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CONFINED ZONE DISPERSION
FLUE GAS DESULFURIZATION DEMONSTRATION

NOV 22 1993

Quarterly Report No. 10
For the Period
February 17 to May 31, 1993

Prepared for:
U.S. Department of Energy
Pennsylvania Electric Company
Pennsylvania Energy Development Authority
New York State Electric & Gas Corporation
Rockwell Lime Company

Prepared by:
Bechtel Corporation
Fifty Beale Street
San Francisco, California 94105-1895

November 15, 1993

Cooperative Agreement No. DE-FC22-90PC90546
Patents Cleared by Chicago on May 4, 1993

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Section 1

SUMMARY

This is the tenth quarterly report for the CZD flue gas desulfurization demonstration. It covers work performed on Phase 3b from February 17 through May 31, 1993.

Water and lime injection operations remained off-line throughout the month of February due to continuing low inlet duct temperatures. The boiler problems suspected of causing the continuing low inlet temperatures to the B-duct have been identified, and arrangements have been made to correct these problems during the next forced boiler outage.

There were no forced boiler outages in March. Therefore, the problems causing the continuing low inlet temperatures in the B-duct could not be corrected. A major project review meeting was held at Penelec's offices in Johnstown, PA on March 24, 1993. Twenty-nine people attended the meeting, including eight representatives from DOE, seven from Bechtel, ten from Penelec, one from PEDDA, two from NYSEG, and one from Rockwell.

On April 3, 1993, Boiler #15 was shut down after an unusually long run of more than two months' duration. Extensive repairs were accomplished during the outage to seal air leaks and raise the inlet temperature of the CZD duct. Boiler #15 was returned to service on April 8, but had a tube failure and was forced to shut down again on April 12. Normal boiler operations resumed on April 14, and lime injection tests were initiated on April 16 to confirm satisfactory operation of the ESP and the CZD system. All operators were recalled from layoff and were back on site on April 19. Continuous lime injection operations resumed on April 21, 1993, to complete the balance of the demonstration test program. Initial operations show that the repairs have greatly improved the inlet temperature to the B-duct.

The project incurred costs for four months while waiting for a boiler shutdown so that the low-temperature problem could be corrected. The accumulated delays have extended the time frame of the continuous demonstration, further increasing the cost of the project.

During startup, the lime injection was hampered by frequent plugging of nozzles due to aged lime in the silo and in the lime slurry preparation pit. A stable injection was finally achieved on May 3, 1993, but other mechanical problems prevented attainment of the injection rates necessary for optimum SO₂ removal. Frequent removal and cleaning to unplug the atomizers resulted in several atomizers leaking around the flanges and spray tips. We also replaced the fly ash deflectors with new ones, but the new deflectors were oversized and prevented

proper sealing of the atomizers, causing leakage and deposits on the atomizer tips.

The above problems were initially noted when the lowest skin temperature vent decreased from its normal 210°F down to 127°F (alarm). These problems resulted in wetting of the duct floor with deposits that the rotary sootblowers were not able to break up. In addition, the thermal drain valve on the sootblower system was set too low. This allowed condensate to accumulate and discharge from the retractable sootblowers at the turning vanes each time they were operated. This discharged condensate cooled the thermocouples on the turning vanes and upset the slurry flow rate. Because the lime slurry injection flow rate is controlled by the lowest temperature of these thermocouples, the net result was the formation of duct deposits that were too heavy to be removed by the sootblowers. By the time the operations were smoothed out, the deposits had progressed into the confined zone. Because of these deposits, we had to limit the rate of the lime slurry injection that resulted in low levels of SO₂ removal. The results of the 633 hours of operation in the period April 21 to May 25, 1993, show an average SO₂ removal of only 17.4% in contrast with the earlier results of 45% to 55% SO₂ removal, as described in *Quarterly Report #8*.

To avoid further accelerated growth of the deposits, the lime injection was stopped on May 25, 1993, when it was decided to manually remove the deposits during the next boiler maintenance outage, tentatively scheduled for May 31, 1993.

We have taken a number of actions to prevent a recurrence of duct deposits. Because proper functioning of the atomizer nozzles is crucial to both SO₂ removal and duct cleanliness, we have been using computational fluid dynamics analysis to model the flow field around the CZD spray nozzles. Our goal is to eliminate the formation of nozzle tip deposits and minimize the possibility of mechanical leakage. Additionally, we have put together a test program for an automated system for continuous monitoring of spray head performance and diagnosis of developing anomalies.

To maximize the amount of SO₂ removed and ensure complete drying of the lime slurry before it contacts the duct, we need to use all the heat available in the flue gas. However, the existing flue gas flow pattern in the duct is not uniform, and temperatures vary significantly from side to side and from top to bottom. This is especially troublesome at the C-section because we control the lime slurry flow based on the lowest C-section temperature. We have used our computational fluid dynamics analysis to model the flow of flue gas and design a baffle system. The baffles create a significantly more uniform and symmetrical velocity profile through the spray nozzles and downstream in the duct. This feature is critical since the trajectory of the spray droplets is likely to follow the direction of the flue gas flow at the duct entrance.

Figure 1-1 shows the major milestone status from pre-award activities of the CZD demonstration through the end of May 1993.

Bechtel does not anticipate any CZD demonstration activities during the month of June 1993 because of the problems with Boiler #15.

Bechtel intends to discontinue the DOE demonstration program effective July 1, 1993, since it has completed its financial obligations to DOE.

This is the last quarterly report for this project.

Figure 1-1 Major Milestone Status From Pre-Award Activities Through May 31, 1993

Section 2

INTRODUCTION

The CZD process involves injecting a finely atomized slurry of reactive lime into the flue gas duct work of a coal-fired utility boiler. The principle of the confined zone is to form a wet zone of slurry droplets in the middle of the duct confined in an envelope of hot gas between the wet zone and the duct walls. The lime slurry reacts with part of the SO_2 in the gas, and the reaction products dry to form solid particles. A solids collector, typically an electrostatic precipitator (ESP) downstream from the point of injection, captures the reaction products along with the fly ash entrained in the flue gas.

The features that distinguish the CZD process from other similar injection processes are:

- Injection of an alkaline slurry directly into the duct, instead of injection of dry solids into the duct ahead of a fabric filter.
- Use of an ultrafine calcium/magnesium hydroxide, type S pressure-hydrated dolomitic lime. This commercial product is made from plentiful, naturally occurring dolomite.
- Low residence time, made possible by the presence of very fine particles of Type S lime and their resultant large surface area.
- Localized dispersion of the reagent. Slurry droplets contact only part of the gas while the droplets are drying, to remove up to 50 percent of the SO_2 . The process uses dual fluid rather than rotary atomizers.
- Improved electrostatic precipitator performance via gas conditioning from the increased water vapor content, and lower temperatures.

The waste product is composed of magnesium and calcium sulfite and sulfate, with some excess lime. This product mixed with fly ash is self-stabilizing because of the excess lime values, and thus tends to retain heavy metals in insoluble forms within the fly ash.

The demonstration is being conducted at Penelec's Seward Station, Unit No. 15. This boiler is a 147 MWe coal-fired unit, which utilizes Pennsylvania bituminous coal (approximately 1.2 to 2.5% sulfur). One of the two flue gas ducts leading from the boiler has been retrofitted with the CZD technology. The first existing ESP installed in the station is immediately behind the air preheater. The second ESP, installed about 15 years ago, is about 80 feet away from the first ESP. The station has two more boilers (#12 and #14) that burn the same coal and are connected to the common flue gas stack. The arrangement of Seward Station is shown in Figure 2-1.

The goal of this demonstration is to prove the technical and economic feasibility of the CZD technology on a commercial scale. The process is expected to achieve 50% SO₂ removal at lower capital and O&M costs than other systems.

The U.S. Department of Energy and Bechtel Corporation are engaged in a cooperative project to demonstrate the CZD Technology. DOE is providing \$5.2 million of the project's total \$12.2 million cost. Others contributing to the project are Pennsylvania Electric Company (\$3.6 million), Bechtel (\$2.5 million), the Pennsylvania Energy Development Authority (\$750,000), New York Gas and Electric Company (\$100,000), and Rockwell Lime Company (\$23,000).

To achieve its objectives, the project is divided into the following three phases:

- Phase 1: Design and Permitting
- Phase 2: Construction and Start-up
- Phase 3: Operation and Disposition

Phase 1 activities were completed on January 31, 1991. Phase 2 activities were essentially concluded on July 31, 1991, and Phase 3a, Parametric Testing, was initiated on July 1, 1991. This Quarterly Technical Progress Report covers Phase 3b activities from February 17 through May 31, 1993.

For further information on the structure of this demonstration project, Appendix A provides a project description by phase, a work breakdown structure (WBS) Diagram, and a detailed description of the WBS.

Figure 2-1 Seward Station Arrangement

Section 3

PROJECT STATUS

This section of the report provides details of the work performed from February 17 through May 31, 1993. It describes the activities carried out as part of the CZD demonstration with continuous operation. Figure 3-1 shows a Seward Station overall process flow diagram.

Figures 3-2 through 3-5 show the Seward CZD system overview, the lime storage and lime slurry preparation, the lime slurry feed system, and the lime slurry injection, respectively, for continuous operation.

3.1 COMPLETION OF DESIGN, PROCUREMENT, AND INSTALLATION (WBS 1.3.3)

All these activities have been completed.

3.2 COMPLETION OF FACILITY CONSTRUCTION (WBS 1.3.4)

All these activities have been completed.

3.3 CZD DEMONSTRATION WITH CONTINUOUS OPERATION (WBS 1.3.6)

3.3.1 February 17 to May 31, 1993

Water and lime injection operations remained off-line throughout the months of February and March 1993 due to continuing low inlet duct temperatures. The boiler problems suspected of causing the continuing low inlet temperatures to the B-duct have been identified. During the next forced outage, Penelec plans to repair the leaks in several expansion joints ahead of the air preheater, as well as air leaks in several other areas of the boiler. They will also attempt to reactivate an abandoned air by-pass duct around the air heater.

Lime injections can be resumed when duct inlet temperatures of approximately 300°F can be achieved and maintained.

On April 3, 1993, Boiler #15 was shut down after an unusually long run of more than two months' duration.

Figure 3-1 Seward Station Overall Process Flow Diagram

Figure 3-2 Seward CZD System Overview

Figure 3-3 Lime Storage and Slurry Preparation – Continuous Operation

Figure 3-4 Lime Slurry Feed System – Continuous Operation

Figure 3-5 Lime Slurry Injection – Continuous Operation

Repairs accomplished during the April 3 to 8 forced outage included:

- The bottom radial seals on the A-side air heater were replaced.
- Holes were repaired in the B-side air heater, gas inlet ducting, and expansion joints up to the economizer hoppers.
- A 3-inch gap was repaired in the boiler casing (above the economizer on the B-side), which extended for 10 feet along the corner. A 6-foot section of the corner itself was also repaired.
- The B-side air heater airside recirculation damper was removed so it could be rebuilt and reinstalled during a later outage.
- The top section was cut out of the airside duct coils in the A and B air heaters because of bent fins that impeded air flow.

Boiler #15 was returned to service on April 8 but had a tube failure and was forced down again on April 12. Normal boiler operations resumed on April 14, and lime injection tests were initiated on April 16 to confirm satisfactory operation of the ESP and the CZD system. All operators were recalled from layoff and were back on site by April 19.

Continuous lime injection operations resumed on April 21, 1993, to complete the balance of the demonstration test program.

The operations showed that the repairs greatly improved the inlet temperature to the B-duct. During startup, the lime injection was hampered by frequent plugging of the nozzles due to aged lime in the silo and in the lime slurry preparation pit. A stable injection was finally achieved on May 3, 1993, but other mechanical problems prevented attainment of the injection rates necessary for optimum SO₂ removal. Frequent removal and cleaning to unplug the atomizers resulted in several atomizers leaking around the flanges and spray tips. We also replaced the fly ash deflectors with new ones, but the new deflectors were oversized and prevented proper sealing of the atomizers, causing leakage and deposits on the atomizer tips.

The above problems were initially noted when the lowest skin temperature vent decreased from its normal 210°F down to 127°F (alarm). These problems resulted in wetting of the duct floor with deposits that the rotary sootblowers were not able to break up. In addition, the thermal drain valve on the sootblower system was set too low. This allowed condensate to accumulate and discharge from the retractable sootblowers at the turning vanes each time they were operated. This discharged condensate cooled the thermocouples on the turning vanes and upset the slurry flow rate. Because the lime slurry injection flow rate is controlled by the lowest temperature of these thermocouples, the net result was the formation of duct deposits that were too heavy to be removed by the sootblowers. By the time the operations were smoothed out, the deposits had progressed into the

confined zone. To avoid further accelerated growth of these deposits, the lime injection was stopped on May 25, 1993, when it was decided to manually remove the deposits during the next boiler maintenance outage, tentatively scheduled for May 31, 1993.

The timing of the maintenance outage was reviewed by Penelec, and it will not occur as scheduled. Consequently, completion of the CZD continuous demonstration program may again be delayed, pending scheduling of a boiler shutdown when the duct deposits can be removed. Previously, the project incurred costs for four months while waiting for a boiler shutdown to allow correction of a low temperature problem. Such delays extend the continuous demonstration period and greatly increase the cost of the project. Current estimates indicate that the final project cost may easily reach \$12.4 million.

We have taken a number of actions to prevent a recurrence of duct deposits. Because proper functioning of the atomizer nozzles is crucial to both SO₂ removal and duct cleanliness, we have been using computational fluid dynamics analysis to model the flow field around the CZD spray nozzles. Our goal is to eliminate the formation of nozzle tip deposits and minimize the possibility of mechanical leakage. Additionally, we have put together a test program for an automated system for continuous monitoring of spray head performance and diagnosis of developing anomalies.

To maximize the amount of SO₂ removed and ensure complete drying of the lime slurry before it contracts the duct, we need to use all the heat available in the flue gas. However, the existing flue gas flow pattern in the duct is not uniform, and temperatures vary significantly from side to side and from top to bottom. This is especially troublesome at the C-section because we control the lime slurry flow based on the lowest C-section temperature. We have used our computational fluid dynamics analysis to model the flow of flue gas and design a baffle system. The baffles create a significantly more uniform and symmetrical velocity profile through the spray nozzles and downstream in the duct. This feature is critical since the trajectory of the spray droplets is likely to follow the direction of the flue gas flow at the duct entrance. The excellent temperature mixing effect of the baffles will cause the 75°F temperature gradient present at the outlet of the first ESP to be reduced to less than 6°F within a short distance downstream of the nozzles. The gradient at the C-section is expected to be negligible.

3.3.2 Daily CZD Summaries April 21 to May 25, 1993

Table 3-1 shows summaries of daily CZD operating data from April 21 through May 25, 1993 (a total lime slurry injection period of 633.5 hours).

Table 3-1 also includes the following daily averages:

- SO₂ in and SO₂ removal as lb-moles per day
- Pressure-hydrated dolomitic lime (PHDL) used as lb-moles per day
- Average daily percentage utilization of PHDL
- Average daily flue gas temperature in – and at – the C-section

Table 3-2 shows the CZD system summary for the period April 21 through May 25, 1993, presenting operating averages and lower values. Table 3-3 shows the CZD performance summary for the period April 21 through May 25, 1993.

Table 3-4 shows the CZD system availability in hours and percentage of time during the period April 21 to May 25, 1993 and the CZD unavailability due to the atomizer and other mechanical problems.

Appendix C presents detailed operating data, recorded every 15 minutes, between April 21 and May 25, 1993. These data include:

- Inlet and outlet SO₂ in lb/MMBtu
- Inlet and outlet percent of CO₂ and % CO₂ dilution
- Inlet flue gas temperature, average temperature (arithmetic average of 24 thermocouples) at C-section (at the turning vanes), and the lowest temperature of the 24 thermocouples
- Inlet flue gas flow rate in thousands of scfm
- The B-duct opacity percentage as an instantaneous reading, and the percentage of stack opacity as a one-minute average.
- SO₂ reduction

Table 3-1
Daily CZD Summaries: April 17 - May 25, 1993

Date	Inject. Time Hours	Avg. Load MW	Low Load MW	Avg Gas In Temp °F	Low Gas In Temp °F	Avg FG Flow In KSCFM	Avg C Sect. Temp °F	Low C Sect. Temp °F	Avg Slurry Flow gpm	Avg Slurry Solids %	Avg SO2 Red. %	Max SO2 Red. %	Avg SO2 In PPM	SO2 In #moles	SO2 Rem. #moles	Lime Used #moles	Avg Lime Util. %
4/21	6.25	142	137	288	286	195	225	200	24.8	3.8	7.2	9.7	801	154	11	43	28
4/22	13.75	127	106	290	279	176	209	184	27.1	4.2	9.3	12.2	780	300	28	112	26
4/23	14.75	138	115	295	289	193	202	174	32.4	4.2	10.4	13.2	771	347	36	147	25
4/24	24.00	139	122	295	287	193	197	164	34.0	4.2	11.3	16.8	790	581	66	247	27
4/25	22.25	126	105	299	290	182	199	163	32.4	5.1	14.9	27.7	743	478	72	268	27
4/26	1.25	145	142	288	287	206	195	177	39.4	8.1	6.6	14.2	831	34	2	30	9
4/27	24.00	135	104	292	281	189	195	176	37.8	6.2	14.7	22.7	822	590	86	416	21
4/28	16.50	129	106	297	285	175	195	174	41.5	6.1	16.1	26.3	819	375	59	307	19
4/29	23.25	134	105	303	289	61	193	175	45.8	6.2	15.9	24.1	829	190	30	483	6
4/30	24.00	132	104	304	294	164	191	171	46.6	7.0	19.2	28.0	801	501	95	578	16
5/1	2.75	111	105	308	299	154	188	171	47.6	6.0	22.3	25.9	778	52	11	58	21
5/3	9.75	143	136	301	299	176	187	173	47.7	7.1	14.8	17.8	800	217	32	246	13
5/4	24.00	134	107	299	295	168	188	165	45.1	7.1	19.9	26.3	817	521	103	568	18
5/5	17.50	135	106	300	293	175	184	161	40.1	7.3	20.6	31.4	797	388	78	381	21
5/7	7.25	142	136	298	290	190	188	170	46.2	10.1	18.6	24.0	799	174	33	254	13
5/8	24.00	132	105	299	291	180	181	161	49.9	10.0	26.5	34.3	886	608	159	902	18
5/9	24.00	126	104	299	292	168	180	160	43.3	9.8	27.8	36.2	855	545	150	763	20
5/10	14.50	134	102	295	284	178	188	162	39.7	10.2	21.8	29.5	783	320	70	443	16
5/11	24.00	135	105	295	280	181	179	158	43.2	9.9	25.7	36.6	876	609	153	774	20
5/12	24.00	137	105	297	290	190	180	150	43.0	8.0	17.4	27.5	1188	862	149	617	24
5/13	23.75	134	105	293	285	181	175	155	42.7	8.0	11.3	28.1	755	521	95	605	15
5/14	24.00	134	105	295	281	187	182	159	41.2	8.0	17.1	25.5	1200	851	145	588	25
5/15	24.00	131	105	301	291	190	185	160	43.3	9.7	19.1	31.2	1183	854	164	771	22
5/16	24.00	131	103	297	286	134	180	160	44.1	12.0	26.8	39.3	1146	583	158	970	16
5/17	21.25	134	105	293	277	113	183	165	42.2	12.0	24.0	30.4	1166	451	101	823	12
5/18	24.00	135	108	285	276	185	178	160	40.8	11.5	26.1	44.3	1100	774	202	854	24
5/19	16.50	131	108	284	277	185	180	159	38.7	10.6	24.8	37.8	1092	530	130	513	26
5/20	24.00	134	107	281	272	187	178	160	39.5	9.7	22.6	32.4	1135	806	181	689	26
5/21	24.00	132	108	278	268	189	175	161	38.7	8.0	19.7	29.1	1171	841	165	554	30
5/22	24.00	128	106	276	262	181	179	164	33.1	1.0	7.0	24.4	1146	790	54	67	80
5/23	24.00	124	105	280	269	174	187	175	31.7	0.0	0.2	9.7	1113	737	1	0	0
5/24	24.00	130	106	278	261	179	184	173	33.8	3.4	7.1	20.8	1109	753	56	205	30
5/25	14.25	129	104	264	255	175	181	171	28.9	4.1	10.3	16.1	1128	447	46	122	38
Summary:	633.50	133	102	292	255	173	186	165 (Avg)	39.8	7.3	17.4	44.3	965	16783	2919	14398	20.3

Table 3-2
CZD System Summary
April 21 to May 25, 1993

System Summary	Units	During PHDL Injection
Injection Time	hours	633.5
Average Slurry Flow	gpm	39.8
Average Slurry Solids	wt%	7.3
Average Boiler Load	MW	133.0
Low Boiler Load	MW	102.0
Average Gas Inlet Temperature	°F	292.0
Low Gas Inlet Temperature	°F	255.0
Average Duct Flow In	kscfm	173
Average C-Section Temperature	°F	186
Average Lowest C-Section Temperature	°F	165
Approach to Saturation Temperature	°F	66°F

Table 3-3
CZD Performance Summary
April 21 to May 25, 1993

Performance Summary	Units	During PHDL Injection
Average SO ₂ Removed	%	17.4
Maximum SO ₂ Removed	%	44.3
Total B-duct SO ₂	lb-moles	16,783
SO ₂ Removed	lb-moles	2,919
PHDL Injected	lb-moles	14,398
PHDL/Inlet SO ₂	lb-moles/lb-mole	0.858
PHDL/SO ₂ Removed	lb-moles/lb-mole	4.93
Average PHDL Utilization	%	20.3
<u>Reaction Products + Spent Reagent</u> Fly Ash	tons/ton	1.08

Table 3-4
CZD System Availability for Lime Injection
April 21 to May 25, 1993

Availability	Hours (subtotal)	Hours (total)	%
CZD Available:		814.00	87.0
Lime Injection	633.50		
Water Test *	0.25		
Boiler Unavailable	180.25		
CZD Unavailable:		122.00	13.0
Atomizer Problems	62.50		
Other Mechanical Problems	59.50		
Total	936.00	936.00	100.00

* System available for lime injection.

Tables 3-5 through 3-10 and Figures 3-6 through 3-11 graphically depict CZD operating results with the PHDL injection for continuous operation during the period April 21 through May 25, 1993. Based on daily averages, these figures show the following variations.

- Table 3-5 and Figure 3-6: the percentage of SO₂ removal versus the lime slurry flow rate with a constant slurry solids content and 1.6% sulfur in coal
- Table 3-6 and Figure 3-7: the percentage of SO₂ removal versus the slurry flow rate with a constant slurry solids content and 2.3% sulfur in coal
- Table 3-7 and Figure 3-8: the percentage of SO₂ removal versus the sulfur in coal at a constant slurry flow rate and constant slurry solids content
- Table 3-8 and Figure 3-9: the percentage of SO₂ removal versus the lime slurry solids content at constant slurry flow rate of about 40 gpm
- Table 3-9 and Figure 3-10: the percentage of lime utilization versus the lime slurry solids content at a constant slurry flow rate of 45 gpm
- Table 3-10 and Figure 3-11: the percentage of SO₂ removal versus the approach to saturation temperature at a constant lime slurry flow rate and constant slurry solids content

Table 3-5
SO₂ Removal Versus Lime Slurry Flow Rate at Constant Slurry Solids
and 1.6% Sulfur Content in Coal

Based on Daily Averages – April 21 to May 25, 1993

Date	Sulfur in Coal (%)	Slurry Flow (gpm)	Average Slurry Solids (%)	Average C-Section Temp (°F)	Avg. App. to Sat. Temp. at C-Section	Avg. SO ₂ Removal (%)	Avg. Lime Utilization (%)
	<u>1.6</u>		<u>4.2</u>				
4/22	1.6	27.1	4.2	209	89	9.3	26
4/23	1.6	32.4	4.2	202	82	10.4	25
4/24	1.6	34.0	4.2	197	77	11.3	27
	<u>1.6</u>		<u>6.0-6.2</u>				
4/27	1.6	37.8	6.2	195	75	14.7	21
4/28	1.6	41.5	6.1	195	75	16.1	19
5/1	1.6	47.6	6.0	188	68	22.3	21
	<u>1.6</u>		<u>9.8-10.2</u>				
5/10	1.6	39.7	10.2	188	68	21.8	16
5/9	1.6	43.3	9.8	180	60	27.8	20

Figure 3-6 shows that the percentage of SO₂ removal increases with the lime slurry flow rate increase. When operating conditions at the B-duct of Unit #15 have a slurry flow rate of less than 40 gpm, the percentage of SO₂ removal is limited to about 20% or less.

The slurry solids concentration also has a positive influence on the percentage of SO₂ removal. For example:

- With 6% slurry solids and a 47.6 gpm slurry flow rate, the average percentage of SO₂ removal on May 1 was 22.3%. On May 9, with an average of 9.8% slurry solids, the percentage of SO₂ removal increased to 27.8% – about a 25% increase in the percentage of SO₂ removal – but an increase of 63% in the percentage of slurry solids.
- Under the following specific conditions – 1.6% sulfur in coal, 60°F approach to saturation temperature, low boiler load, etc. – an increase in the percentage of slurry solids much above 7-8% will result in only a limited increase in the percentage of SO₂ removal, but will have a substantial negative effect on the percentage of lime utilization.

Figure 3-6 SO₂ Removal Versus Lime Slurry Flow Rate at Constant Slurry Solids and 1.6% Sulfur Content in Coal

Table 3-6
SO₂ Removal Versus Lime Slurry Flow Rate at Constant Slurry Solids
and 2.3% Sulfur Content in Coal

Based on Daily Averages – April 21 to May 25, 1993

Date	Sulfur in Coal (%)	Slurry Flow (gpm)	Average Slurry Solids (%)	Average C-Section Temp (°F)	Avg. App. to Sat. Temp. at C-Section	Avg. SO ₂ Removal (%)	Avg. Lime Utilization (%)
	2.3		8				
5/14	2.3	41.2	8	182	62	17.1	25
5/12	2.3	43.0	8	180	60	17.4	24
	2.3		10.6-12				
5/19	2.3	38.7	10.6	180	60	24.8	26
5/18	2.3	40.8	11.5	178	58	26.1	24
5/16	2.3	44.1	12.0	180	60	26.8	16

Figure 3-7 shows that the percentage of SO₂ removal increases as the lime slurry flow rate increases, independent of the percentage of sulfur content in the coal. The slurry solids concentration also has a positive influence on the percentage of SO₂ removal. For example:

- With a 43.3 gpm lime slurry flow rate, 9.8% solids concentration, and 1.6% sulfur in coal, the average SO₂ removal was 27.8%. With a 44.1 gpm lime slurry flow rate, 12% solids concentration, and 2.3% sulfur in coal, the average SO₂ removal was 26.8%.
- With about the same lime slurry flow rate and percentage of solids concentration, the percentage of SO₂ removal was about the same for a 1.6% to 2.3% increase of sulfur in coal.

Figure 3-7 SO₂ Removal Versus Lime Slurry Flow Rate at Constant Slurry Solids and 2.3% Sulfur Content in Coal

Table 3-7
SO₂ Removal Versus Sulfur in Coal at Constant Lime Slurry Flow Rate
and Constant Slurry Solids Content

Based on Daily Averages – April 21 to May 25, 1993

Date	Sulfur in Coal (%)	Slurry Flow (gpm)	Average Slurry Solids (%)	Average C-Section Temp (°F)	Avg. App. to Sat. Temp. at C-Section	Avg. SO ₂ Removal (%)	Avg. Lime Utilization (%)
		40	10				
5/10	1.6	39.7	10.2	188	68	21.8	16
5/20	2.3	39.5	9.7	178	58	22.6	26
		43	8				
5/13	1.6	42.7	8.0	175	55	11.3	15
5/12	2.3	43.0	8.0	180	60	17.4	24

Figure 3-8 shows that with a constant 43 gpm and 8% slurry solids, the percentage of SO₂ removal increases with the percentage of sulfur in the coal from 11.3% SO₂ removal with 1.6% sulfur in coal to 17.4% SO₂ removal with 2.3% sulfur in coal. In the case of a constant flow rate of 40 gpm and 10% slurry solids, the percentage of SO₂ removal increases with the percentage of sulfur in the coal from 21.8% to 22.6% SO₂ removal when the sulfur in the coal increases from 1.6% to 2.3%. Aside from the increase in the percentage of SO₂ removal with higher sulfur in the coal, the percentage of lime utilization increased from 15% to 24% with 8% slurry solids, and from 16% to 26% with 10% slurry solids.

Figure 3-8 SO₂ Removal Versus Sulfur in Coal at Constant Lime Slurry Flow Rate and Constant Slurry Solids Content

Table 3-8
SO₂ Removal Versus Lime Slurry Solids Content at Constant
Lime Slurry Flow Rate of About 40 gpm

Based on Daily Averages – April 21 to May 25, 1993

Date	Sulfur in Coal (%)	Slurry Flow (gpm)	Average Slurry Solids (%)	Average C-Section Temp (°F)	Avg. App. to Sat. Temp. at C-Section	Avg. SO ₂ Removal (%)	Avg. Lime Utilization (%)
		<u>40.1-43.2</u>	<u>6.1-11.5</u>				
4/28	1.6	41.5	6.1	195	75	16.1	19
5/5	1.6	40.1	7.3	184	64	20.6	21
5/11	1.6	43.2	9.9	179	59	25.7	20
5/18	2.3	40.8	11.5	178	58	26.1	24

Figure 3-9 shows that the percentage of SO₂ removal increases quickly when the percentage of lime slurry is increased from 6% to 8% – that is, an increase in the percentage of SO₂ removal from 16.1% to about 22% (a 37.5% increase) occurs when the lime slurry concentration is increased from 6% to 8%, or about 33%. By increasing the percentage of the lime slurry solids content from 8% to 10% (an increase of 25%), the percentage of SO₂ removal improves by 22% to 25.7% (about a 16.8% increase in SO₂ removal).

A further increase in the percentage of lime slurry solids content from 10% to 11.5% (a 15% increase in lime slurry concentration), improves the percentage of SO₂ removal from 25.7% to 26.1% – about a 1.6% increase.

It can be seen that an increase in the percentage of slurry solids above an 8% to 10% level (depending on the sulfur content in the coal and the approach to saturation temperature) will not contribute to a substantial increase in the percentage of SO₂ removal.

Figure 3-9 SO₂ Removal Versus Lime Slurry Solids Content at Constant Slurry Flow Rate of 40 gpm

Table 3-9
Lime Utilization Versus Lime Slurry Solids Content at a
Constant Lime Slurry Flow Rate of 45 gpm

Based on Daily Averages – April 21 to May 25, 1993

Date	Sulfur in Coal (%)	Slurry Flow (gpm)	Average Slurry Solids (%)	Average C-Section Temp (°F)	Avg. App. to Sat. Temp. at C-Section	Avg. SO ₂ Removal (%)	Avg. Lime Utilization (%)
		42.2-47.6	6-12				
5/1	1.6	47.6	6.0	188	68	22.3	21
4/30	1.6	46.6	7.0	191	71	19.2	16
5/13	1.6	42.7	8.0	175	55	11.3	15
5/7	1.6	46.2	10.1	188	68	18.6	13
5/17	2.3	42.2	12.0	183	63	24.0	12

Figure 3-10 shows that at a constant lime slurry flow rate of about 45 gpm, the percentage of lime utilization decreases from 21% to 12% when the lime slurry content is increased from 6% to 12%.

Figure 3-10 Lime Utilization Versus Lime Slurry Solids Content at Constant Slurry Flow Rate of 45 gpm

Table 3-10
SO₂ Removal as a Function of the Approach to Saturation Temperature at a
Constant Slurry Flow Rate and Constant Slurry Solids Content

Based on Daily Averages – April 21 to May 25, 1993

Date	Sulfur in Coal (%)	Slurry Flow (gpm)	Average Slurry Solids (%)	Average C-Section Temp (°F)	Avg. App. to Sat. Temp. at C-Section	Avg. SO ₂ Removal (%)	Avg. Lime Utilization (%)
		<u>45.8-47.6</u>	<u>6.0-6.2</u>		<u>68-73</u>		
4/29	1.6	45.8	6.2	193	73	15.9	6
5/1	1.6	47.6	6.0	188	68	22.3	21
		<u>38.7-41.2</u>	<u>8.0</u>		<u>55-62</u>		
5/14	2.3	41.2	8.0	182	62	17.1	25
5/21	2.3	38.7	8.0	175	55	19.7	30
		<u>39.7-43.2</u>	<u>10.0</u>		<u>59-68</u>		
5/10	1.6	39.7	10.2	188	68	21.8	16
5/11	1.6	43.2	9.9	179	59	25.7	20
		<u>40.8-42.2</u>	<u>11.5-12</u>		<u>58-68</u>		
5/17	2.3	42.2	12	183	63	24	12
5/18	2.3	40.8	11.5	178	58	26.1	24

Figure 3-11 shows that at a constant lime slurry flow rate, constant slurry solids percentage and constant percentage of sulfur in coal, the approach to saturation temperature has an important effect on the percentage of SO₂ removal. The higher the approach to saturation temperature, the lower the percentage of SO₂ removal.

The approach to saturation temperature is called the ΔT between the average temperature of 24 thermocouples at the C-section (at the flue gas duct turning vanes) and the adiabatic saturation temperature in the flue gas duct. Under Seward Station conditions, this is about 120°F.

The following examples show the effect on the percentage of SO₂ removal of the approach to saturation temperature:

- With 6% slurry solids, 46 gpm slurry flow, and 1.6% sulfur in coal, the percentage of SO₂ removal varied from 15.9% to 22.3% when the approach to saturation temperature varied from 73°F to 68°F.
- With 10% slurry solids, 41 gpm slurry flow, and 1.6% sulfur in coal, the percentage of SO₂ removal varied from 21.8% to 25.7% when the approach to saturation temperature decreased from 68°F to 59°F.
- With 8% slurry solids, 40 gpm slurry flow, and 2.3% sulfur in coal, the percentage of SO₂ removal varied from 17.1% to 19.7% when the approach to saturation temperature varied from 62°F to 55°F.
- With 12% slurry solids, 41 gpm slurry flow, and 2.3% sulfur in coal, the percentage of SO₂ removal varied from 24% to 26.1% when the approach to saturation temperature varied from 63°F to 58°F.

Figure 3-11 SO₂ Removal Versus Approach to Saturation Temperature at Constant Slurry Flow Rate and Constant Slurry Solids Content

Appendix E presents daily charts with the one-minute average stack opacity percentage for the period April 21 through May 5, 1993. Because Bailey Controls Company was replacing the control system for units 12 and 14 at Seward Station during this period, no opacity percentage charts were recorded for those units. However, all the opacity percentage data for the B-duct and station stack for the period May 6 through May 25, 1993, are included with the detailed operational data, recorded every 15 minutes, presented in Appendix C.

Appendix D presents charts of instant opacity percentage in the B-duct outlet. These include the following data.

- May 10 – the instant opacity percentage when burning low sulfur coal
- May 14 – the instant opacity percentage when burning higher sulfur coal
- May 21 – the instant opacity percentage when burning higher sulfur coal and when the first ESP was being de-energized, causing a 250% fly ash increase in the B-duct.

3.3.3 Calcium-to-Sulfur Ratio

Table 3-3 indicated that the following data were collected during the 633.5 hours of lime injection into the B-duct:

- 16,783 moles of SO₂ at the duct inlet
- 14,398 lb-moles of PHDL injection as slurry
- 2,919 lb-moles of SO₂ removed
- 20.3% average lime utilization

The ratio $\frac{Ca}{S}$ is as follows:

$$\frac{14.398 \text{ lb-moles PHDL}}{16.783 \text{ lb-moles inlet SO}_2} = 0.858$$

An average 0.858 lb-mole of PHDL was used for lb-mole at the SO₂ inlet.

$$\frac{14.398 \text{ lb-moles of PHDL}}{2.919 \text{ lb-moles of SO}_2 \text{ removed}} = 4.93$$

An average 4.93 lb-moles PHDL were used per mole of SO₂ removed.

NOTE:

1. Table 3-1 (Page 3-10) shows the daily averages of lb-moles for SO₂ in, SO₂ removed, and lime used. Therefore, the calcium-to-sulfur ratio can be easily calculated for every day of CZD operations.
2. Pressure-Hydrated Dolomitic Lime (PHDL) contains 57% Ca(OH)₂ + 38.5% Mg(OH)₂ + 4.5% inerts and moisture. The molecular weight of pure PHDL is calculated to be 66.6 lb-moles. The molecular weight of as-received PHDL is calculated to be 69.7 lb-moles. The lb-moles of lime used represent PHDL as received.
3. The percentage of slurry solids is expressed on a weight basis. The ppm of SO₂ in the flue gas is expressed on a volume basis.

3.3.4 Results of CZD Operations with Higher Sulfur Coal

To determine how burning higher sulfur coal affects the CZD percentage of lime slurry concentration, how the percentage of lime slurry concentration affects the electrostatic precipitator (ESP) particulate removal efficiency, and how these processes affect the stack opacity, Penelec and Bechtel requested PaDER approval to conduct tests at Seward Station with higher sulfur coal (not to exceed a sulfur content of 2.4%) for a 15-day period. The test protocol and summary of the proposed test are presented in Appendix J.

Table 3-11 shows a comparison between the daily CZD summaries of operating data for burning higher sulfur coal and regular sulfur coal.

Table 3-12 shows that the average SO₂ removal and maximum SO₂ removal were higher during the period when higher sulfur coal was burned. The percentage of lime utilization was also higher. These results were expected because the higher SO₂ concentration creates a higher partial pressure, leading to the faster reaction with water and SO₂ absorbent.

The higher lime slurry concentration (10-12%) did not affect the plant stack opacity, and the B-duct opacity remained comfortably low. Appendix C contains tables with CZD PHDL-slurry injection operating data, including the duct opacity percentage and stack opacity data, recorded every 15 minutes. These data show that even when higher lime slurry concentrations were injected (May 7 to May 25, 1993), the stack opacity percentage was less than 10% most of the time. The permissible EPA and Pa DER stack opacity limit for power plants is 20%. Power company management is charged a penalty every time the stack opacity rises above 20% for more than 3 minutes.

Another test conducted while burning higher sulfur coal verified the effect of increasing the fly ash concentration in the B-duct by about 250% by de-energizing the first ESP (the Research Cottrell ESP). This test took place on May 21 and 22 during a period of 25 hours, and stack opacity percentage and duct opacity were comfortably low. This means that the stack opacity percentage is not affected by the increase of fly ash grain loading in the flue gas when a CZD system is ahead of the ESP. Additional information on this subject is included in Section 3.3.5, CZD System Influence on ESP Particulate Removal Efficiency.

The results of chemical analyses of solid wastes accumulated during the period when higher sulfur coal was burned are included in Section 3.4.2, Chemical Analysis of Solid Wastes.

Table 3-11
Comparison of Daily CZD Summaries of Operating Data
with Regular Sulfur Coal Versus Higher Sulfur Coal

Burning Higher Sulfur Coal
May 16-19, 1993

Date	Inject. Time Hours	Avg. Load MW	Low Load MW	Avg Gas in Temp °F	Low Gas in Temp °F	Avg FG Flow in kscfm	Avg C Sect. Temp °F	Low C Sect. Temp °F	Avg Slurry Flow gpm	Avg Slurry Solids %	Avg SO ₂ Red. %	Max SO ₂ Red. %	Avg SO ₂ in ppm	SO ₂ in #moles	SO ₂ Rem. #moles	Lime Used #moles	Avg Lime Util. %
5/16	24.00	131	103	297	286	134	180	160	44.1	12.0	26.8	39.3	1,146	583	158	970	16
5/17	21.25	134	105	293	277	113	183	165	42.2	12.0	24.0	30.4	1,166	451	101	823	12
5/18	24.00	135	108	285	276	185	178	160	40.8	11.5	26.1	44.3	1,100	774	202	854	24
5/19	16.50	131	108	284	277	185	180	159	38.7	10.6	24.8	37.8	1,092	530	130	513	26
Summary	86	132.8	103	290	276	154	180	159	41.5	11.5	25.4	44.3	1,126	2,338	591	3,160	18.7

Burning Regular Sulfur Coal
May 7-10, 1993

Date	Inject. Time Hours	Avg. Load MW	Low Load MW	Avg Gas in Temp °F	Low Gas in Temp °F	Avg FG Flow in kscfm	Avg C Sect. Temp °F	Low C Sect. Temp °F	Avg Slurry Flow gpm	Avg Slurry Solids %	Avg SO ₂ Red. %	Max SO ₂ Red. %	Avg SO ₂ in ppm	SO ₂ in #moles	SO ₂ Rem. #moles	Lime Used #moles	Avg Lime Util. %
5/7	7.25	142	136	298	290	190	188	170	46.2	10.1	18.6	24.0	799	174	33	254	13
5/8	24.00	132	105	299	291	180	181	161	49.9	10.0	26.5	34.3	886	608	159	902	18
5/9	24.00	126	104	299	292	168	180	160	43.3	9.8	27.8	36.2	855	545	150	763	20
5/10	14.50	134	102	295	284	178	188	162	39.7	10.2	21.8	29.5	783	320	70	443	16
Summary	70	133.5	102	298	284	179	184	160	44.8	10.0	23.7	36.2	830	1,647	412	2,362	17.4

Table 3-12
Coal Proximate Analysis and Daily Ton/Day Consumption During May 1993,
Including the Two-Week Supply of Higher Sulfur Coal

SEWARD STATION HEAT RATE QUALITY - MAY 1993

DATE	# 12 TONS	# 14 TONS	# 15 TONS	% MOIST	% ASH	% SULFER	BTU	# SUL/ 10E6 BTU	% VOL
1	0	0	1123	7.40	11.88	1.48	12393	1.19	20.69
2	0	0	982	7.28	12.12	1.46	12377	1.46	19.83
3	0	0	1110	7.24	12.53	1.63	12216	1.34	21.05
4	0	0	1149	6.68	12.85	1.52	12310	1.24	21.29
5	0	0	919	7.42	12.43	1.64	12227	1.34	21.01
6	0	0	0						
7	0	0	685	6.02	14.98	1.72	12005	1.43	20.84
8	0	0	1153	7.61	11.98	1.64	12262	1.34	20.84
9	0	0	786	6.62	13.81	1.55	12136	1.28	20.84
10	0	0	1042	5.74	13.64	1.50	12304	1.22	30.14
11	0	0	1680	5.84	13.10	2.15	12392	1.74	23.28
12	0	0	1236	6.22	13.26	2.41	12368	1.95	24.19
13	0	0	1249	4.98	14.70	2.36	12395	1.91	24.40
14	0	0	1201	4.69	15.56	2.24	12287	1.83	23.14
15	0	0	1227	4.57	12.81	2.21	12740	1.73	23.37
16	0	0	1159	4.52	13.98	2.27	12534	1.81	24.32
17	0	0	1254	4.73	15.80	2.28	12242	1.87	23.37
18	0	0	1241	5.53	14.90	2.07	12258	1.69	23.31
19	0	0	1185	5.36	16.81	2.23	11928	1.87	23.96
20	0	0	1255	5.21	15.42	2.30	12183	1.89	25.15
21	0	0	1214	7.35	12.00	1.40	12351	1.13	21.07
22	0	0	1179	4.82	15.83	2.37	12173	1.95	21.07
23	0	0	1126	4.31	13.28	2.14	12716	1.68	23.04
24	0	0	1161	6.43	14.64	1.64	12092	1.36	21.48
25	0	0	1154	6.51	11.12	1.54	12721	1.21	20.34
26	0	0	1211	6.36	11.50	1.56	12582	1.25	20.86
27	0	0	1169	6.81	11.20	1.46	12499	1.17	21.69
28	0	0	1134	6.46	11.73	1.77	12506	1.43	22.47
29	0	0	1098	6.32	11.26	1.60	12634	1.27	21.66
30	0	0	1146	6.17	13.19	1.41	12345	1.14	20.83
31	0	0	1101	6.83	13.10	1.45	12287	1.18	20.34
TOTAL-12	0			ERR	ERR	ERR	ERR	ERR	ERR
TOTAL-14		0		ERR	ERR	ERR	ERR	ERR	ERR
TOTAL-15			34329	6.03	13.39	1.86	12356	1.51	22.41

HIGHER SULFUR COAL

NOTE: WEEKENDS AND HOLIDAYS BASED ON GRAB SAMPLES

NOTE: VOLATILE MATTER NOT RUN FOR GRAB SAMPLES, AVERAGE OF PREVIOUS DAYS USED

NOTE: STOCKPILE AS OF 5/31/93 104681.42 TONS

3.3.5 CZD System Influence on ESP Particulate Removal Efficiency, Measured by Opacity Percentage of Flue Gas Emissions at Seward Station

In general, during CZD parametric testing for short or longer durations (48 hours) and during continuous operation, the CZD System had a beneficial effect on ESP performance, measured by the lower percentage of stack opacity and B-duct opacity. The data that serve as the basis for this statement on opacity are included in the following quarterly reports:

- *Quarterly Report #5*, for the period November/December 1991 and January 1992, on parametric testing. The report includes:
 - The effects of the CZD system at Seward Station on the stack opacity percentage; Section 3.3.3 (page 3-20).
 - The stack opacity percentage before, during, and after the lime slurry injection, Table 3-2 (page 3-14), Table 3-3 (page 3-16), and Table 3-4 (page 3-18).
- *Quarterly Report #6*, for the period February, March and April 1992. Short-term and long-term (48-hour) parametric testing include:
 - Stack opacity percentages before, during, and after lime slurry injection, Table 3-8 (page 3-21) and Table 3-9 (page 3-25).
 - A table with test data during the 48-hour continuous run, recorded every 15 minutes, Appendix C (page C-1).
 - The effect on ESP performance during the 48 hours of lime slurry injection, Section 3.3.1 (page 3-2).
- *Quarterly Report #7*, for the period May, June, July and 16 days of August 1992, concluding parametric testing. The report includes:
 - A summary of Phase 3a activities, May 1992, Appendix C (page C-1) and CZD activity summary for May 1992, Table C-1, with stack opacity percentages before and during lime slurry injection.
 - A summary for the month of July is presented on page C-10 and in Table C-3 (page C-14) with recorded data for stack opacity percentages before and after lime slurry injection.
 - A summary for the first half of August 1992, presented on page C-19 and in Table C-4, includes stack opacity percentages before and after the lime slurry injection.

- *Quarterly Report #8*, for the period August 17 through November 16, 1992, during continuous CZD operation. The report includes:
 - CZD system influence on ESP particulate removal efficiency, Sections 3.3.6.1 to 3.3.6.3 (pages 3-57 to 3-59).
 - Tables with summaries of lime slurry injection data that include one-minute average values of the opacity percentages in the plant stack, recorded every 15 minutes during lime slurry injection. See Appendix C (pages C-1 to C-11), Appendix D (pages D-1 to D-4), and Appendix E (pages E-1 to E-29).
 - Buell ESP fields operating log, presenting instant values of duct opacities, recorded every 15 minutes during lime slurry injection from October 12 through November 16, 1992, Appendix I (pages I-1 to I-50).
- *Quarterly Report #9*, for the period November 17, 1992 through February 16, 1993, during continuous CZD operation. The report includes:
 - Daily averages of CZD operating data. These data include one-minute average values of the opacity percentages in the plant stack, with maximum and minimum percentages every day for the period November 17 to December 16, 1992, Table 3-2 (page 3-16).
 - Average operating data during lime slurry injection from November 17 to December 16, 1992. This table includes one-minute average values of the opacity percentages in the plant stack during this period, Table 3-3 (page 3-17).
 - A summary of lime slurry injections from November 17 to December 16, 1992. These tables include one-minute average values of the opacity percentages in the plant stack, recorded every 15 minutes during lime slurry injections, Appendix C (pages C-1 to C-12).

During CZD operation between April 21 and May 25, 1993, the stack and B-duct opacity percentage was comfortably low when 1.6% and 2.4% sulfur coal was burned. Tables with lime slurry injection operation data collected between April 21 and May 25, 1993, are included in Appendix C (pages C-1 through C-66). The tables include duct opacity and stack opacity percentages, recorded every 15 minutes. We consider the stack opacity percentages to be comfortably low because most of this time they were less than 10%, and the 30-day average was less than 7%, compared with the EPA's 20% limit.

On May 21 and 22, 1993, the first ESP (the Research Cottrell ESP), that removes about 60% of the fly ash was de-energized for 25 hours, and the full amount of fly ash moved through the B-duct. Although grain loading in the flue gas increased by 250% in the B-duct, opacity percentage in the B-duct and plant stack remained comfortably low, indicating that the CZD system has a positive influence on ESP performance.

Appendix C contains tables for the CZD operation for the period April 21 through May 25, 1993. The data in these tables include the instant values of the opacity percentage in the plant stack, recorded every 15 minutes, during the lime injection.

The plant stack opacity daily charts in Appendix E show the opacity percentage during the period April 21 through May 5, 1993. The stack opacity was not recorded between May 6 and May 25, 1993, because the Bailey Controls Company was revamping the automatic controls for Boilers #12 and #14.

In Appendix D, the B-duct charts with instant opacity percentages during the CZD operation show the continuous opacity percentage on May 10 when 1.6% sulfur coal was burned, on May 14 when 2.4% sulfur coal was burned, and on May 21, when the first ESP was de-energized and grain loading in the B-duct increased by about 250%.

Our explanations for the beneficial influence of CZD on ESP performance are as follows:

- Through evaporation of water in the lime slurry injected into the duct, the flue gas is cooled from 300°F to about 180°F. This cooling decreases the gas volume and gas velocity in the ESP, and the longer residence time improves particulate removal efficiency.
- By decreasing the temperature, the particulates' resistivity is lowered, thereby improving ESP performance.
- The increased humidity becomes a conditioning agent for reducing the cake resistivity, improving ESP performance.
- The size of fly ash particles, from the pulverized coal boiler varies from submicron to about 100 microns, with a mean diameter of 10-20 microns. The larger particles are easily removed by the ESP, but the submicron to about two-micron particles are more difficult to remove due to reintrainment during the rapping. The ESP removal efficiency depends on the percentage of very fine particles in the flue gas. If a method to agglomerate the fines into larger particles were available, then ESP performance would come close to 100 percent.

- The fine atomized lime slurry – made of fine particles of hydrated lime or PHDL with a mean diameter of 5 microns – is injected into the flue gas loaded with fly ash at a velocity of about 1,000 ft/sec (sonic velocity). The fine particles intercept and impact the fly ash particles, agglomerating them to create larger particles and making it easier to remove them by the ESP. This process is illustrated in Figure 3-13 of *Quarterly Report #9*, which shows a CZD solids waste analysis by a scanning electron micrograph (SEM). The reaction products and unreacted lime are shown as micron particles agglomerating with the small- and medium-sized fly ash particles in the form of spheres.

The larger the fly ash concentration in the flue gas, the better the chances are for agglomeration and formation of larger particles that are more easily removed by the ESP. On May 21, 1993, when the first ESP was de-energized and the fly ash concentration in the flue gas increased by 250%, ESP removal efficiency increased nearly 100% because the opacity percentage did not increase — although the total amount of particulates substantially increased. This theory of impaction and agglomeration also explains why the injection of atomizing lime slurry into the duct was more effective in decreasing the stack opacity percentage than the injection of atomized water.

In a few cases we had problems with the higher opacity percentage during the lime slurry injection. Sometimes this was caused by mechanical or electrical failure of the Buell ESP, such as a broken ground connection wire or broken discharge wires that created a short circuit in the ESP. Once these problems were defined and corrected, the opacity returned to normal.

At other times when the problem persisted, we consulted an ESP specialist, Mr. Ted Schafebook of General Electric Environmental Systems. Mr. Schafebook has been involved with Buell's ESP from the time it was installed at Seward Station. He visited the station in October and December 1992 and gathered precipitator performance data related to the CZD operation. In January 1993, he also inspected the ESP, collecting plates and discharge wires when the unit was down. Mr. Schafebook's observations, which are summarized below, are presented in Appendix K in a letter dated March 10, 1993, from Mr. A. Schaal to Mr. Michael Bodosky, Group Supervisor, Mechanical Maintenance, at Penelec.

- The lime slurry injection into the duct has a positive effect as long as the solids are dried before entering the ESP
- Once lime slurry or water in the liquid phase begins to pass through the ESP, the cake begins to cling to the plates so persistently that no amount of rapping or time will remove it
- Mr. Schafebook recommended a complete washoff of the precipitator plates.

3.3.6 Solid Waste Produced by the CZD Operation

The average hourly amount of solid waste calculated as being collected in the ESP hoppers during CZD operations between April 28 and May 25, 1993, are discussed below. This solid waste contains:

- Fly ash
- Reaction products
- Unreacted PHDL (excess reagent)

Fly Ash

Table 3-13 shows the amount of fly ash calculated as being collected during the 633.5 hours of lime slurry injection into the B-duct between April 28 and May 25, 1993. The average hourly amount of fly ash collected in the ESP hoppers of the B-duct is calculated to be 2.67 tons/hour. Based on R&C ESP particulate removal efficiency, about 60% of this amount was collected in the first ESP (Research Cottrell ESP); the remaining 40% was collected in the second ESP (Buell ESP) together with reaction products and excess reagent, with a removal efficiency above 99%. The average fly ash per hour collected in the Buell ESP during the lime slurry injection is calculated as :

$$2.67 \text{ tons/hr} \times 40\% = 1.068 \text{ tons/hr fly ash}$$

Reaction Products

Table 3-3 shows that 2,919 lb-moles of SO₂ were removed during the 635.5 hours of lime injection, or about 4.61 lb-moles/hr of removed SO₂. Assuming that one lb-mole of PHDL reacts with one lb-mole of SO₂ removed to produce 0.6 lb-mole Ca SO₄ • 2 H₂O and 0.4 lb-mole of Ca SO₃ • 1/2 H₂O, the average amount per hour of reaction products was:

$$\begin{aligned} 4.61 \text{ lb-moles/hr} \times 154.8 \text{ lb/lb-mole} &= 713.63 \text{ lb/hr} \\ &= 0.36 \text{ tons/hr reaction products} \end{aligned}$$

Unreacted PHDL (Excess Reagent)

Table 3-3 shows that during the 633.5 hours of lime slurry injection, 14,398 moles of PHDL were used, or about $\frac{14,398 \text{ lb-moles}}{633.5 \text{ hours}} = 22.73 \text{ lb-moles/hr PHDL}$.

With a molecular weight of 70, the total weight of unreacted PHDL/hr was:

$$\begin{aligned} 22.73 \text{ lb-moles/hr} \times 70 \text{ lb/lb-mole} &= 1,591 \text{ lbs/hr} \\ &= 0.795 \text{ tons/hr} \end{aligned}$$

Table 3-13
Total Fly Ash From Boiler #15 During the In-Duct
Lime Slurry Injection from April 21 to May 25, 1993

Date	Coal Burned (tons)	Ash (%)	% of Time Per Day of Lime Injection	Total Ash** (tons)
April 21, 1993	1,184	13.34	25 (6/24 hrs)	39.5
April 22, 1993	1,243	13.26	57.3 (13.75/24 hrs)	94.4
April 23, 1993	1,266	13.27	61.46 (14.75/24 hrs)	103.2
April 24, 1993	1,274	10.93	100 (24/24 hrs)	139.3
April 25, 1993	1,135	10.96	92.7 (22.25/24 hrs)	115.3
April 26, 1993	1,222	13.51	5.2 (1.25/24 hrs)	8.6
April 27, 1993	1,289	12.28	100 (24/24 hrs)	158.3
April 28, 1993	1,158	13.32	68.8 (16.5/24 hrs)	106.1
April 29, 1993	1,158	13.04	96.9 (23.25/24 hrs)	146.3
April 30, 1993	1,143	12.64	100 (24/24 hrs)	144.5
May 1, 1993	1,123	11.88	11.5 (2.75/24 hrs)	15.3
May 3, 1993	1,110	12.53	40.6 (9.75/24 hrs)	56.5
May 4, 1993	1,149	12.85	100 (24/24 hrs)	147.7
May 5, 1993	919	12.43	72.9 (17.5/24 hrs)	83.3
May 7, 1993	685	14.98	30.2 (7.25/24 hrs)	53.1
May 8, 1993	1,153	11.98	100 (24/24 hrs)	138.1
May 9, 1993	786	13.81	100 (24/24 hrs)	108.6
May 10, 1993	1,042	13.64	60.4 (14.5/24 hrs)	87.0
May 11, 1993	1,680*	13.10	100 (24/24 hrs)	220.1
May 12, 1993	1,236*	13.26	100 (24/24 hrs)	163.9
May 13, 1993	1,249*	14.70	99 (23.75/24 hrs)	181.7
May 14, 1993	1,201*	15.56	100 (24/24 hrs)	186.9
May 15, 1993	1,227*	12.81	100 (24/24 hours)	157.2

* Higher Sulfur Coal

** "Total ash" refers only to the time during which lime was being injected.

Table 3-13 (continued)

Date	Coal Burned (tons)	Ash (%)	% of Time Per Day of Lime Injection	Total Ash** (tons)
May 16, 1993	1,159*	13.98	100 (24/24 hrs)	162.0
May 17, 1993	1,254*	15.80	88.5 (21.25/24 hrs)	175.4
May 18, 1993	1,241*	14.90	100 (24/24 hrs)	184.9
May 19, 1993	1,185*	16.81	68.6 (16.5/24 hrs)	137.0
May 20, 1993	1,255*	15.42	100 (24/24 hrs)	193.5
May 21, 1993	1,214*	12.00	100 (24/24 hrs)	145.7
May 22, 1993	1,179*	15.83	100 (24/24 hrs)	186.6
May 23, 1993	1,126*	13.28	100 (24/24 hrs)	149.5
May 24, 1993	1,161	14.65	100 (24/24 hrs)	170.0
May 25, 1993	1,154	11.12	59.4 (14.25/24 hrs)	76.2
				4,235.7

* Higher Sulfur Coal

** "Total ash" refers only to the time during which lime was being injected.

Solid Waste Summary

The total average amount per hour of solid waste collected from the CZD operation during the period April 21 through May 25, 1993, was as follows:

- Fly ash collected by Buell ESP = 1.068 tons/hr
- Reaction products by Buell ESP = 0.360 tons/hr
- Unreacted reagent by Buell ESP = 0.795 tons/hr

Average = 2.223 tons/hr

Reaction products and unreacted reagents represent about 52%, and fly ash 48%, of the average 2.223 ton/hr of solid waste.

As described in Section 3.3, the lime injection procedure between April 21 through May 25, 1993 was hampered by frequent plugging of the atomizers due to aged lime in the silo and in the lime slurry preparation pit. A stable injection was finally achieved on May 3, 1993, but other mechanical problems prevented attainment of the injection rates necessary for optimum SO₂ removal. Frequent removal and cleaning to unplug the atomizers resulted in severe atomizer leaking around the flanges and spray tips. In addition, the thermal drain valve on the sootblower system was set too low, allowing condensate to accumulate and be discharged from the retractable sootblowers at the turning vanes each time they were operated. This discharged condensate cooled the thermocouples on the turning vanes and upset the slurry flow rate. Because the lime slurry injection flow rate is controlled by the lowest temperature of these thermocouples, the net result was the formation of duct deposits that were too heavy to be removed by the sootblowers.

All these deficiencies have now been corrected; and we therefore expect to obtain a 50% SO₂ reduction with a reagent utilization of better than 40%. If this occurs, the expected average amount of solid waste per hour will be as follows:

- Fly ash collected by Buell ESP = 1.068 tons/hr
- Reaction products:

$$\frac{16,783 \text{ lb-moles SO}_2 \text{ in} \times 50\% \times 154.8 \text{ mol wt}}{633.5 \text{ hours} \times 2,000 \text{ lbs/ton}} = 1.025 \text{ tons/hr}$$

- Unreacted reagent:

$$\frac{12,587.25 \text{ lb-moles PHDL} \times 70 \text{ lbs/mole}}{633.5 \text{ hours} \times 2,000 \text{ lbs/ton}} = 0.695 \text{ tons/hr}$$

Average = 2.788 tons/hr

The average 2.788 tons/hr of solid waste expected to be collected in the Buell ESP under Seward Station operating conditions with 50% SO₂ removal and 40% lime utilization, or about 61.7% reaction products and unreacted reagent.

If the first ESP (Research Cottrell ESP) would not be energized and all the fly ash would be collected in the Buell ESP, the total amount of solid waste would be:

■ Fly ash	= 2.670 tons/hr
■ Reaction products	= 1.025 tons/hr
■ Unreacted reagent	= 0.695 tons/hr
<hr/>	
Average	= 4.390 tons/hr

Of the total 4.390 tons/hr of solid waste, reaction products plus unreacted reagent would represent about 39% and the fly ash 61%. These values would be valid for the coal composition burned at Seward Station.

In a pulverized coal boiler, the split between bottom ash and fly ash would be about 20% to 80%. Of the 4,235.7 tons of total fly ash, about 3,388.6 tons would be fly ash entrained by the flue gas, and 847.1 tons would be bottom ash. About 50% of the flue gas loaded with fly ash would flow through the B-duct (where the in-duct injection takes place) and 50% would flow through the A-duct.

The total fly ash entrained by the flue gas through the B-duct during the lime slurry injection (April 21 - May 25, 1993) is calculated as 3,388.6 tons x 0.5 = 1,694.3 tons of fly ash.

During the 633.5 hours of lime slurry injection in the B-duct, the fly ash average was about $\frac{1,694.3 \text{ tons}}{633.5 \text{ hours}} = 2.67 \text{ tons/hr}$.

3.4 BASELINE TESTING

3.4.1 Fuel

Penelec analyzed samples of the incoming coal for moisture, ash, sulfur, Btu/lb, and volatile matter. Table 3-6 shows the results of the coal analyses and the tons of coal burned per day during May 1993.

From May 11 through May 23, 1993, a higher sulfur coal was burned to determine the effect of the higher SO₂ concentration in the flue gas on the CZD operation and on the electrostatic precipitator particulate removal (opacity percentage). The higher sulfur coal (with an average of about 46% higher value for # sulfur/mm Btu) did not have any detrimental effect on the CZD operation for SO₂ removal and had a positive effect on the opacity percentage by reducing the stack opacity to less than 10%.

Another test conducted while burning higher sulfur coal involved de-energizing the first ESP (that normally removes 60% of the inlet fly ash) and thereby increasing the fly ash concentration in the CZD duct by 250%. This high increase in the fly ash concentration did not affect the remaining stack opacity percentage at 10-11%. The coal samples for chemical analysis were taken from the conveyor belt ahead of the mills.

The full results of these analyses and further analyses of the amount of coal burned during March, April, and May 1993 (including the Seward Station fly ash reports for April and May 1993) are presented in Appendix G.

3.4.2 Chemical Analysis of Solid Waste Resulting from the CZD Operation of May 19 and 20, 1993

1. The percentage of PHDL utilized was 30.2 - 30.3% — that is, 30.2% of the PHDL lb-moles injected into the B-duct reacted with 30.2 lb-moles of SO_2 removed, producing a mixture of 30.2 lb-moles of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (gypsum) and $\text{CaSO}_3 \cdot 1/2\text{H}_2\text{O}$. The solid waste collected in the ESP hoppers was pneumatically removed from the hoppers every few hours; therefore, the samples for analysis taken from the hoppers did not represent the average per day, but the results of only a few hours of operation. The calculated daily average lime utilization for SO_2 removal during May 19 and 20, 1993, was 26%. (See Daily CZD Summaries, April 21 - May 25, 1993, Section 3.3.2.)
2. Of the total solid waste collected in the ESP hoppers during the CZD operation, Sample #1 of May 19, 1993, contains 25% by weight of reaction products, plus unreacted lime; Sample #2 of May 20, 1993 contains about 37.3% of reaction products and unreacted lime, with the difference being fly ash.
3. The unreacted lime and magnesium hydroxide maintain a high alkalinity of solid waste with a pH of 12.
4. The sulfite concentration in the leachate of solid waste of Samples #1 and #2 is extremely low – about 22 mg/l – due to the very low solubility of calcium sulfite in the water
5. The magnesium concentration in the leachate of solid waste of Samples #1 and #2 is extremely low – about 0.17 mg/l – indicating that magnesium is in the form of $\text{Mg}(\text{OH})_2$, not magnesium sulfite or sulfate.
6. The amount of nitrite, expressed as mg/l nitrogen in the leachate of fly ash from the A-duct (without CZD) and from the B-duct (with CZD) of Samples #1 and #2, is very small – less than 0.05 mg/l nitrogen.

Nitrate, expressed as mg/l nitrogen in the leachate of the fly ash sample from the A-duct (without CZD) is very low — less than 0.05 mg/l nitrogen.

Nitrate, expressed as mg/l nitrogen in the leachate of Samples #1 and #2 from the B-duct (with CZD) are 0.40 mg/l nitrogen in Sample #1 and 1.30 mg/l in Sample #2. The leachate contains 100 g of solid waste in 2 liters of deionized water. This is equivalent to 26 ppm (by weight) of nitrate, expressed as nitrogen, of the solid waste of Sample #2, or about 114 ppm (by weight) of nitrate of the solid waste. It is also equivalent to about 342 ppm (by weight) of nitrate reported to be in the reaction products, plus unreacted lime. This is about 0.684 lbs nitrate per ton of reaction products, plus unreacted lime.

The nitrate found in the solid waste proved that some NO_x was removed from the flue gas. The amount of nitrate in the solid waste varies from 0.40 mg/l in Sample #1 to 1.30 mg/l in Sample #2. More tests are required to determine the conditions that could improve the percentage of NO_x removal.

The chemical analyses of solid waste are based on the CZD operation on May 19 and 20, 1993. The method of calculation involved a comparison of solid wastes from the A-duct (without CZD) and the B-duct (with CZD). The results of these analyses are presented in Appendix F.

Section 4

PLANNED ACTIVITIES

4.1 OPERATION AND DISPOSITION

Bechtel does not anticipate engaging in any CZD demonstration activities during June 1993 because of problems with Boiler #15. We intend to discontinue the DOE demonstration program, effective July 1, 1993, since we have completed our financial obligations to DOE. This is therefore the last quarterly report for this project.

Appendix A

Description of Project and Work Breakdown Structure

Appendix A

DESCRIPTION OF PROJECT AND WORK BREAKDOWN STRUCTURE

A.1 PROJECT DESCRIPTION

To accomplish the objectives of this project, the test program contains two distinct periods:

- The first period, of six months duration, includes daily factorial runs to test different reagents, atomizers, additives, and slurry concentrations.
- The second period, of one year duration, will demonstrate the performance of the CZD system on a continuous basis under actual power plant operating conditions.

A detailed description of the Work Breakdown Structure for this project, is shown in Figure A-1 on page 4-8. The work is scheduled to be accomplished in three phases as follows:

- Phase 1 work was completed on January 31, 1991. During this phase, Bechtel developed a process design, P&IDs, and performed detailed engineering for a new extended duct to be used in the CZD demonstration in Unit 15 at Penelec's Seward Station. Bechtel wrote all the specifications for equipment and instruments, and started procurement activities. Interface with the appropriate environmental agencies was accomplished through Penelec, with Bechtel providing assistance as needed.
- Phase 2 work was substantially completed by July 31, 1991. This phase included equipment acquisition and installation, facility construction, and start-up operations. Bechtel completed procurement of the equipment, instruments, materials, and fabrication of the new long duct. Penelec performed construction and installation of these items in accordance with specifications prepared by Bechtel. At completion of construction, using Penelec operating and maintenance personnel, Bechtel trained the operators, started all major elements of the CZD system, and verified that the installation and control system functioned according to requirements. During this phase, the installation of equipment and instrumentation was limited to that necessary for parametric testing to be accomplished in Phase 3.

