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VOLUME I:
Summary of Results

CONTINUOUS SULFUR DIOXIDE MONITORING OF THE INDUSTRIAL BOILER SYSTEM AT RICKENBACKER AIR FORCE BASE, COLUMBUS, OHIO
VOLUME I

by

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CONTENTS

FIGURES

TABLES

TABLES (continued)

TABLES (continued)

TABLES (continued)

TABLES (continued)

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SECTION 1

INTRODUCTION

The primary purpose of this test was to collect continuous sulfur dioxide (SO_2) emission and removal efficiency data from the flue gas desulfurization (FGD) system serving the industrial boiler system at Rickenbacker Air Force Base (RAFB), near Columbus, Ohio.* The data are to be used to support development of a new source performance standard for industrial boilers.

Because the continuous emission monitoring system (CEM) used gas monitors to collect the data, performance specification (P/S) tests were conducted at the beginning and end of data collection to ensure equivalence to manual reference tests. Additional reference testing was performed throughout the test period to provide quality assurance.

Manual tests for nitrogen oxides (NO_x) and particulates were performed to determine what, if any, removal of these pollutants occurred in the FGD system.

Records of boiler, FGD system, and CEM performance were kept to account for data loss and excursions from normal operations, and to provide information regarding operating parameters for correlation with data.

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* Since the test, the base was transfered to the National Guard and renamed Rickenbacker Air National Guard Base (RANGB).

Volume I of this report presents the results of all tests performed and provides background information concerning the process, equipment, and procedures relevant to the tests. Volume(s) II, III, and IV provide(s) detailed listings, instrument calibration logs, field test data, and process logs relevant to the results presented in Volume I.

SECTION 2

SUMMARY OF RESULTS

Continuous SO_2 data were collected from January 25, 1980 to March 19, 1980, with intermittent data losses caused by CEM and process downtime. Data were obtained for 18 or more hours per day on 29 days and showed an average inlet emission rate of 5.2 lb $SO_2/10^6$ Btu (daily standard deviation of 6.1 percent), an average outlet emission rate of 0.45 lb $SO_2/10^6$ Btu (standard deviation of 26 percent) and an average SO_2 removal efficiency of 91.46 percent (standard deviation of 2.5 percent). Average total boiler load for the period was 109 x 10^6 Btu/h, which is 52 percent of the total rated capacity of the boiler system (210 x 10^6 Btu/h).

The FGD system operated normally 94.1 percent of the time during the test period (1242 hours of normal operation during 1320 total hours from 2400, January 24, to 2400, March 19). The CEM operability was 78.0 percent (969 hours of complete data capture during the 1242 hours available). Because of numerous combined boiler/FGD outages and CEM failures exceeding 6 h per 24 h operating day, 23 days of potential data (18 or more hours of normal FGD operation) were excluded from final averages.

Initial P/S tests demonstrated that the CEM complied with U.S. Environmental Protection Agency (EPA) standards for performance.* Certain tests needed to be repeated to achieve this. Final P/S tests demonstrated continued compliance with standards except for inlet and outlet tests of system relative accuracy, which yielded results of 23.2 and 23.1 percent, whereas standards place the allowable limit for each at 20 percent.

Particulate tests performed on March 10 and 11 showed an average inlet emission rate of 0.33 $lb/10^6$ Btu, an average outlet emission rate of 0.26 $lb/10^6$ Btu, and an average removal efficiency of 21.2 percent.

Nitrogen oxide tests performed on March 10 and 11 showed an average inlet emission rate of 0.65 lb $NO_x/10^6$ Btu, an average outlet rate of 0.63 lb $NO_x/10^6$ Btu, and an average removal efficiency of 3.1 percent.

* Performance Specifications 2 and 3, Federal Register, Vol. 44, No. 197, October 10, 1979.

SECTION 3

RESULTS

3.1 PERFORMANCE SPECIFICATION TESTS

Complete P/S tests were performed at the beginning and end of the test period to ensure equivalence of CEM data to data from manual reference method tests. Tables 3-1 and 3-2 summarize results of the initial P/S tests, and Tables 3-3 and 3-4 summarize the results of the final P/S tests.

3.1.1 Initial P/S Test Results

Sampling Locations--

Both inlet and outlet CEM and manual reference method sampling points were chosen to be representative of the process streams tested and achieve equivalence between manual method and CEM samples. This was achieved in all cases by choosing sampling points centrally located in the ducts at the furthest accessible points downstream from possible process interferences. Inlet manual method samples were drawn immediately downstream from the CEM probe tip (Figure 3-1), whereas outlet CEM and manual method samples were taken from points adjacent in the stack (Figure 3-2).

TABLE 3-1. SUMMARY OF INITIAL PERFORMANCE SPECIFICATION RESULTS FOR THE SO_2 MONITOR

Test parameter	Required performance specifications	Performance testing results		
System relative accuracy	≤20% of the mean value of the reference method test data in pounds per million Btu	Inlet		7.32%
		Outlet		6.64%
Calibration error	≤5% of each (50% of span, 90% of span) calibration gas mixture	High range	High	0.97%
			Mid	0.39%
		Low range	High	1.16%
			Mid	0.58%
Zero drift (2-h)	2% of span	High range		0.06%
		Low range		0.06%
Zero drift (24-h)	2% of span	High range		0.00%
		Low range		0.00%
Calibration drift (2-h)	2% of span	High range		0.25%
		Low range		0.34%
Calibration drift (24-h)	2.5% of span	High range		0.65%
		Low range		1.11%
Response time	15 min maximum	High range		21.2 s
		Low range		50.9 s
Conditioning period	168-h minimum			>168 h
Operational period	168-h minimum			>168 h

TABLE 3-2. SUMMARY OF INITIAL PERFORMANCE SPECIFICATION RESULTS FOR THE O_2 MONITOR

Test parameter	Required performance specifications	Performance testing results	
Calibration error	≤5% of the mean value of the reference method test data	High range Mid range	0.43% 1.58%
Zero drift (2-h)	≤0.4%		0.00%
Zero drift (24-h)	≤0.5%		0.00%
Calibration drift (2-h)	≤0.4%		0.00%
Calibration drift (24-h)	≤0.5%		0.33%
Operational period	168-h minimum		>168 h
Conditioning period	168-h minimum		>168 h
Response time	10 min maximum		21.1 s

TABLE 3-3. SUMMARY OF FINAL PERFORMANCE SPECIFICATION RESULTS FOR THE SO_2 MONITOR

Test parameter	Required performance specifications	Performance testing results		
System relative accuracy	≤20% of the mean value of the reference method test data in pounds per million Btu	Inlet		23.2%
		Outlet		23.1%
Calibration error	≤5% of each (50% of span, 90% of span) calibration gas mixture	High range	High	1.80%
			Mid	0.50%
		Low range	High	0.53%
			Mid	0.59%
Zero drift (2-h)	2% of span	High range		0.00%
		Low range		0.12%
Zero drift (24-h)	2% of span	High range		0.00%
		Low range		0.20%
Calibration drift (2-h)	2% of span	High range		0.20%
		Low range		0.19%
Calibration drift (24-h)	2.5% of span	High range		1.60%
		Low range		1.50%
Response time	15 min maximum	High range		[a]
		Low range		[a]
Conditioning period	168 h-minimum			[a]
Operational period	168 h-minimum			[a]

[a] Not applicable.

TABLE 3-4. SUMMARY OF FINAL PERFORMANCE SPECIFICATION RESULTS FOR THE O_2 MONITOR

Test parameter	Required performance specifications	Performance testing results	
Calibration error	≤5% of the mean value of the reference method test data	High range Mid range	0.00% 0.10%
Zero drift (2-h)	≤0.4%		0.03%
Zero drift (24-h)	≤0.5%		0.03%
Calibration drift (2-h)	≤0.4%		0.09%
Calibration drift (24-h)	≤0.5%		0.48%
Operational period	168-h minimum		a
Conditioning period	168-h minimum		a
Response time	10 min maximum		a

[a] Not applicable.

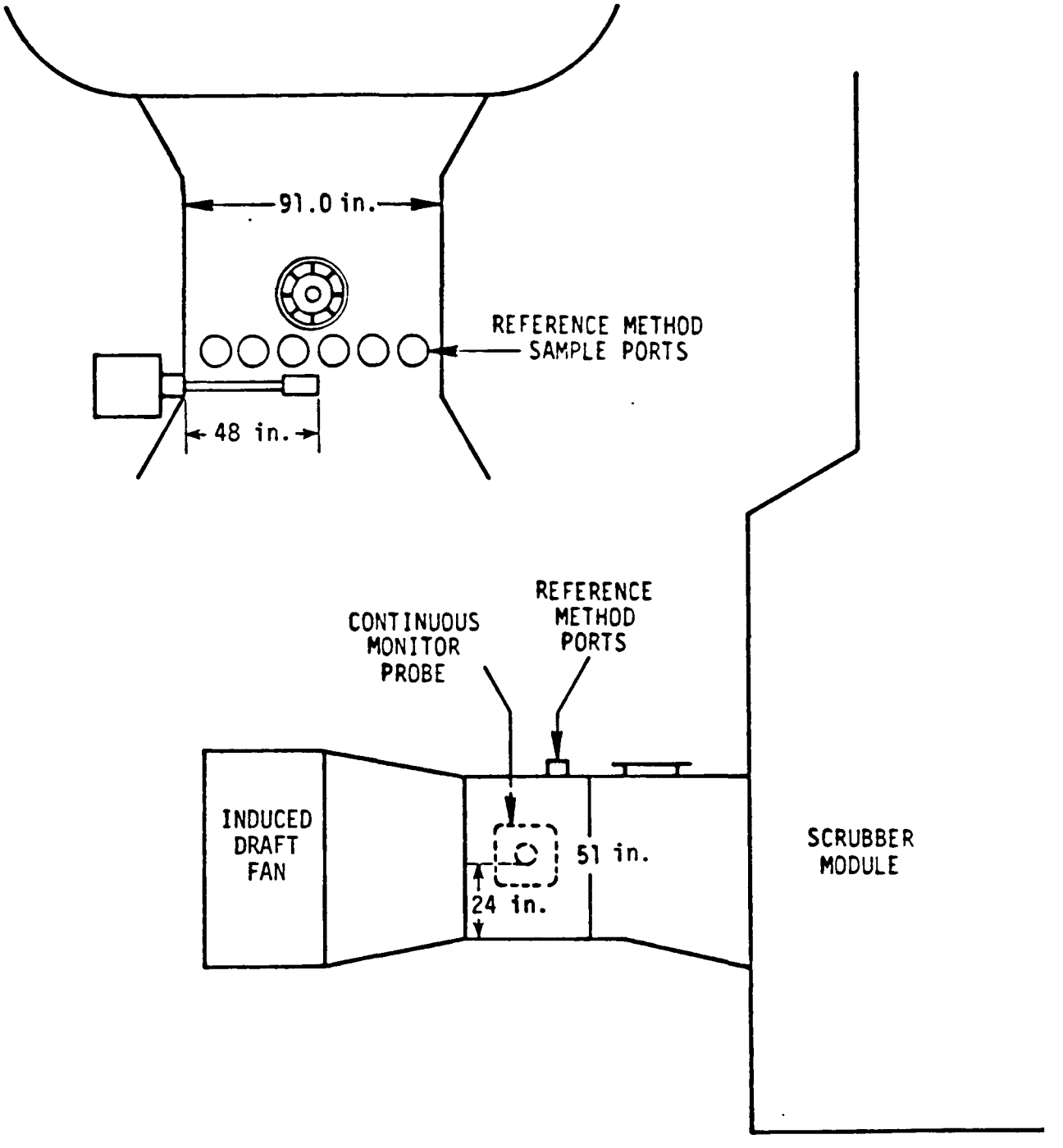

Figure 3-1. Scrubber inlet sampling locations.

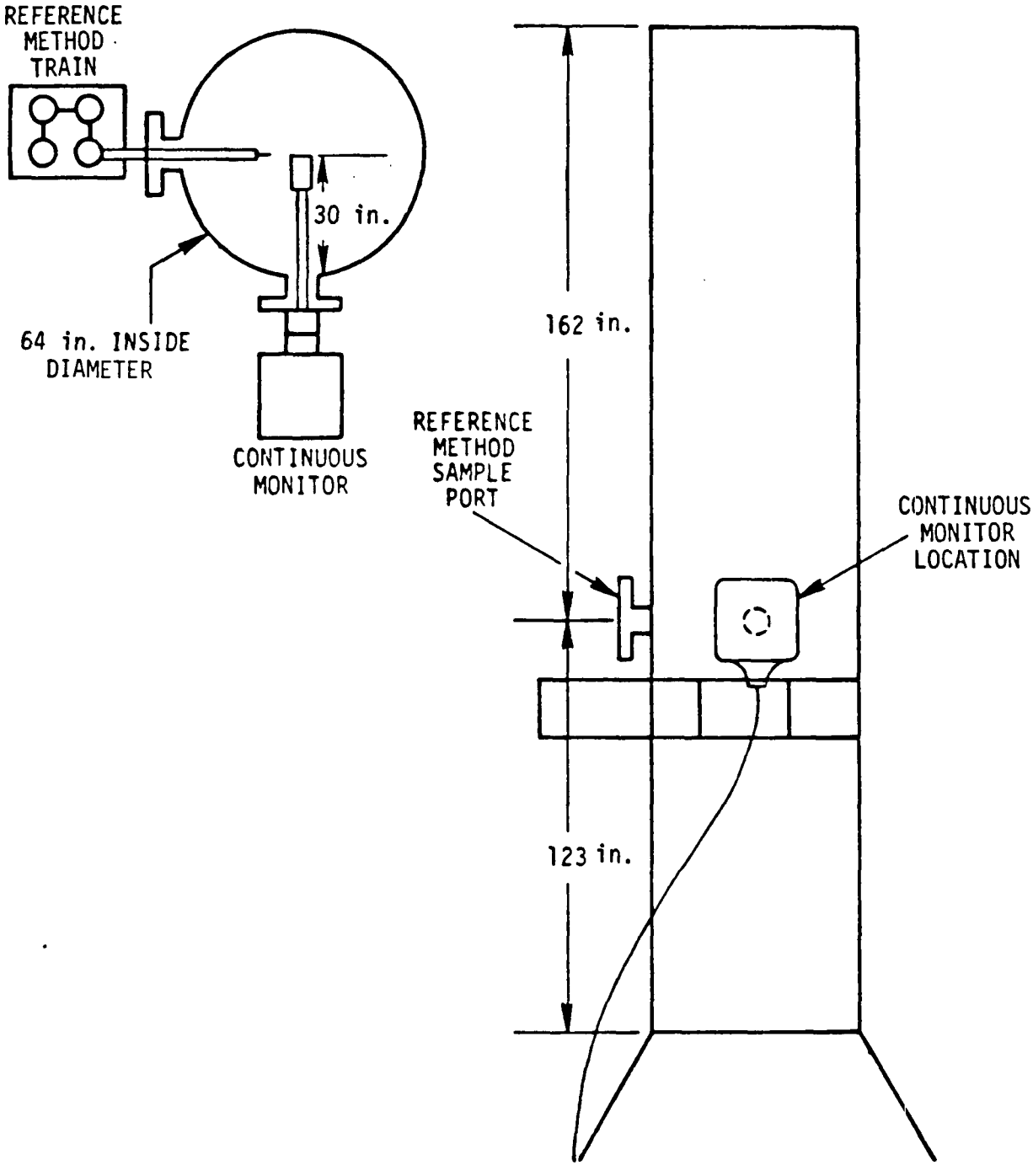

Figure 3-2. Scrubber outlet sampling locations.

Conditioning Period--

The period starting 1400, January 17, 1980, and ending 2400, January 24, 1980, was the conditioning period for the CEM. During this period the CEM was operated in the same manner as it was during the following test period, with no maintenance, repairs, replacements, or adjustments other than specified as routine and required by operation and maintenance manuals or the manufacturers' representatives.

Operational Test Period--

The CEM was operated from the end of the conditioning period, 2400, January 24, 1980, through April 2, 1980, with no maintenance, repairs, replacement, or adjustments not clearly routine or required as specified by the manufacturers. During this period all test data for initial and final P/S tests and all CEM emissions data were collected.

Calibration Gas Certification--

The SO_2 calibration gases were certified by the vendors to have values traceable to National Bureau of Standards (NBS) concentrations. The appendix in this volume includes copies of the certificates of analysis for the four SO_2 calibration gases used. The midrange oxygen calibration gas was analyzed by PEDCo and found to have a value within 5 percent of the vendors tag value; the vendors tag value was used (12.0% O_2). The test data for this analysis are included with the appendix in this volume. Because ambient air (20.95 % O_2) was used as the span gas, no certification was needed.

Calibration Error--

Calibration error tests were performed February 8. The SO_2 monitor met the error limitation of less than 5 percent on both operating ranges, and the O_2 monitor met the same limitation on its single range. Tables 3-5 and 3-6 present the test results for the low- and high-range (outlet and inlet) SO_2 monitor calibration error; the test results for O_2 monitor calibration error are presented in Table 3-7.

2-Hour Zero and Calibration Drift--

The 2-hour drift tests of the SO_2 and O_2 monitors were performed February 9 through February 22. The results of the low- and high-range (outlet and inlet) SO_2 monitor drift tests, presented in Tables 3-8 and Table 3-9 were both within the allowable limit of 2 percent of span for both zero and calibration drift. The O_2 monitor drift test results, presented in Table 3-10, were within the allowable limit of 0.4 percent O_2 for zero and calibration drift.

24-Hour Zero and Calibration Drift--

The 24-hour drift tests were performed from January 24 through January 31. Because CEM failure on the night of January 29 to 30 affected calibration of the SO_2 monitor, the SO_2 drift tests had to be repeated. The repeat drift tests for the SO_2 analyzer were performed from January 31 through February 7. Because the O_2 monitor calibration was unaffected by the CEM failure, the O_2 drift test results obtained from January 24 through January 31 were valid.

