	46	45	49	31	0
Calcium [1,6]	19,700	23,700	21,400	21,600	28		22,000	160,000	150,000	155,500	26	
Sodium [1,6]	1,320	1,370	1,310	1,340	33		63,000	2,600	1,700	2,150	27	
Acid-Forming Anions	mg/kg				%		mg/kg				%	
Chloride as Cl^-	240	262	214	238	29	0	120	82	72	91	72	0
Fluoride as F^- [(2)]	6.9	6.2	5.1	6.1	34	0	1,100	73	72	1,100	N/A	0
Sulfate	186	260	1,680	710	297	0	66,500	49,400	59,900	58,600	33	0

"<"indicates that the quantity measured was less than the detection limit; thus the detection limit is shown.

1. Replicates for #1-Fly Ash for Ba, Ca, and S not used in average, since not consistent with expected values.
2. Fl results for #2- and #3-Fly Ash not used in average because of incomplete water extraction.
3. Since detection limits varied by sample, highest non-detect not used for average.
4. Highest non-detect used for bottom ash average.
5. #1-Bottom Ash was higher than fuel input and not used in average.
6. Included even though neither are trace metals nor air toxics.
7. Trace metals results from bottom ash solid fraction only. For anions, Ca, and Na, solid and liquid fractions analyzed separately and combined proportionately by weight after sluice water blank corrections

Table 22: Air Toxics Analysis of Ash for Calcium-Based DSI

F. Mass Balance Results

Mass balances are an important quality check on toxics emissions data. Using different sample and analytical techniques to measure toxics in both gaseous and solid forms is difficult. Mass balances provide a quick means for determining how well various analytical methods agree. The low absolute quantities of the measured materials, however, makes the occurrence of a 100% mass balance very unlikely.

There are three major sources of potential error in the mass balance: operating conditions, analytical difficulties, and sample collection and handling. Since Arapahoe Unit 4 operated at or near steady-state conditions and the daily tests show that the same coal was fired throughout the tests, operating conditions are not likely to contribute any significant sources of error. Analytical difficulties usually only affect the results of individual replicates or species, so they are considered with each species. Normally, analytical difficulties outweigh sampling problems. On a utility coal-fired unit, however, obtaining representative samples from process streams flowing at thousands of pounds per hour adds a major source of potential error. It should also be noted that uncertainties only represent consistency, not accuracy.

In addition, recent findings from other Department of Energy (DOE) sponsored programs indicate that the sample digestion methods of EPA Method 29 are not effective for large quantities of ash and introduce a 20 to 60% negative bias. The difficulty of finding a correct digestion method and the need for different digestion methods for different elements casts doubt on the validity of the sample preparation procedures of both EPA Method 29 and the ASTM methods which use only one digestion method for all elements.

Only compounds dependent on the fuel inputs can be balanced. Since semi-volatile organic compounds depend on combustion parameters, they cannot be balanced. The boiler/FFDC mass balance uses the coal and calcium-based sorbent as its inputs and the bottom ash, fly ash, and FFDC outlet as its outputs. The boiler mass balance uses the coal for its only input and the FFDC inlet and the bottom ash as its outputs. For the sorbent results, nondetects are treated as zeroes if the detection limit is greater than 25% of the fuel input (selenium, for instance) or if the element is not expected to exist in the sorbent (arsenic and mercury, for example).

Table 23 shows the mass balance results for the calcium-based DSI test period. Based on fuel-input and fly ash levels, the FFDC results for mercury appear to be positively biased. For the boiler/FFDC balance, most species were in the range of 69 to 130%, except for barium, cobalt, and phosphorous. The following may have affected the results for these elements:

- Since the fuel input for barium is considered accurate, the barium levels in the ash are considered negatively biased by 30 to 40%.
- The fuel input for cobalt appears to be biased low.
- Since previous tests produced good closure for phosphorous, the phosphorous levels in the sorbent may be biased low. The phosphorous levels in the bottom ash, however, are higher than those in previous tests, so these values may also be causing the poor closure results.

Species	Inputs		Intermediate	Outputs			Mass Balance	
	Fuel	DSI[1] (Calcium)	FFDC Inlet	Bottom Ash	Fly Ash	FFDC Outlet	Boiler/ FFDC[2]	Boiler[2]
Trace Metals	$lb/10^{12}$ Btu		$lb/10^{12}$ Btu	$lb/10^{12}$ Btu			%	
Arsenic[3]	47	<3.4	20	<4.4	30	0.093	75	52
Barium	17,400	26	NV	3,580	7,300	0.94	62	--
Beryllium	32	<1.4	9.5	13	22	<0.022	105	72
Cadmium[3]	5.4	<3.4	3.9	<3.9	<8.8	0.15	--	72
Chromium	224	14	63	79	157	0.26	99	63
Cobalt	93	<14	53	54	101	<0.22	144	115
Copper	396	14	310	172	308	0.42	117	122
Lead	310	<2.1	55	79	244	0.38	104	43
Manganese	1,450	123	108	448	812	0.59	80	38
Mercury[3]	2.7	<0.25	3.4	<0.072	1.7	0.21	74	128
Molybdenum	38	18	26	<15	46	0.22	110	108
Nickel	141	15	19	57	102	0.22	102	54
Selenium[3]	115	<174	57	38	77	<0.057	100	83
Phosphorus	35,200	532	12,800	20,300	29,800	<1.1	140	94
Vanadium	565	22	194	183	346	<0.11	90	67
Average Metals							**100**	**79**
Calcium[4]	205,000	$1.47(10^6)$	NV	77,300	$1.08(10^6)$	106	69	--
Sodium	27,400	522	NV	4,780	15,000	13	71	--
Acid-Forming Anions	$lb/10^{12}$ Btu		$lb/10^{12}$ Btu	$lb/10^{12}$ Btu			%	
Chloride (Cl^-)[3]	1,720	712	825	848	645	371	77	98
Fluoride (F^-)	6,650	122	6,700	21	7,680	167	116	101
Sulfate	$1.59(10^6)$	3,670	$1.58(10^6)$	2,790	410,000	990,000	88	100
Average Anions							**94**	**100**

"<" indicates that the quantity measured was less than the detection limit; thus the detection limit is shown.

"NP" indicates not performed, "NV" indicates not valid.

1. Sorbent input stream includes trace metal and anion levels in both the calcium sorbent and the sorbent water.
2. Boiler/FFDC mass balance calculated using: (outlet + fly ash + bottom ash)/(fuel + sorbent). Boiler mass balance calculated using: (inlet + bottom ash)/fuel.
3. Fuel concentrations from INAA.
4. Calcium sorbent flow rate as {(weight% of Ca) * (Ca flow rate) * (10^6)} + (sorbent H_2O flow rate).

Table 23: Mass Balance Results for Calcium-Based DSI Test Period

G. Summary of Test Results

Table 24 summarizes the fuel input, FFDC inlet, and FFDC outlet results for each of the test periods. Yampa coal was fired at Arapahoe Unit 4 for low-NO_x combustion, SNCR, and sodium-based DSI test periods. For the calcium-based DSI test period, Edna coal was fired at Arapahoe Unit 4. It is not clear whether the significantly higher values for many trace metals in the coal tested during the sodium- and calcium-based DSI test periods is due to more representative techniques or the coal matrix. The higher levels in the FFDC of these trace metals, however, indicates that changes in the coal matrix caused the higher levels in the fuel input.

The increase of the trace metal levels in the FFDC inlet are consistent with the fuel input levels. However, if the FFDC inlet is considered as a point of uncontrolled emissions, the emissions levels are consistently in the same range.

Improved FFDC removal efficiency with sorbent injection may account for the lower levels of chromium, copper, manganese, nickel, and vanadium in the sodium- and calcium-based DSI test periods. Both sodium and calcium injection before the FFDC significantly reduced the FFDC outlet levels of phosphorous, chloride, fluoride, and sulfate. The lower levels of arsenic, mercury, and selenium suggest that calcium injection removes these elements more effectively than sodium injection.

Parameter	Fuel Input				FFDC Inlet				FFDC Outlet			
	Low-NO_x Combustion	SNCR	DSI (Sodium)	DSI (Calcium)	Low-NO_x Combustion	SNCR	DSI (Sodium)	DSI (Calcium	Low-NO_x Combustion	SNCR	DSI (Sodium)	DSI (Calcium)
	lb/10^{12} Btu				lb/10^{12} Btu				lb/10^{12} Btu			
Arsenic	43	56	62	47	23	13	30	20	0.75	0.15	0.47	0.093
Barium	37,600	29,700	24,400	17,400	234	192	189	431	1.1	1.1	2.5	0.94
Beryllium	20	48	34	32	9.0	7.5	9.0	9.5	<0.021	<0.023	<0.023	<0.022
Cadmium	<4.5	<5.3	3.5	5.4	2.3	2.0	3.6	3.9	0.12	<0.066	<0.058	0.15
Chromium	97	125	272	224	50	51	135	63	0.66	0.30	0.15	0.26
Cobalt	84	114	122	93	30	26	43	53	<0.21	<0.23	<0.23	<0.22
Copper	241	324	568	396	169	206	245	310	1.1	1.3	0.59	0.42
Lead	185	195	358	310	64	46	80	55	0.44	0.40	0.36	0.38
Manganese	379	458	2,340	1,450	195	88	113	108	1.0	0.89	0.29	0.59
Mercury	1.9	1.7	4.6	2.7	1.3	1.9	1.2	3.4	<0.29	0.41	0.41	0.21
Molybdenum	9.0	44	45	38	10	12	32	26	0.17	0.27	0.23	0.22
Nickel	53.5	88	175	141	30	29	62	19	1.5	0.45	0.23	0.22
Selenium	73	127	47	115	22	12	<66	57	0.36	<0.064	0.36	<0.057
Phosphorous	36,700	27,700	48,500	35,200	14,300	9,300	11,600	12,800	6.7	4.6	1.5	<1.1
Vanadium	266	379	779	565	135	120	178	194	0.24	0.29	0.13	<0.11
Calcium	NP	185,000	213,000	205,000	NP	880	192	1,240	NP	29	33	106
Sodium	NP	29,300	64,300	27,400	NP	2,700	1,750	2,580	NP	367	112	13
Chloride	2,000	1,400	1,370	1,720	795	1,010	864	825	626	719	811	371
Fluoride	7,600	7,400	9,140	6,650	4,780	5,780	7,670	6,700	4,290	4,810	1140	167
Sulfate	$1.18(10^6)$	$1.15(10^6)$	$1.17(10^6)$	$1.59(10^6)$	$10.6(10^6)$	$9.88(10^5)$	$1.14(10^6)$	$1.58(10^6)$	$9.83(10^5)$	$1.17(10^6)$	$3.69(10^5)$	$9.9(10^5)$
Cyanide	N/A	N/A	N/A	N/A	<8	<12	NP	NP	<7	<9	NP	NP
Ammonia	N/A	N/A	N/A	N/A	<100	12,000	NP	NP	N/A	7,000	NP	NP.

"<"indicates that the quantity measured was less than the detection limit thus the detection limit is shown.
"NP" indicates test not performed.

Table 24: Summary of Fuel Input, FFDC Inlet, and FFDC Outlet Levels

Table 25 compares the trace metal levels in the output streams as a percentage of the fuel input. A larger distribution of the trace metals in the bottom ash improved the mass balances for the sodium- and calcium-based DSI test periods. The bottom ash levels for the SNCR test period appear negatively biased by 15% of fuel input. For the low-NO_x combustion test period, the bottom ash levels appear negatively biased by 20% of fuel input and the fly ash levels appear negatively biased by 15% of fuel input. The use of the same collection methods for all four test periods suggests that the closer adherence to ASTM preparation methods during the sodium- and calcium-based DSI test periods improved the trace metal results. Also, the use of more representative sampling techniques for fly ash during these test periods appears to have reduced the occurrence of poor trace metal results seen during the low-NO_x combustion test period.

Test Period	Output Stream (% of Fuel Input[1])			Total (% Closure)
	Bottom Ash	Fly Ash	FFDC Outlet	
Low-NO_x Combustion[2]	9	53	2	64
SNCR	14	67	2	83
DSI (Sodium)	28	63	1	92
DSI (Calcium)	31	68	1	100

1. Fuel input for sodium- and calcium-based DSI test periods include the sorbent injection streams.
2. The fuel result for molybdenum appears to be severely biased low. The percentages for the low-NO_x combustion test period are based on an average of the molybdenum levels in the fuels from the SNCR and sodium-based DSI test periods.

Table 25: Distribution of Trace Metals Across Output Streams

INTEGRATED DRY NO_x/SO_2 EMISSIONS CONTROL SYSTEM

ENVIRONMENTAL MONITORING REPORT

Calcium-Based Dry Sorbent Injection System Test Period:
April 30, 1993 through November 2, 1993

Calcium DSI Air Toxics Test October 19-20, 1993
Dioxins/Furans Air Toxics Test October 11-13, 1993

Appendix A: State Emission Reports

Opacity Compliance Calculation

Table 26 summarizes the number of 6-minute opacity exceedances reported to the CDH during the testing period. These data are from the compliance reports sent to the CDH that follow.

There were a total of 31 exceedances for a total of 186 minutes above 20% opacity. The calculation used to compute the Arapahoe 4's compliance with the 20% opacity limit is shown below.

Month	Number of Violations
April 30	0
May	5
June	2
July	0
August	5
September	14
October 1-20	5
Total	31

Table 26: Summary of Opacity Violations

$$\%compliance = 100 - \left(\frac{compliance\ time}{operation\ time} \times 100 \right)$$

$$= 100 - \left(\frac{186\ \text{min} \times \frac{1\ h}{60\ \text{min}}}{2{,}108.3\ h - \left(28\ days \times \frac{24\ h}{day}\right) - \left(1\ day \times \frac{23\ h}{day}\right) + 1{,}979\ h + \left(20\ days \times \frac{24\ h}{day}\right)} \times 100 \right)$$

$$= 100 - 0.08005$$

$$= 99.92\%$$

Public Service®

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

July 29, 1993

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

RE: Second Quarter, 1993 Excess Emissions Report, Arapahoe Units #1-4

Dear Roy:

Attached is the excess emissions report for the second quarter, 1993, for the Public Service Company of Colorado Arapahoe Steam Electric Generating Station, Units #1-4.

Dates not reported on the attached emissions report are those in which the units were not running. The operating hours for Units #1-4 during the quarter were: Unit #1 - 1,498.8 hours, Unit #2 - 1,508.9 hours, Unit #3 - 1,405.5 hours and Unit #4 - 2,108.3 hours.

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

Sincerely,

Peter J. Cohlmia

Peter J. Cohlmia
Chief Environmental Scientist

PJC:tc

Attachments

QUARTERLY EXCESS EMISSIONS REPORT (EER)

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 ending:

March 31 (June 30) September 30 December 31

b. Reporting year: 1993

c. Reporting date: 07/14/93

d. Person completing report: Mark Spomer

e. Station name: Arapahoe Station

f. Plant location: 2601 South Platte River Drive

g. Person responsible for review and integrity of report: Peter J. Cohlmia

h. Mailing address for person in 1-g above:

P. O. Box 840, Denver, Colorado 80201

i. Phone number for 1-g above: 294-2810

Part 2 - Instrument information, complete for each instrument.

a.	Opacity Monitor:	Unit 1	Unit 2	Unit 3	Unit 4
b.	Manufacture:	Lear Siegler	L.S.	L.S.	L.S.
c.	Model No:	RM41	RM41	RM41	RM41
d.	Serial No:	568	1409	1369	997
e.	Installation:	1/77	6/79	6/79	7/79

Part 3 - Excess emissions (by pollutant)

Use Table I: Attach separate narrative per instructions.

Part 4 - Conversion factors

a. **Zero and Cal values used, by instruments:**

	Unit 1	Unit 2	Unit 3	Unit 4
Zero	0.0	0.0	0.0	0.0
Cal	52.5	51.7	58.0	48.5

Part 5 - Continuous Monitoring System operation failures

See Table II: Complete one sheet for each monitor attach separate narrative per instructions.

Part 6 - Certification of report integrity, by per 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 Peter J. Cohlmia

Title Chief Environmental Scientist

Date 7/29/93

* Suggested Format for Subpart D sources in:

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

TABLE I

Excess Emissions

Date	Time* From – To	Pollutant	Magnitude* Lb/106 BTU

SO^2

No violations

Opacity

Attached is additional information for excesses occurring during the ~~Third~~ 2nd Quarter

* As defined in the instructions form the applicable section of the Federal Register; attached narrative of causes, etc.

Continuous Monitoring System Operation Failures

Date	Time* From – To	Instrument	Effect on Instrument Output
5/17/93	0815 to 5/17/93 0900	Lear Siegler	Removed for calibration

****

OPACITY MONTHLY DATA REPORT

****

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 2 4/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
4/01	0	0	0	0	0	24	3.4
4/02	0	0	0	0	0	24	3.4
4/03	0	0	0	0	0	24	3.4
4/04	0	0	0	0	0	23	3.2
4/05	0	0	0	0	0	24	3.1
4/06	0	0	0	0	0	24	3.4
4/07	0	0	0	0	0	24	3.6
4/08	0	0	0	0	0	24	3.5
4/09	0	0	0	0	0	24	3.3
4/10	0	0	0	0	0	24	3.5
4/11	0	0	0	0	0	24	3.3
4/12	0	0	0	0	0	24	3.6
4/13	0	0	0	0	0	24	3.4
4/14	0	0	0	0	0	24	3.4
4/15	0	0	0	0	0	24	3.3
4/16	0	0	0	0	0	24	3.3
4/17	0	0	0	0	0	24	3.3
4/18	0	0	0	0	0	24	3.5
4/19	0	0	0	0	0	24	3.5
4/20	0	0	0	0	0	24	3.3
4/21	0	0	0	0	0	24	3.3
4/22	0	0	0	0	0	24	3.5
4/23	0	0	0	0	0	24	3.7
4/24	0	0	0	0	0	24	3.6
4/25	0	0	0	0	0	24	3.4
4/26	0	0	0	0	0	24	3.6
4/27	0	0	0	0	0	24	3.4
4/28	0	0	0	0	0	24	3.4
4/29	0	0	0	0	0	24	3.5
4/30	0	0	0	0	0	24	3.4
MONTHLY TOTALS	0	0	0	0	0	719	3.4

EPORT COMPLETE

OPACITY MONTHLY DATA REPORT

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 2 5/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
5/01	0	0	0	0	0	24	3.4
5/02	0	0	0	0	0	24	3.4
5/03	0	0	0	0	0	24	3.7
5/04	0	0	0	0	0	24	3.6
5/05	0	0	0	0	0	24	3.5
5/06	0	0	0	0	0	24	3.3
5/07	0	0	0	0	0	24	3.3
5/08	4	0	0	1	0	24	5.5
5/09	0	0	0	0	0	24	3.4
5/10	0	0	0	0	0	24	3.5
5/11	0	0	0	0	0	24	3.4
5/12	0	0	0	0	0	24	3.3
5/13	0	0	0	0	0	24	3.6
5/14	0	0	0	0	0	24	4.4
5/15	0	0	0	0	0	24	4.7
5/16	0	0	0	0	0	24	4.5
5/17	0	0	0	0	0	24	4.3
5/18	0	0	0	0	0	24	4.0
5/19	0	0	0	0	0	24	4.3
5/20	0	0	0	0	0	24	4.2
5/21	0	0	0	0	0	24	4.4
5/22	0	0	0	0	0	24	4.5
5/23	0	0	0	0	0	24	4.2
5/24	0	0	0	0	0	24	4.1
5/25	0	0	0	0	0	24	4.1
5/26	0	0	0	0	0	24	4.1
5/27	0	0	0	0	0	24	4.5
5/28	0	0	0	0	0	24	4.3
5/29	0	0	0	0	0	24	4.1
5/30	0	0	0	0	0	24	4.4
5/31	0	0	0	0	0	24	4.4
MONTHLY TOTALS	4	0	0	1	0	744	4.0

REPORT COMPLETE

M (B) 292-12-1994

****

OPACITY MONTHLY DATA REPORT

****

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 2 6/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
6/01	0	0	0	0	0	24	4.3
6/02	0	0	0	0	0	24	4.2
6/03	0	0	0	0	0	24	4.2
6/04	0	0	0	0	0	24	4.2
6/05	0	0	0	0	0	24	6.9
6/06	0	0	0	0	0	24	3.7
6/07	0	0	0	0	0	24	4.2
6/08	0	0	0	0	0	24	3.5
6/09	0	0	0	0	0	24	4.0
6/10	0	0	0	0	0	24	3.3
6/11	0	0	0	0	0	24	3.6
6/12	0	0	0	0	0	24	3.4
6/13	0	0	0	0	0	24	3.6
6/14	0	0	0	0	0	24	3.4
6/15	0	0	0	0	0	24	3.7
6/16	0	0	0	0	0	24	3.6
6/17	0	0	0	0	0	24	3.9
6/18	0	0	0	0	0	24	4.3
6/19	0	0	2	0	0	24	3.6
6/20	0	0	0	0	0	24	3.2
6/21	0	0	0	0	0	24	3.3
6/22	0	0	0	0	0	24	3.3
6/23	0	0	0	0	0	24	3.3
6/24	0	0	0	0	0	24	3.5
6/25	0	0	0	0	0	24	3.4
6/26	0	0	0	0	0	24	3.2
6/27	0	0	0	0	0	24	3.3
6/28	0	0	0	0	0	24	3.5
6/29	0	0	0	0	0	24	3.4
6/30	0	0	0	0	0	24	3.4
MONTHLY TOTALS	0	0	2	0	0	720	3.7

REPORT COMPLETE

FORM (B) 292-12-1994

****

OPACITY Violation Report

****

POWER PLANT: ARAPAHOE
Unit: 4 Source = CURRENT
Report Period: Quarter = 2 1993

REASON CODES FOR:
HOURLY EXCLUSIONS = none
UPSET EXCLUSIONS = none

START DATE-TIME	END DATE-TIME	MIN-%	MAX-%	AVG-%	TYPE	VIOLATION REASON
05/08/1993 12:12	05/08/1993 12:17	21.8	21.8	21.8	VIO	UNIT STARTUP
05/08/1993 12:30	05/08/1993 12:41	21.0	38.0	29.5	VIO	UNIT STARTUP
05/08/1993 12:54	05/08/1993 13:05	24.3	25.0	24.6	VIO	UNIT STARTUP
05/14/1993 11:54	05/14/1993 12:05	36.3	40.1	38.2	VIO	~~UNSPECIFIED~~ CALIB/NOT COUNTED
06/19/1993 04:00	06/19/1993 04:11	30.4	31.7	31.1	VIO	UNIT STARTUP

Public Service®

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

October 28, 1993

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

RE: Third Quarter, 1993 Excess Emissions Report, Arapahoe Units #1-4

Dear Roy:

Attached is the excess emissions report for the third quarter, 1993, for the Public Service Company of Colorado Arapahoe Steam Electric Generating Station, Units #1-4.