- Phase 3 work will be conducted in two parts. Parametric testing, Phase 3a, was scheduled for the period from June 3, 1991 through November 29, 1991, but the start was delayed until early August. During this period, Bechtel planned to carry out a parametric test program to optimize the performance of the CZD process. The test program is designed to develop operating conditions that will achieve high reliability and low cost operation. Phase 3b was scheduled from December 2, 1991 to July 1, 1993, to complete this demonstration project. The initial program included a period of time from December 2, 1991 to July 1992 when no CZD testing was scheduled. With DOE's concurrence, this "no CZD testing" was modified by extending the CZD parametric testing until July 1992 for debugging and training the Penelec operating and maintenance personnel. In this way, the demonstration in July 1992 will be assured.

Based on the results of the parametric tests, Bechtel is now completing additional design, procurement, installation and facility construction as necessary to permit a 1-year continuous demonstration. At this time the CZD system is in the process of being fully instrumented and integrated with the operation of Penelec's Unit #15. The goal is to demonstrate the performance of the CZD process for SO₂ removal without significantly affecting either the boiler operation or plant particulate emissions.

Bechtel will supervise the 1-year continuous demonstration, and will carry out various performance tests, data acquisition, and chemical analyses. After the demonstration is completed, the system may remain in operation or the test apparatus may be dismantled and the site restored to its former condition, depending on Penelec's wishes. In either case, the new long straight duct will remain in operation.

To promote the dissemination of technical information to industry during the CZD demonstration, technical papers will be presented at various conferences. These papers will provide non-proprietary technical and economic data, results, and conclusions. The technical papers will also be made available for publication in appropriate journals. Representatives of the utilities will be invited to visit the demonstration site to learn first hand how the CZD process handles SO₂ and NO_x removal from utility flue gas operations.

A.2 WORK BREAKDOWN STRUCTURE DESCRIPTION

The following tasks will be performed during the three phases of the project to demonstrate the cost effective control of SO₂ and NO_x emissions from the pre-NSPS coal-fired utility boiler No. 15 at Penelec's Seward Station:

Phase 1: Design and Permitting

WBS No. 1.1.2 *Design and Procurement*

- Prepare process flow diagrams for each of the two periods, including material balances and stream properties. Prepare technical specifications for process equipment.
- Prepare detailed designs for the fabrication of the duct extension and its associated construction and installation.
- Prepare site-specific detailed designs for installation of the compressed air system, lime feed system, and atomizers with their related headers and distribution piping, including instruments and controls.
- Prepare technical specifications for procurement of required support equipment, and its associated construction and installation.
- Issue bids for equipment with long delivery times.

WBS No.1.1.3 *Management and Travel*

- Project Management. Provide overall management of the work required to complete this phase, including coordination with Penelec and the groups providing project financial assistance. Bechtel's project management plan includes provisions for meetings with the DOE and formal reviews of project work, as well as provisions for submitting reports in accordance with the Federal Assistance Reporting Checklist, Attachment C.
- Travel. Bechtel travel includes project management travel to the Penelec site and to DOE's offices for meetings, and travel by the project engineer and other members of the project team as required to complete the task activities. All travel and subsistence to be in accordance with Government regulations.

Phase 2: Construction and Start-up

WBS No. 1.2.1 *Equipment Acquisition and Installation*

- Procure air compressors and electric power supply.
- Procure atomizers.
- Procure instruments and controls.
- Procure lime feed system.
- Procure lime transfer system.
- Provide assistance to Penelec for installation of all process and support equipment, including drawings, specifications, design packages for bidding, and other related design information.

WBS No. 1.2.2 Facility Construction

- Approve shop drawings for fabrication of duct extension.
- Provide site engineering support and related assistance to Penelec as required for quality and schedule control.

WBS No. 1.2.3 Start-up (Checkout) and Operator Training for Parametric Testing

- Provide start-up engineer to supervise commissioning of all CZD components and systems.
- Train Penelec's operators to run the CZD system and perform the tasks required to conduct parametric testing.
- Establish procedures for coordination of test operations with Penelec's plant management and operations personnel.
- Finalize all elements of Test Plan.

WBS No. 1.2.4 Construction Management

- Provide construction management support to Penelec as requested. Penelec will have prime control and responsibility for all construction activities at Seward Station.

WBS No. 1.2.5 Management and Travel

- Project Management. Provide overall management of the work required to complete this phase, including coordination with Penelec and the groups providing project financial assistance. Plan and conduct meetings with the DOE and the project team for review of project work. Submit reports in accordance with the Federal Assistance Reporting Checklist, Attachment C.
- Travel. Bechtel travel includes project management travel to the Penelec site and to DOE's offices for meetings, and travel by the project engineer and other members of the project team as required to complete the task activities. All travel and subsistence to be in accordance with Government regulations.

Phase 3: Operation and Disposition

WBS No. 1.3.1 Lime Procurement

- Procure all types of lime and other reagents required to conduct parametric and continuous (one-year) test programs.

WBS No. 1.3.2 CZD Parametric Testing

- Perform wind tunnel tests on atomizers at the University of California at Davis to determine performance characteristics. Select atomizers to be used in the parametric test program.

- Evaluate performance of electrostatic precipitators (ESPs) during parametric tests. Consult with ESP experts, if necessary, to improve performance.
- Evaluate effects of process variables on emission control performance.
- Determine operating conditions for optimum overall performance.
- Evaluate effects of using alternative coals and reagents:
 - High and medium sulfur coals
 - Alternate reagents including pressure-hydrated dolomitic lime, hydrated calcitic lime, and fresh slaked calcitic lime.

WBS No. 1.3.3 *Completion of Design, Procurement and Installation*

- Based on the results of the parametric tests, complete the design packages and procure all process equipment needed to completely automate and integrate the operation of the CZD system with boiler No. 15 at Seward Station.
- Procure all instruments and controls needed for continuous operation, monitoring, and data collection.

WBS No. 1.3.4 *Completion of Facility Construction*

- Install facilities for lime unloading and storage to support the increased capacity required for continuous operation of the CZD system.
- Insulate piping and provide weather protection and enclosures as required to permit continuous, all-year operation of the CZD system.
- Provide construction management support to Penelec as requested. Penelec will have prime control and responsibility for all construction activities at Seward Station.

WBS No. 1.3.5 *Start-up (Checkout) and Operator Training for Continuous Operation*

- Provide start-up engineer to supervise commissioning of all new CZD components and systems.
- Train Penelec's operators to run the CZD system and perform the tasks required to conduct the one-year continuous demonstration.
- Establish procedures for coordination of data collection and reduction with Penelec's plant management and operations personnel.

WBS No. 1.3.6 *CZD Demonstration with Continuous Operation*

- Operate the CZD system under optimized conditions for one year completely integrated with the power plant operation.
- Measure emission control system performance:

- SO₂ and NO_x performance tests
- ESP performance tests
- ESP performance improvements, if required
- Chemical analysis of solid wastes
- Continuous data recording and acquisition
- Determine power plant impacts.

WBS No. 1.3.7 Duct and Hopper Cleaning

- Perform periodic inspection and cleaning, if necessary, during intervals when the boiler is not operating to determine the long-term extent of duct fouling resulting from CZD system operation.

WBS No. 1.3.8 Data Evaluation and Reporting

- Correlate and evaluate all data collected during the entire CZD test program, including parametric tests as well as continuous operation.
- Summarize key data and test results:
 - Inlet and outlet concentration of SO₂, NO_x, and oxygen
 - Amount of lime used and lime utilization
 - Variation in flue gas temperature during lime slurry injection
 - Variation in ESP recorded data
 - Variation in percent opacity at the stack
 - Lime deposition on duct surfaces
- Use technological, economic, environmental, and operating evaluations from the demonstration project to prepare Demonstration Test Reports and a Technology Performance and Economic Evaluation Report.

WBS No. 1.3.9 Disposition

- Disposition of the CZD system equipment installation:
 - The new long straight duct will remain in operation.
 - The disposition of all other equipment (continued operation or removal and storage) will be decided by Penelec.

WBS No. 1.3.10 Management and Travel

- Project Management. Provide overall management of the work required to complete this phase, including coordination with Penelec and the groups providing project financial assistance. Plan and conduct meetings with the DOE and the project team for review of project work. Submit

reports in accordance with the Federal Assistance Reporting Checklist, Attachment C.

- **Travel.** Bechtel travel includes project management travel to the Penelec site and to DOE's offices for meetings, and travel by the project engineer and other members of the project team as required to complete the task activities. All travel and subsistence to be in accordance with Government regulations.

Appendix B

Report Distribution List

Appendix B
REPORT DISTRIBUTION LIST

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Appendix C

**Tables with CZD-PHDL Slurry
Injection Operating Data
April 21 through May 25, 1993**

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/21	1745	140.8	290	250	241	246	27.0	0.8	11.4	8.7	191	211	797	657	11.1	9.6	15.6	4.7
4/21	1800	141.2	288	255	246	254	26.8	1.3	12.9	8.5	190	211	803	687	11.1	9.8	13.3	3.1
4/21	1815	141.3	289	218	201	238	26.8	2.8	11.3	8.2	194	217	790	635	10.9	9.6	13.5	8.8
4/21	1830	140.1	289	218	200	233	25.9	3.3	11.4	7.4	192	215	789	644	11.0	9.6	14.6	6.4
4/21	1845	142.2	290	218	200	233	25.7	3.9	12.1	8.9	196	223	790	646	11.0	9.6	14.6	6.2
4/21	1900	142.3	290	221	200	233	24.6	4.0	13.0	9.0	194	218	793	647	10.8	9.6	12.5	8.2
4/21	1915	143.8	291	222	200	234	24.5	3.9	14.5	8.3	198	221	797	643	11.0	9.5	15.8	6.6
4/21	1930	145.3	289	226	201	234	24.5	4.0	14.1	9.7	196	222	787	640	11.0	9.6	14.6	6.9
4/21	1945	144.5	288	231	200	233	25.7	3.8	14.4	9.3	199	226	799	641	11.0	9.6	14.6	8.0
4/21	2000	142.7	289	225	200	234	23.5	4.2	16.2	9.6	196	220	795	654	10.9	9.6	13.5	6.7
4/21	2015	145.6	288	221	196	233	25.0	4.0	17.5	9.2	201	225	793	639	11.0	9.5	15.8	6.7
4/21	2030	145.8	289	222	195	234	24.7	4.0	18.3	9.8	203	228	775	642	10.8	9.7	11.3	7.9
4/21	2045	144.6	288	222	195	233	23.7	4.0	17.7	10.0	199	223	798	644	11.0	9.6	14.6	7.6
4/21	2100	140.8	288	222	195	232	24.6	4.0	18.6	10.1	195	216	798	644	11.0	9.5	15.8	6.6
4/21	2115	144.5	287	219	195	231	26.0	3.8	19.5	10.3	198	222	798	636	11.0	9.5	15.8	7.7
4/21	2130	142.5	286	225	196	231	25.8	4.1	17.6	11.7	197	221	812	642	11.1	9.5	16.8	7.6
4/21	2145	142.8	286	231	195	232	23.7	4.0	18.0	18.2	196	223	811	643	11.1	9.6	15.6	8.3
4/21	2200	141.8	287	223	195	232	23.7	4.4	23.4	9.4	194	216	823	659	11.1	9.7	14.4	8.3
4/21	2215	137.6	287	224	195	232	22.5	4.1	57.7	0.1	191	212	818	652	11.2	9.6	16.7	7.0
4/21	2230	138.0	288	225	195	233	22.6	4.3	22.2	18.5	190	213	805	660	11.1	9.7	14.4	6.1
4/21	2245	137.3	288	226	195	233	22.4	4.7	26.0	13.8	189	213	820	656	11.2	9.7	15.5	7.7
4/21	2300	137.2	287	223	195	232	22.7	4.4	23.8	16.3	188	212	820	656	11.2	9.7	15.5	7.7
4/21	2315	141.9	286	213	171	229	32.1	4.3	18.4	16.4	195	221	820	634	11.2	9.6	16.7	9.7
4/21	2330	136.9	286	220	191	231	23.5	4.8	22.2	15.0	192	216	791	642	11.0	9.5	15.8	6.0
4/21	2345	137.0	286	223	195	233	23.0	4.8	25.3	13.7	189	216	807	644	11.0	9.6	14.6	8.6
4/22	0000	138.9	287	221	194	232	23.4	5.2	27.8	16.7	194	217	813	657	11.1	9.7	14.4	7.6
4/22	0015	143.9	287	222	194	232	23.3	5.1	29.2	16.0	199	221	808	648	11.2	9.6	16.7	6.4
4/22	0030	140.7	288	223	195	233	22.3	5.0	31.8	15.8	194	218	795	647	11.0	9.5	15.8	5.8
4/22	0045	131.1	290	224	196	232	23.1	5.4	24.2	12.0	184	207	821	647	11.0	9.7	13.4	10.6
4/22	0100	117.8	293	222	195	232	24.1	5.4	21.6	12.0	177	199	809	626	10.9	9.3	17.2	9.2
4/22	0115	111.8	297	222	195	231	24.6	4.2	24.2	13.7	168	192	792	607	10.7	9.1	17.6	9.8
4/22	0130	109.5	297	217	196	229	25.2	4.6	23.8	13.2	165	192	765	604	10.6	9.2	15.2	9.0
4/22	0145	106.1	295	225	195	231	21.8	4.1	20.9	9.8	161	188	759	593	10.4	9.0	15.6	9.7
4/22	0200	109.6	293	215	190	227	22.0	4.5	19.3	9.6	161	188	758	576	10.4	9.0	15.6	12.2
4/22	0215	109.5	289	214	190	226	22.4	4.3	16.8	8.4	159	186	763	597	10.4	9.1	14.3	10.6

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/22	0230	106.8	289	215	190	225	21.5	4.6	22.7	13.3	154	182	741	599	10.2	9.1	12.1	9.5
4/22	0245	109.2	287	213	190	224	21.1	4.3	23.2	11.3	159	186	752	580	10.4	8.9	16.9	9.9
4/22	0300	110.1	287	213	190	225	22.5	4.0	21.4	10.5	158	186	766	593	10.4	9.0	15.6	10.6
4/22	0315	107.1	284	214	190	223	19.9	4.2	22.2	11.6	153	180	756	591	10.3	9.0	14.4	10.6
4/22	0330	106.2	282	215	190	223	19.4	4.2	22.4	11.5	150	177	744	592	10.2	8.9	14.6	8.9
4/22	0345	105.9	282	209	185	220	20.8	4.4	15.5	8.2	152	180	752	575	10.2	8.8	15.9	11.4
4/22	0400	105.8	284	210	186	221	20.8	3.9	16.5	9.2	153	181	749	577	10.2	8.8	15.9	10.7
4/22	0415	105.7	282	209	186	220	20.6	4.2	18.6	14.1	151	184	762	576	10.4	8.9	16.9	11.6
4/22	0430	108.9	284	209	185	221	22.2	4.1	19.0	9.6	152	183	763	583	10.5	8.9	18.0	9.9
4/22	0445	112.2	283	212	185	222	19.6	4.3	22.1	10.9	154	183	772	595	10.6	9.1	16.5	10.2
4/22	0500	110.5	284	212	185	223	21.0	4.0	20.3	10.8	155	185	762	591	10.6	9.1	16.5	9.6
4/22	0515	106.0	285	212	186	223	21.5	4.4	19.6	11.9	149	180	765	583	10.4	8.9	16.9	10.9
4/22	0530	106.2	286	214	186	224	19.6	4.0	22.2	11.6	150	182	739	580	10.3	9.0	14.4	10.3
4/22	0545	110.0	285	215	185	225	20.0	4.2	25.0	12.9	151	183	750	584	10.4	8.9	16.9	9.0
4/22	0600	113.1	284	215	185	225	19.0	4.5	24.0	12.4	154	186	767	604	10.5	9.1	15.4	9.1
4/22	0615	110.5	283	213	185	225	19.4	4.4	22.4	11.5	150	184	761	596	10.5	9.0	16.7	8.6
4/22	0630	113.2	282	206	185	222	22.2	4.1	18.1	12.2	155	185	759	596	10.5	9.2	14.1	10.3
4/22	0645	122.8	282	206	186	222	22.6	4.1	21.5	11.1	162	193	775	592	10.6	9.2	15.2	12.0
4/22	0700	135.2	279	220	184	228	17.5	4.3	30.4	15.3	174	202	783	649	10.8	9.6	12.5	6.7
4/22	1745	138.2	294	200	182	213	35.1	2.9	13.0	7.1	191	222	776	613	10.8	9.5	13.7	10.3
4/22	1800	137.6	294	199	180	213	35.3	3.9	12.7	8.0	186	217	767	619	10.7	9.5	12.6	9.1
4/22	1815	136.6	294	198	180	213	35.6	1.1	12.6	7.8	188	219	769	615	10.8	9.5	13.7	9.0
4/22	1830	137.5	294	199	180	213	35.1	3.4	13.2	7.3	188	218	770	614	10.8	9.5	13.7	9.3
4/22	1845	138.7	295	201	180	214	34.5	4.8	14.5	8.1	191	221	779	617	10.9	9.5	14.7	9.2
4/22	1900	137.2	294	205	178	215	29.1	4.5	13.6	7.6	188	223	793	624	10.9	9.6	13.5	10.6
4/22	1915	139.3	293	206	180	214	34.9	4.2	14.1	8.0	191	219	793	626	11.0	9.6	14.6	9.6
4/22	1930	139.6	294	202	180	215	34.9	4.3	15.0	9.0	192	222	787	627	10.9	9.5	14.7	8.6
4/22	1945	140.0	294	200	180	215	33.8	4.5	14.5	7.5	194	224	782	631	10.9	9.6	13.5	8.4
4/22	2000	142.7	295	201	180	215	34.6	4.2	14.6	9.0	196	224	779	623	10.8	9.6	12.5	10.0
4/22	2015	145.6	294	201	180	216	35.2	4.1	15.3	8.8	199	226	780	621	10.8	9.6	12.5	10.4
4/22	2030	145.5	293	203	180	217	33.7	4.2	18.5	9.2	198	226	768	625	10.8	9.6	12.5	8.4
4/22	2045	145.5	293	201	174	217	32.4	4.1	18.7	10.1	199	229	777	618	10.9	9.6	13.5	9.7
4/22	2100	145.7	293	203	175	216	34.8	4.3	16.9	10.1	200	228	777	636	10.9	9.5	14.7	6.0
4/22	2115	145.4	294	204	176	218	33.3	4.2	18.5	9.5	198	227	777	618	10.9	9.5	14.7	8.7
4/22	2130	145.6	294	203	175	217	34.0	3.7	20.0	9.5	200	227	804	619	11.2	9.4	19.1	8.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/22	2145	135.5	296	201	173	214	32.8	4.2	15.1	8.7	187	217	828	635	11.2	9.4	19.1	8.6
4/22	2200	139.8	294	212	175	217	32.8	4.2	14.9	9.2	189	218	822	634	11.2	9.6	16.7	10.0
4/22	2215	136.2	293	201	175	214	32.0	3.9	14.7	8.7	188	217	829	628	11.4	9.5	20.0	9.1
4/22	2230	135.1	294	203	175	215	31.5	4.1	14.9	8.1	187	215	813	624	11.1	9.4	18.1	9.4
4/22	2245	139.3	294	203	175	216	32.1	3.6	15.7	9.8	189	218	820	624	11.2	9.5	17.9	10.3
4/22	2300	143.2	293	203	175	217	32.5	4.1	17.5	9.5	197	222	820	624	11.2	9.5	17.9	10.3
4/22	2315	141.4	293	202	175	216	32.8	3.9	16.0	9.0	194	221	820	643	11.2	9.8	14.3	10.4
4/22	2330	135.2	295	201	175	215	32.4	4.0	15.4	7.4	188	217	807	638	11.1	9.6	15.6	8.6
4/22	2345	136.3	295	202	175	216	31.4	3.9	14.6	8.6	185	213	820	642	11.2	9.7	15.5	9.6
4/23	0000	135.8	295	202	175	216	31.9	4.2	14.3	8.8	189	218	818	633	11.2	9.6	16.7	9.7
4/23	0015	144.9	293	200	175	216	33.5	3.6	16.2	8.7	198	225	830	634	11.2	9.8	14.3	12.7
4/23	0030	145.7	293	199	175	217	33.4	4.1	17.3	10.9	201	229	797	641	11.0	9.7	13.4	8.8
4/23	0045	145.6	293	199	175	217	34.3	4.1	16.0	9.1	201	230	817	636	11.2	9.7	15.5	10.1
4/23	0100	143.8	292	200	174	217	32.7	4.0	18.0	10.5	199	225	817	621	11.1	9.4	18.1	10.3
4/23	0115	145.6	292	200	175	217	33.1	4.2	20.2	12.1	200	224	791	608	11.0	9.4	17.0	10.1
4/23	0130	142.5	291	198	174	216	33.7	4.2	17.3	12.0	203	228	778	615	10.8	9.5	13.7	10.1
4/23	0130	142.5	291	198	174	216	33.7	4.2	17.3	12.0	203	228	778	615	10.8	9.5	13.7	10.1
4/23	0200	139.4	289	207	175	217	32.5	4.1	13.8	13.0	193	221	813	622	11.0	9.5	15.8	11.3
4/23	0215	136.6	291	202	175	218	29.3	4.2	17.0	9.1	191	217	806	624	10.9	9.3	17.2	9.2
4/23	0230	137.4	291	199	176	217	31.2	4.1	17.6	10.3	190	217	791	613	11.0	9.4	17.0	9.3
4/23	0245	145.3	289	199	176	218	31.4	4.3	17.6	10.3	199	224	797	621	11.0	9.6	14.6	10.6
4/23	0300	145.1	291	197	176	217	33.4	4.0	16.4	9.8	203	228	805	599	10.9	9.3	17.2	12.7
4/23	0315	136.6	291	201	174	217	29.2	4.2	15.7	10.4	194	221	789	601	10.8	9.2	17.4	10.6
4/23	0330	125.3	295	206	175	219	28.3	4.2	17.8	11.2	180	204	806	621	10.9	9.3	17.2	9.6
4/23	0345	120.8	295	206	176	220	26.9	4.4	17.3	8.5	176	200	805	624	10.9	9.4	16.0	10.0
4/23	0400	114.5	298	207	177	219	28.5	4.1	16.6	8.4	171	197	804	600	10.8	9.2	17.4	12.3
4/23	0415	115.1	299	212	175	223	25.3	4.1	17.9	11.8	169	195	794	608	10.8	9.3	16.1	11.0
4/23	0430	119.4	295	210	172	223	26.4	4.1	17.8	11.3	172	198	790	610	10.9	9.3	17.2	9.5
4/23	0445	124.6	294	211	174	223	26.0	4.3	18.8	10.7	174	203	811	610	11.0	9.3	18.3	11.0
4/23	0500	129.3	293	212	175	224	26.8	4.1	19.2	11.5	178	205	809	623	11.0	9.4	17.0	9.9
4/23	0515	135.0	292	210	175	224	27.0	4.0	22.8	12.6	183	213	802	625	11.0	9.6	14.6	10.7
4/23	0530	135.5	290	209	175	223	27.1	3.7	21.1	11.5	186	214	786	616	11.0	9.5	15.8	9.3
4/23	0545	135.7	290	204	172	220	29.7	4.2	18.9	11.8	187	213	788	612	10.9	9.5	14.7	10.9
4/23	0600	136.0	290	202	169	219	30.2	4.1	18.9	14.1	190	210	770	605	10.8	9.3	16.1	8.8
4/23	0615	145.7	290	204	173	220	31.5	4.1	20.4	12.0	199	225	779	604	10.9	9.4	16.0	10.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/23	0630	141.2	290	204	171	220	30.7	3.9	17.4	11.4	198	224	761	613	10.5	9.3	12.9	9.2
4/23	0645	145.1	289	206	170	223	27.9	4.3	20.5	12.4	201	227	751	602	10.4	9.3	11.8	10.4
4/23	0700	141.3	289	206	173	220	33.0	3.9	20.0	11.4	196	220	757	596	10.4	9.3	11.8	12.0
4/23	0715	145.7	289	212	172	228	23.5	4.1	26.7	13.9	199	223	756	628	10.4	9.5	9.5	9.1
4/23	0730	145.8	290	211	165	228	26.1	3.9	24.9	15.1	202	225	741	625	10.4	9.4	10.6	6.7
4/23	0745	145.5	290	211	165	229	25.6	4.2	30.9	16.1	202	227	751	629	10.4	9.5	9.5	8.3
4/23	1730	135.8	300	199	176	217	36.9	5.4	18.4	10.4	190	203	710	606	10.2	9.6	6.2	9.3
4/23	1745	139.5	301	198	175	217	36.4	5.1	14.5	7.8	191	207	719	599	10.3	9.6	7.3	10.6
4/23	1800	137.4	300	199	176	217	35.7	5.0	16.5	8.5	190	202	713	598	10.2	9.5	7.4	10.0
4/23	1815	140.3	300	200	173	215	36.8	4.4	14.8	7.8	193	210	719	580	10.4	9.6	8.3	12.6
4/23	1830	139.2	300	199	175	215	34.9	4.3	16.2	8.2	194	207	724	584	10.5	9.6	9.4	11.8
4/23	1845	140.5	301	198	174	215	36.4	4.4	15.3	8.7	195	206	725	594	10.3	9.6	7.3	12.1
4/23	1900	141.6	300	200	175	217	36.0	4.3	17.3	9.1	198	211	716	583	10.4	9.5	9.5	10.8
4/23	1915	144.2	298	202	175	218	34.9	4.1	18.9	9.1	199	210	716	584	10.4	9.4	10.6	9.8
4/23	1930	139.5	300	197	173	215	36.3	4.3	16.7	9.2	194	206	719	589	10.4	9.5	9.5	10.3
4/23	1945	142.5	299	201	174	217	34.3	4.1	18.5	9.2	196	204	703	586	10.1	9.5	6.3	11.3
4/23	2000	146.0	300	203	175	219	33.5	4.2	22.9	10.4	199	210	720	583	10.4	9.7	7.2	13.2
4/23	2015	145.8	299	201	175	216	37.5	4.2	18.1	8.8	203	214	719	580	10.3	9.5	8.4	12.6
4/23	2030	145.2	299	202	175	217	36.6	4.0	20.2	11.1	203	214	705	594	10.3	9.6	7.3	9.6
4/23	2045	145.4	298	202	175	218	35.4	4.3	22.9	12.3	202	210	712	594	10.2	9.6	6.2	11.5
4/23	2100	137.8	297	200	176	215	36.1	4.1	17.1	8.9	193	202	712	601	10.2	9.7	5.2	11.2
4/23	2115	136.0	299	198	175	214	35.0	4.1	16.9	9.2	191	202	712	595	10.2	9.5	7.4	10.2
4/23	2130	135.4	298	198	175	214	34.9	4.5	17.3	10.4	191	202	790	597	11.2	9.6	16.7	11.8
4/23	2145	139.6	298	199	175	214	35.0	4.2	16.8	8.0	192	203	808	605	11.4	9.7	17.5	11.9
4/23	2200	141.5	296	200	175	215	34.3	4.2	19.2	9.6	192	207	809	618	11.4	9.8	16.3	11.1
4/23	2215	145.1	294	206	175	214	36.8	4.1	18.3	10.1	202	216	791	595	11.2	9.6	16.7	12.2
4/23	2230	142.3	294	205	175	215	34.5	4.0	20.7	10.0	205	216	783	612	11.1	9.5	16.8	8.6
4/23	2245	137.0	294	197	175	212	36.0	4.1	15.8	9.0	195	203	808	602	11.3	9.5	18.9	11.3
4/23	2300	135.0	295	199	175	213	34.1	4.4	17.4	8.2	192	204	808	602	11.3	9.5	18.9	11.4
4/23	2315	141.3	293	201	175	214	33.5	3.8	22.4	10.9	199	209	808	629	11.3	9.7	16.5	9.4
4/23	2330	135.7	293	191	171	210	36.4	4.2	14.2	7.4	190	204	796	616	11.2	9.8	14.3	11.6
4/23	2345	135.1	292	198	169	211	33.9	3.8	15.2	7.8	191	204	805	604	11.2	9.6	16.7	12.4
4/24	0000	135.2	294	196	170	211	33.6	4.2	18.4	9.7	194	208	807	604	11.2	9.6	16.7	12.8
4/24	0000	135.2	294	196	170	211	33.6	4.2	18.4	9.7	194	208	807	604	11.2	9.6	16.7	12.8
4/24	0030	145.1	291	201	170	214	33.9	4.1	24.4	16.8	205	216	784	613	11.1	9.7	14.4	10.5

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/24	0045	145.3	290	200	171	214	35.0	4.0	21.2	13.6	206	217	792	619	11.1	9.7	14.4	10.6
4/24	0100	145.5	290	199	170	213	33.9	4.2	25.2	15.4	206	217	774	620	11.0	9.7	13.4	9.1
4/24	0115	145.6	290	195	165	211	35.2	4.0	17.7	13.3	202	211	798	631	11.1	9.7	14.4	9.5
4/24	0130	145.7	290	196	165	212	35.0	4.1	21.8	11.4	206	216	783	609	11.1	9.6	15.6	10.1
4/24	0145	143.7	290	197	165	212	34.5	4.0	21.3	10.9	202	212	796	610	11.1	9.5	16.8	10.5
4/24	0200	140.7	288	196	165	211	33.4	4.1	21.8	12.1	201	212	800	618	11.1	9.5	16.8	9.7
4/24	0215	138.3	288	195	165	210	34.3	4.0	14.4	8.3	201	211	791	614	11.0	9.6	14.6	11.1
4/24	0230	136.4	290	195	165	210	34.0	3.9	16.8	8.8	193	205	800	610	11.1	9.5	16.8	10.9
4/24	0245	136.2	290	196	165	210	33.3	3.8	19.9	9.4	197	209	813	635	11.2	9.8	14.3	10.6
4/24	0300	135.2	290	196	165	210	33.6	4.2	16.6	9.3	192	204	821	629	11.2	9.6	16.7	10.7
4/24	0315	135.5	290	190	164	207	34.9	4.0	12.8	9.6	193	205	814	606	11.2	9.6	16.7	13.2
4/24	0330	135.8	289	195	166	208	35.0	4.0	12.9	12.7	193	205	789	608	11.0	9.5	15.8	10.7
4/24	0345	137.9	289	193	164	209	32.7	4.3	15.3	13.1	196	209	803	588	11.1	9.5	16.8	14.5
4/24	0400	139.1	288	198	164	211	32.1	4.0	15.3	9.0	197	209	800	617	11.1	9.6	15.6	10.7
4/24	0415	142.2	287	200	165	213	31.6	4.4	14.5	7.7	201	210	812	626	11.2	9.5	17.9	9.1
4/24	0430	131.7	291	198	164	212	32.3	4.2	14.9	10.9	191	205	788	615	10.9	9.4	16.0	9.5
4/24	0445	125.0	295	195	160	210	33.3	3.8	14.0	7.2	185	196	796	605	10.9	9.4	16.0	11.9
4/24	0500	121.9	296	190	161	206	35.7	4.3	11.7	6.7	180	193	806	600	11.1	9.5	16.8	13.1
4/24	0515	131.1	293	190	160	207	35.2	4.2	11.9	8.7	184	195	814	617	11.1	9.7	14.4	13.4
4/24	0530	135.6	290	192	160	208	34.5	4.1	13.5	7.5	189	203	798	625	11.1	9.8	13.3	11.2
4/24	0545	144.9	288	194	161	209	34.3	4.3	16.2	9.6	198	210	797	616	11.0	9.8	12.2	13.2
4/24	0600	145.2	288	193	161	209	36.5	3.9	17.3	10.1	203	218	790	622	11.0	9.6	14.6	9.7
4/24	0615	135.3	290	188	161	206	36.5	4.2	13.2	8.3	195	207	809	624	11.0	9.7	13.4	12.5
4/24	0630	135.9	289	189	160	206	35.8	4.0	12.4	9.3	194	207	764	602	10.7	9.4	13.8	10.2
4/24	0645	144.6	289	190	160	206	35.7	3.8	14.3	10.0	198	212	809	622	11.2	9.9	13.1	13.1
4/24	0700	135.8	290	190	160	206	36.2	4.0	14.1	8.9	193	206	823	639	11.2	9.7	15.5	10.3
4/24	0715	137.8	293	192	160	207	35.0	4.0	13.0	8.3	191	206	808	621	11.1	9.7	14.4	12.1
4/24	0730	140.2	290	190	163	206	37.6	3.8	12.8	8.4	195	208	776	625	11.0	9.7	13.4	8.5
4/24	0745	144.8	288	188	155	205	37.9	4.0	12.6	9.0	202	215	788	596	10.9	9.7	12.4	15.0
4/24	0800	141.0	290	188	160	207	35.4	3.7	13.1	7.8	194	209	796	617	11.1	9.7	14.4	11.3
4/24	0815	145.4	290	190	160	209	35.5	4.0	15.2	8.0	201	212	799	613	11.0	9.7	13.4	13.0
4/24	0830	145.3	292	191	160	210	35.7	4.0	14.7	9.5	201	214	785	616	11.0	9.7	13.4	11.0
4/24	0845	139.4	291	194	160	209	36.2	4.3	12.8	7.7	195	208	805	615	10.9	9.7	12.4	14.2
4/24	0900	141.0	294	191	161	210	36.1	4.2	14.1	8.9	196	210	822	618	11.1	9.8	13.3	14.9
4/24	0915	140.8	292	191	160	210	34.8	4.2	13.4	8.1	195	206	802	621	10.9	9.7	12.4	13.0

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/24	0930	140.3	294	192	161	212	34.2	4.1	15.7	9.1	196	208	792	623	11.0	9.7	13.4	10.8
4/24	0945	140.3	296	192	162	211	38.7	4.3	15.1	10.7	194	207	819	616	11.2	9.8	14.3	14.1
4/24	1000	137.1	296	189	158	209	36.4	4.1	13.4	7.9	187	205	810	608	11.1	9.7	14.4	14.0
4/24	1015	136.0	296	198	161	210	37.0	4.3	12.2	9.7	187	202	804	603	11.0	9.7	13.4	15.0
4/24	1030	135.8	297	190	160	210	35.9	4.4	13.4	8.9	189	204	799	600	11.2	9.8	14.3	14.3
4/24	1045	135.8	300	191	161	211	37.5	4.2	13.6	7.9	189	205	806	605	11.1	9.8	13.3	15.0
4/24	1100	136.3	298	186	161	209	38.0	4.1	12.6	9.0	188	204	814	590	11.3	9.8	15.3	16.4
4/24	1115	135.2	299	183	157	207	40.8	4.0	13.1	7.3	188	206	798	598	11.1	10.0	11.0	16.8
4/24	1130	135.1	298	194	156	212	29.1	4.0	16.8	10.7	186	204	798	615	11.2	9.8	14.3	12.0
4/24	1145	140.1	296	206	166	221	29.2	3.8	17.0	10.1	191	209	800	637	11.2	9.8	14.3	8.9
4/24	1200	140.8	298	204	165	223	30.8	4.1	22.8	11.7	193	205	790	627	11.0	9.8	12.2	11.0
4/24	1215	140.7	298	206	165	226	27.6	4.2	26.2	13.8	192	203	808	627	11.1	9.9	12.1	13.0
4/24	1230	135.1	298	205	166	225	29.4	4.1	21.8	12.7	185	197	789	643	11.2	9.8	14.3	6.8
4/24	1245	138.4	297	203	165	225	30.0	4.1	22.7	12.8	194	206	788	617	11.0	9.8	12.2	12.1
4/24	1300	135.9	298	200	166	223	31.0	3.9	19.9	12.9	186	199	794	612	11.1	9.8	13.3	12.6
4/24	1315	145.1	295	198	166	222	31.2	4.0	22.2	12.2	195	214	801	616	11.1	9.8	13.3	12.9
4/24	1330	142.9	296	202	170	222	34.0	4.0	16.5	11.0	195	209	767	637	11.1	9.8	13.3	5.9
4/24	1345	145.6	295	193	165	218	34.6	4.0	14.4	9.3	197	211	780	602	11.0	9.8	12.2	13.3
4/24	1400	144.8	296	191	165	215	36.5	3.9	14.9	8.5	198	209	771	610	10.9	9.8	11.2	12.0
4/24	1415	145.2	297	192	165	217	34.8	3.6	15.8	9.7	199	212	783	612	11.0	9.8	12.2	12.2
4/24	1430	143.0	298	195	165	213	37.0	4.3	12.1	7.5	195	207	784	611	11.1	9.8	13.3	11.7
4/24	1445	144.8	298	195	165	213	36.5	3.8	11.7	8.6	198	214	785	612	11.0	9.8	12.2	12.4
4/24	1500	143.8	299	196	165	214	36.6	4.3	12.1	7.7	198	211	767	609	10.8	9.6	12.5	10.6
4/24	1515	142.7	298	195	165	213	37.3	4.0	11.5	7.2	196	207	774	600	10.9	9.6	13.5	11.9
4/24	1530	146.3	298	195	165	214	37.4	4.3	11.3	8.5	197	213	768	609	11.0	9.7	13.4	10.0
4/24	1545	143.2	299	196	165	214	37.5	4.1	12.8	8.2	200	213	773	598	10.7	9.5	12.6	12.9
4/24	1600	142.1	298	196	172	212	41.8	4.3	11.2	7.6	196	211	761	588	10.6	9.4	12.8	12.9
4/24	1615	144.6	300	197	164	216	35.7	4.1	12.0	8.4	202	217	778	604	10.8	9.5	13.7	11.7
4/24	1630	140.6	298	209	163	219	34.6	4.1	12.1	8.2	197	210	756	627	10.8	9.6	12.5	6.7
4/24	1645	141.2	299	207	164	222	29.3	4.1	15.1	9.9	191	206	780	634	10.9	9.5	14.7	6.8
4/24	1700	141.5	299	207	164	223	31.1	4.3	15.3	9.3	195	209	786	633	10.9	9.7	12.4	9.4
4/24	1715	140.0	299	209	164	225	28.5	4.5	15.0	9.1	191	202	766	636	10.7	9.6	11.5	7.4
4/24	1730	141.0	299	210	165	227	28.4	4.3	18.0	12.8	194	206	770	622	10.9	9.5	14.7	7.3
4/24	1745	141.5	299	209	167	226	30.5	4.0	17.6	9.2	192	204	782	619	10.8	9.5	13.7	10.0
4/24	1800	141.2	300	209	165	226	31.4	4.3	16.8	9.9	194	207	766	634	10.8	9.7	11.3	7.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/24	1815	136.3	301	207	165	225	30.6	4.5	15.8	9.3	188	201	778	621	10.9	9.6	13.5	9.3
4/24	1830	138.5	300	207	166	224	31.3	4.5	16.9	9.7	191	205	765	613	10.9	9.5	14.7	8.0
4/24	1845	140.2	299	206	166	224	31.9	4.5	16.0	10.2	191	206	778	618	10.9	9.5	14.7	8.8
4/24	1900	139.8	299	205	166	221	35.1	4.1	13.8	8.7	193	209	773	593	10.8	9.5	13.7	12.8
4/24	1915	135.0	301	202	165	221	31.8	4.1	14.0	10.0	186	200	769	615	10.7	9.6	11.5	10.9
4/24	1930	136.1	300	201	164	223	29.3	4.5	14.8	10.0	185	199	755	599	10.8	9.6	12.5	10.7
4/24	1945	136.8	300	206	166	226	30.7	4.6	15.5	9.7	187	203	771	611	10.8	9.5	13.7	9.9
4/24	2000	142.6	299	202	165	228	29.1	4.3	21.2	11.8	195	208	759	606	10.8	9.5	13.7	9.3
4/24	2015	141.5	299	204	165	230	30.2	4.1	22.0	12.1	197	208	765	602	10.8	9.6	12.5	11.5
4/24	2030	140.6	299	202	166	225	32.4	4.2	18.2	9.5	195	208	746	598	10.7	9.5	12.6	9.7
4/24	2045	141.0	300	199	167	223	34.1	4.2	14.7	9.6	188	200	781	615	11.1	9.6	15.6	8.9
4/24	2100	140.7	299	197	165	222	33.9	3.8	15.7	9.2	193	208	781	610	11.1	9.7	14.4	10.7
4/24	2115	136.3	300	195	165	220	32.4	4.2	13.4	9.5	188	201	781	584	11.1	9.3	19.4	10.8
4/24	2130	135.9	301	198	165	221	33.6	4.0	13.2	8.4	188	204	802	606	11.2	9.4	19.1	9.9
4/24	2145	135.7	301	197	165	220	34.2	4.1	13.0	9.5	186	202	818	604	11.3	9.5	18.9	12.1
4/24	2200	135.6	300	196	166	219	34.0	4.0	12.5	9.4	185	201	813	593	11.3	9.5	18.9	13.2
4/24	2215	138.8	301	197	164	220	32.9	2.8	13.4	8.4	192	208	801	609	11.2	9.6	16.7	11.2
4/24	2230	135.7	300	199	166	220	35.0	5.6	12.8	10.3	191	204	787	606	11.1	9.5	16.8	10.0
4/24	2245	135.6	301	199	165	221	31.8	5.1	14.8	9.1	191	205	807	595	11.2	9.5	17.9	13.1
4/24	2300	135.7	301	194	166	218	35.4	4.8	12.4	9.1	189	203	805	595	11.2	9.5	17.9	12.9
4/24	2315	135.0	301	192	165	216	35.8	4.7	13.0	9.6	185	202	805	622	11.2	9.7	15.5	10.7
4/24	2330	134.5	300	191	165	216	34.1	5.1	12.1	9.0	184	199	791	607	11.3	9.6	17.7	9.6
4/24	2345	121.5	305	195	165	217	33.5	5.2	12.3	7.7	175	187	795	604	11.1	9.5	16.8	11.3
4/25	0000	116.4	307	195	165	217	32.5	5.2	12.2	10.1	170	185	793	583	11.1	9.4	18.1	13.1
4/25	0015	106.3	309	195	165	215	34.2	5.5	11.7	7.9	164	183	771	564	10.8	9.2	17.4	14.1
4/25	0030	110.5	310	195	165	215	34.5	5.2	11.6	11.3	164	183	759	546	10.6	8.9	19.1	14.4
4/25	0045	115.0	305	190	166	212	36.7	5.3	11.4	8.7	169	189	773	554	10.7	9.1	17.6	15.8
4/25	0100	112.3	304	192	172	210	41.1	5.3	10.2	6.9	166	185	792	559	11.1	9.4	18.1	16.6
4/25	0115	115.5	302	192	164	212	33.3	5.3	10.9	7.3	166	184	770	564	11.1	9.5	16.8	14.5
4/25	0130	109.9	303	192	165	212	32.8	5.2	11.4	10.1	165	183	750	552	10.9	9.4	16.0	14.7
4/25	0145	111.1	304	193	165	213	33.2	5.5	11.0	10.2	166	186	767	561	10.9	9.3	17.2	14.2
4/25	0200	111.4	305	191	165	212	35.3	5.2	10.8	11.3	164	183	766	543	10.9	9.2	18.5	16.1
4/25	0215	108.8	304	188	164	211	34.8	5.0	10.9	6.8	167	185	746	522	10.5	9.0	16.7	18.5
4/25	0230	107.6	304	192	165	212	33.6	5.3	11.2	5.9	166	185	736	536	10.6	9.0	17.8	14.3
4/25	0245	113.5	301	193	166	213	33.9	4.8	11.7	11.7	167	185	756	545	10.7	9.1	17.6	15.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/25	0300	115.7	301	192	165	212	34.4	5.0	12.1	6.7	172	190	744	527	10.7	9.0	18.9	15.9
4/25	0315	115.6	300	193	164	211	33.4	5.2	11.4	6.2	167	184	751	521	10.7	9.2	16.3	19.2
4/25	0330	115.3	299	194	166	212	34.0	4.9	11.5	8.7	170	187	734	535	10.7	9.3	15.1	16.2
4/25	0345	114.2	296	190	165	209	33.5	5.0	10.9	7.3	168	186	740	539	10.6	9.4	12.8	17.9
4/25	0400	115.5	294	191	165	209	32.9	5.2	11.6	7.3	171	187	733	530	10.6	9.3	14.0	17.6
4/25	0415	115.7	295	190	164	211	30.9	5.2	11.4	8.5	170	186	733	529	10.5	9.2	14.1	17.7
4/25	0430	114.4	296	195	164	209	33.1	4.9	10.8	7.2	165	185	722	524	11.1	9.3	19.4	13.4
4/25	0445	107.6	299	192	165	209	34.2	5.1	10.5	8.4	167	185	668	450	10.1	8.1	24.7	16.0
4/25	0500	116.2	296	192	164	208	31.9	5.1	15.7	9.7	167	184	708	533	10.3	9.4	9.6	17.5
4/25	0515	114.8	296	200	163	216	27.2	4.9	12.9	8.6	172	186	720	565	10.3	9.2	12.0	12.2
4/25	0530	115.9	295	197	163	214	28.3	5.1	12.0	10.1	169	183	720	508	10.4	9.1	14.3	19.3
4/25	0545	115.9	296	199	165	216	28.9	5.3	12.6	7.6	169	182	734	552	10.4	9.2	13.0	15.0
4/25	0600	115.4	297	199	165	218	30.3	5.2	13.3	10.5	171	186	736	567	10.4	9.3	11.8	13.9
4/25	0615	107.9	296	198	166	216	30.2	4.8	12.4	8.5	163	180	732	548	10.4	9.1	14.3	14.5
4/25	0630	105.4	298	195	161	214	27.0	5.1	13.0	8.0	164	179	704	532	10.0	8.8	13.6	14.2
4/25	0645	111.4	297	190	164	209	34.0	4.9	53.1	0.1	166	183	716	510	10.2	8.8	15.9	17.4
4/25	0700	115.1	297	196	165	215	29.3	4.9	12.9	9.0	167	185	737	553	10.4	9.2	13.0	15.1
4/25	0715	115.8	296	195	165	215	30.3	5.0	13.1	9.5	170	186	727	543	10.4	9.2	13.0	15.6
4/25	0730	114.9	296	192	165	212	31.9	5.1	11.9	7.8	170	186	720	551	10.3	9.3	10.8	15.3
4/25	0745	107.5	298	194	165	213	31.3	5.0	11.8	8.3	164	180	737	546	10.4	9.2	13.0	16.2
4/25	0800	110.2	299	194	165	213	31.9	5.2	12.6	8.2	168	183	725	531	10.4	9.1	14.3	16.2
4/25	0815	121.4	299	194	166	212	34.0	4.8	12.6	8.0	173	188	727	536	10.3	9.3	10.8	18.3
4/25	0830	137.6	294	193	166	212	35.0	4.8	14.2	9.6	189	205	751	569	10.9	9.7	12.4	14.9
4/25	0845	138.5	290	191	165	211	35.0	5.2	12.9	9.7	195	208	724	542	10.5	9.4	11.7	16.4
4/25	0900	114.9	295	191	164	210	35.1	5.1	11.2	7.5	178	190	745	470	10.3	8.5	21.2	23.6
4/25	0915	120.0	300	193	165	211	32.3	5.3	11.3	9.4	169	186	722	528	10.6	9.5	11.6	18.4
4/25	0930	117.3	295	216	169	229	18.3	5.3	16.9	9.9	165	179	721	606	10.7	9.4	13.8	4.2
4/25	0945	116.5	291	212	170	224	22.1	5.0	14.1	9.9	173	186	695	581	10.1	9.5	6.3	11.1
4/25	1000	115.0	292	211	171	226	25.0	4.7	18.4	11.6	174	185	683	540	9.8	8.9	10.1	12.9
4/25	1015	121.6	294	208	170	226	25.4	5.0	17.8	9.2	175	185	681	535	10.0	9.1	9.9	13.8
4/25	1030	121.2	297	210	170	227	25.0	5.0	19.0	11.4	176	187	700	547	10.4	9.2	13.0	11.7
4/25	1045	121.5	297	209	170	227	26.5	5.4	19.5	10.3	176	188	696	543	10.2	9.1	12.1	12.6
4/25	1100	121.5	298	210	170	227	26.7	5.2	20.7	10.1	177	188	702	553	10.2	9.2	10.9	12.6
4/25	1115	121.4	298	209	169	227	25.4	5.1	20.7	12.7	177	189	695	557	10.3	9.1	13.2	9.3
4/25	1130	121.2	298	206	177	221	38.6	5.1	14.3	8.2	178	190	700	556	10.3	9.2	12.0	11.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/25	1145	114.9	299	211	170	228	26.1	5.2	22.2	11.2	174	185	704	586	10.0	9.2	8.7	9.4
4/25	1200	115.2	299	210	170	227	26.7	5.3	19.8	11.7	171	182	703	537	10.0	9.0	11.1	15.1
4/25	1215	116.1	299	210	170	227	27.2	4.9	21.9	11.1	173	183	686	541	10.0	9.0	11.1	12.4
4/25	1230	118.8	298	207	172	226	30.3	5.2	20.4	11.5	175	186	688	533	10.2	8.9	14.6	11.3
4/25	1245	123.3	296	204	169	224	29.1	4.8	20.1	9.8	179	191	685	523	10.0	9.0	11.1	15.2
4/25	1300	119.7	297	205	170	225	27.4	4.5	21.2	10.7	179	191	692	514	10.0	8.9	12.4	16.5
4/25	1315	120.6	299	203	170	223	30.1	4.9	17.5	10.2	177	192	784	489	10.3	8.9	15.7	27.7
4/25	1330	120.2	299	208	169	227	24.0	5.2	25.1	10.3	177	189	715	545	10.5	8.9	18.0	10.1
4/25	1345	133.5	303	202	166	225	32.0	4.7	20.4	10.9	189	203	718	493	10.4	8.4	23.8	15.0
4/25	1400	141.5	303	205	165	228	32.7	5.0	27.5	14.2	201	215	746	587	10.6	9.2	15.2	9.4
4/25	1415	144.7	304	199	156	225	32.6	5.1	24.4	12.7	208	221	750	570	10.6	9.3	14.0	13.4
4/25	1430	141.3	304	199	155	222	31.0	4.9	17.3	9.2	191	205	801	627	11.2	9.7	15.5	9.6
4/25	1445	143.7	302	207	161	228	31.2	5.1	26.2	12.0	195	206	779	598	10.8	9.4	14.9	11.8
4/25	1500	144.7	302	205	160	229	31.2	5.2	25.5	13.5	196	207	781	598	10.9	9.5	14.7	12.2
4/25	1515	144.3	303	204	161	227	34.2	5.0	24.0	11.9	198	207	775	587	10.8	9.5	13.7	13.9
4/25	1530	144.2	304	198	161	223	38.3	5.3	17.7	9.1	197	209	779	564	10.8	9.3	16.1	15.9
4/25	1545	145.2	305	204	164	227	32.9	5.2	23.4	11.8	200	211	769	558	10.7	9.4	13.8	17.4
4/25	1600	145.3	304	202	163	226	33.4	5.1	20.5	10.3	201	212	775	574	10.7	9.4	13.8	15.7
4/25	1615	141.0	304	215	160	234	27.0	4.8	30.2	15.9	201	206	775	624	10.8	9.3	16.1	6.5
4/25	1630	146.2	303	209	156	230	34.1	5.1	32.5	16.2	207	215	771	610	10.8	9.3	16.1	8.0
4/25	1645	146.8	303	204	157	225	37.9	4.7	26.9	13.5	209	216	776	580	10.7	9.3	15.1	14.0
4/25	1700	146.9	304	201	158	223	38.9	4.9	24.2	13.0	211	219	768	564	10.7	9.3	15.1	15.5
4/25	1715	147.1	303	200	160	221	38.3	5.1	21.8	11.4	210	216	763	553	10.7	9.3	15.1	16.6
4/25	1730	146.8	302	202	163	221	38.1	4.8	21.9	11.3	207	215	754	564	10.6	9.3	14.0	14.7
4/25	1745	147.3	302	199	165	220	38.9	5.2	20.0	12.8	208	216	762	543	10.6	9.2	15.2	17.9
4/25	1800	147.3	302	196	166	219	38.9	5.4	18.2	9.6	209	217	764	548	10.6	9.3	14.0	18.3
4/25	1815	140.4	302	193	150	216	35.9	4.9	16.0	9.2	200	208	761	528	10.4	9.0	15.6	19.8
4/25	1830	141.8	301	198	154	220	31.8	5.1	20.9	11.3	194	204	774	550	10.8	9.2	17.4	16.6
4/25	1845	139.2	300	198	156	220	34.8	5.1	17.2	9.3	193	200	779	581	10.8	9.1	18.7	11.4
4/25	1900	142.5	301	196	151	219	30.2	5.1	16.9	9.3	198	206	776	558	10.8	9.3	16.1	16.5
4/25	1915	141.1	300	201	151	222	33.9	5.1	19.9	10.8	198	208	768	569	10.7	9.2	16.3	13.7
4/25	1930	142.6	301	197	152	219	37.7	5.0	18.5	9.9	199	208	757	542	10.7	9.1	17.6	15.9
4/25	1945	142.3	300	195	152	217	39.1	4.9	17.3	9.8	202	209	759	534	10.5	9.2	14.1	19.8
4/25	2000	145.5	302	195	153	217	39.1	5.3	17.3	9.8	204	215	770	542	10.7	9.3	15.1	18.9
4/25	2015	145.3	300	195	155	217	39.0	4.9	17.6	10.2	208	219	763	547	10.7	9.2	16.3	16.6

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/25	2030	144.9	297	194	157	214	38.6	5.1	15.6	8.4	202	207	760	554	10.7	9.3	15.1	16.2
4/25	2045	143.7	296	192	158	213	39.0	5.4	13.9	8.5	204	212	772	534	10.8	9.1	18.7	17.9
4/25	2100	142.1	296	191	157	212	39.0	5.1	13.3	8.6	203	209	772	530	10.8	9.1	18.7	18.6
4/25	2115	140.6	295	201	157	219	29.1	5.1	22.7	12.5	200	205	772	575	10.8	9.2	17.4	12.5
4/25	2130	139.6	293	198	155	216	33.1	5.1	14.9	10.0	194	202	780	561	10.9	9.3	17.2	15.7
4/25	2145	142.2	292	199	152	216	36.7	4.8	14.5	9.8	198	209	782	573	10.9	9.3	17.2	14.1
4/25	2200	140.1	292	198	143	218	22.6	5.3	18.8	10.7	194	203	774	558	10.9	9.1	19.8	13.6
4/26	2315	147.4	288	194	175	206	39.9	8.0	11.4	7.0	210	242	842	639	11.3	9.5	18.9	9.7
4/26	2330	147.7	287	193	175	206	40.1	7.4	11.4	6.3	212	245	802	620	10.9	9.5	14.7	11.3
4/26	2345	142.9	288	192	174	204	39.3	6.6	12.4	6.8	203	236	826	606	11.0	9.4	17.0	14.2
4/27	0000	137.4	288	192	175	204	38.5	7.2	10.5	7.3	197	228	842	625	11.2	9.6	16.7	13.4
4/27	0015	146.5	286	191	175	204	38.9	7.1	10.7	6.7	207	240	843	620	11.2	9.7	15.5	15.0
4/27	0030	140.2	288	191	174	204	38.9	6.5	10.1	6.0	201	232	822	609	11.1	9.5	16.8	13.4
4/27	0045	120.7	292	191	175	202	36.5	6.4	11.7	6.7	178	209	855	610	10.9	9.5	14.7	18.2
4/27	0100	115.7	298	191	175	202	37.9	6.2	9.9	5.9	177	209	843	566	11.0	9.2	19.6	19.7
4/27	0115	118.4	296	190	175	201	38.2	6.5	10.1	6.2	179	210	810	556	10.8	9.1	18.7	18.6
4/27	0130	128.2	293	189	176	201	38.3	6.3	11.0	6.0	185	221	804	562	11.0	9.2	19.6	16.4
4/27	0145	140.5	284	189	174	201	37.5	6.3	10.0	5.8	196	230	812	575	11.0	9.5	15.8	18.0
4/27	0200	139.7	286	189	175	201	37.2	5.9	9.9	6.3	195	226	836	614	11.1	9.8	13.3	16.9
4/27	0215	135.4	289	189	175	202	37.7	5.7	9.5	15.7	187	219	840	604	11.2	9.7	15.5	16.9
4/27	0230	120.6	292	189	175	201	36.1	6.1	9.5	8.4	175	206	817	588	11.0	9.6	14.6	17.5
4/27	0245	106.6	298	189	175	200	36.9	5.8	9.6	13.8	167	200	804	565	10.7	9.3	15.1	19.2
4/27	0300	103.7	303	190	175	199	36.4	5.9	12.0	11.7	162	194	790	541	10.6	9.1	16.5	20.3
4/27	0315	103.7	301	190	175	200	36.4	6.0	9.6	7.8	161	195	789	547	10.6	9.1	16.5	19.2
4/27	0330	103.9	301	191	176	200	35.8	6.2	10.6	5.7	161	194	773	537	10.6	9.1	16.5	19.1
4/27	0345	104.3	302	191	175	201	36.3	6.1	9.8	12.6	161	197	786	527	10.5	9.1	15.4	22.7
4/27	0400	104.2	302	191	175	200	36.2	6.0	9.7	6.3	165	199	785	545	10.7	9.1	17.6	18.4
4/27	0415	103.7	303	195	175	204	34.2	5.7	11.5	6.2	164	199	788	556	10.5	9.1	15.4	18.5
4/27	0430	103.9	300	196	175	204	34.1	5.5	10.4	6.1	164	201	772	553	10.5	9.0	16.7	16.5
4/27	0445	104.1	299	197	175	205	33.3	6.2	11.3	19.9	163	199	786	572	10.5	9.1	15.4	16.1
4/27	0500	118.1	295	197	175	206	32.7	6.5	11.8	10.3	169	201	782	587	10.6	9.3	14.0	14.4
4/27	0515	124.9	289	198	175	207	32.6	7.1	13.8	9.0	179	216	792	611	10.9	9.5	14.7	11.6
4/27	0530	137.8	284	200	175	210	31.1	6.8	17.9	12.1	193	230	797	599	11.1	9.5	16.8	12.1
4/27	0545	135.4	281	190	173	204	34.2	6.9	12.1	10.4	190	228	841	603	11.1	9.5	16.8	16.1
4/27	0600	134.7	285	192	176	206	34.3	6.6	11.9	5.8	192	231	822	600	11.0	9.5	15.8	15.4
4/27	0615	136.3	284	192	174	206	33.4	6.8	11.4	6.1	195	230	800	593	10.8	9.4	14.9	14.9
4/27	0630	140.9	284	194	175	207	33.0	7.1	13.1	7.2	196	230	804	599	11.0	9.5	15.8	13.7
4/27	0645	143.8	281	194	175	207	33.2	7.0	12.1	6.3	199	233	820	604	11.0	9.6	14.6	15.5

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Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/27	0700	144.9	282	191	175	204	36.9	6.7	11.8	6.6	203	236	809	616	10.9	9.7	12.4	14.4
4/27	0715	145.0	282	192	175	204	35.4	6.8	12.1	6.7	202	237	818	614	10.9	9.6	13.5	14.7
4/27	0730	147.4	283	192	175	204	36.0	6.6	11.7	7.4	203	235	802	620	11.0	9.8	12.2	13.2
4/27	0745	145.8	283	192	175	204	35.8	6.8	11.2	6.9	200	232	822	616	11.0	9.8	12.2	15.9
4/27	0800	138.6	285	192	175	204	34.7	6.5	11.0	5.8	191	227	824	631	11.1	9.8	13.3	13.3
4/27	0815	137.4	287	194	175	205	33.0	6.6	11.3	7.9	188	223	829	621	11.0	9.7	13.4	15.0
4/27	0830	137.5	286	195	175	206	34.1	6.4	12.0	8.8	190	223	812	609	11.1	9.7	14.4	14.2
4/27	0845	137.6	285	196	174	206	35.9	6.0	12.6	10.9	190	221	820	623	11.1	9.7	14.4	13.1
4/27	0900	137.7	286	196	175	207	34.2	5.9	12.1	8.5	187	221	820	624	11.0	9.8	12.2	14.5
4/27	0915	142.3	285	197	175	208	33.6	6.0	13.6	9.6	198	234	806	611	10.9	9.6	13.5	14.0
4/27	0930	142.9	285	198	175	209	33.4	6.2	13.3	11.8	198	232	788	609	10.8	9.6	12.5	13.0
4/27	0945	147.3	285	201	178	213	33.5	6.0	23.8	15.4	203	237	811	609	10.9	9.5	14.7	13.8
4/27	1000	147.8	282	205	175	216	32.4	6.6	20.6	9.9	204	236	803	628	10.9	9.5	14.7	10.3
4/27	1015	147.0	283	206	175	217	33.0	6.3	21.4	11.3	204	236	807	628	10.8	9.5	13.7	11.4
4/27	1030	144.6	284	207	175	217	32.8	6.3	22.2	11.0	200	230	790	629	10.8	9.5	13.7	9.5
4/27	1045	146.3	285	207	175	218	33.7	6.4	20.5	9.3	202	232	774	625	10.8	9.5	13.7	8.1
4/27	1100	144.0	286	206	175	217	33.3	6.1	20.9	9.9	197	230	781	629	10.6	9.7	9.3	12.0
4/27	1115	142.5	286	202	177	213	38.1	6.2	16.3	8.1	198	231	812	626	10.9	9.5	14.7	11.4
4/27	1130	140.4	287	192	176	206	41.2	6.2	13.0	8.7	197	231	790	591	10.7	9.5	12.6	15.7
4/27	1145	137.9	288	189	175	204	41.1	6.0	11.9	8.6	197	232	805	574	10.8	9.5	13.7	18.9
4/27	1200	137.4	289	190	173	204	39.0	6.2	12.1	10.1	193	224	794	584	10.6	9.4	12.8	17.0
4/27	1215	141.9	289	193	175	206	38.8	6.1	13.8	11.8	198	231	798	595	10.7	9.6	11.5	16.9
4/27	1230	142.5	288	194	175	207	40.5	6.2	13.2	11.6	201	236	791	580	10.9	9.3	17.2	14.0
4/27	1245	146.6	288	195	175	209	40.5	5.8	14.8	10.9	206	240	804	593	10.9	9.5	14.7	15.3
4/27	1300	141.8	290	195	175	209	38.4	5.6	15.0	11.6	200	233	801	603	10.7	9.5	12.6	15.2
4/27	1315	147.3	290	203	193	212	38.2	6.1	16.4	12.5	208	239	800	622	10.6	9.5	11.6	13.2
4/27	1330	145.0	291	201	179	214	39.0	6.1	16.9	13.2	212	246	764	632	10.5	9.1	15.4	4.6
4/27	1345	143.7	291	199	176	212	38.2	6.0	15.8	9.4	202	229	801	609	10.8	9.2	17.4	10.8
4/27	1400	140.1	291	195	174	209	40.6	6.2	14.4	10.5	199	229	823	607	10.9	9.5	14.7	15.4
4/27	1415	140.5	291	197	174	210	39.3	6.3	13.8	11.9	193	224	809	603	10.9	9.6	13.5	15.4
4/27	1430	138.1	293	197	177	209	40.3	5.5	14.0	9.1	191	222	809	603	10.9	9.6	13.5	15.4
4/27	1445	139.4	293	194	176	208	41.5	6.1	13.8	11.9	193	224	835	608	11.1	9.2	20.7	12.1
4/27	1500	138.8	294	192	176	206	42.3	6.1	12.9	9.6	190	223	852	597	11.4	9.6	18.8	16.8
4/27	1515	135.3	296	192	176	205	42.7	6.4	11.4	8.9	188	221	843	596	11.3	9.5	18.9	15.9
4/27	1530	136.4	295	190	173	206	42.3	5.9	13.6	27.6	193	229	847	578	11.5	9.5	21.1	17.4

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/27	1545	140.4	294	197	187	206	42.0	6.2	12.2	8.1	194	229	807	556	10.9	9.2	18.5	18.4
4/27	1600	137.1	296	195	173	210	36.3	6.2	13.0	8.4	187	216	845	603	11.2	9.5	17.9	15.8
4/27	1615	142.1	297	204	176	219	36.7	5.8	19.6	11.6	211	242	847	578	11.5	9.0	27.8	12.8
4/27	1630	139.7	295	203	175	218	36.1	5.9	17.4	9.5	191	218	818	618	11.0	9.3	18.3	10.6
4/27	1645	138.3	296	202	174	218	36.3	6.3	16.1	9.7	189	217	863	638	11.3	9.7	16.5	13.9
4/27	1700	138.2	296	202	175	218	36.1	6.0	16.1	9.2	187	218	844	630	11.2	9.7	15.5	13.8
4/27	1715	139.2	296	202	175	218	34.9	6.1	16.2	9.6	185	216	857	642	11.3	9.7	16.5	12.8
4/27	1730	140.8	297	201	175	217	37.4	6.2	15.3	9.1	187	215	857	637	11.5	9.7	18.6	11.9
4/27	1745	144.2	297	200	175	217	37.1	6.2	15.0	8.4	187	218	860	654	11.5	9.9	16.2	11.7
4/27	1800	138.4	299	201	175	217	36.5	6.6	14.1	9.3	180	207	890	671	11.8	10.0	18.0	11.0
4/27	1815	138.9	301	201	175	217	37.4	6.3	14.4	8.8	181	212	869	656	11.5	9.9	16.2	12.3
4/27	1830	140.0	299	201	175	217	37.6	6.5	15.8	8.7	186	217	844	627	11.5	9.8	17.3	12.7
4/27	1845	138.9	299	199	178	214	41.1	6.3	13.3	9.6	182	215	869	620	11.4	9.6	18.8	15.3
4/27	1900	134.0	301	193	177	209	43.3	6.1	12.0	7.7	179	212	856	606	11.4	9.7	17.5	16.9
4/27	1915	136.1	300	192	174	208	42.4	6.2	12.7	9.2	181	218	850	596	11.4	9.7	17.5	17.6
4/27	1930	135.7	299	198	189	208	42.7	5.8	11.5	8.1	180	217	820	582	11.2	9.6	16.7	17.2
4/27	1945	136.7	297	196	172	211	38.3	5.8	13.3	14.7	185	219	843	593	11.3	9.6	17.7	17.2
4/27	2000	141.4	296	200	175	213	38.3	5.8	14.8	9.4	187	224	840	616	11.3	9.6	17.7	13.7
4/27	2015	143.9	295	199	177	212	42.4	6.1	14.4	8.8	189	223	842	628	11.5	9.7	18.6	11.6
4/27	2030	144.3	293	196	175	210	42.8	6.0	12.5	8.4	188	223	839	618	11.4	9.6	18.8	12.5
4/27	2045	144.4	294	195	176	210	43.0	6.3	13.0	9.2	191	226	850	624	11.4	9.7	17.5	13.7
4/27	2100	140.1	293	195	179	208	43.0	6.3	12.0	9.5	185	220	850	626	11.4	9.7	17.5	13.4
4/27	2115	144.3	291	194	165	207	42.9		12.2	13.0	193	232	850	579	11.4	9.2	23.9	15.6
4/27	2130	139.4	291	195	175	208	40.8		11.5	11.7	186	221	841	596	11.4	9.4	21.3	14.0
4/27	2145	135.6	294	195	176	209	42.0	6.1	12.1	8.3	183	217	862	613	11.4	9.5	20.0	14.7
4/27	2200	135.1	295	194	174	208	42.4	6.2	12.2	8.2	182	216	865	604	11.5	9.5	21.1	15.5
4/27	2215	135.7	294	193	177	207	43.6	6.0	11.4	7.4	184	216	855	617	11.5	9.6	19.8	13.5
4/27	2230	134.1	294	191	174	206	43.2	6.1	11.8	8.6	185	215	846	604	11.4	9.5	20.0	14.4
4/27	2245	133.9	292	191	175	206	43.0	6.2	11.4	7.2	185	218	850	599	11.4	9.4	21.3	14.6
4/27	2300	134.4	292	192	175	205	43.1	5.7	11.2	6.9	187	217	850	599	11.4	9.4	21.3	14.6
4/27	2315	142.4	289	194	182	206	42.4	5.7	12.8	7.5	194	229	850	621	11.4	9.6	18.8	13.2
4/27	2330	136.7	291	193	177	206	42.1	5.8	12.1	7.2	188	222	834	628	11.3	9.7	16.5	12.2
4/27	2345	133.6	292	195	175	208	41.5	5.8	13.3	7.6	188	221	829	619	11.1	9.6	15.6	13.7
4/28	0000	120.1	295	194	175	206	40.6	5.8	11.2	7.4	172	200	852	599	11.2	9.4	19.1	16.3
4/28	0015	110.3	300	193	175	205	40.5	6.0	11.0	7.2	164	196	811	572	10.9	9.1	19.8	15.5