TABLE 3-5. INITIAL TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR CALIBRATION ERROR (ppm SO_2 except as indicated)

Date in 1980	Test No.	Calibration gas concentration (A)	Monitor reading (B)	Arithmetic difference (A-B)	
				Mid	Span
2/8	1	254	254.5	-0.5	
2/8	2	427	431.5		-4.5
2/8	3	254	253.5	+0.5	
2/8	4	0	0		
2/8	5	427	431.5		-4.5
2/8	6	254	255	-1.0	
2/8	7	0	0		
2/8	8	254	254	0.0	
2/8	9	427	431		-4.0
2/8	10	0	0		
2/8	11	427	432		-5.0
2/8	12	254	255.5	-1.5	
2/8	13	0	0		
2/8	14	427	431.5		-4.5
2/8	15	0	1.0		
		Arithmetic mean		-0.5	-4.5
		95% confidence interval		0.98	0.44
		Calibration error, % A		0.58	1.16

TABLE 3-6. INITIAL TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR CALIBRATION ERROR (ppm SO_2 except as indicated)

Date in 1980	Test No.	Calibration gas concentration (A)	Monitor reading (B)	Arithmetic difference (A-B)	
				Mid	Span
2/8	1	0	0		
2/8	2	2000	1995	5	
2/8	3	4250	4220		30
2/8	4	2000	2000	0	
2/8	5	4250	4215		35
2/8	6	0	5		
2/8	7	4250	4210		40
2/8	8	0	5		
2/8	9	4250	4210		40
2/8	10	2000	2000	0	
2/8	11	4250	4215		35
2/8	12	2000	2010	-10	
2/8	13	0	10		
2/8	14	2000	2000	0	
2/8	15	0	10		
			Arithmetic mean	-1.0	36
			95% confidence interval	6.80	5.2
			Calibration error, % A	0.39%	0.97%

TABLE 3-7. INITIAL TEST RESULTS FOR O_2 MONITOR CALIBRATION ERROR
(% O_2 except as indicated)

Test No.	Calibration gas concentration (A)	Monitor reading (B)	Arithmetic difference (A-B)	
			Mid	Span
1	12	12.04	-0.04	
2	20.95	20.85		0.0
3	12	12.16	-0.16	
4	0	0		
5	12	12.08	-0.08	
6	0	0		
7	20.95	20.90		0.05
8	0	0		
9	20.95	20.85		0.10
10	0	0		
11	20.95	20.93		0.02
12	12	12.18	-0.18	
13	0	0		
14	12	12.14	-0.14	
15	20.95	20.95		0.0
		Arithmetic mean	-0.12	+0.03
		95% confidence interval	0.07	0.06
		Calibration error,[a] % A	1.58	0.43

[a] $\%A = \frac{(|AM| + CI95)}{A} = 100.$

TABLE 3-8. INITIAL TEST RESULTS FOR LOW-RANGE (OUTLET) MONITOR
2-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980	Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
		Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/8	1315	1600	0.2	0.2	0.0	86.3	86.5	0.2	0.2
2	2/8	1600	1800	0.2	0.0	-0.2	86.5	85.8	-0.7	-0.5
3	2/9	1330	1530	0.0	0.0	0.0	85.7	85.8	0.1	0.1
4	2/11	0900	1100	0.0	0.0	0.0	85.5	85.6	0.1	0.1
5	2/11	1100	1300	0.0	0.0	0.0	85.6	85.4	-0.2	-0.2
6	2/11	1300	1500	0.0	0.0	0.0	85.4	85.4	0.0	0.0
7	2/11	1500	1700	0.0	0.0	0.0	85.4	85.2	-0.3	-0.3
8	2/11	1700	1900	0.0	0.2	0.2	85.2	85.6	0.4	0.2
9	2/11	1900	2100	0.2	0.0	-0.2	85.6	85.7	0.1	0.3
10	2/11	2100	2300	0.0	0.0	0.0	85.7	85.7	0.0	0.0
11	2/13	2100	2300	0.0	0.0	0.0	86.0	86.3	0.3	0.3
12	2/14	1315	1515	0.0	0.0	0.0	86.0	85.0	-1.0	-1.0
13	2/15	1200	1400	0.0	0.0	0.0	86.2	85.5	-0.7	-0.7
14	2/15	1400	1600	0.0	0.0	0.0	86.2	86.3	0.1	0.1
15	2/22	1330	1530	0.0	0.0	0.0	86.5	86.7	0.2	0.2
		Arithmetic mean				-0.01				-0.08
		95% confidence interval				0.05				0.21
		2-hour drift,[b] %				0.07				0.34

[a] Calibration gas concentration of 427 ppm SO2 and scale from 0 to 500 ppm SO_2.

[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-9. INITIAL TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR
2-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980	Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
		Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/8	1400	1600	0.2	0.0	-0.2	84.3	83.9	-0.4	-0.2
2	2/8	1600	1800	0.0	0.0	0.0	83.9	84.0	0.1	0.1
3	2/9	1330	1530	0.0	0.0	0.0	83.8	83.7	-0.1	-0.1
4	2/11	0900	1100	0.0	0.0	0.0	83.7	83.7	0.0	0.0
5	2/11	1100	1300	0.0	0.0	0.0	83.7	83.4	-0.3	-0.3
6	2/11	1300	1500	0.0	0.0	0.0	83.4	83.2	-0.2	-0.2
7	2/11	1500	1700	0.0	0.0	0.0	83.2	83.6	0.4	0.4
8	2/11	1700	1900	0.0	0.0	0.0	83.6	83.5	-0.1	-0.1
9	2/11	1900	2100	0.0	0.0	0.0	83.5	83.6	0.1	0.1
10	2/11	2100	2300	0.0	0.0	0.0	83.6	83.7	0.1	0.1
11	2/13	2100	2300	0.0	-0.1	-0.1	84.4	84.3	-0.1	0.1
12	2/14	1315	1515	0.0	0.0	0.0	83.8	83.7	-0.1	-0.1
13	2/15	1200	1400	0.0	0.0	0.0	84.7	84.0	-0.7	-0.7
14	2/15	1400	1600	0.0	0.0	0.0	84.5	84.4	-0.1	-0.1
15	2/22	1330	1530	0.0	0.0	0.0	83.3	83.2	-0.1	-0.1
		Arithmetic mean				-0.02				-0.08
		95% confidence interval				0.03				0.13
		2-hour drift,[b] %				0.06				0.25

[a] Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-10. INITIAL TEST RESULTS FOR O_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980	Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
		Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/8	1400	1600	0.0	0.0	0.0	87.0	86.9	-0.1	-0.1
2	2/8	1600	1800	0.0	0.0	0.0	86.9	86.9	0.0	0.0
3	2/9	1330	1530	0.0	0.0	0.0	86.9	87.1	+0.2	+0.2
4	2/11	0900	1100	0.0	0.0	0.0	86.7	86.9	+0.2	+0.2
5	2/11	1100	1300	0.0	0.0	0.0	86.9	86.8	-0.1	-0.1
6	2/11	1300	1500	0.0	0.0	0.0	86.8	86.7	-0.1	-0.1
7	2/11	1500	1700	0.0	0.0	0.0	86.7	86.8	+0.1	+0.1
8	2/11	1700	1900	0.0	0.1	+0.1	86.8	86.9	+0.0	0.0
9	2/11	1900	2100	0.1	0.1	0.0	86.9	86.9	0.0	0.0
10	2/11	2100	2300	0.1	0.0	-0.1	86.9	86.8	-0.1	0.0
11	2/13	2100	2300	0.0	0.0	0.0	87.0	87.0	0.0	0.0
12	2/14	1315	1515	0.0	0.0	0.0	86.8	86.5	-0.3	-0.3
13	2/15	1200	1400	0.0	0.0	0.0	86.5	86.3	-0.2	-0.2
14	2/15	1400	1600	0.0	0.0	0.0	86.3	86.4	+0.1	+0.1
15	2/22	1315	1515	0.0	0.0	0.0	87.2	87.0	-0.2	-0.2
		Arithmetic mean				0.00				-0.03
		95% confidence interval				0.02				0.08
		2-hour drift,[b] $\%O_2$				0.00				0.02

[a] Calibration gas concentration of 20.95% O_2 and scale from 0 to 25% O_2.

[b] Determined as $(|AM| + CI_{95}) \times 0.25$.

Tables 3-11 and 3-12 present results of the low- and high-range SO_2 monitor 24-hour drift tests; the data show compliance with the 2 and 2.5 percent limits for SO_2 monitor zero and calibration drift. The drift data from the failed tests are listed on the tables, but not included in calculations. Table 3-13 presents results of the O_2 monitor 24-hour zero and calibration drift tests; the data show compliance with the 0.5 percent limit for O_2 monitor zero and calibration drift.

CEM Response Time--

The instrument and system response times for DuPont 460 and Thermox WDG III gas monitors have been shown by previous testing to be well within the 15 minute specification. Verification of this was obtained by tests performed March 3, showing the average response time in all cases to be less than 1 minute. Tables 3-14 and 3-15 present results of the low- and high-range (outlet and inlet) SO_2 monitor tests. Table 3-16 shows test results of the O_2 monitor.

System Relative Accuracy--

Ten inlet system relative accuracy tests were performed on January 29 and 30. Results showed relative accuracy of 7.3 percent, complying with the specified limit of 20 percent.

Tests of outlet system relative accuracy were performed from January 31 through February 20. The extended period for the completion of these tests was needed because of CEM maintenance on February 4, FGD maintenance from February 6 through 8,

TABLE 3-11. INITIAL TEST RESULTS FOR LOW-RANGE (OUTLET) SO2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980		Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	1/24	1/25	1820	1800	0.8	-0.5	-1.3	83.2	88.0	4.8	6.1
2	1/25	1/26	1800	1530	-0.5	0.0	0.5	88.0	87.0	-1.0	-1.5
3	1/26	1/27	1530	1330	1.0	0.6	-0.4	87.0	85.0	-2.0	-1.6
4	1/27	1/28	1330	1630	0.6	0.6	0.0	85.0	87.0	2.0	2.0
5	1/28	1/29	1630	1600	2.0	0.5	-1.5	96.0	94.4	-1.6	-0.1
6	1/29	1/30	1600	0900	0.5	3.5	3.0	94.4	OFF SCALE: VOID		
7	1/30	1/31	2000	0900	0.0	0.0	0.0	82.3	83.2	0.9	0.9
1	1/31	2/1	0900	0915	0.0	0.0	0.0	81.3	81.8	0.5	0.5
2	2/1	2/2	0915	1400	0.0	0.0	0.0	81.8	81.5	-0.3	-0.3
3	2/2	2/3	1400	1430	0.0	0.0	0.0	82.2	82.8	0.5	0.5
4	2/3	2/4	1430	1530	0.0	0.0	0.0	82.8	81.6	-1.2	-1.2
5	2/4	2/5	1630	0900	0.0	0.0	0.0	83.6	84.0	0.4	0.4
6	2/5	2/6	1830	1648	0.0	0.0	0.0	81.0	81.5	0.5	0.5
7	2/6	2/7	1648	2130	0.0	0.0	0.0	86.4	87.6	1.2	1.2
Arithmetic mean							0.0				0.23
95% confidence interval							0.0				0.71
24-hour drift,[b] %							0.0				1.11

[a] Calibration gas concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.

[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-12. INITIAL TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980		Test time		Zero reading		Zero drift	Span reading		Span drift	Calibration drift
	Start	End	Start	End	Start (A)	End (B)	(C=B-A)	Start (D)	End (E)	(F=E-D)	(G=F-C)
1	1/24	1/25	1820	1800	1.1	0.0	-1.1	84.3	89.0	4.7	5.8
2	1/25	1/26	1800	1530	0.0	1.2	1.2	89.0	86.4	-2.6	-3.8
3	1/26	1/27	1530	1330	1.2	1.3	0.1	86.4	85.4	-1.0	-1.1
4	1/27	1/28	1330	1630	1.4	0.8	-0.5	85.4	87.4	2.0	2.5
5	1/28	1/29	1630	1600	0.8	0.3	-0.5	94.8	95.3	0.5	1.0
6	1/29	1/30	1600	0900	0.3	0.2	-0.1	95.3	OFF SCALE: VOID		
7	1/30	1/31	2000	0900	0.0	0.0	0.0	84.9	85.0	+0.1	0.1
1	1/31	2/1	0900	0915	0.0	0.0	0.0	83.8	83.6	-0.2	-0.2
2	2/1	2/2	0915	1400	0.0	0.0	0.0	83.6	83.6	0.0	0.0
3	2/2	2/3	1400	1430	0.0	0.0	0.0	84.6	84.2	-0.4	-0.4
4	2/3	2/4	1430	1530	0.0	0.0	0.0	84.2	84.5	0.3	0.3
5	2/4	2/5	1530	0900	0.0	0.0	0.0	85.0	84.6	-0.4	-0.4
6	2/5	2/6	0900	1648	0.0	0.0	0.0	84.0	83.6	-0.4	-0.4
7	2/6	2/7	1648	2130	0.0	0.0	0.0	83.8	85.0	1.2	1.2
Arithmetic mean							0.0				0.01
95% confidence interval							0.0				0.54
24-hour drift,[b] %							0.0				0.65

[a] Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-13. INITIAL TEST RESULTS FOR O_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980		Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	1/24	1/25	1820	1800	0.0	0.0	0.0	88.0	88.0	0.0	0.0
2	1/25	1/26	1800	1530	0.0	0.0	0.0	88.0	88.0	0.0	0.0
3	1/26	1/27	1530	1330	0.0	0.0	0.0	88.0	88.0	0.0	0.0
4	1/27	1/28	1330	1630	0.0	0.0	0.0	88.0	88.3	0.0	0.0
5	1/28	1/29	1630	1600	0.0	0.0	0.0	88.3	88.6	0.0	0.0
6	1/29	1/30	1600	0930	0.0	0.0	0.0	88.6	86.0	-2.6	-2.6
7	1/30	1/31	2000	0900	0.0	0.0	0.0	87.0	86.7	-0.3	-0.3
Arithmetic mean							0.0				-0.41
95% confidence interval							0.0				0.90
24-hour drift,[b] % O_2							0.0				0.33

[a] Calibration gas concentration of 20.95% O_2 and scale from 0 to 25% O_2.

[b] Determined as % O_2 = (|AM| + CI_{95}) x 0.25.

TABLE 3-14. TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR RESPONSE TIME[a] (seconds)

Test No.	Upscale	Downscale
1	46.0	50.5
2	45.8	51.0
3	46.0	51.2
Average	A = 45.9	B = 50.9

System response time (slower of A and B) = 50.9

C = (A - B) = 5.0 (must be less than 15% of average or 5 seconds, whichever is less)

[a] Tests run at 1200 on March 3, 1980, with span gas concentration of 427 ppm SO_2.

TABLE 3-15. TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR RESPONSE TIME[a] (seconds)

Test No.	Upscale	Downscale
1	20.8	21.2
2	20.5	21.0
3	20.6	21.3
Average	A = 20.6	B = 21.2

System response time (slower of A and B) = 21.2

C = (A - B) = 0.6 (must be less than 15% of average or 5 seconds, whichever is less)

[a] Tests run at 1206 on March 3, 1980, with span gas concentration of 4250 ppm SO_2.

TABLE 3-16. TEST RESULTS FOR O_2 MONITOR RESPONSE TIME[a] (seconds)

Test No.	Upscale	Downscale
1	21.0	21.0
2	21.2	20.9
3	21.2	21.5
Average	A = 21.1	B = 21.1

System response time (slower of A and B) = 21.1

C = (A - B) = 0.0 (must be less than 15% of average or 5 seconds, whichever is less)

[a] Tests run on March 3, 1980, with span gas concentration of 20.95% O_2.

and the need to repeat several tests that were void because of operational problems. Four tests performed January 31 were void because the air supply to the CEM probe blowback was not operating during the test, two tests performed February 5 were void because the CEM was operating in an unrepresentative configuration (a sample gas conditioner was being tested), and three tests performed February 12 were void because of a high apparent error of undetermined cause.

The operational problems during initial tests prompted a complete repeat of outlet system relative accuracy tests on February 19 and 20. These showed a relative accuracy of 6.64 percent, within the 20 percent limit. Results of the first two tests performed February 19 were discarded from calculation because of a faulty manual methods test probe, which was replaced before further testing.

Tables 3-17 and 3-18 present results of the inlet and outlet system relative accuracy tests.

3.1.6 Final P/S Test Results

Calibration Error--

Final calibration error tests were performed on April 1 and yielded consistent with those of the initial tests performed on February 8. Tables 3-19 and 3-20 present the results of the low- and high-range (outlet and inlet) SO_2 monitor calibration error tests; the O_2 monitor calibration error results are presented in Table 3-21.

TABLE 3-17. INITIAL TEST RESULTS FOR SCRUBBER INLET CERTIFICATION

Date in 1980	Test No.	Test time		O_2, vol. %		SO_2, ppm				SO_2, lb/10^6 Btu			
		Start	End	RM[a]	M[b]	RM[a]	M[b]	Diff. (x_i)	x_i^2	RM[a]	M[b]	Diff. (x_i)	x_i^2
1/29	SO-I-1	1145	1208	13.0	13.6	1101	1156	+55	3,025	5.19	5.31	+0.12	0.0144
1/29	SO-I-2	1328	1351	13.1	13.0	1110	1212	+102	10,404	5.26	5.18	-0.08	0.0064
1/29	SO-I-3	1447	1510	13.0	13.0	1119	1179	+60	3,600	5.23	5.03	-0.20	0.04
1/30	SO-I-4	1005	1028	13.0	13.0	1134	1171	+37	1,369	4.94	5.00	+0.06	0.0036
1/30	SO-I-5	1113	1136	12.8	12.8	1216	1199	-17	289	5.07	4.99	-0.08	0.0064
1/30	SO-I-6	1214	1237	13.2	12.8	1060	1175	+115	13,225	4.53	4.90	+0.37	0.1369
1/30	SO-I-7	1321	1344	13.0	12.7	1172	1208	+36	1,296	4.97	4.99	+0.02	0.0004
1/30	SO-I-8	1426	1449	12.9	12.9	1237	1237	0	0	5.21	5.19	-0.02	0.0004
1/30	SO-I-9	1528	1551	12.9	13.4	1088	1177	+89	7,921	4.62	5.30	+0.68	0.4624
1/30	SO-I-10	1647	1710	13.0	13.2	1125	1205	+80	6,400	4.68	5.27	+0.59	0.3481
Average				13.0	13.0	1136	1192	+55.7	4,753	4.97	5.12	+0.15	0.1019

95% confidence interval = 0.214 lb $SO_2/10^6$ Btu

System relative accuracy = 7.32% of average RM

[a] Reference method value.