Dates not reported on the attached emissions report are those in which the units were not running. The operating hours for Units #1-4 during the quarter were: Unit #1 - 740.5 hours, Unit #2 - 679.2 hours, Unit #3 - 932.3 hours and Unit #4 - 1,979 hours.

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

Sincerely,

Peter J. Cohlmia

Peter J. Cohlmia
Chief Environmental Scientist

PJC:tc

Attachments

SO_2 .861
from Marilyn

QUARTERLY EXCESS EMISSIONS REPORT (EER)

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 ending:

March 31 June 30 (September 30) December 31

b. Reporting year: 1993

c. Reporting date: 10/14/93

d. Person completing report: Mark Spomer

e. Station name: Arapahoe Station

f. Plant location: 2601 South Platte River Drive

g. Person responsible for review and integrity of report: Peter J. Cohlmia

h. Mailing address for person in 1-g above:

P. O. Box 840, Denver, Colorado 80201

i. Phone number for 1-g above: 294-2810

Part 2 - Instrument information, complete for each instrument.

a.	Opacity Monitor:	Unit 1	Unit 2	Unit 3	Unit 4
b.	Manufacture:	Lear Siegler	L.S.	L.S.	L.S.
c.	Model No:	RM41	RM41	RM41	RM41
d.	Serial No:	568	1409	1369	997
e.	Installation:	1/77	6/79	6/79	7/79

Part 3 - Excess emissions (by pollutant)

Use Table I: Attach separate narrative per instructions.

Part 4 - Conversion factors

a. Zero and Cal values used, by instruments:

	Unit 1	Unit 2	Unit 3	Unit 4
Zero	0.0	0.0	0.0	0.0
Cal	52.5	51.7	58.0	48.5

Part 5 - Continuous Monitoring System operation failures

See Table II: Complete one sheet for each monitor attach separate narrative per instructions.

Part 6 - Certification of report integrity, by per 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 Peter J. Cohlmia

Title Chief Environmental Scientist

Date 10/28/93

* Suggested Format for Subpart D sources in:

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

TABLE I

Excess Emissions

Date	Time* From -- To	Pollutant	Magnitude* Lb/106 BTU

SO^2

No violations

Opacity

Attached is additional information for excesses occurring during the Third Quarter

* As defined in the instructions form the applicable section of the Federal Register; attached narrative of causes, etc.

Continuous Monitoring System Operation Failures

Date	Time* From -- To	Instrument	Effect on Instrument Output
7/14/93	0900 to 7/14 1545	#3 L.S.	Calib. and filter audit
7/28/93	0755 to 7/28 1400	#2 L.S.	Calib. and filter audit
9/10/93	0800 to 9/13 1423	#1 L.S.	Calib. and filter audit
9/27/93	0640 to 9/27 1355	#4 L.S.	Calib. and filter audit

OPACITY MONTHLY DATA REPORT

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 3 7/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
7/01	0	0	0	0	0	24	3.1
7/02	0	0	0	0	0	24	3.1
7/03	0	0	0	0	0	24	3.6
7/04	0	0	0	0	0	24	3.3
7/05	0	0	0	0	0	24	3.4
7/06	0	0	0	0	0	24	3.1
7/07	0	0	0	0	0	24	3.3
7/08	0	0	0	0	0	24	3.5
7/09	0	0	0	0	0	24	3.4
7/10	0	0	0	0	0	24	2.9
7/11	0	0	0	0	0	24	3.6
7/12	0	0	0	0	0	24	3.2
7/13	0	0	0	0	0	24	3.9
7/14	0	0	0	0	0	24	4.4
7/15	0	0	0	0	0	24	4.3
7/16	0	0	0	0	0	24	4.1
7/17	0	0	0	0	0	24	4.3
7/18	0	0	0	0	0	24	3.9
7/19	0	0	0	0	0	24	4.3
7/20	0	0	0	0	0	24	4.4
7/21	0	0	0	0	0	24	4.0
7/22	0	0	0	0	0	24	4.0
7/23	0	0	0	0	0	24	4.3
7/24	0	0	0	0	0	24	4.3
7/25	0	0	0	0	0	24	3.9
7/26	0	0	0	0	0	24	3.8
7/27	0	0	0	0	0	24	4.0
7/28	0	0	0	0	0	24	4.0
7/29	0	0	0	0	0	24	4.2
7/30	0	0	0	0	0	24	4.2
7/31	0	0	0	0	0	24	3.9
MONTHLY TOTALS	0	0	0	0	0	744	3.8

PORT COMPLETE

****

OPACITY MONTHLY DATA REPORT

****

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 3 8/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
8/01	0	0	0	0	0	24	4.2
8/02	0	0	0	0	0	24	4.4
8/03	0	0	0	0	0	24	4.8
8/04	0	0	0	0	0	24	4.3
8/05	0	0	0	0	0	24	4.2
8/06	0	0	0	0	0	24	4.2
8/07	0	0	0	0	0	24	3.9
8/08	0	0	0	0	0	24	3.9
8/09	0	0	0	0	0	24	3.8
8/10	0	0	0	0	0	24	4.3
8/11	0	0	0	0	0	24	4.2
8/12	0	0	0	0	0	24	4.6
8/13	0	0	0	0	0	24	4.4
8/14	0	0	0	0	0	24	4.1
8/15	0	0	0	0	0	24	4.0
8/16	0	0	0	0	0	24	4.0
8/17	0	0	0	0	0	24	3.9
8/18	0	0	0	0	0	24	4.5
8/19	0	0	0	0	0	24	4.3
8/20	0	0	0	0	0	24	4.5
8/21	0	0	0	0	0	24	4.0
8/22	0	0	0	0	0	24	3.7
8/23	0	0	0	0	0	24	3.6
8/24	0	0	0	0	0	24	3.4
8/25	0	0	0	0	0	24	3.6
8/26	0	0	0	0	0	24	4.3
8/27	0	0	0	0	0	23	5.9
8/28	0	0	0	0	0	24	5.6
8/29	0	2	1	1	1	24	5.9
8/30	0	0	0	0	0	24	4.9
8/31	0	0	0	0	0	24	4.9
MONTHLY TOTALS	0	2	1	1	1	743	4.3

ᴾORT COMPLETE

****

OPACITY MONTHLY DATA REPORT

****

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 3 9/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
9/01	0	0	0	0	0	24	5.0
9/02	0	0	0	0	0	24	4.9
9/03	0	0	0	0	0	24	4.8
9/04	0	0	0	0	0	24	5.2
9/05	0	0	0	0	0	24	5.1
9/06	0	0	0	0	0	24	4.9
9/07	0	0	0	0	0	24	5.4
9/08	0	0	0	0	0	24	5.3
9/09	0	0	0	0	0	24	5.2
9/10	0	0	0	0	0	24	5.3
9/11	0	0	0	0	0	24	5.4
9/12	0	0	0	0	0	24	5.3
9/13	0	0	0	0	0	24	5.5
9/14	0	0	0	0	0	24	5.3
9/15	0	0	0	0	0	24	5.3
9/16	0	0	0	0	0	24	5.6
9/17	0	0	0	0	0	24	5.3
9/18	0	0	0	0	0	24	5.1
9/19	0	0	0	0	0	24	4.8
9/20	0	0	0	0	0	24	5.2
9/21	0	0	0	0	0	24	5.4
9/22	0	0	0	0	0	24	5.4
9/23	1	3	0	1	0	24	5.9
9/24	3	1	1	2	2	24	6.8
9/25	0	0	0	0	0	24	5.1
9/26	0	0	0	0	0	24	5.4
9/27	0	0	0	0	0	20	3.3
9/28	0	0	0	0	0	24	0.9
9/29	0	0	0	0	0	24	1.1
9/30	0	0	0	0	0	24	1.1
MONTHLY TOTALS	4	4	1	3	2	716	4.8

EPORT COMPLETE

FORM (B) 292-12-1994

OPACITY Violation Report

POWER PLANT: ARAPAHOE
Unit: 4 Source = CURRENT
Report Period: Quarter = 3 1993

REASON CODES FOR:
HOURLY EXCLUSIONS = none
UPSET EXCLUSIONS = none

START DATE-TIME	END DATE-TIME	MIN-%	MAX-%	AVG-%	TYPE	VIOLATION REASON
07/13/1993 15:00	07/13/1993 15:05	36.1	36.1	36.1	VIO	CALIB.-NOT COUNTED
08/29/1993 15:00	08/29/1993 15:05	29.6	29.6	29.6	VIO	UNIT STARTUP
08/29/1993 17:00	08/29/1993 17:23	29.1	45.3	35.8	VIO	UNIT STARTUP
09/23/1993 11:36	09/23/1993 12:05	22.9	36.9	28.9	VOF	UNIT SHUTDOWN
09/24/1993 02:24	09/24/1993 02:29	59.6	59.6	59.6	VIO	UNIT STARTUP
09/24/1993 02:36	09/24/1993 03:11	21.4	50.8	35.4	VIO	UNIT STARTUP
09/24/1993 04:36	09/24/1993 04:41	22.0	22.0	22.0	VIO	UNIT STARTUP
09/24/1993 05:06	09/24/1993 05:11	29.8	29.8	29.8	VIO	COAL MILL OPERATION
09/27/1993 13:06	09/27/1993 13:11	44.8	44.8	44.8	VIO	CALIB & AUDIT NOT COUNTED

Public Service®

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

January 27, 1994

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

RE: Fourth Quarter, 1993 Excess Emissions Report, Arapahoe Units #1-4

Dear Roy:

Attached is the excess emissions report for the fourth quarter, 1993, for the Public Service Company of Colorado Arapahoe Steam Electric Generating Station, Units #1-4.

Dates not reported on the attached emissions report are those in which the units were not running. The operating hours for Units #1-4 during the quarter were: Unit #1 - 2,033.7 hours, Unit #2 - 2,068.2 hours, Unit #3 - 2,070.3 hours and Unit #4 - 2,181.9 hours.

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

Sincerely,

Peter J. Cohlmia

Peter J. Cohlmia
Chief Environmental Scientist

PJC:tc

Attachments

QUARTERLY EXCESS EMISSIONS REPORT (EER)

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 ending:

March 31 June 30 September 30 (December 31)

b. Reporting year: 1993

c. Reporting date: 01/12/94

d. Person completing report: Mark Spomer

e. Station name: Arapahoe Station

f. Plant location: 2601 South Platte River Drive

g. Person responsible for review and integrity of report: Peter J. Cohlmia

h. Mailing address for person in 1-g above:

P. O. Box 840, Denver, Colorado 80201

i. Phone number for 1-g above: 294-2810

Part 2 - Instrument information, complete for each instrument.

a.	Opacity Monitor:	Unit 1	Unit 2	Unit 3	Unit 4
b.	Manufacture:	Lear Siegler	L.S.	L.S.	L.S.
c.	Model No:	RM41	RM41	RM41	RM41
d.	Serial No:	568	1409	1369	997
e.	Installation:	1/77	6/79	6/79	7/79

Part 3 - Excess emissions (by pollutant)

Use Table I: Attach separate narrative per instructions.

Part 4 - Conversion factors

a. Zero and Cal values used, by instruments:

	Unit 1	Unit 2	Unit 3	Unit 4
Zero	0.0	0.0	0.0	0.0
Cal	53.4	51.7	58.0	49.5

Part 5 - Continuous Monitoring System operation failures

See Table II: Complete one sheet for each monitor attach separate narrative per instructions.

Part 6 - Certification of report integrity, by per 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 Peter J. Cohlmia

Title Chief Environmental Scientist

Date 1/27/94

* Suggested Format for Subpart D sources in:

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

TABLE I

Excess Emissions

Date	Time* From -- To	Pollutant	Magnitude* Lb/106 BTU

SO^2

No violations

Opacity

Attached is additional information for excesses occurring during the ~~Third~~ Fourth Quarter

* As defined in the instructions form the applicable section of the Federal Register; attached narrative of causes, etc.

1(8) 292-12-1994

OPACITY MONTHLY DATA REPORT

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 4 10/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
10/01	0	0	0	0	0	24	1.0
10/02	0	0	0	0	0	24	1.2
10/03	0	0	0	0	0	24	1.4
10/04	0	0	0	0	0	24	1.7
10/05	0	0	0	0	0	24	1.9
10/06	0	0	0	0	0	24	1.8
10/07	0	0	0	0	0	24	1.7
10/08	0	0	0	0	0	24	0.8
10/09	1	0	1	[illegible]	1	24	2.2
10/10	0	0	0	1	0	24	1.1
10/11	0	0	0	0	0	24	1.2
10/12	0	0	0	0	0	24	1.0
10/13	0	0	0	0	0	24	1.2
10/14	0	0	0	0	0	24	1.7
10/15	0	0	0	0	0	24	1.7
10/16	0	0	0	0	0	24	1.5
10/17	0	0	0	0	0	24	1.7
10/18	0	0	0	0	0	24	1.2
10/19	0	0	0	0	0	24	0.9
10/20	0	0	0	0	0	24	0.7
10/21	0	0	0	0	0	24	1.3
10/22	0	0	0	0	0	24	1.6
10/23	0	0	0	0	0	24	1.9
10/24	0	0	0	0	0	24	1.7
10/25	0	0	0	0	0	24	1.5
10/26	0	0	0	0	0	24	1.5
10/27	0	0	0	0	0	24	1.6
10/28	0	0	0	0	0	24	1.2
10/29	0	0	0	0	0	24	1.8
10/30	0	0	0	0	0	24	2.1
10/31	0	0	0	0	0	25	2.0
MONTHLY TOTALS	1	0	1	2	1	745	1.5

EPORT COMPLETE

****

OPACITY MONTHLY DATA REPORT

****

POWER PLANT: ARAPAHOE
UNIT: 4 SOURCE = CURRENT
REPORT START TIME: QUARTER = 4 11/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
11/01	0	0	0	0	0	24	1.6
11/02	0	0	0	0	0	24	2.1
11/03	0	0	0	0	0	24	1.7
11/04	0	0	0	0	0	24	1.4
11/05	0	0	0	0	0	24	1.3
11/06	0	0	0	0	0	24	1.2
11/07	0	0	0	0	0	24	1.2
11/08	0	0	0	0	0	24	1.4
11/09	0	0	0	0	0	24	1.4
11/10	0	0	0	0	0	24	1.4
11/11	0	0	0	0	0	24	1.5
11/12	0	0	0	0	0	24	1.4
11/13	0	0	0	0	0	24	0.8
11/14	0	0	0	0	0	24	1.1
11/15	0	0	0	0	0	24	1.3
11/16	0	0	0	0	0	24	1.4
11/17	0	0	0	0	0	24	1.3
11/18	0	0	0	0	0	24	1.1
11/19	0	0	0	0	0	24	1.4
11/20	0	0	0	0	0	24	1.0
11/21	0	0	0	0	0	24	1.3
11/22	0	0	0	0	0	24	1.5
11/23	0	0	0	0	0	24	2.0
11/24	0	0	0	0	0	24	1.6
11/25	0	0	0	0	0	24	1.6
11/26	0	0	0	0	0	24	1.2
11/27	0	0	0	0	0	24	1.0
11/28	0	0	0	0	0	24	1.4
11/29	0	0	0	0	0	24	1.2
11/30	0	0	0	0	0	24	1.6
MONTHLY TOTALS	0	0	0	0	0	720	1.4

REPORT COMPLETE

****

OPACITY MONTHLY DATA REPORT

****

POWER PLANT: ARAPAHOE

UNIT: 4 SOURCE = CURRENT

REPORT START TIME: QUARTER = 4 12/1993

DAY	VIOLATION CATEGORY A 20-25%	B 25-30%	C 30-35%	D 35-45%	E OVER 45%	WEIGHT FACTOR	AVERAGE OPACITY %
12/01	0	0	0	0	0	24	1.4
12/02	0	0	0	0	0	24	1.3
12/03	0	0	0	0	0	24	1.4
12/04	0	0	0	0	0	24	0.9
12/05	0	0	0	0	0	24	1.4
12/06	0	0	0	0	0	24	1.8
12/07	0	0	0	0	0	24	1.3
12/08	0	0	0	0	0	24	1.5
12/09	0	0	0	0	0	24	1.2
12/10	0	0	0	0	0	24	1.0
12/11	0	0	0	0	0	24	1.5
12/12	0	0	0	0	0	24	1.4
12/13	0	0	0	0	0	24	1.3
12/14	0	0	0	0	0	24	1.4
12/15	0	0	0	0	0	24	1.9
12/16	0	0	0	0	0	24	1.7
12/17	0	0	0	0	0	24	1.7
12/18	0	0	0	0	0	24	1.8
12/19	0	0	0	0	0	24	1.9
12/20	0	0	0	0	0	24	1.5
12/21	0	0	0	0	0	24	1.8
12/22	0	0	0	0	0	24	1.6
12/23	0	0	0	0	0	24	1.7
12/24	0	0	0	0	0	24	1.3
12/25	0	0	0	0	0	24	1.2
12/26	0	0	0	0	0	24	1.4
12/27	0	0	0	0	0	24	1.9
12/28	0	0	0	0	0	24	1.4
12/29	0	0	0	0	0	24	1.8
12/30	0	0	0	0	0	24	1.9
12/31	0	0	0	0	0	24	1.8
MONTHLY TOTALS	0	0	0	0	0	744	1.5

PORT COMPLETE

INTEGRATED DRY NO_x/SO_2 EMISSIONS CONTROL SYSTEM

ENVIRONMENTAL MONITORING REPORT

Calcium-Based Dry Sorbent Injection System Test Period:
April 30, 1993 through November 2, 1993

Calcium DSI Air Toxics Test October 19-20, 1993
Dioxins/Furans Air Toxics Test October 11-13, 1993

Appendix B: Aqueous Stream Compliance Data

DDRESS P. O. BOX 840
DENVER, COLORADO 80201

ACILITY ARAPAHOE
OCATION

CO-0001091 — PERMIT NUMBER

001A — DISCHARGE NUMBER

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	04	01	TO	93	04	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) (46-53) AVERAGE	QUANTITY OR LOADING (54-61) MAXIMUM	UNITS	QUALITY OR CONCENTRATION (4 Card Only) (38-45) MINIMUM	QUALITY OR CONCENTRATION (46-53) AVERAGE	QUALITY OR CONCENTRATION (54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
TEMPERATURE WATER DEG FAHRENHEIT	SAMPLE MEASUREMENT						68.200	(15)	0	20/30	
00011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						86.000 Daily Max.	DEGF		5/7	INSIT
PH	SAMPLE MEASUREMENT				7.490		8.750	(12)	0	20/30	
00400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT				6.500 Minimum		9.000 Maximum	SU		5/7	GR
SOLIDS, TOTAL TSS SUSPENDED	SAMPLE MEASUREMENT					21.300	24.000	(19)	0	4 /30	
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					30.000 30-Day Avg.	100.000 Daily Max.	MG/L		1/7	8HR C
OIL AND GREASE FREON EXTR GRAV METH	SAMPLE MEASUREMENT				Contingent			(19)	0	4 /30	
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					15.000 30-Day Avg.	20.000 Daily Max.	MG/L		1/7	GR
ZINC, TOTAL (AS ZN)	SAMPLE MEASUREMENT					<0.005	<0.005	(19)	0	1 /30	
01092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					0.880 30-Day Avg.	0.880 Daily Max.	MG/L		1/30	GR
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	0.225	0.778	(03)					0	39/30	
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	1.000 30-Day Avg.		MGD						30/30	INST.
CHLORINE TOTAL RESIDUAL	SAMPLE MEASUREMENT						<0.05	(19)	0	4 /30	
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						0.110 Daily Max.	MG/L		1/7	GR

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

JEKELS, JAMES R.
MGR, GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)*

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE AREA CODE	TELEPHONE NUMBER	DATE YEAR	DATE MO	DATE DAY
303	2942808	93	05	11

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

ODDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

CO-0001091 — PERMIT NUMBER

001A — DISCHARGE NUMBER

FINAL

Expires 3-31-86

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	04	01	TO	93	04	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
OIL AND GREASE VISUAL	SAMPLE MEASUREMENT		0	1 YES 0 NO					0	4 /30	
84066 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT		Inst. Max.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
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	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
WEXELS, JAMES R.
MGR, GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION, I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT. SEE 18 USC § 1001 AND 33 USC § 1319. *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)*

James R. Wexels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	05	11
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

CO-0001091 — PERMIT NUMBER

002A — DISCHARGE NUMBER

FINAL

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	04	01	TO	93	04	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
TEMPERATURE WATER DEG FAHRENHEIT 00011 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
PH 00400 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
SOLIDS, TOTAL TSS SUSPENDED 00530 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
OIL AND GREASE FREON EXTR-GRAV METH 00556 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
ZINC, TOTAL (AS ZN) 01092 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
FLOW, IN CONDUIT OR THRU TREATMENT PLANT 50050 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
CHLORINE TOTAL RESIDUAL 50060 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER	CERTIFICATION	SIGNATURE	TELEPHONE AREA CODE	TELEPHONE NUMBER	DATE YEAR	MO	DAY
JEXELS, JAMES R. MGR, GOVT & ENV AFFRS (TYPED OR PRINTED)	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)	James R. Dexels — SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	303	942808	93	05	11

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

ility Name/Location if different)

ME PUBLIC SERVICE COMPANY OF COLORADO

DRESS P. O. BOX 840

DENVER, COLORADO 80201

CILITY ARAPAHOE

CATION

(2-16)

CO 0001091	002A
PERMIT NUMBER	DISCHARGE NUMBER

FINAL

	MONITORING PERIOD						
	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	04	01	TO	93	04	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
IL AND GREASE ISUAL 4066 1 0 0 FFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
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	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

IEXELS, JAMES R.
IGR,GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)*

X James R. Wexels

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	05	11
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