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/28	0030	110.7	301	194	175	206	40.7	6.1	11.0	7.1	168	199	787	548	10.7	8.9	20.2	16.3
4/28	0045	110.0	299	195	175	206	39.7	6.2	10.9	6.7	162	196	750	557	10.3	9.1	13.2	16.0
4/28	0100	106.7	300	194	177	206	39.5	6.2	10.8	12.9	161	198	791	553	10.7	9.1	17.6	17.8
4/28	0115	107.9	298	195	173	206	38.5	6.4	11.2	9.9	159	192	793	545	10.7	9.1	17.6	19.2
4/28	0130	105.9	299	198	175	208	38.0	6.1	11.4	11.6	156	191	779	559	10.7	9.1	17.6	15.6
4/28	0145	105.9	302	200	175	209	38.2	6.5	11.5	6.6	155	188	804	565	10.8	9.1	18.7	16.5
4/28	0200	105.9	301	195	178	206	41.6	6.5	11.6	5.7	154	194	797	567	10.7	9.2	16.3	17.2
4/28	0215	109.6	301	195	174	208	39.1	6.7	12.5	6.6	161	198	829	563	11.0	8.9	23.6	16.1
4/28	0230	107.4	298	191	179	203	42.9	6.5	10.3	5.4	158	196	789	561	10.7	9.1	17.6	16.4
4/28	0245	106.5	301	186	177	199	45.0	6.5	9.7	6.0	156	197	795	548	10.7	9.2	16.3	19.8
4/28	0300	105.9	302	184	175	196	45.2	6.6	9.5	7.4	155	194	790	526	10.7	9.1	17.6	21.6
4/28	0315	107.4	301	184	175	196	44.8	6.1	9.4	6.6	155	195	786	504	10.7	9.1	17.6	24.6
4/28	0330	107.6	299	185	174	196	45.0	6.1	9.3	13.8	159	197	747	502	10.4	8.9	16.9	21.4
4/28	0345	109.2	297	184	174	196	43.2	5.9	9.3	7.2	159	198	783	518	10.4	9.1	14.3	24.4
4/28	0400	109.3	296	186	175	197	43.7	6.0	9.3	10.6	158	196	789	532	10.7	9.1	17.6	20.8
4/28	0415	109.3	295	186	176	198	43.0	5.7	9.6	7.3	163	201	784	528	10.6	9.0	17.8	20.6
4/28	0430	110.5	295	185	175	196	43.8	5.8	9.1	8.0	160	198	758	511	10.4	8.9	16.9	21.2
4/28	0445	107.7	295	185	175	196	43.4	6.1	9.4	7.4	158	197	784	516	10.6	9.0	17.8	22.6
4/28	0500	109.6	296	186	175	194	45.2	6.1	9.8	6.5	159	197	802	497	10.7	9.0	18.9	26.3
4/28	0515	106.7	299	184	174	195	44.0	6.1	9.0	6.0	156	196	791	510	10.7	9.0	18.9	23.3
4/28	0530	119.5	299	187	174	197	43.5	6.3	9.8	6.9	162	200	792	557	10.8	9.4	14.9	19.2
4/28	0545	128.4	291	188	175	199	43.7	5.9	9.4	6.3	172	211	826	574	11.2	9.4	19.1	17.2
4/28	0600	139.8	285	188	173	199	43.3	6.0	9.8	4.5	179	216	828	598	11.2	9.8	14.3	17.4
4/28	0615	142.7	285	190	175	202	42.9	6.1	10.3	5.1	189	226	850	633	11.5	9.9	16.2	13.4
4/28	0630	145.6	285	191	177	204	43.3	6.0	11.6	5.4	198	235	843	637	10.9	9.9	10.1	16.8
4/28	0645	136.6	285	188	175	200	44.2	6.0	9.6	4.8	184	217	860	636	11.4	9.9	15.2	14.9
4/28	0700	136.3	288	187	174	200	44.1	6.2	9.5	5.5	182	218	843	611	11.3	9.8	15.3	16.4
4/28	0715	140.5	286	187	175	200	43.5	6.6	10.4	5.4	186	223	841	606	11.2	9.8	14.3	17.6
4/28	0730	141.0	285	187	174	201	41.9	6.2	10.5	6.1	185	226	819	596	11.3	9.7	16.5	15.2
4/28	0745	134.9	287	189	176	202	42.6	6.1	11.5	6.6	184	225	823	611	11.2	9.8	14.3	15.1
4/28	0800	136.3	288	188	175	201	42.5	5.7	10.3	5.6	183	217	798	585	11.1	9.6	15.6	15.2
4/28	0815	135.3	289	190	176	203	43.0	6.0	10.8	6.4	183	222	825	590	11.2	9.7	15.5	17.4
4/28	0830	140.4	289	190	176	203	44.2	6.0	10.9	5.6	187	227	805	596	11.2	9.7	15.5	14.5
4/28	0845	142.2	290	188	172	203	45.6	6.0	11.0	5.9	191	230	788	584	10.9	9.8	11.2	17.6
4/28	0900	139.9	291	189	172	203	44.0	6.2	10.8	5.9	186	223	824	600	11.1	9.8	13.3	17.6

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/28	0915	144.5	291	193	174	206	41.8	6.3	12.5	6.1	189	231	830	608	11.3	9.8	15.3	15.6
4/28	0930	145.9	292	194	176	208	43.5	6.0	12.5	6.6	189	229	818	606	11.3	9.8	15.3	14.5
4/28	0945	141.5	293	193	175	206	44.1	6.0	12.1	5.7	185	225	821	598	11.3	9.7	16.5	15.1
4/28	1000	143.8	294	195	172	210	42.4	5.8	14.1	6.8	189	224	827	613	11.1	9.8	13.3	16.0
4/28	1015	141.1	294	201	173	216	37.7	6.0	16.7	8.2	187	223	831	637	11.3	9.8	15.3	11.6
4/28	1030	143.1	295	205	175	218	38.3	6.0	17.0	7.8	186	223	811	637	11.2	9.7	15.5	9.3
4/28	1045	140.0	296	205	175	218	38.4	6.0	16.2	7.7	182	217	826	630	11.3	9.8	15.3	12.0
4/28	1100	135.8	298	205	175	219	37.6	5.9	16.9	7.4	179	218	834	628	11.3	9.7	16.5	12.2
4/28	1115	136.1	298	205	175	219	39.4	6.1	15.3	6.9	178	214	829	628	11.3	9.7	16.5	11.7
4/28	1130	140.0	297	204	175	219	40.2	6.1	17.2	7.7	185	222	823	628	11.3	9.7	16.5	11.1
4/28	1145	140.3	299	203	176	219	40.1	6.2	16.6	6.9	181	219	842	631	11.5	9.7	18.6	11.2
4/28	1200	140.8	298	202	176	218	40.6	6.1	16.6	7.3	181	217	838	620	11.4	9.8	16.3	13.9
4/28	1215	140.1	300	200	179	216	44.1	5.8	16.4	7.3	180	226	829	600	11.4	9.6	18.8	14.1
4/28	1230	140.0	302	196	178	211	47.0	6.2	13.9	6.1	183	221	811	587	11.3	9.7	16.5	15.6
4/28	1245	141.1	301	192	175	209	47.0	6.0	13.2	6.7	182	218	829	572	11.3	9.7	16.5	19.6
4/28	1300	144.3	304	193	175	209	47.2	6.1	12.9	6.0	183	220	825	594	11.3	9.8	15.3	17.0
4/28	1315	137.2	303	193	173	209	45.8	6.0	13.1	6.4	181	216	850	605	11.4	9.9	15.2	18.1
4/28	1330	140.7	304	196	172	212	43.4	5.5	14.2	7.0	179	211	871	610	11.8	10.0	18.0	17.3
4/28	1345	140.7	303	202	173	216	41.3	6.0	15.5	7.0	182	219	863	632	11.6	10.0	16.0	15.0
4/28	1400	139.8	302	205	175	219	41.3	6.2	18.4	10.2	189	226	856	627	11.5	9.5	21.1	11.3
4/28	1415	140.9	302	205	174	219	40.0	5.9	18.8	16.4	181	219	850	649	11.5	9.9	16.2	11.3
4/28	1430	142.3	301	209	175	223	36.9	6.2	22.6	12.9	182	218	841	656	11.6	10.0	16.0	9.5
4/28	1445	141.6	302	211	175	225	38.1	5.8	21.9	15.0	181	216	849	658	11.5	10.1	13.9	11.7
4/28	1500	140.4	304	210	174	224	33.7	5.9	20.9	13.5	178	215	858	664	11.7	10.0	17.0	9.4
4/28	1515	139.9	305	210	174	225	32.5	6.2	53.4	0.1	176	212	844	661	11.4	10.0	14.0	10.8
4/28	1530	140.6	304	208	164	224	33.9	5.9	22.5	14.4	181	220	854	651	11.6	9.9	17.2	10.6
4/28	1545	141.4	303	206	158	222	33.9	5.8	17.1	12.4	179	216	834	631	11.3	9.8	15.3	12.8
4/28	1600	141.2	305	206	154	222	34.0	5.8	18.6	15.1	182	217	854	626	11.4	9.8	16.3	14.7
4/28	1615	141.4	305	207	153	221	35.1	6.2	18.5	13.5	180	219	845	640	11.3	9.8	15.3	12.7
4/29	0045	106.0	310	207	179	215	39.5	6.8	10.6	7.2	146	186	836	647	11.0	9.3	18.3	8.4
4/29	0100	105.6	311	197	179	206	42.7	7.1	10.5	6.8	150	194	831	614	10.9	9.4	16.0	14.4
4/29	0115	107.1	310	194	177	203	44.1	6.7	9.5	5.8	149	190	843	618	11.0	9.3	18.3	13.3
4/29	0130	108.3	308	192	176	202	44.1	6.6	9.6	6.0	147	192	840	606	11.0	9.3	18.3	14.7
4/29	0145	108.9	308	192	175	202	43.7	7.1	9.5	6.3	149	194	851	603	11.3	9.3	21.5	13.9
4/29	0200	109.0	306	191	176	200	44.4	6.6	9.3	5.6	148	197	847	588	11.2	9.2	21.7	15.5

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/29	0215	109.0	307	189	175	199	44.2	7.0	9.3	7.6	145	195	827	572	11.1	9.3	19.4	17.4
4/29	0230	108.8	307	190	174	199	43.1	6.5	9.1	5.9	142	188	822	570	11.0	9.2	19.6	17.2
4/29	0245	108.1	304	193	173	202	40.6	6.5	9.2	9.6	147	192	829	585	11.0	9.4	17.0	17.5
4/29	0300	108.9	303	204	172	211	31.0	6.5	14.6	9.7	148	194	831	653	11.0	9.5	15.8	8.9
4/29	0315	108.5	303	225	172	230	27.5	6.2	22.8	13.7	144	182	853	696	11.1	9.4	18.1	3.7
4/29	0330	109.0	305	209	173	216	39.9	6.4	10.7	8.8	146	189	801	647	10.7	9.4	13.8	8.1
4/29	0345	108.5	307	196	174	206	43.9	6.2	9.2	9.2	146	190	825	589	10.8	9.3	16.1	17.1
4/29	0400	107.6	304	188	170	199	44.6	6.1	9.1	6.1	146	191	807	546	10.7	9.3	15.1	22.1
4/29	0415	105.5	304	185	169	196	45.1	6.1	8.6	5.3	144	188	825	529	10.9	9.2	18.5	24.1
4/29	0430	105.1	307	185	169	196	45.0	6.2	9.2	7.7	143	188	808	537	10.7	9.2	16.3	22.7
4/29	0445	106.2	307	185	169	196	44.9	6.2	8.5	5.5	146	192	824	538	10.8	9.3	16.1	24.1
4/29	0500	107.2	307	187	168	198	43.5	6.4	8.7	5.1	146	190	812	541	10.8	9.3	16.1	22.7
4/29	0515	108.1	306	192	166	201	40.7	6.3	9.1	5.4	147	192	790	585	10.5	9.1	15.4	14.6
4/29	0530	121.6	300	199	166	206	39.9	5.8	10.0	5.8	155	203	813	650	10.9	9.5	14.7	8.3
4/29	0545	139.5	292	201	166	208	39.1	6.2	11.9	6.8	174	221	849	641	11.3	9.7	16.5	12.0
4/29	0600	141.9	289	202	188	209	35.7	6.1	12.5	6.4	176	220	848	650	11.3	9.9	14.1	12.5
4/29	0615	141.8	291	193	181	204	44.2	6.0	10.2	5.6	176	221	862	637	11.5	10.0	15.0	15.0
4/29	0630	146.4	291	189	176	202	44.6	6.0	9.9	5.6	179	226	870	635	11.5	10.1	13.9	16.9
4/29	0645	136.0	294	190	173	202	44.1	6.0	10.0	5.8	173	213	855	640	11.3	10.1	11.9	16.3
4/29	0700	138.9	293	189	176	201	43.7	5.9	9.4	5.3	174	215	854	624	11.3	10.0	13.0	17.4
4/29	0715	145.5	293	189	174	201	44.0	6.1	9.7	5.9	176	225	884	611	11.5	10.0	15.0	20.5
4/29	0730	142.6	292	194	180	202	45.9	6.1	10.2	7.8	172	220	868	658	11.5	10.1	13.9	13.7
4/29	0745	135.3	296	189	175	200	45.3	6.0	10.2	8.7	169	212	883	637	11.4	10.0	14.0	17.8
4/29	0800	135.9	299	188	177	199	46.5	6.0	10.1	9.0	168	212	874	621	11.4	9.9	15.2	18.2
4/29	0815	136.1	299	187	175	200	45.8	5.6	10.1	11.8	168	211	863	612	11.3	9.8	15.3	18.3
4/29	0830	135.8	300	191	173	202	43.8	6.4	10.8	16.0	170	213	863	617	11.4	9.8	16.3	16.7
4/29	0845	140.4	297	192	175	202	44.5	6.9	10.5	12.3	173	219	863	617	11.4	9.8	16.3	16.7
4/29	0900	140.0	296	191	176	202	44.3	6.6	10.8	12.0	172	215	863	617	11.4	9.8	16.3	16.7
4/29	0915	141.0	299	191	176	203	45.8	6.1	10.7	11.2	172	217	863	617	11.0	9.6	14.6	18.0
4/29	0930	145.4	298	193	175	204	44.4	6.4	11.1	10.3	177	224	858	612	11.3	9.6	17.7	16.1
4/29	0945	140.7	300	193	175	NA	45.0	6.5	11.2	9.4	NA	NA	855	604	11.3	9.6	17.7	16.8
4/29	1000	143.6	300	195	175	NA	43.5	6.1	11.8	12.2	NA	NA	839	601	11.1	9.6	15.6	17.1
4/29	1015	144.8	299	198	174	NA	42.1	6.2	12.2	9.5	NA	NA	846	604	11.3	9.8	15.3	17.6
4/29	1030	143.3	300	200	176	NA	42.0	6.2	11.9	9.3	NA	NA	845	612	11.2	9.7	15.5	16.4
4/29	1045	144.3	301	201	175	NA	42.1	6.1	12.6	11.1	NA	NA	827	599	11.0	9.6	14.6	17.0

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/29	1100	144.2	301	201	175	NA	41.8	6.0	13.1	11.8	NA	NA	NA	831	596	11.0	9.4	17.0	16.0
4/29	1115	143.0	301	203	175	NA	42.2	6.0	14.0	12.7	NA	NA	NA	820	591	10.8	9.3	16.1	16.3
4/29	1130	143.9	302	203	177	NA	43.6	6.0	13.5	10.8	NA	NA	NA	822	598	10.8	9.5	13.7	17.2
4/29	1145	143.5	302	202	180	NA	45.0	6.0	13.5	11.7	NA	NA	NA	821	594	10.8	9.4	14.9	16.8
4/29	1200	138.1	304	199	178	NA	47.6	6.4	11.5	11.8	NA	NA	NA	828	603	10.9	9.4	16.0	15.6
4/29	1215	136.9	305	195	175	NA	47.8	6.0	11.3	11.3	NA	NA	NA	830	613	10.9	9.6	13.5	16.2
4/29	1230	135.7	309	194	175	NA	47.9	6.2	11.7	11.3	NA	NA	NA	860	610	11.0	9.6	14.6	18.7
4/29	1245	143.5	306	194	177	NA	48.4	6.2	11.8	9.8	NA	NA	NA	863	620	11.1	9.7	14.4	17.7
4/29	1300	141.6	308	195	175	NA	48.7	6.0	11.9	11.4	NA	NA	NA	845	610	11.1	9.6	15.6	16.6
4/29	1315	145.3	306	194	178	NA	51.0	6.0	11.8	11.1	NA	NA	NA	842	608	11.0	9.6	14.6	17.3
4/29	1330	145.5	305	200	184	NA	49.7	5.6	12.5	10.9	NA	NA	NA	810	633	10.8	9.5	13.7	11.2
4/29	1345	144.8	307	190	176	NA	51.6	6.3	11.8	10.6	NA	NA	NA	823	576	11.0	9.6	14.6	19.8
4/29	1400	140.6	309	188	174	NA	50.6	5.9	11.5	10.8	NA	NA	NA	826	573	11.0	9.5	15.8	19.7
4/29	1415	143.1	310	189	175	NA	51.0	6.2	11.6	11.5	NA	NA	NA	819	582	11.1	9.6	15.6	17.8
4/29	1430	140.6	311	189	175	NA	51.0	6.0	11.5	12.2	NA	NA	NA	823	583	11.1	9.7	14.4	18.9
4/29	1445	142.9	310	187	176	NA	53.3	6.0	11.6	11.4	NA	NA	NA	816	613	11.0	9.9	11.1	16.5
4/29	1500	136.8	310	187	179	NA	53.7	6.0	11.0	12.3	NA	NA	NA	825	585	11.1	9.5	16.8	17.1
4/29	1515	136.7	312	184	144	NA	51.0	6.1	11.1	11.4	NA	NA	NA	821	591	11.0	9.6	14.6	17.4
4/29	1530	143.9	309	195	178	NA	50.1	6.3	10.4	10.6	NA	NA	NA	831	635	11.2	9.6	16.7	10.8
4/29	1545	145.5	309	200	184	NA	49.8	6.4	10.4	12.3	NA	NA	NA	827	604	11.1	9.7	14.4	16.4
4/29	1600	136.8	312	192	173	NA	49.7	5.7	10.5	10.9	NA	NA	NA	840	612	11.1	9.6	15.6	15.8
4/29	1615	141.0	309	191	170	NA	50.2	6.1	10.3	12.5	NA	NA	NA	811	598	10.9	9.5	14.7	15.4
4/29	1630	143.8	307	192	172	NA	49.9	6.0	11.4	13.6	NA	NA	NA	792	576	10.7	9.4	13.8	17.3
4/29	1645	145.6	307	193	175	NA	49.9	5.9	12.0	10.5	NA	NA	NA	808	611	10.9	9.6	13.5	14.2
4/29	1700	139.6	308	193	174	NA	48.7	6.1	10.8	11.8	NA	NA	NA	791	593	10.6	9.3	14.0	14.6
4/29	1715	140.0	308	193	175	NA	49.6	6.3	11.0	11.2	NA	NA	NA	802	585	10.9	9.4	16.0	15.3
4/29	1730	136.4	307	192	175	NA	47.7	6.1	10.5	11.5	NA	NA	NA	812	590	10.9	9.5	14.7	16.6
4/29	1745	142.4	307	197	185	NA	48.4	5.9	11.5	11.6	NA	NA	NA	830	631	11.0	9.6	14.6	12.9
4/29	1800	140.3	306	196	184	NA	47.5	6.1	10.9	12.3	NA	NA	NA	808	618	10.7	9.4	13.8	12.9
4/29	1815	139.2	308	193	181	NA	48.9	6.1	10.9	13.8	NA	NA	NA	826	623	11.0	9.6	14.6	13.5
4/29	1830	138.5	307	190	176	NA	49.4	6.0	10.5	12.2	NA	NA	NA	839	603	11.0	9.4	17.0	15.8
4/29	1845	136.7	306	189	175	NA	49.0	6.2	10.4	13.4	NA	NA	NA	838	602	10.9	9.5	14.7	17.5
4/29	1900	135.1	310	189	175	NA	48.0	6.0	10.4	13.5	NA	NA	NA	845	617	10.9	9.5	14.7	16.2
4/29	1915	134.9	309	188	176	NA	50.3	5.9	10.6	11.5	NA	NA	NA	849	598	10.8	9.3	16.1	18.2
4/29	1930	135.6	304	187	174	NA	49.4	5.9	10.5	12.9	NA	NA	NA	807	576	10.6	9.2	15.2	17.7

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/29	1945	144.2	303	193	181	NA	49.6	6.0	11.3	12.6	NA	NA	805	583	10.6	9.3	14.0	17.5
4/29	2000	137.3	302	188	177	NA	49.0	5.9	10.0	12.0	NA	NA	791	583	10.4	9.2	13.0	16.7
4/29	2015	138.9	303	186	174	NA	49.5	6.1	10.5	12.3	NA	NA	806	572	10.6	9.2	15.2	18.3
4/29	2030	144.5	301	188	177	NA	50.2	6.2	10.9	11.8	NA	NA	807	584	10.7	9.3	15.1	16.7
4/29	2045	144.4	301	188	174	NA	49.9	6.1	10.8	12.6	NA	NA	816	589	10.7	9.2	16.3	16.1
4/29	2100	140.0	301	188	175	NA	49.9	5.9	11.4	12.9	NA	NA	816	576	10.7	8.9	20.2	15.1
4/29	2115	139.8	300	188	173	NA	47.5	6.0	10.3	12.8	NA	NA	816	577	10.7	9.0	18.9	16.0
4/29	2130	135.6	303	187	174	NA	48.0	5.9	10.2	14.0	NA	NA	816	585	11.3	9.3	21.5	12.9
4/29	2145	140.3	301	192	170	NA	48.2	6.1	10.9	13.2	NA	NA	811	575	11.0	9.2	19.6	15.2
4/29	2200	140.3	299	192	175	NA	46.2	5.9	10.8	12.2	NA	NA	805	581	10.9	9.2	18.5	14.5
4/29	2215	145.3	299	194	174	NA	46.3	6.0	12.8	12.2	NA	NA	818	581	10.9	9.2	18.5	15.8
4/29	2230	136.2	300	194	175	NA	45.8	5.9	10.7	9.8	NA	NA	793	555	10.8	8.9	21.3	15.1
4/29	2245	144.8	300	196	175	NA	45.0	5.9	12.4	9.2	NA	NA	794	583	10.9	9.3	17.2	13.9
4/29	2300	137.6	298	194	174	NA	44.9	6.3	11.0	8.6	NA	NA	794	583	10.9	9.3	17.2	13.9
4/29	2315	138.8	298	194	175	NA	43.5	6.1	11.2	8.7	NA	NA	794	605	10.9	9.2	18.5	9.7
4/29	2330	135.9	299	194	175	NA	42.8	6.1	11.6	9.2	NA	NA	797	596	10.9	9.2	18.5	11.4
4/29	2345	131.1	299	199	185	NA	41.9	6.1	10.7	7.7	NA	NA	803	598	10.8	9.2	17.4	12.5
4/30	0000	107.1	308	195	186	NA	42.9	5.9	9.9	8.1	NA	NA	800	553	10.8	9.0	20.0	17.0
4/30	0015	104.7	310	191	177	NA	42.0	7.0	9.9	9.0	NA	NA	794	546	10.6	9.0	17.8	18.9
4/30	0030	104.7	313	192	176	NA	41.8	7.1	9.8	5.9	NA	NA	785	537	10.4	8.9	16.9	20.0
4/30	0045	105.0	312	192	175	NA	40.8	7.2	10.1	5.5	NA	NA	778	521	10.3	8.8	17.0	21.6
4/30	0100	104.6	315	190	177	NA	44.2	6.9	9.8	5.5	146	NA	783	526	10.5	8.9	18.0	20.7
4/30	0115	105.5	313	189	175	NA	43.7	6.8	10.0	5.3	148	NA	785	519	10.4	8.9	16.9	22.7
4/30	0130	104.7	309	190	176	NA	40.7	7.2	10.1	6.1	148	NA	787	513	10.4	8.8	18.2	23.0
4/30	0145	106.9	311	191	176	NA	42.3	7.0	10.0	5.7	146	NA	788	502	10.4	8.8	18.2	24.7
4/30	0200	104.7	312	189	176	NA	44.1	7.0	9.9	14.1	145	NA	778	510	10.4	8.8	18.2	22.6
4/30	0215	106.9	309	183	177	NA	46.8	6.9	9.5	10.2	145	NA	772	512	10.4	8.9	16.9	22.5
4/30	0230	104.9	310	181	175	NA	48.0	6.9	9.8	6.3	147	NA	777	510	10.3	8.8	17.0	23.2
4/30	0245	104.5	311	179	168	NA	46.4	7.1	9.5	6.7	145	NA	772	480	10.2	8.8	15.9	28.0
4/30	0300	104.4	311	181	169	NA	45.4	7.1	9.5	6.5	147	NA	786	501	10.1	8.8	14.8	26.7
4/30	0315	105.2	308	190	179	NA	45.3	7.0	9.5	5.8	144	NA	794	516	10.5	8.9	18.0	23.4
4/30	0330	103.7	309	190	172	NA	44.0	6.9	9.7	6.6	141	NA	771	493	10.4	8.7	19.5	23.5
4/30	0345	104.3	309	186	171	NA	44.4	7.1	9.4	5.9	140	NA	782	511	10.5	8.9	18.0	23.0
4/30	0400	105.9	309	184	171	NA	45.6	6.9	9.4	5.8	143	NA	786	531	10.5	9.0	16.7	21.3
4/30	0415	106.8	308	184	170	NA	45.1	7.1	9.5	6.9	142	NA	782	458	10.4	8.4	23.8	27.5

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/30	0430	105.4	309	182	171	NA	45.4	7.1	9.2	5.4	143	NA	808	522	10.6	8.9	19.1	23.1
4/30	0445	105.6	306	182	170	NA	44.5	7.1	9.8	6.9	147	NA	802	516	10.5	8.9	18.0	24.0
4/30	0500	107.2	306	182	171	NA	45.8	7.1	9.3	5.8	146	NA	775	496	10.4	8.9	16.9	25.2
4/30	0515	107.2	306	181	171	NA	45.7	6.9	9.2	5.7	147	NA	790	492	10.5	8.9	18.0	26.4
4/30	0530	107.8	307	187	176	NA	45.5	6.9	9.4	6.0	146	NA	775	488	10.4	8.9	16.9	26.5
4/30	0545	105.0	307	184	174	NA	46.4	7.2	9.9	6.9	142	NA	786	488	10.4	8.8	18.2	26.6
4/30	0600	106.2	309	181	172	NA	47.3	7.0	9.0	5.6	147	NA	799	492	10.4	8.8	18.2	27.2
4/30	0615	121.6	304	181	171	NA	46.4	7.0	9.3	6.3	152	NA	788	513	10.4	9.3	11.8	27.2
4/30	0630	140.0	297	184	171	NA	46.7	6.7	10.4	5.8	173	NA	831	574	10.8	9.6	12.5	22.3
4/30	0645	141.5	294	185	170	NA	46.3	7.0	10.3	6.8	177	NA	823	573	10.7	9.4	13.8	20.7
4/30	0700	145.1	294	187	170	NA	46.6	7.0	11.2	6.0	184	NA	833	582	10.7	9.4	13.8	20.5
4/30	0715	145.4	294	188	171	NA	46.2	6.6	11.0	6.1	183	NA	830	593	10.7	9.5	12.6	19.5
4/30	0730	145.5	295	188	170	NA	46.5	6.9	39.6	0.1	182	NA	829	593	10.8	9.5	13.7	18.7
4/30	0745	145.7	296	188	170	NA	46.7	7.2	11.2	6.1	184	NA	842	596	10.7	9.5	12.6	20.3
4/30	0800	142.7	296	190	169	NA	45.3	7.0	11.6	7.9	181	NA	839	591	10.6	9.3	14.0	19.7
4/30	0815	145.5	294	186	176	NA	49.9	7.0	10.7	6.7	185	NA	825	610	10.6	9.4	12.8	16.6
4/30	0830	146.3	297	182	172	NA	52.3	6.7	10.6	6.5	189	NA	822	604	10.8	9.5	13.7	16.4
4/30	0845	133.1	299	184	172	NA	51.9	7.2	13.1	6.7	202	NA	856	588	10.3	9.5	8.4	25.4
4/30	0900	146.8	298	182	170	NA	52.6	7.1	10.9	5.5	194	NA	788	566	10.4	9.4	10.6	20.5
4/30	0915	145.5	298	185	165	NA	52.4	6.8	11.8	5.8	190	NA	809	564	10.5	9.3	12.9	21.3
4/30	0930	145.4	301	182	157	NA	50.2	7.1	10.5	5.7	190	NA	807	559	10.6	9.3	14.0	21.1
4/30	0945	145.2	302	195	170	NA	40.1	7.1	15.8	5.6	185	NA	809	584	10.6	9.3	14.0	17.6
4/30	1000	146.5	301	199	174	NA	45.6	7.3	12.2	7.0	188	NA	812	613	10.7	9.4	13.8	14.1
4/30	1015	145.4	301	200	176	NA	45.2	7.1	12.6	6.2	186	NA	803	596	10.6	9.4	12.8	16.3
4/30	1030	145.3	302	209	190	NA	44.4	6.9	13.1	6.3	187	NA	803	591	10.7	9.3	15.1	15.2
4/30	1045	145.5	302	198	160	NA	44.9	7.1	13.7	6.8	184	NA	813	601	10.7	9.4	13.8	15.9
4/30	1100	145.6	302	198	158	NA	44.8	7.0	14.1	6.7	185	NA	804	591	10.7	9.4	13.8	16.4
4/30	1115	145.5	301	198	173	NA	47.1	6.8	13.3	7.6	186	NA	793	606	10.7	9.3	15.1	12.0
4/30	1130	145.6	303	200	170	NA	44.3	7.1	14.0	7.6	183	NA	817	622	10.8	9.5	13.7	13.4
4/30	1145	145.7	305	201	170	NA	45.0	6.6	13.7	6.9	181	NA	818	632	10.9	9.6	13.5	12.3
4/30	1200	143.0	305	202	170	NA	42.5	7.1	14.0	14.0	175	NA	831	642	11.0	9.7	13.4	12.3
4/30	1215	140.0	305	202	170	NA	42.5	7.0	15.3	12.8	178	NA	827	635	10.8	9.5	13.7	12.7
4/30	1230	137.5	305	199	172	NA	45.5	7.3	13.5	14.2	174	NA	815	617	10.7	9.5	12.6	14.7
4/30	1245	145.0	304	199	172	NA	45.8	6.5	13.5	12.7	177	NA	827	602	10.9	9.5	14.7	16.5
4/30	1300	141.0	306	201	182	NA	45.3	6.5	13.2	12.9	175	NA	849	624	11.0	9.6	14.6	15.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/30	1315	140.4	308	198	172	NA	44.7	7.0	14.0	14.7	174	NA	813	605	10.7	9.6	11.5	17.0
4/30	1330	145.5	305	197	171	NA	46.3	6.9	13.8	13.7	177	NA	825	602	10.9	9.5	14.7	16.3
4/30	1345	145.8	305	198	170	NA	45.5	6.7	14.1	13.8	178	NA	822	618	10.9	9.6	13.5	14.6
4/30	1400	145.2	305	197	170	NA	45.2	7.1	15.0	14.2	177	NA	829	602	10.9	9.5	14.7	16.6
4/30	1415	139.9	306	198	170	NA	44.9	7.0	14.6	12.9	174	NA	821	606	10.8	9.5	13.7	16.1
4/30	1430	139.5	305	198	170	NA	44.4	7.1	15.3	13.3	175	NA	807	594	10.8	9.7	11.3	18.0
4/30	1445	135.0	308	197	171	NA	44.9	6.7	13.9	13.8	168	NA	806	586	10.8	9.4	14.9	16.4
4/30	1500	134.7	307	200	184	NA	44.4	7.0	14.5	13.9	167	NA	800	620	10.6	9.5	11.6	13.5
4/30	1515	135.8	307	192	176	NA	49.4	6.9	12.8	13.8	171	NA	801	576	10.6	9.4	12.8	18.9
4/30	1530	135.6	309	190	171	NA	50.3	7.3	12.4	13.4	171	NA	788	574	10.7	9.4	13.8	17.1
4/30	1545	139.6	308	191	170	NA	49.7	7.1	11.8	11.0	171	NA	791	570	10.8	9.4	14.9	17.3
4/30	1600	135.6	309	193	171	NA	49.6	7.4	11.4	11.2	172	NA	796	581	10.7	9.5	12.6	17.8
4/30	1615	145.5	305	193	170	NA	49.3	7.2	13.8	11.1	181	NA	796	583	10.8	9.5	13.7	16.7
4/30	1630	142.5	305	194	170	NA	48.4	6.5	13.8	10.8	178	NA	793	587	10.7	9.6	11.5	17.5
4/30	1645	138.3	306	192	171	NA	49.1	7.0	12.5	24.6	175	NA	799	581	10.9	9.5	14.7	16.5
4/30	1700	137.5	308	193	171	NA	48.5	6.9	12.1	10.1	175	NA	792	558	10.7	9.4	13.8	19.8
4/30	1715	139.7	306	192	169	NA	48.9	7.1	12.5	12.3	172	NA	802	565	10.9	9.4	16.0	18.3
4/30	1730	140.9	303	198	162	NA	46.6	6.9	12.0	8.9	175	NA	774	557	10.6	9.3	14.0	18.0
4/30	1745	135.9	306	190	154	NA	48.1	7.4	12.0	7.5	169	NA	805	552	10.9	9.3	17.2	19.6
4/30	1800	137.3	306	189	155	NA	48.5	7.2	12.2	7.0	170	NA	813	563	10.9	9.5	14.7	20.5
4/30	1815	138.8	304	197	173	NA	44.9	6.7	13.9	6.5	174	NA	797	566	10.8	9.4	14.9	18.4
4/30	1830	142.0	302	193	175	NA	49.0	7.2	13.5	7.1	179	NA	785	580	10.6	9.3	14.0	15.7
4/30	1845	145.5	303	191	170	NA	49.3	7.0	13.6	6.2	183	NA	777	575	10.6	9.5	11.6	17.4
4/30	1900	142.8	302	192	168	NA	48.3	6.9	13.9	6.8	186	NA	761	542	10.5	9.1	15.4	17.8
4/30	1915	142.3	302	193	170	NA	47.9	6.6	14.6	7.1	188	NA	774	556	10.7	8.5	25.9	9.6
4/30	1930	137.3	305	193	171	NA	47.7	6.8	12.4	10.3	175	NA	803	597	10.8	9.7	11.3	17.2
4/30	1945	135.8	305	193	171	NA	48.4	7.4	12.0	8.3	174	NA	799	565	10.8	9.3	16.1	17.9
4/30	2000	140.2	304	192	170	NA	47.9	7.0	12.9	8.8	177	NA	787	561	10.6	9.4	12.8	19.7
4/30	2015	136.7	303	191	171	NA	48.6	7.3	11.3	8.0	173	NA	782	572	10.5	9.4	11.7	18.3
4/30	2030	139.8	303	190	170	NA	47.9	7.2	12.1	6.8	174	NA	791	571	10.8	9.4	14.9	17.1
4/30	2045	140.8	303	190	168	NA	48.2	6.6	12.8	6.6	180	NA	789	576	10.6	9.5	11.6	18.6
4/30	2100	140.5	301	197	182	NA	48.1	6.8	11.7	5.5	178	NA	789	555	10.6	9.3	14.0	19.9
4/30	2115	144.8	301	190	172	NA	48.6	7.0	12.5	6.2	184	NA	789	547	10.6	9.3	14.0	21.0
4/30	2130	140.8	302	190	171	NA	48.2	6.9	12.3	6.0	181	NA	814	564	11.1	9.2	20.7	16.5
4/30	2145	140.4	302	190	171	NA	48.5	7.0	12.7	6.2	183	NA	807	541	10.8	9.1	18.7	20.4

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
4/30	2200	140.7	299	188	170	NA	48.6	6.9	12.6	5.9	181	NA	797	541	10.9	9.1	19.8	18.6
4/30	2215	145.0	299	189	171	NA	49.5	6.8	12.8	6.1	188	NA	799	554	10.9	9.3	17.2	18.8
4/30	2230	144.8	298	188	171	NA	49.9	6.7	12.6	6.0	188	NA	819	562	11.0	9.3	18.3	18.7
4/30	2245	142.0	299	188	179	NA	49.9	7.1	11.1	5.4	183	NA	796	546	10.9	9.3	17.2	19.6
4/30	2300	135.7	300	187	160	NA	49.7	6.6	10.5	5.5	176	NA	796	546	10.9	9.3	17.2	19.6
4/30	2315	140.4	302	194	174	NA	48.6	7.1	12.1	6.5	180	NA	796	546	10.9	9.5	14.7	21.3
4/30	2330	136.0	300	191	171	NA	47.6	6.9	11.1	5.9	173	NA	820	577	11.1	9.4	18.1	16.9
4/30	2345	135.8	302	192	171	NA	47.8	7.0	12.4	6.7	176	NA	813	574	11.0	9.3	18.3	16.4
5/1	0000	135.6	301	192	170	NA	47.0	6.9	12.1	7.1	174	NA	818	568	11.0	9.3	18.3	17.9
5/1	0015	136.0	299	191	170	NA	47.2	7.1	12.2	7.6	177	NA	826	567	11.1	9.2	20.7	17.1
5/1	0030	109.8	306	189	169	NA	46.5	6.7	10.3	6.7	153	NA	794	547	10.6	9.1	16.5	19.8
5/1	0045	108.5	310	189	171	NA	46.1	7.1	10.3	7.4	152	NA	785	519	10.5	8.9	18.0	21.9
5/1	0100	105.2	310	187	173	NA	48.7	7.2	9.6	8.3	150	NA	773	499	10.6	8.8	20.5	22.2
5/1	0115	105.9	312	185	171	NA	49.2	6.7	9.5	7.2	150	NA	765	501	10.4	9.0	15.6	24.4
5/1	0130	105.5	312	185	170	NA	47.9	5.9	9.7	7.3	148	NA	766	496	10.5	8.9	18.0	23.6
5/1	0145	105.1	311	186	171	NA	48.1	5.1	10.1	9.3	150	NA	746	473	10.3	8.8	17.0	25.7
5/1	0200	104.6	311	186	171	NA	48.5	4.9	10.0	7.0	146	NA	760	476	10.4	8.8	18.2	25.9
5/1	0215	104.5	310	191	176	NA	48.2	4.3	9.2	6.3	145	NA	765	490	10.4	8.8	18.2	24.3
5/1	0230	105.1	308	186	169	NA	46.3	4.1	9.8	5.5	146	NA	760	500	10.5	8.9	18.0	22.4
5/3	1400	140.3	303	192	177	NA	48.9	6.6	10.0	99.1	170	NA	797	713	10.1	9.5	6.3	4.9
5/3	1515	140.8	303	200	185	NA	46.0	7.4	10.3	3.1	165	NA	813	642	10.8	9.7	11.3	12.0
5/3	1530	136.2	303	192	177	NA	47.6	7.2	10.1	3.2	162	NA	809	628	10.8	9.7	11.3	13.5
5/3	1545	136.0	305	191	176	NA	48.2	6.9	10.2	3.4	161	NA	805	615	10.9	9.6	13.5	13.2
5/3	1600	139.5	305	191	175	NA	47.9	7.0	37.2	0.1	166	NA	807	616	10.8	9.6	12.5	14.0
5/3	1615	142.2	303	191	176	NA	47.7	7.2	9.9	3.6	169	NA	807	616	10.8	9.6	12.5	14.1
5/3	1630	143.7	303	191	175	NA	48.2	6.9	10.5	3.5	176	NA	799	615	10.6	9.5	11.6	14.0
5/3	1645	144.3	303	194	176	NA	48.2	7.4	8.0	3.8	180	NA	787	593	10.4	9.3	11.8	15.8
5/3	1700	141.3	302	199	179	NA	48.4	7.2	10.9	3.7	176	NA	791	590	10.7	9.2	16.3	13.2
5/3	1715	140.5	302	196	176	NA	49.5	6.6	9.7	3.2	173	NA	795	590	10.6	9.4	12.8	16.3
5/3	1730	142.0	303	189	171	NA	48.1	7.0	10.0	3.3	173	NA	802	595	10.7	9.5	12.6	16.3
5/3	1745	144.8	302	190	170	NA	48.0	6.9	10.1	3.5	175	NA	802	604	10.6	9.6	10.4	16.8
5/3	1800	142.4	304	188	169	NA	48.4	7.1	10.0	3.4	175	NA	802	600	10.6	9.6	10.4	17.5
5/3	1815	141.2	302	190	170	NA	48.2	6.9	10.2	3.4	176	NA	806	586	10.6	9.3	14.0	17.2
5/3	1830	143.4	300	189	170	NA	48.1	7.0	10.0	3.7	178	NA	779	588	10.4	9.2	13.0	14.6
5/3	1845	144.1	299	190	169	NA	47.9	6.9	10.1	3.7	184	NA	771	567	10.4	9.2	13.0	16.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

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5/3	1900	145.3	300	193	170	NA	47.7	7.4	10.3	4.0	184	NA	775	578	10.4	9.2	13.0	15.7
5/3	1915	145.3	301	194	173	NA	48.7	6.8	11.1	4.3	181	NA	777	574	10.4	9.2	13.0	16.4
5/3	1930	145.6	300	200	179	NA	48.3	6.9	10.3	3.9	183	NA	784	576	10.5	9.3	12.9	17.0
5/3	1945	144.9	299	193	171	NA	47.8	7.0	10.1	3.7	183	NA	797	586	10.5	9.4	11.7	17.8
5/3	2000	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2015	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2030	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2045	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2100	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2115	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2130	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2145	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2200	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2215	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2230	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2245	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2300	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2315	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2330	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/3	2345	143.9	300	191	171	NA	47.6	7.3	10.2	3.4	179	NA	806	594	10.5	9.4	11.7	17.7
5/4	0000	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0015	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0030	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0045	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0100	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0115	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0130	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0145	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0200	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0215	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0230	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0245	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0300	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0315	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0330	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/4	0345	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0400	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0415	108.7	301	197	167	NA	40.0	7.1	10.2	3.1	133	NA	824	593	10.1	9.1	11.0	20.1
5/4	0430	109.8	301	206	190	NA	39.6	7.0	10.5	3.0	136	NA	826	592	10.2	9.0	13.3	18.7
5/4	0445	106.7	300	194	165	NA	39.5	7.5	10.1	3.0	134	NA	815	580	9.9	8.9	11.2	20.8
5/4	0500	107.8	305	192	182	NA	46.7	7.0	10.1	3.2	137	NA	814	598	10.0	8.9	12.4	17.4
5/4	0515	107.5	302	180	169	NA	47.3	7.3	9.6	3.1	133	NA	830	566	10.0	8.8	13.6	22.6
5/4	0530	109.6	303	177	165	NA	47.7	6.7	9.4	2.8	138	NA	818	567	9.9	9.1	8.8	24.6
5/4	0545	108.0	302	185	171	NA	47.7	6.8	9.9	3.8	135	NA	824	572	10.1	9.1	11.0	23.1
5/4	0600	116.5	301	187	173	NA	48.0	7.5	9.6	3.9	140	NA	824	581	10.0	9.3	7.5	24.3
5/4	0615	126.9	301	181	168	NA	47.7	7.2	9.5	3.4	149	NA	832	613	10.1	9.5	6.3	21.7
5/4	0630	137.7	298	183	167	NA	49.7	7.0	10.1	3.9	167	NA	851	620	10.6	9.4	12.8	17.8
5/4	0645	136.9	295	184	165	NA	48.6	7.0	10.6	4.1	172	NA	838	589	10.2	9.1	12.1	21.2
5/4	0700	142.5	295	184	165	NA	48.7	7.5	9.8	3.5	174	NA	840	605	10.4	9.3	11.8	19.4
5/4	0715	145.8	295	185	166	NA	49.8	6.6	10.1	4.0	181	NA	839	611	10.2	9.4	8.5	21.0
5/4	0730	145.2	295	186	165	NA	49.0	7.1	10.1	4.0	179	NA	852	619	10.4	9.5	9.5	20.5
5/4	0745	145.1	295	186	165	NA	49.0	6.9	10.0	3.5	179	NA	846	623	10.5	9.5	10.5	18.5
5/4	0800	145.5	296	189	166	NA	49.0	7.3	10.6	4.1	182	NA	850	620	10.4	9.4	10.6	19.3
5/4	0815	145.8	296	188	167	NA	49.7	6.7	10.2	4.0	181	NA	851	620	10.4	9.5	9.5	20.3
5/4	0830	146.0	295	194	175	NA	49.7	7.1	10.0	3.7	181	NA	863	658	10.5	9.4	11.7	14.8
5/4	0845	145.5	295	189	164	NA	49.4	6.5	10.1	3.6	181	NA	861	647	10.5	9.4	11.7	16.1
5/4	0900	145.8	295	188	165	NA	49.0	7.0	10.4	3.8	183	NA	861	668	10.5	9.5	10.5	14.2
5/4	0915	145.3	298	189	164	NA	48.9	6.9	10.5	4.1	183	NA	900	637	10.6	9.4	12.8	20.2
5/4	0930	145.5	296	188	165	NA	48.7	6.8	10.7	3.7	180	NA	874	657	10.5	9.5	10.5	16.9
5/4	0945	145.6	296	188	164	NA	48.6	7.0	10.5	3.4	180	NA	873	650	10.5	9.6	9.4	18.5
5/4	1000	145.8	296	186	168	NA	50.6	6.6	10.4	3.9	178	NA	873	656	10.5	9.4	11.7	16.1
5/4	1015	145.5	296	193	165	NA	48.7	7.0	10.3	3.7	180	NA	872	671	10.5	9.6	9.4	15.9
5/4	1030	145.3	297	194	165	NA	48.6	7.2	10.3	3.4	179	NA	871	664	10.6	9.6	10.4	15.8
5/4	1045	145.5	297	193	165	NA	48.7	7.1	10.3	3.4	180	NA	878	648	10.6	9.6	10.4	18.6
5/4	1100	143.5	298	190	168	NA	50.0	7.0	10.0	3.4	176	NA	865	649	10.6	9.5	11.6	16.2
5/4	1115	146.0	298	184	168	NA	53.1	7.1	10.0	3.6	180	NA	859	628	10.5	9.5	10.5	19.2
5/4	1130	145.8	298	186	168	NA	52.9	7.2	10.3	3.6	180	NA	859	620	10.6	9.5	11.6	19.4
5/4	1145	146.1	297	199	185	NA	48.9	7.2	10.5	3.9	185	NA	844	653	10.3	9.3	10.8	14.3
5/4	1200	143.3	298	188	166	NA	50.1	7.4	10.0	3.4	179	NA	852	637	10.5	9.4	11.7	16.5
5/4	1215	143.2	298	186	165	NA	51.0	7.3	10.1	3.4	183	NA	846	614	10.3	9.3	10.8	19.7

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/4	1230	141.0	299	187	165	NA	50.2	7.4	10.1	3.2	176	NA	829	608	10.3	9.3	10.8	18.7
5/4	1245	145.6	298	189	166	NA	49.6	7.0	10.3	3.7	185	NA	831	613	10.4	9.5	9.5	19.3
5/4	1300	140.4	298	188	165	NA	48.9	7.3	9.9	3.3	177	NA	826	611	10.2	9.3	9.7	19.0
5/4	1315	141.0	298	189	160	NA	46.8	7.3	10.2	3.2	178	NA	809	594	10.3	9.3	10.8	18.7
5/4	1330	141.0	297	194	164	NA	45.3	6.8	11.3	3.9	175	NA	816	632	10.3	9.5	8.4	16.1
5/4	1345	141.1	297	193	172	NA	48.2	7.1	10.6	3.8	179	NA	803	606	10.2	9.3	9.7	17.2
5/4	1400	140.7	299	179	163	NA	55.9	7.1	9.4	2.9	177	NA	825	583	10.4	9.3	11.8	21.0
5/4	1415	138.6	300	179	163	NA	50.1	7.3	9.6	3.0	174	NA	818	555	10.4	9.2	13.0	23.4
5/4	1430	139.8	298	199	183	NA	47.9	6.8	10.3	3.3	175	NA	814	615	10.4	9.4	10.6	16.4
5/4	1445	140.3	299	201	185	NA	48.0	6.6	10.4	3.5	174	NA	820	614	10.4	9.4	10.6	17.1
5/4	1500	137.1	301	196	178	NA	46.2	6.9	10.5	3.5	172	NA	815	626	10.4	9.3	11.8	14.1
5/4	1515	141.1	300	186	159	NA	50.8	6.8	10.2	3.4	178	NA	800	587	10.4	9.4	10.6	18.8
5/4	1530	138.5	299	182	146	NA	40.1	7.7	10.1	3.3	175	NA	793	523	10.4	9.3	11.8	26.3
5/4	1545	139.3	300	186	166	NA	40.4	7.6	10.2	3.2	176	NA	773	584	10.2	9.3	9.7	17.1
5/4	1600	138.9	300	182	162	NA	42.5	7.4	10.2	3.4	176	NA	787	564	10.3	9.4	9.6	21.5
5/4	1615	145.6	298	183	161	NA	43.2	7.5	10.0	3.6	186	NA	782	545	10.4	9.2	13.0	21.2
5/4	1630	144.3	298	180	162	NA	44.4	7.3	9.7	3.6	183	NA	771	553	10.3	9.3	10.8	20.6
5/4	1645	145.4	298	188	173	NA	44.4	7.1	9.9	3.8	184	NA	771	548	10.3	9.3	10.8	21.3
5/4	1700	145.6	297	186	171	NA	44.8	7.6	9.5	3.6	183	NA	775	555	10.3	9.4	9.6	21.6
5/4	1715	146.8	298	183	160	NA	42.8	7.5	10.0	3.7	187	NA	782	570	10.5	9.4	11.7	18.5
5/4	1730	147.4	297	180	160	NA	43.9	7.3	9.6	3.5	186	NA	760	537	10.2	9.2	10.9	21.8
5/4	1745	147.5	298	180	162	NA	45.6	6.7	9.5	3.8	189	NA	762	552	10.2	9.2	10.9	19.7
5/4	1800	147.5	298	177	160	NA	44.6	6.9	9.5	3.2	186	NA	772	540	10.3	9.3	10.8	22.6
5/4	1815	144.1	299	175	158	NA	45.2	6.7	10.1	3.4	178	NA	767	553	10.2	9.4	8.5	21.8
5/4	1830	146.2	300	178	162	NA	45.9	6.9	9.4	3.7	186	NA	767	536	10.3	9.2	12.0	21.7
5/4	1845	147.7	300	177	160	NA	46.2	6.8	9.2	3.5	192	NA	767	517	10.0	9.1	9.9	25.9
5/4	1900	147.2	298	179	159	NA	45.7	7.0	9.7	3.6	196	NA	759	515	10.0	9.0	11.1	24.6
5/4	1915	144.4	298	179	157	NA	44.4	6.9	9.5	3.6	189	NA	741	518	10.0	9.0	11.1	22.4
5/4	1930	140.4	299	184	149	NA	44.8	6.8	9.3	3.8	182	NA	758	527	10.1	9.2	9.8	23.7
5/4	1945	139.5	297	185	162	NA	42.3	7.0	9.2	3.4	178	NA	770	552	10.2	9.2	10.9	20.6
5/4	2000	141.1	299	184	161	NA	41.5	7.8	9.5	3.2	182	NA	760	550	10.2	9.3	9.7	20.6
5/4	2015	141.9	299	181	162	NA	43.5	7.6	9.3	3.2	182	NA	777	545	10.3	9.2	12.0	21.5
5/4	2030	142.6	298	179	161	NA	44.5	7.3	9.4	3.4	185	NA	772	540	10.3	9.3	10.8	22.5
5/4	2045	145.1	298	179	160	NA	44.4	7.5	9.3	3.3	185	NA	777	552	10.2	9.4	8.5	23.0
5/4	2100	146.7	298	178	160	NA	44.5	7.2	9.5	3.7	187	NA	777	549	10.2	9.3	9.7	22.6

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/4	2115	146.9	298	179	159	NA	44.0	7.1	9.3	3.4	186	NA	777	532	10.2	8.9	14.6	21.5
5/4	2130	139.3	298	178	159	NA	43.3	6.8	9.2	3.4	179	NA	777	565	10.7	9.2	16.3	15.4
5/4	2145	137.5	299	185	164	NA	39.9	7.2	9.8	3.6	179	NA	830	563	10.5	9.2	14.1	22.6
5/4	2200	137.0	298	192	170	NA	39.8	6.9	9.4	3.3	176	NA	819	563	10.5	9.1	15.4	20.7
5/4	2215	138.3	298	187	162	NA	39.9	7.3	9.5	3.6	178	NA	821	582	10.6	9.1	16.5	17.5
5/4	2230	139.0	296	183	159	NA	40.4	6.9	9.4	3.5	181	NA	804	565	10.4	9.0	15.6	18.9
5/4	2245	141.9	297	185	161	NA	40.8	6.7	9.9	3.7	186	NA	813	567	10.4	9.1	14.3	20.3
5/4	2300	137.9	298	183	161	NA	41.1	7.3	9.5	3.4	180	NA	812	567	10.5	9.1	15.4	19.4
5/4	2315	143.1	298	182	161	NA	42.1	6.9	9.5	4.2	181	NA	812	536	10.5	9.1	15.4	23.8
5/4	2330	137.6	296	181	160	NA	42.1	6.6	9.2	3.6	179	NA	807	548	10.3	8.9	15.7	21.4
5/4	2345	136.7	298	182	160	NA	41.5	7.0	9.4	3.7	180	NA	805	544	10.2	9.0	13.3	23.4
5/5	0000	136.6	299	183	161	NA	41.4	7.0	9.4	3.7	179	NA	826	562	10.5	9.1	15.4	21.5
5/5	0015	143.6	298	185	163	NA	40.4	7.0	10.0	3.6	181	NA	815	555	10.4	9.1	14.3	22.1
5/5	0030	146.6	297	193	172	NA	40.9	7.1	10.5	4.4	188	NA	817	564	10.5	9.2	14.1	21.2
5/5	0045	144.4	298	187	166	NA	40.8	6.9	10.1	3.5	187	NA	822	573	10.4	9.2	13.0	21.2
5/5	0100	140.4	297	180	161	NA	42.1	7.0	9.6	3.6	185	NA	821	567	10.3	9.2	12.0	22.6
5/5	0115	121.8	298	175	159	NA	40.3	7.0	9.5	3.0	161	NA	820	537	10.2	9.0	13.3	25.8
5/5	0130	107.2	301	180	157	NA	40.5	7.4	9.3	3.3	152	NA	798	494	10.1	8.8	14.8	29.0
5/5	0145	106.6	304	177	161	NA	37.6	7.0	8.9	2.7	148	NA	797	481	10.0	8.7	14.9	30.7
5/5	0200	107.9	305	176	160	NA	38.9	6.8	8.9	2.9	146	NA	802	501	9.9	8.7	13.8	28.9
5/5	0215	111.1	305	174	160	NA	39.0	7.0	9.0	3.4	148	NA	806	494	10.2	8.8	15.9	29.0
5/5	0230	114.7	303	174	161	NA	40.1	7.0	8.9	2.8	150	NA	804	506	10.3	8.8	17.0	26.3
5/5	0245	113.2	303	174	160	NA	40.2	7.1	9.0	3.6	148	NA	806	487	10.1	8.7	16.1	29.8
5/5	0300	111.1	303	174	160	NA	39.4	7.0	9.0	3.1	151	NA	780	495	10.0	8.7	14.9	27.1
5/5	0315	109.1	302	176	161	NA	38.2	6.9	9.0	3.4	147	NA	788	506	9.9	8.8	12.5	27.8
5/5	0330	109.2	300	182	166	NA	37.8	7.2	9.1	3.6	148	NA	779	510	10.0	8.9	12.4	26.5
5/5	0345	109.2	300	179	162	NA	38.0	6.8	9.0	2.7	146	NA	789	505	9.9	8.7	13.8	27.1
5/5	0400	106.2	304	172	155	NA	40.1	6.8	9.1	2.7	146	NA	774	495	9.8	8.8	11.4	28.8
5/5	0415	108.8	304	172	156	NA	39.7	7.4	8.9	3.1	149	NA	769	494	9.8	8.8	11.4	28.5
5/5	0430	108.9	304	173	155	NA	39.8	7.2	8.9	3.4	148	NA	778	495	9.9	8.7	13.8	27.6
5/5	0445	112.9	302	173	155	NA	39.2	6.9	9.3	3.2	147	NA	790	502	10.1	8.9	13.5	27.9
5/5	0500	115.0	303	177	155	NA	38.8	7.3	9.1	3.5	151	NA	782	503	10.0	8.8	13.6	26.9
5/5	0515	115.1	302	175	157	NA	40.7	7.0	9.2	3.6	152	NA	780	513	9.9	8.8	12.5	26.1
5/5	0530	114.7	301	170	157	NA	41.6	7.3	9.4	3.7	151	NA	798	512	10.3	8.9	15.7	25.7
5/5	0545	108.3	301	173	134	NA	36.7	6.9	10.2	4.4	143	NA	788	477	10.1	8.9	13.5	31.4

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Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/5	0600	111.6	300	184	160	NA	35.2	7.3	9.0	3.3	144	NA	792	527	10.2	8.8	15.9	23.0
5/5	0615	111.2	298	191	166	NA	34.7	7.1	9.1	3.5	146	NA	791	546	10.2	8.8	15.9	19.9
5/5	0630	130.1	298	190	164	NA	36.3	7.0	9.4	3.0	156	NA	812	600	10.5	9.2	14.1	15.6
5/5	0645	140.4	293	184	155	NA	37.4	7.2	9.8	3.6	174	NA	809	599	10.3	9.2	12.0	17.0
5/5	0700	148.1	294	182	157	NA	41.6	7.1	10.3	4.3	189	NA	805	608	10.3	9.3	10.8	16.4
5/5	0715	147.5	295	179	156	NA	42.8	7.3	9.9	3.7	190	NA	815	584	10.5	9.1	15.4	17.4
5/5	0730	147.5	295	179	155	NA	42.8	7.0	9.9	3.6	188	NA	800	591	10.4	9.3	11.8	17.3
5/5	0745	147.0	296	180	155	NA	42.9	7.2	9.8	3.8	189	NA	805	588	10.4	9.3	11.8	18.3
5/5	0800	147.7	297	181	154	NA	41.6	7.4	9.8	3.6	188	NA	810	586	10.5	9.3	12.9	18.3
5/5	0815	147.0	296	179	159	NA	43.8	7.0	36.9	0.1	187	NA	816	586	10.4	9.3	11.8	19.7
5/5	0830	147.4	297	174	155	NA	45.7	6.7	9.4	3.9	187	NA	816	586	10.4	9.3	11.8	19.7
5/5	0845	147.5	298	175	155	NA	45.0	7.3	9.6	3.5	188	NA	816	586	10.4	9.3	11.8	19.7
5/5	0900	146.8	299	177	155	NA	45.2	6.8	9.6	3.9	189	NA	816	586	10.4	9.3	11.8	19.7
5/5	0915	147.7	300	185	162	NA	40.3	5.7	10.3	3.7	187	NA	816	586	10.4	9.3	11.8	19.7
5/5	0930	146.7	298	193	178	NA	39.8	7.9	10.0	3.9	187	NA	816	586	10.4	9.3	11.8	19.7
5/5	0945	147.7	297	191	157	NA	40.1	7.7	10.0	3.9	187	NA	816	586	10.4	9.3	11.8	19.7
5/5	1000	147.5	297	194	157	NA	36.4	7.8	11.0	4.3	187	NA	816	586	10.4	9.3	11.8	19.7
5/5	1015	146.6	298	190	156	NA	38.6	7.6	10.3	3.8	185	NA	816	586	10.4	9.3	11.8	19.7
5/5	1030	147.8	300	184	157	NA	42.3	7.7	10.1	3.6	189	NA	816	586	10.4	9.3	11.8	19.7
5/5	1045	147.6	299	182	156	NA	42.2	7.7	9.8	3.6	183	NA	816	586	10.4	9.3	11.8	19.7
5/5	1100	147.0	299	181	157	NA	44.5	7.5	9.8	3.3	189	NA	816	586	10.4	9.3	11.8	19.7
5/5	1115	146.8	300	180	155	NA	44.5	7.4	9.5	3.1	187	NA	816	586	10.4	9.3	11.8	19.7
5/5	1130	147.8	302	184	155	NA	40.5	7.0	10.4	3.5	190	NA	816	586	10.4	9.3	11.8	19.7
5/5	1145	147.5	301	208	194	NA	34.8	6.8	11.7	4.6	189	NA	816	586	10.4	9.3	11.8	19.7
5/5	1200	145.8	300	210	195	NA	35.2	7.3	13.6	6.1	189	NA	800	638	10.4	9.1	14.3	8.9
5/5	1215	147.1	300	203	182	NA	35.0	7.0	13.1	5.8	187	NA	807	635	10.5	9.2	14.1	10.2
5/5	1230	147.2	301	192	161	NA	40.4	7.3	11.8	4.6	187	NA	816	606	10.7	9.3	15.1	14.5
5/5	1245	147.9	302	191	156	NA	40.2	7.0	12.2	4.5	191	NA	815	603	10.6	9.3	14.0	15.6
5/5	1300	147.9	302	190	157	NA	41.4	7.1	11.0	4.2	190	NA	815	611	10.5	9.2	14.1	14.5
5/5	1315	147.9	303	189	155	NA	41.8	6.9	11.1	4.0	191	NA	817	610	10.6	9.3	14.0	14.9
5/5	1330	147.8	303	188	156	NA	42.5	7.1	11.2	4.7	193	NA	801	594	10.5	9.2	14.1	15.3
5/5	1345	147.7	302	190	155	NA	42.6	8.0	10.8	4.4	191	NA	794	587	10.4	9.2	13.0	16.4
5/5	1400	147.7	302	186	154	NA	41.4	8.1	10.9	4.1	191	NA	799	589	10.4	9.2	13.0	16.7
5/5	1415	147.1	302	190	157	NA	41.5	8.2	11.5	4.6	193	NA	792	591	10.4	9.2	13.0	15.7
5/5	1430	147.4	302	183	157	NA	43.9	8.0	10.2	4.1	190	NA	781	583	10.3	9.2	12.0	16.5

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SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