[b] Monitor value

TABLE 3-18. INITIAL TEST RESULTS FOR SCRUBBER OUTLET CERTIFICATION

Date in 1980	Test No.	Test time		O_2, vol. %		SO_2, ppm				SO_2, lb/10^6 Btu			
		Start	End	RM[a]	M[b]	RM	M	Diff. (x_i)	x_i^2	RM[a]	M[b]	Diff. (x_i)	x_i^2
2/19	SO-0-1[c]	1357	1420		15.4	19	91	72	5,184	0.123	0.555	0.432	0.1866
2/19	SO-0-2[c]	1737	1400	13.1	13.3	9	132	123	15,129	0.036	0.476	0.027	0.3014
2/19	SO-0-3	1927	1950	13.7	13.5	100	105	5	25	0.449	0.476	0.027	0.0007
2/20	SO-0-4	0847	0910	12.9	12.9	119	118	-1	1	0.500	0.498	-0.002	0.000004
2/20	SO-0-5	0947	1010	12.8	12.8	95	101	6	36	0.396	0.420	0.024	0.0006
2/20	SO-0-6	1047	1110	13.4	12.9	81	82	1	1	0.365	0.343	-0.022	0.0005
2/20	SO-0-7	1147	1210	13.1	13.1	77	82	5	25	0.333	0.350	0.017	0.0003
2/20	SO-0-8	1247	1310	13.6	13.8	75	77	2	4	0.344	0.363	0.019	0.0004
2/20	SO-0-9	1347	1410	13.9	13.6	133	132	-1	1	0.638	0.611	-0.027	0.0007
2/20	SO-0-10	1457	1520	13.4	13.6	131	134	3	9	0.587	0.614	0.027	0.0007
2/20	SO-0-11	1557	1620	13.2	13.3	141	149	8	64	0.618	0.657	0.039	0.0015
2/20	SO-0-12	1657	1720	14.3	14.5	48	49	1	1	0.245	0.255	0.010	0.0001
Average				13.4	13.4	100	103	2.9	16.7	0.4475	0.459	0.0112	0.00073

95% confidence interval = .016 lb $SO_2/10^6$ Btu
System relative accuracy = 6.64% of average RM

[a] Reference method value.

[b] Monitor value.

[c] Tests not used in averages and calculations.

TABLE 3-19. FINAL TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR CALIBRATION ERROR
(ppm SO_2 except as indicated)

Date in 1980	Test No.	Calibration gas concentration (A)	Monitor reading (B)	Arithmetic difference (A-B)	
				Mid	Span
4/1	1	427	428		+1
4/1	2	254	254	0	
4/1	3	0	0		
4/1	4	254	253	-1	
4/1	5	427	429		+2
4/1	6	0	0		
4/1	7	427	428		+1
4/1	8	0	0		
4/1	9	254	253	-1	
4/1	10	427	429		+2
4/1	11	0	0		
4/1	12	254	253	-1	
4/1	13	0	0		
4/1	14	427	429		+2
4/1	15	254	255	+1	
			Arithmetic mean	-0.40	+1.60
			95% confidence interval	1.11	0.68
			Calibration error,[a] %	0.59	0.53

[a]Determined as calibration error = $\frac{|AM| + CI_{95}}{A} \times 100$.

TABLE 3-20. FINAL TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR CALIBRATION ERROR
(ppm SO_2 except as indicated)

Date in 1980	Test No.	Calibration gas concentration (A)	Monitor reading (B)	Arithmetic difference (A-B)	
				Mid	Span
4/1	1	0	-5		
4/1	2	2000	1990	-10	
4/1	3	4250	4204		-46
4/1	4	0	0		
4/1	5	4250	4199		-51
4/1	6	0	0		
4/1	7	2000	1990	-10	
4/1	8	4250	4199		-51
4/1	9	0	0		
4/1	10	2000	1990	-10	
4/1	11	4250	4199		-51
4/1	12	2000	1990	-10	
4/1	13	0	0		
4/1	14	4250	4179		-71
4/1	15	2000	1990	-10	
			Arithmetic mean	-10	-54
			95% confidence interval	0	12
			Calibration error,[a] % A	0.5	1.8

[a] Calibration error = $\frac{|AM| + CI_{95}}{A} \times 100$.

TABLE 3-21. FINAL TEST RESULTS FOR O_2 MONITOR CALIBRATION ERROR
(% O2 except as indicated)

Date in 1980	Test No.	Calibration gas concentration (A)	Monitor reading (B)	Arithmetic difference (A-B)	
				Mid	Span
4/1	1	20.9	20.9		0.0
4/1	2	0.0	0.0		
4/1	3	12.0	12.1	0.1	
4/1	4	0.0	0.0		
4/1	5	20.9	20.9		0.0
4/1	6	0.0	0.0		
4/1	7	20.9	20.9		0.0
4/1	8	12.0	12.1	0.1	
4/1	9	0.0	0.0		
4/1	10	12.0	12.1	0.1	
4/1	11	20.9	20.9		0.0
4/1	12	0.0	0.0		
4/1	13	12.0	12.1	0.1	
4/1	14	20.9	20.9		0.0
4/1	15	12.0	12.1	0.1	
			Arithmetic mean	0.1	0.0
			95% confidence interval	0.0	0.0
			Calibration error,	0.1	0.0

[a] $\% A = \frac{(|AM| + CI95)}{A} \times 100.$

2-Hour Zero and Calibration Drift--

Final 2-hour drift tests were performed from March 19 through 20 and yielded results consistent with those of the tests performed February 8 through 22. Tables 3-22 and 3-23 present the results for the low- and high-range (outlet and inlet) SO_2 monitor 2-hour drift tests; the results of the O_2 monitor 2-hour drift tests are presented in Table 3-24.

24-Hour Zero and Calibration Drift--

Final 24-hour drift tests were performed from March 11 through 18 and demonstrated compliance with the allowable limits. Tables 3-25 and 3-26 present the results of the low- and high-range (outlet and inlet) SO_2 monitor 24-hour drift tests; the O_2 monitor 24-hour drift results are presented in Table 3-27.

System Relative Accuracy--

Final system relative accuracy tests were performed from March 31 through April 2. The inlet and outlet tests results, presented in Tables 3-28 and 3-29, show system relative accuracies of 23.2 and 23.1 percent. It is suspected that the error during these tests resulted from RM O_2 data of questionable quality; the ORSAT reagent used was found to be contaminated and was discarded following these tests.

TABLE 3-22. FINAL TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR 2-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980	Test time		Zero reading		Zero drift	Span reading		Span drift	Calibration drift
		Start	End	Start (A)	End (B)	(C=B-A)	Start (D)	End (E)	(F=E-D)	(G=F-C)
1	3/18	0915	1115	0.0	0.0	0.0	88.4	88.7	0.3	0.3
2	3/18	1115	1315	0.0	0.0	0.0	88.7	88.6	-0.1	-0.1
3	3/18	1315	1515	0.0	0.0	0.0	88.6	88.6	0.0	0.0
4	3/18	1515	1715	0.0	0.4	0.4	88.6	88.9	0.3	-0.1
5	3/18	1715	1915	0.4	0.2	-0.2	88.9	88.9	0.0	0.2
6	3/18	1915	2115	0.2	0.1	-0.1	88.9	88.8	-0.1	0.0
7	3/19	0900	1100	0.1	0.1	0.0	88.8	88.9	0.1	0.1
8	3/19	1100	1300	0.1	-0.2	-0.3	88.9	88.4	-0.5	-0.2
9	3/19	1300	1500	-0.2	-0.4	-0.2	88.4	88.0	-0.4	-0.2
10	3/19	1500	1700	-0.4	0.0	0.4	88.0	88.7	0.7	0.3
11	3/19	1700	1900	0.0	0.0	0.0	88.7	88.6	-0.1	-0.1
12	3/20	1045	1235	0.0	0.0	0.0	87.2	87.0	-0.2	-0.2
13	3/20	1235	1455	0.0	0.0	0.0	87.0	87.2	0.2	0.2
14	3/20	1455	1645	0.0	0.0	0.0	87.2	86.6	-0.6	-0.6
15	3/20	1645	1845	0.0	0.0	0.0	86.6	86.9	0.3	0.3
		Arithmetic mean				0.00				-0.02
		95% confidence interval				0.12				0.14
		2-hour drift,[b] %				0.12				0.19

[a] Calibration gas concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.
[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-23. FINAL TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR 2-HOUR ZERO AND CALIBRATION DRIFT[a] (% of scale except as indicated)

Test No.	Date in 1980	Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (F=F-C)
		Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/18	0915	0915	0.0	0.0	0.0	85.8	86.0	0.2	0.2
2	3/18	1115	1315	0.0	0.0	0.0	86.0	86.0	0.0	0.0
3	3/18	1315	1515	0.0	0.0	0.0	86.0	86.0	0.0	0.0
4	3/18	1515	1715	0.0	0.0	0.0	86.0	85.9	-0.1	-0.1
5	3/18	1715	1915	0.0	0.0	0.0	85.9	86.2	0.3	0.3
6	3/18	1915	2115	0.0	0.0	0.0	86.2	86.0	-0.2	-0.2
7	3/19	0900	1100	0.0	0.0	0.0	86.2	86.3	0.1	0.1
8	3/19	1100	1300	0.0	0.0	0.0	86.3	85.8	-0.5	-0.5
9	3/19	1300	1500	0.0	0.0	0.0	85.8	85.6	0.2	0.2
10	3/19	1500	1700	0.0	0.0	0.0	85.6	85.4	-0.2	-0.2
11	3/19	1700	1900	0.0	0.0	0.0	85.4	85.4	0.0	0.0
12	3/20	1045	1235	0.0	0.0	0.0	84.3	84.7	0.4	0.4
13	3/20	1235	1455	0.0	0.0	0.0	84.7	84.5	-0.3	-0.3
14	3/20	1455	1645	0.0	0.0	0.0	84.5	84.2	-0.3	-0.3
15	3/20	1645	1845	0.0	0.0	0.0	84.2	84.4	0.2	0.2
		Arithmetic mean				0.0				-0.03
		95% confidence interval				0.0				0.14
		2-hour drift,[b] %				0.0				0.20

[a] Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-24. FINAL TEST RESULTS FOR O_2 MONITOR 2-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980	Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
		Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/18	0915	1115	0.0	-0.1	-0.1	86.2	86.4	0.2	0.3
2	3/18	1115	1315	-0.1	-0.1	0.0	86.4	86.4	0.0	0.0
3	3/18	1315	1515	-0.1	-0.1	0.0	86.4	86.4	0.0	0.0
4	3/18	1515	1715	-0.1	-0.1	0.0	86.4	86.4	0.0	0.0
5	3/18	1715	1915	-0.1	0.0	0.1	86.4	86.4	0.0	-0.1
6	3/18	1915	2115	0.0	-0.1	-0.1	86.4	86.4	0.0	0.1
7	3/19	0900	1100	0.0	0.0	0.0	86.6	86.3	-0.3	-0.3
8	3/19	1100	1300	0.0	0.2	0.2	86.3	86.5	0.2	0.0
9	3/19	1300	1500	0.2	0.2	0.0	86.5	86.3	-0.2	-0.2
10	3/19	1500	1700	0.2	0.1	-0.1	86.3	86.0	-0.3	-0.2
11	3/19	1700	1900	0.1	0.2	-0.1	86.0	86.0	0.0	-0.1
12	3/20	1045	1235	0.0	-0.3	-0.3	84.5	84.1	-0.4	-0.1
13	3/20	1235	1455	-0.3	-0.4	-0.1	84.1	85.5	1.6	1.7
14	3/20	1455	1645	-0.4	-0.5	-0.1	85.5	86.0	0.5	0.6
15	3/20	1645	1845	-0.5	-0.5	0.0	86.0	85.8	-0.2	-0.2
		Arithmetic mean				-0.04				0.08
		95% confidence interval				0.08				0.28
		2-hour drift,[b] %				0.03				0.09

[a] Calibration gas concentration of 20.95% O_2 and scale from 0 to 25% O_2.

[b] % $O_2 = (|AM| + CI_{95}) \times 0.25$.

TABLE 3-25. FINAL TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980		Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/11	3/12	2045	2045	0.0	0.4	0.4	87.0	86.5	-0.5	-0.9
2	3/12	3/13	2045	2145	0.4	0.2	-0.2	86.5	85.6	-0.9	-0.7
3	3/13	3/14	2145	1700	0.2	0.0	-0.2	85.6	87.6	2.0	2.2
4	3/14	3/15	1700	1345	-0.2	0.0	0.2	86.1	86.8	0.7	0.5
5	3/15	3/16	1345	1500	0.0	0.0	0.0	86.1	85.8	-0.3	-0.3
6	3/16	3/17	1500	1400	0.0	0.0	0.0	85.8	83.8	-2.0	-2.0
7	3/17	3/18	1400	0900	0.0	0.0	0.0	85.7	88.4	2.7	2.7
Arithmetic mean							0.0				0.2
95% confidence interval							0.2				1.1
24-hour drift,[b] %							0.2				1.5

[a] Calibration gas concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.

[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-26. FINAL TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT[a] (% of scale except as indicated)

Test No.	Date in 1980		Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G-F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/11	3/12	2045	2045	0	0	0	85.3	84.3	-1.0	-1.0
2	3/12	3/13	2045	2145	0	0	0	84.3	83.0	-1.3	-1.3
3	3/13	3/14	2145	1700	0	0	0	83.0	84.9	1.9	1.9
4	3/14	3/15	1700	1345	0	0	0	83.9	84.0	0.1	0.1
5	3/15	3/16	1345	1500	0	0	0	83.7	82.8	-0.9	-0.9
6	3/16	3/17	1500	1400	0	0	0	82.8	81.6	-1.2	-1.2
7	3/17	3/18	1400	0900	0	0	0	83.9	85.8	1.9	1.9
	Arithmetic mean						0				-0.07
	95% confidence interval						0				1.32
	24-hour drift,[b] %						0.0				1.63

[a] Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b] See Subsection 6.2.3 for explanation of units.

TABLE 3-27. FINAL TEST RESULTS FOR O_2 2-HOUR ZERO AND CALIBRATION DRIFT[a]
(% of scale except as indicated)

Test No.	Date in 1980		Test time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/11	3/12	2045	2045	0.0	0.0	0.0	86.5	83.0	-3.5	-3.5
2	3/12	3/13	2045	2145	0.0	0.0	0.0	83.0	86.4	3.4	3.4
3	3/13	3/14	2145	1700	0.0	0.0	0.0	86.4	85.7	-0.7	-0.7
4	3/14	3/15	1700	1345	0.0	0.0	0.0	85.7	86.0	0.3	0.3
5	3/15	3/16	1345	1500	0.0	0.0	0.0	86.0	86.0	0.0	0.0
6	3/16	3/17	1500	1400	0.0	0.0	0.0	86.0	85.6	-0.4	-0.4
7	3/17	3/18	1400	0900	0.0	0.3	0.3	85.6	86.3	0.7	0.4
	Arithmetic mean						0.04				-0.08
	Confidence interval						0.08				1.84
	24-hour drift,[b] % O_2						0.03				0.48

[a] Calibration gas concentration of 20.95% O_2 and scale from 0 to 25% O_2.

[b] Percent $O_2 = (|AM| + CI_{95}) \times 0.25$.

TABLE 3-28. FINAL TEST RESULTS FOR SCRUBBER INLET CERTIFICATION

Date in 1980	Test No.	Test time		O_2, vol. %		SO_2, ppm				SO_2, lb/10^6 Btu			
		Start	End	RM[a]	M[b]	RM[a]	M[b]	Diff. (x_i)	x_i^2	RM[a]	M[b]	Diff. (x_i)	x_i^2
3/31	RI-1[c]	1627	1650	11.2	14.8	1008	978	-30	900	3.50	5.40	+1.90	3.160
3/31	RI-2[c]	1757	1820	11.5	15.4	792	883	+91	8,281	2.84	5.43	+2.59	6.710
4/1	RI-3	1237	1300	13.9	14.1	872	870	-2	4	4.19	4.32	+0.13	0.017
4/1	RI-4	1347	1410	13.4	16.0	781	631	-150	22,500	3.51	4.32	+0.81	0.656
4/1	RI-5	1457	1520	14.0	15.3	707	699	-8	64	3.45	4.20	+0.75	0.563
4/2	RI-6	0807	0830	13.7	14.7	875	869	-6	36	4.09	4.73	+0.64	0.410
4/2	RI-7	0937	1000	13.0	13.7	1062	1058	-4	16	4.52	4.91	+0.39	0.152
4/2	RI-8	1047	1110	14.1	13.4	1147	1101	-46	2,116	5.68	4.91	-0.77	0.593
4/2	RI-9	1207	1230	13.4	14.4	1023	991	-32	1,024	4.59	5.11	+0.52	0.270
4/2	RI-10	1457	1520	13.1	15.7	789	764	-25	625	3.40	4.90	+1.50	2.250
4/2	RI-11[c]	1607	1630	12.8	15.7	796	792	-4	16	3.31	5.09	+1.78	3.170
4/2	RI-12	1727	1750	13.2	15.3	853	818	-35	1,225	3.73	4.90	+1.17	1.370
Average				13.5	14.7	901	867	-3.42	3,067.8	4.13	4.70	+0.74	0.700

95% confidence interval = 0.215 lb $SO_2/10^6$ Btu

System relative accuracy = 23.2% of RM

[a] Reference method value.