Facility Name/Location if different
NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

(2-10)	
CO 0001091	001A
PERMIT NUMBER	DISCHARGE NUMBER

FINAL

Expires 3-31-80

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	05	01	TO	93	05	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	QUALITY OR CONCENTRATION (4 Card Only) (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
TEMPERATURE WATER DEG FAHRENHEIT	SAMPLE MEASUREMENT						72.400	(15)	0	20/31	
00011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						86.000 Daily Max.	DEGF		5/7	INSIT
PH	SAMPLE MEASUREMENT				8.110		8.740	(12)	0	20/31	
00400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT				6.500 Minimum		9.000 Maximum	SU		5/7	GR
SOLIDS, TOTAL TSS SUSPENDED	SAMPLE MEASUREMENT				.	21.150	28.000	(19)	0	4 /31	
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					30.000 30-Day Avg.	100.000 Daily Max.	MG/L		1/7	8HR C[illegible]
OIL AND GREASE FREON EXTR GRAV METH	SAMPLE MEASUREMENT				Contingent			(19)	0	4 /31	
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					15.000 30-Day Avg.	20.000 Daily Max.	MG/L		1/7	GR
ZINC, TOTAL (AS ZN)	SAMPLE MEASUREMENT					<0.005	<0.005	(19)	0	1 /31	
01092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					0.880 30-Day Avg.	0.880 Daily Max.	MG/L		1/30	GR
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	0.184	0.547	(03)					0	43/31	
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	1.000 30-Day Avg.		MGD						30/30	INST
CHLORINE, TOTAL RESIDUAL	SAMPLE MEASUREMENT						<0.05	(19)	0	4 /31	
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						0.110 Daily Max.	MG/L		1/7	GR

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
HEXELS, JAMES R. MGR, GOVT & ENV AFFRS	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)*		303	2942808	93	06	14
TYPED OR PRINTED		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

EPA Form 3320-1 (Rev. 10-79) PREVIOUS EDITION TO BE USED

NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

CO-0001091 — PERMIT NUMBER

001A — DISCHARGE NUMBER

FINAL

MONITORING PERIOD	YEAR	MO	DAY
FROM	93	05	01
TO	93	05	31

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (4 Card Only) (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	QUALITY OR CONCENTRATION (4 Card Only) (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
OIL AND GREASE VISUAL 84066 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT		0 1	YES					0	4 /31	
			0	NO							
	PERMIT REQUIREMENT		Inst. Max.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
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	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
WEXELS, JAMES R.
MGR, GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

X James R. Wexels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE AREA CODE	NUMBER	DATE YEAR	MO	DAY
303	2942808	93	06	14

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

EPA Form 3320-1 (Rev. 10-79) PREVIOUS EDITION TO BE USED

PERMITTEE NAME/ADDRESS (Include Facility Name/Location if different)
NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER COLORADO 80201

FACILITY ARAPAHOE
LOCATION

DISCHARGE MONITORING REPORT

PERMIT NUMBER (2-16)	DISCHARGE NUMBER (17-19)
CO 0001091	002A

FINAL

Expires 3-31-88

MONITORING PERIOD	YEAR (20-21)	MO (22-23)	DAY (24-25)		YEAR (26-27)	MO (28-29)	DAY (30-31)
FROM	93	05	01	TO	93	05	31

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	QUALITY OR CONCENTRATION (4 Card Only) MINIMUM (38-45)	AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
TEMPERATURE WATER DEG FAHRENHEIT	SAMPLE MEASUREMENT	NO DISCHARGE									
00011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
PH	SAMPLE MEASUREMENT	NO DISCHARGE									
00400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
SOLIDS, TOTAL TSS SUSPENDED	SAMPLE MEASUREMENT	NO DISCHARGE									
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
OIL AND GREASE FREON EXTR GRAV METH	SAMPLE MEASUREMENT	NO DISCHARGE									
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
ZINC, TOTAL (AS ZN)	SAMPLE MEASUREMENT	NO DISCHARGE									
01092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	NO DISCHARGE									
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
CHLORINE TOTAL RESIDUAL	SAMPLE MEASUREMENT	NO DISCHARGE									
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
WEXELS, JAMES R.
MGR, GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

James R. Wexels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE AREA CODE	NUMBER	DATE YEAR	MO	DAY
303	9422808	93	06	14

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

DISCHARGE MONITORING REPORT

Expires 3-31-88

Facility Name/Location if different)

NAME [illegible]

ADDRESS P. O. BOX 840

DENVER, COLORADO 80201

FACILITY ARAPAHOE

LOCATION

(2-16)	(17-19)
CO-0001091	002A
PERMIT NUMBER	DISCHARGE NUMBER

FINAL

MONITORING PERIOD	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	05	01	TO	93	05	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING — AVERAGE (3 Card Only) (46-53)	MAXIMUM (54-61)	UNITS	QUALITY OR CONCENTRATION — MINIMUM (4 Card Only) (38-45)	AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
IL AND GREASE ISUAL 4066 1 0 0 FFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

EXELS, JAMES R.
GR,GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN, AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT. SEE 18 USC § 1001 AND 33 USC § 1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)

X James R. Wefels

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	06	14
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

(Rev. 10-79) PREVIOUS EDITION TO BE USED

DISCHARGE MONITORING REPORT

NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

(2-16)	(17-19)
CO-0001091	001A
PERMIT NUMBER	DISCHARGE NUMBER

FINAL

Expires 3-31-88

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	06	01	TO	93	06	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
EMPERATURE ATER DEG FAHRENHEIT	SAMPLE MEASUREMENT						79.200	(15)	0	27/30	
0011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						86.000 Daily Max.	DEGF		5/7	INSIT
H	SAMPLE MEASUREMENT				7.770		8.960	(12)	0	27/30	
0400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT				6.500 Minimum		9.000 Maximum	SU		5/7	GR
SOLIDS, TOTAL TSS SUSPENDED	SAMPLE MEASUREMENT					16.367	32.000	(19)	0	6 /30	
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					30.000 30-Day Avg.	100.000 Daily Max.	MG/L		1/7	8HR CO
OIL AND GREASE FREON EXTR-GRAV METH	SAMPLE MEASUREMENT				Contingent			(19)	0	6 /30	
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					15.000 30-Day Avg.	20.000 Daily Max.	MG/L		1/7	GR
ZINC, TOTAL (AS ZN)	SAMPLE MEASUREMENT					<0.005	<0.005	(19)	0	1 /30	
01092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					0.880 30-Day Avg.	0.880 Daily Max.	MG/L		1/30	GR
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	0.119	0.187	(03)					0	24/30	
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	1.000 30-Day Avg.		MGD						30/30	INST
CHLORINE TOTAL RESIDUAL	SAMPLE MEASUREMENT						<0.05	(19)	0	4 /30	
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						0.110 Daily Max.	MG/L		1/7	GR

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

WEXELS, JAMES R.
MGR, GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)*

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	3942808	93	07	12
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

EPA Form 3320-1 (Rev. 10-79) PREVIOUS EDITION TO BE USED

NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

(2-16)
CO 0001091
PERMIT NUMBER

(17-19)
001A
DISCHARGE NUMBER

FINAL

Expires 3-31-88

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	06	01	TO	93	06	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
OIL AND GREASE VISUAL 84066 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT		0	1 YES 0 NO					0	6 /30	
	PERMIT REQUIREMENT		Inst. Max.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
JEXELS, JAMES R.
MGR, GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	07	12
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

DDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

CO-0001091
PERMIT NUMBER

002A
DISCHARGE NUMBER

FINAL

Expires 3-31-86

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	06	01	TO	93	06	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) (54-61) AVERAGE	MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
EMPERATURE ATER DEG FAHRENHEIT 0011 1 0 0	SAMPLE MEASUREMENT	NO DISCHARGE									
EFLUENT GROSS VALUE	PERMIT REQUIREMENT										
H	SAMPLE MEASUREMENT	NO DISCHARGE									
0400 1 0 0 EFLUENT GROSS VALUE	PERMIT REQUIREMENT										
OLIDS, TOTAL TSS USPENDED	SAMPLE MEASUREMENT	NO DISCHARGE									
0530 1 0 0 EFLUENT GROSS VALUE	PERMIT REQUIREMENT										
IL AND GREASE REON EXTR-GRAV METH	SAMPLE MEASUREMENT	NO DISCHARGE									
0556 1 0 0 EFLUENT GROSS VALUE	PERMIT REQUIREMENT										
INC, TOTAL AS ZN)	SAMPLE MEASUREMENT	NO DISCHARGE									
1092 1 0 0 EFLUENT GROSS VALUE	PERMIT REQUIREMENT										
LOW, IN CONDUIT OR HRU TREATMENT PLANT	SAMPLE MEASUREMENT	NO DISCHARGE									
0050 1 0 0 EFLUENT GROSS VALUE	PERMIT REQUIREMENT										
HLORINE TOTAL ESIDUAL	SAMPLE MEASUREMENT	NO DISCHARGE									
0060 1 0 0 EFLUENT GROSS VALUE	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

EXELS, JAMES R.
GR, GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN, AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)*

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	07	12
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

AME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

ACILITY ARAPAHOE
OCATION

DISCHARGE MONITORING REPORT (2-16) (17-19)

CO-0001091
PERMIT NUMBER

002A
DISCHARGE NUMBER

FINAL

OMB No. 2040-00
Expires 3-31-88

	MONITORING PERIOD					
	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	06	01	TO	93	06	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	(4 Card Only) QUALITY OR CONCENTRATION MINIMUM (38-45)	AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
IL AND GREASE ISUAL 4066 1 0 0 EFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
EXELS, JAMES R.
IGR, GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

X James R. Wexels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	07	12
AREA CODE	NUMBER	YEAR	MO	DAY

OMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

PERMIT NUMBER	DISCHARGE NUMBER
CO 0001091	001A

FINAL

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	[illegible]	07	01	TO	[illegible]	07	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) (46-53) AVERAGE	QUANTITY OR LOADING (54-61) MAXIMUM	UNITS	QUALITY OR CONCENTRATION (4 Card Only) (38-45) MINIMUM	QUALITY OR CONCENTRATION (46-53) AVERAGE	QUALITY OR CONCENTRATION (54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
MPERATURE TER DEG FAHRENHEIT	SAMPLE MEASUREMENT						83.000	(15)	0	15/31	
011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						86.000 Daily Max.	DEGF		5/7	INSIT
I	SAMPLE MEASUREMENT				7.600		8.840	(12)	0	15/31	
0400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT				6.500 Minimum		9.000 Maximum	SU		5/7	GR
OLIDS, TOTAL TSS USPENDED	SAMPLE MEASUREMENT					12.833	16.200	(19)	0	3 /31	
0530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					30.000 30-Day Avg.	100.000 Daily Max.	MG/L		1/7	8HR COM
IL AND GREASE REON EXTR GRAV METH	SAMPLE MEASUREMENT				Contingent			(19)	0	3 /31	
0556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					15.000 30-Day Avg.	20.000 Daily Max.	MG/L		1/7	GR
INC, TOTAL AS ZN)	SAMPLE MEASUREMENT					0.008	0.008	(19)	0	1 /31	
1092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					0.880 30-Day Avg.	0.880 Daily Max.	MG/L		1/30	GR
LOW, IN CONDUIT OR HRU TREATMENT PLANT	SAMPLE MEASUREMENT	0.182	0.726	(03)					0	18/31	
0050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	1.000 30-Day Avg		MGD						30/30	INST
HLORINE TOTAL ESIDUAL	SAMPLE MEASUREMENT						<0.05	(19)	0	3 /31	
0060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						0.110 Daily Max.	MG/L		1/7	GR

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER: EXELS, JAMES R. MGR, GOVT & ENV AFFRS (TYPED OR PRINTED)

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT. SEE 18 U.S.C. § 1001 AND 33 U.S.C. § 1319. *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)*

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE AREA CODE	TELEPHONE NUMBER	DATE YEAR	MO	DAY
303	2942808	93	08	11

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

...y Name/Location if different)
...E PUBLIC SERVICE COMPANY OF COLORADO
...RESS P. O. BOX 840
DENVER, COLORADO 80201

...ILITY ARAPAHOE
...ATION

DISCHARGE MONITORING ...

(2-16)	(17-19)
CO 0001091	001A
PERMIT NUMBER	DISCHARGE NUMBER

FINAL

Expires 3-31-88

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	07	01	TO	93	07	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
...L AND GREASE ...SUAL ...066 1 0 0 ...FLUENT GROSS VALUE	SAMPLE MEASUREMENT		0	YES 0 - NO					0	3 /31	
	PERMIT REQUIREMENT		Inst. Max.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

...AME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
...EXELS, JAMES R. ...GR, GOVT & ENV AFFRS	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT. SEE 18 USC § 1001 AND 33 USC § 1319. (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)	x James R. Wexels	303	2942808	93	08	11
TYPED OR PRINTED		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

...MMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

E PUBLIC SERVICE COMPANY OF COLORADO
RESS P. O. BOX 840
DENVER, COLORADO 80201

LITY ARAPAHOE
ATION

(2-16)	(17-19)	
CO 0001091	0020	FINAL
PERMIT NUMBER	DISCHARGE NUMBER	

Expires 3-31-88

	MONITORING PERIOD						
	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	07	01	TO	93	07	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	QUALITY OR CONCENTRATION (4 Card Only) (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
MPERATURE TER DEG FAHRENHEIT 011 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
400 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
LIDS, TOTAL TSS SPENDED 530 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
L AND GREASE EON EXTR GRAV METH 556 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
NC, TOTAL S ZN) 092 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
OW, IN CONDUIT OR RU TREATMENT PLANT 050 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
LORINE TOTAL SIDUAL 060 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										

ME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
XELS, JAMES R. R, GOVT & ENV AFFRS	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE, ACCURATE AND COMPLETE. I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION, INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT. SEE 18 U.S.C. § 1001 AND 33 U.S.C. § 1319. *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.)*		303	9942808	93	08	11
TYPED OR PRINTED		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

MENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

Form 3320-1 (Rev. 10-79) PREVIOUS EDITION TO BE USED

NE PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

(2-10) PERMIT NUMBER	(11-17) DISCHARGE NUMBER
CO 0001021	002A

FINAL

Expires 3-31-88

MONITORING PERIOD	YEAR (20-21)	MO (22-23)	DAY (24-25)		YEAR (26-27)	MO (28-29)	DAY (30-31)
FROM	[illegible]	[illegible]	01	TO	[illegible]	07	31

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (4 Card Only) AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	QUALITY OR CONCENTRATION (4 Card Only) MINIMUM (38-45)	AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
L AND GREASE SUAL 066 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
XELS, JAMES R.
MGR,GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)*

X James R. Wefels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE AREA CODE	NUMBER	DATE YEAR	MO	DAY
303	2942808	93	08	11

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

Expires 3-31-88

DRESS P. O. BOX 840
DENVER COLORADO 80201

COUNTY ARAPAHOE
LOCATION

PERMIT NUMBER	DISCHARGE NUMBER	
CO 0001091	001A	FINAL

MONITORING PERIOD

	YEAR (20-21)	MO (22-23)	DAY (24-25)		YEAR (26-27)	MO (28-29)	DAY (30-31)
FROM	93	08	01	TO	93	08	31

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
MPERATURE TER DEG FAHRENHEIT	SAMPLE MEASUREMENT						79.000	(15)	0	10/31	
011 1 0 0 ELUENT GROSS VALUE	PERMIT REQUIREMENT						86.000 Daily Max.	DEGF		5/7	INSIT
	SAMPLE MEASUREMENT				8.150		8.670	(12)	0	10/31	
400 1 0 0 ELUENT GROSS VALUE	PERMIT REQUIREMENT				6.500 Minimum		9.000 Maximum	SU		5/7	GR
LIDS, TOTAL TSS SPENDED	SAMPLE MEASUREMENT					12.400	15.600	(19)	0	2 /31	
530 1 0 0 ELUENT GROSS VALUE	PERMIT REQUIREMENT					30.000 30-Day Avg.	100.000 Daily Max.	MG/L		1/7	8HR COMP
L AND GREASE EON EXTR-GRAV METH	SAMPLE MEASUREMENT				Contingent			(19)	0	0 /31	
556 1 0 0 ELUENT GROSS VALUE	PERMIT REQUIREMENT					15.000 30-Day Avg.	20.000 Daily Max.	MG/L		1/7	GR
NC, TOTAL S ZN)	SAMPLE MEASUREMENT					0.024	0.024	(19)	0	1 /31	
092 1 0 0 ELUENT GROSS VALUE	PERMIT REQUIREMENT					0.880 30-Day Avg.	0.880 Daily Max.	MG/L		1/30	GR
OW. IN CONDUIT OR RU TREATMENT PLANT	SAMPLE MEASUREMENT	0.227	0.346	(03)					0	6 /31	
050 1 0 0 ELUENT GROSS VALUE	PERMIT REQUIREMENT	1.000 30-Day Avg.		MGD						30/30	INST
LORINE TOTAL SIDUAL	SAMPLE MEASUREMENT						<0.05	(19)	0	2 /31	
060 1 0 0 ELUENT GROSS VALUE	PERMIT REQUIREMENT						0.110 Daily Max.	MG/L		1/7	GR

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
XELS, JAMES R. R,GOVT & ENV AFFRS	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)*		303	9428008	93	09	13
TYPED OR PRINTED		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

AME PUBLIC SERVICE COMPANY OF COLORADO
ODRESS P. O. BOX 840
DENVER, COLORADO [illegible]

ACILITY ARAPAHOE
OCATION

PERMIT NUMBER (2-16)	DISCHARGE NUMBER (17-19)
CO 0001091	001A

FINAL

OMB No. 2040-00[illegible]
Expires 3-31-88

MONITORING PERIOD

	YEAR (20-21)	MO (22-23)	DAY (24-25)		YEAR (26-27)	MO (28-29)	DAY (30-31)
FROM	93	08	01	TO	93	08	31

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) AVERAGE (46-53)	QUANTITY OR LOADING MAXIMUM (54-61)	UNITS	QUALITY OR CONCENTRATION (4 Card Only) MINIMUM (38-45)	AVERAGE (46-53)	MAXIMUM (54-61)	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
IL AND GREASE ISUAL 4066 1 0 0	SAMPLE MEASUREMENT		0	1 YES 0 NO					0	2 /31	
EFLUENT GROSS VALUE	PERMIT REQUIREMENT		INST. MAX.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

JEXELS, JAMES R.
IGR, GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

James R. Wexels

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE AREA CODE	NUMBER	DATE YEAR	MO	DAY
303	2942808	93	09	13

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

PERMIT NUMBER | DISCHARGE NUMBER

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	08	01	TO	93	08	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
TEMPERATURE WATER DEG FAHRENHEIT 00011 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
PH 00400 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
SOLIDS, TOTAL TSS SUSPENDED 00530 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
OIL AND GREASE FREON EXTR GRAV METH 00556 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
ZINC, TOTAL (AS ZN) 01092 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
FLOW, IN CONDUIT OR THRU TREATMENT PLANT 50050 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
CHLORINE TOTAL RESIDUAL 50060 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
VEXELS, JAMES R.
MGR, GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	09	13
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

ME [illegible]
DRESS P. O. BOX 310
DENVER, COLORADO 80201

CILITY ARAPAHOE
CATION

PERMIT NUMBER	DISCHARGE NUMBER
CO-0001091	001A

MONITORING PERIOD

	YEAR (20-21)	MO (22-23)	DAY (24-25)		YEAR (26-27)	MO (28-29)	DAY (30-31)
FROM	93	07	01	TO	93	07	30

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
IL AND GREASE ISUAL 4066 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT		.0	1 YES 0 NO					0	3 /30	
	PERMIT REQUIREMENT		INST. MAX.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
EXELS, JAMES R.
DR, GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (*Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years*)

James R. Wexels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
AREA CODE	NUMBER	YEAR	MO	DAY
303	5942808	93	10	12

COMMENT AND EXPLANATION OF ANY VIOLATIONS (*Reference all attachments here*)

AME PUBLIC SERVICE COMPANY OF COLORADO
DDRESS P. O. BOX 840
DENVER, COLORADO 80201

ACILITY ARAPAHOE
OCATION

(2-16)	(17-19)
CO-0001091	002A
PERMIT NUMBER	DISCHARGE NUMBER

FINAL

Expires 3-31-88

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	09	01	TO	93	09	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	QUALITY OR CONCENTRATION (4 Card Only) (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
EMPERATURE ATER DEG FAHRENHEIT	SAMPLE MEASUREMENT	NO DISCHARGE									
0011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
H	SAMPLE MEASUREMENT	NO DISCHARGE									
0400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
OLIDS, TOTAL TSS USPENDED	SAMPLE MEASUREMENT	NO DISCHARGE									
0530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
IL AND GREASE RCON EXTR GRAV METH	SAMPLE MEASUREMENT	NO DISCHARGE									
0556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
INC, TOTAL AS ZN)	SAMPLE MEASUREMENT	NO DISCHARGE									
1092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
LOW, IN CONDUIT OR HRU TREATMENT PLANT	SAMPLE MEASUREMENT	NO DISCHARGE									
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										
HLORINE TOTAL ESIDUAL	SAMPLE MEASUREMENT	NO DISCHARGE									
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
EALES, JAMES R.
GR,GOVT & ENV AFFRS
TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (*Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.*)

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	3942808	93	10	12
AREA CODE	NUMBER	YEAR	MO	DAY

OMMENT AND EXPLANATION OF ANY VIOLATIONS (*Reference all attachments here*)

Expires 3-31-88

DRESS P. O. BOX 840
DENVER, COLORADO 80201

CILITY ARAPAHOE
CATION

CO-0001091	002A
PERMIT NUMBER	DISCHARGE NUMBER

FINAL

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	09	01	TO	93	09	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
L AND GREASE SUAL 066 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE,									
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER			TELEPHONE		DATE		
WEXELS, JAMES R. MGR,GOVT & ENV AFFRS	I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)	James R. Wexels (signature)	303	2942800	93	10	12
TYPED OR PRINTED		SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT	AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

NAME PUBLIC SERVICE COMPANY OF COLORADO
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