		Boller	B Duct	C Avg	C Low	ID Fan	Lime	Slurry	B Duct	Stack	FG	FG	SO2	SO2	CO2	CO2	CO2	SO2
Date	Time	Load	Temp	Temp	Temp	Out Temp	Flow	Solids	Opacity	Opacity	Flow In	Flow Out	In	Out	In	Out	Dilution	Red
MW	°F	°F	°F	°F	°F	gpm	%	%	%	%	KSCFM	KSCFM	ppm	ppm	%	%	%	%
5/5	1445	147.5	300	180	157	NA	45.6	7.8	9.7	3.5	195	NA	762	558	10.1	9.2	9.8	19.6
5/5	1500	142.1	299	183	158	NA	40.0	8.0	10.3	4.0	190	NA	751	560	10.0	9.2	8.7	19.0
5/5	1515	142.4	297	194	178	NA	40.1	7.9	9.9	3.8	187	NA	753	566	10.1	9.1	11.0	16.6
5/5	1530	137.8	297	194	170	NA	39.8	8.0	9.8	3.5	179	NA	769	567	10.2	9.2	10.9	18.4
5/5	1545	137.7	299	189	155	NA	39.1	7.7	10.0	4.0	179	NA	772	583	10.1	9.4	7.4	18.8
5/5	1600	136.7	300	187	156	NA	39.5	8.1	10.1	3.8	179	NA	764	574	10.0	9.2	8.7	18.3
5/5	1615	144.7	298	185	156	NA	41.6	7.8	10.4	3.9	187	NA	761	572	10.1	9.2	9.8	17.5
5/5	1630	146.5	298	195	167	NA	34.6	8.2	11.7	4.9	189	NA	769	580	10.2	9.4	8.5	18.1
5/5	1645	147.7	299	202	182	NA	35.0	8.3	13.6	5.6	189	NA	771	628	10.1	9.3	9.6	11.5
5/5	1700	147.6	300	205	186	NA	34.7	8.0	15.4	6.7	192	NA	759	626	10.0	9.2	8.7	10.4
5/5	1715	147.0	300	194	169	NA	40.1	8.1	13.6	5.7	193	NA	750	586	9.9	9.3	6.5	16.8
5/7	1645	143.0	301	200	186	NA	43.3	10.1	17.4	9.5	188	NA	748	652	9.9	9.3	6.5	7.3
5/7	1700	142.3	302	194	175	NA	45.0	10.9	14.2	8.0	188	NA	755	611	10.1	9.4	7.4	13.1
5/7	1715	145.5	302	194	176	NA	45.2	10.2	15.9	9.3	192	NA	748	608	10.0	9.4	6.4	13.6
5/7	1730	145.8	302	198	175	NA	43.0	10.4	15.1	8.2	191	NA	747	595	10.0	9.3	7.5	14.3
5/7	1745	145.8	301	207	178	NA	43.1	10.2	17.4	10.0	190	NA	749	614	10.1	9.4	7.4	11.9
5/7	1800	135.7	303	197	176	NA	42.4	10.1	19.7	9.5	178	NA	742	607	9.9	9.3	6.5	12.9
5/7	1815	135.6	303	197	175	NA	41.6	10.0	18.7	9.7	177	NA	746	604	9.9	9.4	5.3	14.7
5/7	1830	137.6	303	194	174	NA	44.0	10.0	17.6	9.6	179	NA	750	594	10.0	9.4	6.4	15.7
5/7	1845	137.5	303	192	171	NA	44.3	10.1	18.2	9.0	179	NA	756	596	10.0	9.4	6.4	16.1
5/7	1900	135.9	303	191	171	NA	44.0	10.0	19.8	9.3	177	NA	755	592	9.9	9.4	5.3	17.5
5/7	1915	135.5	302	191	170	NA	43.6	10.1	18.9	9.5	178	NA	769	592	10.0	9.4	6.4	18.1
5/7	1930	136.1	302	190	170	NA	44.5	9.9	17.4	9.2	177	NA	763	583	10.0	9.4	6.4	18.7
5/7	1945	135.9	301	190	171	NA	44.1	10.1	17.8	8.6	178	NA	770	588	9.9	9.4	5.3	19.5
5/7	2000	138.1	301	189	170	NA	44.5	9.8	19.4	10.0	180	NA	782	588	10.0	9.4	6.4	20.0
5/7	2015	139.5	299	186	172	NA	45.2	10.0	18.1	9.7	184	NA	785	593	10.0	9.5	5.3	20.4
5/7	2030	143.1	299	187	171	NA	45.7	10.0	20.2	9.9	188	NA	780	585	9.9	9.4	5.3	21.0
5/7	2045	145.8	297	187	173	NA	46.6	10.1	15.8	9.6	194	NA	775	583	9.7	9.3	4.3	21.6
5/7	2100	145.8	296	194	172	NA	47.0	9.8	15.8	9.2	194	NA	775	581	9.7	9.2	5.4	21.0
5/7	2115	145.9	297	183	168	NA	49.1	10.3	16.0	8.5	194	NA	775	561	9.7	8.9	9.0	21.2
5/7	2130	143.6	296	181	166	NA	49.7	10.3	14.6	7.3	196	NA	848	587	10.5	9.1	15.4	20.1
5/7	2145	143.5	296	182	166	NA	49.2	9.8	16.3	6.8	197	NA	863	591	10.5	9.2	14.1	21.8
5/7	2200	143.4	295	180	164	NA	48.1	10.1	14.4	7.6	194	NA	871	585	10.5	9.1	15.4	22.5
5/7	2215	145.5	295	182	166	NA	48.6	9.8	16.8	8.8	199	NA	878	600	10.6	9.1	16.5	20.4
5/7	2230	145.8	294	190	170	NA	48.9	9.9	16.9	8.8	202	NA	867	584	10.4	8.9	16.9	21.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/7	2245	145.1	293	186	169	NA	48.7	10.1	14.5	8.1	200	NA	874	591	10.4	9.0	15.6	21.9
5/7	2300	145.7	292	177	162	NA	50.6	9.7	12.7	7.7	200	NA	872	591	10.3	9.0	14.4	22.5
5/7	2315	145.9	293	176	160	NA	49.9	10.0	13.9	7.4	203	NA	872	554	10.3	8.6	19.8	24.0
5/7	2330	141.7	292	176	160	NA	50.1	9.9	13.2	7.9	203	NA	857	591	10.1	8.9	13.5	21.7
5/7	2345	139.3	290	175	160	NA	49.6	10.2	12.4	6.4	197	NA	885	571	10.4	8.8	18.2	23.8
5/8	0000	134.0	291	173	160	NA	49.2	10.1	10.7	5.2	185	NA	891	577	10.4	9.0	15.6	25.2
5/8	0015	114.1	294	169	159	NA	48.7	9.8	9.6	4.4	171	NA	892	518	10.2	8.6	18.6	31.1
5/8	0030	109.6	297	170	159	NA	47.2	9.8	9.2	4.3	165	NA	862	506	10.1	8.6	17.4	31.0
5/8	0045	108.9	297	172	162	NA	47.2	9.8	9.9	4.6	162	NA	871	516	10.1	8.6	17.4	30.4
5/8	0100	110.2	297	177	167	NA	47.1	10.1	10.2	4.9	163	NA	842	502	9.8	8.6	14.0	32.0
5/8	0115	110.3	295	182	168	NA	47.1	9.9	10.2	5.1	161	NA	874	510	10.0	8.7	14.9	33.0
5/8	0130	108.0	296	174	160	NA	45.5	9.9	10.1	4.0	159	NA	875	522	10.1	8.8	14.8	31.5
5/8	0145	107.9	298	174	161	NA	46.6	10.1	10.1	3.9	160	NA	868	506	10.0	8.6	16.3	32.2
5/8	0200	108.0	298	174	160	NA	46.7	10.2	9.8	3.9	157	NA	873	520	10.1	9.1	11.0	33.8
5/8	0215	105.3	296	171	161	NA	47.0	9.7	9.3	3.5	155	NA	896	507	10.1	8.7	16.1	34.3
5/8	0230	106.7	295	179	163	NA	47.2	10.0	9.1	4.1	156	NA	876	493	10.1	8.6	17.4	33.9
5/8	0245	106.7	297	177	161	NA	47.8	10.2	9.0	4.3	153	NA	876	495	10.0	8.6	16.3	34.2
5/8	0300	105.6	297	173	158	NA	45.9	9.7	9.2	3.1	155	NA	883	509	10.0	8.6	16.3	33.0
5/8	0315	107.7	296	172	159	NA	45.8	9.8	9.2	3.8	155	NA	865	507	9.8	8.6	14.0	33.3
5/8	0330	105.9	294	173	159	NA	45.1	10.2	9.3	3.9	154	NA	867	509	10.0	8.6	16.3	31.8
5/8	0345	107.2	295	174	160	NA	44.8	10.0	9.4	4.1	153	NA	878	523	10.0	8.7	14.9	31.5
5/8	0400	107.4	295	175	161	NA	45.0	10.2	9.2	4.1	156	NA	831	522	10.0	8.6	16.3	31.1
5/8	0415	105.9	297	175	161	NA	45.2	9.8	9.2	4.3	153	NA	866	512	9.9	8.6	15.1	32.0
5/8	0430	106.6	297	174	159	NA	45.5	10.2	9.3	4.3	153	NA	855	508	9.8	8.6	14.0	32.3
5/8	0445	108.9	295	182	158	NA	45.3	9.8	9.2	4.7	153	NA	867	517	9.9	8.7	13.8	32.1
5/8	0500	110.1	294	177	166	NA	45.1	10.2	9.2	4.7	153	NA	869	522	9.8	8.7	12.6	32.3
5/8	0515	107.1	294	176	156	NA	43.6	9.9	9.5	4.5	152	NA	870	527	9.8	8.6	14.0	31.0
5/8	0530	108.8	295	178	161	NA	44.2	10.2	9.8	4.4	152	NA	861	541	9.8	8.6	14.0	28.4
5/8	0545	108.1	296	177	160	NA	44.0	10.0	9.8	4.4	152	NA	862	557	9.8	8.6	14.0	26.4
5/8	0600	106.5	296	178	160	NA	44.1	9.9	9.9	4.6	152	NA	854	544	9.7	8.5	14.1	27.4
5/8	0615	107.4	296	177	160	NA	43.8	10.1	9.8	4.6	151	NA	870	551	9.8	8.7	12.6	28.7
5/8	0630	108.9	296	183	163	NA	43.9	9.7	10.0	4.8	153	NA	851	559	9.8	8.8	11.4	26.9
5/8	0645	110.0	296	187	165	NA	43.9	9.4	10.0	5.1	152	NA	853	554	9.7	8.8	10.2	28.4
5/8	0700	108.1	296	178	159	NA	44.0	10.0	10.0	4.9	151	NA	858	554	9.6	8.7	10.3	28.7
5/8	0715	112.7	295	179	160	NA	43.0	10.1	10.7	4.8	153	NA	849	563	9.9	8.8	12.5	25.5

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/8	0730	128.5	294	181	163	NA	45.2	10.2	12.0	5.3	164	NA	883	589	10.2	9.1	12.1	25.2
5/8	0745	137.8	291	182	160	NA	45.3	9.6	12.7	5.8	175	NA	914	628	10.5	9.4	11.7	23.3
5/8	0800	137.6	292	182	161	NA	45.9	10.1	14.0	6.2	180	NA	898	620	10.2	9.3	9.7	24.3
5/8	0815	143.5	292	182	163	NA	49.5	9.6	14.3	7.4	193	NA	878	621	10.3	9.2	12.0	20.8
5/8	0830	142.4	294	180	161	NA	50.2	10.1	13.9	6.1	192	NA	882	616	10.2	9.2	10.9	22.6
5/8	0845	135.9	294	177	159	NA	49.3	9.7	12.0	5.6	187	NA	882	597	10.0	9.0	11.1	24.7
5/8	0900	143.7	295	180	163	NA	50.5	9.8	13.0	5.9	195	NA	895	601	10.1	9.0	12.2	24.7
5/8	0915	147.8	296	179	160	NA	52.0	9.8	13.9	7.0	199	NA	888	606	10.2	9.2	10.9	24.3
5/8	0930	147.3	296	191	167	NA	52.0	9.9	13.3	7.9	200	NA	903	614	10.3	9.2	12.0	23.9
5/8	0945	147.8	299	185	160	NA	49.7	9.8	15.1	7.3	199	NA	908	631	10.3	9.2	12.0	22.1
5/8	1000	147.7	299	184	161	NA	50.4	10.0	15.0	6.8	198	NA	916	648	10.4	9.4	10.6	21.8
5/8	1015	147.6	300	182	160	NA	51.0	9.9	14.8	6.2	198	NA	922	627	10.4	9.3	11.8	24.0
5/8	1030	147.6	300	182	161	NA	52.2	10.0	14.4	6.9	200	NA	908	627	10.3	9.3	10.8	23.5
5/8	1045	146.5	299	181	160	NA	52.0	9.9	13.9	6.3	198	NA	912	614	10.3	9.3	10.8	25.3
5/8	1100	147.7	300	181	161	NA	52.5	10.1	14.4	6.0	199	NA	918	633	10.3	9.4	9.6	24.4
5/8	1115	147.5	301	182	160	NA	51.5	10.2	13.4	6.4	198	NA	927	632	10.3	9.3	10.8	24.5
5/8	1130	147.5	300	183	160	NA	51.6	9.9	15.0	7.0	199	NA	912	632	10.3	9.3	10.8	23.3
5/8	1145	147.5	301	184	160	NA	52.0	10.0	16.3	7.0	200	NA	904	631	10.3	9.3	10.8	22.7
5/8	1200	147.1	301	184	158	NA	52.2	9.9	12.8	6.0	197	NA	908	621	10.3	9.3	10.8	24.3
5/8	1215	146.9	301	192	154	NA	50.0	9.8	15.9	7.1	198	NA	911	627	10.4	9.3	11.8	23.0
5/8	1230	147.4	300	189	155	NA	47.6	10.2	19.5	8.5	197	NA	915	640	10.4	9.4	10.6	22.6
5/8	1245	147.8	300	193	159	NA	47.0	9.8	22.7	10.5	197	NA	901	653	10.3	9.3	10.8	19.8
5/8	1300	146.9	300	192	164	NA	49.1	10.1	20.2	10.0	198	NA	907	650	10.2	9.2	10.9	20.6
5/8	1315	147.8	301	188	162	NA	53.3	9.9	17.2	7.8	202	NA	897	631	10.2	9.2	10.9	21.9
5/8	1330	146.6	302	185	161	NA	54.5	10.1	16.3	6.8	204	NA	887	608	10.1	9.1	11.0	23.9
5/8	1345	143.7	302	182	160	NA	53.8	9.9	12.9	5.2	194	NA	901	590	10.2	9.0	13.3	25.7
5/8	1400	144.3	301	182	160	NA	53.2	10.0	12.7	5.2	189	NA	913	616	10.4	9.3	11.8	24.5
5/8	1415	147.3	302	183	161	NA	54.7	9.9	13.7	5.5	198	NA	906	607	10.4	9.3	11.8	25.1
5/8	1430	147.7	303	181	161	NA	55.4	10.0	13.6	5.6	199	NA	888	600	10.2	9.2	10.9	25.1
5/8	1445	146.1	303	179	157	NA	51.9	10.2	13.1	5.3	199	NA	890	580	10.2	9.3	9.7	28.6
5/8	1500	144.7	302	182	159	NA	48.9	10.0	14.1	5.8	194	NA	890	609	10.2	9.3	9.7	24.9
5/8	1515	147.0	303	185	161	NA	48.7	10.1	14.6	6.2	193	NA	907	625	10.4	9.4	10.6	23.8
5/8	1530	143.3	302	186	163	NA	52.2	10.1	14.2	6.0	189	NA	904	628	10.3	9.3	10.8	23.0
5/8	1545	145.0	303	185	162	NA	54.1	10.0	14.9	6.5	195	NA	886	605	10.2	9.2	10.9	24.3
5/8	1600	143.6	303	182	160	NA	55.1	10.3	13.6	5.7	194	NA	874	584	10.1	9.1	11.0	25.8

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Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/8	1615	143.9	303	182	163	NA	55.1	10.0	13.1	5.5	192	NA	880	609	10.1	9.3	8.6	24.8
5/8	1630	143.8	304	178	162	NA	57.5	9.6	12.3	4.7	191	NA	898	587	10.3	9.3	10.8	27.6
5/8	1645	145.9	304	178	161	NA	57.7	10.2	35.4	0.2	194	NA	892	584	10.3	9.3	10.8	27.5
5/8	1700	146.0	305	179	160	NA	57.5	9.9	11.5	4.6	194	NA	883	582	10.2	9.2	10.9	26.9
5/8	1715	146.5	304	178	159	NA	56.9	10.0	11.6	4.6	194	NA	885	576	10.2	9.3	9.7	28.6
5/8	1730	143.7	305	181	161	NA	56.4	10.0	11.2	4.7	192	NA	881	579	10.2	9.1	12.1	26.3
5/8	1745	141.5	304	178	160	NA	57.5	10.1	10.7	4.1	189	NA	886	565	10.2	9.2	10.9	29.2
5/8	1800	141.8	303	176	159	NA	56.2	10.1	10.5	4.1	188	NA	883	555	10.1	9.2	9.8	31.0
5/8	1815	137.9	302	192	174	NA	47.9	9.9	12.3	5.4	182	NA	877	598	10.0	9.1	9.9	25.1
5/8	1830	136.8	302	188	166	NA	50.0	10.1	12.7	5.1	180	NA	886	595	10.2	9.2	10.9	25.6
5/8	1845	136.7	302	184	161	NA	50.8	10.2	12.7	5.1	182	NA	880	586	10.0	9.2	8.7	27.7
5/8	1900	137.4	301	184	161	NA	50.9	9.9	13.0	5.0	181	NA	890	590	10.1	9.2	9.8	27.2
5/8	1915	137.8	300	182	161	NA	51.4	10.0	11.9	4.8	181	NA	884	571	10.1	9.1	11.0	28.4
5/8	1930	137.8	301	182	161	NA	53.3	10.1	12.0	5.1	187	NA	880	630	10.1	9.2	9.8	21.4
5/8	1945	138.2	301	182	160	NA	52.3	10.1	11.8	4.7	184	NA	880	614	10.0	9.2	8.7	24.1
5/8	2000	138.6	300	181	160	NA	53.0	10.0	11.4	4.5	184	NA	880	605	10.1	9.0	12.2	22.9
5/8	2015	142.2	299	181	160	NA	53.3	9.7	11.6	5.1	188	NA	887	607	10.2	9.2	10.9	24.1
5/8	2030	147.6	300	183	161	NA	55.5	9.8	12.5	5.7	199	NA	867	608	10.1	9.2	9.8	23.1
5/8	2045	147.3	300	186	155	NA	55.7	10.1	13.1	5.6	200	NA	879	591	10.1	9.1	11.0	25.3
5/8	2100	145.5	300	190	155	NA	50.3	10.1	19.8	9.7	201	NA	879	588	10.1	9.1	11.0	25.8
5/8	2115	147.7	300	192	160	NA	50.9	10.1	19.7	10.2	200	NA	879	599	10.1	8.7	16.1	20.9
5/8	2130	146.7	299	190	161	NA	51.1	9.9	17.2	7.7	196	NA	897	616	10.4	9.0	15.6	20.6
5/8	2145	147.9	300	188	161	NA	53.3	10.0	16.1	7.7	201	NA	899	621	10.4	9.1	14.3	21.1
5/8	2200	146.8	299	188	160	NA	53.4	10.1	16.7	7.7	202	NA	882	616	10.1	9.1	11.0	22.5
5/8	2215	141.8	299	185	158	NA	53.5	10.3	12.2	5.7	195	NA	883	591	10.1	9.0	12.2	24.9
5/8	2230	137.9	298	184	155	NA	51.8	9.9	11.4	4.9	184	NA	893	588	10.3	9.1	13.2	25.5
5/8	2245	137.2	298	186	160	NA	49.6	9.9	13.0	5.9	186	NA	897	630	10.2	9.2	10.9	22.1
5/8	2300	136.7	299	185	161	NA	50.6	10.2	12.2	4.9	184	NA	892	630	10.2	9.2	10.9	21.8
5/8	2315	123.5	299	181	159	NA	49.6	10.0	10.7	4.1	173	NA	893	529	10.2	8.4	21.4	28.0
5/8	2330	108.2	302	177	158	NA	47.9	10.6	9.5	3.2	155	NA	880	529	10.2	8.8	15.9	30.4
5/8	2345	109.3	301	177	160	NA	47.9	9.8	9.4	3.3	153	NA	899	539	10.2	8.9	14.6	31.3
5/9	0000	106.2	300	176	160	NA	48.3	9.8	9.3	3.6	150	NA	895	525	10.2	8.8	15.9	32.0
5/9	0015	107.9	299	180	165	NA	48.1	9.7	9.0	3.7	151	NA	890	517	10.2	8.8	15.9	32.7
5/9	0030	105.8	299	176	158	NA	47.2	9.7	8.8	3.7	147	NA	882	504	10.2	8.8	15.9	33.8
5/9	0045	106.0	299	175	157	NA	43.3	9.8	8.8	3.8	150	NA	872	506	10.0	8.8	13.6	34.1

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/9	0100	105.9	300	178	161	NA	43.7	10.2	9.4	3.4	151	NA	878	517	10.1	8.7	16.1	31.7
5/9	0115	107.3	298	176	160	NA	43.5	10.0	9.3	3.8	148	NA	877	513	10.2	8.8	15.9	32.2
5/9	0130	106.0	300	177	160	NA	43.4	10.0	9.4	3.9	147	NA	872	518	10.1	8.8	14.8	31.8
5/9	0145	108.2	301	178	161	NA	43.6	9.8	9.5	3.1	148	NA	870	510	10.1	8.8	14.8	32.7
5/9	0200	106.2	301	178	160	NA	44.2	10.0	9.4	3.0	148	NA	891	522	10.2	8.8	15.9	32.1
5/9	0215	108.0	298	176	159	NA	42.6	9.9	9.4	3.7	147	NA	876	513	10.1	8.8	14.8	32.7
5/9	0230	110.5	297	178	161	NA	43.0	10.0	9.4	3.7	147	NA	882	523	10.2	9.0	13.3	32.8
5/9	0245	108.9	297	178	160	NA	43.3	10.2	9.3	3.8	146	NA	879	515	10.2	8.8	15.9	32.1
5/9	0300	107.7	296	177	161	NA	43.5	10.2	9.3	3.9	149	NA	880	523	10.2	8.9	14.6	31.9
5/9	0315	105.8	297	176	160	NA	43.5	9.7	9.2	4.0	146	NA	860	507	10.0	8.8	13.6	33.0
5/9	0330	105.2	298	176	161	NA	44.3	9.8	8.9	4.1	144	NA	856	503	10.0	8.7	14.9	32.5
5/9	0345	104.8	296	176	159	NA	43.2	10.1	9.0	4.2	144	NA	859	497	10.0	8.8	13.6	34.2
5/9	0400	104.5	296	176	160	NA	42.7	10.2	9.0	4.2	143	NA	855	498	9.9	8.7	13.8	33.7
5/9	0415	105.2	295	176	161	NA	43.2	10.2	9.0	4.4	144	NA	844	486	9.9	8.6	15.1	33.7
5/9	0430	104.4	294	180	160	NA	45.2	9.9	8.9	4.6	144	NA	838	478	9.9	8.6	15.1	34.3
5/9	0445	105.4	294	172	147	NA	42.8	10.3	8.9	4.1	143	NA	845	469	9.9	8.6	15.1	36.2
5/9	0500	105.2	293	178	157	NA	40.0	10.1	9.4	4.4	142	NA	837	511	9.9	8.6	15.1	29.6
5/9	0515	105.0	295	178	158	NA	36.1	10.0	9.2	4.6	144	NA	837	501	9.8	8.6	14.0	31.8
5/9	0530	104.5	296	178	161	NA	38.4	10.0	9.3	4.8	143	NA	833	520	9.8	8.7	12.6	29.7
5/9	0545	105.1	294	174	160	NA	38.8	9.9	9.1	4.4	140	NA	852	529	10.0	8.7	14.9	28.6
5/9	0600	104.7	294	173	160	NA	38.6	9.8	9.1	4.6	141	NA	854	538	10.0	8.7	14.9	27.6
5/9	0615	104.9	294	173	160	NA	38.6	10.0	9.0	4.6	139	NA	858	535	10.0	8.7	14.9	28.3
5/9	0630	105.3	294	172	160	NA	38.7	9.8	9.0	4.6	138	NA	849	527	10.1	8.8	14.8	28.8
5/9	0645	104.5	294	172	160	NA	38.2	10.0	8.9	4.5	136	NA	867	523	10.1	8.8	14.8	30.7
5/9	0700	109.1	293	173	161	NA	38.8	10.0	9.3	4.8	143	NA	811	496	9.6	8.5	12.9	31.0
5/9	0715	109.1	292	173	160	NA	37.8	9.9	9.2	4.9	139	NA	818	535	9.9	8.9	11.2	27.2
5/9	0730	112.9	293	175	160	NA	38.2	10.0	9.2	4.7	140	NA	869	537	10.3	8.8	17.0	27.7
5/9	0745	110.1	294	175	160	NA	38.2	10.0	9.6	4.8	141	NA	865	537	10.2	8.8	15.9	28.0
5/9	0800	108.6	295	176	161	NA	38.3	10.1	9.3	4.5	140	NA	858	519	10.2	8.7	17.2	29.1
5/9	0815	111.0	295	176	162	NA	40.1	9.8	9.4	4.8	143	NA	862	549	10.0	8.8	13.6	27.6
5/9	0830	111.4	295	173	160	NA	40.8	10.0	9.2	4.9	144	NA	857	532	10.0	8.9	12.4	30.2
5/9	0845	108.1	297	173	160	NA	40.6	9.7	9.1	4.7	143	NA	853	513	10.0	8.7	14.9	30.9
5/9	0900	108.5	296	173	161	NA	40.9	9.9	9.3	4.7	142	NA	859	523	10.1	8.9	13.5	31.0
5/9	0915	109.6	297	173	161	NA	41.2	9.9	9.4	4.8	144	NA	849	500	10.1	8.7	16.1	31.7
5/9	0930	108.4	298	172	160	NA	41.5	10.0	9.3	4.8	139	NA	856	479	10.2	8.5	20.0	32.9

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/9	0945	106.2	298	185	169	NA	34.2	9.8	10.5	5.1	139	NA	840	573	10.0	8.7	14.9	21.7
5/9	1000	109.5	297	196	180	NA	34.9	10.0	12.3	4.9	139	NA	852	576	10.1	8.8	14.8	22.5
5/9	1015	110.5	299	178	162	NA	40.0	9.9	10.5	4.7	140	NA	852	529	10.0	8.8	13.6	29.5
5/9	1030	114.8	300	178	161	NA	39.6	10.0	10.5	4.8	144	NA	837	513	10.0	8.8	13.6	30.4
5/9	1045	128.5	298	181	162	NA	41.1	9.9	11.4	5.1	156	NA	862	557	10.3	8.9	15.7	25.2
5/9	1100	134.7	298	182	161	NA	41.8	10.0	13.0	5.3	167	NA	879	587	10.3	9.1	13.2	24.5
5/9	1115	144.7	297	186	162	NA	43.0	10.1	15.8	6.8	184	NA	880	591	10.5	9.2	14.1	23.3
5/9	1130	144.3	299	187	162	NA	44.8	9.8	16.9	8.8	195	NA	859	571	10.4	9.0	15.6	23.1
5/9	1145	145.6	301	186	161	NA	45.4	10.3	17.2	7.6	193	NA	862	564	10.3	9.0	14.4	25.2
5/9	1200	145.9	302	187	161	NA	46.1	10.1	17.8	8.5	197	NA	867	577	10.4	9.0	15.6	23.2
5/9	1215	145.6	303	187	160	NA	45.6	10.0	18.4	9.1	195	NA	851	569	10.3	9.0	14.4	23.5
5/9	1230	144.6	303	186	161	NA	47.2	10.1	16.6	7.4	193	NA	848	559	10.3	9.1	13.2	25.4
5/9	1245	144.4	302	184	159	NA	45.4	10.1	16.8	7.5	191	NA	864	546	10.5	9.0	16.7	26.4
5/9	1300	144.3	303	186	160	NA	44.9	10.1	19.4	8.4	192	NA	863	567	10.4	9.2	13.0	25.8
5/9	1315	142.8	303	185	160	NA	45.4	10.2	17.8	7.5	188	NA	866	558	10.5	9.1	15.4	25.6
5/9	1330	138.1	302	184	159	NA	44.4	10.2	17.2	7.1	184	NA	858	551	10.4	9.1	14.3	26.6
5/9	1345	137.7	302	182	161	NA	45.0	10.1	14.0	5.5	179	NA	863	552	10.5	9.2	14.1	27.0
5/9	1400	138.0	303	181	161	NA	46.1	10.1	14.9	5.8	185	NA	860	553	10.5	9.1	15.4	25.8
5/9	1415	137.0	303	179	161	NA	46.4	9.8	12.5	4.8	176	NA	864	557	10.5	9.3	12.9	27.2
5/9	1430	140.7	304	179	161	NA	47.1	10.2	14.0	5.4	184	NA	873	555	10.6	9.2	15.2	26.8
5/9	1445	139.2	303	184	158	NA	47.0	10.1	12.4	5.0	184	NA	867	560	10.5	9.1	15.4	25.5
5/9	1500	138.4	303	181	151	NA	46.8	10.3	13.2	4.9	184	NA	856	553	10.4	9.2	13.0	27.0
5/9	1515	140.9	304	185	161	NA	44.6	10.3	17.2	7.6	189	NA	852	575	10.5	9.1	15.4	22.1
5/9	1530	141.8	304	183	161	NA	45.6	10.0	15.5	6.6	185	NA	841	561	10.5	9.1	15.4	23.0
5/9	1545	143.7	303	182	160	NA	45.6	10.1	16.0	6.0	185	NA	847	563	10.5	9.2	14.1	24.2
5/9	1600	145.5	305	184	164	NA	46.5	9.9	19.8	8.4	192	NA	849	564	10.5	9.2	14.1	24.2
5/9	1615	146.1	306	192	173	NA	46.5	10.2	19.5	9.3	196	NA	834	561	10.4	9.0	15.6	22.2
5/9	1630	146.9	307	187	162	NA	46.4	9.7	23.4	10.5	195	NA	838	567	10.4	9.2	13.0	23.5
5/9	1645	147.7	307	186	160	NA	46.4	10.0	22.5	11.0	196	NA	838	562	10.3	9.2	12.0	24.9
5/9	1700	147.4	308	186	161	NA	47.1	9.7	21.2	9.3	198	NA	846	556	10.4	9.1	14.3	25.0
5/9	1715	146.1	308	186	160	NA	47.5	10.0	24.1	12.0	196	NA	844	548	10.5	9.1	15.4	25.2
5/9	1730	145.0	306	185	159	NA	46.7	9.8	20.5	9.8	193	NA	824	545	10.2	9.2	10.9	26.8
5/9	1745	143.1	305	184	160	NA	46.0	10.0	17.8	8.4	191	NA	840	559	10.4	9.3	11.8	25.6
5/9	1800	143.1	305	184	160	NA	46.3	10.0	18.3	9.3	193	NA	841	544	10.3	9.0	14.4	26.0
5/9	1815	141.4	305	183	160	NA	46.1	9.9	16.5	7.0	186	NA	841	543	10.3	9.2	12.0	27.7

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/9	1830	138.7	304	182	160	NA	45.3	9.9	15.1	6.2	184	NA	853	542	10.3	9.2	12.0	28.9
5/9	1845	138.7	304	182	161	NA	45.0	10.2	12.9	5.5	182	NA	856	535	10.4	9.1	14.3	28.7
5/9	1900	138.2	303	186	152	NA	45.3	10.2	14.8	5.5	181	NA	850	526	10.3	9.1	13.2	29.9
5/9	1915	138.1	304	182	150	NA	41.0	9.8	17.5	6.6	179	NA	853	539	10.3	9.2	12.0	29.3
5/9	1930	137.6	301	188	163	NA	44.1	10.3	17.6	8.8	181	NA	853	604	10.5	9.1	15.4	18.2
5/9	1945	137.1	301	182	160	NA	44.3	9.8	15.4	6.6	184	NA	856	555	10.4	9.2	13.0	26.7
5/9	2000	136.1	300	180	160	NA	44.0	9.9	14.3	5.9	183	NA	857	567	10.4	8.9	16.9	22.8
5/9	2015	137.1	300	180	161	NA	44.3	10.2	13.6	6.1	184	NA	842	553	10.3	9.0	14.4	24.7
5/9	2030	138.8	298	179	160	NA	45.1	9.7	13.9	5.4	186	NA	848	550	10.4	9.1	14.3	25.9
5/9	2045	141.4	299	180	161	NA	45.4	9.9	15.3	6.3	193	NA	829	557	10.2	9.1	12.1	24.7
5/9	2100	142.4	298	179	160	NA	44.9	10.0	15.1	6.0	191	NA	829	542	10.2	9.0	13.3	26.0
5/9	2115	141.8	298	181	160	NA	45.3	10.0	14.5	6.6	193	NA	829	525	10.2	8.6	18.6	24.9
5/9	2130	140.3	297	179	159	NA	44.2	9.8	13.4	5.6	187	NA	847	530	10.5	9.1	15.4	27.9
5/9	2145	145.0	296	181	160	NA	43.2	10.0	15.3	5.8	191	NA	863	542	10.6	9.1	16.5	26.9
5/9	2200	147.4	296	185	161	NA	44.4	9.9	18.3	8.4	199	NA	862	550	10.5	9.1	15.4	26.4
5/9	2215	147.1	296	181	158	NA	48.6	8.1	12.6	6.5	202	NA	854	536	10.4	9.2	13.0	29.0
5/9	2230	143.9	295	188	157	NA	41.6	7.3	13.8	5.2	193	NA	852	553	10.6	9.2	15.2	25.2
5/9	2245	137.9	294	185	159	NA	40.9	6.3	15.0	7.1	189	NA	856	578	10.4	9.2	13.0	23.7
5/9	2300	136.6	294	182	161	NA	41.2	5.5	12.9	5.1	181	NA	855	578	10.4	9.2	13.0	23.7
5/9	2315	146.7	293	183	162	NA	41.6	4.7	15.5	6.3	192	NA	855	545	10.4	8.8	18.2	24.7
5/9	2330	129.7	294	177	160	NA	41.7	7.2	10.7	4.1	173	NA	849	552	10.5	8.9	18.0	23.3
5/9	2345	126.7	294	176	159	NA	41.0	8.3	10.4	3.7	171	NA	861	551	10.6	9.1	16.5	25.4
5/10	0000	112.1	296	173	158	NA	40.4	8.8	9.0	3.5	158	NA	840	516	10.3	8.8	17.0	28.1
5/10	0245	115.0	290	188	161	NA	33.3	11.0	11.6	4.3	152	NA	866	547	10.5	8.8	19.3	24.6
5/10	0300	112.8	290	187	163	NA	32.9	10.4	11.1	3.7	153	NA	863	592	10.6	9.1	16.5	20.1
5/10	0315	114.5	289	194	171	NA	33.0	10.0	10.2	3.4	150	NA	851	587	10.4	9.0	15.6	20.4
5/10	0330	113.5	290	186	165	NA	33.6	10.2	10.7	3.6	149	NA	843	589	10.5	9.1	15.4	19.3
5/10	0345	107.4	290	184	161	NA	33.1	9.8	10.4	3.3	148	NA	837	575	10.3	9.0	14.4	21.3
5/10	0400	102.3	295	184	160	NA	32.6	10.5	11.3	3.6	140	NA	790	516	9.8	8.6	14.0	25.6
5/10	0415	102.7	293	184	160	NA	32.4	10.1	11.6	3.9	140	NA	810	527	10.0	8.6	16.3	24.3
5/10	0430	103.6	292	186	160	NA	32.7	9.9	12.9	4.9	142	NA	794	523	10.1	8.7	16.1	23.6
5/10	0445	104.7	292	184	160	NA	33.2	9.9	11.8	4.4	140	NA	812	516	10.0	8.7	14.9	27.0
5/10	0500	104.2	291	185	160	NA	32.9	10.1	12.3	4.5	141	NA	806	518	10.0	8.7	14.9	26.1
5/10	0515	107.7	291	186	160	NA	33.0	9.6	13.2	4.8	144	NA	793	534	9.9	8.6	15.1	22.5
5/10	0530	110.6	289	185	159	NA	34.0	10.4	12.5	5.0	145	NA	803	534	10.1	8.7	16.1	22.9

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/10	0545	113.2	289	194	166	NA	34.2	9.9	12.3	5.4	148	NA	815	539	10.1	8.9	13.5	24.9
5/10	0600	127.9	289	190	163	NA	36.6	9.9	15.7	9.1	167	NA	804	534	10.0	8.9	12.4	25.3
5/10	0615	128.9	289	188	161	NA	35.1	10.2	16.2	6.4	165	NA	830	565	10.3	9.2	12.0	23.8
5/10	0630	138.9	288	190	160	NA	35.6	9.7	19.6	8.9	174	NA	821	558	10.4	9.2	13.0	23.1
5/10	0645	139.9	286	193	160	NA	35.9	10.1	25.6	12.5	183	NA	791	564	10.0	9.1	9.9	21.6
5/10	0700	146.2	287	195	160	NA	36.9	10.0	33.2	14.9	193	NA	798	563	10.1	9.1	11.0	21.6
5/10	0715	144.4	288	192	160	NA	38.0	9.9	21.3	10.7	184	NA	797	544	10.3	9.1	13.2	22.6
5/10	0730	147.2	288	194	160	NA	37.6	10.1	29.1	13.8	191	NA	794	560	10.2	9.2	10.9	21.8
5/10	0745	146.9	289	197	148	NA	37.8	10.1	30.8	14.1	194	NA	803	550	10.1	9.1	11.0	24.0
5/10	0800	142.6	289	191	142	NA	39.2	10.1	23.8	11.6	185	NA	808	544	10.2	9.1	12.1	24.5
5/10	0815	135.7	289	194	149	NA	35.7	9.8	22.8	11.8	177	NA	814	559	10.1	9.1	11.0	23.8
5/10	1215	147.6	305	194	173	NA	44.3	12.0	16.2	7.0	196	NA	793	559	10.6	9.2	15.2	18.8
5/10	1230	146.7	306	193	171	NA	45.1	12.0	15.6	6.7	198	NA	794	557	10.7	9.2	16.3	18.4
5/10	1245	147.6	307	193	170	NA	45.5	11.4	16.0	7.0	198	NA	788	539	10.7	9.0	18.9	18.6
5/10	1300	147.1	306	193	170	NA	45.9	10.5	16.6	6.9	199	NA	788	533	10.7	9.0	18.9	19.5
5/10	1315	146.9	306	192	172	NA	46.7	10.3	16.0	6.8	199	NA	786	526	10.5	9.1	15.4	22.8
5/10	1330	147.2	307	189	173	NA	48.3	10.3	13.2	5.3	199	NA	798	531	10.7	9.0	18.9	21.0
5/10	1345	147.8	307	196	177	NA	44.7	10.1	19.9	8.9	198	NA	789	560	10.6	9.1	16.5	17.4
5/10	1400	147.9	307	189	173	NA	47.9	10.0	14.9	6.1	198	NA	788	527	10.7	9.1	17.6	21.4
5/10	1415	147.9	307	186	170	NA	47.8	9.5	0.0	5.8	199	NA	787	505	10.6	9.1	16.5	25.2
5/10	1430	117.0	307	180	168	NA	49.1	9.9	22.3	10.5	178	NA	787	506	10.6	9.1	16.5	25.1
5/10	1830	148.0	300	188	175	NA	45.6	11.4	10.1	4.2	187	NA	776	542	10.9	9.3	17.2	18.1
5/10	1845	148.0	301	185	171	NA	45.5	11.6	10.0	4.5	189	NA	775	503	10.9	9.2	18.5	23.1
5/10	1900	149.0	300	184	169	NA	45.2	10.9	9.9	4.7	191	NA	766	505	10.9	9.4	16.0	23.6
5/10	1915	147.0	299	184	168	NA	45.4	10.2	9.9	4.3	189	NA	777	492	10.9	9.3	17.2	25.8
5/10	1930	139.0	299	184	165	NA	44.8	10.3	10.4	4.5	191	NA	740	476	10.3	8.7	18.4	23.8
5/10	1945	146.0	297	183	165	NA	44.5	10.4	10.1	4.6	189	NA	763	483	10.5	9.1	15.4	27.0
5/10	2000	147.0	297	186	169	NA	43.9	10.1	10.3	4.6	189	NA	784	540	10.8	9.4	14.9	20.9
5/10	2015	148.0	297	178	165	NA	47.8	10.2	9.6	4.0	191	NA	783	470	10.8	9.2	17.4	29.5
5/10	2030	141.0	297	185	168	NA	44.9	10.2	10.0	4.6	191	NA	732	464	10.2	8.7	17.2	25.7
5/10	2045	146.0	296	180	146	NA	41.4	10.1	10.6	4.5	190	NA	756	464	10.5	8.8	19.3	26.8
5/10	2100	144.0	297	188	152	NA	39.9	10.1	11.6	5.1	192	NA	756	518	10.5	9.1	15.4	20.9
5/10	2115	144.0	298	189	156	NA	40.2	10.2	12.8	5.9	191	NA	756	458	10.5	8.3	26.5	23.4
5/10	2130	138.0	297	190	159	NA	40.2	10.3	17.2	8.0	194	NA	728	470	10.1	8.3	21.7	21.4
5/10	2145	138.0	296	186	157	NA	39.7	9.5	15.4	7.6	191	NA	720	452	10.1	8.4	20.2	24.5

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/10	2200	137.0	293	188	138	NA	39.9	10.2	16.1	7.9	192	NA	721	469	10.1	8.5	18.8	22.7
5/10	2215	145.0	293	192	149	NA	38.8	9.8	8.4	8.6	195	NA	718	493	10.1	8.0	26.3	13.3
5/10	2315	136.0	289	185	160	NA	38.2	9.9	11.3	5.0	173	NA	722	488	10.0	8.7	14.9	22.3
5/10	2330	136.0	289	185	160	NA	37.9	10.1	11.1	4.7	174	NA	766	504	10.6	9.0	17.8	22.5
5/10	2345	144.0	309	186	161	NA	38.0	9.9	11.9	5.2	187	NA	786	511	10.9	9.0	21.1	21.3
5/11	0000	121.0	289	184	159	NA	34.9	10.0	10.2	3.9	140	NA	749	487	10.3	8.4	22.6	20.3
5/11	0015	111.0	286	181	160	NA	34.7	10.1	9.8	3.8	147	NA	709	476	9.9	8.2	20.7	18.9
5/11	0030	109.0	285	179	160	NA	35.9	10.4	8.9	3.2	145	NA	707	432	9.8	8.2	19.5	27.0
5/11	0045	109.0	286	175	160	NA	37.0	10.1	8.8	3.1	143	NA	699	429	9.4	8.2	14.6	29.6
5/11	0100	108.0	286	172	160	NA	36.5	9.9	8.3	3.0	144	NA	715	421	9.9	8.4	17.9	30.6
5/11	0115	107.0	287	172	160	NA	36.5	9.8	9.0	2.8	140	NA	722	421	9.7	8.5	14.1	33.5
5/11	0130	105.0	286	170	160	NA	35.5	10.3	8.9	2.9	142	NA	739	396	10.1	8.3	21.7	34.8
5/11	0145	106.0	286	171	160	NA	36.5	10.0	8.8	2.7	134	NA	737	402	10.1	8.3	21.7	33.6
5/11	0200	109.0	286	171	160	NA	36.9	9.9	8.7	2.6	141	NA	728	414	10.0	8.5	17.6	33.1
5/11	0215	107.0	285	171	160	NA	37.0	9.7	8.7	2.6	140	NA	726	405	9.9	8.3	19.3	33.5
5/11	0230	108.0	284	170	160	NA	36.2	9.9	8.7	2.7	136	NA	736	404	10.1	8.4	20.2	34.0
5/11	0245	109.0	282	175	160	NA	36.1	9.6	8.7	2.9	145	NA	743	399	10.2	8.3	22.9	34.0
5/11	0300	109.0	281	170	156	NA	36.1	9.8	8.7	2.7	135	NA	733	405	10.1	8.4	20.2	33.6
5/11	0315	110.0	280	175	155	NA	36.2	9.8	8.6	3.0	145	NA	750	397	10.2	8.4	21.4	35.7
5/11	0330	110.0	280	179	159	NA	36.2	10.3	8.9	3.2	131	NA	737	380	10.2	8.3	22.9	36.6
5/11	0345	110.0	280	170	160	NA	34.8	10.1	8.9	3.0	137	NA	742	394	10.0	8.3	20.5	36.0
5/11	0400	110.0	282	172	160	NA	33.6	9.8	9.3	3.1	133	NA	731	425	9.9	8.4	17.9	31.5
5/11	0415	110.0	281	172	160	NA	34.1	10.1	9.3	3.2	141	NA	731	423	10.1	8.4	20.2	30.4
5/11	0430	110.0	281	174	160	NA	33.6	10.2	8.9	3.0	146	NA	731	408	10.1	8.2	23.2	31.3
5/11	0445	110.0	280	175	160	NA	33.4	9.7	9.5	3.2	145	NA	731	416	10.1	8.3	21.7	30.7
5/11	0500	110.0	280	174	161	NA	34.1	9.9	9.4	3.2	142	NA	731	419	9.9	8.3	19.3	31.6
5/11	0515	110.0	281	170	160	NA	36.0	10.0	9.3	3.3	144	NA	731	438	9.9	8.3	19.3	28.6
5/11	0530	110.0	280	170	160	NA	36.3	9.8	9.2	3.4	144	NA	731	446	9.9	8.3	19.3	27.2
5/11	0545	110.0	282	170	160	NA	36.3	9.9	9.3	3.5	144	NA	731	433	10.2	8.3	22.9	27.2
5/11	0600	110.0	282	170	160	NA	36.3	10.2	9.3	3.5	144	NA	731	425	10.4	8.3	25.3	27.2
5/11	0615	110.0	282	170	160	NA	36.3	9.9	9.3	3.5	144	NA	731	425	10.4	8.3	25.3	27.2
5/11	0630	146.5	291	179	161	NA	44.2	10.0	11.6	5.0	199	NA	758	487	10.5	8.9	18.0	24.3
5/11	0645	140.8	291	178	161	NA	44.7	9.8	11.8	5.4	200	NA	756	484	10.1	8.9	13.5	27.4
5/11	0700	140.3	291	178	161	NA	44.5	10.0	11.4	5.5	199	NA	735	463	10.0	8.6	16.3	26.7
5/11	0715	146.5	289	191	140	NA	38.9	10.1	12.9	6.1	199	NA	739	497	10.1	8.8	14.8	22.7

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/11	0730	147.7	289	192	169	NA	39.2	9.9	16.0	7.9	199	NA	754	511	10.4	9.0	15.6	21.6
5/11	0745	147.6	290	184	162	NA	41.4	10.2	15.8	7.0	199	NA	760	504	10.4	8.9	16.9	22.5
5/11	0800	145.1	292	184	162	NA	42.7	10.2	15.0	7.5	199	NA	745	511	10.1	8.8	14.8	21.3
5/11	0815	145.6	292	183	161	NA	42.7	9.9	14.4	6.9	199	NA	754	494	10.1	8.8	14.8	24.8
5/11	0830	145.6	292	182	161	NA	43.3	9.8	13.0	6.3	199	NA	746	499	10.2	8.8	15.9	22.5
5/11	0845	147.4	294	182	161	NA	43.9	10.2	14.2	6.0	199	NA	757	492	10.4	8.9	16.9	24.1
5/11	0900	147.6	295	183	159	NA	42.5	9.9	14.6	6.3	198	NA	778	511	10.6	9.1	16.5	23.4
5/11	0915	148.0	295	185	160	NA	42.6	9.8	14.5	6.9	197	NA	766	518	10.5	9.0	16.7	21.1
5/11	0930	146.9	296	185	160	NA	42.5	9.9	15.9	7.1	196	NA	773	513	10.5	8.9	18.0	21.7
5/11	0945	142.0	297	184	161	NA	43.4	9.9	15.1	6.9	197	NA	747	503	10.0	9.0	11.1	25.3
5/11	1000	141.7	296	178	159	NA	41.8	10.2	12.5	5.3	183	NA	785	503	10.6	8.8	20.5	22.8
5/11	1015	141.4	298	184	161	NA	43.4	9.9	14.1	6.5	192	NA	788	527	10.6	8.9	19.1	20.4
5/11	1030	147.6	300	186	162	NA	44.5	9.7	16.1	7.3	198	NA	781	514	10.6	9.0	17.8	22.4
5/11	1045	147.6	302	186	160	NA	44.7	9.9	16.8	7.9	199	NA	775	507	10.5	8.9	18.0	22.8
5/11	1100	147.8	302	188	160	NA	44.4	10.1	18.9	9.6	200	NA	783	518	10.4	8.9	16.9	22.8
5/11	1115	147.7	303	189	163	NA	45.8	10.0	18.8	9.2	201	NA	788	535	10.5	8.9	18.0	19.9
5/11	1130	146.9	304	187	160	NA	44.7	9.7	19.5	9.0	202	NA	803	523	10.4	8.9	16.9	23.8
5/11	1145	147.6	305	195	166	NA	41.5	9.9	21.3	13.0	200	NA	816	539	10.5	8.9	18.0	22.1
5/11	1200	147.9	303	206	174	NA	41.4	9.9	30.3	13.2	199	NA	827	580	10.5	9.0	16.7	18.3
5/11	1215	147.2	304	196	179	NA	45.1	10.0	26.8	13.6	198	NA	836	566	10.4	9.0	15.6	21.8
5/11	1230	146.9	305	183	166	NA	47.8	9.6	18.9	9.1	199	NA	846	562	10.5	9.0	16.7	22.5
5/11	1245	147.8	306	180	161	NA	48.8	9.7	16.1	7.5	200	NA	855	558	10.5	9.0	16.7	23.8
5/11	1300	147.6	306	179	161	NA	49.5	9.9	16.0	7.2	201	NA	864	550	10.5	9.0	16.7	25.7
5/11	1315	147.8	306	178	159	NA	49.6	9.9	15.8	6.9	202	NA	863	547	10.4	8.9	16.9	25.9
5/11	1330	147.6	306	180	159	NA	48.5	10.2	17.3	7.7	201	NA	866	564	10.4	8.9	16.9	23.9
5/11	1345	147.5	306	180	161	NA	48.6	10.0	18.2	8.3	200	NA	878	568	10.4	8.9	16.9	24.4
5/11	1400	148.1	307	179	159	NA	48.5	10.0	16.2	7.1	198	NA	891	581	10.4	9.0	15.6	24.7
5/11	1415	147.8	306	180	159	NA	47.2	10.0	16.3	7.0	194	NA	920	608	10.6	9.1	16.5	23.1
5/11	1430	147.8	307	182	161	NA	47.9	10.3	3.2	8.2	196	NA	930	604	10.5	9.0	16.7	24.3
5/11	1445	147.8	307	181	161	NA	48.8	10.0	3.1	8.4	198	NA	938	616	10.5	9.0	16.7	23.5
5/11	1500	147.1	306	180	161	NA	49.3	10.2	1.3	7.7	201	NA	934	606	10.5	8.9	18.0	23.4
5/11	1515	147.2	308	181	162	NA	49.3	10.0	1.3	9.0	201	NA	931	599	10.4	8.8	18.2	23.9
5/11	1530	147.9	307	187	165	NA	48.2	10.1	3.1	8.6	200	NA	945	614	10.4	8.9	16.9	24.0
5/11	1545	148.0	306	194	147	NA	45.1	10.1	4.6	11.2	199	NA	964	619	10.4	8.9	16.9	24.9
5/11	1600	146.8	306	189	156	NA	44.9	9.8	4.4	14.4	199	NA	960	650	10.2	8.8	15.9	21.6

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/11	1615	147.7	307	190	161	NA	44.3	10.2	5.1	16.4	199	NA	959	673	10.3	8.9	15.7	18.7
5/11	1630	147.8	306	190	162	NA	45.1	10.2	6.7	14.7	199	NA	972	678	10.3	8.9	15.7	19.3
5/11	1645	147.8	306	189	161	NA	45.8	10.1	5.7	16.7	201	NA	973	672	10.0	8.9	12.4	22.4
5/11	1700	147.7	306	188	160	NA	45.8	10.0	3.5	13.8	201	NA	987	671	10.1	8.9	13.5	22.9
5/11	1715	147.7	305	188	160	NA	46.2	10.3	2.6	11.9	199	NA	987	672	10.2	8.9	14.6	22.0
5/11	1730	146.5	305	185	156	NA	47.2	10.0	3.6	10.2	201	NA	983	656	10.2	8.9	14.6	23.5
5/11	1745	147.9	300	182	154	NA	44.7	9.7	2.2	8.3	194	NA	987	647	10.2	8.8	15.9	24.0
5/11	1800	146.5	299	182	155	NA	44.7	9.7	0.6	7.2	193	NA	984	666	10.1	8.8	14.8	22.3
5/11	1815	146.9	301	184	157	NA	45.5	10.1	0.7	8.4	196	NA	1002	672	10.2	8.8	15.9	22.3
5/11	1830	141.0	302	179	157	NA	48.6	10.2	0.7	6.0	195	NA	984	672	9.9	8.6	15.1	21.4
5/11	1845	140.5	300	174	153	NA	45.5	10.0	0.1	4.3	181	NA	1048	666	10.4	9.0	15.6	26.5
5/11	1900	137.4	300	177	155	NA	45.0	9.8	0.0	4.7	183	NA	1019	683	10.1	8.8	14.8	23.1
5/11	1915	137.5	299	175	155	NA	45.0	9.9	0.0	3.9	180	NA	1036	679	10.4	8.9	16.9	23.3
5/11	1930	137.9	298	176	155	NA	44.4	10.0	0.0	4.2	180	NA	1038	695	10.3	8.9	15.7	22.5
5/11	1945	146.2	300	179	157	NA	47.5	9.9	0.8	5.5	194	NA	1058	737	10.4	9.1	14.3	20.4
5/11	2000	143.7	301	173	152	NA	49.6	9.9	0.0	4.5	193	NA	1056	690	10.2	8.9	14.6	25.2
5/11	2015	143.6	300	171	150	NA	49.8	10.1	0.0	3.9	192	NA	1053	670	10.2	8.9	14.6	27.1
5/11	2030	140.4	299	168	149	NA	50.0	9.6	0.0	3.9	185	NA	1048	655	10.2	8.9	14.6	28.4
5/11	2045	141.8	298	169	151	NA	50.3	10.0	0.0	4.3	192	NA	1063	684	10.2	9.0	13.3	27.0
5/11	2100	141.2	297	166	152	NA	50.1	9.7	5.6	4.1	185	NA	1063	664	10.2	8.8	15.9	27.5
5/11	2115	142.5	296	163	151	NA	51.4	10.3	0.0	4.4	186	NA	1063	584	10.2	8.3	22.9	32.5
5/11	2130	141.1	296	163	147	NA	50.0	10.1	0.0	4.6	191	NA	1097	633	10.4	8.6	20.9	30.2
5/11	2145	138.3	296	169	149	NA	45.6	9.9	0.0	4.1	188	NA	1135	684	10.5	8.7	20.7	27.3
5/11	2200	137.5	296	170	152	NA	47.8	9.9	0.0	4.2	186	NA	1143	722	10.5	8.7	20.7	23.7
5/11	2215	146.9	297	170	152	NA	49.1	10.1	0.0	4.6	197	NA	1168	743	10.5	9.0	16.7	25.7
5/11	2230	141.4	298	176	153	NA	48.3	10.3	0.0	5.1	194	NA	1151	743	10.5	8.6	22.1	21.1
5/11	2245	142.0	297	171	150	NA	49.7	9.5	0.0	4.6	198	NA	1177	726	10.3	8.7	18.4	27.0
5/11	2300	138.4	296	170	149	NA	47.0	8.8	5.5	5.0	188	NA	1172	726	10.3	8.7	18.4	26.7
5/11	2315	145.4	296	170	151	NA	48.6	8.6	0.0	5.3	197	NA	1172	693	10.3	8.2	25.6	25.8
5/11	2330	142.1	296	169	149	NA	48.2	8.4	0.0	5.0	190	NA	1197	719	10.4	8.6	20.9	27.3
5/11	2345	146.2	297	175	149	NA	47.1	8.3	0.0	4.3	201	NA	1202	774	10.5	8.7	20.7	22.2
5/12	0000	139.2	296	175	149	NA	46.4	8.4	0.0	4.2	194	NA	1208	767	10.5	8.6	22.1	22.4
5/12	0015	147.7	297	180	149	NA	44.7	7.8	0.0	4.0	202	NA	1225	777	10.7	8.7	23.0	21.9
5/12	0030	147.9	297	182	150	NA	44.9	7.9	0.0	4.7	206	NA	1184	793	10.5	8.8	19.3	20.1
5/12	0045	141.6	298	182	151	NA	46.0	8.2	0.0	4.8	201	NA	1163	831	10.2	8.8	15.9	17.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/12	0100	138.1	295	176	148	NA	44.3	8.0	0.0	3.3	188	NA	1188	776	10.4	8.7	19.5	22.0
5/12	0115	146.4	295	180	149	NA	43.6	8.1	3.5	0.1	200	NA	1157	823	10.2	8.9	14.6	18.5
5/12	0130	142.3	296	183	150	NA	43.8	8.3	0.0	4.2	201	NA	1138	806	10.1	8.9	13.5	19.6
5/12	0145	126.7	295	176	148	NA	42.7	7.8	0.0	3.4	177	NA	1146	778	10.1	8.6	17.4	20.2
5/12	0200	107.1	297	172	146	NA	41.3	8.1	0.0	4.7	162	NA	1113	703	9.7	8.3	16.9	26.2
5/12	0215	109.8	297	173	145	NA	38.8	8.3	0.0	4.6	161	NA	1088	706	9.6	8.2	17.1	24.0
5/12	0230	107.3	295	173	145	NA	39.7	7.8	0.0	4.8	158	NA	1087	700	9.7	8.3	16.9	24.7
5/12	0245	106.8	297	174	144	NA	40.3	8.0	0.0	5.4	165	NA	1101	683	9.7	8.3	16.9	27.5
5/12	0300	106.0	305	179	146	NA	40.5	8.0	0.0	4.4	164	NA	1099	749	9.7	8.3	16.9	20.4
5/12	0315	105.9	307	183	150	NA	40.1	8.0	0.0	4.5	164	NA	1102	749	9.8	8.3	18.1	19.7
5/12	0330	105.9	307	184	151	NA	40.2	8.1	0.0	4.7	163	NA	1082	747	9.7	8.2	18.3	18.4
5/12	0345	106.2	306	184	151	NA	40.2	8.0	0.0	4.8	163	NA	1094	743	9.7	8.2	18.3	19.7
5/12	0400	106.8	303	197	151	NA	34.8	8.1	0.0	5.5	163	NA	1083	761	9.6	8.3	15.7	18.7
5/12	0415	105.3	302	204	148	NA	34.9	7.8	0.0	6.1	160	NA	1076	772	9.6	8.3	15.7	17.0
5/12	0430	105.4	302	182	147	NA	40.0	8.2	0.0	5.1	161	NA	1068	720	9.8	8.4	16.7	21.4
5/12	0445	107.0	304	182	146	NA	40.0	8.0	0.0	4.8	160	NA	1077	720	9.7	8.4	15.5	22.9
5/12	0500	106.8	303	181	146	NA	40.0	7.8	0.0	5.5	161	NA	1068	724	9.8	8.4	16.7	21.0
5/12	0515	107.7	303	182	146	NA	40.0	8.0	0.0	5.5	162	NA	1066	726	9.8	8.4	16.7	20.5
5/12	0530	108.6	305	189	146	NA	36.9	8.1	0.5	5.6	162	NA	1064	770	9.8	8.5	15.3	16.6
5/12	0545	126.5	295	186	146	NA	37.0	8.1	0.0	5.8	169	NA	1094	749	10.1	8.5	18.8	18.7
5/12	0600	134.9	290	185	147	NA	37.2	8.1	0.0	5.5	173	NA	1100	786	10.1	8.8	14.8	17.9
5/12	0615	142.0	290	192	147	NA	37.3	8.0	1.0	9.2	195	NA	1089	807	10.3	8.8	17.0	13.2
5/12	0630	146.2	291	191	147	NA	36.8	8.3	1.5	7.6	193	NA	1072	805	10.2	8.9	14.6	14.0
5/12	0645	147.5	292	195	147	NA	37.2	7.8	2.8	10.3	199	NA	1082	803	10.2	8.8	15.9	14.0
5/12	0700	147.2	292	195	147	NA	37.1	7.9	1.1	11.6	199	NA	1061	796	10.1	8.8	14.8	13.9
5/12	0715	147.5	292	196	147	NA	37.2	7.9	2.5	12.0	198	NA	1071	823	10.1	8.9	13.5	12.8
5/12	0730	143.6	292	194	147	NA	36.7	8.0	2.4	8.9	193	NA	1057	800	10.2	8.7	17.2	11.3
5/12	0745	144.0	291	201	148	NA	32.9	8.1	6.2	18.4	191	NA	1052	822	10.0	8.8	13.6	11.2
5/12	0800	138.6	290	201	166	NA	33.0	8.2	3.0	14.4	181	NA	1042	801	10.0	8.7	14.9	11.6
5/12	0815	137.9	291	198	170	NA	37.4	7.8	1.1	11.0	183	NA	1043	792	10.1	8.7	16.1	11.9
5/12	0830	137.9	290	199	164	NA	32.9	7.8	3.3	7.7	179	NA	1046	761	10.1	8.7	16.1	15.5
5/12	0845	137.9	291	196	156	NA	32.9	8.0	2.7	9.5	180	NA	1037	785	10.0	8.6	16.3	12.0
5/12	0900	137.5	291	201	164	NA	32.9	8.6	2.5	12.2	180	NA	1052	783	10.1	8.6	17.4	12.6
5/12	0915	139.6	293	200	168	NA	32.6	8.0	5.9	16.5	184	NA	1056	806	10.3	8.7	18.4	9.7
5/12	0930	142.4	295	192	162	NA	38.2	8.0	4.7	12.5	189	NA	1030	781	10.0	8.8	13.6	13.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/12	0945	138.9	296	190	161	NA	39.1	8.0	0.2	9.9	188	NA	1025	754	9.8	8.5	15.3	15.2
5/12	1000	147.5	297	190	161	NA	40.1	8.4	0.0	10.4	196	NA	1048	779	10.0	8.7	14.9	14.5
5/12	1015	147.5	299	188	162	NA	42.2	8.1	23.5	10.0	199	NA	1032	753	10.0	8.6	16.3	15.1
5/12	1030	147.7	299	187	159	NA	41.9	7.8	21.7	10.0	200	NA	1032	743	10.0	8.7	14.9	17.3
5/12	1045	147.1	300	190	159	NA	40.8	7.7	23.8	11.8	199	NA	1032	743	10.0	8.7	14.9	17.3
5/12	1100	147.3	300	189	157	NA	41.8	7.9	23.4	11.2	197	NA	1032	743	10.0	8.7	14.9	17.3
5/12	1115	147.8	300	189	152	NA	41.6	8.0	23.6	11.8	197	NA	1032	743	10.0	8.7	14.9	17.3
5/12	1130	147.7	301	183	154	NA	45.1	8.2	17.2	7.6	198	NA	1032	777	10.0	8.7	14.9	13.5
5/12	1230	147.5	301	203	162	NA	39.2	7.8	22.8	10.8	197	NA	1273	909	11.2	9.0	24.4	11.1
5/12	1245	147.7	302	193	161	NA	44.1	7.9	22.2	12.1	197	NA	1289	896	11.2	8.9	25.8	12.5
5/12	1300	147.8	303	184	149	NA	44.3	8.0	18.5	8.2	198	NA	1299	877	11.1	9.0	23.3	16.7
5/12	1315	147.7	302	183	151	NA	44.3	8.3	16.2	6.3	198	NA	1295	870	11.1	8.9	24.7	16.2
5/12	1330	148.0	302	183	148	NA	46.2	7.7	15.6	7.6	198	NA	1321	873	11.2	8.6	30.2	13.9
5/12	1345	146.9	302	175	151	NA	52.9	7.8	12.9	5.8	200	NA	1337	878	11.0	8.9	23.6	18.9
5/12	1400	146.9	303	175	149	NA	45.8	7.8	12.6	4.7	201	NA	1353	908	11.1	9.0	23.3	17.2
5/12	1415	147.5	302	180	149	NA	46.4	7.9	12.9	4.9	201	NA	1353	896	11.1	8.9	24.7	17.4
5/12	1430	147.3	303	169	149	NA	51.9	8.1	12.5	4.7	200	NA	1353	889	11.1	9.0	23.3	18.9
5/12	1445	148.0	304	165	146	NA	54.0	7.9	12.1	6.0	204	NA	1370	869	11.0	9.0	22.2	22.5
5/12	1500	147.5	302	164	145	NA	54.1	8.1	11.0	6.2	205	NA	1339	874	10.8	8.9	21.3	20.8
5/12	1515	147.9	299	163	143	NA	54.4	8.2	11.5	7.2	206	NA	1356	840	10.8	8.9	21.3	24.8
5/12	1530	147.4	298	164	146	NA	52.5	8.1	11.6	6.8	205	NA	1300	864	10.8	8.9	21.3	19.4
5/12	1545	147.8	297	163	147	NA	54.0	7.9	10.2	8.2	207	NA	1323	860	10.8	8.8	22.7	20.2
5/12	1600	147.6	297	163	148	NA	54.6	8.1	16.1	7.7	210	NA	1315	814	10.7	8.8	21.6	24.7
5/12	1615	147.8	296	162	146	NA	54.5	8.1	10.7	8.5	206	NA	1285	803	10.8	8.9	21.3	24.1
5/12	1630	147.7	295	162	143	NA	55.8	8.1	13.3	7.4	207	NA	1269	811	10.7	8.9	20.2	23.1
5/12	1645	142.3	295	168	132	NA	41.5	8.1	10.3	7.1	207	NA	1260	786	10.2	8.7	17.2	26.9
5/12	1700	142.0	293	188	148	NA	39.7	8.1	10.0	5.0	206	NA	1280	892	10.3	8.6	19.8	16.5
5/12	1715	140.9	292	187	155	NA	42.2	8.2	8.9	5.6	194	NA	1288	866	10.5	8.8	19.3	19.8
5/12	1730	139.3	292	167	146	NA	45.0	7.9	11.3	5.4	195	NA	1307	890	10.8	9.0	20.0	18.2
5/12	1745	137.7	292	164	145	NA	44.8	8.3	9.3	6.8	191	NA	1332	884	10.8	8.8	22.7	18.5
5/12	1800	137.3	295	166	146	NA	46.3	8.2	9.6	6.2	191	NA	1327	881	10.9	8.9	22.5	18.7
5/12	1815	138.8	295	165	146	NA	46.4	8.1	8.7	6.4	191	NA	1338	876	11.0	8.9	23.6	19.0
5/12	1830	136.9	295	164	146	NA	47.2	8.1	9.4	6.5	190	NA	1277	843	10.9	8.9	22.5	19.1
5/12	1845	140.0	295	166	147	NA	46.5	8.0	9.4	6.9	193	NA	1293	808	10.9	8.8	23.9	22.6
5/12	1900	140.8	296	175	152	NA	45.0	7.9	9.0	5.5	197	NA	1285	821	11.0	8.8	25.0	20.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

		Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/12	1915	136.6	295	167	145	NA	43.9	8.1	8.8	5.1	189	NA	1266	818	10.9	8.8	23.9	20.0
5/12	1930	137.7	295	167	146	NA	44.0	7.9	8.8	5.2	188	NA	1241	816	11.0	8.7	26.4	16.9
5/12	1945	140.2	295	167	147	NA	46.1	7.9	9.3	5.7	193	NA	1239	817	10.9	8.9	22.5	19.3
5/12	2000	145.7	297	169	149	NA	48.3	8.4	9.3	5.5	201	NA	1252	856	11.0	9.0	22.2	16.5
5/12	2015	147.2	298	164	148	NA	53.8	8.2	9.8	6.7	205	NA	1240	782	11.0	8.9	23.6	22.1
5/12	2030	146.4	299	161	145	NA	54.5	7.8	9.9	6.4	206	NA	1196	773	10.9	9.0	21.1	21.7
5/12	2045	146.3	300	166	145	NA	52.6	7.9	10.1	7.6	205	NA	1214	778	11.0	9.0	22.2	21.7
5/12	2100	146.0	298	182	142	NA	41.7	8.0	9.1	4.6	207	NA	1214	762	11.0	9.0	22.2	23.3
5/12	2115	147.4	296	186	152	NA	43.7	7.9	9.4	3.4	205	NA	1214	814	11.0	8.6	27.9	14.2
5/12	2130	139.2	297	180	143	NA	41.8	8.1	9.4	3.5	200	NA	1133	792	10.6	8.6	23.3	13.9
5/12	2145	138.1	295	172	146	NA	43.6	7.9	8.8	3.7	189	NA	1187	784	11.0	8.7	26.4	16.5
5/12	2200	137.8	295	171	145	NA	43.7	7.9	8.8	3.8	187	NA	1230	814	11.3	9.0	25.6	17.0
5/12	2215	138.9	295	172	146	NA	44.6	7.6	9.0	4.0	195	NA	1196	794	11.0	8.9	23.6	18.0
5/12	2230	137.0	296	172	146	NA	42.8	8.1	8.9	3.8	188	NA	1178	808	10.9	9.0	21.1	16.9
5/12	2245	137.8	296	176	149	NA	41.7	7.9	9.1	3.6	187	NA	1217	803	11.1	8.8	26.1	16.8
5/12	2300	136.6	295	177	151	NA	41.6	8.2	9.0	3.6	187	NA	1219	803	11.1	8.8	26.1	16.9
5/12	2315	146.3	297	178	154	NA	44.5	8.1	9.3	3.1	201	NA	1219	794	11.1	8.6	29.1	16.0
5/12	2330	142.6	298	177	152	NA	46.0	8.1	9.4	3.7	203	NA	1174	798	10.8	8.8	22.7	16.6
5/12	2345	141.7	299	174	150	NA	46.5	8.2	9.1	4.1	194	NA	1195	790	11.0	8.8	25.0	17.4
5/13	0000	137.6	297	172	150	NA	46.1	7.6	9.0	4.3	193	NA	1221	766	11.0	8.8	25.0	21.6
5/13	0015	117.9	298	167	148	NA	43.4	8.2	8.8	4.9	168	NA	1205	724	10.9	8.6	26.7	23.9
5/13	0030	107.7	299	167	148	NA	42.2	8.1	9.3	4.9	162	NA	1151	742	10.6	8.6	23.3	20.5
5/13	0045	109.3	300	166	148	NA	43.2	8.0	9.0	4.0	159	NA	1174	698	10.6	8.4	26.2	25.0
5/13	0100	109.0	298	165	147	NA	42.1	8.0	8.8	5.4	159	NA	1193	714	10.6	8.6	23.3	26.3
5/13	0115	107.8	299	166	147	NA	40.7	8.0	8.8	6.1	157	NA	1188	701	10.6	8.4	26.2	25.6
5/13	0130	106.0	300	167	148	NA	40.3	8.2	8.5	5.8	153	NA	1151	710	10.5	8.5	23.5	23.8
5/13	0145	107.5	298	167	148	NA	40.7	8.4	8.5	5.8	155	NA	1186	698	10.7	8.4	27.4	25.1
5/13	0200	106.0	298	166	148	NA	40.5	7.9	8.4	6.1	153	NA	1177	703	10.6	8.4	26.2	24.7
5/13	0215	105.9	297	166	148	NA	40.2	8.0	8.4	6.2	152	NA	1177	697	10.6	8.4	26.2	25.2
5/13	0230	107.4	293	169	149	NA	40.5	8.2	8.4	7.2	154	NA	1149	692	10.6	8.3	27.7	23.1
5/13	0245	107.8	294	172	147	NA	40.3	8.0	8.4	7.2	154	NA	1178	678	10.5	8.4	25.0	28.1
5/13	0300	106.1	301	181	161	NA	38.7	8.0	8.6	5.1	157	NA	1207	793	10.8	8.6	25.6	17.5
5/13	0315	105.3	305	185	170	NA	39.0	8.0	8.9	5.4	157	NA	1219	746	10.8	8.5	27.1	22.3
5/13	1245	147.6	294	170	155	NA	48.6	8.2	9.5	5.6	196	NA	1241	812	11.0	9.0	22.2	20.0
5/13	1300	147.3	295	170	155	NA	48.3	7.9	9.6	5.9	195	NA	1221	815	11.0	9.1	20.9	19.3