[b] Monitor value.

[c] Tests not used in averages and calculations.

TABLE 3-29. FINAL TEST RESULTS FOR SCRUBBER OUTLET CERTIFICATION

Date in 1980	Test No.	Test time		O_2, vol. %		SO_2, ppm				SO_2, lb/10^6 Btu			
		Start	End	RM[a]	M[b]	RM[a]	M[b]	Diff. (x_i)	x_i^2	RM[a]	M[b]	Diff. (x_i)	x_i^2
3/31	RO-1	1712	1735	13.5	16.4	86	64	-22	484	0.390	0.475	0.085	0.0072
4/2	RO-2	0732	0755	14.7	14.1	386	249	-137	18,769	1.800	1.240	-0.560	0.3136
4/2	RO-3	0902	0925	12.1	13.4	636	472	-164	26,896	2.430	2.110	-0.320	0.1024
4/2	RO-4	1013	1036	12.8	13.5	466	377	-89	7,921	1.940	1.720	-0.220	0.0484
4/2	RO-5	1122	1145	13.7	14.4	141	118	-23	529	0.660	0.617	-0.040	0.0016
4/2	RO-6	1242	1305	11.4	14.5	135	85	-50	2,500	0.480	0.442	-0.040	0.0016
4/2	RO-7	1422	1445	13.6	14.8	99	57	-42	1,764	0.450	0.319	-0.130	0.0172
4/2	RO-8	1532	1555	13.9	15.2	55	27	-28	784	0.270	0.159	-0.110	0.0121
4/2	RO-9	1642	1705	12.9	15.4	176	147	-29	841	0.740	0.896	0.160	0.0256
4/3	RO-10	0912	0935	13.5	14.1	71	64	-7	49	0.320	0.316	-0.004	0.00002
4/3	RO-11	1012	1035	14.2	13.1	136	116	-20	400	0.680	0.499	-0.180	0.0328
4/3	RO-12	1112	1135	14.9	13.6	62	106	44	1,936	0.330	0.487	0.160	0.0256
Average				13.4	14.4	204	157	-54.6	5,239	0.874	0.736	-0.080	0.0490

95% confidence interval = 0.137 lb $SO_2/10^6$ Btu

System relative accuracy = 23.1% of RM

[a] Reference method value.

[b] Monitor value.

No retests were scheduled because FGD operation was likely to differ from that of the test period for two reasons:

1. The boiler loads were expected to be reduced with the onset of warmer weather.

2. The lime used in the FGD system and purchased for the test was nearly depleted, and the system was scheduled to returned to limestone operation in early April.

3.2 CONTINUOUS SULFUR DIOXIDE DATA

3.2.1 Data Listings

15-Minute Readings--

Computer printouts list complete 15-minute readings showing the wet basis FGD inlet and outlet SO_2 and O_2 concentrations, the moisture content of each gas stream tested, and the corrected (dry basis) inlet and outlet SO_2 and O_2 values. Inlet and outlet emission rates (lb $SO_2/10^6$ Btu) and FGD system efficiencies are calculated and listed on an hourly basis. These listings are presented in Appendix A.

1-Hour Averages--

The 1-hour averages of inlet and outlet emission rates and FGD efficiency were averaged for two periods: January 25 to March 1 and March 2 to 19. The total averages for the two periods were calculated from available hourly values for days when data were collected for 18 or more hours and are presented in Tables 3-30 and 3-31. Daily hourly listings are presented with the appendix included in this volume.

TABLE 3-30. SUMMARY OF RESULTS USING 1-HOUR AVERAGES, JANUARY 25 TO MARCH 1, 1980

30 OPERATING DAYS
SUMMARY OF RESULTS
USING 1-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80

	LOAD	E IN	E OUT	EFF
# AVERAGES	719.	622.	496.	426.
% OF DATA	100.	86.	69.	59.
MINIMUM	23.	3.628	.097	77.940
MAXIMUM	134.	6.935	1.166	98.207
MEAN	110.	5.380	.436	91.988
STD.DEV.	18.	.308	.181	3.412
% STD.DEV.	9.	5.725	41.433	3.710

30-DAY REMOVAL EFICIENCY USING

(MEAN) $^{1}_{30}$ E , E : 91.902%
IN OUT

NOTE: (MEAN) $^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

TABLE 3-31. SUMMARY OF RESULTS USING 1-HOUR AVERAGES, MARCH 2 TO MARCH 19, 1980

17 OPERATING DAYS
SUMMARY OF RESULTS
USING 1-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80

	LOAD	E IN	E OUT	EFF
# AVERAGES	408.	381.	261.	237.
% OF DATA	100.	93.	64.	58.
MINIMUM	72.	3.598	.039	53.005
MAXIMUM	145.	6.229	2.358	99.168
MEAN	108.	4.965	.467	90.581
STD.DEV.	17.	.818	.361	6.877
% STD.DEV.	15.	8.410	72.894	7.596

30-DAY REMOVAL EFICIENCY USING
(MEAN) $^{1}_{30}$ E IN , E OUT : 90.587%

NOTE: (MEAN) $^{Y}_{X}$ IS DEFINED AS:
THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

24 Hour Averages--

The 24-hour (daily) averages of inlet and outlet emission rates and FGD system efficiency were also calculated for the two periods and are presented in Tables 3-32 and 3-33. As with the 1-hour averages, data were included only for days that met the minimum data capture requirement of 18 hours.

Frequency Distributions--

Histograms were plotted and demonstrate the variability of 1-hour and 24-hour data. These are presented in the appendix included in this volume.

3.2.2 Omitted Data

There were three basic reasons that data periods did not appear in the above listings or calculations.

Absence of Data Caused by Process Shutdown or CEM Failure--

During these occurrences no data were available for listing. During occurrences where only one parameter (inlet or outlet readings) was omitted, the other, if available, was listed. These instances were caused by periods of CEM sampling interface failing in the case of the affected parameter, but continuing to operate in the case of the unaffected parameter. FGD efficiency data could not be calculated in such cases.

Unrepresentative Process Operation--

During periods when the FGD system was being operated in a manner that did not reflect normal operational process control,

TABLE 3-32. SUMMARY OF RESULTS USING 24-HOUR AVERAGES, JANUARY 25 TO MARCH 1, 1980

30 OPERATING DAYS
SUMMARY OF RESULTS
USING 24-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80

DATE	LOAD	E IN	E OUT	EFF
1-25-80	107.	4.710	.491	89.7
1-26-80	107.	5.050	.534	89.4
1-27-80	110.	5.340	.373	93.0
1-28-80	108.	5.293	.416	92.3
1-31-80	113.	5.211	.546	89.5
2- 1-80	113.	5.456	.452	91.7
2- 2-80	113.	5.710	######	#####
2- 3-80	114.	5.255	######	#####
2- 4-80	116.	5.422	.605	88.8
2- 5-80	110.	5.375	.432	92.0
2- 7-80	113.	5.511	######	#####
2- 8-80	109.	5.240	######	#####
2- 9-80	112.	5.671	.341	93.8
2-10-80	111.	5.543	######	#####
2-11-80	113.	5.389	.439	91.8
2-12-80	112.	5.159	.288	94.4
2-13-80	111.	5.126	######	#####
2-14-80	109.	5.435	.219	96.0
2-15-80	103.	5.678	######	#####
2-16-80	106.	5.658	######	#####
2-17-80	113.	5.653	.449	92.0
2-18-80	112.	5.620	.295	94.7
2-19-80	93.	5.565	.295	94.6
2-20-80	97.	######	.427	#####
2-21-80	89.	######	.422	#####
2-26-80	108.	######	.628	#####
2-27-80	120.	5.252	.477	90.9
2-28-80	115.	5.282	.466	91.2
2-29-80	113.	5.385	.509	90.6
3- 1-80	121.	5.338	.502	90.6
# AVERAGES	30.	27.	22.	19.
% OF DATA	97.	87.	71.	61.
MINIMUM	89.	4.710	.219	88.803
MAXIMUM	121.	5.710	.628	95.975
MEAN	110.	5.375	.437	91.948
STD.DEV.	7.	.222	.104	2.038
% STD.DEV.	6.	4.125	23.736	2.216

30-DAY REMOVAL EFICIENCY USING
24
(MEAN) E , E = 91.876%
30 IN OUT

NOTE: (MEAN) Y IS DEFINED AS:
X
THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

TABLE 3-33. SUMMARY OF RESULTS USING 24-HOUR AVERAGES, MARCH 2 TO MARCH 19, 1980

17 OPERATING DAYS
SUMMARY OF RESULTS
USING 24-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80

DATE	LOAD	E IN	E OUT	EFF
3- 2-80	130.	5.878	######	#####
3- 3-80	125.	5.259	.462	91.3
3- 4-80	110.	4.986	.308	93.8
3- 5-80	102.	5.281	.430	91.9
3- 6-80	116.	5.502	.495	90.9
3- 7-80	104.	4.916	.350	93.4
3- 8-80	105.	4.592	######	#####
3- 9-80	114.	4.680	######	#####
3-10-80	107.	4.581	######	#####
3-11-80	104.	5.026	######	#####
3-13-80	120.	4.924	######	#####
3-14-80	119.	######	.309	#####
3-15-80	107.	5.187	.687	86.6
3-16-80	99.	5.227	.649	87.6
3-17-80	96.	4.935	.661	86.8
3-18-80	82.	4.628	.348	92.4
3-19-80	93.	4.482	.441	90.6
# AVERAGES	17.	16.	11.	10.
% OF DATA	55.	52.	35.	32.
MINIMUM	82.	4.482	.308	86.638
MAXIMUM	130.	5.502	.687	93.790
MEAN	108.	4.965	.467	90.551
STD.DEV.	12.	.287	.141	2.640
% STD.DEV.	11.	5.785	30.265	2.916

30-DAY REMOVAL EFICIENCY USING
24
(MEAN) E , E : 90.589%
30 IN OUT

Y
NOTE: (MEAN) IS DEFINED AS:
X
THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

data were not included in the data listings. Where available, they are listed in Appendix A, but were not used in calculations concerning 1-hour and 24-hour averages of FGD performance.

Failure to Obtain a Sufficient Data Base for Computation--

At least two 15-minute readings per hour were necessary for an hourly reading to be computed in the initial data listing, and at least eighteen 1-hour averages of a parameter were needed for data to be included into the summaries of 1-hour and 24-hour results.

3.2.3 Process Operations Affecting SO_2 Emission Rates--

Inlet Emission Rates--

Inlet SO_2 emission rates were affected primarily by the sulfur content of the coal burned. Peabody Coal Company supplied the coal from the beginning of the test through February 28, whereas Yancy Minerals supplied the coal from February 29 through the end of the test. Because of a 3- to 5-day lag between delivery and burning of coal, the data collected from January 25 through March 1 can be viewed as representative of the coal supplied by the first vendor, and the data collected from March 2 through 19 as representative of a mixture of coals from both vendors.

Outlet Emission Rates--

Outlet SO_2 rates reflect FGD system efficiency, which varied according to the lime feed rate. Section 4 describes the FGD process and control practices.

3.3 DATA CAPTURE AND LOSS

Table 3-34 lists the daily hours of data capture and loss from January 25 to March 19, and Table 3-35 summarizes process and CEM operations. The performance of the FGD system and CEM affected data capture and are described below.

3.3.1 FGD System Performance

Total operating data showed that FGD system availability, reliability, and operability were all 99.5 percent and that utilization was 99.3 percent; however, 69 hours (5.3 percent of the total FGD system operating time) was not regarded as representative of normal process control and was excluded from the data base. The periods excluded were times when mechanical breakdowns caused loss of lime feed and thus reduction of SO_2 removal efficiency.

3.3.2 CEM Performance

CEM Operability--

Total data from January 25 to March 19 show that CEM inlet operability was 87.1 percent, outlet operability was 81.1 percent and total system operability (concurrent operation of inlet and outlet monitors) was 78.0 percent.

CEM Downtime--

A breakdown of the causes for inlet and outlet data losses due to CEM failures is shown in Tables 3-36 and 3-37.

TABLE 3-34. DAILY DATA CAPTURE AND LOSS
(hours except as indicated)

Data day No.	Date in 1980	Normal process operation	Process downtime (abnormal operation)	Inlet data capture	Outlet data capture	Efficiency data capture	O_2 monitor downtime	SO_2 monitor downtime	Sampling interface downtime
1	1/25	24	0	20	20	20	0	0	4[a]
2	1/26	24	0	24	24	24	0	0	0
3	1/27	18	6[b]	24	18	18	0	0	0
4	1/28	23	1[c]	23	23	23	0	0	0
	1/29	24	0	14	14	14	0	10[d]	0
	1/30	24	0	13	13	13	0	11[e]	0
5	1/31	24	0	22	22	22	0	2[f]	0
6	2/1	22	2[g]	24	22	22	0[h]	0	0
	2/2	11	13[g]	21	11	10	3[h]	0	0
	2/3	20	4[g]	21	17	17	3[h]	0	0
7	2/4	24	0	22	22	22	0	2[i]	0
8	2/5	24	0	23	21	21	0	1[j]	2[m]
	2/6	18	6[g]	12	6	6	0[h]	0	12[j]
	2/7	0	24[k]	23	0	0	1[h]	0[l]	0
	2/8	13	11[k]	23	11	11	0	1[l]	0
9	2/9	24	0	24	24	24	0	0	0[j]
	2/10	24	0	14	14	14	0	0	10[j]
10	2/11	24	0	24	24	24	0	0	0

(continued)

TABLE 3-34 (continued)

Data day No.	Date in 1980	Normal process operation	Process downtime (abnormal operation)	Inlet data capture	Outlet data capture	Efficiency data capture	O_2 monitor downtime	SO_2 monitor downtime	Sampling interface downtime
11	2/12	24	0	24	24	24	0	0[m]	0[j]
	2/13	24	0	23	17	17	0	1[m]	6[j]
12	2/14	24	0	24	24	24	0	0[n]	0[j]
	2/15	24	0	23	13	13	0	1[n]	10[j]
	2/16	24	0	24	9	9	0	0	15[j]
13	2/17	23	1[c]	24	23	23	0	0	0
14	2/18	22	2[c]	24	22	22	0	0	0
15	2/19	24	0	24	24	24	0[h]	0	0
	2/20	24	0	12	23	12	1[h]	0[p]	12[o]
	2/21	24	0	13	22	13	1[h]	1[p]	11[p]
	2/22	18	6[q]	15	15	15	3[h]	0	0
	2/23	24	0	4	4	4	20[h]	0	0
	2/24	24	0	9	9	9	15[h]	0	0
	2/25	24	0	15	15	15	9[h]	0	0[o]
	2/26	24	0	17	24	17	0	0	7[o]
16	2/27	22	2[r]	22	22	22	0	0	0
17	2/28	24	0	24	24	24	0	0	0
18	2/29	24	0	24	24	24	0	0	0
19	3/1	24	0	19	19	19	5[h]	0	0

(continued)

TABLE 3-34 (continued)

Data day No.	Date in 1980	Normal process operation	Process downtime (abnormal operation)	Inlet data capture	Outlet data capture	Efficiency data capture	O_2 monitor downtime	SO_2 monitor downtime	Sampling interface downtime
	3/2	24	0	24	17	17	0	0	7[j]
20	3/3	24	0	24	21	21	0	0	3[j]
21	3/4	24	0	24	24	24	0	0	0
22	3/5	24	0	24	24	24	0	0	0
23	3/6	24	0	24	24	24	0	0	0
24	3/7	24	0	24	24	24	0	0	0
	3/8	24	0	24	12	12	0	0	12[j]
	3/9	24	0	24	10	10	0	0	14[j]
	3/10	24	0	24	15	15	0	0	9[j]
	3/11	24	0	22	12	12	0	0	12[j]
	3/12	24	0	12	0	0	12[s]	0	12[j]
	3/13	24	0	23	17	17	0	0	7[j,t]
	3/14	24	0	14	24	14	0	0	10[u]
25	3/15	24	0	24	24	24	0	0	0
26	3/16	24	0	24	24	24	0	0	0
27	3/17	24	0	24	24	24	0	0	0
28	3/18	24	0	24	24	24	0	0	0
29	3/19	24	0	24	24	24	0	0	0

[a] Installed gas conditioner (permeation dryer) failed and caused loss of sample. Device was removed after failure.

[b] Loss of lime slaker resulted in poor FGD performance.

[c] Temporary low lime feed rate to system.

[d] Seven hours lost because the sample timer was off, 3 hours lost because of zero card maintenance.

[e] Ten hours lost because of the sample timer, 1 hour lost because of an integrity check.

[f] Audit checks performed.

[g] Lime slaker maintenance.

[h] Oxygen recorder chart drive stuck.

[i] Ultraviolet bulb changed.

[j] Outlet probe filter plugged.

[k] Lime slaker down for repairs.

[l] Calibration test.

[m] Sample cell windows were cleaned.

[n] Calibration checks, routine maintenance.

[o] Inlet blowback valve leak.

[p] Inlet blowback valve leak and repair.

[q] FGD system down for repairs.

[r] Boilers down.

[s] Oil in outlet line caused false reading.

[t] Power disconnected to probes for 1 hour.

[u] Inlet probe tube plugged.