CO 0001091
PERMIT NUMBER

001A
DISCHARGE NUMBER

FINAL

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	10	01	TO	93	10	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	QUALITY OR CONCENTRATION (4 Card Only) (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
EMPERATURE ATER DEG FAHRENHEIT	SAMPLE MEASUREMENT						72.500	(15)	0	20/31	
0011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						86.000 Daily Max.	DEGF		5/7	INSIT
H	SAMPLE MEASUREMENT				8.430		8.810	(12)	0	20/31	
0400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT				6.500 Minimum		9.000 Maximum	SU		5/7	GR
SOLIDS, TOTAL TSS SUSPENDED	SAMPLE MEASUREMENT					16.200	20.000	(19)	0	4 /31	
00530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					30.000 30-Day Avg.	100.000 Daily Max.	MG/L		1/7	8HR CO
OIL AND GREASE FREON EXTR GRAV METH	SAMPLE MEASUREMENT				Contingent			(19)	0	0 /31	
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					15.000 30-Day Avg.	20.000 Daily Max.	MG/L		1/7	GR
ZINC, TOTAL (AS ZN)	SAMPLE MEASUREMENT					0.025	0.025	(19)	0	1 /31	
01092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					0.880 30-Day Avg.	0.880 Daily Max.	MG/L		1/30	GR
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	0.487	9.255	(03)					0	31/31	
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	1.000 30-Day Avg.		MGD						30/30	INST
CHLORINE TOTAL RESIDUAL	SAMPLE MEASUREMENT						<0.05	(19)	0	4 /31	
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						0.110 Daily Max.	MG/L		1/7	GR

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

JEKELS, JAMES R.
MGR.GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	11	16
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here)

DDRESS P. O. BOX 840
DENVER, COLORADO 80201

ACILITY ARAPAHOE
OCATION

PERMIT NUMBER

DISCHARGE NUMBER

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	10	01	TO	93	10	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
IL AND GREASE ISUAL 84066 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT		0	1=YES 0=NO					0	4 /31	
	PERMIT REQUIREMENT		INST MAX.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

WEXELS, JAMES R.
MGR.GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 (*Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years.*)

X James R. Wexels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	9942808	93	11	16
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS (*Reference all attachments here*)

DENVER, COLORADO 80201

ILITY ARAPAHOE

ATION

PERMIT NUMBER

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	73	10	01	TO	73	10	31
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
MPERATURE TER DEG FAHRENHEIT 011 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
400 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
LIDS, TOTAL TSS SPENDED 0530 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
L AND GREASE REON EXTR-GRAV METH 0556 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
INC, TOTAL AS ZN) 1092 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
LOW, IN CONDUIT OR HRU TREATMENT PLANT 0050 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
HLORINE TOTAL ESIDUAL 0060 1 0 0 FLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										

AME/TITLE PRINCIPAL EXECUTIVE OFFICER

EXELS, JAMES R.
GR, GOVT & ENV AFFRS

TYPED OR PRINTED

I CERTIFY UNDER PENALTY OF LAW THAT I HAVE PERSONALLY EXAMINED AND AM FAMILIAR WITH THE INFORMATION SUBMITTED HEREIN AND BASED ON MY INQUIRY OF THOSE INDIVIDUALS IMMEDIATELY RESPONSIBLE FOR OBTAINING THE INFORMATION I BELIEVE THE SUBMITTED INFORMATION IS TRUE ACCURATE AND COMPLETE I AM AWARE THAT THERE ARE SIGNIFICANT PENALTIES FOR SUBMITTING FALSE INFORMATION INCLUDING THE POSSIBILITY OF FINE AND IMPRISONMENT SEE 18 USC § 1001 AND 33 USC § 1319 *(Penalties under these statutes may include fines up to $10,000 and or maximum imprisonment of between 6 months and 5 years)*

SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	242808	73	11	16
AREA CODE	NUMBER	YEAR	MO	DAY

OMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

NAME [illegible]
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

PERMIT NUMBER	DISCHARGE NUMBER
CO-0001091	002A

FINAL

MONITORING PERIOD

	YEAR (20-21)	MO (22-23)	DAY (24-25)		YEAR (26-27)	MO (28-29)	DAY (30-31)
FROM	93	10	01	TO	93	10	31

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		(3 Card Only) QUANTITY OR LOADING (46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(4 Card Only) QUALITY OR CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
IL AND GREASE ISUAL 4066 1 0 0 FFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
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	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
EXELS, JAMES R.
DR,GOVT & ENV AFFRS
TYPED OR PRINTED

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X James R. Wexels
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE AREA CODE	NUMBER	DATE YEAR	MO	DAY
303	2942008	93	11	16

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

AMS

DDRESS P. O. BOX 840
DENVER, COLORADO 80201

ACILITY ARAPAHOE
OCATION

CO-0001091	001A	FINAL
PERMIT NUMBER	DISCHARGE NUMBER	

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	11	01	TO	93	11	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

NOTE: Read instructions before completing this form.

PARAMETER (32-37)		QUANTITY OR LOADING (3 Card Only) AVERAGE (46-53)	QUANTITY OR LOADING MAXIMUM (54-61)	UNITS	QUALITY OR CONCENTRATION (4 Card Only) MINIMUM (38-45)	QUALITY OR CONCENTRATION AVERAGE (46-53)	QUALITY OR CONCENTRATION MAXIMUM (54-61)	UNITS	NO. EX (62-63)	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (69-70)
EMPERATURE ATER DEG FAHRENHEIT	SAMPLE MEASUREMENT						52.000	(15)	0	25/30	
0011 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						86.000 Daily Max.	DEGF		5/7	INSIT
H	SAMPLE MEASUREMENT				8.430		8.810	(12)	0	25/30	
0400 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT				6.500 Minimum		7.000 Maximum	SU		5/7	GR
OLIDS, TOTAL TSS USPENDED	SAMPLE MEASUREMENT					14.560	22.800	(19)	0	5 /30	
0530 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					30.000 30-Day Avg.	100.000 Daily Max.	MG/L		1/7	8HR CO
OIL AND GREASE FREON EXTR-GRAV METH	SAMPLE MEASUREMENT				Contingent			(19)	0	0 /30	
00556 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					15.000 30-Day Avg.	20.000 Daily Max.	MG/L		1/7	GR
ZINC, TOTAL (AS ZN)	SAMPLE MEASUREMENT					0.018	0.018	(19)	0	1 /30	
01092 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT					0.880 30-Day Avg.	0.880 Daily Max.	MG/L		1/30	GR
FLOW, IN CONDUIT OR THRU TREATMENT PLANT	SAMPLE MEASUREMENT	0.354	0.806	(03)					0	30/30	
50050 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT	1.000 30-Day Avg.		MGD						30/30	INST
CHLORINE TOTAL RESIDUAL	SAMPLE MEASUREMENT						<0.05	(19)	0	5 /30	
50060 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT						0.110 Daily Max.	MG/L		1/7	GR

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
DEXELS, JAMES B.
MGR, GOVT & ENV AFFRS
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SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	12	14
AREA CODE	NUMBER	YEAR	MO	DAY

OMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

NAME PUBLIC SERVICE COMPANY OF [illegible]
ADDRESS P. O. BOX 840
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

CO-0001091	[illegible]
PERMIT NUMBER	DISCHARGE NUMBER

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	93	11	01	TO	93	11	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

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OIL AND GREASE VISUAL	SAMPLE MEASUREMENT		0	1=YES 0=NO					0	5 /30	
84066 1 0 0 EFFLUENT GROSS VALUE	PERMIT REQUIREMENT		INST. MAX.							1/7	VIS
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
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	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER
WEXELS, JAMES R.
MGR.GOVT & ENV AFFRS
TYPED OR PRINTED

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X [signature]
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	2942808	93	12	1[illegible]
AREA CODE	NUMBER	YEAR	MO	DAY

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

ADDRESS P. O. BOX 890
DENVER, COLORADO 80201

FACILITY ARAPAHOE
LOCATION

PERMIT NUMBER

MONITORING PERIOD

	YEAR (20-21)	MO (22-23)	DAY (24-25)		YEAR (26-27)	MO (28-29)	DAY (30-31)
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TEMPERATURE WATER DEG FAHRENHEIT 00011 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
PH 00400 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
SOLIDS, TOTAL TSS SUSPENDED 00530 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
OIL AND GREASE FREON EXTR-GRAV METH 00556 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
ZINC, TOTAL (AS ZN) 01092 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
FLOW, IN CONDUIT OR THRU TREATMENT PLANT 50050 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
CHLORINE TOTAL RESIDUAL 50060 1 0 0 EFFLUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										

NAME/TITLE PRINCIPAL EXECUTIVE OFFICER

WEXELS, JAMES R.
MGR,GOVT & ENV AFFRS

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TELEPHONE		DATE		
AREA CODE	NUMBER	YEAR	MO	DAY
303	2942008	93	12	14

COMMENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

EPA Form 3320-1 (Rev. 10-79) PREVIOUS EDITION TO BE USED

PUBLIC SERVICE ...
P. O. BOX 840
DENVER, COLORADO 80201

...TY ARAPAHOE
...TION

CO-0001091
PERMIT NUMBER

0020
DISCHARGE NUMBER

FINAL

MONITORING PERIOD

	YEAR	MO	DAY		YEAR	MO	DAY
FROM	73	11	01	TO	73	11	30
	(20-21)	(22-23)	(24-25)		(26-27)	(28-29)	(30-31)

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... AND GREASE ...UAL ...66 1 0 0 ...LUENT GROSS VALUE	SAMPLE MEASUREMENT	NO DISCHARGE									
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
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	PERMIT REQUIREMENT										
	SAMPLE MEASUREMENT										
	PERMIT REQUIREMENT										

...ME/TITLE PRINCIPAL EXECUTIVE OFFICER

...XELS, JAMES R.
...R.GOVT & ENV AFFRS

TYPED OR PRINTED

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x James R. Wells [signature]
SIGNATURE OF PRINCIPAL EXECUTIVE OFFICER OR AUTHORIZED AGENT

TELEPHONE		DATE		
303	942808	73	12	14
AREA CODE	NUMBER	YEAR	MO	DAY

...MENT AND EXPLANATION OF ANY VIOLATIONS *(Reference all attachments here)*

Form 3320-1 (Rev. 10-72) PREVIOUS EDITION TO BE USED ...

PAGE ... OF ...

INTEGRATED DRY NO_x/SO_2 EMISSIONS CONTROL SYSTEM

ENVIRONMENTAL MONITORING REPORT

Calcium-Based Dry Sorbent Injection System Test Period:
April 30, 1993 through November 2, 1993

Appendix C: Calcium-Based DSI System Data Summary

Data Used For Duct Injection Trend Plots.

Test	Date	Load	Ca/S	Tapp. calc	ΔSO2	ΔSO2 @ Ca/S=2
582	5/12/93	108	1.54	49	21.2	27.5
605	6/28/93	107	1.63	65	12.1	14.8
605	6/28/93	109	1.66	76	9.2	11.1
605	6/28/93	108	1.76	61	19.1	21.7
605	6/29/93	108	2.07	40	20.5	19.8
605	6/29/93	106	1.87	43	20.5	21.9
610	7/1/93	109	1.69	36	32.0	37.9
610	7/1/93	106	1.82	25	29.4	32.3
582	5/12/93	108	1.36	69	13.8	
582	5/12/93	108	1.41	67	16.3	
612	7/2/93	104	1.07	38	14.8	
578	5/10/93	100	1.69	59	20.0	23.7
579	5/11/93	100	1.71	56	19.1	22.3
580	5/11/93	100	1.85	50	19.5	21.1
584	5/13/93	100	1.55	48	20.7	26.7
610	7/1/93	100	1.69	36	32.6	38.6
603	6/22/93	95	1.75	47	20.8	23.8
576	5/3/93	100	2.41			
579	5/11/93	100	0.95	51	12.0	
584	5/13/93	99	0.78	47	11.4	
610	7/1/93	98	1.09	24	22.6	
605	6/28/93	91	1.69	41	22.6	26.7
605	6/28/93	91	1.74	39	20.8	23.9
605	6/28/93	91	1.33	45	16.9	
605	6/29/93	86	1.63	41	23.4	
600	6/16/93	80	1.86	40	23.3	25.1
604	6/22/93	80	1.78	36	17.8	20.0
599	6/15/93	80	0.40	35	2.3	
601	6/17/93	80	0.85	45	12.9	
602	6/21/93	80	0.39	45	3.9	
610	7/1/93	78	1.42	42	19.3	
612	7/2/93	79	1.40	44	20.6	
581	5/12/93	70	1.73	44	20.3	23.5
586	5/14/93	70	1.70	20	37.0	43.7
583	5/13/93	70	1.66	38	19.3	23.3
604	6/22/93	50	1.75	45	22.2	25.4
604	6/22/93	59	1.53	45	23.8	31.1
606	6/29/93	60	1.64	38	22.5	27.4
606	6/30/93	58	1.75	38	18.8	21.5
608	7/1/93	60	1.72	34	19.7	22.9
609	7/1/93	60	1.72	29	23.4	27.2
611	7/2/93	61	1.59	36	25.5	32.1
705	10/19/93	112	2.06	28	37.0	35.9
706	10/20/93	112	2.07	28	35.4	34.2
707	10/20/93	112	2.10	29	37.8	36.0
709	10/26/93	102	2.03	50	26.9	26.5
712	10/27/93	101	1.97	29	28.1	28.5
715	11/1/93	112	2.23	32	34.4	30.9
717	11/1/93	113	1.90	35	30.9	32.5
719	11/2/93	114	2.04	36	26.8	26.3
720	11/2/93	114	2.10	32	28.6	27.2
721	11/2/93	114	2.15	30	32.9	30.6

PSCC Arapahoe Unit 4 Calcium/Humidification-Duct Injection. Ca(OH)2 calculations based upon 68% CaO

		Boiler		Sorbent Feed			Injector cal		ΔSO2 Red		Humidification					Baghouse Temps					Humid calc	
Test	Date & Time	Load	O2cr	Loc	A.w	B.e	Flow	Ca/S*	Comp	Calc	Air	Tgo	Twl	H2O	A/W	Grid	Out	IDin	Opsis	Ta	Tcalc	H2Oe
		MWe	%wet		%	%	lb/min		%	%	scfm	°F	°F	gpm	-	°F	°F	°F	°F	°F	°F	%w
575	4/30/93 1420	100	3.90	Duct	50	50	19.2	1.02	5	1.3	3684			35.0	1.05	202	206					8.27
575	4/30/93 1500	100	3.90	Duct	50	50	19.2	1.02	8	2.8	3639			40.0	0.90	194	199					8.25
575	4/30/93 1635	100	3.90	Duct	50	50	19.2	1.01	8	3.4	3550			47.0	0.70	175	185					8.28
576	5/3/93 1615	100	3.50	Duct	100	100	38.4	2.41	21	18.0	3457	258	52	54.0	0.60	223	180				149	8.53
577	5/6/93 1130	53	7.30	Duct			0.0	0.00	2	3.4	4200	248	55	30.0	1.57	160	185*		170	49	165	6.77
577	5/6/93 1340	55	7.10	Duct	45	45	17.3	1.81	10	4.8	4188	252	55	31.0	1.55	160			167		169	6.75
577	5/6/93 1515	55	7.00	Duct	45	45	17.3	1.85	13	7.1	4145	254	55	35.5	1.31	150			160		160	6.74
577	5/6/93 1735	55	7.00	Duct	45	45	17.3	1.84	16	9.8	4109	255	56	38.5	1.21	142			154		151	6.87
578	5/10/93 0800	105	4.10	Duct	0	0	0.0	0.00		-2.3									253			8.83
578	5/10/93 1405	100	3.70	Duct	88	88	33.8	1.68	19	15.3	3990	276	55	48.0	0.89	160	173		179	56	179	8.34
578	5/10/93 1600	100	3.60	Duct	88	88	33.8	1.56	22	18.6	3973	278	56	49.0	0.87	160	170		173	53	173	8.83
578	5/10/93 1800	100	3.60	Duct	96	96	36.9	1.69	23	20.0	3957	282	55	50.0	0.84	160	170		174	53	175	8.93
578	5/10/93 2023	100	3.64	Duct	96	96	36.9	1.71	26	22.4	3960	280	56	50.0	0.84	160	168		174	51	173	9.11
578	5/10/93 2221	100	3.57	Duct	96	96	36.9	1.86	27	23.0	3974	276	56	49.0	0.86	160	167		173	50	173	8.99
578	5/11/93 0032	100	3.97	Duct	90	90	34.6	1.82	28	21.0	4000	271	56	47.0	0.91	160	167		172	50	174	9.00
578	5/11/93 0230	100	3.94	Duct	85	85	32.7	1.76	22	19.1	4029	266	55	45.0	0.96	160	165		171	48	173	8.99
578	5/11/93 0430	100	3.93	Duct	85	85	32.7	1.71	22	20.1	4023	266	55	45.0	0.95	160	164		170	47	172	8.99
578	5/11/93 0620	100	3.93	Duct	85	85	32.7	1.66	24	20.7	4011	266	55	45.0	0.94	160	164		170	47	172	8.99
578	5/11/93 0830	100	4.00	Duct	85	85	32.7	1.64	20	14.9	3980	270	54	46.0	0.91	160	164		170	47	174	8.96
579	5/11/93 1100	100	4.00	Duct	0	90	17.4	0.90	18	12.3	3917	275	56	52.0	0.79	150	162		167	45	167	8.89
579	5/11/93 1300	100	4.20	Duct	0	90	17.4	0.94	17	13.2	3875	280	56	54.0	0.75	150	163		167	46	167	9.00
579	5/11/93 1500	100	4.00	Duct	0	90	17.4	0.96	16	11.5	3875	281	54	54.0	0.75	150	164		170	47	169	8.96
579	5/11/93 1700	100	3.90	Duct	0	90	17.4	0.99	16	11.4	3867	282	55	55.0	0.74	150	163		168	46	168	9.02
579	5/11/93 1900	100	3.96	Duct	0	90	17.4	1.00	19	11.6	3866	283	55	55.0	0.72	150	164		168	47	169	9.05
580	5/11/93 2100	100	3.94	Duct	90	90	34.6	1.94	26	20.2	3861	284	55	56.0	0.71	150	162		168	45	168	9.28
580	5/11/93 2300	100	3.95	Duct	80	80	30.8	1.76	23	19.1	3869	278	56	55.0	0.73	150	161		167	44	165	9.34
581	5/12/93 0010	70	5.84	Duct	56	56	21.5	1.80	22	21.5	4040	258	55	41.0	1.06	150	156		160	41	160	7.99
581	5/12/93 0200	70	5.83	Duct	53	53	20.4	1.70	25	19.6	4057	254	55	40.0	1.11	150	154		156	39	159	7.96
581	5/12/93 0400	70	5.86	Duct	53	53	20.4	1.69	24	20.0	4062	253	55	40.0	1.11	150	153		155	38	158	7.88
581	5/12/93 0545	70	5.86	Duct	53	53	20.4	1.66	12	10.0	4481	252	56	0.0		241	183		188	68	252	7.87
582	5/12/93 1240	108	3.20	Duct	95	95	36.5	1.81	23	14.8	3866	288	56	55.0	0.74	160	184		189	65	180	9.51
582	5/12/93 1420	108	3.20	Duct	95	95	36.5	1.54	24	21.2	3810	291	56	63.0	0.69	150	175		180	56	168	9.59
582	5/12/93 2040	108	3.31	Duct	95	95	36.5	1.36	16	13.8	3877	288	56	51.0	0.79	170	201			82	188	9.49
582	5/12/93 2250	108	3.31	Duct	100	100	38.4	1.41	19	16.3	3908	286	57	51.0	0.81	170	182		190	63	186	9.49
583	5/13/93 0020	70	5.25	Duct	80	80	30.8	1.74	23	21.2	4013	261	56	44.0	1.00	142	169		169	53	153	8.30
583	5/13/93 0300	70	5.21	Duct	75	75	28.8	1.64	25	19.3	4049	256	56	42.0	1.06	142	154		155	38	153	8.22
583	5/13/93 0430	70	5.23	Duct	75	75	28.8	1.67	25	19.2	4046	255	55	41.0	1.07	142	150		152	34	154	8.23
584	5/13/93 0530	100	3.48	Duct	100	100	38.4	1.57	22	18.9	3989	266	55	45.0	0.95	160	160		165	44	171	9.54
584	5/13/93 0735	100	3.50	Duct	100	100	38.4	1.55	24	20.7	3897	274	56	52.0	0.80	152	162		168	46	165	9.39
584	5/13/93 0930	99	3.40	Duct	0	100	19.4	0.78	17	11.4	3867	277	56	53.5	0.76	149	160		165	44	164	9.27
585	5/14/93 0035	69	5.37	Duct	60	60	23.1	1.68	30	23.8	3998	259	55	46.0	0.94	128	156		156	41	144	8.06
585	5/14/93 0230	70	5.27	Duct	60	60	23.1	1.64	30	24.6	4011	255	55	46.0	0.95	129	144		145	29	142	8.00
586	5/14/93 0310	70	5.19	Duct	60	60	23.1	1.66	38	36.1	3971	256	56	49.0	0.86	124	140		142	25	136	8.04
586	5/14/93 0420	70	5.26	Duct	60	60	23.1	1.72	37	37.6	3977	254	55	49.0	0.88	124	137		139	22	134	8.00
586	5/14/93 0545	70	5.26	Duct	60	60	23.1	1.71	44	39.4	3979	254	56	48.0	0.89	125	136		137	21	136	7.98
586	5/14/93 0705	70	5.50	Duct	60	60	23.1	1.69	41	35.1	3971	252	56	49.0	0.86	124	134		136	19	132	8.16