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

		Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/13	1315	147.4	295	170	155	NA	48.6	7.8	9.5	6.1	194	NA	1245	828	11.1	9.0	23.3	18.0
5/13	1330	148.1	296	171	156	NA	48.9	7.8	9.5	5.9	197	NA	1262	830	11.1	9.1	22.0	19.8
5/13	1345	147.6	295	170	155	NA	49.3	8.0	9.6	5.9	196	NA	1262	830	11.1	9.1	22.0	19.8
5/13	1400	148.0	294	169	141	NA	48.8	8.1	9.5	7.1	197	NA	1262	830	11.1	9.1	22.0	19.8
5/13	1415	147.8	294	170	147	NA	45.7	8.0	9.5	4.9	193	NA	1315	871	11.4	9.3	22.6	18.8
5/13	1430	146.3	295	172	152	NA	46.6	7.8	9.6	5.1	193	NA	1349	883	11.4	9.1	25.3	18.0
5/13	1515	147.6	295	175	156	NA	44.8	8.4	10.2	4.3	196	NA	1280	893	11.2	9.1	23.1	14.2
5/13	1530	147.3	294	175	156	NA	45.6	8.0	10.2	4.6	196	NA	1290	896	11.2	9.1	23.1	14.5
5/13	1545	148.0	296	176	156	NA	46.0	8.3	10.0	4.6	197	NA	1287	880	11.2	9.2	21.7	16.8
5/13	1600	147.4	295	175	156	NA	46.2	8.0	10.1	4.0	196	NA	1273	862	11.3	9.1	24.2	15.9
5/13	1615	147.9	295	176	156	NA	46.7	8.1	10.0	4.7	199	NA	1278	851	11.2	9.1	23.1	18.1
5/13	1630	147.5	295	174	155	NA	47.2	8.0	9.9	4.8	195	NA	1286	849	11.2	9.1	23.1	18.8
5/13	1645	148.1	296	174	156	NA	47.8	8.0	9.9	4.2	195	NA	1272	846	11.2	9.2	21.7	19.0
5/13	1700	145.5	295	173	155	NA	47.8	8.3	10.0	4.6	196	NA	1248	833	11.1	9.2	20.7	19.5
5/13	1715	146.5	295	172	155	NA	47.2	8.2	9.9	4.8	193	NA	1271	831	11.2	9.1	23.1	19.5
5/13	1730	147.3	295	173	155	NA	46.8	8.2	23.4	0.1	191	NA	1284	847	11.3	9.3	21.5	19.8
5/13	1745	147.4	296	173	156	NA	47.4	7.7	9.9	5.2	195	NA	1308	822	11.3	9.2	22.8	22.8
5/13	1800	147.6	296	172	146	NA	47.8	8.1	9.8	5.4	198	NA	1246	789	11.2	9.2	21.7	22.9
5/13	1815	148.5	296	166	138	NA	47.6	8.0	9.2	5.0	191	NA	1262	836	11.1	9.4	18.1	21.8
5/13	1830	146.2	294	185	150	NA	42.5	8.0	10.7	4.2	197	NA	1234	855	11.2	9.0	24.4	13.8
5/13	1845	142.5	293	189	154	NA	37.5	7.8	11.6	4.1	190	NA	1239	886	11.0	8.9	23.6	11.7
5/13	1900	138.2	292	186	156	NA	38.8	8.0	10.9	4.1	185	NA	1243	886	10.9	9.0	21.1	13.6
5/13	1915	138.3	292	182	155	NA	37.7	7.9	9.9	3.5	181	NA	1254	859	10.9	8.9	22.5	16.1
5/13	1930	138.6	294	184	157	NA	39.8	7.9	10.9	3.6	190	NA	1256	871	11.0	9.0	22.2	15.3
5/13	1945	141.4	294	178	158	NA	43.5	8.2	9.8	3.5	190	NA	1258	865	11.0	9.0	22.2	16.0
5/13	2000	140.2	295	173	156	NA	44.1	8.0	9.4	4.2	188	NA	1237	851	11.0	9.0	22.2	15.9
5/13	2015	139.2	295	172	152	NA	44.6	7.8	9.0	4.4	184	NA	1272	851	11.0	9.1	20.9	19.1
5/13	2030	143.3	294	173	156	NA	44.5	7.8	10.6	4.7	191	NA	1251	845	11.0	9.1	20.9	18.3
5/13	2045	144.8	293	173	156	NA	45.6	8.2	9.2	4.8	192	NA	1225	848	11.1	9.2	20.7	16.5
5/13	2100	144.0	293	174	155	NA	45.7	7.9	9.5	4.8	196	NA	1225	846	11.1	9.2	20.7	16.7
5/13	2115	145.8	294	174	153	NA	45.6	8.3	9.3	5.0	192	NA	1225	846	11.5	9.2	25.0	13.7
5/13	2130	148.4	291	175	145	NA	45.7	7.8	10.0	5.0	201	NA	1243	785	11.3	9.0	25.6	20.7
5/13	2145	145.1	288	184	154	NA	31.3	7.6	14.1	4.7	196	NA	1234	864	10.9	8.9	22.5	14.2
5/13	2200	145.0	286	185	155	NA	36.8	8.2	10.0	4.1	191	NA	1242	861	11.2	9.0	24.4	13.7
5/13	2215	148.2	287	186	155	NA	39.3	8.1	11.2	4.2	202	NA	1182	880	10.9	8.7	25.3	6.7

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/13	2230	143.5	286	183	155	NA	39.0	8.1	9.7	4.0	188	NA	1265	854	11.1	9.1	22.0	17.7
5/13	2245	139.7	285	181	155	NA	37.8	7.7	9.3	3.9	182	NA	1226	865	10.9	8.9	22.5	13.6
5/13	2300	124.6	285	173	155	NA	40.8	7.9	8.5	5.1	169	NA	1316	865	11.2	8.9	25.8	17.3
5/13	2315	107.0	288	169	154	NA	37.3	7.9	8.6	6.9	162	NA	1174	865	10.0	8.9	12.4	17.3
5/13	2330	106.0	289	171	155	NA	36.9	7.8	8.7	7.1	158	NA	1186	803	10.2	8.5	20.0	18.7
5/13	2345	105.7	289	172	155	NA	36.7	7.8	8.5	7.3	158	NA	1204	779	10.4	8.3	25.3	19.0
5/14	0000	105.8	290	172	155	NA	37.2	8.1	8.4	7.5	159	NA	1165	780	10.2	8.3	22.9	17.7
5/14	0015	107.4	288	173	155	NA	34.6	8.2	8.4	7.4	159	NA	1198	763	10.3	8.2	25.6	20.0
5/14	0030	107.3	286	173	155	NA	35.2	8.3	8.3	6.6	157	NA	1202	772	10.4	8.3	25.3	19.6
5/14	0045	108.8	291	177	156	NA	39.9	7.9	8.5	6.6	167	NA	1203	811	10.3	8.6	19.8	19.3
5/14	0100	105.7	300	176	158	NA	42.4	7.8	8.3	5.5	169	NA	1202	792	10.5	8.5	23.5	18.6
5/14	0115	107.4	302	175	156	NA	43.2	7.9	8.4	4.1	168	NA	1238	770	10.6	8.5	24.7	22.4
5/14	0130	105.2	303	174	155	NA	44.0	7.9	8.4	5.2	165	NA	1200	751	10.4	8.5	22.4	23.5
5/14	0145	105.7	301	172	155	NA	43.5	7.9	8.9	5.3	165	NA	1225	762	10.6	8.6	23.3	23.4
5/14	0200	105.9	303	173	155	NA	43.8	8.1	8.8	5.1	166	NA	1198	761	10.5	8.5	23.5	21.5
5/14	0215	106.8	304	173	156	NA	44.4	7.9	9.1	5.0	169	NA	1205	775	10.4	8.7	19.5	23.1
5/14	0230	105.5	302	171	154	NA	43.6	8.2	8.7	4.9	165	NA	1232	767	10.8	8.6	25.6	21.8
5/14	0245	106.0	303	172	154	NA	43.6	7.7	8.8	5.2	165	NA	1213	753	10.6	8.6	23.3	23.5
5/14	0300	105.6	305	173	156	NA	44.7	7.8	8.9	5.1	168	NA	1172	743	10.4	8.5	22.4	22.4
5/14	0315	105.4	303	171	155	NA	44.5	7.6	8.6	5.1	167	NA	1208	729	10.5	8.5	23.5	25.5
5/14	0330	105.7	300	170	153	NA	43.9	8.1	8.8	5.2	164	NA	1220	754	10.6	8.7	21.8	24.7
5/14	0345	107.6	300	172	153	NA	42.7	8.3	8.8	5.3	167	NA	1232	756	10.7	8.7	23.0	24.6
5/14	0400	107.3	301	177	154	NA	42.5	8.1	8.6	5.1	166	NA	1212	762	10.6	8.7	21.8	23.4
5/14	0415	109.9	300	173	145	NA	36.7	8.1	9.2	5.2	164	NA	1219	753	10.5	8.7	20.7	25.5
5/14	0430	109.7	299	181	157	NA	36.4	7.9	9.6	5.6	166	NA	1228	837	10.5	8.7	20.7	17.7
5/14	0445	107.2	300	181	156	NA	38.2	8.1	9.2	5.2	164	NA	1243	824	10.7	8.8	21.6	19.4
5/14	0500	106.4	300	177	156	NA	39.8	8.0	9.1	5.3	164	NA	1180	835	10.3	8.6	19.8	15.2
5/14	0515	105.3	302	179	155	NA	39.9	8.1	9.2	5.2	163	NA	1213	836	10.4	8.7	19.5	17.7
5/14	0530	106.4	301	179	155	NA	40.0	8.1	9.1	5.3	164	NA	1200	829	10.4	8.6	20.9	16.5
5/14	0545	105.8	298	179	155	NA	39.6	8.1	9.0	5.6	163	NA	1204	829	10.3	8.6	19.8	17.6
5/14	0600	106.1	302	180	157	NA	39.5	8.0	9.0	5.0	164	NA	1188	825	10.4	8.8	18.2	17.9
5/14	0615	110.8	299	183	155	NA	39.5	7.9	9.1	5.6	158	NA	1226	824	10.4	8.8	18.2	20.6
5/14	0630	132.7	284	178	155	NA	36.8	8.3	9.4	8.0	178	NA	1254	857	10.7	8.8	21.6	16.9
5/14	0645	148.6	281	180	157	NA	39.9	7.8	10.0	7.3	197	NA	1226	877	10.9	9.3	17.2	16.2
5/14	0700	146.2	284	181	159	NA	40.2	7.8	11.2	7.0	201	NA	1235	875	10.9	9.3	17.2	16.9

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Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/14	0715	148.1	284	188	151	NA	40.4	7.5	9.7	6.8	198	NA	1234	861	10.9	9.1	19.8	16.4
5/14	0730	146.0	284	185	157	NA	37.8	8.2	10.5	5.8	197	NA	1256	885	10.7	9.1	17.6	17.2
5/14	0745	148.5	285	182	156	NA	41.3	8.0	10.5	5.9	202	NA	1232	859	10.8	9.2	17.4	18.2
5/14	0800	139.5	285	180	156	NA	40.3	8.2	11.1	6.0	197	NA	1190	850	10.6	9.0	17.8	15.9
5/14	0815	137.6	288	178	156	NA	40.2	7.9	9.8	6.1	192	NA	1229	869	10.6	8.9	19.1	15.7
5/14	0830	137.5	287	179	158	NA	38.2	7.7	9.5	5.7	184	NA	1268	862	11.0	8.9	23.6	16.0
5/14	0845	137.4	287	184	162	NA	37.8	8.0	9.8	5.9	180	NA	1171	897	10.1	9.2	9.8	15.9
5/14	0900	138.2	288	185	150	NA	37.7	7.5	9.6	5.3	179	NA	1171	897	10.1	9.2	9.8	15.9
5/14	0915	137.9	289	184	154	NA	36.6	8.6	10.0	5.0	180	NA	1171	897	10.1	9.2	9.8	15.9
5/14	0930	138.5	290	183	156	NA	39.2	8.2	10.0	5.3	186	NA	1171	897	10.1	9.2	9.8	15.9
5/14	0945	141.7	290	183	156	NA	40.7	8.3	10.2	5.0	192	NA	1171	897	10.1	9.2	9.8	15.9
5/14	1000	140.6	291	181	156	NA	41.5	7.9	9.8	5.0	189	NA	1171	897	10.1	9.2	9.8	15.9
5/14	1015	147.6	291	182	153	NA	40.6	8.1	10.2	4.9	196	NA	1171	897	10.1	9.2	9.8	15.9
5/14	1030	150.5	292	187	155	NA	40.7	8.1	11.0	4.3	199	NA	1171	897	10.1	9.2	9.8	15.9
5/14	1045	147.9	292	185	158	NA	42.7	7.9	10.3	4.3	200	NA	1171	897	10.1	9.2	9.8	15.9
5/14	1100	148.5	293	183	156	NA	43.2	7.8	10.4	4.2	198	NA	1171	897	10.1	9.2	9.8	15.9
5/14	1115	146.6	293	186	160	NA	39.8	7.6	10.3	3.9	194	NA	1268	822	11.0	9.1	20.9	21.6
5/14	1130	149.4	293	191	166	NA	39.2	8.6	10.5	4.3	198	NA	1224	867	11.0	9.2	19.6	15.3
5/14	1145	148.4	293	191	146	NA	39.8	8.2	10.6	4.3	199	NA	1252	866	11.0	9.2	19.6	17.3
5/14	1200	147.8	294	192	156	NA	39.5	8.1	13.0	5.7	199	NA	1241	921	11.1	9.4	18.1	12.4
5/14	1215	147.3	295	188	155	NA	38.3	7.9	13.4	5.2	194	NA	1294	920	11.3	9.4	20.2	14.5
5/14	1230	147.9	296	188	155	NA	38.1	7.8	13.6	5.0	197	NA	1265	916	11.2	9.4	19.1	13.7
5/14	1245	146.8	295	188	155	NA	39.5	7.8	13.0	4.7	195	NA	1233	904	10.9	9.4	16.0	15.0
5/14	1300	147.4	294	185	155	NA	40.4	7.9	12.0	4.6	195	NA	1226	890	11.0	9.4	17.0	15.0
5/14	1315	147.8	296	186	161	NA	43.5	8.2	13.3	4.8	201	NA	1229	885	11.0	9.3	18.3	14.8
5/14	1330	147.7	296	180	157	NA	45.7	8.2	11.1	4.2	200	NA	1227	873	10.9	9.3	17.2	16.6
5/14	1345	147.5	297	179	156	NA	46.2	7.2	10.9	4.5	199	NA	1227	883	11.0	9.4	17.0	15.8
5/14	1400	147.8	297	179	156	NA	46.9	8.1	11.4	4.2	203	NA	1208	865	11.0	9.3	18.3	15.3
5/14	1415	147.9	297	178	154	NA	47.1	8.4	10.7	4.5	202	NA	1222	862	10.9	9.4	16.0	18.2
5/14	1430	147.8	298	190	162	NA	40.1	7.9	12.1	5.2	202	NA	1223	889	11.0	9.4	17.0	14.9
5/14	1445	147.7	296	196	176	NA	40.2	8.4	12.2	5.0	199	NA	1217	895	10.9	9.3	17.2	13.8
5/14	1500	148.1	297	184	155	NA	44.1	8.1	11.8	4.5	200	NA	1213	880	11.1	9.4	18.1	14.4
5/14	1515	147.6	299	183	155	NA	43.7	8.4	11.7	4.5	199	NA	1232	888	11.0	9.4	17.0	15.6
5/14	1530	148.6	298	184	155	NA	43.9	7.9	11.5	4.7	201	NA	1203	867	10.9	9.3	17.2	15.5
5/14	1545	147.8	298	184	156	NA	44.2	8.2	11.6	4.5	202	NA	1223	852	10.9	9.4	16.0	19.2

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5/14	1600	147.4	299	184	156	NA	45.0	8.1	11.8	4.7	202	NA	1193	850	10.9	9.3	17.2	16.5
5/14	1615	147.6	299	184	157	NA	44.2	8.0	12.2	4.5	203	NA	1199	861	10.9	9.3	17.2	15.8
5/14	1630	147.4	300	184	161	NA	42.6	8.1	14.6	4.8	198	NA	1216	870	10.8	9.2	17.4	16.1
5/14	1645	147.7	300	177	158	NA	49.6	8.0	11.3	4.9	205	NA	1202	829	10.9	9.3	17.2	19.2
5/14	1700	147.4	300	174	157	NA	49.6	7.8	10.8	4.1	200	NA	1185	822	10.9	9.4	16.0	19.6
5/14	1715	147.4	301	177	159	NA	47.5	7.9	10.6	3.6	198	NA	1224	844	11.0	9.4	17.0	19.4
5/14	1730	147.3	301	177	161	NA	46.9	7.9	10.9	4.2	199	NA	1194	825	10.9	9.3	17.2	19.0
5/14	1745	147.8	301	177	163	NA	45.1	8.2	10.2	4.0	202	NA	1184	789	10.9	9.3	17.2	21.9
5/14	1800	143.4	300	184	167	NA	39.7	8.2	10.8	5.1	195	NA	1161	852	10.9	9.3	17.2	14.0
5/14	1815	141.1	299	183	169	NA	40.0	8.1	11.6	4.7	189	NA	1143	842	10.8	8.9	21.3	10.6
5/14	1830	144.1	299	182	168	NA	44.7	7.9	10.5	3.9	198	NA	1153	847	10.9	9.2	18.5	13.0
5/14	1845	140.8	299	191	175	NA	40.3	8.2	12.4	5.4	193	NA	1142	881	10.7	9.2	16.3	10.3
5/14	1900	138.1	299	190	175	NA	39.0	8.0	13.4	4.8	191	NA	1130	868	10.7	9.1	17.6	9.7
5/14	1915	138.0	299	190	175	NA	39.0	7.9	12.6	4.8	188	NA	1164	868	10.7	9.2	16.3	13.2
5/14	1930	137.9	299	191	176	NA	36.9	7.9	14.5	6.3	189	NA	1162	863	10.7	9.2	16.3	13.6
5/14	1945	138.2	297	194	179	NA	34.9	8.2	17.0	6.5	188	NA	1150	867	10.8	9.2	17.4	11.5
5/14	2000	139.6	297	196	178	NA	36.7	7.9	19.6	8.4	191	NA	1141	867	10.8	9.2	17.4	10.7
5/14	2015	138.7	296	194	176	NA	35.8	7.9	14.9	5.9	185	NA	1177	875	10.9	9.3	17.2	12.8
5/14	2030	147.6	296	197	176	NA	37.8	8.1	16.3	8.1	196	NA	1126	871	10.9	9.3	17.2	9.4
5/14	2045	145.1	295	192	174	NA	40.8	8.0	12.8	5.9	197	NA	1133	837	10.9	9.3	17.2	13.5
5/14	2100	142.4	295	187	167	NA	42.2	8.0	11.9	4.5	196	NA	1133	836	10.9	9.3	17.2	13.6
5/14	2115	142.1	294	181	165	NA	46.3	7.8	9.8	3.6	195	NA	1133	836	11.3	9.3	21.5	10.4
5/14	2130	138.2	294	173	151	NA	46.8	7.6	9.3	4.5	194	NA	1193	747	11.0	8.9	23.6	22.6
5/14	2145	138.3	291	188	162	NA	41.3	7.5	9.7	4.2	190	NA	1205	877	10.9	9.1	19.8	12.9
5/14	2200	137.9	292	185	159	NA	40.4	8.1	10.1	3.7	189	NA	1189	866	10.9	9.1	19.8	12.7
5/14	2215	146.3	291	188	160	NA	39.2	8.3	12.9	6.5	205	NA	1175	853	11.0	9.1	20.9	12.3
5/14	2230	143.4	291	188	160	NA	39.3	7.9	11.8	5.3	200	NA	1178	818	10.8	9.1	18.7	17.6
5/14	2245	145.7	291	187	161	NA	40.7	8.3	13.5	5.8	207	NA	1245	795	10.8	9.1	18.7	24.2
5/14	2300	145.5	291	184	159	NA	41.4	7.8	11.0	4.8	201	NA	1159	795	10.8	9.1	18.7	18.6
5/14	2315	137.7	292	178	153	NA	41.2	7.7	9.0	3.8	183	NA	1201	795	10.7	9.1	17.6	22.2
5/14	2330	133.7	289	177	153	NA	41.0	7.7	9.1	4.0	180	NA	1167	815	10.8	8.9	21.3	15.2
5/14	2345	108.1	294	177	154	NA	38.8	7.6	8.9	4.5	170	NA	1150	754	10.0	8.3	20.5	21.0
5/15	0000	106.0	296	177	155	NA	38.7	8.0	8.8	5.0	170	NA	1121	734	9.9	8.2	20.7	20.9
5/15	0015	105.5	296	175	155	NA	40.3	7.8	8.8	5.5	167	NA	1157	750	10.1	8.3	21.7	21.1
5/15	0030	111.6	299	178	158	NA	41.9	8.1	8.8	5.1	178	NA	1156	791	10.1	8.4	20.2	17.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

		Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/15	0045	112.7	301	177	157	NA	43.8	7.9	8.7	5.5	179	NA	1186	782	10.2	8.5	20.0	20.9
5/15	0100	110.8	300	174	156	NA	44.0	7.7	8.5	5.7	176	NA	1167	773	10.3	8.6	19.8	20.7
5/15	0115	106.0	301	180	161	NA	39.8	8.3	8.8	5.7	171	NA	1162	800	10.1	8.4	20.2	17.2
5/15	0130	106.8	301	181	162	NA	40.0	8.3	8.8	5.7	172	NA	1168	788	10.2	8.5	20.0	19.0
5/15	0145	107.4	299	184	164	NA	39.7	7.7	9.3	6.6	173	NA	1138	782	10.0	8.3	20.5	17.2
5/15	0200	108.6	299	182	156	NA	40.1	8.2	9.6	6.0	172	NA	1130	765	10.1	8.4	20.2	18.6
5/15	0215	114.4	299	182	156	NA	40.2	8.1	9.8	4.9	179	NA	1171	790	10.2	8.5	20.0	19.1
5/15	0230	115.8	299	184	158	NA	40.3	8.1	10.0	5.9	179	NA	1163	786	10.2	8.5	20.0	18.9
5/15	0245	113.7	299	183	146	NA	41.0	8.1	9.8	4.8	179	NA	1161	769	10.2	8.6	18.6	21.5
5/15	0300	112.4	300	188	158	NA	36.5	8.1	11.9	4.3	177	NA	1132	781	10.1	8.6	17.4	18.9
5/15	0315	104.9	300	190	159	NA	36.1	8.0	10.8	5.1	170	NA	1129	753	10.1	8.4	20.2	19.9
5/15	0330	109.1	301	190	161	NA	38.8	8.3	10.2	4.7	175	NA	1136	775	9.9	8.5	16.5	20.6
5/15	0345	112.8	300	190	160	NA	38.7	7.7	10.3	5.0	177	NA	1139	741	10.1	8.4	20.2	21.8
5/15	0400	109.4	301	189	160	NA	38.1	8.0	10.3	5.2	175	NA	1107	748	9.9	8.4	17.9	20.4
5/15	0415	111.9	298	190	160	NA	37.8	8.0	10.5	5.1	174	NA	1140	768	10.2	8.5	20.0	19.2
5/15	0430	114.1	297	190	161	NA	38.0	8.3	10.5	5.2	175	NA	1149	786	10.2	8.6	18.6	18.9
5/15	0445	113.1	299	190	160	NA	38.6	7.7	10.5	5.1	177	NA	1149	777	10.3	8.6	19.8	19.0
5/15	0500	113.0	295	187	160	NA	38.3	8.0	10.2	5.8	174	NA	1132	805	10.2	8.6	18.6	15.6
5/15	0515	114.6	295	188	160	NA	39.4	8.0	10.3	5.6	178	NA	1168	806	10.2	8.5	20.0	17.2
5/15	0530	115.5	296	186	161	NA	40.1	8.0	10.8	6.2	180	NA	1147	793	10.2	8.5	20.0	17.0
5/15	0545	106.0	297	194	161	NA	37.0	7.8	10.5	6.1	169	NA	1155	782	10.2	8.4	21.4	17.8
5/15	0600	104.9	298	188	160	NA	37.2	8.1	10.1	5.4	168	NA	1136	798	10.0	8.4	19.0	16.3
5/15	0615	104.8	299	187	160	NA	36.8	7.7	10.3	5.5	170	NA	1137	803	10.0	8.5	17.6	17.0
5/15	0630	104.8	299	187	160	NA	37.9	8.1	10.1	5.4	168	NA	1144	787	10.0	8.5	17.6	19.0
5/15	0645	107.6	299	185	160	NA	39.2	8.2	9.9	5.9	169	NA	1160	788	10.2	8.7	17.2	20.3
5/15	0700	104.7	299	183	160	NA	39.3	7.8	9.8	6.0	169	NA	1130	774	10.1	8.5	18.8	18.6
5/15	0715	114.0	298	187	160	NA	38.2	8.0	10.3	5.9	172	NA	1184	810	10.2	8.7	17.2	19.8
5/15	0730	114.9	298	188	160	NA	38.8	8.1	10.7	5.8	175	NA	1181	832	10.2	8.7	17.2	17.4
5/15	0745	136.7	294	189	160	NA	38.8	8.0	11.2	6.7	187	NA	1171	848	10.3	9.1	13.2	18.0
5/15	0800	144.0	291	191	160	NA	38.7	8.0	13.5	6.0	197	NA	1174	865	10.8	9.2	17.4	13.4
5/15	0815	140.5	292	191	160	NA	40.1	8.0	11.9	5.5	195	NA	1192	850	10.7	9.4	13.8	18.8
5/15	0830	136.5	294	190	153	NA	41.2	8.2	10.4	6.0	190	NA	1156	815	10.5	9.0	16.7	17.7
5/15	0845	136.3	296	196	156	NA	39.7	8.1	12.7	5.8	193	NA	1225	821	10.8	9.0	20.0	19.6
5/15	0900	136.4	298	199	159	NA	40.3	7.9	12.0	7.8	196	NA	1144	844	11.0	9.1	20.9	10.9
5/15	0915	136.4	298	203	158	NA	39.8	8.1	12.6	5.9	193	NA	1196	875	10.8	9.3	16.1	15.0

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/15	0930	135.2	300	196	160	NA	39.7	7.8	14.5	6.2	188	NA	1230	910	11.0	9.3	18.3	12.5
5/15	0945	138.3	300	190	162	NA	42.9	8.1	35.5	0.1	191	NA	1230	910	11.0	9.3	18.3	12.5
5/15	1000	137.7	301	187	161	NA	44.2	8.1	11.1	97.2	194	NA	1230	910	11.0	9.3	18.3	12.5
5/15	1015	143.7	302	189	162	NA	45.3	8.1	13.0	97.1	208	NA	1294	892	11.0	9.3	18.3	18.5
5/15	1030	138.8	303	185	161	NA	45.6	8.0	11.0	97.1	198	NA	1277	821	11.9	9.1	30.8	15.9
5/15	1045	144.1	303	184	162	NA	46.3	8.1	11.7	97.2	201	NA	1253	820	11.8	9.2	28.3	16.0
5/15	1100	141.9	303	182	161	NA	48.3	8.0	10.6	97.2	201	NA	1224	808	11.6	9.2	26.1	16.8
5/15	1115	141.6	303	180	160	NA	48.9	7.9	9.9	97.2	197	NA	1253	794	11.5	9.2	25.0	20.8
5/15	1130	138.6	305	180	160	NA	48.7	8.0	10.2	97.2	200	NA	1218	796	11.3	9.1	24.2	18.8
5/15	1145	141.8	304	179	160	NA	48.3	7.8	10.8	97.3	201	NA	1206	786	11.5	9.1	26.4	19.6
5/15	1200	138.7	304	188	160	NA	47.1	8.0	10.4	87.3	198	NA	1211	786	11.5	9.1	26.4	18.0
5/15	1215	136.2	304	194	149	NA	44.2	8.0	10.2	0.1	193	NA	1232	792	11.4	9.0	26.7	18.6
5/15	1230	135.4	305	186	153	NA	43.9	9.9	10.8	5.3	193	NA	1232	792	11.4	9.0	26.7	18.6
5/15	1245	145.2	304	190	158	NA	44.4	9.9	13.3	6.0	204	NA	1232	787	11.4	8.8	29.5	17.2
5/15	1300	146.3	304	188	162	NA	46.0	10.1	12.4	5.6	202	NA	1237	794	11.4	8.8	29.5	16.8
5/15	1315	145.2	305	188	160	NA	45.8	10.0	12.9	6.3	205	NA	1229	801	11.6	9.0	28.9	16.0
5/15	1330	145.5	304	188	160	NA	45.9	9.8	13.5	6.2	206	NA	1207	784	11.5	8.9	29.2	16.1
5/15	1345	146.3	304	188	161	NA	46.8	10.0	13.1	5.9	206	NA	1266	788	11.5	9.0	27.8	20.5
5/15	1400	146.3	305	185	161	NA	47.9	10.0	12.5	5.8	205	NA	1207	785	11.6	8.9	30.3	15.3
5/15	1415	146.6	304	184	161	NA	48.7	9.9	12.0	6.1	207	NA	1214	788	11.5	9.0	27.8	17.0
5/15	1430	147.5	304	183	161	NA	49.3	10.4	11.6	5.4	207	NA	1239	788	11.5	9.0	27.8	18.7
5/15	1445	147.7	305	183	162	NA	50.4	10.7	11.9	5.9	209	NA	1239	788	11.5	9.9	16.2	26.1
5/15	1500	148.4	305	178	160	NA	52.1	12.1	10.9	5.4	208	NA	1239	784	11.5	9.4	22.3	22.6
5/15	1515	145.9	306	177	160	NA	54.4	12.1	10.9	5.4	208	NA	1082	764	11.5	9.3	23.7	12.7
5/15	1530	146.8	306	177	162	NA	52.8	12.2	10.7	5.8	207	NA	1099	768	10.3	9.2	12.0	21.8
5/15	1545	147.9	306	174	160	NA	54.1	11.9	10.6	5.6	206	NA	1099	770	10.3	9.2	12.0	21.5
5/15	1600	145.8	307	173	160	NA	54.5	12.1	10.3	5.7	206	NA	1099	668	11.1	8.4	32.1	19.6
5/15	1615	147.1	307	173	158	NA	54.0	12.0	10.6	5.7	204	NA	1099	698	11.9	8.7	36.8	13.1
5/15	1630	146.8	307	175	162	NA	51.8	12.0	10.9	5.3	202	NA	1099	730	11.7	8.9	31.5	12.7
5/15	1645	147.3	307	174	160	NA	53.6	11.8	10.9	5.5	206	NA	1099	700	11.6	9.0	28.9	17.9
5/15	1700	147.6	305	185	168	NA	40.2	12.2	17.7	8.0	203	NA	1206	752	11.4	9.1	25.3	21.9
5/15	1715	145.2	304	194	179	NA	43.9	12.3	24.2	16.2	203	NA	1207	804	11.2	9.0	24.4	17.1
5/15	1730	143.0	304	190	156	NA	45.1	12.2	14.5	7.3	199	NA	1200	736	11.2	8.9	25.8	22.8
5/15	1745	138.0	304	183	153	NA	44.6	12.3	13.0	5.9	191	NA	1194	753	11.0	9.0	22.2	22.9
5/15	1800	136.8	304	185	160	NA	43.4	12.1	14.1	6.9	192	NA	1191	767	11.1	8.9	24.7	19.6

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/15	1815	137.7	305	185	160	NA	43.2	11.9	15.3	6.8	190	NA	1196	753	11.1	8.9	24.7	21.5
5/15	1830	137.6	303	186	167	NA	43.3	11.8	15.4	7.3	192	NA	1199	784	10.9	8.9	22.5	19.9
5/15	1845	139.2	303	187	170	NA	42.9	12.1	15.3	6.6	189	NA	1198	795	11.0	9.1	20.9	19.8
5/15	1900	137.9	303	187	166	NA	44.4	12.1	13.7	6.5	188	NA	1189	786	11.0	9.0	22.2	19.2
5/15	1915	137.9	303	183	162	NA	45.3	11.8	13.0	6.5	188	NA	1199	780	11.0	9.1	20.9	21.4
5/15	1930	137.6	303	177	162	NA	47.1	11.8	11.5	5.1	186	NA	1211	753	11.0	9.0	22.2	24.0
5/15	1945	137.7	302	181	164	NA	36.8	12.0	19.4	5.6	188	NA	1199	736	11.0	9.0	22.2	25.0
5/15	2000	141.6	302	188	178	NA	47.5	12.4	12.4	8.1	193	NA	1183	736	11.1	9.0	23.3	23.3
5/15	2015	138.6	301	197	166	NA	39.6	11.7	22.4	11.7	190	NA	1191	836	10.9	9.0	21.1	15.0
5/15	2030	142.3	301	192	163	NA	41.2	12.1	25.7	12.5	199	NA	1194	768	10.9	9.0	21.1	22.0
5/15	2045	145.5	301	191	160	NA	41.3	12.1	24.8	13.1	197	NA	1185	779	10.9	9.0	21.1	20.4
5/15	2100	143.7	301	190	161	NA	43.7	11.9	22.0	14.2	201	NA	1185	779	10.9	9.0	21.1	20.4
5/15	2115	141.7	301	187	160	NA	44.9	11.9	18.4	9.0	199	NA	1185	780	10.9	9.0	21.1	20.3
5/15	2130	140.7	299	186	159	NA	43.8	11.7	17.2	7.6	197	NA	1283	710	10.9	8.3	31.3	27.3
5/15	2145	141.9	298	187	168	NA	43.7	12.2	17.1	10.0	199	NA	1271	735	11.7	8.6	36.0	21.3
5/15	2200	139.4	297	191	158	NA	43.7	12.0	16.8	8.9	196	NA	1211	728	11.2	8.7	28.7	22.6
5/15	2215	143.9	296	195	159	NA	43.8	11.6	19.5	8.2	202	NA	1210	728	11.4	8.7	31.0	21.2
5/15	2230	137.4	297	186	165	NA	43.4	12.1	13.7	5.7	189	NA	1258	719	11.3	8.7	29.9	25.8
5/15	2245	140.5	296	178	155	NA	48.9	11.9	11.7	6.1	191	NA	1188	738	11.2	8.8	27.3	21.0
5/15	2300	138.8	295	177	152	NA	42.8	12.1	12.7	6.0	196	NA	1188	738	11.2	8.8	27.3	20.9
5/15	2315	140.5	296	184	158	NA	44.6	11.9	15.0	6.9	200	NA	1188	738	11.2	8.8	27.3	20.9
5/15	2330	137.8	296	182	157	NA	43.2	12.1	13.1	6.3	192	NA	1188	775	9.8	9.3	5.4	31.2
5/15	2345	137.3	298	186	159	NA	42.1	11.9	14.0	7.1	192	NA	1034	765	9.8	9.2	6.5	21.1
5/16	0000	135.0	300	187	161	NA	43.3	12.0	14.5	6.5	189	NA	1071	759	9.8	9.1	7.7	23.7
5/16	0015	121.0	303	183	160	NA	43.2	11.9	11.7	5.4	175	NA	1125	751	9.8	9.1	7.7	28.1
5/16	0030	107.2	307	181	160	NA	43.3	11.8	10.2	5.3	165	NA	1078	656	9.7	8.5	14.1	30.6
5/16	0045	104.8	309	182	160	NA	43.5	12.2	10.1	5.3	165	NA	1048	628	9.5	8.3	14.5	31.4
5/16	0100	105.0	308	181	160	NA	43.2	11.8	10.2	5.3	162	NA	1030	632	9.5	8.4	13.1	30.6
5/16	0115	105.3	307	180	160	NA	43.3	12.1	10.4	5.8	163	NA	1059	635	9.6	8.4	14.3	31.5
5/16	0130	109.2	308	181	162	NA	44.7	12.1	10.1	6.8	168	NA	1058	660	9.7	8.4	15.5	28.0
5/16	0145	109.8	307	180	162	NA	46.0	11.8	9.9	7.6	169	NA	1064	655	9.6	8.5	12.9	30.5
5/16	0200	114.0	304	177	160	NA	46.3	12.1	10.1	7.2	169	NA	1073	653	10.0	8.5	17.6	28.4
5/16	0215	110.2	305	175	159	NA	46.4	12.0	9.8	7.6	166	NA	1085	622	9.9	8.5	16.5	33.3
5/16	0230	123.4	303	178	161	NA	46.2	11.8	10.6	7.3	177	NA	1099	686	10.0	8.7	14.9	28.2
5/16	0245	106.5	304	175	159	NA	46.1	11.8	9.7	7.6	164	NA	1108	623	10.0	8.4	19.0	33.0

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5/16	0300	109.7	305	176	159	NA	45.3	12.2	9.7	7.6	162	NA	1074	651	10.0	8.6	16.3	29.5
5/16	0315	105.6	305	176	160	NA	45.3	11.9	10.0	7.9	161	NA	1086	632	9.9	8.4	17.9	31.5
5/16	0330	108.9	304	176	160	NA	44.5	12.0	9.6	7.7	162	NA	1098	654	9.9	8.6	15.1	31.4
5/16	0345	110.4	304	176	160	NA	44.7	11.6	9.5	8.0	163	NA	1108	637	10.1	8.6	17.4	32.5
5/16	0400	105.2	303	177	161	NA	43.6	11.9	9.7	8.0	160	NA	1069	672	10.0	8.5	17.6	26.1
5/16	0415	107.4	302	176	160	NA	44.0	12.1	9.7	7.9	162	NA	1101	660	9.9	8.6	15.1	31.0
5/16	0430	108.1	301	176	154	NA	44.1	12.1	9.2	8.4	162	NA	1105	648	10.0	8.6	16.3	31.9
5/16	0445	104.9	300	181	154	NA	44.1	12.0	9.0	8.7	157	NA	1103	620	9.9	8.5	16.5	34.5
5/16	0500	104.2	300	173	153	NA	40.4	11.8	9.2	8.0	158	NA	1092	636	10.0	8.5	17.6	31.5
5/16	0515	107.0	300	181	159	NA	37.2	12.0	11.1	7.7	157	NA	1127	678	10.0	8.5	17.6	29.2
5/16	0530	104.9	298	188	164	NA	36.8	12.0	10.7	8.7	158	NA	1122	708	9.9	8.6	15.1	27.3
5/16	0545	104.2	299	199	168	NA	37.1	11.8	12.2	9.1	156	NA	1138	709	10.1	8.6	17.4	26.9
5/16	0600	104.5	299	187	161	NA	39.1	12.1	13.0	7.6	155	NA	1094	720	9.9	8.6	15.1	24.2
5/16	0615	104.3	299	183	161	NA	39.3	11.8	11.8	8.1	156	NA	1114	690	9.9	8.5	16.5	27.9
5/16	0630	103.4	298	182	160	NA	39.0	12.1	11.6	8.4	155	NA	1120	684	10.0	8.5	17.6	28.2
5/16	0645	108.3	298	183	160	NA	39.5	12.2	12.2	8.1	159	NA	1122	687	9.9	8.6	15.1	29.5
5/16	0700	107.9	297	183	160	NA	39.0	11.9	12.1	7.9	158	NA	1108	709	10.0	8.6	16.3	25.6
5/16	0715	114.6	297	183	161	NA	40.8	12.1	11.8	7.9	164	NA	1157	746	10.3	8.8	17.0	24.5
5/16	0730	115.7	297	182	161	NA	41.6	12.0	11.6	8.2	165	NA	1160	743	10.3	8.8	17.0	25.0
5/16	0745	133.2	289	180	159	NA	41.5	12.1	11.5	9.0	174	NA	1161	759	10.4	9.0	15.6	24.4
5/16	0800	135.9	286	179	159	NA	40.4	11.9	11.8	9.0	176	NA	1171	769	10.5	9.0	16.7	23.4
5/16	0815	137.6	286	180	161	NA	41.1	11.9	11.3	8.8	177	NA	1154	771	10.5	9.1	15.4	22.9
5/16	0830	143.1	288	182	162	NA	42.4	11.9	13.1	8.3	186	NA	1152	779	10.6	9.2	15.2	22.1
5/16	0845	140.2	291	181	161	NA	43.8	12.3	11.5	7.6	183	NA	1168	782	10.7	9.3	15.1	23.0
5/16	0900	144.5	293	181	162	NA	45.4	11.7	13.3	7.7	194	NA	1142	763	10.7	9.2	16.3	22.3
5/16	0915	144.9	294	179	162	NA	46.4	11.9	11.9	7.3	193	NA	1179	783	10.7	9.3	15.1	23.6
5/16	0930	144.4	294	177	161	NA	47.2	12.1	11.7	7.5	192	NA	1188	756	10.7	9.3	15.1	26.8
5/16	0945	144.8	296	180	161	NA	48.2	11.9	10.9	8.9	194	NA	1175	740	10.7	9.2	16.3	26.8
5/16	1000	144.2	296	174	150	NA	46.8	12.1	11.9	7.5	194	NA	1178	735	10.8	9.2	17.4	26.8
5/16	1015	143.7	296	176	153	NA	43.7	12.0	12.9	6.9	189	NA	1188	755	10.7	9.2	16.3	26.1
5/16	1030	144.6	296	181	162	NA	45.6	11.9	14.5	7.4	194	NA	1157	795	10.6	9.2	15.2	20.9
5/16	1045	144.0	297	180	161	NA	46.2	11.8	13.8	7.1	193	NA	1187	782	10.7	9.2	16.3	23.4
5/16	1100	144.7	297	179	161	NA	46.5	12.5	13.3	7.0	191	NA	1162	764	10.7	9.1	17.6	22.7
5/16	1115	144.5	297	179	161	NA	47.4	12.1	13.4	7.2	193	NA	1174	763	10.7	9.2	16.3	24.4
5/16	1130	145.1	298	179	161	NA	47.8	12.0	13.5	7.0	194	NA	1164	751	10.6	9.2	15.2	25.7

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/16	1145	144.3	298	177	160	NA	48.1	12.3	13.3	7.1	192	NA	1174	722	10.7	9.2	16.3	28.5
5/16	1200	144.6	298	178	162	NA	49.3	12.4	13.8	8.2	197	NA	1167	722	10.5	9.2	14.1	29.3
5/16	1215	140.8	298	175	160	NA	50.2	12.0	11.7	7.4	190	NA	1167	722	10.5	9.2	14.1	29.3
5/16	1230	144.8	298	175	160	NA	49.5	11.6	12.4	6.8	194	NA	1167	747	10.5	9.5	10.5	29.2
5/16	1245	144.6	299	180	160	NA	45.2	12.0	13.0	7.4	194	NA	1038	732	9.5	9.4	1.1	28.7
5/16	1300	144.4	298	183	158	NA	46.4	12.4	13.9	6.9	192	NA	1035	765	9.8	9.3	5.4	22.2
5/16	1315	141.8	299	183	161	NA	46.8	12.1	15.6	8.0	194	NA	1073	806	9.8	9.4	4.3	21.7
5/16	1330	139.7	299	180	160	NA	45.9	12.1	14.3	7.1	188	NA	1128	775	10.1	9.3	8.6	25.4
5/16	1345	139.9	297	180	160	NA	45.4	12.2	13.5	6.8	185	NA	1128	775	10.1	9.3	8.6	25.4
5/16	1400	136.4	297	180	160	NA	44.9	12.2	13.2	6.9	181	NA	1128	775	10.1	9.3	8.6	25.4
5/16	1415	138.7	297	180	160	NA	45.4	12.2	13.0	6.5	184	NA	1128	775	10.1	9.3	8.6	25.4
5/16	1430	134.6	298	178	161	NA	45.9	11.9	12.5	7.5	179	NA	1128	775	10.1	9.3	8.6	25.4
5/16	1445	134.9	298	181	159	NA	45.1	11.7	12.3	7.0	178	NA	1128	650	10.1	9.3	8.6	37.4
5/16	1500	135.0	298	179	159	NA	43.5	12.0	12.7	6.3	176	NA	1265	698	11.7	9.3	25.8	30.5
5/16	1515	134.6	298	180	161	NA	43.6	12.2	13.1	6.8	176	NA	1271	737	11.5	8.7	32.2	23.3
5/16	1530	134.4	298	180	161	NA	44.0	12.1	13.1	6.7	176	NA	1270	735	11.5	8.8	30.7	24.3
5/16	1545	137.8	298	180	161	NA	44.4	11.8	14.1	6.9	181	NA	1250	727	11.3	8.9	27.0	26.2
5/16	1600	140.5	297	179	161	NA	45.9	12.2	13.8	7.2	184	NA	1207	728	11.3	8.9	27.0	23.5
5/16	1615	144.0	298	180	162	NA	46.8	12.0	13.5	6.8	189	NA	1211	719	11.1	8.9	24.7	26.0
5/16	1630	145.0	297	178	161	NA	47.7	12.2	13.8	7.2	190	NA	1198	699	11.1	9.0	23.3	28.1
5/16	1645	143.3	297	178	161	NA	48.3	12.2	14.3	7.5	193	NA	1192	687	11.2	8.9	25.8	27.5
5/16	1700	144.8	297	177	161	NA	48.7	11.8	12.9	6.9	194	NA	1178	695	11.2	9.0	24.4	26.6
5/16	1715	135.3	297	174	158	NA	48.6	11.8	11.5	6.7	180	NA	1219	704	11.0	9.0	22.2	29.4
5/16	1730	136.2	296	175	158	NA	46.6	12.3	12.1	6.9	182	NA	1183	687	10.9	8.9	22.5	28.9
5/16	1745	134.7	296	176	159	NA	45.1	12.2	11.9	6.3	179	NA	1195	702	11.0	8.9	23.6	27.4
5/16	1800	137.8	296	178	161	NA	44.9	12.1	13.8	7.2	180	NA	1200	718	11.2	9.0	24.4	25.5
5/16	1815	138.0	296	178	161	NA	44.1	12.0	13.1	6.6	NA	NA	1196	698	11.1	9.0	23.3	28.0
5/16	1830	138.0	296	178	157	NA	45.3	11.8	12.9	6.4	NA	NA	1182	696	10.9	8.9	22.5	27.9
5/16	1845	138.0	295	179	159	NA	42.9	12.1	15.0	7.5	NA	NA	1178	694	10.9	8.9	22.5	27.8
5/16	1900	139.0	294	187	167	NA	40.0	12.3	20.6	10.8	NA	NA	1133	730	10.9	8.9	22.5	21.1
5/16	1915	141.0	294	191	173	NA	39.8	12.3	20.8	10.5	NA	NA	1142	736	10.8	8.9	21.3	21.8
5/16	1930	138.0	293	191	162	NA	39.7	12.2	20.0	9.8	NA	NA	1148	708	10.7	8.8	21.6	25.0
5/16	1945	138.0	293	185	160	NA	40.4	12.4	22.3	11.0	NA	NA	1129	721	10.6	8.9	19.1	23.9
5/16	2000	139.0	292	186	160	NA	39.9	11.8	22.8	11.1	NA	NA	1108	717	10.7	9.0	18.9	23.1
5/16	2015	141.0	293	186	161	NA	40.7	12.0	21.8	11.0	NA	NA	1142	741	10.7	9.0	18.9	22.9

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/16	2030	138.0	292	184	160	NA	41.5	12.2	20.3	10.0	NA	NA	1143	718	10.6	8.9	19.1	25.2
5/16	2045	138.0	292	183	162	NA	42.9	11.8	18.2	9.0	NA	NA	1152	748	10.8	8.9	21.3	21.2
5/16	2100	138.0	292	180	161	NA	44.1	11.8	15.2	7.8	NA	NA	1152	748	10.8	8.9	21.3	21.2
5/16	2115	138.0	291	179	161	NA	44.6	11.8	13.4	7.1	NA	NA	1152	749	10.8	9.0	20.0	22.0
5/16	2130	146.0	290	179	161	NA	45.5	12.0	14.0	8.0	NA	NA	1289	689	10.8	8.4	28.6	31.3
5/16	2145	143.0	291	177	161	NA	45.8	11.8	12.8	7.6	NA	NA	1270	688	11.7	8.6	36.0	26.3
5/16	2200	142.0	290	181	164	NA	42.1	12.3	16.0	8.5	NA	NA	1206	729	11.3	8.7	29.9	21.5
5/16	2215	145.0	289	191	166	NA	42.0	12.5	16.4	9.7	NA	NA	1202	718	11.2	8.7	28.7	23.1
5/16	2230	146.0	289	197	169	NA	41.8	12.1	17.2	10.2	NA	NA	1211	722	11.1	8.7	27.6	23.9
5/16	2245	148.0	290	181	160	NA	43.5	11.9	17.8	8.8	NA	NA	1169	712	11.2	8.8	27.3	22.5
5/16	2300	145.0	291	179	160	NA	44.3	12.1	16.2	8.2	NA	NA	1187	712	11.0	8.8	25.0	25.0
5/16	2315	147.0	290	180	161	NA	44.5	12.3	16.0	8.6	NA	NA	1187	712	11.0	8.8	25.0	25.0
5/16	2330	139.0	290	178	159	NA	44.0	11.8	14.3	7.6	NA	NA	1187	712	8.9	8.8	1.1	39.3
5/16	2345	136.0	290	178	159	NA	42.4	12.2	14.3	7.9	NA	NA	1036	712	9.5	9.2	3.3	29.0
5/17	0000	109.0	299	180	161	NA	42.3	12.1	11.0	6.9	NA	NA	1028	735	9.6	8.8	9.1	22.0
5/17	0015	107.0	302	179	161	NA	43.7	12.1	11.8	6.4	NA	NA	1050	675	9.4	8.6	9.3	29.7
5/17	0030	106.0	305	180	160	NA	43.3	11.8	11.4	6.3	NA	NA	1085	690	9.6	8.7	10.3	29.8
5/17	0045	111.0	303	180	159	NA	43.4	12.0	12.4	6.3	NA	NA	1100	708	9.7	8.7	11.5	28.2
5/17	0100	107.0	301	186	163	NA	36.4	12.1	15.9	7.0	NA	NA	1106	722	9.9	8.7	13.8	25.7
5/17	0115	113.0	299	191	168	NA	36.9	11.8	20.3	10.1	NA	NA	1163	778	10.4	8.8	18.2	20.9
5/17	0130	114.0	299	192	169	NA	39.6	12.0	20.5	11.1	NA	NA	1170	787	10.3	8.8	17.0	21.3
5/17	0145	110.0	297	185	166	NA	40.0	12.0	15.2	9.0	NA	NA	1169	716	10.2	8.9	14.6	29.8
5/17	0200	111.0	297	191	161	NA	40.3	11.8	48.7	0.1	NA	NA	1122	704	10.1	8.7	16.1	27.2
5/17	0215	112.0	298	184	161	NA	39.9	11.8	13.6	7.7	NA	NA	1153	720	10.2	8.7	17.2	26.8
5/17	0230	109.0	299	183	161	NA	40.3	12.2	14.2	8.4	NA	NA	1121	686	10.1	8.6	17.4	28.1
5/17	0245	108.0	300	183	160	NA	40.2	12.1	14.8	8.4	NA	NA	1165	704	10.3	8.8	17.0	29.3
5/17	0300	106.0	299	183	160	NA	39.9	12.1	14.3	7.8	NA	NA	1120	703	10.1	8.6	17.4	26.3
5/17	0315	106.0	299	183	160	NA	40.0	11.8	14.5	8.1	NA	NA	1159	687	10.2	8.5	20.0	28.9
5/17	0330	106.0	299	182	160	NA	40.5	12.3	14.0	7.8	NA	NA	1155	703	10.2	8.6	18.6	27.8
5/17	0345	106.0	298	182	160	NA	40.4	11.8	14.1	8.4	NA	NA	1141	688	10.1	8.5	18.8	28.4
5/17	0400	106.0	298	181	161	NA	40.8	11.8	13.4	7.8	NA	NA	1121	683	10.1	8.5	18.8	27.6
5/17	0415	106.0	297	179	160	NA	41.8	12.2	13.0	7.9	NA	NA	1144	675	10.1	8.5	18.8	29.9
5/17	0430	106.0	297	179	160	NA	41.7	11.8	12.7	7.7	NA	NA	1137	667	10.1	8.4	20.2	29.5
5/17	0445	105.0	296	179	161	NA	41.9	11.9	12.7	9.0	NA	NA	1153	667	10.1	8.4	20.2	30.4
5/17	0500	110.0	295	188	163	NA	41.5	12.0	11.9	9.3	NA	NA	1118	649	10.1	8.4	20.2	30.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/17	0515	116.0	291	180	160	NA	36.2	12.0	14.1	9.3	NA	NA	1138	693	10.2	8.6	18.6	27.8
5/17	0530	132.0	280	177	151	NA	40.0	12.2	14.3	9.9	NA	NA	1171	720	10.4	8.9	16.9	28.2
5/17	0545	143.0	277	180	161	NA	37.1	12.0	19.4	11.8	NA	NA	1186	767	10.5	9.0	16.7	24.6
5/17	0600	137.0	280	180	161	NA	39.0	12.0	15.9	9.7	NA	NA	1177	773	10.5	8.9	18.0	22.5
5/17	0615	138.0	282	181	160	NA	37.0	11.7	19.0	10.4	NA	NA	1221	738	10.8	8.9	21.3	26.7
5/17	0630	148.0	282	183	161	NA	39.9	12.0	25.3	14.5	NA	NA	1140	729	10.3	9.0	14.4	26.8
5/17	0645	147.0	284	181	162	NA	41.6	12.1	20.4	11.4	NA	NA	1139	722	10.4	9.0	15.6	26.8
5/17	0700	143.0	285	178	161	NA	42.6	12.1	15.2	8.6	NA	NA	1129	722	10.2	9.0	13.5	27.5
5/17	0715	148.0	283	181	164	NA	45.3	12.0	21.4	12.1	NA	NA	1096	742	10.1	9.0	12.2	24.0
5/17	0730	147.0	285	182	165	NA	39.7	12.0	23.9	13.0	NA	NA	1124	750	10.3	9.0	14.4	23.6
5/17	0745	144.0	286	183	166	NA	38.9	11.7	22.4	12.0	NA	NA	1111	754	10.1	8.9	13.5	23.0
5/17	0800	148.0	285	188	170	NA	37.3	12.0	29.9	15.7	NA	NA	1087	787	10.3	9.1	13.2	18.1
5/17	0815	147.2	286	188	170	NA	37.7	11.9	30.7	14.6	189	NA	1129	792	10.4	9.3	11.8	21.6
5/17	1130	145.5	294	188	176	NA	43.5	13.2	13.5	6.3	186	NA	1213	815	11.4	9.1	25.3	15.9
5/17	1145	144.3	295	185	170	NA	44.0	12.5	11.7	5.2	180	NA	1193	802	11.2	9.0	24.4	16.3
5/17	1200	142.6	295	185	168	NA	44.9	12.1	12.2	6.0	184	NA	1206	798	11.3	9.2	22.8	18.7
5/17	1215	145.7	296	185	169	NA	44.5	12.3	13.1	6.3	187	NA	1187	812	11.2	9.2	21.7	16.7
5/17	1230	144.8	296	184	165	NA	44.7	12.0	12.9	5.9	184	NA	1236	789	11.4	9.2	23.9	20.9
5/17	1245	145.6	295	183	163	NA	45.1	12.2	12.1	5.9	181	NA	1210	812	11.2	9.2	21.7	18.3
5/17	1300	146.0	295	185	165	NA	45.3	12.0	14.0	6.7	188	NA	1195	782	11.1	9.1	22.0	20.2
5/17	1315	145.2	295	185	166	NA	45.0	12.2	16.7	7.6	192	NA	1202	774	11.0	9.0	22.2	21.3
5/17	1330	145.5	294	183	165	NA	43.6	12.2	14.7	6.6	187	NA	1202	763	11.0	8.9	23.6	21.5
5/17	1345	146.2	295	182	168	NA	47.5	11.8	13.5	6.4	188	NA	1202	763	11.0	8.9	23.6	21.5
5/17	1400	145.0	296	181	166	NA	47.5	11.9	13.6	6.6	191	NA	1202	763	11.0	8.9	23.6	21.5
5/17	1415	145.1	295	181	165	NA	45.3	12.1	13.3	8.1	188	NA	1202	763	11.0	8.9	23.6	21.5
5/17	1430	145.7	293	189	177	NA	44.0	12.3	15.1	7.8	190	NA	1202	829	11.0	9.3	18.3	18.4
5/17	1445	145.3	293	195	182	NA	43.7	12.0	15.3	8.1	187	NA	1202	839	12.0	9.4	27.7	10.9
5/17	1500	145.6	295	185	169	NA	46.7	11.9	16.4	8.5	191	NA	1273	813	11.8	9.4	25.5	19.9
5/17	1515	145.3	297	183	166	NA	46.9	11.9	15.1	8.2	188	NA	1276	797	11.5	9.4	22.3	23.6
5/17	1530	145.4	297	181	164	NA	46.7	11.9	14.7	7.3	187	NA	1264	791	11.5	9.5	21.1	24.2
5/17	1545	146.0	295	181	165	NA	47.1	12.2	14.5	7.7	188	NA	1248	763	11.4	9.4	21.3	25.9
5/17	1600	145.7	296	181	167	NA	47.1	12.0	15.0	7.6	188	NA	1223	767	11.4	9.3	22.6	23.1
5/17	1615	145.1	296	181	167	NA	47.0	12.3	14.7	7.5	189	NA	1234	761	11.3	9.3	21.5	25.1
5/17	1630	145.6	295	181	166	NA	47.3	12.0	15.3	8.6	191	NA	1236	755	11.3	9.3	21.5	25.8
5/17	1645	145.1	296	181	167	NA	47.1	11.9	16.1	8.7	194	NA	1254	737	11.2	9.3	20.4	29.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/17	1700	144.2	296	181	167	NA	45.5	11.9	15.6	7.5	186	NA	1204	779	11.2	9.4	19.1	22.9
5/17	1715	145.3	296	179	164	NA	46.6	12.0	14.7	8.0	188	NA	1205	727	11.2	9.2	21.7	26.6
5/17	1730	140.8	295	176	160	NA	46.6	11.9	13.1	6.6	179	NA	1233	733	11.2	9.3	20.4	28.4
5/17	1745	137.4	297	174	159	NA	46.4	11.9	12.5	6.6	177	NA	1207	726	11.1	9.2	20.7	27.4
5/17	1800	137.2	295	181	164	NA	41.4	12.3	13.2	6.7	176	NA	1209	754	11.2	9.2	21.7	24.1
5/17	1815	136.9	296	184	169	NA	41.9	12.2	15.5	8.2	178	NA	1218	757	11.1	9.3	19.4	25.8
5/17	1830	134.9	296	187	169	NA	41.6	12.1	13.8	10.2	175	NA	1252	757	11.3	9.2	22.8	25.8
5/17	1845	139.2	294	193	162	NA	41.3	12.3	17.3	8.2	174	NA	1204	765	11.1	9.3	19.4	24.2
5/17	1900	137.3	294	189	169	NA	40.4	11.8	22.1	10.5	177	NA	1213	774	11.2	9.3	20.4	23.2
5/17	1915	135.7	296	185	165	NA	40.9	11.7	18.4	9.8	175	NA	1231	770	11.2	9.3	20.4	24.6
5/17	1930	135.4	297	186	165	NA	40.0	12.0	20.0	9.4	173	NA	1215	759	11.1	9.3	19.4	25.5
5/17	1945	141.5	294	186	165	NA	40.9	11.8	21.1	11.2	183	NA	1197	726	11.1	9.3	19.4	27.7
5/17	2000	137.1	292	186	166	NA	41.5	11.9	27.4	16.2	190	NA	1116	700	10.9	9.0	21.1	24.0
5/17	2015	135.3	294	186	167	NA	40.9	12.0	27.3	13.5	186	NA	1136	736	10.7	9.0	18.9	22.9
5/17	2030	139.8	292	183	165	NA	40.5	12.1	22.2	10.8	182	NA	1202	732	11.1	9.2	20.7	26.6
5/17	2045	146.1	290	184	164	NA	41.3	11.9	21.1	10.5	184	NA	1134	738	11.2	9.3	20.4	21.6
5/17	2100	140.9	290	183	163	NA	39.9	12.0	17.0	9.0	177	NA	1134	742	11.2	9.3	20.4	21.2
5/17	2115	147.4	287	184	164	NA	42.3	12.1	23.9	14.1	197	NA	1134	742	11.2	9.3	20.4	21.2
5/17	2130	137.7	290	182	166	NA	43.5	12.0	19.9	8.9	191	NA	1134	686	11.2	8.5	31.8	20.3
5/17	2145	137.1	291	180	165	NA	41.2	12.0	15.3	8.3	185	NA	1098	681	9.9	8.7	13.8	29.4
5/17	2200	137.7	288	189	168	NA	42.1	11.9	12.9	10.3	183	NA	1076	701	10.3	8.7	18.4	22.8
5/17	2215	138.4	287	192	181	NA	42.1	12.1	13.2	7.1	181	NA	1132	690	10.6	8.7	21.8	25.7
5/17	2230	137.6	288	182	162	NA	41.2	12.2	14.2	7.3	181	NA	1134	727	10.7	8.9	20.2	23.0
5/17	2245	141.1	287	183	166	NA	41.5	11.8	16.0	9.0	187	NA	1146	745	10.9	9.2	18.5	22.9
5/17	2300	139.2	286	181	163	NA	41.0	12.2	12.4	7.0	177	NA	1124	745	10.8	9.2	17.4	22.2
5/17	2315	141.2	285	183	164	NA	41.8	12.1	14.1	8.6	187	NA	1124	745	10.8	9.2	17.4	22.2
5/17	2330	138.8	286	183	165	NA	41.6	11.6	15.4	9.4	186	NA	1124	680	10.8	8.6	25.6	24.0
5/17	2345	137.8	285	181	164	NA	42.1	12.0	13.9	7.9	184	NA	999	674	9.6	8.7	10.3	25.5
5/18	0000	136.6	287	182	166	NA	41.4	11.9	13.8	7.8	186	NA	1028	675	10.1	8.7	16.1	23.7
5/18	0015	124.9	289	180	165	NA	41.3	12.0	12.2	6.7	176	NA	1100	659	10.2	8.7	17.2	29.8
5/18	0030	112.1	290	178	163	NA	40.0	12.1	10.8	7.3	166	NA	1064	627	9.9	8.3	19.3	29.7
5/18	0045	112.1	289	178	165	NA	40.1	11.9	11.1	6.5	172	NA	1028	615	9.6	8.2	17.1	30.0
5/18	0100	108.6	288	178	165	NA	39.2	11.9	9.8	6.6	165	NA	1024	602	9.7	8.2	18.3	30.5
5/18	0115	111.5	286	178	165	NA	38.1	12.4	11.8	5.8	166	NA	1071	643	10.0	8.5	17.6	29.3
5/18	0130	112.9	286	178	165	NA	37.4	12.0	10.3	7.2	163	NA	1083	638	10.1	8.5	18.8	30.1

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/18	0145	113.2	285	177	165	NA	37.4	12.2	11.1	7.1	163	NA	1087	643	10.2	8.6	18.6	29.8
5/18	0200	113.9	282	187	174	NA	37.1	12.2	10.4	8.1	167	NA	1064	649	10.1	8.5	18.8	27.5
5/18	0215	110.7	281	195	174	NA	36.1	11.9	11.6	8.6	163	NA	1080	640	10.1	8.5	18.8	29.6
5/18	0230	112.3	281	183	163	NA	33.3	12.3	15.8	7.9	165	NA	1078	682	10.1	8.5	18.8	24.8
5/18	0245	113.9	282	182	159	NA	36.5	12.2	13.6	8.9	168	NA	1085	686	10.1	8.5	18.8	24.9
5/18	0300	113.3	281	183	162	NA	32.7	12.4	16.6	9.0	166	NA	1066	692	10.1	8.5	18.8	22.9
5/18	0315	113.9	279	179	165	NA	36.7	11.7	13.0	8.2	166	NA	1089	686	10.1	8.5	18.8	25.1
5/18	0330	109.3	279	178	165	NA	35.0	12.1	11.8	8.2	165	NA	1087	704	10.1	8.5	18.8	23.0
5/18	0345	108.0	280	178	165	NA	35.4	12.1	11.5	8.3	163	NA	1075	690	10.0	8.4	19.0	23.5
5/18	0400	107.6	281	178	165	NA	35.4	11.7	10.9	8.3	164	NA	1050	678	9.9	8.4	17.9	23.9
5/18	0415	109.5	283	179	165	NA	36.7	11.7	10.5	8.7	167	NA	1054	667	9.8	8.2	19.5	24.4
5/18	0430	107.7	283	178	165	NA	35.6	11.8	11.1	8.7	164	NA	1071	673	9.9	8.3	19.3	25.1
5/18	0445	108.5	279	177	165	NA	34.3	12.0	11.5	8.9	164	NA	1079	673	9.9	8.3	19.3	25.7
5/18	0500	110.5	279	177	165	NA	36.3	11.8	11.1	8.5	166	NA	1047	685	9.9	8.4	17.9	22.9
5/18	0515	109.2	280	178	165	NA	35.5	12.2	11.4	8.4	164	NA	1097	688	10.1	8.4	20.2	24.6
5/18	0530	115.9	280	178	165	NA	36.8	11.8	11.8	8.8	170	NA	1083	700	10.0	8.5	17.6	24.0
5/18	0545	124.3	277	178	165	NA	36.7	12.0	12.0	8.7	174	NA	1104	726	10.2	8.7	17.2	22.9
5/18	0600	134.2	276	179	165	NA	37.8	11.7	14.3	9.1	185	NA	1090	734	10.4	8.9	16.9	21.4
5/18	0615	135.3	277	179	165	NA	38.4	11.8	12.9	8.3	181	NA	1165	780	10.7	9.1	17.6	21.3
5/18	0630	148.3	276	180	166	NA	39.1	11.7	14.6	9.1	192	NA	1101	758	10.8	9.1	18.7	18.3
5/18	0645	146.2	278	181	166	NA	38.9	12.2	14.2	10.2	193	NA	1164	755	10.8	9.2	17.4	23.9
5/18	0700	147.1	276	184	172	NA	40.1	12.1	14.8	8.5	194	NA	1117	744	10.9	9.2	18.5	21.1
5/18	0715	145.1	279	180	166	NA	40.7	11.9	14.4	8.4	192	NA	1178	762	10.9	9.2	18.5	23.3
5/18	0730	146.1	279	179	164	NA	40.2	12.3	14.0	8.5	192	NA	1161	774	10.8	9.2	17.4	21.7
5/18	0745	146.5	280	180	165	NA	39.9	12.2	14.7	8.4	194	NA	1158	775	10.8	9.2	17.4	21.4
5/18	0800	145.5	281	180	165	NA	40.6	11.9	15.6	7.9	192	NA	1149	763	10.8	9.2	17.4	22.0
5/18	0815	136.4	282	180	165	NA	39.8	12.0	14.5	7.6	186	NA	1209	783	10.7	9.1	17.6	23.9
5/18	0830	137.0	282	180	166	NA	39.8	12.0	13.7	7.6	182	NA	1199	767	10.7	9.0	18.9	24.0
5/18	0845	137.3	283	180	165	NA	40.0	12.0	13.5	7.7	185	NA	1173	746	10.6	9.0	17.8	25.1
5/18	0900	137.3	284	180	166	NA	39.8	12.1	13.4	7.4	184	NA	1147	754	10.7	9.0	18.9	21.8
5/18	0915	136.5	284	180	165	NA	39.3	12.0	12.9	7.1	181	NA	1196	748	10.8	9.1	18.7	25.8
5/18	0930	139.9	284	181	166	NA	39.6	12.3	13.6	7.6	186	NA	1190	745	10.9	9.1	19.8	25.0
5/18	0945	145.4	285	183	166	NA	40.6	11.8	17.0	8.0	190	NA	1167	729	10.9	9.2	18.5	26.0
5/18	1000	145.4	287	183	165	NA	40.7	12.0	17.0	7.8	192	NA	1147	739	10.9	9.3	17.2	24.5
5/18	1015	145.8	289	182	166	NA	41.6	11.8	16.4	8.8	194	NA	1152	722	10.9	9.2	18.5	25.7