TABLE 3-35. SUMMARY OF PROCESS AND CEM OPERATIONS DURING TEST

Parameter	Hours
Total time in operating period	1320
Total boiler operating time	1318
Total FGD system operating time	1311
Total time of representative FGD system operation	1242
Total inlet data capture time	1142
Total outlet data capture time	1007
Total efficiency data capture time	969
O_2 monitor downtime	73
SO_2 monitor downtime	30
Inlet sampling interface downtime	52
Outlet sampling interface downtime	116
Simultaneous downtime of inlet and outlet sampling interface	19
FGD system downtime	7
Boiler downtime	2
Total time of unrepresentative FGD system operation	69

TABLE 3-36. INLET DATA LOSS

No. of hours lost	No. of occurrences	Description	Remedy
4	1	Testing of gas conditioner	a
17	1	Timer off	Turned timer on
3	1	Zero card maintenance	a
5	4	Integrity, audit, calibration checks	a
54	9	Chart drive sticking, O_2 recorder	Repaired chart drive
2	1	Change ultraviolet lamp bulb	a
16	4	Outlet interface failure and correction	a
1	1	SO_2 sample cell dirty	Cleaned cell
12	1	Oil in plant air	plant performed maintenance
23	1	Blowback valve leak	Repaired leak
7	1	Blowback solenoid valve failure	Replaced valve
10	1	Inlet probe plugged	Replaced probe
5	1	O_2 recorder chart paper out	New roll paper
Total 159	27		

[a] Not applicable.

TABLE 3-37. OUTLET DATA LOSS

No. of hours lost	No. of occurrences resulting in data loss	Description	Remedy
4	1	Testing gas conditioner	a
17	1	Timer off	Turned timer on
3	1	Zero card maintenance	a
4	3	Integrity audit, calibration	a
55	10	Chart drive sticking, O_2 recorder	Repaired chart drive
2	1	Change ultraviolet lamp bulb	a
131	13	Outlet probe filter plugged	Changed filter
1	1	Inlet blowback repairs	a
1	1	Sample cell dirty	Cleaned all
12	1	Oil in plant air	Plant performed maintenance
5	1	O_2 recorder paper out	Replaced roll
Total 235	34		

[a] Not applicable.

CEM Problems--

The only apparently unsolvable problem that occured with CEM operations was the recurrence of outlet probe filter pluggage. The remedy for the problem was replacement of probe filters when they showed signs of plugging, but this was generally an unsatisfactory solution because pluggage frequently occurred at night, when CEM operators were not present. Large periods of data loss in excess of 6 hours per 24-hour day resulted. Two major factors contributed to the high incidence of this problem:

1. High mist carryover from the FGD process through the test period. This was evidenced by a very obvious rainout downwind of the stack and heavy accumulations of wet slurry on the outlet probe.

2. Oil in the probe filter blowback air supply. This was discovered only once in the test period, but probably contributed to the unusually high incidence of probe pluggage from March 8 through 12.

3.4 QUALITY ASSURANCE

A quality assurance (QA) program was performed to support the reliability of the data between initial and final P/S testing. In addition to the records of CEM operation summarized in Subsection 3.3, two levels of testing were performed. The first level consisted of ongoing 24-hour zero and calibration drift tests for the entire period of January 25 through March 18, and the second consisted of manual methods tests for system relative accuracy and CEM moisture values.

3.4.1 CEM 24 Hour Drift Tests

The 24-hour zero and calibration drift tests of both SO_2 monitor ranges and of the O_2 monitor were performed on a weekly basis. Data represent 24-hour SO_2 monitor drift from February 7 to March 13 and 24-hour O_2 monitor drift from January 31 to March 13. Table 3-38 summarizes the weekly QA test results, and Tables 3-39 through 3-54, provide detailed results.

3.4.2 System Relative Accuracy Tests

System relative accuracy tests were performed on a weekly basis throughout the test period. Between January 25 and February 22, the weekly schedule was not followed because the primary effort was directed toward completion of initial P/S tests. The results of the QA system relative accuracy tests are presented in Table 3-55, and Table 3-56 summarizes these results.

3.4.3 CEM Sample Mositure Determinations

The CEM moisture values used in calculations were determined from manual tests and checked to ensure that they did not exceed the lowest dewpoint before analysis in the O_2 and SO_2 monitors. The values are presented in Table 3-57.

Manual methods results obtained during system relative accuracy tests were used in all cases except during the period from February 12 through March 5 when manual determinations were made at the CEM monitor for the outlet stream. This was done because the low dewpoint determination did not appear to be

TABLE 3-38. SUMMARY OF WEEKLY QA TEST RESULTS FOR 24-HOUR ZERO AND CALIBRATION DRIFT

Weekly period in 1980	Low-range SO_2 monitor 24-hour drift		High-range SO_2 monitor 24-hour drift		O_2 monitor 24-hour drift	
	Zero, % of scale	Calibration, % of scale	Zero, % of span	Calibration, % of span	Zero, vol. % O_2	Calibration, vol. % O_2
1/31-2/7	a	a	a	a	0.00	0.06
2/7-2/14	0.0	1.0	0.1	0.7	0.00	0.18
2/14-2/21	0.0	1.0	0.0	1.0	0.03	0.18
2/21-2/28	0.1	0.9	0.1	1.1	0.00	0.13
2/28-3/6	0.4	1.0	0.1	1.1	0.03	0.06
3/6-3/13	0.3[b]	1.1[b]	0.0[b]	1.2[b]	0.00[b]	0.48[b]

[a] Data presented in P/S test results.
[b] Data overlap final P/S data.

TABLE 3-39. QA TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR
24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 7 THROUGH 14[a]
(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/7	2/8	2130	1300	0.0	0.0	0.0	86.2	86.3	0.1	0.1
2	2/8	2/9	1300	1530	0.0	0.0	0.0	86.3	85.8	-0.5	-0.5
3	2/9	2/10	1530	1430	0.0	0.0	0.0	85.8	86.8	1.0	1.0
4	2/10	2/11	1430	1100	0.0	0.0	0.0	86.8	85.6	-1.2	-1.2
5	2/11	2/12	1100	2300	0.0	0.0	0.0	85.6	86.8	1.2	1.2
6	2/12	2/13	2300	2300	0.0	0.0	0.0	86.0	85.7	-0.3	-0.3
7	2/13	2/14	2300	1515	0.0	0.0	0.0	85.7	85.0	-0.7	-0.7
						Arithmetic mean	0.0				-0.06
						95% confidence interval	0.0				0.82
						24-hour drift,[b] %	0.0				1.03

[a]Calibration concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.
[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-40. QA TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 14 THROUGH 21[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/14	2/15	1515	1600	0.0	0.0	0.0	85.0	86.3	1.3	1.3
2	2/15	2/16	1600	1515	0.0	0.0	0.0	86.3	86.3	0.0	0.0
3	2/16	2/17	1515	1430	0.0	0.0	0.0	86.3	87.1	0.8	0.8
4	2/17	2/18	1430	1315	0.0	0.0	0.0	85.9	85.7	-0.2	-0.2
5	2/18	2/19	1315	1100	0.0	0.0	0.0	85.7	86.2	0.5	0.5
6	2/19	2/20	1100	2000	0.0	0.0	0.0	86.2	85.9	-0.3	-0.3
7	2/20	2/21	2000	1615	0.0	0.0	0.0	85.9	86.3	0.4	0.4
						Arithmetic mean	0.0				0.36
						95% confidence interval	0.0				0.53
						24-hour drift,[b] %	0.0				1.04

[a]Calibration gas concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-41. QA TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 21 THROUGH 28[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/21	2/22	1615	1530	0.0	0.0	0.0	86.3	86.7	0.4	0.4
2	2/22	2/23	1530	1445	0.0	0.0	0.0	86.7	87.0	0.3	0.3
3	2/23	2/24	1445	1500	0.0	0.0	0.0	87.0	86.0	-1.0	-1.0
4	2/24	2/25	1500	1700	0.0	0.0	0.0	86.0	85.3	-0.7	-0.7
5	2/25	2/26	1700	2000	0.0	-0.2	-0.2	85.3	86.5	1.2	1.4
6	2/26	2/27	2000	2245	-0.2	0.0	0.2	86.5	86.4	-0.1	-0.3
7	2/27	2/28	2245	2300	0.0	0.0	0.0	86.4	86.5	0.1	0.1
						Arithmetic mean	0.0				0.03
						95% confidence interval	0.0				0.74
						24-hour drift,[b] %	0.0				0.90

[a]Calibration gas concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-42. QA TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR[a]
24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 28 THROUGH MARCH 6

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/28	2/29	2300	1730	0.0	0.0	0.0	86.5	87.5	1.0	1.0
2	2/29	3/1	1730	1415	0.0	0.3	0.3	86.2	86.4	0.2	-0.1
3	3/1	3/2	1415	1545	0.3	-0.4	-0.7	86.4	85.4	-1.0	0.6
4	3/2	3/3	1545	1200	-0.4	0.0	0.4	85.4	86.0	1.0	-0.4
5	3/3	3/4	1200	1845	0.0	0.0	0.0	86.0	85.0	-1.0	-1.0
6	3/4	3/5	1845	1800	0.0	-0.2	-0.2	86.0	86.6	0.6	0.8
7	3/5	3/6	1800	1745	0.0	0.0	0.0	86.4	86.6	0.2	0.2
						Arithmetic mean	-0.03				0.16
						95% confidence interval	0.33				0.66
						24-hour drift,[b] %	0.36				0.96

[a]Calibration gas concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-43. QA TEST RESULTS FOR LOW-RANGE (OUTLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, MARCH 6 THROUGH MARCH 13[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/6	3/7	1745	1700	0.0	-0.4	-0.4	86.6	85.6	-1.0	0.3
2	3/7	3/8	1700	1430	-0.4	0.0	0.4	85.6	86.1	0.5	0.1
3	3/8	3/9	1430	1445	0.0	0.0	0.0	86.1	86.7	0.6	0.6
4	3/9	3/10	1445	1745	0.0	0.0	0.0	86.7	85.3	-1.4	-1.4
5	3/10	3/11	1745	2045	0.0	0.0	0.0	86.0	87.0	1.0	1.0
6	3/11	3/12	2045	2045	0.0	0.4	0.4	87.0	86.5	-0.5	-0.9
7	3/12	3/13	2045	2145	0.4	0.2	-0.2	86.5	85.6	-0.9	-0.7
						Arithmetic mean	0.03				-0.14
						95% confidence interval	0.22				0.81
						24-hour drift,[b] %	0.25				1.11

[a]Calibration gas concentration of 427 ppm SO_2 and scale from 0 to 500 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-44. QA TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR
24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 7 THROUGH 14[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/7	2/8	2130	1300	0.0	0.0	0.0	84.0	84.4	0.4	0.4
2	2/8	2/9	1300	1530	0.0	0.0	0.0	84.3	83.7	-0.6	-0.6
3	2/9	2/10	1530	1430	0.0	0.0	0.0	83.7	84.0	0.3	0.3
4	2/19	2/11	1430	1100	0.0	0.0	0.0	84.0	83.7	-0.3	-0.3
5	2/11	2/12	1100	2300	0.0	0.0	0.0	83.7	84.7	1.0	1.0
6	2/12	2/13	2300	2300	0.0	-0.1	-0.1	84.7	84.3	-0.4	-0.3
7	2/13	2/14	2300	1515	-0.1	0.0	0.1	84.3	83.7	-0.6	-0.7
						Arithmetic mean	0.00				-0.03
						95% confidence interval	0.05				0.57
						24-hour drift,[b] %	0.05				0.70

[a]Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-45. QA TEST RESULTS FOR HIGH RANGE (INLET) SO_2 MONITOR
24-HOUR ZERO AND CALIBRATION DRIFT[a], FEBRUARY 14 - 21

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/14	2/15	1515	1600	0.0	0.0	0.0	83.7	84.4	0.7	0.7
2	2/15	2/16	1600	1515	0.0	0.0	0.0	84.4	84.9	0.5	0.5
3	2/16	2/17	1515	1430	0.0	0.0	0.0	84.9	84.0	-0.9	-0.9
4	2/17	2/18	1430	1315	0.0	0.0	0.0	84.0	84.8	0.8	0.8
5	2/18	2/19	1315	1100	0.0	0.0	0.0	84.8	83.7	-1.1	-1.1
6	2/19	2/20	1100	2000	0.0	0.0	0.0	83.7	84.0	0.3	0.3
7	2/20	2/21	2000	1615	0.0	0.0	0.0	84.0	84.4	0.4	0.4
					Arithmetic mean		0.0				0.1
					95% confidence interval		0.0				0.71
					24-hour drift[b], percent		0.0				0.95

[a]Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.
[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-46. QA TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 21 THROUGH 28[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/21	2/22	1615	1530	0.0	0.0	0.0	84.4	83.2	-1.2	-1.2
2	2/22	2/23	1530	1445	0.0	0.0	0.0	83.2	84.0	0.8	0.8
3	2/23	2/24	1445	1500	0.0	0.0	0.0	84.0	84.0	0.0	0.0
4	2/24	2/25	1500	1700	0.0	0.0	0.0	84.0	83.0	-1.0	-1.0
5	2/25	2/26	1700	2000	0.0	-0.1	-0.1	83.0	84.3	1.3	1.4
6	2/26	2/27	2000	2245	-0.1	0.0	0.1	84.3	83.8	-0.5	-0.6
7	2/27	2/28	2245	2300	0.0	0.0	0.0	83.8	83.8	0.0	0.0
				Arithmetic mean			0.0				-0.08
				95% confidence interval			0.05				0.87
				24-hour drift,[b] %			0.05				1.12

[a]Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-47. QA TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 28 THROUGH MARCH 6[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/28	2/29	2300	1730	0.0	0.0	0.0	83.8	85.3	1.5	1.5
2	2/29	3/1	1730	1415	0.0	0.0	0.0	83.7	83.6	-0.1	-0.1
3	3/11	3/2	1415	1545	0.0	0.0	0.0	83.6	83.4	-0.2	-0.2
4	3/2	3/3	1545	1200	0.0	-0.2	-0.2	83.4	83.6	0.2	0.4
5	3/3	3/4	1200	1845	-0.2	0.0	0.2	83.6	81.9	-1.7	-1.9
6	3/4	3/5	1845	1800	0.0	0.0	0.0	83.9	84.4	0.5	0.5
7	3/5	3/6	1800	1745	0.0	0.0	0.0	84.2	84.0	-0.2	-0.2
						Arithmetic mean	0.0				0.00
						95% confidence interval	0.11				0.95
						24-hour drift,[b] %	0.11				1.12

[a]Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-48. QA TEST RESULTS FOR HIGH-RANGE (INLET) SO_2 MONITOR
24-HOUR ZERO AND CALIBRATION DRIFT, MARCH 6 THROUGH MARCH 13[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/6	3/7	1745	1700	0.0	0.0	0.0	84.0	84.0	0.0	0.0
2	3/7	3/8	1700	1430	0.0	0.0	0.0	84.0	83.5	-0.5	-0.5
3	3/8	3/9	1430	1445	0.0	0.0	0.0	83.5	84.4	0.9	0.9
4	3/9	3/10	1445	1745	0.0	0.0	0.0	84.4	83.0	-1.4	-1.4
5	3/10	3/11	1745	2045	0.0	0.0	0.0	84.4	85.3	0.9	0.9
6	3/11	3/12	2045	2045	0.0	0.0	0.0	85.3	84.3	-1.0	-1.0
7	3/12	3/13	2045	2145	0.0	0.0	0.0	84.3	83.0	-1.0	-1.0
						Arithmetic mean	0.0				-0.30
						95% confidence interval	0.0				0.86
						24-hour drift,[b] %	0.0				1.16

[a]Calibration gas concentration of 4250 ppm SO_2 and scale from 0 to 5000 ppm SO_2.

[b]See Subsection 6.2.3 for explanation of units.

TABLE 3-49. QA TEST RESULTS FOR O_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, JANUARY 31 THROUGH FEBRUARY 7[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	1/31	2/1	0900	0915	0.0	0.0	0.0	86.7	86.5	-0.2	-0.2
2	2/1	2/2	0915	1400	0.0	0.0	0.0	86.5	86.5	0.0	0.0
3	2/2	2/3	1400	1430	0.0	0.0	0.0	86.5	86.5	0.0	0.0
4	2/3	2/4	1430	1600	0.0	0.0	0.0	86.5	86.5	0.0	0.0
5	2/4	2/5	1600	1830	0.0	0.0	0.0	86.5	86.5	0.0	0.0
6	2/5	2/6	1830	1648	0.0	0.0	0.0	86.5	86.5	0.0	0.0
7	2/6	2/7	1648	2130	0.0	0.0	0.0	86.5	87.0	0.5	0.5
						Arithmetic mean	0.0				0.04
						95% confidence interval	0.0				0.20
						24-hour drift,[b] % O_2	0.0				0.06

[a]Calibration gas concentration of 20.95% O_2 and scale from 0 to 25% O_2.

[b]Percent O_2 = $(|AM| + CI_{95}) \times 0.25$.

TABLE 3-50. QA TEST RESULTS FOR O_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 7 THROUGH 14[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/7	2/8	2130	1300	0.0	0.0	0.0	87.0	87.0	0.0	0.0
2	2/8	2/9	1300	1530	0.0	0.0	0.0	87.0	87.1	0.1	0.1
3	2/9	2/10	1530	1430	0.0	0.0	0.0	87.1	85.8	-1.3	-1.3
4	2/10	2/11	1430	1100	0.0	0.0	0.0	85.8	86.9	1.1	1.1
5	2/11	2/12	1100	2300	0.0	0.0	0.0	86.9	87.0	0.1	0.1
6	2/12	2/13	2300	2300	0.0	0.0	0.0	87.0	87.0	0.0	0.0
7	2/13	2/14	2300	1515	0.0	0.0	0.0	87.0	86.5	-0.5	-0.5
						Arithmetic mean	0.0				-0.07
						95% confidence interval	0.0				0.67
						24-hour drift,[b] % O_2	0.0				0.18

[a]Calibration gas concentration of 20.95% O_2 and scale from 0 to 25 percent O_2.