PSCC Arapahoe Unit

Test	Date & Time	GAS ANAL ECON-DRY (1-12) NO	CO	SO2	CO2	O2	GAS ANALYSIS INLET-WET ...... NO	CO	SO2	CO2	H2O	O2	GAS ANALYSIS OUTLET-WET ...... NO	CO	SO2	CO2	H2O	O2	Comments
		ppm	ppm	ppm	%	%dry	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	%	%	%	
575	4/30/93 1420	235	194	424	13.53	5.25	180	154	348	12.02	8.22	4.90	192	233	332	11.73	10.46	4.90	
575	4/30/93 1500	235	194	424	13.53	5.25	180	180	347	12.05	8.20	4.90	187	281	328	11.89	10.88	4.75	
575	4/30/93 1635	235	194	424	13.53	5.25	179	184	351	12.07	8.26	4.85	187	329	329	11.54	11.54	4.60	
576	5/3/93 1615	225	166	320	13.04	5.27	195	153	268	10.87	7.69	6.30	208	663	227	11.44	11.85	5.00	
577	5/6/93 1130	199	11	263	10.28	9.20	160	14	235	9.41	6.76	8.60	164	7	232	9.25	9.38	8.55	Humid
577	5/6/93 1340	199	11	263	10.28	9.20	163	11	228	9.21	6.63	8.78	163	7	208	9.08	9.39	8.65	
577	5/6/93 1515	199	11	263	10.28	9.20	166	11	225	9.23	6.66	8.72	164	6	198	8.98	9.63	8.67	
577	5/6/93 1735	202	10	259	10.43	8.95	163	10	225	9.22	6.63	8.75	165	6	193	8.99	9.87	8.60	
578	5/10/93 0800	255	44	370	14.10	5.50	181	50	295	10.94	7.62	7.05	195	183	355	12.96	8.91	4.60	
578	5/10/93 1405	255	44	370	14.10	5.50	203	225	398	13.62	9.14	3.65	195	97	295	12.03	11.64	5.05	
578	5/10/93 1600	230	194	445	14.78	4.42	194	344	430	13.53	9.06	3.62	189	89	311	12.15	11.89	4.75	
578	5/10/93 1800	230	194	445	14.78	4.42	203	135	427	13.62	9.03	3.85	184	105	308	12.28	12.07	4.72	
578	5/10/93 2023	230	194	445	14.78	4.42	199	104	422	13.59	9.24	3.80	186	49	291	12.19	12.08	4.91	
578	5/10/93 2221	219	96	422	14.72	4.70	199	51	385	13.47	9.18	3.96	189	60	266	12.22	12.02	4.91	
578	5/11/93 0032	241	63	383	14.58	4.92	208	52	367	13.40	9.29	4.00	194	37	259	12.08	11.97	5.05	
578	5/11/93 0230	241	63	383	14.58	4.92	195	126	365	13.67	9.46	3.70	198	45	261	12.09	11.63	5.03	
578	5/11/93 0430	234	71	392	14.41	4.80	207	50	368	13.39	9.18	4.05	194	62	265	12.13	11.73	5.00	
578	5/11/93 0620	234	71	392	14.41	4.80	208	55	380	13.43	9.20	4.01	192	57	270	12.12	11.73	5.05	
578	5/11/93 0830	234	71	392	14.41	4.80	212	52	383	13.44	9.15	4.05	188	91	295	12.27	11.89	4.90	
579	5/11/93 1100	234	71	392	14.41	4.80	207	50	375	13.36	9.08	4.05	190	53	292	12.00	12.08	5.10	
579	5/11/93 1300	234	71	392	14.41	4.80	215	32	352	13.17	8.99	4.38	191	98	279	12.05	12.10	5.00	
579	5/11/93 1500	239	123	368	14.36	4.95	213	44	348	13.34	9.17	4.15	192	87	275	11.83	12.24	5.10	
579	5/11/93 1700	239	123	368	14.36	4.95	215	57	338	13.30	9.26	4.10	192	116	266	11.87	12.45	5.10	
579	5/11/93 1900	239	123	368	14.36	4.95	206	89	339	13.44	9.43	3.87	188	64	267	12.01	12.66	4.85	
580	5/11/93 2100	239	123	368	14.36	4.95	214	185	345	13.37	9.68	3.85	185	46	240	11.80	12.93	5.11	
580	5/11/93 2300	239	123	368	14.36	4.95	200	155	345	13.68	9.96	3.50	190	85	242	11.98	12.78	4.95	
581	5/12/93 0010	223	29	284	11.80	7.75	201	14	266	11.04	8.20	6.80	179	17	185	9.89	10.94	7.65	
581	5/12/93 0200	223	29	284	11.80	7.75	205	12	267	11.00	8.17	6.80	182	17	191	9.98	10.84	7.62	
581	5/12/93 0400	223	29	284	11.80	7.75	205	13	270	11.16	8.14	6.72	174	22	193	10.10	10.90	7.48	
581	5/12/93 0545	223	29	284	11.80	7.75	199	15	282	11.59	8.36	6.35	180	30	231	10.48	7.78	7.63	H2O off
582	5/12/93 1240	240	387	387.4	14.62	4.55	214	161	363	13.47	9.71	3.80	196	277	278	12.20	12.71	4.70	
582	5/12/93 1420	240	387	387.4	14.62	4.55	· 212	189	430	13.63	9.88	3.65	189	363	305	12.21	13.13	4.50	
582	5/12/93 2040	247	557	505	14.41	4.60	205	742	488	13.48	9.84	3.60	198	399	375	12.04	12.42	4.72	
582	5/12/93 2250	247	557	505	14.41	4.60	206	860	499	13.54	9.87	3.55	199	344	369	12.11	12.39	4.82	
583	5/13/93 0020	211	113	428	12.20	7.25	190	21	406	11.46	8.51	6.32	167	88	285	10.30	11.56	7.08	
583	5/13/93 0300	211	113	428	12.20	7.25	194	16	399	11.20	8.32	6.50	172	44	289	10.28	11.29	7.18	
583	5/13/93 0430	211	113	428	12.20	7.25	199	16	395	11.35	8.37	6.43	168	53	287	10.33	11.30	7.10	
584	5/13/93 0530	224	212	500	14.48	4.60	187	194	480	13.61	9.89	3.60	181	144	345	12.06	12.23	4.85	
584	5/13/93 0735	224	213	500	14.48	4.60	194	309	487	13.59	9.69	3.68	182	152	340	11.98	12.58	4.90	
584	5/13/93 0930	220	373	496	14.31	4.70	191	484	490	13.54	9.65	3.65	180	188	380	11.93	12.57	4.95	
585	5/14/93 0035	210	61	350	12.17	7.20	194	19	328	11.64	8.45	5.98	164	46	217	10.21	11.67	7.05	
585	5/14/93 0230	210	61	350	12.17	7.20	200	18	335	11.60	8.47	5.85	170	79	219	10.37	11.67	6.95	
586	5/14/93 0310	210	61	350	12.17	7.20	199	25	325	11.46	8.33	6.15	165	83	186	10.46	11.99	6.75	
586	5/14/93 0420	210	61	350	12.17	7.20	199	39	325	11.98	8.62	5.60	181	38	172	10.37	11.77	7.00	
586	5/14/93 0545	210	61	350	12.17	7.20	200	38	322	11.82	8.46	5.80	159	164	170	10.40	11.91	6.80	
586	5/14/93 0705	210	61	350	12.17	7.20	201	24	309	11.24	8.17	6.60	173	62	179	10.08	11.56	7.25	O2 changd

PSCC Arapahoe Unit 4 Calcium/Humidification-Duct Injection, Ca(OH)2 calculations based upon 68% CaO

		Boiler		Sorbent Feed			Injector cal		ΔSO2 Red		Humidification					Baghouse Temps					Humid calc	
Test	Date & Time	Load	O2cr	Loc	A.w	B.e	Flow	Ca/S*	Comp	Calc	Air	Tgo	Twl	H2O	A/W	Grid	Out	IDin	Opsis	Ta	Tcalc	H2Oe
		MWe	%wet		%	%	lb/min		%	%	scfm	°F	°F	gpm	-	°F	°F	°F	°F	°F	°F	%w
575	4/30/93 1420	100	3.90	Duct	50	50	19.2	1.02	5	1.3	3684			35.0	1.05	202	206					8.27
575	4/30/93 1500	100	3.90	Duct	50	50	19.2	1.02	8	2.8	3639			40.0	0.90	194	199					8.25
575	4/30/93 1635	100	3.90	Duct	50	50	19.2	1.01	8	3.4	3550			47.0	0.70	175	185					8.28
576	5/3/93 1615	100	3.50	Duct	100	100	38.4	2.41	21	18.0	3457	258	52	54.0	0.60	223	180				149	8.53
577	5/6/93 1130	53	7.30	Duct			0.0	0.00	2	-3.4	4200	248	55	30.0	1.57	160	185*		170	49	165	6.77
577	5/6/93 1340	55	7.10	Duct	45	45	17.3	1.81	10	4.8	4188	252	55	31.0	1.55	160			167		169	6.75
577	5/6/93 1515	55	7.00	Duct	45	45	17.3	1.85	13	7.1	4145	254	55	35.5	1.31	150			160		160	6.74
577	5/6/93 1735	55	7.00	Duct	45	45	17.3	1.84	16	9.8	4109	255	56	38.5	1.21	142			154		151	6.87
578	5/10/93 0800	105	4.10	Duct	0	0	0.0	0.00		-2.3									253			8.83
578	5/10/93 1405	100	3.70	Duct	88	88	33.8	1.68	19	15.3	3990	276	55	48.0	0.89	160	173		179	56	179	8.34
578	5/10/93 1600	100	3.60	Duct	88	88	33.8	1.56	22	18.6	3973	278	56	49.0	0.87	160	170		173	53	173	8.83
578	5/10/93 1800	100	3.60	Duct	96	96	36.9	1.69	23	20.0	3957	282	55	50.0	0.84	160	170		174	53	175	8.93
578	5/10/93 2023	100	3.64	Duct	96	96	36.9	1.71	26	22.4	3960	280	56	50.0	0.84	160	168		174	51	173	9.11
578	5/10/93 2221	100	3.57	Duct	96	96	36.9	1.86	27	23.0	3974	276	56	49.0	0.86	160	167		173	50	173	8.99
578	5/11/93 0032	100	3.97	Duct	90	90	34.6	1.82	28	21.0	4000	271	56	47.0	0.91	160	167		172	50	174	9.00
578	5/11/93 0230	100	3.94	Duct	85	85	32.7	1.76	22	19.1	4029	266	55	45.0	0.96	160	165		171	48	173	8.99
578	5/11/93 0430	100	3.93	Duct	85	85	32.7	1.71	22	20.1	4023	266	55	45.0	0.95	160	164		170	47	172	8.99
578	5/11/93 0620	100	3.93	Duct	85	85	32.7	1.66	24	20.7	4011	266	55	45.0	0.94	160	164		170	47	172	8.99
578	5/11/93 0830	100	4.00	Duct	85	85	32.7	1.64	20	14.9	3980	270	54	46.0	0.91	160	164		170	47	174	8.96
579	5/11/93 1100	100	4.00	Duct	0	90	17.4	0.90	18	12.3	3917	275	56	52.0	0.79	150	162		167	45	167	8.89
579	5/11/93 1300	100	4.20	Duct	0	90	17.4	0.94	17	13.2	3875	280	56	54.0	0.75	150	163		167	46	167	9.00
579	5/11/93 1500	100	4.00	Duct	0	90	17.4	0.96	16	11.5	3875	281	54	54.0	0.75	150	164		170	47	169	8.96
579	5/11/93 1700	100	3.90	Duct	0	90	17.4	0.99	16	11.4	3867	282	55	55.0	0.74	150	163		168	46	168	9.02
579	5/11/93 1900	100	3.96	Duct	0	90	17.4	1.00	19	11.6	3866	283	55	55.0	0.72	150	164		168	47	169	9.05
580	5/11/93 2100	100	3.94	Duct	90	90	34.6	1.94	26	20.2	3861	284	55	56.0	0.71	150	162		168	45	168	9.28
580	5/11/93 2300	100	3.95	Duct	80	80	30.8	1.76	23	19.1	3869	278	56	55.0	0.73	150	161		167	44	165	9.34
581	5/12/93 0010	70	5.84	Duct	56	56	21.5	1.80	22	21.5	4040	258	55	41.0	1.06	150	156		160	41	160	7.99
581	5/12/93 0200	70	5.83	Duct	53	53	20.4	1.70	25	19.6	4057	254	55	40.0	1.11	150	154		156	39	159	7.96
581	5/12/93 0400	70	5.86	Duct	53	53	20.4	1.69	24	20.0	4062	253	55	40.0	1.11	150	153		155	38	158	7.88
581	5/12/93 0545	70	5.86	Duct	53	53	20.4	1.66	12	10.0	4481	252	56	0.0		241	183		188	68	252	7.87
582	5/12/93 1240	108	3.20	Duct	95	95	36.5	1.81	23	14.8	3866	288	56	55.0	0.74	160	184		189	65	180	9.51
582	5/12/93 1420	108	3.20	Duct	95	95	36.5	1.54	24	21.2	3810	291	56	63.0	0.69	150	175		180	56	168	9.59
582	5/12/93 2040	108	3.31	Duct	95	95	36.5	1.36	16	13.8	3877	288	56	51.0	0.79	170	201			82	188	9.49
582	5/12/93 2250	108	3.31	Duct	100	100	38.4	1.41	19	16.3	3908	286	57	51.0	0.81	170	182		190	63	186	9.49
583	5/13/93 0020	70	5.25	Duct	80	80	30.8	1.74	23	21.2	4013	261	56	44.0	1.00	142	169		169	53	153	8.30
583	5/13/93 0300	70	5.21	Duct	75	75	28.8	1.64	25	19.3	4049	256	56	42.0	1.06	142	154		155	38	153	8.22
583	5/13/93 0430	70	5.23	Duct	75	75	28.8	1.67	25	19.2	4046	255	55	41.0	1.07	142	150		152	34	154	8.23
584	5/13/93 0530	100	3.48	Duct	100	100	38.4	1.57	22	18.9	3989	266	55	45.0	0.95	160	160		165	44	171	9.54
584	5/13/93 0735	100	3.50	Duct	100	100	38.4	1.55	24	20.7	3897	274	56	52.0	0.80	152	162		168	46	165	9.39
584	5/13/93 0930	99	3.40	Duct	0	100	19.4	0.78	17	11.4	3867	277	56	53.5	0.76	149	160		165	44	164	9.27
585	5/14/93 0035	69	5.37	Duct	60	60	23.1	1.68	30	23.8	3998	259	55	46.0	0.94	128	156		156	41	144	8.06
585	5/14/93 0230	70	5.27	Duct	60	60	23.1	1.64	30	24.8	4011	255	55	46.0	0.95	129	144		145	29	142	8.00
586	5/14/93 0310	70	5.19	Duct	60	60	23.1	1.86	38	38.1	3971	258	58	49.0	0.86	124	140		142	25	136	8.04
586	5/14/93 0420	70	5.28	Duct	60	60	23.1	1.72	37	37.6	3977	254	55	49.0	0.88	124	137		139	22	134	8.00
586	5/14/93 0545	70	5.26	Duct	60	60	23.1	1.71	44	39.4	3979	254	58	48.0	0.89	125	136		137	21	136	7.98
586	5/14/93 0705	70	5.50	Duct	60	60	23.1	1.69	41	35.1	3971	252	56	49.0	0.86	124	134		136	19	132	8.16

PSCC Arapahoe Unit

Test	Date & Time	GAS ANAL ECON-DRY (1-12) NO	CO	SO2	CO2	O2	GAS ANALYSIS INLET-WET ...... NO	CO	SO2	CO2	H2O	O2	GAS ANALYSIS OUTLET-WET ...... NO	CO	SO2	CO2	H2O	O2	Comments
		ppm	ppm	ppm	%	%dry	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	%	%	%	
575	4/30/93 1420	235	194	424	13.53	5.25	180	154	348	12.02	8.22	4.90	192	233	332	11.73	10.48	4.90	
575	4/30/93 1500	235	194	424	13.53	5.25	180	180	347	12.05	8.20	4.90	187	281	328	11.89	10.88	4.75	
575	4/30/93 1635	235	194	424	13.53	5.25	179	184	351	12.07	8.26	4.85	187	329	329	11.54	11.54	4.60	
576	5/3/93 1615	225	166	320	13.04	5.27	195	153	268	10.87	7.69	6.30	208	663	227	11.44	11.85	5.00	
577	5/6/93 1130	199	11	263	10.28	9.20	160	14	235	9.41	6.76	8.60	164	7	232	9.25	9.38	8.55	Humid
577	5/6/93 1340	199	11	263	10.28	9.20	163	11	228	9.21	6.63	8.78	163	7	208	9.08	9.39	8.65	
577	5/6/93 1515	199	11	263	10.28	9.20	166	11	225	9.23	6.66	8.72	164	6	198	8.98	9.63	8.67	
577	5/6/93 1735	202	10	259	10.43	8.95	163	10	225	9.22	6.63	8.75	165	6	193	8.99	9.87	8.60	
578	5/10/93 0800	255	44	370	14.10	5.50	181	50	295	10.94	7.62	7.05	195	183	355	12.96	8.91	4.60	
578	5/10/93 1405	255	44	370	14.10	5.50	203	225	398	13.62	9.14	3.65	195	97	295	12.03	11.64	5.05	
578	5/10/93 1600	230	194	445	14.78	4.42	194	344	430	13.53	9.06	3.62	189	89	311	12.15	11.89	4.75	
578	5/10/93 1800	230	194	445	14.78	4.42	203	135	427	13.62	9.03	3.85	184	105	308	12.28	12.07	4.72	
578	5/10/93 2023	230	194	445	14.78	4.42	199	104	422	13.59	9.24	3.80	186	49	291	12.19	12.08	4.91	
578	5/10/93 2221	219	96	422	14.72	4.70	199	51	385	13.47	9.18	3.96	189	60	266	12.22	12.02	4.91	
578	5/11/93 0032	241	63	383	14.58	4.92	208	52	367	13.40	9.29	4.00	194	37	259	12.08	11.97	5.05	
578	5/11/93 0230	241	63	383	14.58	4.92	195	126	365	13.67	9.46	3.70	198	45	261	12.09	11.63	5.03	
578	5/11/93 0430	234	71	392	14.41	4.80	207	50	368	13.39	9.18	4.05	194	62	265	12.13	11.73	5.00	
578	5/11/93 0620	234	71	392	14.41	4.80	208	55	380	13.43	9.20	4.01	192	57	270	12.12	11.73	5.05	
578	5/11/93 0830	234	71	392	14.41	4.80	212	52	383	13.44	9.15	4.05	188	91	295	12.27	11.89	4.90	
579	5/11/93 1100	234	71	392	14.41	4.80	207	50	375	13.36	9.08	4.05	190	53	292	12.00	12.08	5.10	
579	5/11/93 1300	234	71	392	14.41	4.80	215	32	352	13.17	8.99	4.38	191	98	279	12.05	12.10	5.00	
579	5/11/93 1500	239	123	368	14.36	4.95	213	44	348	13.34	9.17	4.15	192	87	275	11.83	12.24	5.10	
579	5/11/93 1700	239	123	368	14.36	4.95	215	57	338	13.30	9.26	4.10	192	116	266	11.87	12.45	5.10	
579	5/11/93 1900	239	123	368	14.36	4.95	206	89	339	13.44	9.43	3.87	188	64	267	12.01	12.66	4.85	
580	5/11/93 2100	239	123	368	14.36	4.95	214	185	345	13.37	9.68	3.85	185	46	240	11.80	12.93	5.11	
580	5/11/93 2300	239	123	368	14.36	4.95	200	155	345	13.68	9.96	3.50	190	85	242	11.98	12.78	4.95	
581	5/12/93 0010	223	29	284	11.80	7.75	201	14	266	11.04	8.20	6.80	179	17	185	9.89	10.94	7.65	
581	5/12/93 0200	223	29	284	11.80	7.75	205	12	267	11.00	8.17	6.80	182	17	191	9.98	10.84	7.62	
581	5/12/93 0400	223	29	284	11.80	7.75	205	13	270	11.16	8.14	6.72	174	22	193	10.10	10.90	7.48	
581	5/12/93 0545	223	29	284	11.80	7.75	199	15	282	11.59	8.36	6.35	180	30	231	10.48	7.78	7.63	H2O off
582	5/12/93 1240	240	387	387.4	14.62	4.55	214	161	363	13.47	9.71	3.80	196	277	278	12.20	12.71	4.70	
582	5/12/93 1420	240	387	387.4	14.62	4.55	212	189	430	13.63	9.88	3.65	189	363	305	12.21	13.13	4.50	
582	5/12/93 2040	247	557	505	14.41	4.60	205	742	488	13.48	9.84	3.60	198	399	375	12.04	12.42	4.72	
582	5/12/93 2250	247	557	505	14.41	4.60	206	860	499	13.54	9.87	3.55	199	344	369	12.11	12.39	4.82	
583	5/13/93 0020	211	113	428	12.20	7.25	190	21	406	11.46	8.51	6.32	167	88	285	10.30	11.56	7.08	
583	5/13/93 0300	211	113	428	12.20	7.25	194	16	399	11.20	8.32	6.50	172	44	289	10.28	11.29	7.18	
583	5/13/93 0430	211	113	428	12.20	7.25	199	16	395	11.35	8.37	6.43	168	53	287	10.33	11.30	7.10	
584	5/13/93 0530	224	212	500	14.48	4.60	187	194	480	13.61	9.89	3.60	181	144	345	12.06	12.23	4.85	
584	5/13/93 0735	224	213	500	14.48	4.60	194	309	487	13.59	9.69	3.68	182	152	340	11.98	12.58	4.90	
584	5/13/93 0930	220	373	496	14.31	4.70	191	484	490	13.54	9.65	3.65	180	188	380	11.93	12.57	4.95	
585	5/14/93 0035	210	61	350	12.17	7.20	194	19	328	11.64	8.45	5.98	164	46	217	10.21	11.67	7.05	
585	5/14/93 0230	210	61	350	12.17	7.20	200	18	335	11.60	8.47	5.85	170	79	219	10.37	11.67	6.95	
586	5/14/93 0310	210	61	350	12.17	7.20	199	25	326	11.46	8.33	6.15	165	83	186	10.46	11.99	6.75	
586	5/14/93 0420	210	61	350	12.17	7.20	199	39	325	11.98	8.62	5.60	181	38	172	10.37	11.77	7.00	
586	5/14/93 0545	210	61	350	12.17	7.20	200	38	322	11.82	8.48	5.80	159	164	170	10.40	11.91	6.80	
586	5/14/93 0705	210	61	350	12.17	7.20	201	24	309	11.24	8.17	6.60	173	62	179	10.08	11.56	7.25	O2 changd

PSCC Arapahoe Unit 4 Calcium/Humidification-Duct Injection, Ca(OH)2 calculations based upon 68% CaO