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/18	1030	145.7	288	180	166	NA	42.0	12.3	15.6	8.4	192	NA	1148	749	10.8	9.2	17.4	23.4
5/18	1045	146.1	290	180	168	NA	44.3	11.9	15.4	8.5	197	NA	1155	742	10.8	9.1	18.7	23.8
5/18	1100	145.5	290	177	166	NA	44.6	12.0	13.6	6.9	195	NA	1122	736	10.8	9.1	18.7	22.2
5/18	1115	145.7	290	178	165	NA	44.9	11.8	13.2	7.7	196	NA	1140	723	10.8	9.1	18.7	24.7
5/18	1130	145.6	290	179	165	NA	45.2	12.1	13.9	7.7	197	NA	1145	732	10.8	9.1	18.7	24.1
5/18	1145	145.3	290	181	166	NA	44.6	12.1	13.6	8.0	196	NA	1119	709	10.7	9.1	17.6	25.5
5/18	1200	146.3	290	185	158	NA	40.1	11.9	18.6	8.4	197	NA	1110	699	10.7	9.1	17.6	26.0
5/18	1215	144.9	290	188	161	NA	39.8	12.0	24.9	12.1	196	NA	1125	760	10.7	9.1	17.6	20.5
5/18	1230	145.6	288	194	185	NA	39.6	11.9	27.8	12.5	198	NA	1105	751	10.5	9.0	16.7	20.8
5/18	1245	145.5	289	184	155	NA	41.7	11.7	22.9	11.3	198	NA	1098	727	10.6	9.0	17.8	21.9
5/18	1300	145.6	287	185	155	NA	40.8	11.9	26.3	12.5	200	NA	1066	719	10.6	9.0	17.8	20.6
5/18	1315	145.6	287	184	158	NA	42.1	11.8	19.8	11.1	198	NA	1089	728	10.6	9.0	17.8	21.2
5/18	1330	144.1	288	181	156	NA	43.3	12.3	16.7	9.5	197	NA	1098	725	10.7	9.1	17.6	22.3
5/18	1345	145.1	287	180	156	NA	42.7	12.5	17.4	9.1	199	NA	1082	703	10.5	9.1	15.4	25.1
5/18	1400	144.1	287	179	156	NA	43.4	12.0	15.5	8.8	199	NA	1035	694	10.5	9.0	16.7	21.7
5/18	1415	138.7	287	176	154	NA	43.4	12.0	12.0	7.3	187	NA	1123	667	10.7	9.0	18.9	29.4
5/18	1430	137.6	287	174	155	NA	43.7	11.8	10.9	6.9	185	NA	1077	692	10.6	9.0	17.8	24.3
5/18	1445	137.4	286	174	155	NA	43.5	12.0	11.2	7.1	189	NA	1089	675	10.6	9.0	17.8	27.0
5/18	1500	136.9	287	174	156	NA	43.6	12.1	10.9	6.7	187	NA	1088	678	10.8	9.1	18.7	26.1
5/18	1515	139.8	286	173	156	NA	44.7	11.7	10.6	7.0	191	NA	1097	680	10.7	9.1	17.6	27.1
5/18	1530	141.4	286	172	155	NA	44.6	11.7	10.9	6.9	191	NA	1108	673	10.8	9.1	18.7	27.9
5/18	1545	139.4	287	173	156	NA	43.6	12.0	11.2	7.1	192	NA	1119	659	10.9	8.9	22.5	28.0
5/18	1600	145.0	285	172	155	NA	45.5	12.0	10.4	6.7	193	NA	1054	646	10.7	9.1	17.6	27.9
5/18	1615	145.6	286	172	155	NA	45.4	11.9	11.0	6.9	198	NA	1063	635	10.6	9.2	15.2	31.1
5/18	1630	145.5	287	172	155	NA	44.9	12.1	11.3	6.8	199	NA	1085	642	10.6	9.0	17.8	30.3
5/18	1645	144.6	287	172	155	NA	45.7	12.0	10.9	6.4	195	NA	1093	652	10.7	9.1	17.6	29.9
5/18	1700	140.4	287	170	154	NA	46.1	11.8	9.9	6.4	187	NA	1124	666	10.7	9.1	17.6	30.3
5/18	1715	143.0	286	171	154	NA	45.9	11.1	10.2	6.8	190	NA	1110	632	10.6	9.0	17.8	32.9
5/18	1730	144.8	288	172	156	NA	46.2	10.5	10.3	6.3	194	NA	1082	654	10.7	9.1	17.6	29.0
5/18	1745	146.1	288	171	156	NA	46.1	10.5	10.7	7.0	199	NA	1110	640	10.7	9.1	17.6	32.2
5/18	1800	138.1	288	168	155	NA	46.0	10.3	9.5	6.2	188	NA	1114	666	10.8	9.2	17.4	29.9
5/18	1815	137.7	287	168	155	NA	45.5	10.4	30.4	0.1	184	NA	1145	648	10.8	9.1	18.7	32.8
5/18	1830	146.3	286	169	157	NA	47.2	10.0	10.2	6.6	197	NA	1068	646	10.8	9.0	20.0	27.4
5/18	1845	145.7	287	168	156	NA	48.0	9.9	9.9	6.2	200	NA	1143	622	10.8	9.0	20.0	34.7
5/18	1900	144.3	287	167	155	NA	47.6	10.1	9.9	6.4	198	NA	1085	651	10.8	9.1	18.7	28.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

		Boiler	B Duct	C Avg	C Low	ID Fan	Lime	Slurry	B Duct	Stack	FG	FG	SO2	SO2	CO2	CO2	CO2	SO2
		Load	Temp	Temp	Temp	Out Temp	Flow	Solids	Opacity	Opacity	Flow In	Flow Out	In	Out	In	Out	Dilution	Red
Date	Time	MW	°F	°F	°F	°F	gpm	%	%	%	KSCFM	KSCFM	ppm	ppm	%	%	%	%
5/18	1915	145.0	286	168	155	NA	47.0	10.0	10.2	7.1	198	NA	1084	636	10.6	9.0	17.8	30.9
5/18	1930	140.1	287	169	153	NA	47.0	10.2	9.6	7.3	188	NA	1132	644	10.6	8.9	19.1	32.3
5/18	1945	142.1	285	172	138	NA	35.3	10.0	9.9	6.2	190	NA	1045	690	10.5	9.1	15.4	23.8
5/18	2000	139.3	285	179	153	NA	39.6	10.3	11.2	6.4	195	NA	1034	667	10.5	8.9	18.0	23.9
5/18	2015	137.2	285	179	155	NA	39.4	9.9	12.5	6.4	194	NA	1088	726	10.6	9.1	16.5	22.3
5/18	2030	136.6	285	178	155	NA	38.7	10.2	11.4	5.9	186	NA	1187	712	10.9	9.0	21.1	27.4
5/18	2045	137.7	285	177	155	NA	38.9	9.9	10.7	5.4	181	NA	1081	730	10.7	9.1	17.6	20.6
5/18	2100	137.7	285	175	155	NA	40.1	9.8	10.6	5.5	182	NA	1081	730	10.7	9.2	16.3	21.4
5/18	2115	140.5	284	175	155	NA	40.9	10.0	10.7	6.0	189	NA	1081	730	10.7	9.2	16.3	21.4
5/18	2130	138.6	286	176	157	NA	41.7	9.7	11.3	6.2	194	NA	1081	624	8.1	8.4	-3.6	44.3
5/18	2145	137.4	285	174	155	NA	41.8	10.0	10.6	5.9	189	NA	1081	647	9.4	8.6	9.3	34
5/18	2200	137.2	285	174	157	NA	39.3	10.0	11.1	6.5	185	NA	1014	673	9.8	8.8	11.4	26.1
5/18	2215	138.3	283	181	158	NA	41.8	10.1	10.9	8.7	186	NA	1065	675	10.1	8.7	16.1	26.4
5/18	2230	137.0	284	172	137	NA	41.8	10.0	10.5	5.7	187	NA	1092	659	10.3	8.8	17.0	29.3
5/18	2245	137.1	285	171	140	NA	40.3	10.2	9.8	5.8	183	NA	1058	675	10.3	8.8	17.0	25.3
5/18	2300	137.7	284	177	150	NA	38.1	10.1	10.4	5.5	181	NA	1068	675	10.4	8.8	18.2	25.3
5/18	2315	137.8	283	177	153	NA	40.1	9.9	10.9	5.8	187	NA	1068	675	10.4	8.8	18.2	25.3
5/18	2330	137.8	284	177	156	NA	40.7	10.2	11.0	5.8	189	NA	1068	662	8.7	8.4	3.6	35.8
5/18	2345	137.0	283	175	155	NA	40.6	10.2	10.3	5.6	184	NA	1068	678	9.4	8.7	8.0	31.4
5/19	0000	125.5	286	175	156	NA	41.4	9.8	9.8	5.8	180	NA	1068	692	9.5	8.4	13.1	26.7
5/19	0015	125.0	289	174	158	NA	43.0	9.8	10.1	5.9	181	NA	1059	684	9.7	8.4	15.5	25.4
5/19	0030	113.4	292	171	155	NA	43.1	10.0	9.4	6.5	173	NA	1057	621	9.8	8.2	19.5	29.8
5/19	0045	111.9	294	170	155	NA	42.9	10.2	9.1	6.0	172	NA	1024	582	9.6	8.0	20.0	31.8
5/19	0100	112.2	292	170	155	NA	42.2	10.1	9.2	6.2	171	NA	1011	584	9.7	8.2	18.3	31.6
5/19	0115	112.5	292	170	155	NA	42.3	10.2	9.0	5.9	171	NA	1040	595	9.7	8.1	19.8	31.4
5/19	0130	110.7	291	169	155	NA	42.1	10.1	9.0	4.7	169	NA	1017	585	9.5	8.1	17.3	32.6
5/19	0145	108.0	290	168	154	NA	41.7	10.2	9.2	6.4	166	NA	992	571	9.5	8.1	17.3	32.5
5/19	0200	108.1	288	178	159	NA	39.2	10.1	9.6	7.1	169	NA	983	589	9.5	8.0	18.8	28.9
5/19	0215	107.6	287	174	153	NA	36.3	9.9	9.3	6.8	168	NA	999	585	9.5	8.2	15.9	32.1
5/19	0230	109.2	288	174	155	NA	38.5	10.1	9.2	7.4	169	NA	1015	632	9.7	8.3	16.9	27.2
5/19	0245	109.6	287	174	155	NA	38.7	10.0	9.3	6.7	167	NA	1022	632	9.8	8.3	18.1	27.1
5/19	0300	110.3	286	175	155	NA	38.1	10.0	9.1	6.6	170	NA	1019	631	9.7	8.4	15.5	28.5
5/19	0315	113.1	287	175	155	NA	39.9	9.9	9.9	6.9	173	NA	1033	630	9.8	8.3	18.1	27.9
5/19	0330	113.4	288	174	155	NA	39.0	10.2	9.5	7.1	172	NA	1047	631	9.8	8.3	18.1	28.9
5/19	0345	112.2	287	174	155	NA	39.4	10.0	9.2	6.8	169	NA	1080	634	10.0	8.3	20.5	29.2

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/19	0400	112.2	286	174	156	NA	38.9	10.2	9.3	6.8	170	NA	1040	637	10.0	8.3	20.5	26.2
5/19	0415	113.3	287	172	155	NA	40.5	9.9	9.3	6.6	171	NA	1089	654	10.1	8.5	18.8	28.6
5/19	0430	113.3	287	172	155	NA	40.3	9.8	9.3	7.0	170	NA	1084	652	10.0	8.4	19.0	28.5
5/19	0445	113.6	287	172	155	NA	39.9	9.9	9.1	7.2	169	NA	1071	635	10.0	8.4	19.0	29.4
5/19	0500	111.1	288	175	154	NA	37.9	9.9	9.3	7.0	169	NA	1058	659	10.0	8.4	19.0	25.9
5/19	0515	108.2	290	174	155	NA	39.7	9.9	9.3	7.1	167	NA	1076	663	9.9	8.3	19.3	26.5
5/19	0530	109.4	288	182	156	NA	39.5	9.9	9.6	7.8	165	NA	1076	634	10.0	8.2	22.0	28.1
5/19	0545	110.1	289	175	160	NA	39.3	9.9	9.2	7.4	167	NA	1079	638	9.9	8.3	19.3	29.5
5/19	0600	120.1	289	174	155	NA	39.3	9.8	9.7	7.2	174	NA	1059	663	10.2	8.5	20.0	24.8
5/19	0615	126.9	287	175	156	NA	39.9	10.0	9.6	7.2	177	NA	1116	693	10.4	8.8	18.2	26.6
5/19	0630	135.5	282	174	155	NA	39.7	10.1	9.8	7.3	182	NA	1120	706	10.6	8.8	20.5	24.0
5/19	0645	144.7	282	177	156	NA	40.6	9.9	10.6	6.6	195	NA	1176	694	10.8	9.0	20.0	29.2
5/19	0700	144.9	284	176	157	NA	43.0	9.6	10.2	6.4	192	NA	1125	727	10.8	9.1	18.7	23.2
5/19	0715	145.9	284	174	156	NA	43.6	9.9	10.6	7.1	196	NA	1152	727	10.8	9.0	20.0	24.3
5/19	0730	145.3	284	174	155	NA	44.2	9.8	10.0	6.7	197	NA	1129	715	10.7	9.0	18.9	24.7
5/19	0745	145.7	284	174	155	NA	43.4	9.8	9.9	6.5	196	NA	1142	711	10.7	9.0	18.9	26.0
5/19	0800	145.3	285	175	156	NA	44.1	9.6	10.4	6.6	197	NA	1112	712	10.7	9.0	18.9	23.9
5/19	0815	145.6	285	174	155	NA	44.4	10.0	10.1	6.3	195	NA	1152	696	10.7	8.9	20.2	27.4
5/19	0830	144.9	285	174	155	NA	44.5	10.2	10.0	6.2	196	NA	1159	711	10.8	9.0	20.0	26.4
5/19	0845	144.9	285	174	155	NA	44.5	10.2	10.0	6.2	196	NA	1159	711	10.8	9.0	20.0	26.4
5/19	1630	144.0	282	188	159	NA	36.8	8.1	11.9	4.6	196	NA	1140	852	10.6	9.0	17.8	12.0
5/19	1645	144.8	282	189	166	NA	35.5	7.9	11.9	5.8	195	NA	1119	800	10.6	8.9	19.1	14.8
5/19	1700	143.2	282	188	165	NA	36.2	8.4	11.0	4.5	194	NA	1121	802	10.5	8.9	18.0	15.6
5/19	1715	147.6	280	188	164	NA	36.5	8.1	11.5	4.8	200	NA	1115	787	10.5	9.0	16.7	17.7
5/19	1730	144.1	281	189	165	NA	36.6	8.0	11.8	5.0	198	NA	1108	789	10.4	8.8	18.2	15.8
5/19	1745	146.9	281	189	165	NA	35.5	8.2	12.3	5.3	199	NA	1145	780	10.5	8.9	18.0	19.7
5/19	1800	143.4	281	189	165	NA	35.2	8.9	12.7	5.3	194	NA	1113	811	10.5	8.9	18.0	14.1
5/19	1815	142.1	281	187	160	NA	35.0	10.4	11.7	4.8	189	NA	1160	793	10.7	8.9	20.2	17.8
5/19	1830	139.7	280	187	160	NA	35.0	10.2	11.7	4.6	189	NA	1140	790	10.5	8.9	18.0	18.2
5/19	1845	142.0	280	186	160	NA	35.3	10.0	11.9	6.1	193	NA	1121	781	10.5	8.9	18.0	17.8
5/19	1900	139.3	280	186	160	NA	35.0	10.2	11.4	4.8	188	NA	1122	780	10.5	8.9	18.0	18.0
5/19	1915	143.1	279	186	161	NA	35.4	10.4	13.2	5.8	194	NA	1138	780	10.6	9.0	17.8	19.3
5/19	1930	141.4	279	196	172	NA	35.6	10.3	11.3	6.0	195	NA	1132	770	10.6	8.9	19.1	19.0
5/19	1945	143.0	278	197	175	NA	35.3	10.7	16.9	7.4	198	NA	1131	747	10.6	8.8	20.5	20.5
5/19	2000	143.6	278	188	155	NA	35.4	10.1	15.9	7.3	201	NA	1109	761	10.5	8.9	18.0	19.0

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/19	2015	141.9	279	187	157	NA	35.5	10.4	14.6	6.6	196	NA	1142	778	10.6	9.0	17.8	19.8
5/19	2030	138.7	280	186	157	NA	35.4	10.4	12.6	6.1	194	NA	1162	773	10.6	8.9	19.1	20.8
5/19	2045	141.5	279	187	160	NA	35.0	12.2	13.9	6.6	195	NA	1147	759	10.6	8.9	19.1	21.3
5/19	2100	139.5	279	186	160	NA	35.0	11.8	12.9	5.4	191	NA	1147	758	10.6	8.9	19.1	21.3
5/19	2115	146.3	278	186	161	NA	36.3	12.2	13.9	7.2	202	NA	1147	758	10.6	8.9	19.1	21.3
5/19	2130	146.0	278	185	159	NA	36.0	11.5	13.9	7.3	199	NA	1147	714	8.6	8.6	0.0	37.8
5/19	2145	147.0	277	185	161	NA	35.9	11.1	16.3	8.8	200	NA	1147	712	9.3	8.7	6.9	33.7
5/19	2200	140.6	277	195	170	NA	36.0	9.3	13.6	5.8	191	NA	1020	719	9.7	8.7	11.5	21.4
5/19	2215	148.1	277	190	168	NA	36.1	13.1	14.6	7.9	200	NA	1057	695	10.1	8.7	16.1	23.7
5/19	2230	147.6	278	185	160	NA	36.3	15.1	14.0	7.7	199	NA	1067	716	10.2	8.8	15.9	22.2
5/19	2245	139.8	279	184	161	NA	36.4	17.0	14.9	6.8	196	NA	1063	704	10.2	8.6	18.6	21.4
5/19	2300	139.6	279	184	160	NA	36.0	18.0	13.3	6.4	191	NA	1073	704	10.1	8.6	17.4	23.0
5/19	2315	141.5	279	183	160	NA	37.4	18.7	12.9	6.4	193	NA	1073	704	10.1	8.6	17.4	23.0
5/19	2330	138.5	279	182	160	NA	37.8	16.9	12.6	6.3	192	NA	1073	671	8.9	8.7	2.3	36.0
5/19	2345	137.7	279	181	160	NA	36.9	15.2	13.3	5.9	190	NA	1025	683	9.5	8.8	8.0	28.1
5/20	0000	125.4	283	181	160	NA	36.0	13.6	11.4	5.4	180	NA	1045	688	9.7	8.7	11.5	26.6
5/20	0015	123.9	284	180	162	NA	39.8	12.5	10.2	5.1	179	NA	1090	703	10.1	8.8	14.8	26.0
5/20	0030	111.7	286	174	159	NA	39.6	11.5	9.2	5.6	165	NA	1089	662	10.0	8.6	16.3	29.3
5/20	0045	113.7	287	176	160	NA	39.9	11.3	9.0	5.3	173	NA	1054	632	9.6	8.3	15.7	30.7
5/20	0100	112.4	287	177	160	NA	39.4	10.2	9.1	5.4	172	NA	1060	644	9.7	8.3	16.9	29.0
5/20	0115	113.1	287	175	161	NA	39.8	10.3	8.9	5.3	171	NA	1096	643	10.1	8.4	20.2	29.5
5/20	0130	111.1	285	174	160	NA	39.3	10.0	9.1	5.2	169	NA	1096	628	9.9	8.4	17.9	32.4
5/20	0145	110.8	287	174	160	NA	39.8	10.2	8.9	5.7	171	NA	1069	649	9.8	8.5	15.3	30.0
5/20	0200	109.5	286	174	160	NA	39.5	10.3	9.1	6.3	171	NA	1060	644	10.0	8.6	16.3	29.4
5/20	0215	108.9	287	173	160	NA	39.8	10.1	8.7	6.3	170	NA	1080	656	10.0	8.6	16.3	29.4
5/20	0230	107.4	286	181	161	NA	38.1	10.1	9.4	7.3	167	NA	1074	644	10.0	8.5	17.6	29.5
5/20	0245	111.9	284	178	159	NA	35.5	9.7	9.8	6.3	169	NA	1074	673	10.0	8.7	14.9	27.9
5/20	0300	112.9	285	181	160	NA	35.9	9.7	9.5	6.6	172	NA	1047	679	9.9	8.6	15.1	25.4
5/20	0315	110.9	284	181	160	NA	35.9	9.9	9.6	6.8	171	NA	1078	681	10.0	8.6	16.3	26.5
5/20	0330	109.7	283	181	161	NA	35.3	10.4	10.1	6.9	167	NA	1095	698	10.1	8.7	16.1	26.0
5/20	0345	110.6	284	181	160	NA	35.9	9.8	10.4	6.8	171	NA	1077	671	10.1	8.5	18.8	26.0
5/20	0400	109.3	283	181	160	NA	35.8	10.2	10.2	7.0	167	NA	1067	678	10.1	8.6	17.4	25.4
5/20	0415	110.3	283	179	161	NA	37.3	9.6	10.0	7.2	169	NA	1067	664	10.0	8.6	16.3	27.6
5/20	0430	110.8	282	177	160	NA	37.6	10.0	9.7	6.9	170	NA	1076	687	10.1	8.7	16.1	25.8
5/20	0445	113.6	283	177	160	NA	37.5	10.0	9.6	6.9	170	NA	1079	686	10.2	8.7	17.2	25.5

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boller Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/20	0500	111.2	283	178	160	NA	36.4	10.2	10.3	7.1	168	NA	1082	696	10.2	8.9	14.6	26.3
5/20	0515	113.4	283	178	160	NA	37.0	9.7	9.8	6.9	169	NA	1094	688	10.3	8.7	18.4	25.6
5/20	0530	114.3	282	178	160	NA	37.0	10.0	10.1	7.1	171	NA	1086	686	10.2	8.7	17.2	26.0
5/20	0545	117.0	282	178	160	NA	36.9	10.0	10.3	7.3	171	NA	1090	704	10.2	8.8	15.9	25.2
5/20	0600	126.1	278	178	160	NA	35.5	10.5	10.4	7.3	177	NA	1082	718	10.3	8.9	15.7	23.2
5/20	0615	135.2	275	178	160	NA	37.0	10.1	11.0	7.2	185	NA	1118	730	10.6	9.0	17.8	23.0
5/20	0630	143.9	273	179	160	NA	37.4	10.1	12.7	7.5	195	NA	1088	728	10.6	9.0	17.8	21.2
5/20	0645	145.0	273	179	160	NA	37.9	10.1	12.1	8.8	194	NA	1100	730	10.8	9.1	18.7	21.2
5/20	0700	141.6	273	186	159	NA	37.7	9.9	13.5	7.6	192	NA	1078	730	10.4	9.0	15.6	21.7
5/20	0715	145.9	272	180	165	NA	37.7	10.2	12.1	6.5	197	NA	1100	720	10.5	9.0	16.7	23.6
5/20	0730	145.9	274	179	162	NA	39.3	10.2	11.9	6.8	198	NA	1093	745	10.5	9.0	16.7	20.5
5/20	0745	142.7	275	178	160	NA	38.6	9.9	11.1	6.5	194	NA	1110	762	10.6	9.1	16.5	20.0
5/20	0800	141.1	275	178	160	NA	38.3	10.0	10.6	6.3	194	NA	1094	735	10.5	9.1	15.4	22.5
5/20	0815	145.1	275	178	160	NA	38.9	9.8	11.9	6.6	200	NA	1082	697	10.3	8.9	15.7	25.5
5/20	0830	140.4	277	177	159	NA	39.1	10.0	10.7	5.8	193	NA	1120	727	10.5	9.0	16.7	24.2
5/20	0845	135.5	277	178	159	NA	37.7	9.8	10.0	5.8	186	NA	1103	736	10.5	9.0	16.7	22.2
5/20	0900	135.4	277	175	161	NA	40.4	10.1	10.1	6.2	190	NA	1086	719	10.3	8.8	17.0	22.5
5/20	0915	135.3	278	173	160	NA	39.8	9.8	9.9	6.3	186	NA	1126	712	10.5	8.8	19.3	24.6
5/20	0930	135.1	279	173	160	NA	40.1	10.2	9.7	6.2	186	NA	1145	721	10.6	9.0	17.8	25.8
5/20	0945	135.7	280	174	160	NA	40.9	9.9	9.7	6.4	187	NA	1112	712	10.5	9.0	16.7	25.3
5/20	1000	142.5	281	175	161	NA	41.0	10.0	10.7	6.5	192	NA	1101	715	10.7	9.1	17.6	23.7
5/20	1015	145.4	282	175	162	NA	43.4	10.0	10.7	6.3	197	NA	1134	745	10.7	9.3	15.1	24.4
5/20	1030	145.9	282	175	161	NA	43.5	10.2	28.8	0.1	200	NA	1131	700	10.6	9.0	17.8	27.1
5/20	1045	145.8	282	174	160	NA	43.7	10.2	10.3	6.4	198	NA	1109	715	10.6	9.1	16.5	24.9
5/20	1100	145.7	282	175	160	NA	43.6	10.0	10.6	6.4	198	NA	1102	705	10.7	9.1	17.6	24.7
5/20	1115	145.5	283	176	159	NA	41.8	10.1	10.7	5.9	196	NA	1132	710	10.7	9.2	16.3	27.0
5/20	1130	145.5	283	177	160	NA	41.7	9.9	10.6	5.8	195	NA	1147	722	10.8	9.1	18.7	25.3
5/20	1145	145.5	283	177	162	NA	42.1	10.0	11.0	5.9	197	NA	1137	735	10.8	9.1	18.7	23.3
5/20	1200	145.3	284	175	160	NA	44.1	9.9	10.8	6.1	197	NA	1101	729	10.7	9.1	17.6	22.2
5/20	1215	145.7	284	175	160	NA	44.0	9.8	10.5	6.2	197	NA	1111	724	10.7	9.1	17.6	23.3
5/20	1230	145.4	284	174	160	NA	44.4	10.1	10.3	5.9	197	NA	1124	719	10.7	9.1	17.6	24.8
5/20	1245	145.5	283	174	160	NA	44.7	9.7	10.4	6.4	198	NA	1105	719	10.5	9.1	15.4	24.9
5/20	1300	140.4	284	173	159	NA	44.3	10.0	10.1	6.1	194	NA	1105	719	10.5	9.1	15.4	24.9
5/20	1315	141.0	283	179	160	NA	43.9	9.8	9.9	7.1	193	NA	1105	719	10.5	9.1	15.4	24.9
5/20	1330	136.2	283	187	142	NA	36.0	10.5	11.2	6.6	190	NA	1105	719	10.5	9.1	15.4	24.9

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/20	1345	138.8	282	184	165	NA	38.0	10.0	13.1	6.4	192	NA	1105	719	10.5	9.1	15.4	24.9
5/20	1400	135.2	282	180	162	NA	39.6	10.0	11.8	5.8	188	NA	1214	809	10.5	9.4	11.7	25.6
5/20	1415	139.9	282	179	161	NA	40.2	10.0	11.4	6.2	192	NA	1211	809	11.5	9.3	23.7	17.5
5/20	1430	142.0	281	178	160	NA	39.4	10.0	12.0	6.2	194	NA	1200	790	11.4	9.3	22.6	19.3
5/20	1445	145.5	281	179	161	NA	40.6	9.9	12.4	6.2	197	NA	1221	774	11.4	9.2	23.9	21.4
5/20	1500	145.5	282	180	161	NA	40.0	9.6	12.4	6.4	195	NA	1175	775	11.3	9.3	21.5	19.8
5/20	1515	145.3	282	180	160	NA	40.5	9.9	12.1	6.3	196	NA	1190	773	11.2	9.2	21.7	21.0
5/20	1530	145.6	282	180	161	NA	40.9	9.9	12.8	6.7	198	NA	1189	777	11.2	9.2	21.7	20.5
5/20	1545	145.2	282	180	161	NA	41.3	9.8	12.6	6.4	196	NA	1191	779	11.1	9.3	19.4	21.9
5/20	1600	145.8	281	179	159	NA	40.6	9.9	12.1	6.6	199	NA	1152	757	11.1	9.2	20.7	20.7
5/20	1615	145.4	281	180	159	NA	38.1	10.1	13.1	6.2	193	NA	1211	771	11.2	9.2	21.7	22.5
5/20	1630	144.9	281	180	163	NA	41.3	9.7	13.0	6.6	199	NA	1233	818	11.1	9.2	20.7	20.0
5/20	1645	139.8	282	177	161	NA	42.2	10.0	11.4	6.0	194	NA	1209	784	11.0	9.1	20.9	21.7
5/20	1700	140.2	282	176	160	NA	42.7	10.1	11.4	6.0	196	NA	1170	768	10.9	9.0	21.1	20.5
5/20	1715	137.0	283	175	159	NA	41.8	9.9	10.8	5.9	189	NA	1246	791	11.0	9.2	19.6	24.1
5/20	1730	136.5	284	175	159	NA	41.9	10.3	10.5	5.9	186	NA	1248	776	11.1	9.1	22.0	24.1
5/20	1745	138.0	284	175	160	NA	41.6	9.9	10.7	6.2	188	NA	1226	788	11.1	9.1	22.0	21.6
5/20	1800	137.3	284	175	161	NA	42.1	9.9	10.7	6.4	186	NA	1206	764	11.1	9.1	22.0	22.7
5/20	1815	135.9	285	183	159	NA	42.0	9.4	10.4	9.0	189	NA	1230	747	11.0	9.0	22.2	25.8
5/20	1830	139.0	283	195	178	NA	35.1	9.0	14.6	7.6	188	NA	1247	832	11.0	9.1	20.9	19.4
5/20	1845	139.8	284	184	162	NA	37.9	9.1	14.9	7.0	191	NA	1249	801	11.1	9.1	22.0	21.7
5/20	1900	136.2	284	183	160	NA	37.8	8.5	14.2	7.6	186	NA	1212	823	11.1	9.1	22.0	17.2
5/20	1915	135.5	285	183	162	NA	38.7	8.2	14.1	7.5	185	NA	1252	817	11.0	9.1	20.9	21.1
5/20	1930	135.4	285	179	159	NA	40.1	8.1	12.3	5.9	186	NA	1241	829	10.9	9.0	21.1	19.1
5/20	1945	135.6	283	179	159	NA	39.7	7.7	11.6	6.2	186	NA	1237	834	10.8	9.0	20.0	19.1
5/20	2000	138.8	282	178	160	NA	37.9	8.1	12.5	6.3	187	NA	1223	827	11.0	9.0	22.2	17.3
5/20	2015	139.5	279	178	159	NA	38.5	8.2	11.4	6.4	188	NA	1253	809	11.1	8.9	24.7	19.5
5/20	2030	137.5	281	179	160	NA	38.8	8.0	11.9	6.2	189	NA	1194	824	10.9	9.0	21.1	16.4
5/20	2045	144.8	279	179	160	NA	39.3	8.0	13.1	7.0	197	NA	1219	815	10.9	9.1	19.8	19.9
5/20	2100	135.7	282	178	160	NA	38.8	7.8	11.0	6.2	187	NA	1219	817	10.9	9.1	19.8	19.8
5/20	2115	137.6	280	178	159	NA	38.6	8.2	10.9	6.2	190	NA	1219	817	10.9	9.1	19.8	19.8
5/20	2145	139.1	280	177	160	NA	39.8	8.0	10.9	6.2	188	NA	1076	795	10.9	8.6	26.7	6.3
5/20	2200	139.4	278	177	156	NA	40.6	8.1	10.0	6.6	190	NA	1113	808	10.9	8.7	25.3	9.1
5/20	2215	141.0	279	187	163	NA	40.3	8.2	11.8	6.4	194	NA	1142	776	10.9	8.6	26.7	13.9
5/20	2230	140.2	279	181	164	NA	40.1	7.9	11.1	6.1	195	NA	1185	775	10.4	8.7	19.5	21.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/20	2245	140.9	279	178	160	NA	38.7	8.2	10.7	6.4	193	NA	1202	798	10.5	8.8	19.3	20.8
5/20	2300	135.2	279	178	160	NA	38.8	8.0	10.3	6.3	188	NA	1190	798	10.5	8.8	19.3	20.0
5/20	2315	145.4	276	179	160	NA	38.1	8.0	11.8	6.7	198	NA	1190	798	10.5	8.8	19.3	20.0
5/20	2330	145.4	275	179	160	NA	37.6	8.1	11.2	6.2	196	NA	1000	792	10.5	8.8	19.3	5.5
5/20	2345	136.1	278	179	159	NA	37.4	7.8	10.4	6.3	187	NA	1081	795	10.5	8.7	20.7	11.3
5/21	0000	126.0	280	178	160	NA	37.1	7.9	10.2	6.0	180	NA	1122	784	10.5	8.5	23.5	13.6
5/21	0015	123.9	281	177	160	NA	36.8	8.0	9.7	6.2	179	NA	1145	741	10.1	8.4	20.2	22.2
5/21	0030	109.4	284	177	160	NA	36.6	8.0	9.1	6.1	170	NA	1136	735	9.9	8.2	20.7	21.9
5/21	0045	112.7	286	177	160	NA	37.6	8.2	9.3	5.5	172	NA	1105	717	9.7	8.2	18.3	23.2
5/21	0100	110.2	285	177	161	NA	36.6	8.0	10.1	6.3	170	NA	1086	698	9.8	8.2	19.5	23.1
5/21	0115	112.2	284	175	160	NA	38.8	8.0	9.4	6.5	174	NA	1117	730	9.7	8.3	16.9	23.7
5/21	0130	111.3	283	176	160	NA	35.9	8.0	8.7	6.2	170	NA	1120	740	9.9	8.4	17.9	22.2
5/21	0145	110.0	283	175	160	NA	37.7	8.1	8.9	6.2	170	NA	1136	744	10.0	8.4	19.0	22.1
5/21	0200	109.1	282	175	160	NA	36.5	7.9	9.1	6.6	168	NA	1115	737	9.9	8.5	16.5	23.0
5/21	0215	108.1	282	182	163	NA	37.1	8.1	8.9	7.5	170	NA	1124	741	9.9	8.5	16.5	23.2
5/21	0230	110.1	281	178	159	NA	35.7	7.7	8.9	6.4	170	NA	1135	736	10.1	8.4	20.2	22.1
5/21	0245	109.2	281	177	159	NA	35.8	8.4	10.1	7.3	170	NA	1118	720	9.9	8.3	19.3	23.1
5/21	0300	109.1	280	177	160	NA	34.8	8.2	10.0	7.9	169	NA	1095	719	9.9	8.3	19.3	21.6
5/21	0315	110.3	278	176	160	NA	36.5	8.0	10.1	7.7	170	NA	1107	721	9.9	8.4	17.9	23.3
5/21	0330	112.5	279	176	160	NA	36.5	7.9	9.7	7.7	174	NA	1079	701	9.6	8.2	17.1	23.9
5/21	0345	110.4	279	176	161	NA	35.6	8.0	9.6	7.8	173	NA	1081	690	9.7	8.2	18.3	24.5
5/21	0400	108.7	280	175	160	NA	36.5	7.9	10.1	7.4	171	NA	1072	700	9.8	8.3	18.1	22.9
5/21	0415	110.7	278	174	160	NA	36.5	7.8	9.7	7.5	169	NA	1123	677	10.0	8.5	17.6	29.1
5/21	0430	109.4	277	174	158	NA	36.0	8.2	10.0	8.1	169	NA	1122	706	10.1	8.4	20.2	24.3
5/21	0445	108.3	277	186	167	NA	35.4	7.7	9.5	7.8	166	NA	1111	694	9.9	8.3	19.3	25.5
5/21	0500	111.2	279	177	162	NA	36.6	8.1	9.9	7.1	170	NA	1100	703	10.1	8.4	20.2	23.2
5/21	0515	111.8	279	174	160	NA	37.1	8.0	9.8	7.4	169	NA	1130	718	10.1	8.3	21.7	22.7
5/21	0530	109.8	279	174	160	NA	36.5	8.1	9.6	7.6	169	NA	1138	729	10.2	8.4	21.4	22.2
5/21	0545	111.6	279	174	160	NA	36.6	8.0	9.8	7.5	170	NA	1117	713	10.0	8.3	20.5	23.1
5/21	0600	113.5	279	175	160	NA	37.1	8.2	9.6	7.2	172	NA	1112	711	10.1	8.4	20.2	23.1
5/21	0615	126.1	274	174	160	NA	37.1	8.3	10.0	7.5	179	NA	1159	752	10.4	8.5	22.4	20.6
5/21	0630	134.9	269	174	160	NA	35.7	8.0	9.8	7.5	182	NA	1155	798	10.6	9.0	17.8	18.6
5/21	0645	145.5	268	174	159	NA	37.0	8.2	10.6	8.0	196	NA	1160	782	10.7	9.1	17.6	20.7
5/21	0700	144.8	269	175	161	NA	37.2	7.8	11.0	6.9	195	NA	1154	791	10.9	9.1	19.8	17.9
5/21	0715	142.0	269	173	160	NA	37.5	7.8	9.9	6.8	191	NA	1215	812	11.0	9.1	20.9	19.2

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Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/21	0730	137.5	271	173	160	NA	37.4	7.7	9.9	6.8	187	NA	1216	813	10.9	9.0	21.1	19.0
5/21	0745	136.2	271	173	159	NA	37.3	8.1	10.0	7.3	188	NA	1198	784	10.7	9.0	18.9	22.2
5/21	0800	135.4	272	174	160	NA	36.0	8.0	10.1	6.4	186	NA	1166	802	10.8	8.9	21.3	16.5
5/21	0815	135.5	272	174	161	NA	37.2	8.0	9.9	6.4	185	NA	1208	791	10.9	9.0	21.1	20.7
5/21	0830	136.7	274	173	160	NA	38.5	8.1	9.6	6.3	184	NA	1208	791	10.9	9.0	21.1	20.7
5/21	0845	133.0	274	174	160	NA	37.7	8.1	9.9	6.6	185	NA	1208	791	10.9	9.0	21.1	20.7
5/21	0900	134.5	274	171	159	NA	37.6	8.0	9.9	7.4	182	NA	1208	791	10.9	9.0	21.1	20.7
5/21	0915	141.9	274	172	160	NA	39.4	8.0	10.2	7.1	191	NA	1208	791	10.9	9.0	21.1	20.7
5/21	0930	145.3	273	172	160	NA	40.7	7.9	11.1	8.0	199	NA	1294	831	10.9	9.4	16.0	25.5
5/21	0945	145.6	273	172	160	NA	40.7	8.2	11.5	8.0	201	NA	1261	833	11.7	9.4	24.5	17.8
5/21	1000	145.0	276	172	160	NA	40.7	8.0	11.1	7.7	202	NA	1209	826	11.5	9.3	23.7	15.5
5/21	1015	144.9	278	174	161	NA	39.9	7.7	11.3	7.4	203	NA	1243	822	11.3	9.3	21.5	19.7
5/21	1030	143.1	278	175	160	NA	38.0	8.1	12.8	7.2	194	NA	1237	829	11.2	9.2	21.7	18.4
5/21	1045	145.6	278	173	163	NA	43.4	8.2	10.5	7.3	203	NA	1221	796	11.2	8.8	27.3	17.1
5/21	1100	143.2	281	172	162	NA	43.2	7.6	10.4	7.3	203	NA	1199	845	11.3	9.2	22.8	13.5
5/21	1115	140.6	282	170	161	NA	44.1	8.0	10.0	7.4	199	NA	1237	818	11.2	9.2	21.7	19.5
5/21	1130	137.7	283	170	159	NA	43.3	8.0	9.9	7.2	198	NA	1246	817	11.2	9.1	23.1	19.3
5/21	1145	138.8	283	171	160	NA	43.4	7.9	10.0	7.4	200	NA	1224	810	11.2	9.1	23.1	18.5
5/21	1200	137.7	283	171	160	NA	42.8	8.1	10.3	7.3	199	NA	1198	806	11.2	9.1	23.1	17.2
5/21	1215	136.2	282	171	159	NA	42.6	8.2	10.0	7.5	198	NA	1222	798	11.0	9.2	19.6	21.9
5/21	1230	136.1	282	178	160	NA	41.3	8.0	10.1	7.6	193	NA	1214	786	11.1	9.0	23.3	20.2
5/21	1245	139.1	282	174	156	NA	41.5	7.7	10.2	6.9	197	NA	1214	784	11.0	9.0	22.2	21.1
5/21	1300	139.1	281	174	160	NA	40.8	8.0	10.6	6.7	197	NA	1194	794	11.1	9.1	22.0	18.9
5/21	1315	138.6	281	174	159	NA	40.6	7.9	10.5	6.3	196	NA	1227	794	11.1	9.1	22.0	21.0
5/21	1330	139.1	282	174	159	NA	40.8	8.0	10.5	6.0	194	NA	1216	795	11.1	9.1	22.0	20.3
5/21	1345	136.2	282	173	160	NA	39.2	8.1	10.5	6.4	192	NA	1208	793	11.0	9.0	22.2	19.7
5/21	1400	136.0	282	174	161	NA	40.2	8.1	10.3	6.2	193	NA	1182	775	11.1	8.9	24.7	18.2
5/21	1415	140.4	282	174	160	NA	41.1	8.1	10.7	5.9	198	NA	1194	800	11.1	9.2	20.7	19.1
5/21	1430	137.3	284	173	161	NA	41.1	8.0	10.4	5.8	195	NA	1226	798	11.1	9.1	22.0	20.6
5/21	1445	139.8	282	173	158	NA	40.4	8.1	10.7	5.8	199	NA	1213	757	11.2	9.0	24.4	22.3
5/21	1500	137.7	282	177	159	NA	38.5	7.9	11.1	5.3	197	NA	1167	807	11.1	9.2	20.7	16.5
5/21	1515	139.5	282	174	164	NA	42.3	8.0	10.4	6.1	198	NA	1206	844	11.2	9.2	21.7	14.8
5/21	1530	142.2	281	177	163	NA	42.2	8.1	10.8	5.9	200	NA	1213	798	11.1	9.1	22.0	19.8
5/21	1545	139.8	282	175	159	NA	40.1	8.0	10.6	5.4	196	NA	1208	814	11.1	9.2	20.7	18.7
5/21	1600	140.8	283	177	159	NA	39.4	7.8	10.9	5.5	195	NA	1199	827	11.2	9.2	21.7	16.0

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5/21	1615	145.5	282	179	160	NA	39.2	8.3	12.1	5.6	201	NA	1190	821	11.1	9.2	20.7	16.8
5/21	1630	143.8	282	179	160	NA	39.8	8.3	11.9	5.5	199	NA	1196	822	11.1	9.2	20.7	17.1
5/21	1645	140.6	282	179	160	NA	39.0	7.9	11.8	5.3	197	NA	1189	817	11.0	9.1	20.9	16.9
5/21	1700	140.3	282	179	161	NA	38.9	8.1	11.9	5.5	196	NA	1182	825	11.1	9.1	22.0	14.9
5/21	1715	139.6	282	179	160	NA	39.5	8.3	11.8	5.4	196	NA	1212	801	11.2	9.1	23.1	18.7
5/21	1730	138.1	281	178	160	NA	38.4	7.9	11.5	5.3	194	NA	1151	805	11.0	9.1	20.9	15.4
5/21	1745	139.4	281	177	160	NA	38.7	7.9	11.4	5.5	197	NA	1208	797	11.1	9.1	22.0	19.5
5/21	1800	138.4	281	181	160	NA	35.8	8.1	12.3	5.3	195	NA	1162	798	11.0	9.1	20.9	17.0
5/21	1815	136.4	280	178	161	NA	39.5	7.8	11.6	5.7	196	NA	1174	801	11.0	9.1	20.9	17.5
5/21	1830	138.6	280	178	165	NA	38.1	8.0	11.5	5.3	196	NA	1207	820	11.2	9.1	23.1	16.3
5/21	1845	135.8	279	186	161	NA	37.5	7.9	10.7	5.4	192	NA	1195	799	11.0	9.0	22.2	18.3
5/21	1900	135.5	278	189	177	NA	37.8	7.5	10.5	5.5	192	NA	1168	789	11.0	9.0	22.2	17.5
5/21	1915	135.4	279	177	162	NA	38.1	7.9	10.6	5.3	192	NA	1212	789	11.1	9.1	22.0	20.7
5/21	1930	136.9	279	176	160	NA	38.1	8.2	10.5	5.6	193	NA	1195	793	11.0	9.0	22.2	18.9
5/21	1945	135.4	279	177	160	NA	37.1	8.0	10.7	5.4	194	NA	1197	782	11.0	9.0	22.2	20.2
5/21	2000	137.1	278	176	161	NA	38.3	7.7	10.6	5.1	194	NA	1163	788	11.0	9.0	22.2	17.2
5/21	2015	138.3	277	176	160	NA	37.8	8.2	10.6	5.4	197	NA	1175	781	11.0	9.0	22.2	18.8
5/21	2030	143.9	276	172	162	NA	41.5	8.0	10.5	6.2	201	NA	1187	796	11.0	9.1	20.9	18.9
5/21	2045	140.7	276	171	160	NA	40.3	8.1	9.7	5.9	196	NA	1200	816	11.2	9.2	21.7	17.2
5/21	2100	140.5	276	171	160	NA	40.8	7.8	9.8	6.0	197	NA	1200	818	11.2	9.2	21.7	17.1
5/21	2115	145.9	274	171	159	NA	40.2	8.2	10.6	6.5	201	NA	1200	818	11.2	9.2	21.7	17.1
5/21	2130	144.9	276	171	161	NA	41.0	7.9	9.8	6.1	201	NA	1200	739	11.2	8.6	30.2	19.9
5/21	2145	145.6	275	171	160	NA	40.5	8.2	9.7	6.2	201	NA	1045	756	11.2	8.9	25.8	9.0
5/21	2200	145.1	274	172	159	NA	39.9	7.9	9.8	6.0	200	NA	1075	769	10.1	8.9	13.5	18.8
5/21	2215	145.3	273	173	161	NA	38.4	8.1	10.0	5.9	200	NA	1129	773	10.4	8.9	16.9	20.1
5/21	2230	141.4	274	184	168	NA	38.2	8.2	9.6	5.7	197	NA	1191	775	10.7	8.8	21.6	20.9
5/21	2245	142.6	271	183	171	NA	38.4	8.0	9.7	5.9	197	NA	1104	769	10.4	8.8	18.2	17.6
5/21	2300	135.8	275	173	161	NA	39.8	7.5	9.4	5.6	195	NA	1174	769	10.6	8.8	20.5	21.0
5/21	2315	136.8	275	172	159	NA	38.2	7.3	9.3	6.3	195	NA	1174	769	10.6	8.8	20.5	21.0
5/21	2330	135.6	275	172	160	NA	38.1	8.5	9.1	6.0	191	NA	1174	775	10.6	8.8	20.5	20.4
5/21	2345	135.6	274	172	160	NA	38.4	8.2	9.5	6.7	193	NA	1024	763	10.6	8.8	20.5	10.3
5/22	0000	135.3	275	173	161	NA	38.2	8.3	9.7	6.2	194	NA	1056	778	10.0	8.9	12.4	17.3
5/22	0015	145.3	272	171	160	NA	38.9	8.3	9.5	6.8	200	NA	1097	777	10.5	9.0	16.7	17.4
5/22	0030	141.3	273	170	160	NA	39.6	6.5	9.3	6.7	195	NA	1156	794	10.6	9.0	17.8	19.1
5/22	0045	140.4	271	170	160	NA	38.6	6.0	9.3	7.3	193	NA	1130	805	10.5	9.0	16.7	16.9

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Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/22	0100	122.7	274	168	159	NA	39.4	5.4	8.6	7.2	185	NA	1112	753	10.3	8.6	19.8	18.9
5/22	0115	110.0	280	168	159	NA	38.1	4.9	8.7	7.2	178	NA	1109	710	10.1	8.3	21.7	22.1
5/22	0130	109.3	281	168	160	NA	37.9	4.9	8.5	7.4	176	NA	1101	703	9.9	8.2	20.7	22.9
5/22	0145	108.1	279	169	160	NA	38.1	4.5	8.5	7.6	174	NA	1105	693	10.0	8.3	20.5	24.4
5/22	0200	110.7	279	170	160	NA	35.7	6.1	8.5	7.6	175	NA	1070	696	9.9	8.2	20.7	21.5
5/22	0215	109.9	279	170	160	NA	37.1	5.0	8.7	7.8	176	NA	1104	706	10.0	8.3	20.5	23.0
5/22	0230	110.2	278	169	160	NA	36.4	4.2	8.5	8.1	175	NA	1106	715	10.0	8.4	19.0	23.0
5/22	0245	108.8	278	168	160	NA	37.6	3.7	40.7	0.1	175	NA	1102	736	10.1	8.5	18.8	20.6
5/22	0300	109.4	278	168	160	NA	37.3	3.3	9.4	8.6	175	NA	1078	738	10.0	8.5	17.6	19.5
5/22	0315	106.2	280	170	160	NA	35.7	3.3	8.9	8.1	174	NA	1094	735	9.9	8.4	17.9	20.9
5/22	0330	108.5	279	170	159	NA	36.3	2.6	9.0	8.4	176	NA	1093	756	9.9	8.4	17.9	18.4
5/22	0345	107.5	278	172	160	NA	35.6	2.3	9.0	8.1	176	NA	1095	766	9.9	8.5	16.5	18.6
5/22	0400	107.0	276	171	161	NA	33.8	1.9	8.9	8.7	174	NA	1057	762	9.9	8.3	19.3	14.1
5/22	0415	106.7	276	183	170	NA	33.9	2.0	8.9	8.6	173	NA	1088	748	9.9	8.3	19.3	18.0
5/22	0430	106.1	277	172	162	NA	34.6	1.6	9.0	8.4	174	NA	1087	770	10.0	8.4	19.0	15.7
5/22	0445	109.6	276	170	160	NA	35.4	1.3	8.9	8.5	174	NA	1098	791	10.0	8.4	19.0	14.2
5/22	0500	109.9	276	170	161	NA	34.8	1.1	8.9	8.6	175	NA	1072	798	9.9	8.4	17.9	12.3
5/22	0515	106.1	275	169	160	NA	35.1	1.2	8.9	8.8	173	NA	1089	794	9.9	8.3	19.3	13.1
5/22	0530	107.9	276	170	160	NA	34.4	1.1	8.8	8.6	173	NA	1102	817	10.1	8.4	20.2	10.8
5/22	0545	106.1	278	171	160	NA	34.3	0.9	8.8	8.4	172	NA	1123	822	10.1	8.5	18.8	13.0
5/22	0600	105.7	278	170	160	NA	34.5	0.8	8.6	8.3	172	NA	1095	823	10.2	8.5	20.0	9.9
5/22	0615	105.7	278	170	159	NA	35.2	0.5	8.7	8.7	172	NA	1122	832	10.1	8.6	17.4	12.9
5/22	0630	105.8	278	171	160	NA	33.7	0.6	8.9	8.6	172	NA	1119	835	10.2	8.5	20.0	10.4
5/22	0645	107.0	278	172	160	NA	33.5	0.6	8.7	8.6	172	NA	1113	839	10.0	8.4	19.0	10.2
5/22	0700	109.9	276	172	160	NA	33.0	0.5	9.1	8.8	174	NA	1098	850	10.2	8.5	20.0	7.1
5/22	0715	109.1	276	171	161	NA	33.3	0.6	8.8	8.6	174	NA	1131	846	10.2	8.5	20.0	10.3
5/22	0730	109.8	276	171	160	NA	35.0	0.5	8.9	8.8	175	NA	1126	856	10.2	8.5	20.0	8.8
5/22	0745	109.4	276	170	160	NA	34.9	0.4	8.8	8.2	174	NA	1119	860	10.2	8.6	18.6	8.9
5/22	0800	109.1	274	169	159	NA	32.0	0.5	9.1	9.3	172	NA	1098	831	10.2	8.4	21.4	8.1
5/22	0815	118.5	274	170	160	NA	34.6	0.4	9.0	8.9	177	NA	1135	868	10.5	8.7	20.7	7.7
5/22	0830	144.9	264	171	160	NA	33.1	0.2	10.1	9.9	195	NA	1191	879	10.8	9.0	20.0	11.5
5/22	0845	143.4	262	172	160	NA	33.6	0.2	10.0	8.8	194	NA	1163	927	11.0	9.2	19.6	4.7
5/22	0900	143.9	264	173	160	NA	33.1	0.4	10.0	7.2	195	NA	1118	898	10.9	9.2	18.5	4.8
5/22	0915	146.0	267	173	160	NA	35.0	0.2	9.9	6.8	197	NA	1151	937	10.9	9.2	18.5	3.5
5/22	0930	144.6	270	175	160	NA	34.7	0.1	9.4	4.7	193	NA	1130	937	10.5	9.3	12.9	6.4

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Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow In KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/22	0945	146.0	269	175	160	NA	33.5	0.0	9.0	3.8	193	NA	1130	937	10.5	9.3	12.9	6.4
5/22	1000	145.2	271	176	160	NA	33.7	0.3	9.1	3.4	193	NA	1167	942	11.0	9.2	19.6	3.4
5/22	1015	147.9	271	177	160	NA	33.4	0.1	9.4	3.5	193	NA	1172	961	11.0	9.3	18.3	3.0
5/22	1030	146.3	273	177	161	NA	33.6	0.1	9.2	3.3	192	NA	1230	965	11.1	9.3	19.4	6.3
5/22	1045	147.8	269	177	160	NA	32.5	0.1	9.9	4.0	194	NA	1181	955	10.9	9.2	18.5	4.2
5/22	1115	140.2	273	179	160	NA	32.2	0.1	10.8	4.4	190	NA	1181	954	10.8	9.1	18.7	4.1
5/22	1130	139.6	275	180	164	NA	30.7	0.1	9.1	3.6	189	NA	1199	963	10.9	9.1	19.8	3.7
5/22	1145	139.7	274	187	162	NA	33.9	0.0	9.3	3.4	189	NA	1203	961	10.9	9.0	21.1	3.3
5/22	1215	135.3	277	177	141	NA	33.6	0.3	10.0	3.5	182	NA	1222	975	10.9	9.1	19.8	4.5
5/22	1230	133.5	278	184	158	NA	30.3	0.0	9.4	3.3	182	NA	1226	986	10.9	9.1	19.8	3.7
5/22	1345	137.4	277	187	160	NA	29.9	0.0	9.9	3.6	181	NA	1210	860	11.1	9.2	20.7	14.2
5/22	1400	139.0	277	187	160	NA	30.4	0.2	10.6	3.9	182	NA	1057	860	10.0	9.2	8.7	11.5
5/22	1415	139.6	277	186	154	NA	31.4	0.0	9.5	3.5	185	NA	1209	860	11.1	9.2	20.7	14.1
5/22	1430	139.5	277	194	182	NA	25.8	0.0	11.8	4.1	184	NA	1127	860	10.4	9.2	13.0	13.7
5/22	1445	135.8	279	193	167	NA	29.8	0.2	12.8	5.2	180	NA	1127	920	10.4	9.2	13.0	7.7
5/22	1500	135.7	279	188	163	NA	29.8	0.0	11.8	3.8	179	NA	1127	859	10.4	9.2	13.0	13.8
5/22	1515	131.8	279	195	176	NA	30.5	0.0	9.0	2.7	176	NA	1127	859	10.4	9.2	13.0	13.8
5/22	1530	130.2	281	189	159	NA	29.6	0.1	9.8	3.3	175	NA	1200	945	10.9	9.2	18.5	6.7
5/22	2230	134.5	274	185	175	NA	30.9	0.0	14.4	6.1	184	NA	1112	966	10.2	9.2	10.9	3.7
5/23	0330	106.1	281	185	174	NA	31.6	0.0	11.4	6.5	165	NA	1089	896	9.9	8.4	17.9	3.0
5/23	2330	115.1	280	192	172	NA	35.6	0.0	13.9	5.0	173	NA	1094	882	10.2	9.1	12.1	9.7
5/24	0245	106.9	282	186	177	NA	35.6	0.0	12.9	5.6	167	NA	1040	867	9.4	8.1	16.0	3.3
5/24	0830	141.3	276	187	175	NA	34.0	0.0	13.7	4.7	188	NA	1230	976	11.2	9.2	21.7	3.4
5/24	0915	135.8	279	181	166	NA	33.9	2.3	10.2	3.0	182	NA	1200	952	11.0	9.0	22.2	3.0
5/24	0945	146.9	277	183	168	NA	34.4	7.3	21.9	11.5	195	NA	1132	927	10.8	9.2	17.4	3.9
5/24	1000	148.4	283	187	175	NA	35.9	8.2	13.6	9.0	198	NA	1153	916	11.1	9.2	20.7	4.1
5/24	1015	146.6	282	189	178	NA	34.6	9.5	15.9	5.8	198	NA	1132	924	10.8	9.2	17.4	4.2
5/24	1030	146.7	283	192	184	NA	34.9	9.8	11.6	5.4	197	NA	1102	924	10.4	9.2	13.0	5.2
5/24	1045	146.5	286	194	187	NA	34.3	9.8	10.7	3.8	197	NA	1102	924	10.4	9.2	13.0	5.2
5/24	1100	146.4	286	196	189	NA	33.4	9.8	10.3	4.2	196	NA	1102	924	10.4	9.2	13.0	5.2
5/24	1115	146.5	286	196	189	NA	33.9	9.7	9.3	3.3	195	NA	1102	924	10.4	9.2	13.0	5.2
5/24	1130	146.6	285	197	187	NA	34.5	9.9	9.2	3.5	194	NA	1102	847	10.4	8.8	18.2	9.1
5/24	1200	146.5	284	196	186	NA	33.5	9.8	9.7	3.7	193	NA	1057	856	10.1	8.9	13.5	8.1
5/24	1215	147.1	285	189	177	NA	37.7	9.9	9.0	3.4	195	NA	1108	852	10.4	9.0	15.6	11.1
5/24	1230	147.1	286	186	171	NA	38.2	8.6	10.2	3.5	194	NA	1107	831	10.4	9.0	15.6	13.2

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5/24	1245	146.2	287	185	170	NA	39.1	8.0	9.0	3.1	194	NA	1129	830	10.5	9.1	15.4	15.2
5/24	1300	146.3	287	186	170	NA	38.5	7.3	9.0	3.5	193	NA	1128	827	10.7	9.2	16.3	14.8
5/24	1315	145.7	284	185	171	NA	37.9	6.5	9.1	3.4	191	NA	1141	820	10.7	9.1	17.6	15.5
5/24	1330	144.7	284	185	170	NA	38.1	6.0	9.0	3.2	193	NA	1131	797	10.6	8.9	19.1	16.1
5/24	1345	146.2	285	183	171	NA	39.5	5.5	9.0	3.5	193	NA	1131	839	10.6	9.1	16.5	13.6
5/24	1400	145.6	285	182	170	NA	39.7	5.1	9.0	3.8	193	NA	1128	838	10.7	9.1	17.6	12.6
5/24	1415	146.3	285	182	170	NA	38.7	5.0	9.0	3.5	192	NA	1128	838	10.7	9.1	17.6	12.6
5/24	1430	145.8	283	186	168	NA	40.6	4.6	9.0	4.3	192	NA	1183	768	11.1	9.1	22.0	20.8
5/24	1445	145.3	282	188	170	NA	36.0	4.2	9.2	3.1	190	NA	1181	800	11.0	8.8	25.0	15.4
5/24	1500	131.0	286	181	169	NA	34.6	4.4	8.7	2.9	172	NA	1181	859	10.8	9.0	20.0	12.7
5/24	1515	140.0	276	181	170	NA	34.8	4.2	9.6	3.5	188	NA	1140	822	11.1	8.8	26.1	9.0
5/24	1530	136.0	284	182	170	NA	34.6	4.1	8.8	3.0	179	NA	1216	828	11.0	9.0	22.2	16.7
5/24	1545	143.4	275	181	170	NA	33.4	4.1	8.9	4.1	183	NA	1176	842	10.9	9.0	21.1	13.3
5/24	1600	141.7	275	180	170	NA	34.2	4.4	8.8	3.4	181	NA	1164	833	10.9	8.9	22.5	12.4
5/24	1615	139.9	275	182	170	NA	32.0	4.3	8.7	3.2	179	NA	1185	846	10.9	9.0	21.1	13.5
5/24	1630	139.7	274	181	170	NA	32.6	3.9	8.9	3.0	179	NA	1186	852	11.0	9.0	22.2	12.2
5/24	1645	140.1	273	187	173	NA	33.4	4.0	8.7	3.5	179	NA	1176	818	10.9	9.0	21.1	15.8
5/24	1700	140.1	273	185	165	NA	33.3	4.1	8.7	2.8	179	NA	1154	836	11.0	9.0	22.2	11.5
5/24	1715	140.0	273	178	164	NA	33.1	4.0	8.7	3.2	179	NA	1169	833	11.0	9.0	22.2	12.9
5/24	1730	139.9	272	181	169	NA	30.6	4.3	8.7	3.3	179	NA	1166	845	11.0	9.1	20.9	12.4
5/24	1745	139.8	272	181	170	NA	31.6	4.1	8.6	3.2	178	NA	1171	842	10.9	9.1	19.8	13.9
5/24	1800	140.3	272	181	170	NA	31.8	4.0	8.6	3.5	179	NA	1141	831	11.0	9.0	22.2	10.9
5/24	1815	140.2	272	180	170	NA	31.4	4.2	9.6	3.4	179	NA	1163	845	10.9	9.0	21.1	12.0
5/24	1830	139.9	271	177	171	NA	31.7	4.1	8.7	3.3	179	NA	1173	849	11.0	9.0	22.2	11.6
5/24	1845	139.9	271	177	170	NA	32.2	4.2	8.6	3.5	180	NA	1159	842	10.9	8.9	22.5	11.0
5/24	1900	140.0	272	177	170	NA	32.5	4.3	8.7	3.1	180	NA	1132	832	10.9	8.9	22.5	10.0
5/24	1915	139.5	273	177	170	NA	33.8	3.7	8.6	3.3	180	NA	1172	844	11.0	9.1	20.9	13.0
5/24	1930	140.0	272	178	170	NA	32.3	4.3	8.5	3.5	178	NA	1154	842	10.9	9.0	21.1	11.6
5/24	1945	139.6	273	178	170	NA	31.5	4.1	8.5	2.9	176	NA	1168	879	11.0	9.3	18.3	11.0
5/24	2000	140.1	271	183	175	NA	32.8	4.1	8.5	3.6	178	NA	1154	848	11.1	9.2	20.7	11.3
5/24	2015	140.2	270	192	170	NA	31.7	3.9	8.6	4.0	178	NA	1166	851	11.1	9.2	20.7	12.0
5/24	2030	140.2	268	179	167	NA	31.9	4.3	8.8	3.1	180	NA	1134	814	10.9	9.0	21.1	13.1
5/24	2045	139.8	268	178	168	NA	31.9	4.2	8.6	3.1	179	NA	1139	809	10.8	8.9	21.3	13.8
5/24	2100	139.7	268	179	169	NA	30.0	4.2	9.0	3.1	179	NA	1139	809	10.8	8.9	21.3	13.8
5/24	2115	140.1	267	179	170	NA	31.2	4.1	8.4	2.9	177	NA	1083	810	10.3	8.9	15.7	13.4

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/24	2130	140.2	269	179	170	NA	29.6	4.5	8.5	3.8	179	NA	1110	786	10.6	8.5	24.7	11.8
5/24	2145	140.2	269	179	170	NA	30.3	4.3	8.3	3.4	179	NA	1126	795	10.8	8.6	25.6	11.3
5/24	2200	139.8	268	178	170	NA	31.8	4.0	8.8	3.4	178	NA	1122	800	10.8	8.7	24.1	11.4
5/24	2215	139.9	267	176	170	NA	32.1	4.1	9.2	3.4	180	NA	1141	801	10.9	8.7	25.3	12.1
5/24	2230	140.0	265	176	170	NA	31.6	4.3	8.4	3.7	180	NA	1141	811	10.8	8.6	25.6	10.8
5/24	2245	139.6	265	182	172	NA	32.3	4.1	8.4	3.3	179	NA	1128	803	10.7	8.6	24.4	11.4
5/24	2300	139.7	263	186	166	NA	31.7	4.3	8.4	3.5	179	NA	1137	803	10.9	8.6	26.7	10.5
5/24	2315	140.7	262	175	163	NA	30.8	4.5	8.6	4.1	181	NA	1109	803	10.7	8.6	24.4	9.9
5/24	2330	139.8	262	176	167	NA	30.0	4.4	8.3	3.4	180	NA	1145	808	10.9	8.7	25.3	11.6
5/24	2345	139.9	261	178	170	NA	28.5	4.0	8.2	3.6	180	NA	1133	820	10.9	8.8	23.9	10.4
5/25	0000	140.0	260	179	170	NA	28.3	4.3	8.6	4.0	179	NA	1099	816	10.8	8.8	22.7	8.9
5/25	0015	139.8	261	178	170	NA	28.9	4.0	8.2	3.5	179	NA	1131	832	10.9	8.8	23.9	8.9
5/25	0030	139.8	260	177	170	NA	28.4	4.1	8.2	3.5	180	NA	1126	816	10.9	8.8	23.9	10.2
5/25	0045	140.2	259	177	171	NA	28.1	4.5	8.2	3.6	181	NA	1104	825	10.7	9.0	18.9	11.1
5/25	0100	139.6	260	177	170	NA	29.9	4.3	8.2	3.3	181	NA	1092	815	10.9	8.9	22.5	8.6
5/25	0115	140.2	260	177	171	NA	27.9	4.0	8.1	3.6	178	NA	1151	816	11.0	8.9	23.6	12.5
5/25	0130	140.7	260	188	178	NA	27.3	4.1	8.3	3.8	182	NA	1108	822	10.8	8.9	21.3	10.0
5/25	0145	140.1	261	194	176	NA	28.7	4.2	8.1	3.5	181	NA	1148	801	11.0	8.8	25.0	12.8
5/25	0200	139.5	263	184	176	NA	27.5	4.2	8.2	3.3	182	NA	1110	843	10.9	8.9	22.5	7.0
5/25	0215	126.0	267	184	178	NA	27.9	4.1	8.1	2.9	178	NA	1182	864	11.0	9.0	22.2	10.6
5/25	0230	106.3	274	182	173	NA	31.0	3.8	8.0	2.8	171	NA	1175	827	10.7	8.6	24.4	12.5
5/25	0245	105.2	278	181	170	NA	31.5	4.1	8.3	2.9	169	NA	1106	780	10.4	8.4	23.8	12.7
5/25	0300	104.6	277	181	170	NA	30.8	4.2	8.2	2.7	168	NA	1072	781	10.3	8.4	22.6	10.6
5/25	0315	105.2	273	180	169	NA	28.1	4.0	8.7	3.0	164	NA	1108	788	10.3	8.4	22.6	12.8
5/25	0330	104.2	270	178	170	NA	30.1	4.3	9.4	2.8	164	NA	1099	790	10.2	8.5	20.0	13.8
5/25	0345	105.1	269	177	170	NA	29.6	4.0	8.7	2.7	162	NA	1095	782	10.3	8.4	22.6	12.4
5/25	0400	104.9	270	177	170	NA	27.9	4.5	8.9	2.7	159	NA	1051	775	10.2	8.4	21.4	10.4
5/25	0415	105.0	270	177	170	NA	29.9	4.3	8.7	2.7	162	NA	1075	792	10.1	8.4	20.2	11.4
5/25	0430	104.6	272	177	170	NA	28.6	5.0	8.6	2.8	161	NA	1083	766	10.2	8.3	22.9	13.1
5/25	0445	104.8	270	176	170	NA	30.2	4.8	8.6	2.8	162	NA	1081	771	10.1	8.3	21.7	13.3
5/25	0500	104.6	269	177	170	NA	29.0	4.6	8.7	3.1	162	NA	1045	759	10.1	8.3	21.7	11.6
5/25	0515	104.5	269	176	170	NA	29.4	4.3	8.5	2.6	161	NA	1066	749	10.0	8.2	22.0	14.3
5/25	0530	110.9	268	183	169	NA	31.4	4.4	8.7	2.9	163	NA	1088	756	10.3	8.5	21.2	15.8
5/25	0545	131.4	259	179	155	NA	31.2	4.3	10.3	3.0	173	NA	1127	790	10.6	8.8	20.5	15.6
5/25	0600	138.6	255	171	158	NA	28.9	4.2	8.7	3.3	177	NA	1113	821	11.0	9.0	22.2	9.8

SEWARD PLANT OPERATING LOG April 21 - May 25, 1993

Date	Time	Boiler Load MW	B Duct Temp °F	C Avg Temp °F	C Low Temp °F	ID Fan Out Temp °F	Lime Flow gpm	Slurry Solids %	B Duct Opacity %	Stack Opacity %	FG Flow KSCFM	FG Flow Out KSCFM	SO2 In ppm	SO2 Out ppm	CO2 In %	CO2 Out %	CO2 Dilution %	SO2 Red %
5/25	0615	136.8	258	175	169	NA	28.3	4.1	8.6	3.3	178	NA	1134	857	10.9	9.0	21.1	8.5
5/25	0630	136.9	258	176	170	NA	27.6	4.0	8.6	2.8	179	NA	1118	835	10.8	8.9	21.3	9.5
5/25	0645	136.5	258	175	170	NA	27.9	4.1	8.6	2.8	177	NA	1150	863	11.0	9.1	20.9	9.3
5/25	0700	136.4	257	176	170	NA	28.1	3.9	8.6	2.9	177	NA	1107	852	10.9	9.0	21.1	6.7
5/25	0715	136.6	257	176	170	NA	28.2	4.3	8.6	4.4	177	NA	1146	863	10.9	9.0	21.1	8.9
5/25	0730	139.5	256	177	171	NA	25.9	4.1	8.6	3.6	177	NA	1137	852	11.0	9.0	22.2	8.4
5/25	0745	136.8	256	176	170	NA	25.6	4.1	8.4	3.2	176	NA	1136	863	10.8	9.1	18.7	9.9
5/25	0800	134.8	258	177	170	NA	25.7	4.4	8.6	2.9	175	NA	1136	864	11.0	9.1	20.9	8.0
5/25	0815	136.6	256	177	169	NA	26.4	4.2	8.6	3.0	176	NA	1136	847	10.9	9.0	21.1	9.6
5/25	0830	138.0	261	191	180	NA	27.2	4.2	9.4	3.0	185	NA	1158	865	11.1	9.1	22.0	8.9
5/25	0845	137.5	263	190	172	NA	27.3	3.9	8.6	2.8	178	NA	1178	864	11.1	9.0	23.3	9.5
5/25	0900	138.3	265	184	174	NA	27.7	3.5	9.0	2.9	184	NA	1152	872	11.1	9.2	20.7	8.7
5/25	0915	138.2	263	184	174	NA	28.1	3.3	8.8	3.2	185	NA	1165	866	11.1	9.1	22.0	9.3
5/25	0930	138.1	261	181	170	NA	27.5	3.2	8.7	2.9	179	NA	1169	861	11.0	8.9	23.6	8.9
5/25	0945	138.0	263	182	177	NA	27.0	2.8	8.8	3.1	180	NA	1182	887	11.2	9.1	23.1	7.6
5/25	1000	137.5	260	185	178	NA	27.3	2.5	8.7	3.1	180	NA	1152	869	11.1	9.1	22.0	8.0
5/25	1015	137.9	264	195	182	NA	28.3	3.9	8.8	3.0	177	NA	1170	898	11.1	9.1	22.0	6.4
5/25	1030	138.4	264	201	181	NA	27.0	4.4	9.1	2.9	182	NA	1184	883	11.2	9.1	23.1	8.2
5/25	1045	136.5	266	188	181	NA	27.1	4.8	9.1	4.1	184	NA	1182	882	11.2	9.2	21.7	9.1
5/25	1100	120.0	279	195	190	NA	26.7	4.6	11.4	3.0	178	NA	1115	867	10.9	8.9	22.5	4.8
5/25	1115	130.8	269	189	184	NA	27.7	4.6	16.3	0.1	179	NA	1166	846	11.0	8.8	25.0	9.3
5/25	1130	131.3	267	187	181	NA	27.9	4.1	9.1	2.8	177	NA	1140	866	10.8	8.9	21.3	7.8
5/25	1145	131.3	265	189	183	NA	33.5	4.1	8.8	3.3	178	NA	1150	905	10.8	9.0	20.0	5.5
5/25	1200	129.3	266	186	164	NA	33.8	4.4	8.7	3.2	177	NA	1139	803	10.9	8.8	23.9	12.7
5/25	1215	132.4	266	187	156	NA	34.8	3.9	8.8	2.8	176	NA	1158	806	10.9	8.8	23.9	13.8
5/25	1230	135.9	257	167	147	NA	33.9	3.5	8.8	2.9	178	NA	1117	764	10.7	8.7	23.0	15.9
5/25	1245	133.5	262	165	147	NA	34.5	3.4	8.7	3.0	177	NA	1148	776	10.8	8.7	24.1	16.1
5/25	1300	134.1	260	176	166	NA	27.8	2.7	8.7	3.4	177	NA	1118	836	10.8	8.8	22.7	8.2
5/25	1315	134.3	259	178	169	NA	29.5	2.6	8.7	3.2	177	NA	1134	840	10.7	8.8	21.6	10.0
5/25	1330	135.4	261	179	171	NA	28.8	4.9	8.6	3.3	178	NA	1147	846	10.7	8.8	21.6	10.4
5/25	1345	137.0	264	179	170	NA	29.1	4.9	8.6	3.1	178	NA	1134	826	10.7	8.8	21.6	11.4
5/25	1400	136.5	267	179	170	NA	30.0	4.6	8.7	2.9	180	NA	1113	816	10.7	8.7	23.0	9.8

Appendix D

Charts Showing Instant Opacity Percentages in the B-Duct Outlet

Appendix D
CHARTS SHOWING INSTANT OPACITY PERCENTAGES
IN THE B-DUCT OUTLET

This appendix presents data on the instant opacity percentage in the B-duct outlet, recorded on the days and under the circumstances listed below:

- On May 10 when burning low sulfur coal (Figure D-1)
- On May 14 when burning higher sulfur coal (Figure D-2)
- On May 21 when burning higher sulfur coal and when the first ESP was being de-energized (Figure D-3)

**Figure D-1 Chart of Instant Opacity Percentage in the B-Duct Outlet
Recorded on May 10, 1993, When Burning Low Sulfur Coal**

**Figure D-2 Chart of Instant Opacity Percentage in the B-Duct Outlet
Recorded on May 14, 1993, When Burning Higher Sulfur Coal**

**Figure D-3 Chart of Instant Opacity Percentage in the B-Duct Outlet
Recorded on May 21, 1993, When Burning Higher Sulfur Coal and
When the First ESP Was Being De-Energized**

Appendix E

Daily Charts with One-Minute Average Stack Opacity Percentages at Seward Station April 21 to May 5, 1993

Appendix E

DAILY CHARTS WITH THE ONE-MINUTE AVERAGE STACK OPACITY PERCENTAGE AT SEWARD STATION APRIL 21 TO MAY 5, 1993

Appendix F

Baseline Testing: Chemical Analyses of Solid Wastes Resulting from the CZD Operation on May 19 and 20, 1993

Appendix F

BASELINE TESTING: CHEMICAL ANALYSES OF SOLID WASTES RESULTING FROM THE CZD OPERATION ON MAY 19 AND 20, 1993

Samples of solid wastes taken from A-duct ESP hoppers (without CZD) and B-duct ESP hoppers (with CZD) on May 19 and 20, 1993, were chemically analyzed by Geochemical Testing Co. This appendix presents data on the results of the chemical analyses and the methods of calculation, based on a comparison of solid wastes from the A-duct (without CZD) with those from the B-duct (with CZD).