[b]Percent O_2 = $(|AM| + CI_{95}) \times 0.25$.

TABLE 3-51. QA TEST RESULTS FOR O_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 14 THORUGH FEBRUARY 21[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/14	2/15	1515	1600	0.0	0.0	0.0	86.5	86.4	-0.1	-0.1
2	2/15	2/16	1600	1515	0.0	-0.2	-0.2	86.4	86.3	-0.1	0.1
3	2/16	2/17	1515	1430	-0.2	0.0	0.2	86.3	86.0	-0.3	-0.5
4	2/17	2/18	1430	1315	0.0	0.0	0.0	86.0	86.6	0.6	0.6
5	2/18	2/19	1315	1100	0.0	0.0	0.0	86.6	86.5	-0.1	-0.1
6	2/19	2/20	1100	2000	0.0	0.0	0.0	86.5	86.0	-0.5	-0.5
7	2/20	2/21	2000	1615	0.0	0.0	0.0	86.0	87.0	-1.0	-1.0
						Arithmetic mean	0.0				-0.21
						95% confidence interval	0.11				0.47
						24-hour drift,[b] % O_2	0.03				0.18

[a]Calibration gas concentration of 20.95 percent O_2 and scale from 0 to 25 percent O_2.

[b]Percent $O_2 = (|AM| + CI_{95}) \times 0.25$.

TABLE 3-52. QA TEST RESULTS FOR O_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 21 THROUGH FEBRUARY 28[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/21	2/22	1615	1530	0.0	0.0	0.0	87.0	87.0	0.0	0.0
2	2/22	2/23	1530	1445	0.0	0.0	0.0	87.0	87.0	0.0	0.0
3	2/23	2/24	1445	1500	0.0	0.0	0.0	87.0	86.0	-1.0	-1.0
4	2/24	2/25	1500	1700	0.0	0.0	0.0	86.0	86.0	0.0	0.0
5	2/25	2/26	1700	2000	0.0	0.0	0.0	86.0	86.0	0.0	0.0
6	2/26	2/27	2000	2245	0.0	0.0	0.0	86.0	86.0	0.0	0.0
7	2/27	2/28	2245	2300	0.0	0.0	0.0	86.0	86.7	0.7	0.7
						Arithmetic mean	0.0				-0.04
						95% confidence interval	0.0				0.46
						24-hour drift,[b] % O_2	0.0				0.13

[a]Calibration gas concentration of 20.95 percent O_2 and scale from 0 to 25 percent O_2.

[b]Percent O_2 = $(|AM| + CI_{95}) \times 0.25$.

TABLE 3-53. QA TEST RESULTS FOR C_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, FEBRUARY 28 THROUGH MARCH 6[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	2/28	2/29	2300	1730	0.0	0.2	0.2	86.7	87.0	0.3	0.1
2	2/29	3/1	1730	1415	0.2	0.0	-0.2	87.0	86.7	-0.3	-0.1
3	3/1	3/2	1415	1545	0.0	0.0	0.0	86.7	86.9	0.2	0.2
4	3/2	3/3	1545	1200	0.0	0.0	0.0	86.9	86.8	-0.1	0.1
5	3/3	3/4	1200	1845	0.0	0.0	0.0	86.8	87.0	0.2	0.2
6	3/4	3/5	1845	1800	0.0	0.0	0.0	87.0	86.7	-0.3	-0.3
7	3/5	3/6	1800	1745	0.0	0.0	0.0	86.7	86.9	0.2	0.2
						Arithmetic mean	0.0				0.06
						95% confidence interval	0.11				0.18
						24-hour drift,[b] % O_2	0.03				0.06

[a]Calibration gas concentration of 20.95 percent O_2 and scale from 0 to 25 percent O_2.

[b]Percent O_2 = $(|AM| + CI_{95}) \times 0.25$.

TABLE 3-54. QA TEST RESULTS FOR O_2 MONITOR 24-HOUR ZERO AND CALIBRATION DRIFT, MARCH 6 THROUGH MARCH 13[a]

(% of scale except as indicated)

Test No.	Test date		Time		Zero reading		Zero drift (C=B-A)	Span reading		Span drift (F=E-D)	Calibration drift (G=F-C)
	Start	End	Start	End	Start (A)	End (B)		Start (D)	End (E)		
1	3/6	3/7	1745	1700	0.0	0.0	0.0	86.9	87.0	0.1	0.1
2	3/7	3/8	1700	1430	0.0	0.0	0.0	87.0	86.0	-0.1	-0.1
3	3/8	3/9	1430	1445	0.0	0.0	0.0	86.0	86.9	0.9	0.9
4	3/9	3/10	1445	1745	0.0	0.0	0.0	86.9	86.5	-0.1	-0.1
5	3/10	3/11	1745	2045	0.0	0.0	0.0	86.5	86.5	0.0	0.0
6	3/11	3/12	2045	2045	0.0	0.0	0.0	86.5	83.0	-3.5	-3.5
7	3/12	3/13	2045	2145	0.0	0.0	0.0	83.0	86.4	3.4	3.4
						Arithmetic mean	0.0				0.10
						95% confidence interval	0.0				1.87
						24-hour drift,[b] % O_2	0.0				0.49

[a] Calibration gas concentration of 20.95% O_2 and scale from 0 to 25% O_2.

[b] Percent O_2 = $(|AM| + CI_{95}) \times 0.25$.

TABLE 3-55. QA TEST RESULTS FOR SYSTEM RELATIVE ACCURACY[a]

Week in 1980	Day in 1980	Sampling location	Test time	O_2 vol., %		SO_2, ppm		SO_2, lb/10^6 Btu		Diff.	Arithmetic difference	
				RM[b]	M[c]	RM[b]	M[c]	RM[b]	M[c]		mass/GCV	% of $\overline{RV}$
1/27-2/2	2/1	Outlet	d	12.0	12.6	120	98	0.45	0.40	-0.05		
1/27-2/2	2/1	Outlet	d	13.7	13.9	135	113	0.59	0.54	-0.05		
1/27-2/2	2/1	Outlet	d	13.3	12.6	123	108	0.55	0.44	-0.11		-12.9
2/3-2/9	2/5	Outlet	0941	14.5	14.4	53	43	0.28	0.22	-0.055		
2/3-2/9	2/5	Outlet	1051	12.0	12.3	123	115	0.46	0.45	-0.010		
2/3-2/9	2/6	Outlet	1446	12.6	13.1	165	172	0.67	0.75	+0.76		
2/3-2/9	2/6	Outlet	1546	12.7	13.5	149	127	0.61	0.58	-0.033		-1.0
2/10-2/16	2/12	Outlet	1757[e]	14.2	13.3	10	42	0.02	0.19	+0.167		
2/10-2/16	2/12	Outlet	1857[e]	14.2	13.2	12	46	0.02	0.20	+0.180		
2/10-2/16	2/12	Outlet	1957[e]	14.0	13.2	42	82	0.09	0.36	+0.264		
2/10-2/16	2/13	Outlet	1057	14.0	13.0	56	63	0.271	0.27	-0.002		
2/10-2/16	2/13	Outlet	1257	14.0	12.1	74	116	0.36	0.44	+0.083		
2/10-2/16	2/13	Outlet	1357	14.0	13.0	46	81	0.22	0.35	+0.126		+24.5
2/24-3/1	2/26	Inlet	1747	12.6	12.7	1121	1297	4.54	5.33	+0.79		
2/24-3/1	2/26	Inlet	1917[e]	d	12.8	983	1271	d	5.28	d		
2/24-3/1	2/26	Inlet	2017[e]	d	12.9	894	1263	d	5.33	d		+17.4
2/24-3/1	2/27	Outlet	1303	12.2	12.2	145	110	0.56	0.43	-0.13		
2/24-3/1	2/27	Outlet	1433	12.0	12.1	182	154	0.69	0.59	-0.10		
2/24-3/1	2/27	Outlet	1556	11.9	11.7	200	134	0.75	0.49	-0.26		-24.5
3/2-3/8	3/6	Inlet	0902	12.8	13.3	1261	1245	5.24	5.49	+0.25		
3/2-3/8	3/6	Inlet	1002	13.2	13.9	1225	1164	5.35	5.58	+0.23		
3/2-3/8	3/6	Inlet	1122	15.5	16.0	814	768	5.07	5.30	+0.23		+4.5
3/2-3/8	3/6	Outlet	1317[e]	12.8	14.4	d	152	d	0.79	d		
3/2-3/8	3/6	Outlet	1417	12.8	13.0	217	180	0.90	0.76	-0.14		
3/2-3/8	3/6	Outlet	1527	13.0	13.6	188	139	0.80	0.64	-0.16		-17.5

(continued)

TABLE 3-55 (continued)

Week in 1980	Day in 1980	Sampling location	Test time	O_2 vol., %		SO_2, ppm		SO_2, lb/10^6 Btu		Diff.	Arithmetic difference	
				RM[b]	M[c]	RM[b]	M[c]	RM[b]	M[c]		mass/GCV	% of $\overline{RV}$
3/9-3/15	3/13	Inlet	1308	12.8	12.8	1187	1193	4.93	4.93	+0.00		
3/9-3/15	3/13	Inlet	1458	12.4	12.8	1165	1160	4.61	4.82	+0.21		
3/9-3/15	3/13	Inlet	1558	12.8	12.9	1110	1130	4.61	4.75	+0.14		
3/9-3/15	3/13	Inlet	1718	12.6	12.7	1182	1178	4.79	4.83	+0.04		+2.1
3/9-3/15	3/13	Outlet	1906	13.0	13.3	167	130	0.71	0.58	-0.13		
3/9-3/15	3/13	Outlet	1546	13.0	13.4	72	126	0.31	0.56	+0.25		
3/9-3/15	3/13	Outlet	1656	13.0	13.4	141	120	0.60	0.53	-0.07		
3/9-3/15	3/13	Outlet	1816	12.7	13.3	136	111	0.56	0.49	-0.07		-3.7

[a] Results for February 17 to 23 and March 30 to April 5 were discussed in Subsection 3.1; during the week of March 16 to 23, data were collected only for the 4 days from March 16 to 19; no tests were scheduled from March 23 to 29.
[b] Reference method value.
[c] Monitor value.
[d] Not available.
[e] Test excluded from data base.

TABLE 3-56. SUMMARY OF QA TEST RESULTS FOR SYSTEM RELATIVE ACCURACY

Week in 1980	Date in 1980	Sampling location	No. of data[a]	Arithmetic mean, lb $SO_2/10^6$ Btu		Aritmethic mean, % ($\frac{M-RM}{RM}$ x 100)
				RM[b]	M[c]	
1/20-1/26	Not tested[d]			e	e	3
1/27-2/2	2/1	Outlet	3	0.53	0.46	-13.2
1/27-2/2	Inlet P/S tests performed[f]			e	e	e
2/3-2/9	2/5-6	Outlet[g]	4	0.51	0.50	-2.0
2/10-2/16	2/12-2/13	Outlet[g]	3[h]	0.28	0.35	+25.0
2/17-2/23	Outlet P/S tests performed[g,i]			e	e	e
2/24-3/1	2/26	Inlet	1[j]	4.54	5.33	+17.4
2/24-3/1	2/27	Outlet	3	0.67	0.54	-19.4
3/2-3/8	3/6	Inlet	3	5.22	5.46	+4.6
3/2-3/8	3/6	Outlet	2[k]	0.85	0.70	-17.6
3/9-3/15		Inlet	4	4.74	4.83	+1.9
3/9-3/15		Outlet	4	0.55	0.54	-1.8
3/16-3/29	No tests performed[l]			e	e	e
3/30-4/5	Inlet and outlet P/S tests performed[m]			e	e	e

[a] Not including tests excluded.
[b] Reference method value.
[c] Monitor value.
[d] No tests scheduled, only 1 of CEM operating.
[e] No QA test data available.
[f] See Table 3-17 for inlet P/S results.
[g] Inlet not tested, efforts concentration on outlet testing.
[h] Six tests completed, three tests discarded because of reference method probe failure.
[i] See Table 3-18 for outlet P/S results.
[j] Three tests completed, two tests discarded because of ORSAT test failure.
[k] Three tests completed, discarded due to SO_2 analysis failure.
[l] The CEM data collection finished March 18; there was no return until March 31 for final P/S testing.
[m] See Table 3-28 and 3-29 for final P/S results.

TABLE 3-57. QA MOISTURE DATA FOR USE WITH CEM RESULTS
(% H_2O)

Date of test in 1980	Inlet[a]	Outlet[a]	Maximum SO_2	Maximum O_2
1/29	3.33	d	14.6	2.76
1/30	3.34	d	14.6	2.76
2/1	d	11.8	14.6	2.76
2/5	d	10.5	14.6	2.76
2/6	d	12.7	14.6	2.76
2/12	d	4.9[e]	14.6	2.76
2/13	d	3.0[e]	14.6	2.76
2/19	d	4.3[e]	14.6	2.76
2/20	d	4.2[e]	14.6	2.76
2/26	1.45	d	14.6	2.76
2/27	d	4.3[e]	14.6	2.76
3/6	2.86	16.5	14.6	2.76
3/8	d	d	10.2	2.76
3/9	d	d	11.3	2.76
3/10	d	d	10.2	2.76
3/11	d	d	9.7	2.76
3/12	d	d	10.2	2.76
3/13	1.88	14.0	9.7	2.76
3/14	d	d	9.2	2.76
3/15	d	d	11.3	2.76
3/16	d	d	10.2	2.76
3/19	d	d	11.3	2.76

[a] Determined during Method 6 SO_2, tests except where noted. When no tests were performed, CEM data were determined from the last previous moisture value or, if no previous value was available, from the next following value.

[b] Determined from moisture saturation at monitor mist knockout trap temperature and pressure (information from calibration sheets in Appendix B).

[c] Determined from moisture saturation at room temperature (68°F) and 5 in. Hg vacuum.

[d] No test.

valid during this period, as evidenced by a lack of condensate accumulation in the mist knockout traps. The reason for this occurrence was cold weather, which apparently cooled portions of the outlet sampling interface to a temperature below the stack moisture dewpoint.

3.5 PARTICULATE AND NO_x RESULTS

The particulate concentration at the FGD system inlet averaged 0.15 gr/dscf with an average emission rate of 0.33 $lb/10^6$ Btu. At the FGD system outlet the particulate concentration averaged 0.12 gr/dscf with an average emission rate of 0.26 $lb/10^6$. Based on these rates, the average FGD system particulate removal efficiency was 21.2 percent. Table 3-58 presents the particulate test results.

The average NO_x concentration at the FGD system inlet was 178 ppm with an average emission rate of 0.65 $lb/10^6$ Btu. At the FGD system outlet the average emission rate of 0.63 $lb/10^6$ Btu. Based on these rates, the FGD system reduced the NO_x emissions by an average of 3.1 percent; however, because of the data scatter, it cannot be statistically concluded that the outlet result differs from the inlet result. Table 3-59 presents NO_x test results.

TABLE 3-58. PARTICULATE TEST RESULTS

Test No.	Date in 1980	Sampling location	Concentration,[a] gr/dscf	Emission rate, lb/10^6 Btu
RI5-1	3/12	Inlet	0.14	0.33
RI5-2	3/12		0.16	0.35
RI5-3	3/13		0.14	0.30
Average			0.15	0.33
RO5-1	3/12	Outlet	0.09	0.21
RO5-2	3/12		0.13	0.29
RO5-3	3/13		0.12	0.27
Average			0.12	0.26

[a]Grains per dry standard cubic foot at 68°F and 29.92 in. Hg.

TABLE 3-59. NITROGEN OXIDE TEST RESULTS

Test No.	Date in 1980	Sampling location	Concentration, ppm	Emission rate, lb/10^6 Btu
NOI-1-A	3/10	Inlet	203	0.77
NOI-1-B	3/10		184	0.71
NOI-1-C	3/10		159	0.60
NOI-1-D	3/10		182	0.63
Average			182	0.68
NOI-2-A	3/10	Inlet	191	0.70
NOI-2-B	3/10		140	0.49
NOI-2-C	3/10		158	0.56
NOI-2-D	3/10		342[a]	NA
Average			163	0.58
NOI-3-A	3/11	Inlet	190	0.60
NOI-3-B	3/11		216	0.68
NOI-3-C	3/11		257	0.82
NOI-3-D	3/11		226	0.67
Average			222	0.69
INLET AVERAGE			189	0.65
NOO-1-A	3/10	Outlet	132	0.64
NOO-1-B	3/10		115	0.54
NOO-1-C	3/10		131	0.63
NOO-1-D	3/10		135	0.63
Average			128	0.61
NOO-2-A	3/10	Outlet	136	0.64
NOO-2-B	3/10		127	0.59
NOO-2-C	3/10		65	0.30
NOO-2-D	3/10		187	0.84
Average			129	0.59

TABLE 3-59 (continued)

Test No.	Date in 1980	Sampling location	Concentration, ppm	Emission rate, lb/10^6 Btu
NOO-3-A	3/11	Outlet	144	0.67
NOO-3-B	3/11		145	0.70
NOO-3-C	3/11		143	0.75
NOO-3-D	3/11		149	0.72
Average			145	0.71
OUTLET AVERAGE			134	0.63

SECTION 4

PROCESS DESCRIPTION

4.1 PHYSICAL PLANT

Table 4-1 lists process information.

4.1.1 Boiler System

The boiler system consists of six industrial-size boilers designed to supply high-temperature water for building and water heating at the base. The five older boilers are rated at 30 x 10^6 Btu/h, and the newer boiler is rated at 60 x 10^6 Btu/h. The boilers are stoker fired, with coal spread on under-air-flow perforated grates and burned at a typical ash bed depth of 3 to 5 inches. Grates are mechanically rotated in all but the oldest operating boiler to remove ash to the pneumatic disposal system. Ash must be removed manually from the grate of the oldest unit in operation.