		Boiler		Sorbent Feed			Injector cal		ΔSO2 Red		Humidification					Baghouse Temps					Humid calc	
Test	Date & Time	Load	O2cr	Loc	A.w	B.e	Flow	Ca/S*	Comp	Calc	Air	Tgo	Twi	H2O	A/W	Grid	Out	IDin	Opsis	Ta	Tcalc	H2Oe
		MWe	%wet		%	%	lb/min		%	%	scfm	°F	°F	gpm	-	°F	°F	°F	°F	°F	°F	%w
587	5/18/93 0907	108	3.60	Econ	0	0	0.0	0.00		0.1									269			
587	5/18/93 1018	108	3.60	Econ	100	0	19.1	0.87		4.7		281	59			275	263				281	
587	5/18/93 1039	108	3.60	Econ	100	0	19.1	0.87		30.4												
587	5/18/93 1046	108	3.60	Econ	100	0	19.1	0.87		2.1												
587	5/18/93 1055	108	3.60	Econ	100	0	19.1	0.87		0.7												
587	5/18/93 1105	108	3.60	Econ	100	0	19.1	0.87		-1.2												
587	5/18/93 1115	108	3.60	Econ	100	0	19.1	0.87		1.5												
587	5/18/93 1123	108	3.60	Econ	100	0	19.1	0.87		1.9												
587	5/18/93 1135	108	3.60	Econ	100	0	19.1	0.87		6.9		285	59						279		285	
587	5/18/93 1150	108	3.60	Econ	100	0	19.1	0.87		4.9												
587	5/18/93 1214	108	3.60	Econ	0	0	0.0	0.00		2.9									281			
587	5/18/93 1214	108	3.60	Econ	0	0	0.0	0.00		-1.5												
588	5/19/93 0943	100	4.00	Econ	0	0	0.0	0.00		-1.8		274	64			269	256		264		274	
588	5/19/93 1043	100	3.95	Econ	82	0	15.6	0.80		4.8		275	65			271	257		266		275	
588	5/19/93 1053	100	3.95	Econ	82	0	15.6	0.80		3.8												
588	5/19/93 1100	100	3.95	Econ	82	0	15.6	0.80		34.1												
588	5/19/93 1108	100	3.95	Econ	82	0	15.6	0.80		1.9												
589	5/19/93 1137	100	3.81	Econ	41	0	7.8	0.40		27.7		277	66			272	259				277	
589	5/19/93 1155	100	3.81	Econ	41	0	7.8	0.40		3.3									270			
589	5/19/93 1206	100	3.81	Econ	41	0	7.8	0.40		2.6												
590	5/19/93 1239	100	4.04	Econ	25	0	4.8	0.24		15.7		280	66			274	262				280	
591	5/19/93 1620	90	4.32	Econ	0	0	0.0	0.00		-0.2		271	68			268	259		267		271	
591	5/19/93 1745	90	4.33	Econ	75	75	28.8	1.70		11.0		274	68			270	258				274	
591	5/19/93 1756	90	4.33	Econ	75	75	28.8	1.70		35.7												
591	5/19/93 1805	90	4.33	Econ	75	75	28.8	1.70		4.6												
591	5/19/93 1814	90	4.33	Econ	75	75	28.8	1.70		0.8												
591	5/19/93 1826	90	4.33	Econ	75	75	28.8	1.70		36.7												
591	5/19/93 1837	90	4.33	Econ	75	75	28.8	1.70		0.0												
591	5/19/93 1845	90	4.33	Econ	75	75	28.8	1.70		2.4												
591	5/19/93 1854	90	4.33	Econ	75	75	28.8	1.70		12.9												
591	5/19/93 1905	90	4.33	Econ	75	75	28.8	1.70		10.4												
591	5/19/93 2001	90	4.33	Econ	0	0	0.0	0.00		1.1												
592	5/20/93 0905	110	3.60	Econ	0	0	0.0	0.00		0.0		282	63			274	259				282	
592	5/20/93 1056	110	3.60	Econ	0	0	0.0	0.00		-1.5	4403	284	66			277	265		278		284	
592	5/20/93 1212	110	3.60	Econ	90	0	17.2	0.81		0.6	4398	289	69			282	271				289	
592	5/20/93 1221	110	3.60	Econ	90	0	17.2	0.81		33.6												
592	5/20/93 1230	110	3.60	Econ	90	0	17.2	0.81		-4.2												
592	5/20/93 1247	110	3.60	Econ	90	0	17.2	0.81		-3.7												
592	5/20/93 1255	110	3.60	Econ	90	0	17.2	0.81		27.0												
592	5/20/93 1303	110	3.60	Econ	90	0	17.2	0.81		-4.4		291	70								291	
592	5/20/93 1320	110	3.60	Econ	90	0	17.2	0.81		27.8												
592	5/20/93 1329	110	3.60	Econ	90	0	17.2	0.81		-4.4												
592	5/20/93 1337	110	3.60	Econ	90	0	17.2	0.81		-7.1												
592	5/20/93 1412	110	3.60	Econ	0	0	0.0	0.00		-11.6												
593	5/21/93 0047	70	5.30	Econ	0	0	0.0	0.00		0.5		255				252	243		250		255	
593	5/21/93 0118	70	5.30	Econ	73	73	28.1	1.66		7.5		255									255	

PSCC Arapahoe Unit

Test	Date & Time	GAS ANAL ECON-DRY (1-12) NO	CO	SO2	CO2	O2	GAS ANALYSIS INLET-WET ······ NO	CO	SO2	CO2	H2O	O2	GAS ANALYSIS OUTLET-WET ······ NO	CO	SO2	CO2	H2O	O2	Comments
		ppm	ppm	ppm	%	%dry	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	%	%	%	
587	5/18/93 0907	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	242	152	365	12.32	8.99	5.10	No Sorbent
587	5/18/93 1018	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	288	155	388	13.84	0.00	5.40	EE 1-12
587	5/18/93 1039	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	248	200	247	11.81	0.00	7.40	EE 1,2
587	5/18/93 1046	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	318	69	411	14.34	0.00	4.90	EE 3,4
587	5/18/93 1055	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	298	75	430	14.89	0.00	4.40	EE 5,6
587	5/18/93 1105	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	290	310	475	16.17	0.00	3.00	EE 7,8
587	5/18/93 1115	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	313	66	410	14.34	0.00	5.05	EE 9,10
587	5/18/93 1123	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	270	17	330	11.50	0.00	8.10	EE 11,12
587	5/18/93 1135	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	293	125	380	13.93	0.00	5.35	EE 1-12
587	5/18/93 1150	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	246	125	345	12.16	8.80	5.25	Altech Out
587	5/18/93 1214	278	138	420	14.26	4.90	278	138	420	14.26	0.00	4.90	288	142	395	13.86	0.00	5.40	Base Drift
587	5/18/93 1214	288	142	395	13.86	5.40	288	142	395	13.86	0.00	5.40	249	120	355	12.01	8.54	5.40	No Sorbent
588	5/19/93 0943	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	223	65	360	11.65	8.75	5.00	No Sorbent
588	5/19/93 1043	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	255	43	378	13.34	0.00	5.10	EE 1-12
588	5/19/93 1053	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	210	48	342	11.73	8.81	4.91	Altech Out
588	5/19/93 1100	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	219	50	214	10.76	0.00	8.00	EE 1,2
588	5/19/93 1108	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	288	24	415	14.22	0.00	4.05	EE 3,4
589	5/19/93 1137	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	228	34	240	10.99	0.00	7.70	EE 1,2
589	5/19/93 1155	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	246	57	390	13.50	0.00	4.85	EE 1-12
589	5/19/93 1206	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	205	53	341	11.66	8.73	5.15	Altech Out
590	5/19/93 1239	261	69	392	13.14	5.30	261	69	392	13.14	0.00	5.30	235	35	283	11.15	0.00	7.55	EE 1,2
591	5/19/93 1620	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	187	49	341	11.79	8.84	4.95	No Sorbent
591	5/19/93 1745	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	217	30	330	12.87	0.00	5.55	EE 1-12
591	5/19/93 1756	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	206	15	205	10.84	0.00	7.70	EE 1,2
591	5/19/93 1805	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	246	16	381	13.92	0.00	4.35	EE 3,4
591	5/19/93 1814	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	225	38	402	14.05	0.00	4.10	EE 9,10
591	5/19/93 1826	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	170	25	196	10.30	0.00	8.10	EE 11,12
591	5/19/93 1837	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	224	50	422	14.84	0.00	3.40	EE 7,8
591	5/19/93 1845	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	229	26	378	13.45	0.00	4.85	EE 5,6
591	5/19/93 1854	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	215	35	330	13.20	0.00	5.20	EE 1-12
591	5/19/93 1905	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	188	25	303	11.45	8.85	5.05	Altech Out
591	5/19/93 2001	222	56	385	13.42	4.95	222	56	385	13.42	0.00	4.95	221	27	370	13.08	0.00	5.40	Base Drift
592	5/20/93 0905	249	38	392	14.02	4.55	249	38	392	14.02	0.00	4.55	214	38	348	12.04	9.30	4.45	No Sorbent
592	5/20/93 1056	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	208	21	359	11.93	9.23	4.70	No Sorbent
592	5/20/93 1212	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	244	54	400	13.80	0.00	4.65	EE 1-12
592	5/20/93 1221	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	233	31	214	10.78	0.00	7.90	EE 1,2
592	5/20/93 1230	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	272	79	435	14.19	0.00	4.05	EE 3,4
592	5/20/93 1247	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	275	59	430	14.47	0.00	4.15	3,4,HiPres
592	5/20/93 1255	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	220	83	240	10.89	0.00	7.65	1,2,HiPres
592	5/20/93 1303	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	237	97	428	13.99	0.00	4.35	1-12,Hi P
592	5/20/93 1320	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	229	120	240	11.00	0.00	7.50	EE 1,2
592	5/20/93 1329	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	273	144	442	14.45	0.00	3.80	EE 3,4
592	5/20/93 1337	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	249	77	427	13.66	0.00	4.80	EE 1-12
592	5/20/93 1412	243	28	405	13.85	4.55	243	28	405	13.85	0.00	4.55	256	57	445	13.53	0.00	4.80	BaseDriftt
593	5/21/93 0047	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	184	8	380	10.41	8.32	6.60	No Sorbent
593	5/21/93 0118	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	217	12	392	11.74	0.00	6.95	EE 1-12

PSCC Arapahoe Unit 4 Calcium/Humidification-Duct Injection, Ca(OH)2 calculations based upon 68% CaO

		Boiler		Sorbent Feed			Injector cal		ΔSO2 Red		Humidification					Baghouse Temps					Humid calc	
Test	Date & Time	Load	O2cr	Loc.	A.w	B.e	Flow	Ca/S*	Comp	Calc	Air	Tgo	Twl	H2O	A/W	Grid	Out	IDin	Opsis	Ta	Tcalc	H2Oe
		MWe	%wet		%	%	lb/min		%	%	scfm	°F	°F	gpm	-	°F	°F	°F	°F	°F	°F	%w
593	5/21/93 0126	70	5.30	Econ	73	73	28.1	1.66		25.1												
593	5/21/93 0138	70	5.30	Econ	73	73	28.1	1.66		0.1												
593	5/21/93 0144	70	5.30	Econ	73	73	28.1	1.66		30.7												
593	5/21/93 0157	70	5.30	Econ	73	73	28.1	1.66		0.2												
593	5/21/93 0210	70	5.30	Econ	73	73	28.1	1.66		9.0									248			
593	5/21/93 0221	70	5.30	Econ	73	73	28.1	1.66		8.4												
593	5/21/93 0301	70	5.30	Econ	73	73	28.1	1.66		11.3									249			
593	5/21/93 0308	70	5.30	Econ	73	73	28.1	1.66		10.0												
593	5/21/93 0316	70	5.30	Econ	73	73	28.1	1.66		38.6												
593	5/21/93 0324	70	5.30	Econ	73	73	28.1	1.66		41.2												
593	5/21/93 0430	70	5.30	Econ	73	73	28.1	1.66		13.5		259									259	
593	5/21/93 0436	70	5.30	Econ	73	73	28.1	1.66		11.2												
593	5/21/93 0535	70	5.30	Econ	0	0	0.0	0.00		3.5									250			
594	6/8/93 1000	113	4.00	Econ	0	0	0.0	0.00		-1.5		283							273		283	
594	6/8/93 1056	113	4.00	Econ	80	80	30.8	1.74		6.3		285				279	263				285	
594	6/8/93 1109	113	4.00	Econ	80	80	30.8	1.74		28.5									278			
594	6/8/93 1119	113	4.00	Econ	80	80	30.8	1.74		0.0									278			
594	6/8/93 1130	113	4.00	Econ	80	80	30.8	1.74		-2.7												
594	6/8/93 1138	113	4.00	Econ	80	80	30.8	1.74		24.0												
594	6/8/93 1147	113	4.00	Econ	80	80	30.8	1.74		6.3									279			
594	6/8/93 1157	113	4.00	Econ	80	80	30.8	1.74		4.3									279			
594	6/8/93 1456	113	4.00	Econ	80	80	30.8	1.74		5.4	3719	294	62	68.0	0.55	160	170		178	43	163	
594	6/8/93 1536	113	4.00	Econ	80	80	30.8	1.74		0.5									229			
594	6/8/93 1551	113	4.00	Econ	80	80	30.8	1.74		-3.4									250			
594	6/8/93 1551	113	4.00	Econ	0	0	0.0	0.00		-1.2												
595	6/9/93 0731	80	5.12	Econ	0	0	0.0	0.00		0.7		260				257	239		250		260	
595	6/9/93 0818	80	5.12	Econ	60	60	23.1	1.67		30.6		264									264	
595	6/9/93 0827	80	5.12	Econ	60	60	23.1	1.67		1.6												
595	6/9/93 0835	80	5.12	Econ	60	60	23.1	1.67		-0.5												
595	6/9/93 0848	80	5.12	Econ	60	60	23.1	1.67		29.5												
595	6/9/93 0900	80	5.12	Econ	60	60	23.1	1.67		10.5									255			
595	6/9/93 0917	80	5.12	Econ	60	60	23.1	1.67		8.3									255			
596	6/9/93 1350	80	5.11	Econ	0	0	0.0	0.00		-0.6		277	68			273	256		267		277	
596	6/9/93 1437	80	5.11	Econ	60	60	23.1	1.70		7.5		278	67						268		278	
596	6/9/93 1455	80	5.11	Econ	60	60	23.1	1.70		6.2									268			
596	6/9/93 1542	80	5.11	Econ	60	60	23.1	1.70		10.3	3857	281	63	56.0	0.69	146	201		203	30	139	
596	6/9/93 1625	80	5.11	Econ	60	60	23.1	1.70		10.3	3857			56.0	0.69	146	169		173	30		
596	6/9/93 1656	80	5.11	Econ	60	60	23.1	1.70		5.7									209			
596	6/9/93 1715	80	5.11	Econ	0	0	0.0	0.00		0.6												
597	6/10/93 1053	80	4.58	Econ*	0	0	0.0	0.00		1.3		268	70			265	255				268	
597	6/10/93 1247	80	4.58	Econ*	60	60	23.1	1.67		26.1		271	75			267	253				271	
597	6/10/93 1259	80	4.58	Econ*	60	60	23.1	1.67		12.6												
597	6/10/93 1306	80	4.58	Econ*	60	60	23.1	1.67		1.3												
597	6/10/93 1315	80	4.58	Econ*	60	60	23.1	1.67		-0.7												
597	6/10/93 1319	80	4.58	Econ*	60	60	23.1	1.67		3.4												
597	6/10/93 1328	80	4.58	Econ*	60	60	23.1	1.67		36.1												

PSCC Arapahoe Unit

Test	Date & Time	GAS ANAL ECON-DRY (1-12) NO	CO	SO2	CO2	O2	GAS ANALYSIS INLET-WET ------ NO	CO	SO2	CO2	H2O	O2	GAS ANALYSIS OUTLET-WET ------ NO	CO	SO2	CO2	H2O	O2	Comments
		ppm	ppm	ppm	%	%dry	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	%	%	%	
593	5/21/93.0126	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	185	32	296	10.98	0.00	7.90	EE 1,2
593	5/21/93.0138	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	228	14	458	12.72	0.00	5.80	EE 3,4
593	5/21/93.0144	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	170	9	209	8.37	0.00	11.00	EE 11,12
593	5/21/93.0157	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	227	9	438	12.24	0.00	6.45	EE 9,10
593	5/21/93.0210	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	214	16	387	11.73	0.00	6.90	EE 1-12
593	5/21/93.0221	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	185	10	350	10.38	8.26	6.60	Altech Out
593	5/21/93.0301	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	213	14	380	11.84	0.00	6.80	EE 1-12
593	5/21/93.0308	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	182	11	346	10.42	8.33	6.51	Altech Out
593	5/21/93.0316	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	186	25	250	11.11	0.00	7.50	EE 1,2
593	5/21/93.0324	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	165	9	181	8.41	0.00	10.80	EE 11,12
593	5/21/93.0430	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	207	26	380	11.97	0.00	6.45	EE 1-12
593	5/21/93.0436	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	177	21	347	10.62	8.36	6.30	Altech Out
593	5/21/93.0535	217	13	430	11.96	6.75	217	13	430	11.96	0.00	6.75	207	42	415	11.74	0.00	6.75	BaseDrift
594	6/8/93:1000	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	253	130	285	11.26	8.14	5.30	No Sorbent
594	6/8/93.1056	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	263	160	298	13.29	0.00	5.15	EE 1-12
594	6/8/93.1109	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	238	375	190	10.30	0.00	7.75	EE 1,2
594	6/8/93.1119	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	309	150	335	13.61	0.00	4.30	EE 3,4
594	6/8/93:1130	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	273	19	345	13.83	0.00	4.25	EE 9,10
594	6/8/93.1138	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	210	20	225	11.72	0.00	6.25	EE 11,12
594	6/8/93.1147	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	261	100	299	13.09	0.00	5.10	EE 1-12
594	6/8/93:1157	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	229	100	280	11.82	8.44	4.65	Altech Out
594	6/8/93.1456	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	212	69	260	11.27	12.40	4.70	Altech Out
594	6/8/93:1536	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	231	75	290	11.87	8.42	4.70	Altech Out
594	6/8/93:1551	272	200	315	12.93	5.30	272	200	315	12.93	0.00	5.30	258	85	330	13.14	0.00	5.10	Base Drift
594	6/8/93:1551	258	85	330	13.14	5.10	258	85	330	13.14	0.00	5.10	231	74	305	12.03	8.47	4.70	No Sorbent
595	6/9/93.0731	213	23	325	12.24	6.10	213	23	325	12.24	0.00	6.10	189	18	289	10.92	8.16	5.95	No Sorbent
595	6/9/93.0818	213	23	325	12.24	6.10	213	23	325	12.24	0.00	6.10	199	25	193	10.07	0.00	8.25	EE 1,2
595	6/9/93.0827	213	23	325	12.24	6.10	213	23	325	12.24	0.00	6.10	240	17	339	13.12	0.00	5.20	EE 3,4
595	6/9/93.0835	213	23	325	12.24	6.10	213	23	325	12.24	0.00	6.10	212	22	344	13.17	0.00	5.30	EE 9,10
595	6/9/93.0848	213	23	325	12.24	6.10	213	23	325	12.24	0.00	6.10	146	59	210	11.05	0.00	7.35	EE 11,12
595	6/9/93.0900	213	23	325	12.24	6.10	213	23	325	12.24	0.00	6.10	209	27	290	12.21	0.00	6.15	EE 1-12
595	6/9/93.0917	213	23	325	12.24	6.10	213	23	325	12.24	0.00	6.10	185	23	270	11.09	8.11	5.80	Altech Out
596	6/9/93.1350	217	25	320	12.16	6.10	217	25	320	12.16	0.00	6.10	195	19	290	10.95	7.98	5.90	No Sorbent
596	6/9/93:1437	217	25	320	12.16	6.10	217	25	320	12.16	0.00	6.10	214	22	289	12.00	0.00	6.45	EE 1-12
596	6/9/93.1455	217	25	320	12.16	6.10	217	25	320	12.16	0.00	6.10	195	20	270	10.98	8.07	5.90	Altech Out
596	6/9/93.1542	217	25	320	12.16	6.10	217	25	320	12.16	0.00	6.10	181	15	240	10.25	12.37	5.95	Altech Out
596	6/9/93.1625	217	25	320	12.16	6.10	217	25	320	12.16	0.00	6.10	181	16	240	10.28	12.44	5.93	Altech Out
596	6/9/93.1656	217	25	320	12.16	6.10	217	25	320	12.16	0.00	6.10	191	18	273	11.11	8.19	5.80	Altech Out
596	6/9/93:1715	217	25	320	12.16	6.10	217	25	320	12.16	0.00	6.10	194	19	290	11.19	8.17	5.70	Base Drift
597	6/10/93:1053	230	175	328	12.62	6.00	230	175	328	12.62	0.00	6.00	211	110	290	11.14	7.89	5.90	No Sorbent
597	6/10/93:1247	230	175	328	12.62	6.00	230	175	328	12.62	0.00	6.00	191	593	240	12.35	0.00	6.15	EE 1,2
597	6/10/93:1259	230	175	328	12.62	6.00	230	175	328	12.62	0.00	6.00	241	300	321	14.49	0.00	4.20	EE 3,4
597	6/10/93:1306	230	175	328	12.62	6.00	230	175	328	12.62	0.00	6.00	246	90	342	13.48	0.00	5.15	EE 5,6
597	6/10/93:1315	230	175	328	12.62	6.00	230	175	328	12.62	0.00	6.00	253	31	360	14.04	0.00	4.65	EE 7,8
597	6/10/93:1319	230	175	328	12.62	6.00	230	175	328	12.62	0.00	6.00	247	20	320	12.71	0.00	5.85	EE 9,10
597	6/10/93:1328	230	175	328	12.62	6.00	230	175	328	12.62	0.00	6.00	190	16	165	9.24	0.00	9.20	EE 11,12

PSCC Arapahoe Unit 4 Calcium/Humidification-Duct Injection, Ca(OH)2 calculations based upon 68% CaO