F.1 CHEMICAL ANALYSIS OF SOLID WASTE MADE BY GEOCHEMICAL TESTING COMPANY

	Basis Solid Waste From A-Duct ESP Hopper Without CZD Taken 5/19/93	Sample #1 Solid Waste From B-Duct ESP Hopper with CZD Taken on 5/19/93	Sample #2 Solid Waste From B-Duct ESP Hopper with CZD Taken on 5/20/93
Aluminum expressed as Al ₂ O ₃	25.11%	20.13%	16.19%
Calcium expressed as CaO	4.85%	11.95%	15.07%
Iron expressed as Fe ₂ O ₃	13.14%	10.14%	7.34%
Magnesium expressed as MgO	1.05%	6.44%	9.44%
Silica expressed as SiO ₂	46.10%	33.53%	29.61%
Sulfate expressed as Sulfur	0.22%	2.75%	4.02%
	90.47%	84.94%	81.67%

Fly ash diluted by adding reaction products and unreacted lime.

SiO ₂	$\frac{46.10}{33.53} = 1.37$	$\frac{46.10}{29.61} = 1.55$
Al ₂ O ₃	$\frac{25.11}{20.13} = 1.25$	$\frac{25.11}{16.19} = 1.55$
Fe ₂ O ₃	$\frac{13.14}{10.14} = 1.30$	$\frac{13.14}{7.34} = 1.79$

Total sulfur in the fly ash in A-duct (without CZD) = 0.22%

Total sulfur in the solid waste in B-duct (with CZD) on 5/19/93 = 2.75%

Total sulfur in the solid waste in B-duct (with CZD) on 5/20/93 = 4.02%

Total Ca expressed as CaO in the fly ash in A-duct (without CZD) on 5/19/93 = 4.85%

Total Ca expressed as CaO in the solid waste in B-duct (with CZD) on 5/19/93 = 11.95%

Total Ca expressed as CaO in the solid waste in B-duct (with CZD) on 5/20/93 = 15.07%

Solid Waste on 5/19/93

Sulfur from solid waste in the B-duct ESP hopper	2.75%
Sulfur from fly ash in the A-duct ESP hopper	<u>0.22%</u>
	2.53%

CaO in the B-duct ESP hopper	11.95%
CaO in the A-duct ESP hopper	<u>4.85%</u>
	7.10%

Additional sulfur in the B-duct ESP hopper = 2.53%

Additional CaO in the B-duct ESP hopper = 7.10%

$$\text{Sulfur} = \frac{2.53\% \text{ S}}{32 \text{ mol wt}} = 0.079\% \text{ lb-moles Sulfur}$$

$$\text{CaO} = \frac{7.10\% \text{ CaO}}{56 \text{ mol wt}} = 0.127\% \text{ lb-moles CaO}$$

0.127 lb-moles CaO - Total CaO

0.079 lb-moles S CaO reacted with SO₂

0.048 lb-moles CaO unreacted with SO₂

$$0.079 \text{ lb-moles CaSO}_4 \cdot 2\text{H}_2\text{O} \times 172 = 13.588\% \text{ CaSO}_4 \cdot 2\text{H}_2\text{O}$$

$$0.048 \text{ lb-moles unreacted CaO as Ca(OH)}_2 = 3.552\% \text{ Ca(OH)}_2$$

MgO in the waste of the B-duct ESP hopper	6.44%
MgO in the ash of the duct ESP hopper	<u>1.05%</u>
	5.39%

$$\text{As Mg(OH)}_2: 5.39 \times \frac{58}{40} = 7.82\%$$

$$\frac{7.82}{58} = 0.135 \text{ lb-moles of Mg(OH)}_2$$

$$\text{Total lb-moles Ca(OH)}_2 = 0.127$$

$$\text{Total lb-moles Mg(OH)}_2 = \underline{0.135}$$

$$0.262 \text{ lb-moles of PHDL}$$

Total lb-moles reacted with 0.079 lb-moles SO₂

$$\frac{0.079}{0.262} \times 100 = 30.2\% \text{ PHDL utilization}$$

Composition of Solid Waste from B-Duct ESP Hopper on 5/19/93

Al ₂ O ₃	20.13%
Fe ₂ O ₃	10.14%
SiO ₂	33.53%
CaSO ₄ • 2H ₂ O	13.59%
Mg(OH) ₂	7.82%
Ca(OH) ₂ (unreacted)	3.55%
CaO (from fly ash)	4.85%
MgO (from fly ash)	1.05%
Sulfate (from fly ash)	<u>0.66%</u>
	95.32%

Solid Waste on 5/20/93 from the B-Duct ESP Hopper

Sulfur in the B-duct (with CZD)	4.02%
Sulfur in the A-duct (without CZD)	<u>0.22%</u>
	3.80%

$$\frac{3.80\% \text{ S}}{32 \text{ mol wt}} = 0.11875 \text{ lb-moles sulfur}$$

CaO in the B-duct ESP hopper (with CZD)	15.07%
CaO in the A-duct ESP hopper (without CZD)	<u>4.85%</u>
	10.22%

$$\frac{10.22\% \text{ CaO}}{56 \text{ mol wt}} = 0.1825 \text{ lb-moles CaO}$$

0.1825 lb-moles CaO
0.1188 lb-moles sulfur dioxide
0.0637 lb-moles unreacted lime

0.1188 lb-moles CaSO₄ • 2H₂O x 172 = 20.43% CaSO₄ • 2H₂O
0.0637 lb-moles Ca(OH)₂ unreacted x 74 = 4.71% Ca(OH)₂

MgO in the B-duct hopper (with CZD)	9.44%
MgO in the A-duct hopper (without CZD)	<u>1.05%</u>
	8.39%

$$\text{As } \text{Mg}(\text{OH})_2 = 8.39 \times \frac{58}{40} = 12.166\%$$

$$\frac{12.166}{58} = 0.2097 \text{ lb-moles } \text{Mg}(\text{OH})_2$$

Total lb-moles $\text{Ca}(\text{OH})_2$	0.1825
Total lb-moles $\text{Mg}(\text{OH})_2$	<u>0.2097</u>
	0.3922 lb-moles PHDL

$$\text{Total PHDL utilized: } \frac{0.1188}{0.3922} \times 100 = 30.30\% \text{ PHDL utilized on 5/20/93}$$

Composition of Solid Waste from B-duct ESP Hopper on 5/20/93

Al_2O_3	16.19%
Fe_2O_3	7.34%
SiO_2	29.61%
$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	20.43%
$\text{Mg}(\text{OH})_2$	12.17%
$\text{Ca}(\text{OH})_2$ (unreacted)	4.71%
CaO (from fly ash)	4.85%
MgO (from fly ash)	1.05%
Sulfate (from fly ash)	<u>0.66%</u>
	97.01%

F.2 CHEMICAL ANALYSIS OF SOLID WASTE RESULTING FROM THE CZD OPERATION OF MAY 19 AND 20, 1993

The results of the chemical analysis of the solid waste collected in the ESP hoppers from the B-duct with CZD, on May 19 and May 20, 1993 show the following:

1. The percentage of PHDL utilized was 30.2 - 30.3% — that is, 30.2% of the PHDL lb-moles injected into the B-duct reacted with 30.2 lb-moles of SO_2 removed, producing 30.2 lb-moles of $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (gypsum). The solid waste collected in the ESP hoppers was pneumatically removed from the

hoppers every few hours; therefore, the samples for analysis taken from the hoppers did not represent the average per day, but the results of only a few hours of operation. The calculated daily average lime utilization for SO₂ removal during May 19 and 20, 1993, was 26%. (See Daily CZD Summaries, April 21 - May 25, 1993, Section 3.3.2.)

2. Of the total solid waste collected in the ESP hoppers during the CZD operation, Sample #1 of May 19, 1993, contains 25% by weight of reaction products, plus unreacted lime; Sample #2 of May 20, 1993 contains about 37.3% of reaction products and unreacted lime, with the difference being fly ash.
3. The unreacted lime and magnesium hydroxide maintain a high alkalinity of solid waste with a pH of 12.
4. The sulfite concentration in the leachate of solid waste of Samples #1 and #2 is extremely low — about 22 mg/l — indicating that the reaction products are mostly sulfate.
5. The magnesium concentration in the leachate of solid waste of Samples #1 and #2 is extremely low — about 0.17 mg/l — indicating that magnesium is in the form of Mg(OH)₂, not magnesium sulfite or sulfate.
6. The amount of nitrite, expressed as mg/l nitrogen in the leachate of fly ash from the A-duct (without CZD) and from the B-duct (with CZD) of Samples #1 and #2, is very small — less than 0.05 mg/l nitrogen.

Nitrate, expressed as mg/l nitrogen in the leachate of the fly ash sample from the A-duct (without CZD) is very low — less than 0.05 mg/l nitrogen.

Nitrate, expressed as mg/l nitrogen in the leachate of Samples #1 and #2 from the B-duct (with CZD) are 0.40 mg/l nitrogen in Sample #1 and 1.30 mg/l in Sample #2. The leachate contains 100 g of solid waste in 2 liters of deionized water. This is equivalent to 26 ppm (by weight) of nitrate, expressed as nitrogen, of the solid waste of Sample #2, or about 114 ppm (by weight) of nitrate of the solid waste. It is also equivalent to about 342 ppm (by weight) of nitrate reported to be in the reaction products, plus unreacted lime. *This is about 0.684 lbs nitrate per ton of reaction products, plus unreacted lime.*

The nitrate found in the solid waste proved that some NO_x was removed from the flue gas. The amount of nitrate in the solid waste varies from 0.40 mg/l in Sample #1 to 1.30 mg/l in Sample #2. More tests are required to determine the conditions that could improve the percentage of NO_x removal.

GEOCHEMICAL TESTING

a division of Energy Center, Inc.

REPORT OF ANALYSIS

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Client: DECHTEL CORPORATION

LAB NO.: 93-E40737

Report Date: 08/13/93

Date Sampled: 05/19/93

Sampled By: Client

Descriptions: ID-M 240519930 M 15E Buell
19-May-93
Cross Reference # E38993
F.O. # 21178-F-101-TSA

Major and Minor Elements in a Solid Matrix

Analyte	Result	Units	Method
Aluminum Oxide	20.13	%	ASTM D 3682
Calcium Oxide	11.95	%	ASTM D 3682
Iron Oxide	10.14	%	ASTM D 3682
Magnesium Oxide	6.44	%	ASTM D 3682
Silicon Dioxide	33.53	%	ASTM D 3682

ASTM Leachate Analysis: Metals

Analyte	Result	Units	Method
Calcium	1036	mg/l	EPA 200.7
Magnesium	0.12	mg/l	EPA 200.7

ASTM Leachate Analysis: Non Metals

Analyte	Result	Units	Method
Nitrite Nitrogen	< 0.05	mg/l as N	EPA 354.1
Nitrate Nitrogen	0.40	mg/l as N	EPA 353.1
Sulfite	22	mg/l	EPA 377.1

Timothy W. Bergstresser

Timothy W. Bergstresser
Director of Environmental Services

GEOCHEMICAL TESTING

a division of Energy Center, Inc.

REPORT OF ANALYSIS

RD2, Box 124
Somerset, PA 15501

814/443-1671
814/445-6666
FAX: 814/445-6729

Client: BECHTEL CORPORATION

LAD NO.: 93-E40737

Report Date: 08/13/93

Page No: 2

Date Sampled: 05/19/93

Sampled By: Client

Description: ID # 260519930 # 15B Buell

Physical Tests

Analyte	Result	Units	Method
Sulfur, total	2.75	%	ASTM D 4239C

ASTM Leachate Analysis: Non Met

Analyte	Result	Units	Method
pH of ASTM leachate	12.0	su	EPA 150.1
Sulfate	360.	mg/l	EPA 200.7
Solids, gram/gram	0.99%	g/g	ASTM D 3987

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Director of Environmental Services

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REPORT OF ANALYSIS

RD2, Box 124
Somerset, PA 15501

814/443-1671
814/445-6666
FAX: 814/445-6729

Client: BECHTEL CORPORATION

LAR NO.: 93-E40739

Report Date: 08/13/93

Date Sampled: 05/20/93

Sampled By: Client

Description: ID # 26052930 # 15R Buell
20-May-93
Cross Reference # E38994
P.O. # 21178-F-101-T3A

Major and Minor Elements in a Solid Matrix

Analyte	Result	Units	Method
Aluminum Oxide	16.19	%	ASTM D 3682
Calcium Oxide	15.07	%	ASTM D 3682
Iron Oxide	7.34	%	ASTM D 3682
Magnesium Oxide	9.44	%	ASTM D 3682
Silicon Dioxide	29.61	%	ASTM D 3682

ASTM Leachate Analysis: Metals

Analyte	Result	Units	Method
Calcium	1170.	mg/l	EPA 200.7
Magnesium	< 0.10	mg/l	EPA 200.7

ASTM Leachate Analysis: Non-Metals

Analyte	Result	Units	Method
Nitrite Nitrogen	< 0.05	mg/l as N	EPA 354.1
Nitrate Nitrogen	1.30	mg/l as N	EPA 353.1
Sulfite	22.	mg/l	EPA 377.1

Timothy W. Bergstrom

Timothy W. Bergstrom
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REPORT OF ANALYSIS

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FAX: 814/445-6729

Client: BECHTEL CORPORATION

LAB NO.: 93-E40730

Report Date: 08/13/93

Page No: 2

Date Sampled: 05/20/93

Sampled By: Client

Description: ID # 26052930 H 15B Buell

Physical Tests

Analyte	Result	Units	Method
Sulfur, total	4.02	%	ASTM D 4239C

ASTM Leachate Analysis: Non Met

Analyte	Result	Units	Method
pH of ASTM leachate	12.0	su	EPA 150.1
Sulfate	370.	mg/l	EPA 200.7
Solids, gram/gram	0.986	g/g	ASTM D 3987

Timothy W. Bergstresser
Director of Environmental Services

REPORT OF ANALYSIS

FAX: 814/445-6729

LAB NO.: 93-E40739

Sampled By: Client

Description: ID # 290519930 ^A # 158 Buell
19-May-93
Cross Reference # E38995
F.O. # 21178-F-101-TSA

Major and Minor Elements in a Solid Matrix

<u>Analyte</u>	<u>Result</u>	<u>Units</u>	<u>Method</u>
Aluminum Oxide	24.83	%	ASTM D 3682
Calcium Oxide	4.66	%	ASTM D 3682
Iron Oxide	12.97	%	ASTM D 3682
Magnesium Oxide	1.03	%	ASTM D 3682
Silicon Dioxide	47.50	%	ASTM D 3682

ASTM Leachate Analysis: Metals

Analyte	Result	Units	Method
Calcium	220.	mg/l	EPA 200.7
Magnesium	< 0.10	mg/l	EPA 200.7

ASTM Leachate Analysis: Non-Metals

Analyte	Result	Units	Method
Nitrite Nitrogen	< 0.05	mg/l as N	EPA 354.1
Nitrate Nitrogen	< 0.05	mg/l as N	EPA 353.1
Sulfite	< 2	mg/l	EPA 377.1

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GEOCHEMICAL TESTING

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REPORT OF ANALYSIS

RD2, Box 124
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814/443-1671
814/445-6666
FAX: 814/445-6729

Client: RECHTEL CORPORATION

LAB NO.: 93-F40739

Report Date: 08/13/93

Page No: 2

Date Sampled: 03/19/93

Sampled By: Client

Description: ID # 290519930 # 15^A Buell

Physical Tests

Analyte	Result	Units	Method
Sulfur, total	0.22	%	ASTM D 4239C

ASTM Leachate Analysis Method

Analyte	Result	Units	Method
pH of ASTM leachate	11.3	su	EPA 150.1
Sulfate	210.	mg/l	EPA 200.7
Solids, gram/gram	1.000	g/g	ASTM D 3997

Timothy W. Bergstresser
Director of Environmental Services

Appendix G

Baseline Testing – Fuel

Appendix G

BASELINE TESTING – FUEL

Penelec analyzed samples of the incoming coal for moisture, ash, sulfur, Btu/lb, and volatile matter. This appendix presents the results of these analyses and further data on the amount of coal burned during March, April, and May 1993. This appendix also contains the Seward Station fly ash reports for April and May 1993.

SEWARD STATION HEAT RATE QUALITY MARCH-1993

DATE	# 12 TONS	# 14 TONS	# 15 TONS	% MOIST	% ASH	% SULFER	BTU	# SUL/ 10E6 BTU	% VOL
1	415	240	1314	6.62	13.24	1.64	12306	1.33	22.06
2	383	231	1291	6.88	13.43	1.67	12220	1.37	23.14
3	380	234	1276	6.17	14.12	1.64	12199	1.35	22.64
4	401	221	1310	7.70	13.77	1.52	12031	1.27	21.18
5	334	218	1327	6.44	12.99	1.61	12351	1.31	22.20
6	342	207	1284	8.92	15.21	1.45	11570	1.25	21.83
7	278	160	1299	6.54	14.57	1.57	12087	1.30	21.72
8	392	205	1303	6.35	13.69	1.53	12334	1.25	20.37
9	346	172	1294	6.45	14.73	1.54	12157	1.27	20.52
10	293	198	1279	6.37	13.77	1.55	12318	1.27	21.21
11	340	177	1302	7.07	13.73	1.53	12173	1.27	20.64
12	344	326	1359	7.09	12.12	1.63	12399	1.32	21.28
13	353	439	1257	6.97	14.17	1.54	12058	1.28	21.59
14	286	321	1361	8.71	11.88	1.33	12184	1.09	21.28
15	314	301	1332	8.43	13.80	1.50	11916	1.26	21.71
16	375	281	1283	7.83	11.05	1.46	12471	1.18	20.75
17	269	270	1290	4.90	15.15	1.53	12282	1.25	20.78
18	336	249	1229	7.24	13.12	1.55	12238	1.27	20.34
19	374	285	1142	6.87	13.49	1.57	12308	1.28	19.03
20	307	311	1303	7.16	13.08	1.49	12243	1.22	20.38
21	373	139	1205	8.86	13.68	1.57	11818	1.33	20.63
22	338	60	1286	7.31	12.12	1.61	12358	1.31	21.31
23	185	168	1064	7.67	12.66	1.56	12168	1.29	20.74
24	346	398	1548	7.69	11.92	1.64	12274	1.35	20.28
25	374	390	1326	8.00	12.48	1.63	12194	1.34	20.03
26	276	339	1286	7.34	14.14	1.56	12070	1.30	20.88
27	275	379	1433	7.27	14.60	1.62	11931	1.36	21.33
28	240	218	1228	7.65	14.80	1.72	11858	1.45	21.21
29	345	355	1254	7.09	13.22	1.57	12158	1.30	20.78
30	220	255	1266	6.22	13.68	1.54	12206	1.27	22.31
31	263	260	1242	7.60	12.10	1.47	12286	1.20	21.64
TOTAL-12	10097			7.23	13.42	1.56	12169	1.29	21.12
TOTAL-14		8007		7.24	13.39	1.56	12168	1.29	21.10
TOTAL-15			39995	7.22	13.43	1.56	12167	1.29	21.15

NOTE: WEEKENDS AND HOLIDAYS BASED ON GRAB SAMPLES

NOTE: VOLATILE MATTER NOT RUN FOR GRAB SAMPLES, AVERAGE OF PREVIOUS DAYS USED

NOTE: STOCKPILE AS OF 3/31/93 74121.22 TONS

SEWARD STATION HEAT RATE QUALITY - APRIL 1993

DATE	# 12 TONS	# 14 TONS	# 15 TONS	% MOIST	% ASH	% SULFER	BTU	# SUL/ 10E6 BTU	% VOL
1	260	285	1289	7.41	12.82	1.50	12309	1.22	21.24
2	369	322	1235	8.05	10.88	1.43	12402	1.16	21.04
3	298	344	478	7.77	11.94	1.45	12235	1.19	21.04
4	203	211	0	8.24	10.91	1.49	12380	1.20	21.23
5	281	193	0	7.72	11.64	1.45	12410	1.17	21.00
6	349	194	0	7.45	11.59	1.51	12447	1.22	20.86
7	373	199	189	6.86	11.64	1.47	12463	1.18	21.34
8	336	217	450	6.47	13.16	1.51	12337	1.23	20.76
9	253	187	1232	5.37	11.56	1.53	12748	1.20	20.76
10	321	251	1211	6.58	12.79	1.57	12369	1.27	21.10
11	284	70	467	6.98	12.05	1.48	12446	1.19	21.34
12	281	10	74	6.47	12.50	1.53	12432	1.24	21.02
13	163	166	65	5.78	13.74	1.61	12355	1.30	20.17
14	183	115	922	6.12	14.60	1.51	12171	1.24	20.42
15	188	120	1319	6.42	13.99	1.61	12217	1.32	20.03
16	433	255	1234	6.35	13.07	1.67	12344	1.36	20.21
17	342	230	1258	7.39	14.24	1.49	12034	1.24	20.13
18	257	190	1181	6.50	12.91	1.65	12408	1.33	20.09
19	335	218	1224	7.06	15.79	1.57	11889	1.33	19.52
20	258	194	1187	7.20	13.53	1.37	12200	1.13	19.79
21	366	214	1184	7.33	13.34	1.42	12182	1.17	20.58
22	253	168	1243	7.30	13.26	1.42	12244	1.17	19.83
23	344	230	1266	6.99	13.27	1.47	12211	1.21	21.07
24	315	179	1274	7.41	10.93	1.41	12571	1.12	20.18
25	356	187	1135	7.28	10.96	1.35	12632	1.07	20.19
26	385	175	1222	7.43	13.51	1.54	12167	1.27	19.85
27	286	100	1289	7.51	12.28	1.53	12314	1.25	20.99
28	150	30	1158	7.45	13.32	1.56	12204	1.28	21.07
29	249	241	1158	6.47	13.04	1.57	12296	1.28	19.66
30	169	130	1143	7.04	12.64	1.46	12311	1.19	19.62
TOTAL-12	8640			7.05	12.68	1.50	12326	1.22	20.55
TOTAL-14		5625		7.07	12.67	1.50	12320	1.22	20.54
TOTAL-15			27087	6.99	12.93	1.51	12301	1.23	20.40

NOTE: WEEKENDS AND HOLIDAYS BASED ON GRAB SAMPLES

NOTE: VOLATILE MATTER NOT RUN FOR GRAB SAMPLES, AVERAGE OF PREVIOUS DAYS USED

NOTE: STOCKPILE AS OF 4/30/93 89624.61 TONS

SEWARD STATION HEAT RATE QUALITY - MAY 1993

DATE	# 12 TONS	# 14 TONS	# 15 TONS	% MOIST	% ASH	% SULFUR	BTU	# SUL/ 10E6 BTU	% VOL
1	0	0	1123	7.40	11.88	1.48	12393	1.19	20.69
2	0	0	982	7.28	12.12	1.46	12377	1.46	19.83
3	0	0	1110	7.24	12.53	1.63	12216	1.34	21.05
4	0	0	1149	6.68	12.85	1.52	12310	1.24	21.29
5	0	0	919	7.42	12.43	1.64	12227	1.34	21.01
6	0	0	0						
7	0	0	685	6.02	14.98	1.72	12005	1.43	20.84
8	0	0	1153	7.61	11.98	1.64	12262	1.34	20.84
9	0	0	786	6.62	13.81	1.55	12136	1.28	20.84
10	0	0	1042	5.74	13.64	1.50	12304	1.22	30.14
11	0	0	1680	5.84	13.10	2.15	12392	1.74	23.28
12	0	0	1236	6.22	13.26	2.41	12368	1.95	24.19
13	0	0	1249	4.98	14.70	2.36	12395	1.91	24.40
14	0	0	1201	4.69	15.56	2.24	12287	1.83	23.14
15	0	0	1227	4.57	12.81	2.21	12740	1.73	23.37
16	0	0	1159	4.52	13.98	2.27	12534	1.81	24.32
17	0	0	1254	4.73	15.80	2.28	12242	1.87	23.37
18	0	0	1241	5.53	14.90	2.07	12258	1.69	23.31
19	0	0	1185	5.36	16.81	2.23	11928	1.87	23.96
20	0	0	1255	5.21	15.42	2.30	12183	1.89	25.15
21	0	0	1214	7.35	12.00	1.40	12351	1.13	21.07
22	0	0	1179	4.82	15.83	2.37	12173	1.95	21.07
23	0	0	1126	4.31	13.28	2.14	12716	1.68	23.04
24	0	0	1161	6.43	14.64	1.64	12092	1.36	21.48
25	0	0	1154	6.51	11.12	1.54	12721	1.21	20.34
26	0	0	1211	6.36	11.50	1.56	12582	1.25	20.86
27	0	0	1169	6.81	11.20	1.46	12499	1.17	21.69
28	0	0	1134	6.46	11.73	1.77	12506	1.43	22.47
29	0	0	1098	6.32	11.26	1.60	12634	1.27	21.66
30	0	0	1146	6.17	13.19	1.41	12345	1.14	20.83
31	0	0	1101	6.83	13.10	1.45	12287	1.18	20.34
HIGHER SULFUR COAL									
TOTAL-12	0			ERR	ERR	ERR	ERR	ERR	ERR
TOTAL-14		0		ERR	ERR	ERR	ERR	ERR	ERR
TOTAL-15			34329	6.03	13.39	1.86	12356	1.51	22.41

NOTE: WEEKENDS AND HOLIDAYS BASED ON GRAB SAMPLES

NOTE: VOLATILE MATTER NOT RUN FOR GRAB SAMPLES, AVERAGE OF PREVIOUS DAYS USED

NOTE: STOCKPILE AS OF 5/31/93 104681.42 TONS

**SEWARD STATION
ASH REPORT**

APRIL 1993

DATE	DAILY TONS BURNED	PERCENT ASH	DAILY TONS ASH
1	1834	12.82	235.12
2	1926	10.88	209.55
3	1120	11.94	133.73
4	414	10.91	45.17
5	474	11.64	55.17
6	543	11.59	62.93
7	761	11.64	88.58
8	1003	13.16	131.99
9	1672	11.56	193.28
10	1783	12.79	228.05
11	821	12.05	98.93
12	365	12.50	45.63
13	394	13.74	54.14
14	1220	14.60	178.12
15	1627	13.99	227.62
16	1922	13.07	251.21
17	1830	14.24	260.59
18	1628	12.91	210.17
19	1777	15.79	280.59
20	1639	13.53	221.76
21	1764	13.34	235.32
22	1664	13.26	220.65
23	1840	13.27	244.17
24	1768	10.93	193.24
25	1678	10.96	183.91
26	1782	13.51	240.75
27	1675	12.28	205.69
28	1338	13.32	178.22
29	1648	13.04	214.90
30	1442	12.64	182.20
TOTAL	41352	12.73	5311.36

**SEWARD STATION
ASH REPORT**

MAY 1993

DATE	DAILY TONS BURNED	PERCENT ASH	DAILY TONS ASH
1	1123	11.88	133.41
2	982	12.12	119.02
3	1110	12.53	139.08
4	1149	12.85	147.65
5	919	12.43	114.23
6	0	0.00	0.00
7	685	14.98	102.61
8	1153	11.98	138.13
9	786	13.81	108.55
10	1042	13.64	142.13
11	1680	13.10	220.08
12	1236	13.26	163.89
13	1249	14.70	183.60
14	1201	15.56	186.88
15	1227	12.81	157.18
16	1159	13.98	162.03
17	1254	15.80	198.13
18	1241	14.90	184.91
19	1185	16.81	199.20
20	1255	15.42	193.52
21	1214	12.00	145.68
22	1179	15.83	186.64
23	1126	13.28	149.53
24	1161	14.64	169.97
25	1154	11.12	128.32
26	1211	11.50	139.27
27	1169	11.20	130.93
28	1134	11.73	133.01
29	1098	11.26	123.63
30	1146	13.19	151.16
31	1101	13.10	144.23
TOTAL	34329	12.95	4596.60

Appendix H

Procedures for Calculating SO₂ and NO_x Removal and the Percentage of Lime Utilization

ESTIMATES OF SO₂ AND NO_x REMOVAL

Bases: Measured Quantities are:

- SO₂, NO_x and O₂ concentrations in inlet and outlet flue gas
- Flue gas flow at the discharge from the test duct
- Inlet and outlet gas temperatures
- Barometric pressure
- Flue gas pressure
- Lime usage
- Lime concentration
- Atomizing air usage
- Dilution water usage

Estimated Quantities are:

- Flue gas flows in and out
- SO₂ and NO_x removal
- Lime utilization
- Solid waste requiring disposal

Flue Gas Flow Measurements

The flue gas flow meter is located at the end of the test duct, just upstream of the second stage Buell ESP. When nothing is being injected into the flue gas, it indicates the instantaneous gas flow in SCFM on a mass flow basis. During the injection of water or of a lime slurry, this meter will be used to indicate the flow of treated flue gas without correction for the effects of changed gas properties on the accuracy of these readings.

Figure 1 contains the planar arrangement of the test duct with the locations of the flue gas flow meter, the lime atomizers and the upstream and downstream SO₂, NO_x and O₂ analyzers indicated on it.

Figure 2 contains the flue gas flow diagram showing the location of ESPs, atomizers and instrumentation required for the determination of SO₂ removal and lime utilization.

Figures 3 and 4 contain the laboratory correlation of lime slurry concentrations with their specific gravities at 40°F, 60°F and 72°F.

Figure 1. Test Duct Arrangement

FIGURE - 1
TEST DUCT ARRANGEMENT
 SHOWING RELATIVE LOCATIONS
 OF FLUE GAS FLOW METER,
 LIME SLURRY ATOMIZERS AND
 UPSTREAM AND DOWNSTREAM
 SO₂, NO_x & O₂ ANALYZERS

Figure 2. Seward CZD System, Test Duct, Flue Gas Flow Diagram

13/12

"N" LIME (HIGH CALCIUM) SPECIFIC GRAVITIES at 72° 60° & 40°F

Figure #4
Correlation of specific gravity of
calcium lime slurry
with % lime concentration
and lb lime/gal
at different lime slurry
temperatures

LIME CONCENTRATION
lb/gal

Lime concentration in lb/gal of slurry

Lime concentration in lb/gal

29.5

% CONCENTRATION (wt %)

CZD TESTING AT SEWARD - ESTIMATING PROCEDURE

In order to understand the operation and performance of CZD system we must know:

- The inlet and outlet flue gas flows and their compositions
- The atomizing air usage
- Lime slurry and dilution water injection rates
- Lime slurry concentration

The inlet and outlet flue gas flows are estimated from the flue gas flow meter reading located downstream of the atomizing nozzles at the inlet to the second stage ESP, from the atomizing air and water usage and from inlet and outlet flue gas analysis (SO_2 , NO_x and O_2).

Atomizing air usage is indicated by a flow indicator. Water usage is estimated from measured lime slurry usage and its water content and from the dilution water usage.

Plant air leakage is based on the oxygen mass balance.

In all, there is a set of 5 linear equation to be solved to estimate the actual SO_2 and NO_x removal.

Lime usage and utilization are based on the measured volumes and specific gravities of the lime slurries injected into the flue gas stream and the above estimates of the associated SO_2 and NO_x removals.

MATHEMATICAL PROCEDURE NOMENCLATURE

<u>Description</u>	<u>Symbol</u>	<u>Units</u>
Inlet flue gas flow	F.G. IN	SCFM
Outlet flue gas flow	F.G. OUT	SCFM
Flue gas flow meter reading	F.G.	SCFM
Atomizing air flow meter reading	A.A.	SCFM
Water content of atomized lime slurry (This is estimated from the flow of lime slurry and dilution water and expressed as the flow of water vapor in SCFM)	W.C.	SCFM
SO ₂ absorbed from flue gas	XSO ₂	SCFM
NO _x absorbed from flue gas	YNO _x	SCFM
Air leakage	Z _{al}	SCFM
Oxygen concentration in inlet flue gas	OX _{IN}	Vol %
Oxygen concentration in outlet flue gas	OX _{OUT}	Vol %
SO ₂ concentration in inlet flue gas	SO ₂ IN	$\frac{\text{ppm}}{10^6}(\text{Vol})$
SO ₂ concentration in outlet flue gas	SO ₂ OUT	$\frac{\text{ppm}}{10^6}(\text{Vol})$
NO _x concentration in inlet flue gas	NO _x IN	$\frac{\text{ppm}}{10^6}(\text{Vol})$
NO _x concentration in outlet flue gas	NO _x OUT	$\frac{\text{ppm}}{10^6}(\text{Vol})$

MASS BALANCE EQUATIONS

1. Inlet Flue Gas (FG_{IN}) = Flue gas flow meter reading (FG) less atomizing air meter reading (AA) less water content of lime slurry used (WC) plus SO₂ absorbed (X_{SO2}) plus NO_x absorbed (Y_{NOx}).

$$(FG_{IN}) = (FG) - (AA) - (WC) + (X_{SO2}) + (Y_{NOx})$$

2. Outlet Flue Gas (FG Discharged from ID fan) = Flue gas flowmeter reading (FG) plus air leakage (Z_{AL})

$$(FG_{OUT}) = (FG) + (Z_{AL})$$

3. Oxygen Balance

$$\text{Inlet Flue Gas (FG}_{IN}) \times \frac{\text{Measured O}_2 \text{ Conc. (OX}_{IN})}{100} + \text{Atom. Air} \times 0.21 + Z_{AL} \times 0.21$$

$$= \text{Outlet Flue gas (FG}_{OUT}) \times \frac{\text{Measured O}_2 \text{ Conc. (OX}_{OUT})}{100}$$

$$(FG_{IN}) \times \frac{(OX_{IN})}{100} + (AA) \times 0.21 + (Z_{AL}) \times 0.21 = (FG_{OUT}) \times \frac{(OX_{OUT})}{100}$$

4. SO₂ Balance

$$\text{SO}_2 \text{ absorbed (X}_{SO2}) = \frac{\text{Inlet Flue Gas (FG}_{IN}) \times \text{measured SO}_2 \text{ concentrate (SO}_2 \text{ ppm)}}{\text{Outlet Flue Gas (FG}_{OUT}) \times \text{measured SO}_2 \text{ concentrate (SO}_2 \text{ ppm)}}$$

$$(X_{SO2}) = (FG_{IN}) \times \frac{(SO2 IN)}{10^6} - (FG_{OUT}) \times \frac{(SO2 OUT)}{10^6}$$

5. NO_x Balance

$$\begin{aligned} \text{NO}_x \text{ absorbed (Y}_{NOx}) = & \text{inlet flue gas (FG}_{IN}) \times \text{measured NO}_x \text{ concentrate } \frac{\text{NO}_x}{10^6} \\ & - \text{outlet flue gas (FG}_{OUT}) \times \text{measured NO}_x \text{ concentrate } \frac{\text{NO}_x}{10^6} \end{aligned}$$

$$Y_{NO_x} = (FG_{IN}) \times \left(\frac{NO_x IN}{10^6} \right) - (FG_{OUT}) \times \left(\frac{NO_x OUT}{10^6} \right)$$

There are 5 mass balance equations from which the 5 unknowns (FG_{IN}, FG_{OUT}, X_{SO2}, NO_x, and Z_{AL}) can be estimated. These equations are:

$$(1) \quad (FG_{IN}) = (FG) - (AA) - (WC) + (X_{SO2}) + (Y_{NOx})$$

$$(2) \quad (FG_{OUT}) = (FG) + (Z_{AL})$$

$$(3) \quad (FG_{IN}) \times \frac{(OX_{IN})}{100} + AA \times 0.21 + Z_{AL} \times 0.21 = (FG_{OUT}) \times \frac{(OX_{OUT})}{100}$$

$$(4) \quad (X_{SO_2}) = (FG_{IN}) \times \frac{(SO_2 IN)}{10^6} - (FG_{OUT}) \times \frac{(SO_2 OUT)}{10^6}$$

$$(5) \quad (Y_{NO_x}) = (FG_{IN}) \times \frac{(NO_x IN)}{10^6} - (FG_{OUT}) \times \frac{(NO_x OUT)}{10^6}$$

To eliminate Z_{AL} (air leakage) multiply equation (2) by 0.21 and add it to equation (3)

$$0.21 (FG_{OUT}) = 0.21 (FG) + 0.21 (Z_{AL})$$

$$+ \frac{(FG_{IN}) \times \frac{(OX_{IN})}{100} + 0.21 (AA) = FG_{OUT} \frac{OX_{OUT}}{100} - Z_{AL} \times 0.21}{0.21 (FG_{OUT}) - 0.21 (FG) + (FG_{IN}) \frac{(OX_{IN})}{100} + 0.21 (AA) = (FG_{OUT}) \frac{(OX_{OUT})}{100}}$$

$$(FG_{OUT}) \left[0.21 - \frac{(OX_{OUT})}{100} \right] = -0.21 AA + 0.21 (FG) - (FG_{IN}) \frac{(OX_{IN})}{100}$$

Substituting X_{SO_2} and Y_{NO_x} in Equation (1) by their values from equations (4) and (5) we will get:

$$FG_{IN} = (FG) - (AA) - (WC) + (FG_{IN}) \times \frac{SO_2 IN}{10^6} - FG_{OUT} \times \frac{SO_2 OUT}{10^6}$$

$$+ (FG_{IN}) \frac{NO_x IN}{10^6} - (FG_{OUT}) \frac{NO_x OUT}{10^6}$$

$$FG_{IN} \left(1 - \frac{SO_2 IN}{10^6} \right) - \frac{NO_x IN}{10^6} = FG - AA - WC - \frac{SO_2 OUT}{10^6} + \frac{NO_x OUT}{10^6}$$

$$FG_{IN} \times \frac{OX_{IN}}{10^6} = 0.21 AA + 0.21 FG - FG_{OUT} \left[0.21 - \frac{OX_{IN}}{100} \right]$$

$$\frac{1 + \frac{SO_2 IN}{10^6} - \frac{NO_x IN}{10^6}}{\frac{OX_{IN}}{100}} = \frac{FG - AA - WC - (FG_{OUT}) \left[\frac{SO_2 OUT}{10^6} + \frac{NO_x OUT}{10^6} \right]}{-0.21 AA + 0.21 FG - (FG_{OUT}) \left[0.21 - \frac{OX_{OUT}}{100} \right]}$$

$$= \frac{FG - AA - WC - (FG_{OUT}) \left[\frac{SO_2 OUT}{10^6} + \frac{NO_x OUT}{10^6} \right]}{-0.21 (AA + FG) - FG_{OUT} \left[0.21 - \frac{OX_{OUT}}{100} \right]}$$

$$\frac{1 - \frac{SO_2 IN}{10^6} + \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} [0.21(AA + FG)] = \frac{1 - \frac{SO_2 IN}{10^6} - \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} FG_{OUT} \left(0.21 - \frac{OX_{OUT}}{100} \right)$$

$$+ FG - AA - WC - FG_{OUT} \left[\frac{SO_2 OUT}{10^6} + \frac{NO_x OUT}{10^6} \right]$$

$$FG_{OUT} \left[\frac{1 + \frac{SO_2 IN}{10^6} + \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} \left(0.21 - \frac{OX_{OUT}}{100} \right) - \frac{SO_2 OUT}{10^6} - \frac{NO_x OUT}{10^6} \right]$$

$$= \left[\frac{1 - \frac{SO_2 IN}{10^6} - \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} \times [0.21(AA + FG)] \right] - FG + AA + WC$$

$$= FG \left[0.21 \frac{1 - \frac{SO_2 IN}{10^6} - \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} - 1 \right] - 0.21 \frac{1 - \frac{SO_2 IN}{10^6} - \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} AA + AA + WC$$

$$FG_{OUT} = \frac{FG \left[0.21 \frac{1 - \frac{SO_2 IN}{10^6} + \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} - 1 \right] - 0.21 \frac{1 + \frac{SO_2 IN}{10^6} - \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} + AA + AA + WC}{\frac{1 - \frac{SO_2 IN}{10^6} + \frac{NO_x IN}{10^6}}{\frac{OX IN}{100}} \left(0.21 - \frac{OX_{OUT}}{100} \right) + \frac{SO_2 OUT}{10^6} + \frac{NO_x OUT}{10^6}}$$

$$FG_{IN} = \frac{FG - AA - WC - FG_{OUT} \left[\frac{SO_2_{OUT}}{10^6} + \frac{NO_x_{OUT}}{10^6} \right]}{1 - \frac{SO_2_{IN}}{10^6} - \frac{NO_x_{IN}}{10^6}}$$

$$Z_{AL} = FG_{OUT} - FG$$

$$X_{SO_2} = FG_{IN} \times \frac{SO_2_{IN}}{10^6} - FG_{OUT} \times \frac{SO_2_{OUT}}{10^6}$$

$$X_{NO_x} = FG_{IN} \times \frac{NO_x_{IN}}{10^6} - FG_{OUT} \times \frac{NO_x_{OUT}}{10^6}$$

$$\% SO_2 \text{ REMOVAL} = \frac{X_{SO_2}}{FG_{IN} \times SO_2_{IN}} \times 100$$

$$\% NO_x \text{ REMOVAL} = \frac{Y_{NO_x}}{FG_{IN} \times NO_{x_{IN}}} \times 100$$

$$\text{Flue Gas Humidity} = \frac{\text{Lb } H_2O \text{ Vap}}{\text{Lb of Dry Air Equivalent of Flue Gas}} = W$$

$$\text{Relative Humidity} = \frac{P}{P_s} \times 100$$

where:

W = Flue gas humidity

P = Water vapor partial pressure
in flue gas

P_s = Saturated steam pressure at flue
gas temperature

$$P = \frac{\text{Relative Humidity} \times P_s}{100}$$

$$W = \frac{18.016 p}{18.967 (P - p)}$$

DETERMINING LIME USAGE

Basis:

There is no data available for correlating the specific gravity of dolomitic hydrate slurries with their hydrate content. Local laboratory will measure specific gravities of dolomitic lime slurries and their hydrate contents at 40°F, 60°F and 80°F and prepare a chart showing the dependence of specific gravity on hydrate concentration at the above temperatures.

During the test runs the actual dolomitic lime usage will be determined by:

- measuring the specific gravity and temperature of the lime slurry in the feed tank
- using the laboratory correlation of the specific gravity with the hydrate concentration to determine the hydrate content of this slurry
- dipping the lime feed tank to determine the volume of the lime slurry and, hence, the amount of lime hydrate used

DETERMINATION OF SPECIFIC GRAVITY OF THE DOLOMITIC LIME SLURRY IN THE LIME FEED TANK

This tank handles up to 20 WT% of lime slurries which are too viscous for determining their specific gravity with a simple hydrometer. However, a hydrometer could be used to determine specific gravity of 20% lime slurry after threefold dilution with water.

Method

Take 100 ml sample of concentrated slurry, weigh it and dilute it with 200 ml of water to a total volume of 300 ml. Measure its specific gravity and then calculate the specific gravity of original sample as follows:

Calculations:

Suppose that 100 ml of original sample weight equals 112.5 gm and that after mixing it with 200 ml of water it has specific gravity equals 1.04 at 80°F.

This specific gravity (from the graph of concentrated vs specific gravity) corresponds to the lime concentrate of 7.3%.

$$\therefore \frac{\text{Lime content of original sample}}{\text{WT of 100 ml of original sample} + 200} \times 100 = 7.3$$

$$\text{Lime content of original sample} = 0.073 (\text{weight of original sample} + 200)$$

Concentration of lime in original sample: =

$$\begin{aligned} &= \frac{0.073 (\text{Wt. of original sample} + 200)}{\text{WT of original sample}} \times 100 \\ &= \frac{0.073 (112.5 + 200)}{112.5} \times 100 = 20.28 \text{ Wt. \%} \end{aligned}$$

Lime concentrated below 10 Wt. % can be measured using hydrometer to determine their specific gravity and then a chart of specific gravity vs. concentrate. To determine slurry concentrate, the lime feed pumps will recirculate 100 GPM of 20 Wt% lime slurry of which about 20 GPM will be fed to the atomizers and about 80 GPM returned to the feed tank. The two lime slurry feed pumps will use up to 1-1/2 GPM of seal water, 80% of which will enter the lime feed tank resulting in progressive dilution of its content. In order to account for it the concentrate of lime slurry in the feed tank should be checked at least twice for each test. The first check should be when lime injection starts and the second check when it stops.

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Lime Usage = (Content of lime feed tank at the start of test run in gallon) x 8.328 x (its specific gravity) x (corresponding slurry concentrate) - content of lime feed tank at the end of test run in gallon) x 8.326 x (FLS specific gravity) x (corresponding slurry concentrate)

Example: Estimate of lime content of the lime slurry in the lime feed tank at the start of test:

Tank diameter = 12'-0"
Slurry Depth = 10'-0" (by tank dipping)

$$\therefore \text{Volume of slurry} = \frac{12^2 \pi}{4} \times 10 = 1,130^4 \text{ cu. ft.}$$

$$= 8,455.4 \text{ GAL.}$$

Specific gravity of slurry = 1.125 (at 60°F, measured)

Corresponding lime concentrate = 19.5 wt % (from the chart relating specific gravity to concentrate)

$$\therefore \text{Lime content of the feed tank at the start of test} = 8,455.4 \times 8.328 \times 1.125 \times 0.195 = 15,447.6 \text{ lbs.}$$

Estimate of lime content of the lime slurry in the lime feed tank at the end of test:

Slurry Depth = 5'9 $\frac{3}{8}$ " (by tank dipping)

$$\therefore \text{Volume of Slurry} = \frac{12^2 \pi}{4} \times 5.7792 \times 7.48 = 4,961.4 \text{ Gal.}$$

Specific gravity of slurry = 1.12

Corresponding lime concentrate = 18.9 WT %

$$\therefore \text{Lime content of the feed tank at the end of test}$$

$$= 4,961.4 \times 8.328 \times 1.12 \times 0.189 = 8,614.3 \text{ lbs.}$$

Hence lime used = 15, 447.6 - 8,614.3 = 6,833 lbs.

Average concentration of lime slurry used

$$= \frac{6,833}{8,455.4 - 4,886.5 + 307.5}$$

Estimated volume of seal water used by P-102A and P-102B during the test.

= 1,7627 lbs of lime hydrate/gallon of slurry corresponding to slurry concentrate of 18.9 WT% from the chart.

$$\text{Lime utilization} = \frac{\text{Mols SO}_2 \text{ ABS} = \frac{1}{2} \text{ Mols NO}_x \text{ ABS}}{\text{Mols of lime used}}$$

$$\text{Mols SO}_2 \text{ ABS} = \frac{X_{\text{SO}_2}}{379.5}$$

$$\text{Mols NO}_x \text{ ABS} = \frac{Y_{\text{NO}_x}}{379.5}$$

Mols of lime used

$$= \frac{\text{WT of lime hydrate} \times 0.385}{58} + \frac{\text{WT of lime hydrate} \times 0.57}{74}$$

$$= \text{WT of lime hydrate used} (0.0066 + 0.0077)$$

$$= \text{WT of lime hydrate used} \times 0.0143$$

TEST DATA
10/10/91

Flue gas flow meter reading = 260,000 SCFM = FG = C
Atomizing air flow meter reading = 1,350 SCFM = AA = D
Water content of lime slurry = 5,180 SCFM = WC = E

Concentrate = 3.4 WT%
Specific Gravity = 1.018 at 60°F
Flow = 30 gpm

$$WC = 30 \times 8.328 \times 1.018 \times 0.966 = 245.7 \text{ lb/mid} = 5,180 \text{ SCFM}$$

Inlet SO₂ concentrate in ppmv = 905.81 ppmv = SO₂ IN = F
Outlet SO₂ concentrate in ppmv = 703.87 = SO₂ OUT = G
Inlet NO_x concentrate in ppmv = 383.25 = NO_x IN = H
Outlet NO_x concentrate in ppmv = 313.87 = NO_x OUT = I
Inlet O₂ concentrate in Vol. % = 6.16 = O₂ IN = J
Outlet O₂ concentrate in Vol. % = 7.41 = O₂ OUT = K

$$FG_{OUT} = \frac{FG \left[.21 \frac{1 + SO_2 IN + NO_x IN}{\frac{O_2 IN}{100}} - 1 \right] + AA \left[1 - 0.21 \frac{1 + SO_2 IN + NO_x IN}{\frac{O_2 IN}{100}} \right] + WS}{\frac{1 + SO_2 IN + NO_x IN}{\frac{O_2 IN}{100}} \left(0.21 - \frac{O_2 OUT}{100} \right) + SO_2 OUT + NO_x OUT}$$

$$= \frac{260,000 \left[.21 \frac{1.0012891}{0.0616} - 1 \right] + 1,350 \left[1 - 0.21 \frac{1.0012891}{0.0616} \right] + 5,180}{\frac{1.0012891}{0.0616} (0.21 - 0.0741) + 0.00070387 + 0.000313851}$$

$$= \frac{627,506.2 + 3,258.2 + 5,180}{2.2090 + 0.00101774} = \frac{629,428}{2.2100} = 284,809 \text{ SCFM}$$

$$\begin{aligned} \text{Inlet FG} = FG_{IN} &= \frac{FG - AA - WC - FG_{OUT} (SO_2 OUT + NO_x OUT)}{1 + SO_2 IN - NO_x IN} \\ &= \frac{260,000 - 1,350 - 5,180 - 284,809 (0.00070367 + 0.00031387)}{1 - 0.00090581 - 0.00038325} \\ &= \frac{253,470 - 289.9}{0.9987109} \\ &= 253,506 \text{ SCFM} \end{aligned}$$

$$\begin{aligned}
 \text{Air Leakage} &= Z_{AL} = FG_{OUT} - FG \\
 &= 284,809 - 260,000 \\
 &= 24,809 \text{ SCFM}
 \end{aligned}$$

$$\begin{aligned}
 \text{SO}_2 \text{ Removed} &= FG_{IN} \times SO_{2\ IN} - FG_{OUT} \times SO_{2\ OUT} \\
 &= 253,506 \times 0.00090581 - 284,809 \times 0.00070387 \\
 &= 229.63 - 200.47 \\
 X_{SO_2} &= 2916 \text{ SCFM}
 \end{aligned}$$

$$\begin{aligned}
 \text{NO}_x \text{ Removed} &= FG_{IN} \times NO_{x\ IN} - FG_{OUT} \times NO_{x\ OUT} \\
 &= 253,506 \times 0.00038325 - 284,809 \times 0.00031387 \\
 Y_{NO_x} &= 97.16 - 89.39 + 7.76 \text{ SCFM}
 \end{aligned}$$

$$\% \text{ SO}_2 \text{ Removal} = \frac{X_{SO_2}}{FG_{IN} \times SO_{2\ IN}} \times 100 = \frac{29.16}{229.56} \times 100 = 12.7\%$$

$$\% \text{ NO}_x \text{ Removal} = \frac{Y_{NO_x}}{FG_{IN} \times NO_{x\ IN}} \times 100 = \frac{7.76}{97.13} \times 100 = 8.00\%$$

Estimate of lime usage:

30 gpm of 3.4 WT% lime slurry

$$\text{SP GT at } 60^\circ\text{F} = 1.018$$

$$\begin{aligned}
 \text{Ca(OH)}_2 \text{ Used} &= 30 \times 8.328 \times 1.018 \times 0.034 \\
 &= 8.6475 \text{ lb/minute}
 \end{aligned}$$

Assume 95.5% purity

$$= \frac{8.6475 \times 0.955}{74}$$

$$= 0.1116 \text{ lb Mol/minute}$$

$$\text{SO}_2 \text{ Removed} = \frac{29.16}{379} = 0.079 \text{ Lb Mol/minute}$$

$$\text{NO}_x \text{ Removed} = \frac{7.76}{379} = 0.0204 \text{ Lb Mol/minute}$$

$$\text{Lime Utilization} = \frac{0.0769 \times \frac{0.0204}{2}}{0.1116} \times 100 = 78.07\%$$

TEST DATA
10/11/91

Flue gas Flow Meter Reading = 268,000 SCFM

Atomizing Air Meter Reading = 1,350 SCFM

Water Content of Lime Slurry = 5,127 SCFM

Concentrate = 5.5 WT %

Sp Gr = 1.03 at 60° F

Flow = 30 gpm

W.C. = $30 \times 8.328 \times 1.03 \times 0.945 = 243.18 \text{ Lb/Min}$
= 5,127 SCFM

Inlet SO₂ Concentrate = 868.56 ppm

Outlet SO₂ Concentrate = 660.49 ppm

Inlet NO_x Concentrate = 400.23 ppm

Outlet NO_x Concentrate = 328.05 ppm

Inlet O₂ Concentrate = 6.32%

Outlet O₂ Concentrate = 7.38%

$$\begin{aligned} FG_{OUT} &= \frac{268,000 \times \left[\frac{1.0012688}{0.0623} - 1 \right] + 1,350 \left[1 - .21 \times \frac{1.0012688}{0.0623} \right] + 5,127}{\frac{1.0012688}{0.0623} (.21 - 0.0738) + 0.00066049 + 0.000328.05} \\ &= \frac{636,517.0 - 3,206.3 + 5,127}{2,1890 + 0.0009885} = \frac{638,437.7}{2.1900} \\ &= 291,524 \text{ SCFM} \end{aligned}$$

$$\begin{aligned} FG_{IN} &= \frac{FG - AA - WC + FG_{OUT} (SO_{2 \text{ OUT}} + NO_{x \text{ OUT}})}{1 + SO_{2 \text{ IN}} + NO_{x \text{ IN}}} \\ &= \frac{268,000 - 1,350 - 5,127 + 295,690.7 (0.00066049 + 0.00032805)}{1 + 0.00086856 + 0.00040023} \\ &= \frac{261,523 + 292.3}{0.9987312} \\ &= 261,562 \text{ SCFM} \end{aligned}$$

$$\begin{aligned}
 \text{Air Leakage} = Z_{AL} &= FG_{OUT} - FG \\
 &= 241,524 - 268,000 \\
 &= 23,524 \text{ SCFM}
 \end{aligned}$$

$$\begin{aligned}
 \text{SO}_2 \text{ Removed} &= FG_{IN} \times SO_2_{IN} - FG_{OUT} \times SO_2_{OUT} \\
 &= 261,562 \times 0.00086856 - 291,524 \times 0.0006604 \\
 &= 227.18 - 192.55 \\
 &= 34.63 \text{ SCFM}
 \end{aligned}$$

$$\begin{aligned}
 \text{NO}_x \text{ Removed} &= 261,562 \times 0.00040023 - 291,524 \times 0.00032805 \\
 &= 104.68 - 95.63 \\
 &= 9.05 \text{ SCFM}
 \end{aligned}$$

$$\% \text{ SO}_2 \text{ REMOVAL} = \frac{34.63}{227.18} 100 = 15.24\%$$

$$\% \text{ NO}_x \text{ REMOVAL} = \frac{9.05}{104.68} 100 = 8.65\%$$

Estimate of Lime Usage

30 gpm of 5.5 WT% lime slurry

Sp Gr = 1.03

$$\begin{aligned}
 30 \times 8.328 \times 1.03 \times 0.55 &= 14.15 \text{ Lb/Hr} \\
 &= 13.5 \text{ Lb of pure Ca (OH)}_2 \\
 &= 0.1827 \text{ Lb Mol/Minute}
 \end{aligned}$$

$$\text{SO}_2 \text{ Removed} = \frac{34.63}{379.5} = 0.0913 \text{ Lb Mol/Minute}$$

$$\text{NO}_x \text{ Removed} = \frac{9.05}{379.5} = 0.0238 \text{ Lb Mol/Minute}$$

$$\begin{aligned}
 \text{Lime Utilization} &= \frac{0.0913 + \frac{0.0238}{2}}{0.1827} 100 \\
 &= 56.50\%
 \end{aligned}$$

TEST DATA
10/14/91

FG = 252,000 SCFM

AA = 1,350 SCFM

Water Content of Lime Slurry = 5,054 SCFM

Concentrate = 8 %
Sp Gr = 1.043F
Flow = 30 gpm

W.C. = $30 \times 8.328 \times 1.03 \times 0.92 = 239.74 \text{ Lb/Min}$
= 5,054 SCFM

Inlet SO₂ Concentrate = 891.1 ppm

Outlet SO₂ Concentrate = 665.9 ppm

Inlet NO_x Concentrate = 423.9 ppm

Outlet NO_x Concentrate = 326.6 ppm

Inlet O₂ Concentrate = 6.2%

Outlet O₂ Concentrate = 7.52%

$$\begin{aligned} FG_{OUT} &= \frac{252,000 \left[.21 \times \frac{1.001315}{0.062} - 1 \right] + 1,350 \left[1 - .21 \times \frac{1.001315}{0.062} \right] + 5,000}{\frac{1.001315}{0.062} (0.21 - 0.0738) + 0.000659 + 0.0003266} \\ &= \frac{602,670.8 - 3,228.6 + 5,054}{2,1771 + 0.0009925} = \frac{604,496.2}{2.1781} \\ &= 277,534.7 \text{ SCFM} \end{aligned}$$

$$\begin{aligned} FG_{IN} &= \frac{252,000 - 1,350 - 5,054 + 277,534.7 (0.0006659 + 0.0003266)}{1 + 0.000891.1 - 0.000423.9} \\ &= \frac{245,320}{0.9987} = 245,643 \text{ SCFM} \end{aligned}$$

Air Leakage = Z_{AL} = FG_{OUT} - FG

$$= 277,534 - 252,000$$

$$= 25,534 \text{ SCFM}$$

$$\text{SO}_2 \text{ Removed} = \text{FG}_{\text{IN}} \times \text{SO}_2 \text{ IN} - \text{FG}_{\text{OUT}} \times \text{SO}_2 \text{ OUT}$$

$$= 245,643 \times 891.1 - 277,535 \times 665.9$$

$$= 218.89 - 184.81$$

$$= 34.08 \text{ SCFM}$$

$$\text{NO}_x \text{ Removed} = 245,643 \times 423.9 - 277,535 \times 326.6$$

$$= 104.13 - 10.64$$

$$= 13.49 \text{ SCFM}$$

$$\% \text{ SO}_2 \text{ REMOVAL} = \frac{34.08}{218.89} 100 = 15.57\%$$

$$\% \text{ NO}_x \text{ REMOVAL} = \frac{13.49}{104.13} 100 = 12.95\%$$

Estimate of Lime Usage

30 gpm of 8 WT% lime slurry

$$\text{Sp Gr} = 1.043$$

$$\text{Purity} = 95.5\%$$

$$30 \times 8.328 \times 1.043 \times 0.08 \times 0.955 = 19.9 \text{ Lb/Min} = 0.269 \text{ Lb Mol/Minute}$$

$$\text{SO}_2 \text{ Removed} = \frac{34.08}{379.5} = 0.0898$$

$$\text{NO}_x \text{ Removed} = \frac{13.49}{379.5} = 0.0355$$

$$\text{Lime Utilization} = \frac{0.0898 + \frac{0.0355}{2}}{0.259} = 40\%$$

PROCEDURES FOR CALCULATING SO₂ AND NO_x REMOVAL AND PERCENTAGE OF LIME UTILIZATION FOR CZD CONTINUOUS OPERATION

Going into the second phase from parametric testing to continuous CZD demonstration, automated and integrated with boiler #15 at Seward Station, all the operating data are automatically recorded. The calculations are computerized, and the results recorded.

The lime slurry concentration is set and controlled by the nuclear-type density gauge and transmitter.

The environmental monitoring system (EMS) for monitoring CZD operations includes:

- Duct and stack opacity
- SO₂ in and out – by dilution system
- NO_x in and out – by dilution system
- CO₂ in and out – by dilution system

The flow of flue gas in the duct is monitored at three locations, using the differential temperature type. Two locations use multipoint probes. These flow measurements, combined with the environmental measurements, form the basis for determining the percentages of SO₂ and NO_x reduction by CZD.