4.1.2 FGD System

The FGD ststem consists of a mechanical collector, Swedish Bahco scrubber tower, lime storage and handling system, clarifier (thickener), booster fan, sludge disposal pond, and associated duct work, pumps, and controls.

Untreated flue gas from the individual boilers enters a common header equipped with a bypass stack and is fed through a mechanical collector where primary particulate removal takes

TABLE 4-1. PROCESS INFORMATION FOR RICKENBACKER AIR FORCE BASE

Installation name	Rickenbacker Air Force Base (Rickenbacker Air National Guard Base)
Installation location	Columbus, Ohio
Fuel characteristics	Coal (3.6% sulfur)
Total rating	55,000 scfm
Number of separate FGD units	1
Number of boilers	6
Source capacity	210×10^6 Btu/h
Control system vendor	Research-Cottrell/Bahco
Control process	Limestone or lime scrubbing
Type of FGD system	Retrofit
Startup date	March 1976
Control system status	Operational
SO_2 removal efficiencies	90%+ design with lime operation; lower with limestone operation
Particulate removal efficiency	98% design
Water makeup	Open loop
Sludge or byproduct disposal	Unstabilized $CaSO_3/SO_4$ sludge to lined pond

place. The mechanical collector has a design removal efficiency of 70 percent and was installed primarily to reduce wear on the booster fan, which is located immediately downstream. The fan introduces the partially cleaned flue gas into the scrubbing tower where SO_2 removal takes place.

The scrubber is a vertical tower consisting of two inverted venturi scrubbing stages. Untreated gas is introduced into the first stage, where it is diverted downward to impinge on the liquid slurry surface of the mill. The gas then rises through the first stage venturi, where it intimately mixes with the slurry droplets now entrained in it. The partially scrubbed gas is then diverted downward onto the liquid slurry surface in the second stage pan, and the process is repeated. The treated gas is then directed upward into a cyclonic mist eliminator where entrained slurry droplets are removed, and then emitted through a stub stack to the atmosphere.

The reagent for the scrubbing system is fine mesh limestone or pebble lime slurry. Normally limestone is used, but for the purpose of this test lime was employed. The reagent slurry is introduced through the scrubbing system in a countercurrent fashion.

The spent scrubbing solution is discharged to the thickener where waste solids settle out. Thickener overflow is returned to the mixing tank. Underflow from the thickener is discharged to a 5-acre Hypalon-lined disposal pond located approximately 400 feet from the FGD system. Figure 4-1 is a flow diagram of the Research-Cottrell (R-C)/Bahco scrubbing system.

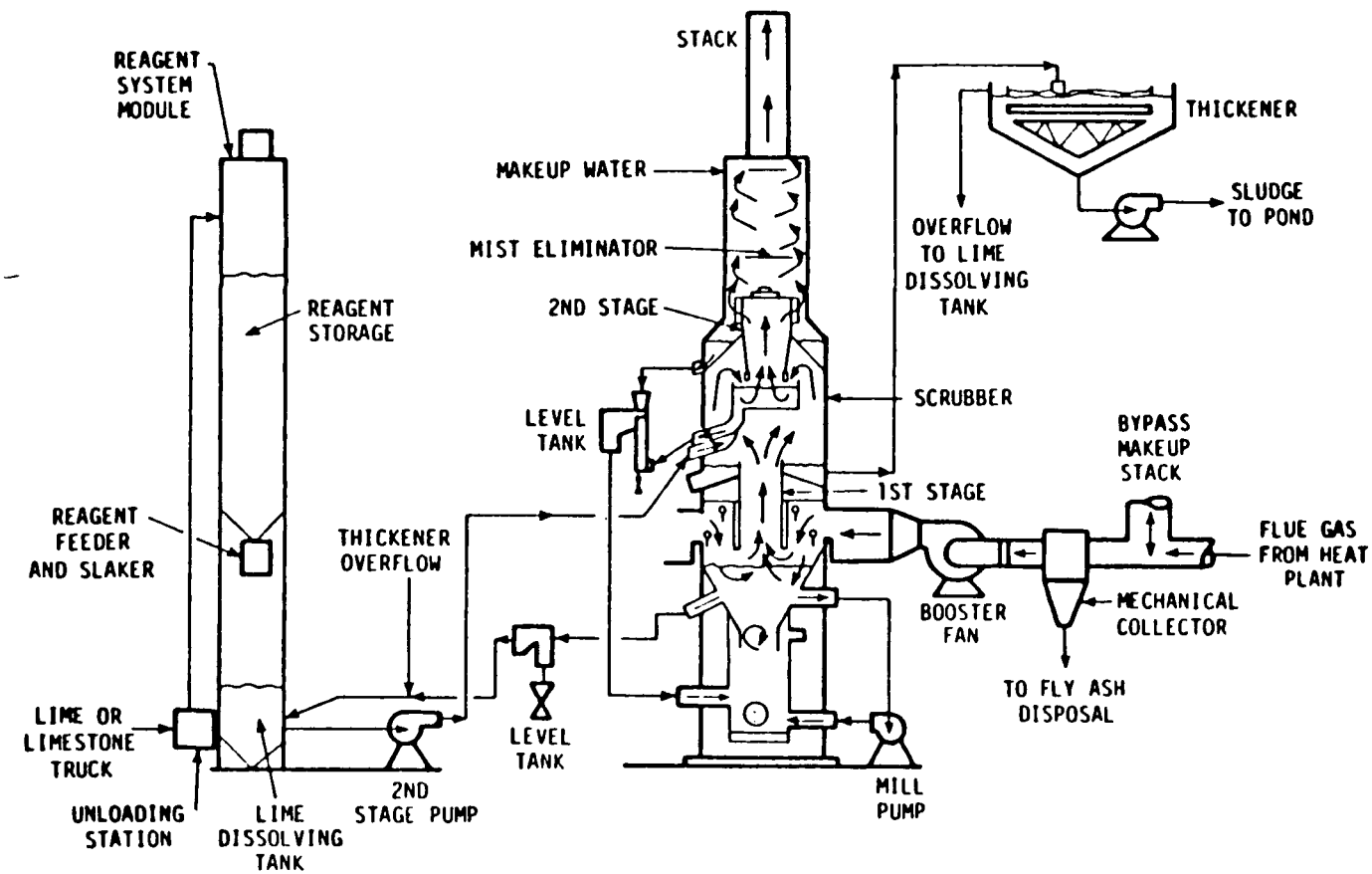

Figure 4-1. R-C/Bahco scrubbing system flow diagram.

4.2 BACKGROUND INFORMATION

4.2.1 Boiler System

Seven stoker-fired boilers, each rated at 31 x 10^6 Btu/h capacity were originally installed between 1954 and 1956. In June 1977, a new stoker-fired boiler rated at 60 x 10^6 Btu/h came into service to replace two of the older units, which have now been demolished.

4.2.2 FGD System

The FGD system was retrofitted to the boiler system and was placed in service in March 1976. It was manufactured by A.B. Bahco Ventilation of Enkoping, Sweden, and installed by Research-Cottrell. Following initial testing using lime as a scrubbing reagent, it has operated mainly on cheaper, less reactive limestone, because such operation was sufficient to meet local requirements for SO_2 removal. From January 19 to April 10, 1980, the system was operated with lime reagent to test the system at 90%+ removal efficiency.

4.3 PROCESS CONTROL DURING TEST

4.3.1 Boiler System

During the test the boiler system was operated in normal fashion. Average total boiler load during data collection days was 109 x 10^6 Btu/h, which is 52 percent of the total system capacity. Generally, three to five boilers were sufficient to meet heat demand during the period, with the remainder on standby status.

Coal for firing was loaded through underground transfer chutes from the reserve coal pile or coal delivery trucks. The coal was transferred to silos, with a 3- to 5-day residence time before loading to the gravity hoppers at the boiler stokers. Coal from the Broken Aro Mine in Ohio (Peabody Coal Company) was supplied from reserves until February 7; truck deliveries from Broken Aro then resumed and continued until February 28. From February 7 to 28, truck deliveries were directly loaded to the transfer silos. From February 29 onward, coal from the Horizon Mine in Ohio (Yancy Minerals) was delivered and directly loaded to the transfer silos. Some Broken Aro Coal was brought from the reserve coal pile during early March, but the total quantity, equaling about a 1/2-day delivery, was insignificant. Proximate assays of coal delivered during the test period are listed in Table 4-2. The assay sheets are included in the appendix in this volume.

4.3.2 FGD System

In addition to SO_2 emissions, parameters that are monitored during normal operation include pressure drop, total gas flow, gas temperature, pH, lime feed, water level, and slurry density. The frequency and function of monitoring these parameters are described in detail.

Pressure drop is tested across the two stages of the scrubber. This serves as a diagnostic check; an increase in pressure drop indicates scaling or plugging. The pressure drop can be adjusted by changing the weir gate heights in the first-

TABLE 4-2. ASSAYS OF COAL DELIVERED AND BURNED FROM JANUARY 16 TO MARCH 19

Date delivered in 1980	Sulfur content (dry),[a] %	Heating value (dry),[a] Btu/lb	SO_2 emission rate,[b] lb/10^6 Btu	Mine	Date burned in 1980
1/16-1/17	2.9	13,080	4.21	Horizon	Stockpiled[d]
1/17-1/29	3.0	13,140	4.34	Horizon	Stockpiled
2/7-2/15	3.9	13,540	5.47	Broken Aro[e]	2/11-2/19[f]
2/15-2/28	3.7	13,470	5.22	Broken Aro	2/19-3/3
2/29-3/6	2.3	12,900	3.39	Horizon	3/3-3/10[g]
3/6-3/14	3.1	13,260	4.44	Horizon	3/10-3/19

[a] See Assay Sheets in appendix.

[b] Determined by the following equation:

$$SO_2 \text{ emission rate} = 2 \times \frac{\% S}{100} \times \frac{10^6}{\text{heating value}} \times (0.95)$$

where 2 = conversion of lb S to lb SO_2

0.95 = proportion factor for SO_2 conversion

10^6 heating value = conversion of Btu/lb to lb/10^6 Btu.

[c] Horizon coal supplied by Yancy Minerals.

[d] Coal delivered and stockpiled; Broken Aro coal from yard burned; no assay of coal burned these dates is available.

[e] Broken Aro coal supplied by Peabody Coal Co.

[f] Four-day lag (average lag of 3 to 5 days) assumed.

[g] Some Broken Aro coal from yard burned.

and second-stage level tanks. During the test period, however, no changes in pressure drop were made.

Total gas flow is measured at the scrubber inlet and is normally recorded continuously. During the test period, the transmitter supplying this data was malfunctioning. Consistent gas flow rates were maintained by monitoring the amperage drawn by the forced draft fan at the scrubber inlet.

Temperature levels are monitored at the scrubber inlet and the scrubber bypass stack. High temperatures indicate the passage of boiler flue gas at either point. Alarms, which are set to activate when inlet temperatures fall below 300°F or when bypass temperatures exceed 300°F, indicate probable boiler or scrubber shutdown.

The pH levels are monitored continuously at the first scrubber stage and at the dissolver tank. The metering system does not operate any control loops, but activates alarms when the pH at either point drops below 4. This alarm indicates that a malfunction of the lime feed mechanism has probably occurred and that remedial action is required. In conjunction with CEM outputs, pH levels are used to adjust the lime feed for desired SO_2 removal efficiency.

Pebble lime feed is regularly checked and recorded during each shift. More frequent checks are indicated by changes in pH or SO_2 emission levels. The feed system is designed to be controlled through an automatic control loop by the outlet SO_2 analyzer. When SO_2 concentration exceeds 200 ppm, the system is

designed to increase the lime feed. This control loop is not normally used because of operational difficulties and was disconnected during the test.

System water levels are automatically readjusted when water level drops in the lime dissolver tank. Makeup water is added by spray nozzles above the second stage of the scrubber and serves the secondary purpose of removing slurry buildup on the inside walls of the scrubber.

Slurry density is monitored continuously at the mill below the first stage of the scrubber. When slurry density exceeds 50 percent, waste sludge is automatically pumped to the pond.

During the test period, the lime feed rate from storage to the slaker was the only significant control needed to achieve desired SO_2 removal efficiency. Plant operators on all shifts made periodic checks of the FGD performance, as evidenced by the CEM output, and adjusted the lime feed rate as needed. Because the CEM used a measuring range ratio of 10:1 for inlet and outlet SO_2 readings and recorded them on the same chart, it was easy for plant operators to note when adjustments were needed. The only significant periods recorded during which the FGD system did not operate at approximately 90% or better SO_2 removal efficiency occurred when the lime feed rate control was lost because of mechanical breakdown of the lime slaker.

SECTION 5

CONTINUOUS EMISSION MONITORING SYSTEM DESCRIPTION

The CEM consisted of an SO_2 monitoring system permanently installed at the plant with an O_2 monitor temporarily installed for the purpose of the test. Additional changes made to the existing system included repositioning the inlet and outlet probes to ensure sampling from centroid cross sectional areas of the ducts, installation of recorders with greater data resolution than existing equipment, and installation of a calibration gas delivery system. Figure 5-1 shows sampling locations in regards to FGD process, and Figure 5-2 is a simplified schematic of the CEM. This section describes the CEM components.

5.1 SAMPLING INTERFACE

The monitoring system utilized a DuPont 460 instrument system to provide the extractive sample from both sampling locations. Sample gas was pulled through a stainless steel mesh filter screen inside the duct through a heated probe equipped with a blowback system, and into a heated teflon sample line. The samples were then drawn to the monitor, which was located in the FGD system control room at ground level. The differentiation between sampling the two different sample gas streams was controlled automatically on a 10-minute cycle by the DuPont

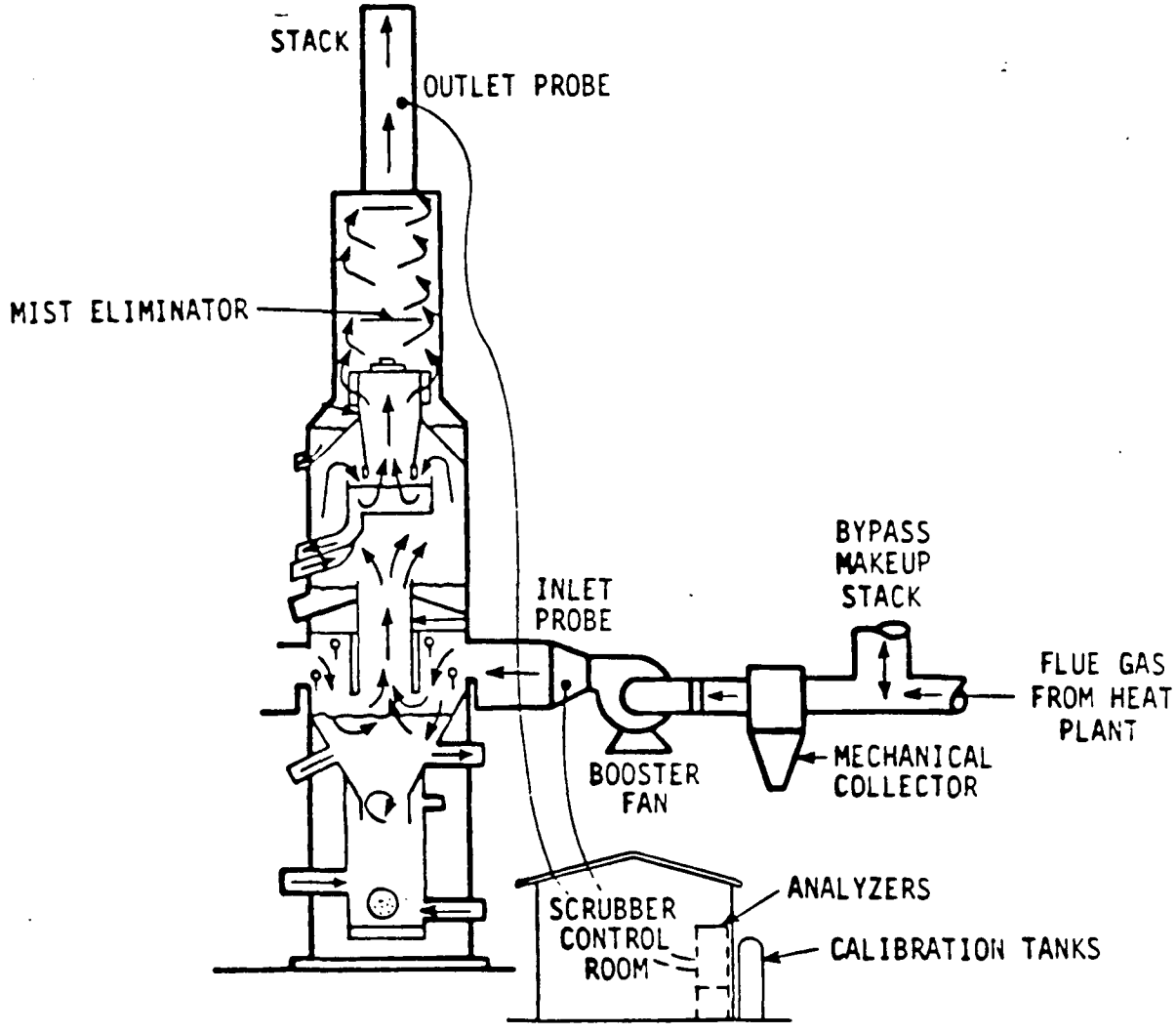

Figure 5-1. Sampling locations after modifications.