		Boiler		Sorbent Feed			Injector cal		ΔSO2 Red		Humidification					Baghouse Temps					Humid calc	
Test	Date & Time	Load	O2cr	Loc	A,w	B,e	Flow	Ca/S*	Comp	Calc	Air	Tgo	Twl	H2O	A/W	Grid	Out	IDin	Opsis	Ta	Tcalc	H2Oe
		MWe	%wet		%	%	lb/min		%	%	scfm	F	°F	gpm		°F	°F	°F	°F	°F	°F	%w
597	6/10/93 1335	80	4 58	Econ*	60	60	23 1	1 67		21 6												
597	6/10/93 1343	80	4 58	Econ*	60	60	23 1	1 67		31 3												
597	6/10/93 1349	80	4 58	Econ*	60	60	23 1	1 67		19 2									264			
597	6/10/93 1355	80	4 58	Econ*	60	60	23 1	1 67		13 5									264			
597	6/10/93 1403	80	4 58	Econ*	60	60	23 1	1 67		11 3		275	77								275	
597	6/10/93 1412	80	4 58	Econ*	60	60	23 1	1 67		12 6												
597	6/10/93 1533	80	4 58	Econ*	60	60	23 1	1 67		16 2	3825	281	62	58 0	0 68	142	190		191	26	134	
597	6/10/93 1625	80	4 58	Econ*	60	60	23 1	1 67		17 7	3838	282	63	57 0	0 70	142	166		164	26	137	
597	6/10/93 1720	80	4 58	Econ*	60	60	23 1	1 67		18 0	3838	282	63	57 0	0 70	142	156		156	26	137	
597	6/10/93 1751	80	4 58	Econ*	0	0	0 0	0 00		5 2												
597	6/10/93 1751	80	4 58	Econ*	0	0	0 0	0 00		-1 5												
598	6/11/93 0741	80	5 14	Econ*	0	0	0 0	0 00		1 7		262	67			258	241		248		262	
598	6/11/93 0838	80	5 14	Econ*	60	60	23 1	1 70		9 2		264	68						252		264	
598	6/11/93 0849	80	5 14	Econ*	60	60	23 1	1 70		33 5									252			
598	6/11/93 0857	80	5 14	Econ*	60	60	23 1	1 70		17 4									254			
598	6/11/93 0906	80	5 14	Econ*	60	60	23 1	1 70		0 6									254			
598	6/11/93 0912	80	5 14	Econ*	60	60	23 1	1 70		-0 5									255			
598	6/11/93 0919	80	5 14	Econ*	60	60	23 1	1 70		0 5									255			
598	6/11/93 0929	80	5 14	Econ*	60	60	23 1	1 70		30 7												
598	6/11/93 0934	80	5 14	Econ*	60	60	23 1	1 70		10 7												
598	6/11/93 0942	80	5 14	Econ*	60	60	23 1	1 70		11 7		269	39						256		269	
598	6/11/93 0957	80	5 14	Econ*	0	0	0 0	0 00		4 6									257			

PSCC Arapahoe Unit

Test	Date & Time	GAS ANAL ECON-DRY (1-12) NO	CO	SO2	CO2	O2	GAS ANALYSIS INLET-WET ...... NO	CO	SO2	CO2	H2O	O2	GAS ANALYSIS OUTLET-WET ...... NO	CO	SO2	CO2	H2O	O2	Comments
		ppm	ppm	ppm	%	%dry	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	%	%	%	
597	6/10/93 1335	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	190	225	240	11 22	0 00	7 00	EE 1
597	6/10/93 1343	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	179	860	239	12 81	0 00	5 10	EE 2
597	6/10/93 1349	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	248	190	303	14 24	0 00	3 85	EE 3
597	6/10/93 1355	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	249	35	299	13 10	0 00	5 20	EE 4
597	6/10/93 1403	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	222	250	294	12 61	0 00	5 85	EE 1-12
597	6/10/93 1412	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	196	225	265	11 44	8 27	5.40	Altech Out
597	6/10/93 1533	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	180	200	230	10 38	12 36	5 85	Altech Out
597	6/10/93 1625	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	174	200	228	10 49	12 73	5 65	Altech Out
597	6/10/93 1720	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	175	150	228	10 55	12 77	5 60	Altech Out
597	6/10/93 1751	230	175	328	12 62	6 00	230	175	328	12 62	0 00	6 00	211	265	310	12 25	0 00	6 05	Base Drift
597	6/10/93 1751	211	265	310	12 25	6 05	211	265	310	12 25	0 00	6 05	190	210	284	11 13	8 37	5 75	Altech Out
598	6/11/93 0741	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	211	53	290	11 29	8 61	5 40	No Sorbent
598	6/11/93 0838	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	230	75	295	12 70	0 00	5 80	EE 1-12
598	6/11/93 0849	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	217	8	155	8 25	0 00	10 10	EE 1,2
598	6/11/93 0857	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5.80	261	23	248	11 45	0 00	6.95	EE 3,4
598	6/11/93 0906	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	270	21	339	13 40	0.00	5 05	EE 5,6
598	6/11/93 0912	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	254	33	360	14 36	0 00	4 25	EE 7,8
598	6/11/93 0919	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	207	154	383	15 38	0 00	3 00	EE 9,10
598	6/11/93 0929	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	172	56	220	12 26	0 00	6 15	EE 11,12
598	6/11/93 0934	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	200	57	262	11 25	8 50	5 50	Altech Out
598	6/11/93 0942	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	225	120	287	12 49	0 00	5 80	EE 1-12
598	6/11/93 0957	240	62	325	12 66	5 80	240	62	325	12 66	0 00	5 80	241	36	304	12 26	0 00	6 10	Base Drift

PSCC Arapahoe Unit 4 Calcium/Humidification-Duct Injection Ca(OH)2 calculations based upon 68% CaO

		Boiler		Sorbent Feed			Injector cal		ΔSO2 Red		Humidification					Baghouse Temps					Humid calc	
Test	Date & Time	Load	O2cr	Loc	A w	B e	Flow	Ca/S*	Comp	Calc	Air	Tgo	Twl	H2O	A/W	Grid	Out	IDin	Opsis	Ta	Tcalc	H2Oe
		MWe	%wet		%	%	lb/min		%	%	scfm	F	°F	gpm	-	°F	°F	°F	°F	°F	°F	%w
599	6/15/93 0750	80	5 70	Duct	0	0	0 0					266							256		266	
599	6/15/93 0915	80	5 70	Duct	35	0	6 7	0 41	9	3 6	3854	271	63	54 0	0 73	150	196		196	30	148	8 80
599	6/15/93 1100	80	6 20	Duct	35	0	6 7	0 42	11	1 7	3797	280	64	59 0	0 66	147	160		160	30	145	8 11
599	6/15/93 1300	80	6 10	Duct	35	0	6 7	0 40	10	2 3	3795	284	64	60 0	0 65	148	154		155	30	150	7 63
600	6/16/93 0840	81	5 00	Duct	70	70	26 9	1 46	24	17 6	3868	267	64	51 0	0 81	147	192		198	30	152	8 42
600	6/16/93 1100	81	5 00	Duct	81	81	31 2	1 88	30	22 1	3850	271	65	51 0	0 79	147	158		158	30	156	8 48
600	6/16/93 1300	80	4 90	Duct	75	74	28 7	1 88	27	21 5	3845	273	65	52 0	0 79	147	157		155	30	155	8 83
600	6/16/93 1500	80	5 00	Duct	70	69	26 8	1 82	30	22 6	3855	272	65	51 0	0 79	147	156		155	30	156	8 66
600	6/16/93 1800	80	5 00	Duct	67	66	25 6	1 82	30	26 8	3840	272	65	51 0	0 79	147	154			30	156	8 75
601	6/17/93 0800	80	5 30	Duct	60	0	11 4	0 87	7	10 2	3976	252	63	41 0	1 03	154	211		201	30	161	9 03
601	6/17/93 0900	81	5 20	Duct	60	0	11 4	0 85	16	12 4	3954	253	63	43 0	0 97	147	170		167	30	158	9 01
601	6/17/93 1100	81	5 20	Duct	60	0	11 4	0 86	20	13 6	3946	256	63	43 0	0 96	147	159		156	30	161	8 81
601	6/17/93 1300	81	5 20	Duct	60	0	11 4	0 84	17	12 0	3958	257	64	43 0	0 97	147	158		156	30	162	8 88
601	6/17/93 1500	81	5 10	Duct	60	0	11 4	0 84	17	13 1	3935	257	63	44 0	0 94	148	157		156	30	160	8.93
601	6/17/93 1550	81	5 20	Duct	60	0	11 4	0 85	17	12 9	3951	257	63	43 0	0 96	146	157		156	30	162	8 97
602	6/21/93 0900	80	5 10	Duct	36	0	6 9	0 38	10	4 3	3880	262	63	45 0	0 88	149	203		198	30	163	8 60
602	6/21/93 1100	81	5 20	Duct	38	0	7 2	0 38	10	4 2	3871	264	64	48 0	0 84	147	166		162	30	160	8 57
602	6/21/93 1300	80	5 20	Duct	40	0	7 6	0 40	10	3 6	3872	269	62	49 0	0 84	147	161		158	30	161	8 31
603	6/22/93 0925	96	4 10	Duct	85	85	32 7	1 59	21	22 9	3827	274	63	56 0	0 70	149	203		196	30	162	8 98
603	6/22/93 1114	95	4 20	Duct	92	92	35 4	1 97	24	18 7	3781	280	63	59 0	0 66	150	161		162	30	160	8 42
603	6/22/93 1300	95	4 20	Duct	80	81	30 9	1 91	27	18 2	3760	283	64	60 0	0 64	147	156		157	30	161	8 08
603	6/22/93 1500	95	4 20	Duct	72	73	27 9	1 64	26	20 2	3791	282	65	57 0	0 68	147	160		161	30	166	8 79
603	6/22/93 1650	95	4 10	Duct	72	73	27 9	1 69	30	24 0	3785	284	64	59 0	0 67	147	162		163	30	164	8 92
604	6/22/93 1850	81	5 50	Duct	63	63	24 2	1 77	22	16 8	3843	275	64	53 0	0 77	143	158		157	30	151	8 61
604	6/22/93 2100	80	5 65	Duct	62	62	23 8	1 79	25	18 8	3866	268	64	49 0	0 85	147	157		157	30	153	9 26
604	6/22/93 2320	50	7 50	Duct	42	42	16 1	1 75	26	22 2	4070	248	64	34 0	1 35	145	153		152	30	156	6 98
604	6/23/93 0100	59	6 90	Duct	42	42	16 1	1 53	25	23 8	4024	248	64	36 0	1 27	146	151		150	30	159	7 32
605	6/28/93 1110	106	4 90	Duct	70	71	27 0	2.00	22	12 8	3681	286	65	65 0	0 58	146	193	187		30	172	9 93
605	6/28/93 1240	106	4 80	Duct	61	62	23 5	1.70	16	12 7	3738	290	65	62 0	0 62	158	184	179	183	40	181	9 98
605	6/28/93 1350	107	4.80	Duct	61	62	23 5	1.63	16	11 5	3740	293	66	61.0	0 63	168	187	182	186	50	187	9 82
605	6/28/93 1500	109	4 60	Duct	65	66	25.1	1.66	14	9 2	3755	295	66	58 0	0 65	177	190	187	190	60	195	9 79
605	6/28/93 1705	108	3 60	Duct	68	69	26 2	1.72	24	18 2	3680	294	65	66 0	0 56	148	173	172	175	30	180	9 76
605	6/28/93 1905	108	4 10	Duct	68	69	26 2	1.78	26	20 1	3689	291	65	65 0	0 58	145	173	170	173	30	179	9 93
605	6/28/93 2100	91	4 70	Duct	56	56	21 5	1.33	23	16 9	3746	279	65	60 0	0 63	146	161	159	162	30	159	8 20
605	6/28/93 2300	91	5 20	Duct	72	72	27 7	1 69	27	22 6	3772	273	65	59 0	0 63	146	155	155	157	30	156	8 34
605	6/29/93 0100	91	5 30	Duct	72	72	27 7	1 71	27	18 8	3772	272	64	59 0	0 65	147	152	155	156	30	155	8 24
605	6/29/93 0300	90	5 30	Duct	72	72	27 7	1.79	27	20 1	3756	272	65	60 0	0 64	146	153	154	155	30	152	7 77
605	6/29/93 0430	91	5 20	Duct	72	72	27 7	1.73	27	21 4	3773	270	65	58 0	0 66	147	152	154	155	30	156	8 11
605	6/29/93 0700	91	5 20	Duct	72	72	27 7	1.72	28	22 9	3757	270	65	59 0	0 64	147	151	153	155	30	154	8.12
605	6/29/93 0905	94	5 10	Duct	72	72	27.7	1.68	30	24.4	3722	276	65	61 0	0 61	147	152	154	156	30	159	8.14
605	6/29/93 1100	96	5.10	Duct	74	74	28 4	1.68	25	17 9	3722	279	65	61 0	0 61	147	154	156	156	30	164	7 82
605	6/29/93 1220	109	4 20	Duct	84	85	32 4	2 03	36	27.7	3545	288	66	75 0	0 46	147	155	156	159	30	157	9 71
605	6/29/93 1550	107	4 20	Duct	84	85	32 4	2.11	38	33 8	3551	292	65	74 0	0 46	149	162	162	166	30	160	9 93
605	6/29/93 1700	106	4 40	Duct	69	69	26 4	1.87	27	20 5	3562	293	65	73 0	0 47	150	155	154	158	30	162	10 31
605	6/29/93 2120	86	5 30	Duct	65	65	25 0	1 63	29	23 4	3702	272	65	60 0	0 63	147	152	153	155	30	158	7 30
606	6/29/93 2300	60	6 80	Duct	48	48	18 5	1 64	28	22 5	3901	256	65	41 0	1 02	144	149	150	149	30	151	7 60

PSCC Arapahoe Unit

Test	Date & Time	GAS ANAL ECON-DRY (1-12) NO	CO	SO2	CO2	O2	GAS ANALYSIS INLET-WET ...... NO	CO	SO2	CO2	H2O	O2	GAS ANALYSIS OUTLET-WET ...... NO	CO	SO2	CO2	H2O	O2	Comments
		ppm	ppm	ppm	%	%dry	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	%	%	%	
599	6/15/93 0750	207	30	378	11.82	6.45													Base
599	6/15/93 0915	207	30	378	11.82	6.45	196	9	339	10.75	8.71	6.02	177	15	298	9.97	12.32	6.42	
599	6/15/93 1100	207	30	378	11.82	6.45	200	7	329	10.42	7.82	6.42	183	12	292	9.64	11.77	6.85	
599	6/15/93 1300	213	17	379	11.51	6.95	196	6	351	10.83	7.87	6.00	179	12	310	9.97	11.82	6.45	ΔLoad
600	6/16/93 0840	226	257	440	12.67	6.45	213	26	396	11.56	8.70	5.45	182	297	290	10.48	12.31	6.22	
600	6/16/93 1100	226	257	440	12.67	6.45	212	27	352	11.41	8.66	5.61	186	126	241	10.25	12.13	6.52	
600	6/16/93 1300	226	257	440	12.67	6.45	221	16	325	11.20	8.98	5.65	191	85	224	10.20	12.79	6.50	
600	6/16/93 1500	226	257	440	12.67	6.45	213	19	318	11.31	8.92	5.48	181	176	220	10.42	12.66	6.15	
600	6/16/93 1800	226	257	440	12.67	6.45	219	21	298	11.19	8.85	5.73	184	53	196	10.36	12.58	6.30	
601	6/17/93 0800	218	77	304	12.22	6.80	205	23	273	11.08	9.15	6.00	175	79	224	10.33	11.99	6.53	
601	6/17/93 0900	218	77	304	12.22	6.80	208	21	268	10.78	8.87	6.40	180	52	210	9.95	11.67	7.15	
601	6/17/93 1100	218	77	304	12.22	6.80	209	21	272	10.92	8.91	6.05	179	64	207	9.69	11.43	7.08	
601	6/17/93 1300	218	77	304	12.22	6.80	211	25	280	10.98	9.04	5.95	182	62	224	10.24	12.13	6.50	
601	6/17/93 1500	218	77	304	12.22	6.80	207	26	280	11.07	9.12	5.90	187	43	216	10.03	11.99	6.78	
601	6/17/93 1550	218	77	304	12.22	6.80	203	27	280	11.14	9.26	5.75	183	48	217	10.10	12.10	6.62	
602	6/21/93 0900	208	49	410	11.79	7.10	208	20	388	11.18	9.19	5.58	182	34	327	10.18	12.10	6.58	
602	6/21/93 1100	208	49	410	11.79	7.10	214	19	392	10.99	8.89	6.00	187	30	334	10.03	12.02	6.80	
602	6/21/93 1300	208	49	410	11.79	7.10	210	24	394	11.08	8.66	5.95	188	27	340	10.19	11.93	6.65	
603	6/22/93 0925	247	69	415	12.87	5.90	217	51	360	10.83	8.52	6.10	189	33	258	10.71	12.43	6.20	
603	6/22/93 1114	247	69	415	12.87	5.90	224	29	345	11.80	8.72	4.90	187	45	245	10.57	12.11	6.00	
603	6/22/93 1300	247	69	415	12.87	5.90	224	31	325	11.77	8.72	4.30	195	63	220	10.46	12.10	6.15	
603	6/22/93 1500	247	69	415	12.87	5.90	221	33	323	11.69	9.03	5.00	189	109	230	10.64	12.18	5.85	
603	6/22/93 1650	247	69	415	12.87	5.90	223	31	311	11.68	9.12	5.05	196	56	208	10.38	12.11	6.10	
604	6/22/93 1850	247	69	415	12.87	5.90	213	27	281	10.92	8.16	6.15	192	21	198	9.45	11.08	7.55	load follow
604	6/22/93 2100	247	69	415	12.87	5.90	214	26	273	10.78	8.71	6.20	188	22	193	9.62	11.68	7.25	
604	6/22/93 2320	165	111	249	9.44	9.80	161	78	258	9.72	7.88	7.70	142	83	163	8.03	9.97	9.45	
604	6/23/93 0100	191	130	266	10.08	9.15	168	74	262	9.99	8.07	7.30	149	107	167	8.51	10.25	8.80	
605	6/28/93 1110	274	18	262	11.61	6.38	216	15	227	10.41	10.54	4.90	221	15	175	9.65	13.47	5.90	w/Nat Gas
605	6/28/93 1240	274	18	262	11.61	6.38	229	13	233	10.54	10.59	4.90	220	14	183	9.81	13.44	5.70	
605	6/28/93 1350	274	18	262	11.61	6.38	251	16	235	10.48	10.14	5.30	235	17	190	9.85	13.08	5.85	
605	6/28/93 1500	274	18	262	11.61	6.38	251	16	243	10.54	10.17	5.22	234	16	203	10.01	13.06	5.70	
605	6/28/93 1705	274	18	262	11.61	6.38	237	18	255	10.73	10.50	4.75	215	20	190	10.08	13.87	5.30	
605	6/28/93 1905	274	18	262	11.61	6.38	253	17	241	10.48	10.43	5.05	208	35	183	10.34	14.40	4.90	
605	6/28/93 2100	250	32	330	12.05	6.80	225	19	297	10.93	8.23	6.20	204	25	230	10.32	12.20	6.25	NGas off
605	6/28/93 2300	250	32	330	12.05	6.80	227	28	298	10.80	8.30	6.30	208	32	210	10.04	11.93	6.70	
605	6/29/93 0100	250	32	330	12.05	6.80	229	18	296	10.88	8.26	6.20	209	21	217	10.05	11.80	6.72	
605	6/29/93 0300	250	26	326	11.86	6.95	227	23	292	10.60	8.01	6.00	207	18	205	9.92	11.67	6.85	
605	6/29/93 0430	250	26	326	11.86	6.95	228	18	290	10.68	8.10	6.40	213	16	206	9.88	11.62	6.90	
605	6/29/93 0700	250	26	326	11.86	6.95	228	18	288	10.71	7.99	6.60	214	19	203	9.83	11.50	6.95	
605	6/29/93 0905	250	26	326	11.86	6.95	239	19	282	10.57	7.92	6.75	215	40	202	10.20	12.01	6.55	
605	6/29/93 1100	250	26	326	11.86	6.95	232	24	290	10.79	7.74	6.55	214	28	215	9.74	11.51	7.00	NGas on
605	6/29/93 1220	264	31	298	12.01	5.90	238	21	260	10.86	9.90	5.05	211	41	170	10.06	13.83	5.55	NGas on
605	6/29/93 1550	264	31	298	12.01	5.90	238	17	258	10.92	10.29	4.80	216	18	152	9.83	13.72	5.62	
605	6/29/93 1700	264	31	298	12.01	5.90	218	17	242	10.76	10.89	4.50	198	19	148	8.54	12.24	7.50	NGas off
605	6/29/93 2120	212	55	295	10.84	8.25	221	23	302	11.10	8.31	5.95	196	72	210	10.27	12.04	6.40	TCshield
606	6/29/93 2300	193	20	280	10.45	8.50	218	26	270	9.91	7.77	7.58	193	28	188	9.02	10.76	8.15	

PSCC Arapahoe Unit 4 Calcium/Humidification-Duct Injection. Ca(OH)2 calculations based upon 68% CaO