During CZD operations, the following data are recorded every 15 minutes:

Field Name	Field Type	Formula
Date	Date	
Time	Time	
R/C Out Temp °F	Number	
I.D. Fan Out Temp °F	Number	
Flue gas flow in KSCFM	Number	
Flue gas flow out KSCFM	Number	
Lime slurry flow gpm	Number	
Lime slurry header pressure psig	Number	
Atomizing air flow SCFM	Number	

Field Name	Field Type	Formula
B-duct opacity %	Number	
Stack opacity %	Number	
Slurry solids %	Number	
Boiler load MW	Number	
SO ₂ inlet ppm	Number	
SO ₂ outlet ppm	Number	
NO _x inlet ppm	Number	
NO _x outlet ppm	Number	
CO ₂ inlet %	Number	
CO ₂ outlet %	Number	
Average C-cross section Temp °F	Number	
Lowest C-cross section Temp °F	Number	
SO ₂ in SCFM	Calculation Number	$(\text{Flue gas (FG) flow in KSCFM} \times \text{SO}_2 \text{ inlet ppm})/1000$
SO ₂ out SCFM	Calculation Number	$(\text{FG flow out KSCFM} \times \text{SO}_2 \text{ outlet ppm})/1000$
NO _x in SCFM	Calculation Number	$(\text{FG flow in KSCFM} \times \text{NO}_x \text{ inlet ppm})/1000$
NO _x out SCFM	Calculation Number	$(\text{FG flow out KSCFM} \times \text{NO}_x \text{ outlet ppm})/1000$
SO ₂ removal %	Calculation Number	$100 (\text{SO}_2 \text{ in SCFM} - \text{SO}_2 \text{ out SCFM})/\text{SO}_2 \text{ in SCFM}$
NO _x removal %	Calculation Number	$100 (\text{NO}_x \text{ in SCFM} - \text{NO}_x \text{ out SCFM})/\text{NO}_x \text{ in SCFM}$
SO ₂ in lb/MM Btu	Calculation Number	$0.03 \times \text{SO}_2 \text{ inlet ppm}/\text{CO}_2 \text{ inlet \%}$
SO ₂ out lb/MM Btu	Calculation Number	$0.03 \times \text{SO}_2 \text{ outlet ppm}/\text{CO}_2 \text{ outlet \%}$
NO _x in lb/MM Btu	Calculation Number	$0.0218 \times \text{NO}_x \text{ inlet ppm}/\text{CO}_2 \text{ inlet \%}$
NO _x out lb/MM Btu	Calculation Number	$0.0218 \times \text{NO}_x \text{ outlet ppm}/\text{CO}_2 \text{ outlet \%}$
SO ₂ reduction %	Calculation Number	$\frac{100 \times (\text{SO}_2 \text{ in lb/MM Btu} - \text{SO}_2 \text{ out lb/MM Btu})}{(\text{SO}_2 \text{ in lb/MM Btu} + 0.00001)}$
NO _x reduction %	Calculation Number	$\frac{100 \times (\text{NO}_x \text{ in lb/MM Btu} - \text{NO}_x \text{ out lb/MM Btu})}{(\text{NO}_x \text{ in lb/MM Btu} + 0.00001)}$
Dilution SO ₂ %	Calculation Number	$100 \times (\text{SO}_2 \text{ inlet ppm}/\text{SO}_2 \text{ outlet ppm} - 1.0)$
Dilution NO _x %	Calculation Number	$100 \times (\text{NO}_x \text{ inlet ppm}/\text{NO}_x \text{ outlet ppm} - 1.0)$
Dilution CO ₂ %	Calculation Number	$100 \times (\text{CO}_2 \text{ inlet \%}/\text{CO}_2 \text{ outlet \%} - 1.0)$
Dilution flue gas flow	Calculation Number	$100 \times (\text{FG flow out KSCFM}/\text{FG flow in KSCFM} - 1.0)$
Lime useage lb mol\min	Calculation Number	$\frac{\text{Lime flow gpm} \times 8.3456 \times \text{Slurry SGU} \times (\text{Slurry Solids \%}/100)}{\text{Lime mol wt.}}$
SO ₂ removed lb mol\min	Calculation Number	$(\text{FG flow in KSCFM} \times \text{SO}_2 \text{ inlet ppm}/1000) \times (\text{SO}_2 \text{ reduction \%}/100)/379$
Lime utilization %	Calculation Number	$100 \times \text{SO}_2 \text{ removed lb-mol}\backslash\text{min}/\text{Lime useage lb mol}\backslash\text{min}$

Lime Storage and Slurry Preparation – Continuous Operation

Lime Slurry Feed System – Continuous Operation

Lime Slurry Injection – Continuous Operation

Lime Utilization Calculations

GIVEN:

$$\text{Lime Sp. Gr.} = 2.29 = 142.965 \text{ lb/cu ft} \quad (2.29 \times 62.43)$$

$$1 \text{ gal H}_2\text{O} = 8.345677 \text{ lb} = 0.13368 \text{ cu ft}$$

THEN:

Slurry Conc WT %	Slurry Wt LB/GAL	Slurry Vol CU FT	Slurry SG
16%	9.94	0.1448	1.0991
15%	9.82	0.1440	1.0923
14%	9.70	0.1432	1.0856
13%	9.59	0.1424	1.0790
12%	9.48	0.1416	1.0725
11%	9.38	0.1409	1.0661
10%	9.27	0.1402	1.0597
9%	9.17	0.1395	1.0534
8%	9.07	0.1388	1.0472
7%	8.97	0.1381	1.0411
6%	8.88	0.1374	1.0350
5%	8.78	0.1368	1.0290
4%	8.69	0.1361	1.0231
3%	8.60	0.1355	1.0172
2%	8.52	0.1349	1.0114
1%	8.43	0.1343	1.0057
0%	8.35	0.1337	1.0000

$$\text{Slurry Wt calculation} \quad 8.345677 / (1 - \text{slurry conc. wt.\% lime})$$

$$\text{Slurry Vol calculation} \quad ((\text{slurry wt} \times \text{slurry lime conc}) / 142.965) + 0.13368$$

$$\text{Slurry SG calculation} \quad (\text{slurry wt} / \text{slurry vol}) / 62.43$$

Lime Used, in LB-MOLS/Minute:

For Dolomitic Lime

$$(\text{Slurry flow [gpm]} \times 8.34568 \times \text{Slurry SG} \times \text{Lime conc. [\%*.01]}) / 70.4$$

For Calcitic Lime

$$(\text{Slurry flow [gpm]} \times 8.34568 \times \text{Slurry SG} \times \text{Lime conc. [\%*.01]}) / 74$$

SO₂ Removed, in LB-MOLS/Minute:

$$(((\text{Flue gas in [KSCFM]} \times \text{SO}_2 \text{ in [PPM]}) / 1000) \times \text{SO}_2 \text{ removed [\%*.01]}) / 379$$

Lime Utilization:

$$(\text{LB-MOLS SO}_2 \text{ Removed} / \text{LB-MOLS Lime used}) \times 100$$

Lime Utilization Calcs

TONS LIME PER HOUR (Dry Weight)

		Slurry Lime Concentration, Wt. %															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Slurry Flow GPM	5	0.01	0.03	0.04	0.05	0.07	0.08	0.09	0.11	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24
	10	0.03	0.05	0.08	0.10	0.13	0.16	0.19	0.22	0.25	0.28	0.31	0.34	0.37	0.41	0.44	0.48
	15	0.04	0.08	0.12	0.16	0.20	0.24	0.28	0.33	0.37	0.42	0.46	0.51	0.56	0.61	0.66	0.72
	20	0.05	0.10	0.15	0.21	0.26	0.32	0.38	0.44	0.50	0.56	0.62	0.68	0.75	0.82	0.88	0.95
	25	0.06	0.13	0.19	0.26	0.33	0.40	0.47	0.54	0.62	0.70	0.77	0.85	0.94	1.02	1.10	1.19
	30	0.08	0.15	0.23	0.31	0.40	0.48	0.57	0.65	0.74	0.83	0.93	1.02	1.12	1.22	1.33	1.43
	35	0.09	0.18	0.27	0.37	0.46	0.56	0.66	0.76	0.87	0.97	1.08	1.19	1.31	1.43	1.55	1.67
	40	0.10	0.20	0.31	0.42	0.53	0.64	0.75	0.87	0.99	1.11	1.24	1.37	1.50	1.63	1.77	1.91
	45	0.11	0.23	0.35	0.47	0.59	0.72	0.85	0.98	1.11	1.25	1.39	1.54	1.68	1.83	1.99	2.15
	50	0.13	0.26	0.39	0.52	0.66	0.80	0.94	1.09	1.24	1.39	1.55	1.71	1.87	2.04	2.21	2.38
	55	0.14	0.28	0.43	0.57	0.72	0.88	1.04	1.20	1.36	1.53	1.70	1.88	2.06	2.24	2.43	2.62
	60	0.15	0.31	0.46	0.63	0.79	0.96	1.13	1.31	1.49	1.67	1.86	2.05	2.24	2.45	2.65	2.86
		8.43	8.52	8.60	8.69	8.78	8.88	8.97	9.07	9.17	9.27	9.38	9.48	9.59	9.70	9.82	9.94
		Slurry Weight, Lb./Gal.															

Appendix I

Calculation of the Injected Lime Slurry Flow Rate Based on the Flue Gas Duct Temperature Difference Between the Inlet and Outlet

Appendix I

CALCULATION OF THE INJECTED LIME SLURRY FLOW RATE BASED ON THE FLUE GAS DUCT TEMPERATURE DIFFERENCE BETWEEN THE INLET AND OUTLET

The factor to approximate slurry or water injection flow rates using duct ΔT was calculated by regression analysis using data collected from August 17 to September 16, 1992. The regression analysis considered three cases:

1. Slurry injection into the duct (from FIT-22 measurements)
2. The water portion of slurry injection into the duct (from FIT-22 and DT-01)
3. Water injection into the duct (from FT-20)

Duct ΔT was taken as the difference between the Kurz temperature measurements just after the Research Cottrell precipitator and at the ID fan outlet (TT-11A and TT-11B). It is understood that the average measured gas temperature in the duct varies along the length of the duct (due to the evaporation, dispersion of moisture, and inleakage) and after the ID fan (due to heat added by the fan work). Therefore, these results do not directly apply to ΔT 's taken at other locations such as the average C section temperature.

In Case 2 the water portion of slurry was calculated from the measurement of slurry flow rate in gpm (FIT-22) and slurry density in wt. % solids (DT-01). The calculation used to find the water portion of the slurry from the flow rate and density measurements is shown in Attachment 1.

The results of the regression analysis of all three cases are summarized below:

		$\Delta T/\text{gpm}$	R^2	99% Confidence Level
Case 1:	Slurry flow	2.07	0.92	2.063 - 2.077
Case 2:	Water portion of slurry flow	2.19	0.92	2.18 - 2.19
Case 3:	Water flow	2.44	0.92	2.42 - 2.45

The detailed regression analysis results are presented for Cases 1, 2, and 3 as Tables 1, 2, and 3 respectively. For cases 1 and 2; 442 of the 458 data points were used. The 16 data points not used appear to be mainly the result of start-up, shut-down, or other transient event where flow rate changed faster than duct temperature. In a few cases the data points lacked readings for TT-11A and TT-11B. For Case 3; 1,485 of the 1,665 data points available were used in the regression analysis. The reason for the greater number of data points excluded is probably due to the accuracy of the water flow measurement (FIT-20; rotameter type with $\pm 2.5\%$ accuracy) being lower than the slurry flow measurement (FIT-22; magnetic type with $\pm 1\%$ accuracy).

The confidence level indicates the range of values that 99% of the actual flow rates fall into for a particular calculated flow rate (during steady conditions). Using Case 3 as an example, at a ΔT of 110°F the calculated flow rate would be 45.1 gpm. The confidence level predicts that 99% of the measured values are expected to fall in the range of 44.9 to 45.5 gpm.

Figures 1, 2, and 3 show the plots of measured versus calculated flow rates for each case studied. These figures are useful for showing the range of flow rates examined and provides a visual check of the relative accuracy of the regression results.

A tabulation of actual and calculated flow rates for the first month of continuous operation is presented as attachment 8. These tables show the data used to construct the regression for case 1 each day that slurry was injected into the duct, and compares the actual and calculated flow rate in each case. The daily slurry flow tables are preceded by a summary tabulation of the daily averages.

The tabulation of actual flue gas flow in – and flue gas flow out – in kscfm during the period August 17 to September 3, 1992, is included in Appendix H of *Quarterly Report #8*.

Attachments:

1. Calculation: "Method to calculate water flow rate portion of slurry flow rate (in gpm)"
2. Table 1: "Regression Analysis Results: Slurry flow from ΔT "
3. Figure 1: "Measured vs. Calculated Slurry Flow Rates"
4. Table 2: "Regression Analysis Results: Water Portion of Slurry Flow from ΔT "
5. Figure 2: "Measured vs. Calculated Water Portion of Slurry Flow Rates"
6. Table 3: "Regression Analysis Results: Water Flow from ΔT "
7. Figure 3: "Measured vs. Calculated Water Flow Rates"
8. Tabulation: "Month No. 1 Actual and Calculated Slurry Flow Rates" (including daily averages)

Calculation Sheet

Originator MIKE SCHALL Date 2/25/93 Calc. No. _____ Rev. No. _____
 Project CZD - SEWARD Job No. 21178-003 Checked _____ Date _____
 Subject WATER FLOW RATE PORTION OF SLURRY FLOWRATE (IN GPM) Sheet No. 1 OF 2

WANTED: CALCULATE THE WATER FLOWRATE PORTION OF THE
LIME SLURRY FLOWRATE

GIVEN: LIME DRY = 2.29 SGU
 8.35 #/GAL H₂O
 SLURRY FLOW, $\frac{\text{GAL}}{\text{MIN}}$
 SOLIDS, Wt. %

SOLUTION:

APPROACH CONVERT VOL. FLOW OF SLURRY TO MASS FLOW, CALCULATE
WATER PORTION OF FLOW ON MASS BASIS THEN CONVERT
MASS FLOW WATER TO VOL. FLOW.

$$\textcircled{1} \text{ SGU SLURRY} = \frac{\text{LIME SGU}}{\left(\text{LIME SGU} - \left(\frac{\text{SLURRY SOL., WT\%}}{100} \right) \right) \times (\text{LIME SGU} - 1.0)}$$

$$\textcircled{2} \text{ SLURRY FLOW, } \frac{\#}{\text{MIN}} = (8.35 \frac{\#}{\text{GAL}} \cdot \text{H}_2\text{O}) \times (\text{SGU SLURRY, } \frac{\#}{\text{H}_2\text{O}}) \times (\text{SLURRY FLOW, } \frac{\text{GAL}}{\text{MIN}})$$

$$\textcircled{3} \text{ WATER FLOW, } \frac{\#}{\text{MIN}} = (\text{SLURRY FLOW, } \frac{\#}{\text{MIN}}) \times \left(\frac{100 - \text{WT\% SOLIDS}}{100} \right)$$

$$\textcircled{4} \text{ WATER FLOW, } \frac{\text{GAL}}{\text{MIN}} = \text{WATER FLOW, } \frac{\#}{\text{MIN}} \left(\frac{1}{8.35 \frac{\#}{\text{GAL}}} \right)$$

EXAMPLE: 35.0 GPM SLURRY FLOW @ 10.3 Wt. % SOLIDS

$$\textcircled{1} \text{ SGU SLURRY} = \frac{2.29}{\left(2.29 - \left(\frac{10.3\%}{100} \right) \right) \times (2.29 - 1.0)} = 1.06 \text{ SGU}$$

$$\textcircled{2} \text{ SLURRY FLOW, } \frac{\#}{\text{MIN}} = (35 \frac{\text{GAL}}{\text{MIN}}) (1.06 \text{ SGU SLURRY}) (8.35 \frac{\#}{\text{GAL}} \cdot \text{H}_2\text{O}) = 310 \frac{\#}{\text{MIN}}$$

Calculation Sheet

Originator MIKE SCHAAAL Date _____ Calc. No. _____ Rev. No. _____
Project _____ Job No. _____ Checked _____ Date _____
Subject _____ Sheet No. 2 OF 2

EXAMPLE: (CONTINUED)

$$\textcircled{3} \text{ WATER FLOW, } \#/\text{MIN} = 310 \#/\text{MIN} \times \left(\frac{100 - 10.3 \text{ WT.}\%}{100} \right) = 278 \#/\text{MIN}$$

$$\textcircled{4} \text{ WATER FLOW, } \text{GAL}/\text{MIN} = 278 \#/\text{MIN} \times \left(\frac{1}{8.35 \#/\text{GAL} \cdot \text{H}_2\text{O}} \right) = \boxed{33.3 \text{ GAL}/\text{MIN}}$$

TABLE 1

REGRESSION ANALYSIS RESULTS: SLURRY FLOW FROM ΔT

Data From Aug 17 to Sep 16, 1992

Regression Statistics

Multiple R	0.961
R Square	0.924
Adjusted R Square	0.922
Standard Error	1.38
Observations	442 (16 data points deleted)

Analysis of Variance

	<i>df</i>	<i>Sum of Squares</i>	<i>Mean Square</i>	<i>F</i>	<i>Significance F</i>
Regression	1	10298.7526	10298.7526	5374.51364	9.1964E-249
Residual	441	845.0531901	1.91622039		
Total	442	11143.80579			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Statistic</i>	<i>P-value</i>	<i>Lower 99 %</i>	<i>Upper 99 %</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A
ΔT , °F	0.483	0.00061226	788.975195	0	0.481473941	0.4846418

2.07 °F ΔT for every 1 gpm slurry flow (FIT-22)Note: ΔT calculated as difference between TT-11A and TT-11B

FIGURE 1
MEASURED VS. CALCULATED SLURRY FLOW RATES

Page I-7

Notes:

1. ΔT calculated as difference between TT-11A and TT-11B.
2. Calculated slurry flow is 1 gpm for 2.07°F ΔT ($R^2=0.92$).

TABLE 2
REGRESSION ANALYSIS RESULTS:
WATER PORTION OF SLURRY FLOW FROM ΔT

Data From Aug 17 to Sep 16, 1992

Regression Statistics

Multiple R	0.959
R Square	0.920
Adjusted R Square	0.918
Standard Error	1.35
Observations	442 (16 data points deleted)

Analysis of Variance

	<i>df</i>	<i>Sum of Squares</i>	<i>Mean Square</i>	<i>F</i>	<i>Significance F</i>
Regression	1	9267.657843	9267.65784	5105.99608	3.0333E-244
Residual	441	800.438748	1.81505385		
Total	442	10068.09659			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Statistic</i>	<i>P-value</i>	<i>Lower 99 %</i>	<i>Upper 99 %</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A
ΔT , °F	0.457	0.000595879	767.702906	0	0.455916238	0.45899934

2.19 °F ΔT for every 1 gpm water flow (FIT-22)

Note: ΔT calculated as difference between TT-11A and TT-11B

FIGURE 2
MEASURED VS. CALCULATED WATER PORTION OF SLURRY FLOW RATES

Notes:

1. ΔT calculated as difference between TT-11A and TT-11B.
2. Calculated slurry flow is 1 gpm for every 2.19°F ΔT ($R^2=0.92$).

TABLE 3
REGRESSION ANALYSIS RESULTS: WATER FLOW FROM ΔT

Data From Aug 17 to Sep 16, 1992

<i>Regression Statistics</i>						
Multiple R	0.957					
R Square	0.917					
Adjusted R Square	0.916					
Standard Error	2.04					
Observations	1485 (180 data points deleted)					

<i>Analysis of Variance</i>						
	<i>df</i>	<i>Sum of Squares</i>	<i>Mean Square</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	67977.93696	67977.937	16322.4494	0	
Residual	1484	6180.399503	4.16468969			
Total	1485	74158.33646				

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Statistic</i>	<i>P-value</i>	<i>Lower 99 %</i>	<i>Upper 99 %</i>
Intercept	0	#N/A	#N/A	#N/A	#N/A	#N/A
ΔT , °F	0.411	0.000762828	538.283841	0	0.408650349	0.41258524

2.44 °F ΔT for every 1 gpm water flow (FIT-20)

Note: ΔT calculated as difference between TT-11A and TT-11B

FIGURE 3
MEASURED VS. CALCULATED WATER FLOW RATES

Notes:

1. ΔT calculated as difference between TT-11A and TT-11B.
2. Calculated water flow is 1 gpm for every 2.44°F ΔT ($R^2=0.92$).

**SEWARD CZD
MEASURED & ACTUAL SLURRY FLOW RATES**

3/4/93 8:55:00

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Daily Averages

Date	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/17/92	306.0	202.1	103.9	50.2	48.6	-7.2
8/20/92	300.2	198.0	102.2	49.4	48.6	-1.6
8/21/92	297.8	189.6	108.2	52.3	53.8	2.9
8/24/92	306.7	197.8	108.9	52.6	53.1	0.8
8/25/92	305.6	197.5	108.1	52.2	51.4	-1.6
8/26/92	306.1	194.5	111.7	53.9	54.3	0.6
8/27/92	298.2	189.2	109.0	52.6	54.8	3.9
8/28/92	305.4	199.6	105.8	51.1	50.7	-1.0
9/2/92	297.8	218.5	79.3	38.3	36.5	-4.9
9/3/92	293.9	218.2	75.7	36.6	35.2	-4.2

NOTES: 1. Daily averages shown above are for times of slurry injection only.
2. Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F.

SEWARD CZD MEASURED & CALCULATED SLURRY FLOWS

3/4/93

8:58:35

Page 1

Date	Time	R&C Out TT-11A °F	ID Fan S-4 TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/17/92	1300	303.7	221.4	82.3	39.8	35.0	-13.6
8/17/92	1315	303.6	220.4	83.2	40.2	38.3	-4.9
8/17/92	1330	304.7	209.3	95.4	46.1	44.8	-2.9
8/17/92	1345	304.8	211.6	93.2	45.0	43.8	-2.8
8/17/92	1400	305.5	203.5	102.0	49.3	50.0	1.4
8/17/92	1415	306.7	204.8	101.9	49.2	17.7	-178.1
8/17/92	1430	302.4	209.1	93.2	45.0	44.5	-1.2
8/17/92	1445	304.5	199.4	105.1	50.8	51.1	0.7
8/17/92	1500	305.8	196.8	109.0	52.7	54.0	2.5
8/17/92	1515	306.4	194.9	111.5	53.8	55.1	2.3
8/17/92	1530	306.4	194.4	112.0	54.1	55.1	1.8
8/17/92	1545	306.5	194.1	112.5	54.3	55.7	2.5
8/17/92	1600	306.8	195.0	111.8	54.0	54.5	0.9
8/17/92	1615	306.8	194.7	112.1	54.2	54.9	1.4
8/17/92	1630	307.4	194.7	112.7	54.4	55.1	1.2
8/17/92	1645	307.6	195.2	112.4	54.3	54.9	1.1
8/17/92	1700	307.7	194.9	112.8	54.5	55.2	1.3
8/17/92	1715	307.8	195.2	112.6	54.4	55.3	1.6
8/17/92	1730	307.0	194.8	112.2	54.2	54.8	1.1
8/17/92	1745	307.6	195.3	112.3	54.3	55.5	2.3
8/17/92	1800	307.6	199.4	108.2	52.3	49.9	-4.8
8/17/92	1815	306.7	202.3	104.4	50.4	48.2	-4.6
8/17/92	1830	306.1	203.3	102.8	49.7	48.0	-3.5
8/17/92	1845	306.4	204.0	102.4	49.5	48.1	-2.8
8/17/92	1900	306.2	205.8	100.4	48.5	45.6	-6.4
8/17/92	1915	306.4	205.9	100.5	48.6	46.7	-4.0
8/17/92	1930	305.3	205.1	100.2	48.4	47.5	-1.9
8/17/92	1945	305.4	204.4	101.0	48.8	48.7	-0.2
8/17/92	2000	305.7	202.9	102.8	49.7	49.0	-1.4
8/17/92	2015	305.8	201.4	104.4	50.4	49.7	-1.5
8/17/92	2030	305.8	200.8	105.0	50.7	49.8	-1.9
8/17/92	2045	305.9	200.6	105.3	50.9	50.6	-0.5
8/17/92	2100	305.9	200.8	105.1	50.8	49.8	-2.0
8/17/92	2115	304.0	214.4	89.6	43.3	34.2	-26.6
Averages:		306.0	202.1	103.9	50.2	48.6	-7.2

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

SEWARD CZD MEASURED & CALCULATED SLURRY FLOWS

3/4/93

8:56:35

Page 2

Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/20/92	1745	303.9	212.0	91.9	44.4	40.1	-10.7
8/20/92	1800	305.1	208.9	96.2	46.0	44.8	-2.7
8/20/92	1815	305.4	202.1	103.3	49.9	49.9	0.0
8/20/92	1830	304.3	201.6	102.7	49.6	48.2	-2.9
8/20/92	1845	303.8	200.3	103.5	50.0	49.4	-1.2
8/20/92	1900	303.5	199.4	104.1	50.3	49.7	-1.2
8/20/92	1915	302.1	198.4	103.7	50.1	49.9	-0.4
8/20/92	1930	301.3	198.0	103.3	49.9	50.0	0.2
8/20/92	1945	301.0	196.5	104.5	50.5	50.3	-0.4
8/20/92	2000	300.1	194.6	105.5	51.0	50.1	-1.7
8/20/92	2015	299.7	197.1	102.6	49.6	47.9	-3.5
8/20/92	2030	299.3	197.8	101.5	49.0	48.2	-1.7
8/20/92	2045	299.8	198.3	101.5	49.0	48.2	-1.7
8/20/92	2100	299.9	198.2	101.7	49.1	47.9	-2.6
8/20/92	2115	299.9	199.0	100.9	48.7	48.4	-0.7
8/20/92	2130	299.4	198.6	100.8	48.7	48.1	-1.2
8/20/92	2145	298.7	198.2	100.5	48.6	47.9	-1.4
8/20/92	2200	297.6	196.7	100.9	48.7	48.1	-1.3
8/20/92	2215	296.7	193.8	102.9	49.7	49.8	0.2
8/20/92	2230	297.0	192.7	104.3	50.4	49.8	-1.2
8/20/92	2245	296.4	192.2	104.2	50.3	49.9	-0.9
8/20/92	2300	296.6	192.4	104.2	50.3	50.3	-0.1
8/20/92	2315	296.6	192.4	104.2	50.3	50.1	-0.5
8/20/92	2330	295.8	191.4	104.4	50.4	50.4	-0.1
Averages:		300.2	198.0	102.2	49.4	48.6	-1.6

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/21/92	1445	308.7	205.6	103.1	49.8	46.9	-6.2
8/21/92	1500	0.0	0.0	0.0	0.0	50.1	100.0
8/21/92	1515	309.1	201.0	108.1	52.2	52.1	-0.2
8/21/92	1530	309.5	199.7	109.8	53.0	54.1	2.0
8/21/92	1545	309.2	198.9	110.3	53.3	54.0	1.3
8/21/92	1600	309.2	198.6	110.6	53.4	54.2	1.4
8/21/92	1615	309.4	198.6	110.8	53.5	54.0	0.9
8/21/92	1630	308.9	197.8	111.1	53.7	53.9	0.4
8/21/92	1645	308.4	198.4	110.0	53.1	54.0	1.6
8/21/92	1700	308.9	197.8	111.1	53.7	54.0	0.6
8/21/92	1715	309.0	197.8	111.2	53.7	54.0	0.5
8/21/92	1730	308.9	198.0	110.9	53.6	54.2	1.2
8/21/92	1745	308.3	197.5	110.8	53.5	54.2	1.2
8/21/92	1800	308.5	198.0	110.5	53.4	54.2	1.5
8/21/92	1815	307.1	197.2	109.9	53.1	54.0	1.7
8/21/92	1830	307.0	195.4	111.6	53.9	54.0	0.2
8/21/92	1845	307.0	196.0	111.0	53.6	54.0	0.7
8/21/92	1900	307.0	196.3	110.7	53.5	54.2	1.3
8/21/92	1915	306.6	195.1	110.5	53.4	54.3	1.7
8/21/92	1930	305.1	193.5	111.6	53.9	54.8	1.6
8/21/92	1945	304.9	191.7	113.2	54.7	55.1	0.8
8/21/92	2000	305.1	191.1	114.0	55.1	55.1	0.0
8/21/92	2015	305.6	193.2	112.4	54.3	55.0	1.3
8/21/92	2030	305.7	193.4	112.3	54.3	55.1	1.5
8/21/92	2045	305.8	193.8	112.0	54.1	55.4	2.3
8/21/92	2100	305.9	193.2	112.7	54.4	55.9	2.6
8/21/92	2115	305.0	192.1	112.9	54.5	55.8	2.3
8/21/92	2130	304.6	189.1	115.5	55.8	55.5	-0.5
8/21/92	2145	303.7	188.9	114.8	55.5	55.2	-0.5
8/21/92	2200	303.8	189.3	114.5	55.3	55.1	-0.4
8/21/92	2215	304.2	190.9	113.3	54.7	54.9	0.3
8/21/92	2230	304.0	190.7	113.3	54.7	55.1	0.7
8/21/92	2245	303.8	190.7	113.1	54.6	55.1	0.8
8/21/92	2300	303.0	188.2	114.8	55.5	55.1	-0.7
8/21/92	2315	302.4	198.1	104.3	50.4	40.6	-24.1
Averages:		297.8	189.6	108.2	52.3	53.8	2.9

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/24/92	1400	307.7	217.5	90.2	43.6	39.8	-9.5
8/24/92	1415	307.2	213.4	93.8	45.3	44.7	-1.4
8/24/92	1430	307.4	212.9	94.5	45.7	44.9	-1.7
8/24/92	1445	307.3	215.3	92.0	44.4	44.9	1.0
8/24/92	1500	306.4	215.8	90.6	43.8	44.9	2.5
8/24/92	1515	306.8	214.6	92.2	44.5	45.0	1.0
8/24/92	1530	306.8	215.4	91.4	44.2	45.1	2.1
8/24/92	1545	307.5	208.7	98.8	47.7	51.3	7.0
8/24/92	1600	308.6	203.7	104.9	50.7	53.9	6.0
8/24/92	1615	308.6	200.5	108.1	52.2	55.0	5.1
8/24/92	1630	309.5	199.9	109.6	52.9	55.2	4.1
8/24/92	1645	309.5	198.0	111.5	53.9	56.5	4.7
8/24/92	1700	309.7	196.8	112.9	54.5	56.9	4.1
8/24/92	1715	309.3	194.0	115.3	55.7	58.9	5.4
8/24/92	1730	310.0	193.2	116.8	56.4	59.0	4.4
8/24/92	1745	309.5	192.4	117.1	56.6	59.0	4.1
8/24/92	1800	309.4	191.9	117.5	56.8	58.9	3.6
8/24/92	1815	308.9	191.1	117.8	56.9	58.9	3.4
8/24/92	1830	308.9	190.4	118.5	57.2	59.2	3.3
8/24/92	1845	308.2	196.6	111.6	53.9	50.2	-7.4
8/24/92	1900	306.9	199.1	107.8	52.1	49.9	-4.4
8/24/92	1915	306.0	197.5	108.5	52.4	52.2	-0.4
8/24/92	1930	306.0	194.2	111.8	54.0	55.2	2.2
8/24/92	1945	306.0	193.8	112.2	54.2	53.5	-1.3
8/24/92	2000	306.1	193.8	112.3	54.3	54.0	-0.5
8/24/92	2015	306.1	192.8	113.3	54.7	55.5	1.4
8/24/92	2030	305.8	191.2	114.6	55.4	56.0	1.1
8/24/92	2045	304.6	189.9	115.7	55.9	55.9	0.0
8/24/92	2100	305.5	190.0	115.5	55.8	56.3	0.9
8/24/92	2115	305.5	191.7	113.8	55.0	54.1	-1.6
8/24/92	2130	305.8	192.6	113.2	54.7	54.2	-0.9
8/24/92	2145	305.7	192.8	112.9	54.5	54.2	-0.6
8/24/92	2200	304.2	191.3	112.9	54.5	54.0	-1.0
8/24/92	2215	302.8	189.5	113.3	54.7	54.0	-1.4
8/24/92	2230	303.2	189.8	113.4	54.8	53.9	-1.6
8/24/92	2245	304.3	191.3	113.0	54.6	53.8	-1.5
8/24/92	2300	303.5	190.9	112.6	54.4	53.9	-0.9
8/24/92	2315	304.4	192.4	112.0	54.1	53.9	-0.4
8/24/92	2330	305.0	192.8	112.2	54.2	54.0	-0.4
8/24/92	2345	304.6	193.0	111.6	53.9	54.0	0.2
Averages:		306.7	197.8	108.9	52.6	53.1	0.8

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/25/92	0000	303.4	191.7	111.7	54.0	54.1	0.3
8/25/92	0015	303.1	190.9	112.2	54.2	54.7	0.9
8/25/92	0030	303.2	190.1	113.1	54.6	54.8	0.3
8/25/92	0045	302.6	188.4	114.2	55.2	54.8	-0.7
8/25/92	0100	301.6	187.5	114.1	55.1	55.0	-0.2
8/25/92	0115	302.4	190.3	112.1	54.2	51.5	-5.2
8/25/92	0130	304.0	194.0	110.0	53.1	50.8	-4.6
8/25/92	0145	302.8	194.0	108.8	52.6	51.2	-2.7
8/25/92	0200	302.2	190.3	111.9	54.1	52.8	-2.4
8/25/92	0215	301.7	194.1	107.6	52.0	50.1	-3.8
8/25/92	0230	302.0	196.7	105.3	50.9	48.2	-5.5
8/25/92	0245	304.0	199.6	104.4	50.4	48.3	-4.4
8/25/92	0300	303.3	198.8	104.5	50.5	49.6	-1.8
8/25/92	0315	303.4	197.5	105.9	51.2	50.3	-1.7
8/25/92	0330	303.8	198.0	105.8	51.1	50.4	-1.4
8/25/92	0345	303.8	198.1	105.7	51.1	49.8	-2.5
8/25/92	0400	304.2	198.6	105.6	51.0	50.3	-1.4
8/25/92	0415	303.1	196.9	106.2	51.3	49.8	-3.0
8/25/92	0430	303.9	198.2	105.7	51.1	49.8	-2.5
8/25/92	0445	303.9	197.0	106.9	51.6	52.1	0.9
8/25/92	0500	304.1	195.5	108.6	52.5	53.7	2.3
8/25/92	0515	303.8	193.7	110.1	53.2	54.1	1.7
8/25/92	0530	303.7	192.1	111.6	53.9	53.9	0.0
8/25/92	0545	304.0	192.4	111.6	53.9	54.0	0.2
8/25/92	0600	302.6	191.5	111.1	53.7	54.3	1.2
8/25/92	0615	302.7	191.9	110.8	53.5	53.3	-0.4
8/25/92	0630	303.2	194.5	108.7	52.5	52.3	-0.4
8/25/92	0645	303.0	194.6	108.4	52.4	52.3	-0.1
8/25/92	0700	303.2	194.3	108.9	52.6	51.8	-1.6
8/25/92	0715	303.6	195.0	108.6	52.5	51.9	-1.1
8/25/92	0730	303.7	195.4	108.3	52.3	51.2	-2.2
8/25/92	0745	303.6	197.9	105.7	51.1	50.0	-2.1
8/25/92	0800	304.3	198.8	105.5	51.0	49.7	-2.5
8/25/92	0815	304.9	199.8	105.1	50.8	50.3	-0.9
8/25/92	0830	303.6	197.8	105.8	51.1	50.3	-1.6
8/25/92	0845	303.6	198.2	105.4	50.9	49.8	-2.2
8/25/92	0900	303.0	198.0	105.0	50.7	49.9	-1.7
8/25/92	0915	304.1	198.4	105.7	51.1	50.2	-1.7
8/25/92	0930	304.6	198.6	106.0	51.2	50.0	-2.4
8/25/92	0945	305.1	198.8	106.3	51.4	49.8	-3.1
8/25/92	1000	305.1	199.1	106.0	51.2	50.2	-2.0
8/25/92	1015	306.1	200.1	106.0	51.2	50.0	-2.4
8/25/92	1030	304.7	200.4	104.3	50.4	50.0	-0.8
8/25/92	1045	306.0	200.1	105.9	51.2	49.9	-2.5
8/25/92	1100	307.0	200.6	106.4	51.4	50.0	-2.8
8/25/92	1115	307.5	201.2	106.3	51.4	49.9	-2.9
8/25/92	1130	306.8	200.6	106.2	51.3	49.9	-2.8
8/25/92	1145	307.9	201.3	106.6	51.5	50.0	-3.0

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/25/92	1200	307.9	201.7	106.2	51.3	50.0	-2.6
8/25/92	1215	308.1	201.8	106.3	51.4	50.1	-2.5
8/25/92	1230	307.7	201.9	105.8	51.1	50.1	-2.0
8/25/92	1245	307.4	200.2	107.2	51.8	51.0	-1.5
8/25/92	1300	307.4	199.6	107.8	52.1	51.0	-2.1
8/25/92	1315	308.2	200.1	108.1	52.2	51.1	-2.2
8/25/92	1330	308.9	201.0	107.9	52.1	51.1	-2.0
8/25/92	1345	309.1	201.0	108.1	52.2	51.1	-2.2
8/25/92	1400	308.3	200.0	108.3	52.3	51.7	-1.2
8/25/92	1415	308.2	200.5	107.7	52.0	51.1	-1.8
8/25/92	1430	308.4	200.8	107.6	52.0	51.1	-1.7
8/25/92	1445	308.8	199.0	109.8	53.0	52.2	-1.6
8/25/92	1500	309.1	200.1	109.0	52.7	51.0	-3.2
8/25/92	1515	309.3	200.2	109.1	52.7	51.0	-3.3
8/25/92	1530	308.9	199.6	109.3	52.8	52.1	-1.3
8/25/92	1545	309.7	198.6	111.1	53.7	53.8	0.2
8/25/92	1600	310.1	197.7	112.4	54.3	55.0	1.3
8/25/92	1615	309.7	196.3	113.4	54.8	55.1	0.6
8/25/92	1630	309.7	195.4	114.3	55.2	55.9	1.2
8/25/92	1645	309.5	195.2	114.3	55.2	56.1	1.6
8/25/92	1700	309.8	195.0	114.8	55.5	56.1	1.1
8/25/92	1715	309.4	194.6	114.8	55.5	56.0	1.0
8/25/92	1730	309.3	194.8	114.5	55.3	54.6	-1.3
8/25/92	1745	308.5	196.9	111.6	53.9	53.1	-1.5
8/25/92	1800	308.3	199.0	109.3	52.8	50.2	-5.2
8/25/92	1815	307.8	202.4	105.4	50.9	48.2	-5.6
8/25/92	1830	306.8	203.0	103.8	50.1	48.1	-4.3
8/25/92	1845	306.3	203.5	102.8	49.7	48.1	-3.2
8/25/92	1900	305.9	203.5	102.4	49.5	48.5	-2.0
8/25/92	1915	304.7	201.3	103.4	50.0	50.0	0.1
8/25/92	1930	305.0	201.0	104.0	50.2	50.0	-0.5
8/25/92	1945	304.3	200.4	103.9	50.2	50.0	-0.4
Averages:		305.6	197.5	108.1	52.2	51.4	-1.6

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/26/92	0245	300.8	209.5	91.3	44.1	40.1	-10.0
8/26/92	0300	300.3	205.5	94.8	45.8	48.0	4.6
8/26/92	0315	305.5	201.6	103.9	50.2	53.4	6.0
8/26/92	0330	306.0	198.2	107.8	52.1	55.6	6.3
8/26/92	0345	306.4	197.3	109.1	52.7	54.8	3.8
8/26/92	0400	305.5	195.6	109.9	53.1	55.7	4.7
8/26/92	0415	306.0	195.2	110.8	53.5	55.9	4.2
8/26/92	0430	307.7	196.1	111.6	53.9	56.3	4.2
8/26/92	0445	308.3	196.5	111.8	54.0	55.8	3.2
8/26/92	0500	306.5	195.5	111.0	53.6	56.3	4.8
8/26/92	0515	306.1	194.9	111.2	53.7	55.9	3.9
8/26/92	0530	305.9	194.8	111.1	53.7	55.7	3.6
8/26/92	0545	306.4	194.6	111.8	54.0	56.3	4.1
8/26/92	0600	306.6	194.4	112.2	54.2	55.9	3.0
8/26/92	0615	306.0	193.8	112.2	54.2	55.9	3.0
8/26/92	0630	306.0	194.0	112.0	54.1	56.3	3.9
8/26/92	0645	305.9	193.5	112.4	54.3	55.9	2.9
8/26/92	0700	306.0	194.1	111.9	54.1	54.8	1.4
8/26/92	0715	306.0	195.4	110.6	53.4	54.2	1.4
8/26/92	0730	306.2	196.1	110.1	53.2	54.4	2.2
8/26/92	0745	306.5	196.8	109.7	53.0	54.2	2.2
8/26/92	0800	307.0	196.3	110.7	53.5	55.1	2.9
8/26/92	0815	307.6	195.9	111.7	54.0	56.5	4.5
8/26/92	0830	306.4	193.8	112.6	54.4	57.4	5.2
8/26/92	0845	307.0	193.0	114.0	55.1	56.8	3.0
8/26/92	0900	305.6	191.9	113.7	54.9	56.8	6.6
8/26/92	0915	304.9	190.7	114.2	55.2	57.1	3.4
8/26/92	0930	305.3	190.3	115.0	55.6	56.7	2.0
8/26/92	0945	305.7	190.5	115.2	55.7	57.1	2.5
8/26/92	1000	306.1	191.0	115.1	55.6	57.2	2.8
8/26/92	1015	306.2	190.8	115.4	55.7	56.9	2.0
8/26/92	1030	305.8	190.0	115.8	55.9	56.9	1.7
8/26/92	1045	305.7	189.4	116.3	56.2	57.0	1.4
8/26/92	1100	306.2	189.9	116.3	56.2	56.8	1.1
8/26/92	1115	307.1	191.1	116.0	56.0	56.0	-0.1
8/26/92	1130	308.1	193.1	115.0	55.6	55.2	-0.6
8/26/92	1145	309.8	194.5	115.3	55.7	55.2	-0.9
8/26/92	1200	309.6	194.5	115.1	55.6	54.7	-1.7
8/26/92	1215	309.6	194.5	115.1	55.6	54.7	-1.7
8/26/92	1230	309.5	197.1	112.4	54.3	53.0	-2.5
8/26/92	1245	310.3	196.6	113.7	54.9	54.2	-1.3
8/26/92	1300	310.5	196.9	113.6	54.9	53.9	-1.8
8/26/92	1315	309.7	196.1	113.6	54.9	53.8	-2.0
8/26/92	1330	309.6	196.3	113.3	54.7	54.0	-1.4
8/26/92	1345	309.8	195.6	114.2	55.2	54.8	-0.7
8/26/92	1400	309.7	195.5	114.2	55.2	55.2	0.1
8/26/92	1415	309.1	194.0	115.1	55.6	55.2	-0.7
8/26/92	1430	308.4	196.6	111.8	54.0	52.0	-3.9

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/26/92	1445	308.6	197.8	110.8	53.5	52.4	-2.1
8/26/92	1500	307.9	197.3	110.6	53.4	52.1	-2.6
8/26/92	1515	308.4	197.0	111.4	53.8	52.1	-3.3
8/26/92	1530	309.0	201.3	107.7	52.0	50.0	-4.1
8/26/92	1545	308.9	197.9	111.0	53.6	50.3	-6.6
8/26/92	1830	306.0	198.8	107.2	51.8	50.0	-3.6
8/26/92	1845	305.9	197.3	108.6	52.5	51.6	-1.7
8/26/92	1900	305.1	195.4	109.7	53.0	52.0	-1.9
8/26/92	1915	304.6	194.6	110.0	53.1	52.0	-2.2
8/26/92	1930	302.8	191.9	110.9	53.6	54.2	1.2
8/26/92	1945	303.0	192.8	110.2	53.2	52.0	-2.4
8/26/92	2000	303.0	193.0	110.0	53.1	52.2	-1.8
8/26/92	2015	302.7	192.4	110.3	53.3	53.3	0.0
8/26/92	2030	303.7	191.3	112.4	54.3	55.2	1.6
8/26/92	2045	304.1	190.9	113.2	54.7	54.8	0.2
8/26/92	2100	304.4	190.7	113.7	54.9	54.9	-0.1
8/26/92	2115	304.2	190.7	113.5	54.8	55.3	0.8
8/26/92	2130	303.8	190.5	113.3	54.7	54.9	0.3
8/26/92	2145	303.7	190.2	113.5	54.8	54.9	0.1
8/26/92	2200	303.2	190.3	112.9	54.5	54.8	0.5
8/26/92	2215	303.6	190.1	113.5	54.8	55.2	0.7
8/26/92	2230	302.8	190.2	112.6	54.4	52.4	-3.8
8/26/92	2245	303.7	192.3	111.4	53.8	52.0	-3.5
8/26/92	2300	305.3	193.3	112.0	54.1	53.2	-1.7
8/26/92	2315	304.6	193.6	111.0	53.6	53.3	-0.6
8/26/92	2330	303.7	192.7	111.0	53.6	53.8	0.3
8/26/92	2345	303.5	192.4	111.1	53.7	53.6	-0.1
Averages:		306.1	194.5	111.7	53.9	54.3	0.6

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/27/92	0000	304.3	192.2	112.1	54.2	54.7	1.0
8/27/92	0015	307.8	194.6	113.2	54.7	54.8	0.2
8/27/92	0030	308.8	195.5	113.3	54.7	54.9	0.3
8/27/92	0045	308.5	195.6	112.9	54.5	55.4	1.6
8/27/92	0100	308.3	194.9	113.4	54.8	55.7	1.6
8/27/92	0115	307.9	194.1	113.8	55.0	56.7	3.0
8/27/92	0130	307.5	193.6	113.9	55.0	56.1	1.9
8/27/92	0145	0.0	0.0	0.0	0.0	56.6	100.0
8/27/92	0200	306.8	194.2	112.6	54.4	54.0	-0.7
8/27/92	0215	305.5	194.3	111.2	53.7	53.2	-1.0
8/27/92	0230	305.3	195.3	110.0	53.1	53.1	-0.1
8/27/92	0245	306.5	195.3	111.2	53.7	53.0	-1.4
8/27/92	0300	307.6	196.6	111.0	53.6	54.3	1.2
8/27/92	0315	307.3	195.7	111.6	53.9	54.5	1.1
8/27/92	0330	306.0	194.8	111.2	53.7	55.1	2.5
8/27/92	0345	306.1	194.4	111.7	54.0	55.4	2.6
8/27/92	0400	306.4	194.3	112.1	54.2	55.4	2.2
8/27/92	0415	305.9	194.1	111.8	54.0	56.1	3.7
8/27/92	0430	305.1	193.7	111.4	53.8	56.2	4.2
8/27/92	0445	305.2	193.8	111.4	53.8	55.9	3.7
8/27/92	0500	305.1	194.3	110.8	53.5	55.0	2.7
8/27/92	0515	305.4	194.6	110.8	53.5	55.2	3.0
8/27/92	0530	305.2	194.1	111.1	53.7	54.1	0.8
8/27/92	0545	304.5	194.1	110.4	53.3	54.0	1.2
8/27/92	0600	304.7	194.2	110.5	53.4	54.2	1.5
8/27/92	0615	304.9	195.2	109.7	53.0	53.0	0.0
8/27/92	0630	304.9	195.8	109.1	52.7	53.0	0.6
8/27/92	0645	304.6	195.5	109.1	52.2	52.3	0.1
8/27/92	0700	303.6	196.1	107.5	51.9	51.0	-1.8
8/27/92	0715	303.9	199.4	104.5	50.5	49.0	-3.0
8/27/92	0730	304.4	200.3	104.1	50.3	49.4	-1.8
8/27/92	0745	0.0	0.0	0.0	0.0	52.1	100.0
8/27/92	0800	305.4	198.1	107.3	51.8	52.8	1.8
8/27/92	0830	304.9	197.2	107.7	52.0	47.7	-9.1
8/27/92	1430	307.0	206.3	100.7	48.6	44.5	-9.3
8/27/92	1445	306.6	203.4	103.2	49.9	52.4	4.9
8/27/92	1500	308.3	197.3	111.0	53.6	53.0	-1.2
8/27/92	1515	308.6	196.9	111.7	54.0	54.2	0.4
8/27/92	1530	309.0	195.6	113.4	54.8	58.3	6.0
8/27/92	1545	309.6	195.9	113.7	54.9	53.9	-1.9
8/27/92	1600	309.4	195.2	114.2	55.2	56.7	2.7
8/27/92	1615	309.4	194.9	114.5	55.3	57.7	4.1
8/27/92	1630	310.0	195.2	114.8	55.5	58.0	4.4
8/27/92	1645	310.5	195.5	115.0	55.6	56.1	1.0
8/27/92	1700	310.7	195.0	115.7	55.9	56.9	1.8
8/27/92	1715	311.4	195.2	116.2	56.1	57.0	1.5
8/27/92	1730	310.7	194.4	116.3	56.2	57.3	1.9
8/27/92	1745	310.9	194.7	116.2	56.1	57.3	2.0

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/27/92	1800	309.8	193.0	116.8	56.4	58.7	3.9
8/27/92	1815	308.5	190.3	118.2	57.1	59.3	3.7
8/27/92	1830	307.7	191.7	116.0	56.0	59.4	5.7
8/27/92	1845	307.0	189.7	117.3	56.7	59.8	3.6
8/27/92	1900	306.8	190.3	116.5	56.3	57.4	2.0
8/27/92	1915	306.5	192.6	113.9	55.0	55.4	0.7
8/27/92	1930	305.6	193.2	112.4	54.3	56.0	3.0
8/27/92	1945	305.1	192.5	112.6	54.4	57.1	4.7
8/27/92	2000	305.1	190.0	115.1	55.6	58.1	4.3
8/27/92	2015	305.5	191.1	114.4	55.3	55.6	0.6
8/27/92	2030	305.0	192.5	112.5	54.3	54.0	-0.6
8/27/92	2045	304.6	192.4	112.2	54.2	55.0	1.4
8/27/92	2100	305.2	192.7	112.5	54.3	55.1	1.4
8/27/92	2115	305.2	192.6	112.6	54.4	55.0	1.1
8/27/92	2130	305.1	192.7	112.4	54.3	55.2	1.6
8/27/92	2145	306.3	193.1	113.2	54.7	54.8	0.2
8/27/92	2200	306.8	192.8	114.0	55.1	55.7	1.1
8/27/92	2215	306.4	192.2	114.2	55.2	55.9	1.3
8/27/92	2230	306.3	194.6	111.7	54.0	53.0	-1.8
8/27/92	2245	305.9	193.4	112.5	54.3	54.8	0.8
8/27/92	2300	305.7	193.4	112.3	54.3	54.8	1.0
8/27/92	2315	306.5	194.3	112.2	54.2	53.2	-1.9
8/27/92	2330	307.3	195.9	111.4	53.8	53.2	-1.2
8/27/92	2345	306.3	194.5	111.8	54.0	53.9	-0.2
Averages:		298.2	189.2	109.0	52.6	54.8	3.9

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/28/92	0000	306.5	194.9	111.6	53.9	54.1	0.3
8/28/92	0015	306.2	194.6	111.6	53.9	53.9	0.0
8/28/92	0030	306.4	193.9	112.5	54.3	55.5	2.1
8/28/92	0045	305.9	192.7	113.2	54.7	55.3	1.1
8/28/92	0100	306.6	193.1	113.5	54.8	55.8	1.7
8/28/92	0115	306.6	193.1	113.5	54.8	55.7	1.6
8/28/92	0130	306.4	192.8	113.6	54.9	55.7	1.5
8/28/92	0145	307.0	193.8	113.2	54.7	55.4	1.3
8/28/92	0200	308.5	194.8	113.7	54.9	55.4	0.9
8/28/92	0215	308.1	195.0	113.1	54.6	55.8	2.1
8/28/92	0230	307.9	194.8	113.1	54.6	55.5	1.6
8/28/92	0245	307.4	194.1	113.3	54.7	55.3	1.0
8/28/92	0300	306.4	193.4	113.0	54.6	52.5	-4.0
8/28/92	0315	305.9	197.8	108.1	52.2	52.6	0.7
8/28/92	0330	305.3	196.5	108.8	52.6	51.6	-1.9
8/28/92	0345	306.8	198.0	108.8	52.6	50.9	-3.3
8/28/92	0400	305.9	198.4	107.5	51.9	51.3	-1.2
8/28/92	0415	304.7	198.0	106.7	51.5	50.8	-1.5
8/28/92	0430	303.9	197.1	106.8	51.6	51.0	-1.2
8/28/92	0445	304.2	197.1	107.1	51.7	51.4	-0.7
8/28/92	0500	303.6	199.2	104.4	50.4	47.9	-5.3
8/28/92	0515	303.6	201.6	102.0	49.3	46.2	-6.7
8/28/92	0530	303.2	202.9	100.3	48.5	46.1	-5.1
8/28/92	0545	304.9	204.8	100.1	48.4	46.2	-4.7
8/28/92	0600	305.8	206.0	99.8	48.2	46.0	-4.8
8/28/92	0615	306.5	203.7	102.8	49.7	50.9	2.4
8/28/92	0630	307.1	201.8	105.3	50.9	52.3	2.7
8/28/92	0645	307.2	199.7	107.5	51.9	53.5	2.9
8/28/92	0700	307.8	198.4	109.4	52.9	55.0	3.9
8/28/92	0715	307.2	197.8	109.4	52.9	54.1	2.3
8/28/92	0730	307.2	197.8	109.4	52.9	54.1	2.3
8/28/92	0745	306.8	198.8	108.0	52.2	52.2	0.0
8/28/92	0800	306.4	202.5	103.9	50.2	48.2	-4.1
8/28/92	0815	307.4	204.3	103.1	49.8	49.1	-1.4
8/28/92	0830	307.6	204.9	102.7	49.6	48.3	-2.7
8/28/92	0845	307.0	204.2	102.8	49.7	51.7	3.9
8/28/92	0900	307.2	202.0	105.2	50.8	52.0	2.3
8/28/92	0915	308.3	200.8	107.5	51.9	53.2	2.4
8/28/92	0930	308.2	200.1	108.1	52.2	53.7	2.8
8/28/92	0945	308.4	200.3	108.1	52.2	50.1	-4.2
8/28/92	1000	309.3	206.9	102.4	49.5	47.2	-4.8
8/28/92	1015	309.3	208.8	100.5	48.6	46.8	-3.7
8/28/92	1615	301.6	207.2	94.4	45.6	40.4	-12.9
8/28/92	1630	301.5	206.2	95.3	46.0	44.5	-3.5
8/28/92	1645	301.9	201.1	100.8	48.7	49.9	2.4
8/28/92	1700	302.8	199.4	103.4	50.0	49.9	-0.1
8/28/92	1715	303.4	197.8	105.6	51.0	52.1	2.1
8/28/92	1730	304.1	198.7	105.4	50.9	50.1	-1.6

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
8/28/92	1745	304.2	199.1	105.1	50.8	49.9	-1.7
8/28/92	1800	304.0	199.1	104.9	50.7	50.1	-1.2
8/28/92	1815	303.6	197.8	105.8	51.1	52.1	1.9
8/28/92	1830	304.5	197.3	107.2	51.8	52.1	0.6
8/28/92	1845	304.5	197.4	107.1	51.7	52.2	0.9
8/28/92	1900	304.7	198.8	105.9	51.2	49.9	-2.5
8/28/92	1915	304.1	199.6	104.5	50.5	47.3	-6.7
8/28/92	1930	304.7	202.8	101.9	49.2	46.3	-6.3
8/28/92	1945	304.4	203.1	101.3	48.9	47.1	-3.9
8/28/92	2000	304.5	203.4	101.1	48.8	47.1	-3.7
8/28/92	2015	304.3	203.1	101.2	48.9	48.1	-1.6
8/28/92	2030	304.1	201.3	102.8	49.7	49.1	-1.1
8/28/92	2045	303.2	200.1	103.1	49.8	48.5	-2.7
8/28/92	2100	302.8	203.0	99.8	48.2	46.8	-3.0
8/28/92	2115	303.1	202.5	100.6	48.6	47.0	-3.4
8/28/92	2130	303.8	202.4	101.4	49.0	48.8	-0.4
8/28/92	2145	304.5	200.4	104.1	50.3	50.9	1.2
8/28/92	2200	303.6	198.5	105.1	50.8	51.0	0.4
8/28/92	2215	302.5	200.1	102.4	49.5	48.1	-2.8
8/28/92	2230	302.1	200.3	101.8	49.2	48.1	-2.2
Averages:		305.4	199.6	105.8	51.1	50.7	-1.0

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
9/2/92	1530	298.6	223.0	75.6	36.5	35.8	-2.0
9/2/92	1545	298.7	219.9	78.8	38.1	38.0	-0.2
9/2/92	1600	299.1	217.6	81.5	39.4	39.4	-2.5
9/2/92	1615	298.8	216.7	82.1	39.7	37.8	-4.9
9/2/92	1630	298.8	216.7	82.1	39.7	37.8	-4.9
9/2/92	1715	298.2	222.6	75.6	36.5	37.0	1.3
9/2/92	1730	298.8	218.8	80.0	38.6	37.3	-3.6
9/2/92	1745	298.9	218.2	80.7	39.0	36.8	-5.9
9/2/92	1800	298.2	218.4	79.8	38.6	37.1	-3.9
9/2/92	1815	298.2	217.2	81.0	39.1	36.8	-6.3
9/2/92	1830	297.7	218.0	79.7	38.5	36.6	-5.2
9/2/92	1845	298.1	218.2	79.9	38.6	36.2	-6.6
9/2/92	1900	297.8	218.6	79.2	38.3	35.9	-6.6
9/2/92	1915	297.7	218.7	79.0	38.2	35.4	-4.8
9/2/92	1930	297.6	216.8	80.8	39.0	39.6	1.4
9/2/92	1945	297.6	217.4	80.2	38.7	36.6	-5.9
9/2/92	2000	297.0	218.0	79.0	38.2	36.0	-6.0
9/2/92	2015	297.0	218.4	78.6	38.0	36.2	-4.9
9/2/92	2030	298.3	219.0	79.3	38.3	35.8	-7.0
9/2/92	2045	297.0	219.0	78.0	37.7	35.6	-5.8
9/2/92	2100	296.8	218.4	78.4	37.9	35.4	-7.0
9/2/92	2115	298.2	219.3	78.9	38.1	35.5	-7.4
9/2/92	2130	295.9	217.4	78.5	37.9	33.9	-11.9
9/2/92	2145	293.0	217.6	75.4	36.4	33.8	-7.8
Averages:		297.8	218.5	79.3	38.3	36.5	-4.9

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

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Date	Time	R&C Out TT-11A °F	ID Fan Out TT-11B °F	ΔT °F	Flow by ΔT gpm	Slurry Flow FIT-22 gpm	Diff %
9/3/92	0915	293.5	219.4	74.1	35.8	35.6	-0.6
9/3/92	0930	293.8	218.2	75.6	36.5	35.9	-1.7
9/3/92	0945	293.9	217.3	76.6	37.0	36.3	-1.9
9/3/92	1000	294.0	218.9	75.1	36.3	35.2	-3.1
9/3/92	1015	294.0	217.0	77.0	37.2	36.9	-0.8
9/3/92	1030	294.0	218.1	75.9	36.7	31.3	-17.1
Averages:		293.9	218.2	75.7	36.6	35.2	-4.2

Note: Slurry flow calculated by ΔT assumes 1 gpm slurry flow for every 2.07°F

Appendix J

PaDER-Penelec Protocol for Testing Higher Sulfur Coal at CZD Demonstration, Seward Station, for a Two-Week Period

**REVISED TEST PROTOCOL
FOR TESTING HIGHER SULFUR COAL
AT SEWARD STATION
(without exceeding 2.8 lbs/MMBTU SO₂ emissions)
February 25, 1993**

INTRODUCTION

Pennsylvania Electric Company (Penelec) and Bechtel Corporation (Bechtel) propose testing at Seward Station with higher sulfur coal (not to exceed a sulfur content of 2.4%) for a 15-day test period to be completed before June 15, 1993. The test needs to be conducted for the following reasons:

- To fulfill Bechtel's obligation to the U.S. Department of Energy (DOE) under the current Cooperative Agreement for the CZD Project. The statement of work requires testing CZD with both high-sulfur and medium-sulfur coal.
- To determine how burning higher sulfur coal affects the CZD percent lime slurry concentration, how the effects to lime slurry concentration affect the electrostatic precipitator particulate removal efficiency and consequently, how the stack opacity is affected (it is expected that the higher sulfurous acid vapor pressure will help increase the percent SO₂ removal).

DESCRIPTION OF TEST (See Table 1)

Units 12 and 14 would operate as normal, burning the coal normally burned. Higher sulfur coal (approximately 2.2% sulfur) would be burned in Unit 15 for 15 days. The CZD system would be operated continuously on the Unit 15 B-duct removing up to 50% of the SO₂ from the B-duct flue gas (approximately 25% of the SO₂ from Unit 15's exhaust gas). Calculations indicate that in order to limit the SO₂ factor to 2.8 lbs/MMBTU for Station totals, an SO₂ removal of slightly less than 40% would be required in the B-duct (when burning 2.2% sulfur coal in Unit 15). Without offsets, total plant SO₂ emissions for 1993 would increase from 18,034 tons/year* to 18,076 tons/year as a result of the test.

The SO₂ emissions factor will be maintained at to 2.8 lbs/MMBTU, or less, during the testing. In the event of an unexpected problem disabling the CZD system for 1-2 days, the active coal storage with higher sulfur coal could be completely replaced with actual coal during a maximum 10 hour period. During this short period of time, the maximum SO₂ factor would be limited to 3.29 lbs/MMBTU. By reducing the Unit 15 boiler load, the SO₂ factor could be lowered during the unexpected CZD outage.

OFFSETTING INCREASED SO₂ EMISSIONS (See Table 1)

After testing has been completed with the higher sulfur coal, the increase in annual SO₂ emissions (approximately 42 tons) will be offset by operating the CZD process continuously for approximately one week to remove an equivalent amount of SO₂ from the B-duct flue gas.

* Quantity taken from "1991 Interim Emission Fee - Seward Station", letter from T. E. McKenzie of Penelec/GPU to PaDER, Department of Air Quality Control, August 26, 1991.

Table 1. SUMMARY OF HIGH SULFUR COAL TEST *

OPERATING CONDITIONS	Boiler #12	Boiler #14	Boiler #15	Station Totals
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NORMAL OPERATING CONDITIONS AT SEWARD STATION

Heat Input (MM BTU/year) **	1,998,439	2,203,816	9,460,237	13,662,492
Heat Input (MM BTU/2 weeks)	76,863	84,762	363,855	525,480
Coal Burned (M tons/year) **	82.71	91.21	391.92	565.84
Coal Burned (M tons/2 weeks)	3.18	3.51	15.07	21.76
SO2 Emissions (tons/year) **	2,539	2,711	12,784	18,034
SO2 Emissions (tons/2 weeks)	97.65	104.27	491.69	693.62
SO2 Factor (lbs/MM BTU) **	2.54	2.48	2.70	2.64

BURNING HIGHER SULFUR COAL WITHOUT CZD OPERATING

SO2 Emissions (tons/2 weeks)	97.65	104.27	663.21	865.13
SO2 Factor (lbs/MMBTU)	2.54	2.48	3.64	3.29

BURNING HIGHER SULFUR COAL WITH CZD REMOVING 39% OF SO2 IN B-DUCT

SO2 Emissions (tons/2 weeks)	97.65	104.27	533.88	735.80
SO2 Factor (lbs/MMBTU)	2.54	2.48	2.93	2.80

TIME REQUIRED TO OFFSET EXCESS SO2 EMISSIONS FROM TEST 1

Total increase in SO2 emissions from Test 1 (tons/2 weeks)	0	0	42.19	42.19
Reduction of SO2 by CZD during normal operating conditions (39% SO2 removal in B-duct) (tons/2weeks)	0	0	98.34	98.34
Number of weeks required to offset SO2 emissions increase	1			

* During this test period, actual sulfur coal (1.6% S) will be replaced with a higher sulfur coal (about 2.2% S) for Unit 15, only. Units 12 and 14 will continue to burn actual sulfur coal. To prevent exceeding Station total emissions factor from exceeding 2.8 lbs/MMBTU, the CZD would be required to remove, at minimum, 39% of the SO2 in the Unit 15 B-duct. During continuous operations at Seward Station, the CZD has demonstrated up to 50% removal of SO2 in the B-duct. A higher SO2 removal is expected with higher sulfur coal.

** Quantity taken from "1991 Interim Emission Fee - Seward Station", letter from T. E. McKenzie of Penelec/GPU to PaDER, Department of Air Quality Control, August 26, 1991.

Appendix K

Ted Shafebook's Observations and Maintenance Practices for an ESP Following a CZD System

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March 10, 1993

Mr. Michael Bodosky
Group Supervisor, Mechanical Maintenance
Pennsylvania Electric Company
Seward Station
R.D. #2, Box 405
New Florence, PA 15944

Subject: #15D Precipitator;
Phone Call to T.Schafebook, G.E. Environmental Systems

Dear Mr. Bodosky;

This past week I called Ted Schafebook of G.E. Environmental Systems to obtain his assessment of #15D precipitator operation. As you recall, Mr. Schafebook visited Seward Station in October, 1992 to gather precipitator performance data related to operation of the Confined Zone Dispersion (CZD) system. Bechtel forwarded additional ESP and CZD operating data to G.E. in December. Mr. Schafebook related to me some of his observations and recommendations based on his visit, the data provided, and our observations of the ESP plates and wires in December, 1992 and January, 1993. His observations and suggested operation and maintenance practices are discussed below:

1. There is a net positive effect of lime slurry injection into the duct as long as all the solids are dried before encountering the ESP.

Ted noted that the combined positive effects of increased humidity and decreased temperature on decreasing cake resistivity (and thereby improving ESP performance) should more than offset the negative effect of lime addition to the cake, which tends to increase the cake resistivity (as was shown in July, 1992 B duct opacity charts). When lime slurry injection is terminated, humidity decreases and temperature increases almost immediately while it may take some hours for the lime entrained cake to be rapped off the plates. The result is an immediate worsening in precipitator performance followed by a gradual improvement in performance.

2. Once lime slurry or water in the liquid phase begins to pass through the ESP the cake will begin to cling to the plates so persistently that no amount of rapping or time will remove it. At some point, the degradation in performance will be so great that continued operation is only possible by reducing the gas temperature and increasing the gas humidity (water injection does both at the same time).

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It is probable that in this operating condition, any deviation from humidity, temperature, or cake constituency or layering, will result in an immediate negative effect on the ESP performance.

3. The low exit gas temperatures that boiler #15 has been operating at since November, 1992 (240 to 270°F) is below the acid dew point. Under this condition there could be an increase in the amount of cake which is difficult to remove by rapping.
4. Based on the above observations, Ted recommended a complete wash off of the precipitator plates. An expected higher exit gas temperature for boiler #15 in the near future could lead to worse ESP performance than has been noted to date due to drying out of the cake.
5. Future operation of CZD should avoid, at all times, operation that would result in wet lime entering the precipitator (whether planned or upset). The existing rapping system should be able to remove the fly ash and dried lime. If wetted lime enters the precipitator, the resultant cake will probably not be removable by any amount of rapping and will require a wash off of the plates.

Ted offered to provide further confirmation of the above observations by reviewing the latest boiler #15 coal analysis and in situ fly ash analysis.

If there is any other way that I may be of assistance in this matter please let me know.

Very truly yours,

A. Michael Schaal
CZD Site Engineer

AMS/ams

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