		Boiler		Sorbent Feed			Injector cal		ΔSO2 Red		Humidification					Baghouse Temps					Humid calc	
Test	Date & Time	Load	O2cr	Loc	A.w	B.e	Flow	Ca/S'	Comp	Calc	Air	Tgo	Twl	H2O	A.W	Grid	Out	IDin	Opsis	Ta	Tcalc	H2Oe
		MWe	%wet		%	%	lb/min		%	%	scfm	°F	°F	gpm	-	°F	°F	°F	°F	°F	°F	%w
606	6/30/93 0100	60	6.40	Duct	48	48	18.5	1.66	23	16.5	3951	250	65	38.0	1.09	147	148	148	147	30	153	7.49
606	6/30/93 0300	60	6.40	Duct	48	48	18.5	1.67	23	15.9	3965	246	65	38.0	1.14	147	147	148	147	30	152	7.29
606	6/30/93 0500	58	6.80	Duct	48	48	18.5	1.74	25	20.5	3965	248	64	38.0	1.12	147	147	149	147	30	150	7.26
606	6/30/93 0630	58	6.80	Duct	48	48	18.5	1.74	24	18.3	3972	247	64	37.0	1.13	147	147	148	147	30	152	7.31
606	6/30/93 0845	58	6.80	Duct	48	48	18.5	1.76	25	17.6	3948	249	65	38.0	1.10	147	147	149	147	30	151	7.37
607	6/30/93 1045	48	6.90	Duct	48	48	18.5	2.15	30	24.4	4022	241	65	32.0	1.38	146	148	149	148	30	149	7.53
607	6/30/93 1400	100	4.10	Duct	42	42	16.1	0.92	24	17.8	3636	280	63	65.0	0.54	148	151	152	154	30	155	9.08
607	6/30/93 1600	91	5.30	Duct	73	73	28.1	1.80	31	28.1	3631	280	64	66.0	0.54	146	150	153	152	30	142	9.57
607	6/30/93 1644	90	4.30	Duct	73	73	28.1	1.79	32	26.6	3683	279	64	61.0	0.60	145	150	151	152	30	156	8.57
607	6/30/93 1900	84	4.80	Duct	66	66	25.4	1.72	43	25.7	3700	275	64	59.0	0.63	145	150	151	152	30	149	8.66
607	6/30/93 2100	90	5.10	Duct	80	80	30.8	1.93	36	31.5	3639	276	64	65.0	0.56	146	149	152	154	30	150	8.57
607	6/30/93 2300	79	6.10	Duct	66	66	25.4	1.82	34	28.1	3756	265	64	54.5	0.71	147	148	151	152	30	147	9.05
607	7/1/93 0100	74	6.40	Duct	62	62	23.8	1.83	32	26.4	3794	260	65	51.0	0.76	146	148	150	151	30	143	8.95
608	7/1/93 0300	60	7.10	Duct	48	48	18.5	1.72	24	18.8	3875	249	64	42.0	0.96	142	144	146	145	30	147	7.74
608	7/1/93 0500	60	7.00	Duct	48	48	18.5	1.72	25	20.6	3889	247	64	41.0	1.00	143	144	145	144	30	147	7.60
609	7/1/93 0645	60	6.90	Duct	48	48	18.5	1.72	28	23.4	3874	247	64	42.5	0.95	137	141	142	141	25	142	7.69
610	7/1/93 1010	100	3.80	Duct	76	76	29.2	1.69	36	32.6	3626	279	65	66.0	0.54	147	148	152	152	30	153	9.32
610	7/1/93 1150	109	3.60	Duct	83	83	31.9	1.69	43	32.0	3547	287	64	72.0	0.48	147	149	152	156	30	155	9.59
610	7/1/93 1340	107	4.30	Duct	85	85	32.7	1.79	36	30.0	3475	289	64	79.0	0.43	146	151	155	158	30	141	9.26
610	7/1/93.1505	105	4.60	Duct	85	85	32.7	1.84		28.8	3515	287	65	75.0	0.47	148	157		163	30	145	9.52
610	7/1/93 1800	98	5.00	Duct	100	0	19.1	1.09	26	22.6	3525	289	65	73.0	0.48	150	157	159	162		141	9.56
610	7/1/93 2300	78	5.90	Duct	100	0	19.1	1.42	22	19.3	3521	272	65	57.0	0.68	151	149	154	155		158	8.08
611	7/2/93 0100	61	6.70	Duct	94	0	17.9	1.70	33	25.8	2917	257	65	44.5	0.86	143	145	148	147	30	149	7.83
611	7/2/93 0300	61	6.90	Duct	86	0	16.4	1.54	30	25.1	2921	256	65	44.5	0.86	143	143	146	145	30	148	7.81
611	7/2/93 0500	61	6.90	Duct	86	0	16.4	1.55	28	21.2	2910	254	64	43.5	0.86	142	146	149	149	30	148	7.44
611	7/2/93 0645	61	6.80	Duct	86	0	16.4	1.52	29	25.6	2890	253	64	43.0	0.88	143	142	146	144	30	146	7.63
612	7/2/93 0915	79	5.80	Duct	100	0	19.1	1.40	13	20.6	2906	269	65	55.0	0.65	152	147	154	154	30	159	7.55
612	7/2/93 1120	106	4.60	Duct	100	0	19.1	1.06	22	12.8	3318	291	64	77.0	0.48	151	150	156	158	30	155	8.56
612	7/2/93 1250	102	4.60	Duct	100	0	19.1	1.08	15	16.8	3348	293	65	75.0	0.51	153	150	157	157	30	156	8.74

PSCC Arapahoe Unit

Test	Date & Time	GAS ANAL ECON-DRY (1-12) NO	CO	SO2	CO2	O2	GAS ANALYSIS INLET-WET ------ NO	CO	SO2	CO2	H2O	O2	GAS ANALYSIS OUTLET-WET ------ NO	CO	SO2	CO2	H2O	O2	Comments
		ppm	ppm	ppm	%	%dry	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	%	%	%	
606	6/30/93 0100	193	20	280	10 45	8 50	214	25	274	10 06	7 84	7 30	191	25	201	9 12	10.61	8 18	
606	6/30/93 0300	230	38	291	10 69	8 90	226	25	259	9 63	7 46	7 98	189	30	160	7 67	9 44	10 60	blr upset
606	6/30/93 0500	187	32	280	10 44	8 80	172	28	264	9 96	7 63	7 56	153	27	184	8 91	10.37	8 45	3mills
606	6/30/93 0630	187	32	280	10 44	8 80	174	26	264	9 96	7 68	7 55	158	21	189	8 91	10 36	8 45	
606	6/30/93 0845	187	32	280	10 44	8 80	177	24	260	9 94	7 74	7 55	157	19	188	8 86	10 52	8 42	
607	6/30/93 1045	197	32	253	9 67	9 38	188	29	232	9 10	7 64	8 50	163	26	160	8 45	10 45	8 87	load follow
607	6/30/93 1400	273	73	348	12 71	5 80	236	43	317	11 85	9 29	4 95	212	51	235	10 78	13 19	5 52	
607	6/30/93 1600	273	73	348	12 71	5 80	244	32	250	9 60	7 79	7 95	199	245	180	9.61	12 50	6 95	
607	6/30/93 1644	237	131	325	12 31	6 75	224	27	302	11 42	8 99	5 50	196	127	203	10 61	13 03	5 80	
607	6/30/93 1900	237	131	325	12 31	6 75	223	24	300	11 29	8 96	5 70	194	49	198	10 21	12 73	6 40	
607	6/30/93 2100	231	81	314	11 63	7 20	229	28	292	10 79	8 79	6 25	203	54	184	10 12	12 79	6 45	
607	6/30/93 2300	231	81	314	11 63	7 20	206	20	265	10 07	8 54	7 30	189	23	174	9 36	12 06	7 60	
607	7/1/93 0100	231	81	314	11 63	7 20	197	17	252	9 61	8 05	7 90	175	21	170	8 97	11 56	8 12	113 sat
608	7/1/93 0300	194	21	271	10 16	9 05	182	18	248	9 53	7 96	8 02	159	14	181	8 72	11 00	8 52	30Ta, 143
608	7/1/93 0500	194	21	271	10 16	9 05	182	18	250	9 58	7 87	7.94	164	18	178	8 73	10.88	8 48	
609	7/1/93 0645	192	21	272	10 34	8 85	178	18	254	9 79	7 99	7 70	161	14	171	8 72	11 00	8 48	25Ta, 138°
610	7/1/93 1010	248	103	345	12 95	5 90	221	35	309	11 61	9 52	5 05	203	109	188	10 70	13 33	5 60	
610	7/1/93 1150	252	199	355	13 43	5 15	236	35	310	11 71	9 34	5 05	209	93	192	10 98	13 59	5 40	
610	7/1/93 1340	252	199	355	13 43	5 15	241	28	295	11 13	8 59	5 75	214	44	188	10 49	13.13	6 00	
610	7/1/93 1505	252	199	355	13 43	5 15	249	22	290	11 08	8 79	5 80	218	43	190	10 42	12 89	6 00	
610	7/1/93 1800	252	199	355	13 43	5 15	221	27	290	10 93	8 32	6 60	216	29	206	9 70	12 08	6 85	Load droppe
610	7/1/93 2300	210	18	279	10 52	8 60	207	17	266	10 19	8 72	6 95	185	16	191	9 33	12 26	7 55	
611	7/2/93 0100	195	21	272	10 32	8.96	182	18	252	9 85	8 43	7 36	165	15	163	8 85	11 65	8 20	a/w=0 5
611	7/2/93 0300	195	21	272	10 32	8 96	183	18	251	9 78	8 30	7.52	166	13	166	8 85	11.55	8 21	
611	7/2/93 0500	195	21	272	10 32	8 96	182	17	253	9 83	8 01	7 40	167	13	174	8 88	11 17	8 25	H2O upset
611	7/2/93 0645	201	16	272	10 42	8 60	187	17	258	9 98	8 17	7 40	165	13	171	9 03	11 25	8 05	
612	7/2/93 0915	201	16	272	10 42	8 60	203	17	268	10 29	8 15	7 00	190	16	195	9 47	11 64	7 30	
612	7/2/93 1120	264	36	332	12 50	6.35	233	27	292	11 15	8 55	5 83	216	24	235	10 52	12.92	5 95	
612	7/2/93 1250	264	36	332	12 50	6 35	229	25	290	10 91	8 55	6.10	207	26	225	10 35	12.75	6 10	

PSCC Arapahoe Unit 4 Calcium Injection Summary Duct Injection Tests cont
Ca(OH)2 Calculations based on 68% CaO

Test	Date & Time	Load MWe	O2cr %wet	Sorbent Feed A (w) %	Sorbent Feed B (e) %	Injector Flow lb/min	cal Ca/S*	ΔSO2 Reduction Cmp %	ΔSO2 Reduction Calc %	ΔNOx ppmc	ΔNOx %	ppmc	ΔNO2 ppmc	ΔNO ppmc	ΔNO/ΔSO2	SO2 inlet ppmdc	Economizer ΔNOx %	Economizer ΔNO ppmc	Economizer ΔNO2i ppmc	Economizer ΔNO/ΔSO2	Humidification Air scfm	Taho °F	Tw °F	H2O gpm	Baghouse Temps Grid °F	Out °F	IDin °F	Opsis °F	Humid calc Tcalc °F	H2Oe %w
705	10/19/93 11:30	112	4.20	57	69	52.2	2.02	38	36.8	196	5.6	15	0.2	15	0.08	532	5.5	7	0.2	0.04	3528	273	58	71.0	140	142	148	150	143	9.07
705	10/19/93 12:30	112	4.20	57	69	52.2	2.02	40	38.5	205	-2.4	-6	0.1	-6	-0.03	531	5.3	10	0.1	0.05	3535	274	58	70.5	141	142	148	149	144	8.84
705	10/19/93 13:30	112	4.10	57	69	52.2	2.09	42	34.4	177	-1.3	-3	0.7	-3	-0.02	513	4.4	8	0.7	0.04	3524	276	58	70.5	142	143	149	151	147	8.72
705	10/19/93 14:30	111	4.20	57	69	52.2	2.12	41	37.7	193	-1.1	-3	0.1	-3	-0.01	511	7.7	17	0.1	0.09	3508	278	57	72.0	141	144	149	152	146	8.62
705	10/19/93 15:30	112	4.20	55	66	50.1	2.02	42	37.0	189	6.7	19	1.6	20	0.11	511	6.9	16	1.6	0.08	3515	278	58	72.5	142	144	149	152	145	8.77
705	10/19/93 16:30	111	4.20	55	66	50.1	2.08	44	37.3	186	-3.6	-9	-0.2	-9	-0.05	499	7.3	15	-0.2	0.08	3529	276	58	69.0	142	144	149	152	147	8.78
706	10/20/93 8:30	112	4.20	57	69	52.4	2.04	40	35.8	189	-2.2	-6	0.0	-5	-0.03	528	3.8	1	0.0	0.01	3569	266	58	66.0	142	142	147	149	146	9.20
706	10/20/93 9:30	112	4.40	57	69	52.4	2.07	40	37.4	196	0.8	2	0.4	2	0.01	522	2.5	1	0.4	0.00	3542	267	58	68.0	142	141	148	150	145	9.15
706	10/20/93 10:30	112	4.60	57	69	52.4	2.08	38	33.4	173	-0.4	-1	-0.5	-2	-0.01	519	-2.3	-11	-0.5	-0.07	3540	264	58	67.0	142	141	149	151	143	9.13
706	10/20/93 11:40	112	4.60	57	69	52.4	2.08	39	36.0	187	-0.9	-2	0.0	-2	-0.01	519	2.5	2	0.0	0.01	3579	264	58	66.5	143	142	149	152	144	9.09
706	10/20/93 12:50	112	4.50	57	69	52.4	2.06	40	34.5	180	-1.7	-4	-0.5	-5	-0.03	523	-1.5	-10	-0.5	-0.06	3568	267	58	66.5	143	142	150	153	145	9.20
707	10/20/93 14:30	113	4.60	57	69	52.4	2.05	35	30.3	158	-1.6	-4	-0.2	-5	-0.03	521	1.6	-2	-0.2	-0.01	3535	267	59	68.0	142	143	150	153	147	8.91
707	10/20/93 15:30	112	4.60	57	69	52.4	2.10	43	40.3	208	0.3	1	-1.3	-1	0.00	515	5.2	8	-1.3	0.01	3486	279	56	74.5	143	145	151	155	149	8.75
707	10/20/93 16:40	112	4.60	57	69	52.4	2.09	43	38.4	198	0.1	0	0.6	1	0.00	516	6.5	12	0.6	0.06	3489	276	58	75.0	141	143	149	152	145	8.73
707	10/20/93 17:30	112	4.60	57	69	52.4	2.19	44	42.1	208	8.3	24	0.0	24	0.11	494	6.1	12	0.0	0.06	3496	276	57	74.5	143	143	149	153	145	8.79
707	10/20/93 18:40	112	4.60	53	64	48.6	2.06	42	37.7	182	2.6	7	0.1	7	0.04	484	5.7	10	0.1	0.05	3509	274	56	72.0	142	143	149	154	146	8.97
708	10/26/93 14:30	101	4.20	28	31	23.1	1.04	14	9.9	50	4.2	9	0.3	9	0.19	507	6.8	9	0.3	0.18	3847	269	58	49.0	163	169	172	172	165	9.10
709	10/26/93 15:50	101	4.20	49	59	44.4	2.03	29	26.9	134	0.3	1	-0.4	0	0.00	499	4.8	6	-0.4	0.04	3845	270	58	50.0	163	163	168	169	166	8.90
710	10/26/93 17:10	101	4.20	71	87	66.1	3.09	34	31.4	153	4.0	9	0.7	10	0.06	489	5.9	10	0.7	0.06	3843	270	57	50.0	163	163	167	168	165	8.99
711	10/27/93 9:40	103	4.20	15	30	16.2	0.97	17	14.3	53	1.2	3	-0.6	2	0.04	372	3.9	2	-0.6	0.03	3802	261	57	55.0	143	153	156	158	148	9.00
712	10/27/93 14:30	101	4.20	25	62	33.4	1.97	36	28.1	109	1.3	3	0.4	3	0.03	388	1.1	-4	0.4	-0.03	3712	277	57	63.0	144	146	151	152	145	8.61
713	10/27/93 15:10	101	4.20	37	98	53.1	3.05	39	34.1	136	4.8	11	1.0	12	0.09	398	5.3	7	1.0	0.05	3697	279	57	64.0	143	148	151	152	146	8.59
714	11/1/93 9:10	111	4.20	0	0	0.0	0.00	0	-1.5	-7	-1.3	-4	1.9	-2	0.24	461	-2.4	-11	1.9	1.61	0	282	48	0.0	276	263		273	282	2.41
715	11/1/93 13:40	112	4.00	32	84	45.3	2.19	33	31.2	133	2.2	6	0.5	6	0.05	426	8.5	18	0.5	0.13	3619	283	55	72.0	145	155	159	163	150	8.78
716	11/1/93 16:50	112	3.80	32	84	45.3	2.26	39	37.5	154	-4.5	-12	1.1	-10	-0.07	412	2.1	1	1.1	0.01	3636	280	55	71.0	145	148	153	156	146	8.93
717	11/1/93 17:50	113	4.10	0	100	37.9	1.90	35	30.9	126	6.8	18	0.8	19	0.15	407	11.8	29	0.8	0.23	3668	277	54	68.0	145	147	153	156	151	8.90
719	11/2/93 11:30	114	4.10	29	75	40.4	2.04	31	26.8	108	-0.7	-2	-0.1	-2	-0.02	401	4.9	8	-0.1	0.08	3667	275	55	67.0	146	155	159	162	153	8.61
720	11/2/93 14:40	114	4.10	29	74	40.0	2.10	40	28.6	110	-4.5	-11	0.0	-11	-0.10	385	6.6	14	0.0	0.13	3644	279	53	71.0	147	146	151	154	149	8.63
721	11/2/93 14:40	114	4.20	50	62	46.0	2.15	36	32.9	142	-0.8	-2	0.8	-1	-0.01	432	3.1	3	0.8	0.02	3631	280	54	72.0	146	146	151	154	147	8.80

PSCC Arapahoe Unit 4
Ca(OH)2 Calculations

		Economizer Exit, dry (1-12)						Baghouse Inlet Gas Analysis, wet							Stack Gas Analysis, wet							
Test	Date & Time	CO	NO2	CO2	O2	SO2	NO	CO	NO2	CO2	H2O	O2	SO2	NO	CO	NO2	CO2	H2O	O2	SO2	NO	Comments
		ppm	ppm	%	%dry	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	
705	10/19/93 11:30	123	3	13.92	4.85	480	240	39	-4	12.62	9.17	4.25	438	227	83	-3	11.47	12.90	4.80	252	195	Toxics 22
705	10/19/93 12:30	97	1	13.92	4.70	475	245	69	-3	13.08	9.25	3.58	457	219	86	-3	11.53	12.82	4.70	247	197	
705	10/19/93 13:30	59	0	13.77	4.90	472	246	40	-4	12.72	8.99	4.00	431	222	45	-3	11.45	12.73	4.85	252	200	
705	10/19/93 14:30	49	0	13.53	5.05	453	247	42	-4	12.95	9.15	3.70	437	221	58	-3	11.47	12.86	4.80	239	196	
705	10/19/93 15:30	56	0	13.72	4.90	460	248	30	-4	12.69	8.99	4.10	426	235	48	-2	11.37	12.79	4.90	240	195	
705	10/19/93 16:30	79	1	13.84	4.70	460	245	66	-4	13.30	9.32	3.35	435	215	55	-3	11.57	12.77	4.80	235	192	
706	10/20/93 8:30	408	4	13.24	5.00	460	230	69	-3	12.50	9.53	4.00	440	210	266	-3	11.15	12.94	5.00	250	190	Toxics 23
706	10/20/93 9:30	99	2	13.29	5.10	457	229	52	-3	12.24	9.42	4.20	430	215	264	-3	11.14	12.98	5.05	240	190	
706	10/20/93 10:30	225	1	13.30	5.05	460	235	20	-3	12.02	9.11	4.62	417	221	109	-3	10.84	12.54	5.35	250	200	
706	10/20/93 11:40	308	1	13.38	5.05	461	234	50	-3	12.18	9.27	4.30	425	213	176	-3	10.95	12.95	5.10	243	192	
706	10/20/93 12:50	138	2	12.82	4.80	450	230	37	-3	12.24	9.28	4.22	431	215	191	-3	11.04	12.70	5.20	250	194	
707	10/20/93 14:30	204	1	13.10	5.30	451	238	35	-4	11.98	9.11	4.50	422	219	200	-4	10.84	12.62	5.25	264	200	Toxics 24
707	10/20/93 15:30	192	1	12.83	5.68	438	242	39	-4	11.79	9.04	4.70	412	221	188	-4	10.82	13.30	5.20	222	200	
707	10/20/93 16:40	198	2	12.92	5.60	449	240	47	-4	11.56	9.10	4.50	418	218	215	-3	10.89	12.98	5.25	230	194	
707	10/20/93 17:30	171	1	12.85	5.50	432	237	28	-3	11.71	8.89	4.85	392	228	179	-3	10.80	12.92	5.25	207	191	
707	10/20/93 18:40	169	1	12.07	5.35	207	240	45	-4	12.07	9.20	4.50	392	221	142	-3	10.83	12.83	5.25	219	193	
708	10/26/93 14:30	259	2	13.84	4.30	468	205	51	-4	12.60	9.16	3.80	430	188	177	-3	11.52	12.13	4.45	355	165	50 deg approach
709	10/26/93 15:50	184	2	13.53	4.70	450	208	38	-2	12.56	9.17	3.82	423	190	14	-2	11.31	11.92	4.83	277	170	
710	10/26/93 17:10	237	1	13.80	4.43	450	205	38	-3	12.45	9.07	3.90	413	188	184	-2	11.54	12.12	4.52	260	165	
711	10/27/93 9:40	312	4	13.40	4.40	338	215	69	-3	12.40	9.09	3.85	315	198	225	-3	11.28	12.22	4.60	245	178	30 deg approach
712	10/27/93 14:30	370	2	13.17	4.50	365	210	134	-4	11.94	8.62	4.10	325	198	224	-3	11.06	12.44	4.70	212	177	
713	10/27/93 15:10	424	1	13.21	4.60	378	210	60	-4	11.87	8.54	4.30	330	195	355	-3	11.04	12.50	4.67	200	170	
714	11/1/93 9:10	256	1	13.66	4.40	413	245	57	-5	12.56	9.06	4.05	385	230	228	-3	12.40	8.89	4.50	380	225	Base
715	11/1/93 13:40	119	2	13.70	4.90	380	260	43	-4	12.58	9.00	4.10	355	233	147	-4	11.47	12.78	4.80	220	205	
716	11/1/93 16:50	215	1	14.60	4.45	397	250	48	-4	12.74	9.02	3.90	348	220	144	-3	11.57	12.75	4.70	195	205	
717	11/1/93 17:50	166	0	14.05	4.70	365	255	42	-4	12.67	9.04	4.05	340	227	167	-3	11.78	12.86	4.40	217	195	B feeder only
719	11/2/93 11:30	220	2	14.04	4.80	360	250	51	-3	12.83	8.83	4.00	337	225	201	-3	11.70	12.38	4.70	223	205	
720	11/2/93 14:40	391	1	13.81	4.70	350	250	70	-3	12.99	8.97	3.70	330	215	215	-2	11.68	12.70	4.60	210	200	
721	11/2/93 14:40	149	2	14.00	4.55	385	240	46	-4	12.80	8.83	4.10	361	216	125	-3	11.71	12.81	4.65	220	197	good?