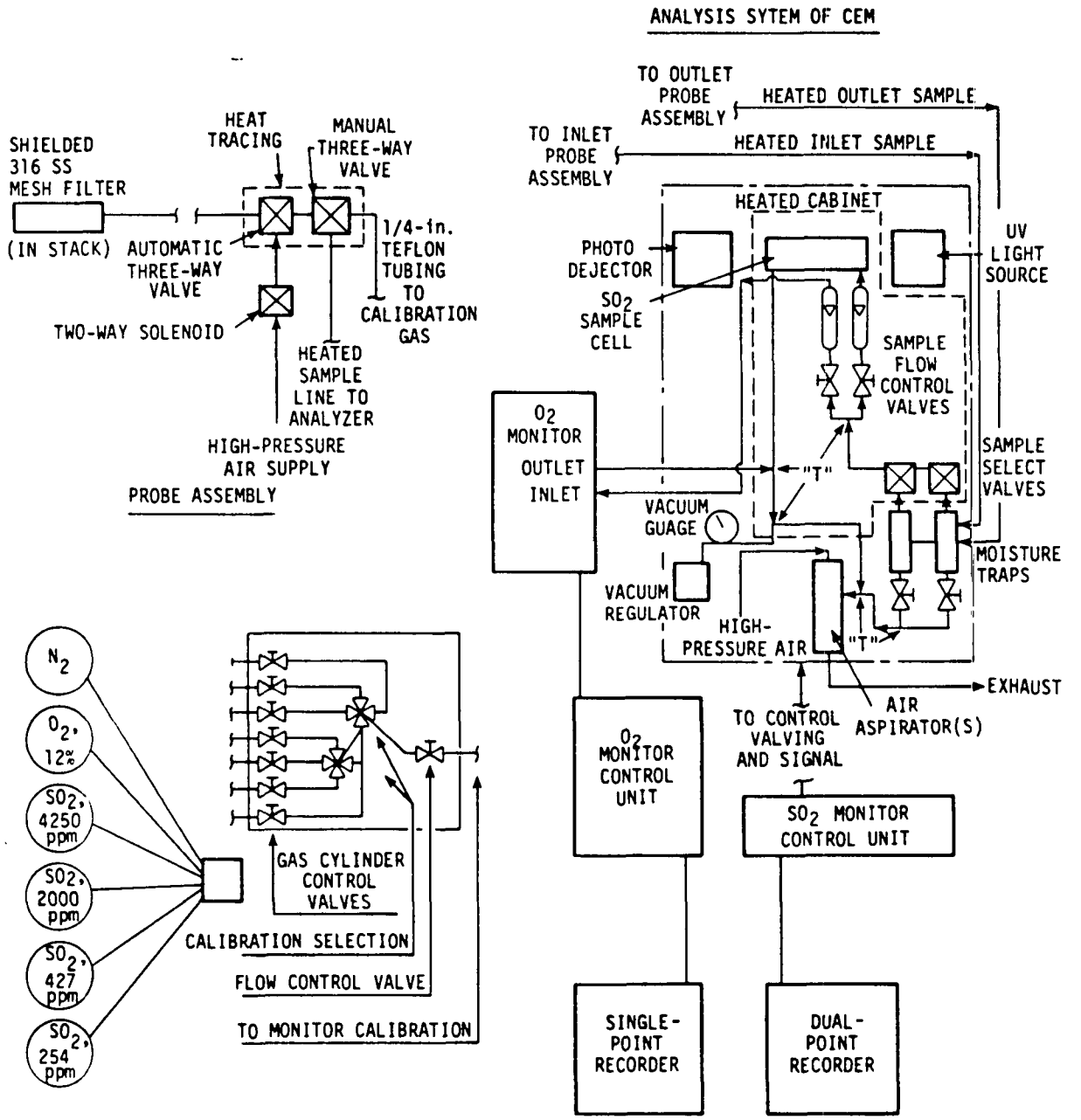

Figure 5-2. Simplified schematic of CEM.

unit. A sidestream sample for the oxygen monitor was taken from the unit in a flow fashion parallel to the SO_2 analysis cell. The sample dewpoint was controlled by temperature-constant mist knockout traps upstream from SO_2 and O_2 analysis. The dewpoint of SO_2 samples were held at a maximum of approximately 120°F and 5 in. Hg vacuum; O_2 sample dewpoints were held at a maximum of 68°F and 5 in. Hg vacuum.

5.2 SO_2 MONITOR

The SO_2 monitor was a DuPont 460 analyzer, which measures SO_2 by ultraviolet spectrophotometry. This is accomplished by drawing a sample into a windowed cell, passing ultraviolet light through the sample, and measuring the photometric output obtained in a wavelength specific to SO_2 absorption. Inlet and outlet samples are differentiated by electronic track and hold circuits that are actuated by the timing mechanism that controls the sample flow. An automatic zeroing system operates on the sample cycle, correcting for fluctuations and drift every 10 minutes.

5.3 O_2 MONITOR

The O_2 monitor was a Thermox WDG III analyzer, which measures O_2 by electrochemical means across a heated zirconium oxide cell. Sample gas flow was provided by the DuPont 460 unit. The inlet and outlet sample streams were differentiated by the occurrence of a purge function in the 10-minute cycle, which showed as an off-scale spike on the recorder chart.

5.4 RECORDERS

Leeds and Northrup Speedomax recorders were used to collect the data for the SO_2 and O_2 monitors. A dual-point recorder was used for the SO_2 data; a single-point recorder, for the O_2 data. The recorders were located in the FGD system control room with the analyzers. Time-marked charts were used to simplify data reduction.

5.5 CALIBRATION SYSTEM

A calibration system was used that included certified calibration gas cylinders and a valving system to facilitate introduction of gases to the CEM sampling interface. Zero, midscale (50% scale), and span (90% scale) gas concentrations were provided for the ranges used in analysis (0 to 500 ppm SO_2, 0 to 5000 ppm SO_2, and 0 to 25% O_2).

SECTION 6

PROCEDURES AND CALCULATIONS

6.1 CONTINUOUS SO_2 DATA COMPUTATIONS

Sulfur dioxide data computation was performed with a Hewlett-Packard 3000 computer system. Raw data were loaded into the program, and complete listing of emission rates and scrubber efficiencies were printed out for the entire test period.

6.1.1 Activities Before Computer Run

Keypunch Card Preparation--

Raw data were reduced and transcribed onto load sheets for keypunching onto computer cards. Additional cards were prepared to identify the data listings by location and date and to provide comments explaining cause and duration of data loss.

Comment cards were prepared by reference to CEM operator's logs and strip charts. Raw data load sheets, containing 15-minute listings of SO_2 and O_2 data and moisture, calibration data, and boiler information were prepared in the following manner:

1. The SO_2 and O_2 data were determined by processing raw strip charts through the use of a data digitizing device, which converted recorder deflections to digital values. The operation was manually performed, with readings for inlet and outlet SO_2 and O_2 being obtained and transcribed on a 15-minute basis.

2. Moisture determinations for each parameter were entered on the basis of availability of test data. Separate determinations were entered for inlet and outlet SO_2 and O_2. Separate determinations were also made for SO_2 and O_2 analysis, because the O_2 monitor operated with an ambient temperature sample line, which tended to remove some moisture.

3. Changes in monitor calibration caused by 24-hour drift were compensated for by entering span gas readings for each parameter on a 6-hour basis. These readings were interpolated from calibration information.

4. Boiler heat rates were taken from plant operating records, which contained summarized heat production rates in terms of 10^6 Btu/h. These were calculated by plant personnel as a determination from total boiler pressure and temperature differentials. The values were transcribed onto the load sheets on an hourly basis.

Other Computer Entries--

Calibration entries and boiler heat units were entered into the program before data runs to differentiate the computation from runs of other data using different values. Calibration entries needed were assays of the span gases used to obtain the readings keypunched with the data. The boiler heat unit entry signalled the proper heading for the listing of heat rates to be 10^6 Btu/h.

6.1.2 Computation and Listing of Data

Data computation was performed once the cards were loaded into the program, and listings were produced. Separate listings were produced for 15-minute SO_2 and O_2 readings; 1-hour average inlet emission rate (Ein), outlet emission rate (Eout), and removal efficiency (Eff); and 24-hour average Ein, Eout, and Eff. Listings also included total averages for 1-hour and 24-hour Ein, Eout, and Eff.

15 Minute Listings--

Complete 15-minute listings were prepared from the information loaded on the cards. These listings presented the following information:

1. Heading, identifying the source and date on each page of listings.

2. Raw CEM data, corrected for calibration, but on a wet basis, presented on a 15-minute basis.

3. Moisture data for each gas stream in percent H_2O, presented on a 15-minute basis.

4. Corrected CEM data, calculated by multiplying raw data by the quantity 100/(100-M), where M equals the moisture percent.

5. Average Ein, Eout, and Eff, calculated on an hourly basis from average corrected SO_2 and O_2 data. The following equaitons were used:

$$\text{lb } SO_2/10^6 \text{ Btu} = (\text{ppm } SO_{2\,dry})(9820)(1.64 \times 10^{-7}) \times \frac{(20.95)}{(20.95 - \%\ O_2 dry)} \qquad \text{(Eq. 6-1)}$$

where 9820 = bituminous coal factor for dscf/10^6 Btu, utilizing excess air factor

1.64×10^{-7} = conversion of ppm SO_2 to lb SO_2/dscf

$\frac{20.95}{(20.95 - \%\ O_2 dry)}$ = excess air factor

$$\text{Eff} = \frac{\text{Ein} - \text{Eout}}{\text{Ein}} \times 100 \qquad \text{(Eq. 6-2)}$$

Two data points per hour were needed for a calculation to be performed. Equation 6-1 was used to calculate Ein and Eout, and Equation 6-2 was used to calculate Eff.

6. Boiler information, printed in 10^6 Btu/h on an hourly average basis.

7. Comments, printed as entered in the appropriate locations to identify data loss periods.

8. Data loss periods, signified by repetition of previous listed number, or with the printing of ### symbols.

1-Hour and 24-Hour Listings and Averages--

Hourly averages of Ein, Eout, and Eff and boiler heat rates were obtained from calculations performed during computation of 15-minute listings. These were compiled to form hourly and daily listings of data on a 1-hour and 24-hour averaging basis. Each listing was summarized in a brief statistical format that listed the data quantity base, minimum and maximum values, mean, and standard deviation for each parameter. Total test averages were grouped into time periods determined by a 30 day limitation on data averaging. The individual listing and averaging procedures are described below:

1. Hourly listings were compiled for each 24-hour calendar day with statistical determinations performed for each parameter that had an occurrence of 75 percent or greater (eighteen 1-hour averages per 24-hour day). For each parameter that met the 75 percent data capture condition, the hourly and daily averages were stored for future computation.

2. The total hourly averages from periods of 75 percent data per day were run through statistical determinations for each parameter. These computations were performed for the groupings determined by the 30-day data computation limitation. For determination of 30-day data, data days were included that listed 18 or more hours of data capture for any parameter (excluding heat rates), even if FGD efficiency was not determined during a particular day.

3. The 24-hour listings and averages were performed for the 30-day data groupings described above. All data representing 18 or more hours of data capture per day of Ein, Eout, or Eff were listed. Statistical determinations were performed on the 30-day data groupings independently and presented following each listing.

6.2 PERFORMANCE SPECIFICATION TESTING

The P/S test procedures and calculations were in accordance with guidelines specified by Performance Specifications 2 and 3 in the Federal Register, Vol. 44, No. 197, October 10, 1979. Manual Methods 3 and 6 were performed to complete system relative accuracy tests. In addition to the procedures outlined below pertaining to the performance of these tests, procedures were needed to ascertain CEM outputs correctly. The procedures and calculations employed for determining CEM outputs in the field are outlined in Section 6.5.

6.2.1 Calibration Gas Certification

All SO_2 and O_2 calibration gases were traceable to NBS standards. The procedures for establishing traceability are outlined below.

Sulfur Dioxide Calibration Gas Certification--

The SO_2 calibration gases were supplied with certificates of analysis from the vendors establishing that the gases were analyzed by an acceptable instrument technique using calibration with NBS standards.

Oxygen Calibration Gas Certification--

The O_2 midrange (12%) was analyzed by ORSAT (EPA Method 3) and found to have a value within 5 percent of the vendor's tag value. The tag value was thus certified as acceptable. Ambient air was used as an O_2 span value calibration gas and needed no certification testing to establish its oxygen concentration.

6.2.2 Conditioning Period

The conditioning period was noted as beginning once the complete CEM, as described in Section 5, was determined to be fully operational. After 168 hours of continuous operation without modification or maintenance except as specified as routine and/or necessary by the CEM analyzer manufacturers, the period was deemed successfully completed.

6.2.3 Operational Test Period

Because of the extensive nature of the P/S testing (involving two complete sets of tests) and the short period of data acquistion (spanning less than 2 months), no distinct period of 168 hours was set aside, and the entire period of data acquisition was involved in operation testing. The QA testing was in providing continuity between initial and final P/S testing. The P/S tests procedures followed during this period are outlined below.

Calibration Error--

Both operational ranges of the SO_2 monitor and the single operational range of the O_2 monitor were involved in this test. Calibration values of midrange and span gases were used as determined in Section 6.2.2. The individual checks were performed by running zero, midrange, and span gases in random order through the monitors until five complete sets (15 data points) for each operating range were obtained. Figure 6-1 presents a sample data sheet and the equations used to determine calibration error.

Run no.	Calibration gas concentration, ppm	Measurement system reading, ppm	Arithmetic differences, ppm	
	A	B	A-B	
			Mid	High
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
Arithmetic Mean =				
Confidence Interval =				
Calibration Error =				

Arithmetic Mean (AM) $= \frac{\Sigma x}{n}$

95% Confidence Interval (CI_{95}) $= \frac{t_{0.975}}{\sqrt{n-1}} \sqrt{n\Sigma(x^2) - (\Sigma x)^2}$

Calibration Error $= \frac{|AM| + CI_{95}}{RV}$

where x = arithmetic difference, ppm
n = number of data points
RV = calibration gas concentration, ppm
$t_{0.975}$ = t value as shown below

n^a	$t_{0.975}$	n^a	$t_{0.975}$	n^a	$t_{0.975}$
2	12.706	7	2.447	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

[a] Values are already corrected for n-1 degrees of freedom; use n equal to the number of individual values.

Figure 6-1. Sample data sheet and equations for the determination of calibration error.

System Response Time--

Both SO_2 operating ranges and the single O_2 operating range were checked for response time. The procedure entailed the alternating introduction of zero and span gases into the system and the recording of elapsed time between introduction and a stable reading. During the tests, gases were introduced to the sampling interface at the probe mountings, so that the response time included any lag caused by the sample line length. Gas flow rates during these tests were consistent with normal sampling procedures. Three sets of zero-to-span and span-to-zero checks were performed for each parameter. Response from either span or zero calibration gas to flue gas was not used because of minute-to-minute variability of flue gas readings, leading to inconsistent results. Figure 6-2 presents a sample data sheet and the equations used to determine system response time.

2-Hour Zero and Calibration Drift--

Both SO_2 operating ranges and the single O_2 operating range were tested to determine 2-hour drift. The strategy was to introduce consecutively zero and span gas at 2-hour intervals until 15 sets of data were obtained. Figure 6-3 presents a sample data sheet and the equations used.

24-Hour Zero and Calibration Drift--

Both SO_2 operating ranges and the single O_2 operating range were tested to determine 24-hour drift. Initial readings were

Date_____ High-level = _____ ppm

Test Run	Upscale, min	Downscale, min
1		
2		
3		
Average	A =	B =

System Response Time (slower of A and B) = _____ min.

$$\text{Average} = \frac{\Sigma x}{n}$$

$$\frac{|A-B|}{(\text{Slower of A and B})} \times 100 \leq 15\%; \text{ otherwise retesting is required.}$$

where x = individual response, minutes
n = number of test runs (3)

Figure 6-2. Sample data sheet and equations for determination of system response time.

Data set no.	Date	Time Begin	Time End	Zero Rdg Init. A	Zero Rdg Fin. B	Zero drift C=B-A	Hi-level Rdg Init. D	Hi-level Rdg Fin. E	Span drift F=E-D	Calib. drift G=F-C
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
Arithmetic Mean										
Confidence Interval										
Zero Drift							Calibration drift			

Arithmetic Mean (AM) $= \frac{\Sigma x}{n}$

95% Confidence Interval (CI_{95}) $= \frac{t_{0.975}}{n\sqrt{n-1}} \sqrt{n\Sigma(x^2) - (\Sigma x)^2}$

Zero or Calibration Drift (SO_2 monitor) $= \frac{|AM| + CI_{95}}{RV} \times 100$

Zero or Calibration Drift (O_2 monitor) $= (|AM| + CI_{95}) \times 0.25$

where
x = individual drift, %
n = number of data points (15)
Zero RV = total scale, % (100)
Calibration RV = calibration gas assay multiplied by 100 and divided by the range, ppm
$t_{0.975}$ = t value as shown below
0.25 = conversion of % scale to % O_2

n[a]	$t_{0.975}$	n[a]	$t_{0.975}$	n[a]	$t_{0.975}$
2	12.706	7	2.447	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

[a] Values are already corrected for n-1 degrees of freedom; use n equal to the number of individual values.

Figure 6-3. Sample data sheet and equations for determination of 2-hour zero and calibration drift.

obtained for each 24-hour period by calibrating each instrument and recording the zero and span readings after calibration. Final readings were obtained by recording the precalibration zero and span readings on the following day. A complete set of data for 24-hour drift determination consisted of seven consecutive 24-hour drift determinations. Figure 6-4 presents a sample data sheet and the equations used.

System Relative Accuracy--

System relative accuracy tests consisted of comparing CEM and reference method determined emission rates in lb $SO_2/10^6$ Btu. The CEM determinations were obtained by utilizing integrated averages of monitor output. Reference method determinations were obtained using Methods 6 and 3 for SO_2 and O_2. Moisture determinations were performed with Reference Method 6 to enable comparison of CEM and reference method results on a dry basis. Guidelines provided by Performance Specification 2 in the Federal Register, Vol. 44, No. 197, October 10, 1979, were followed.

1. Reference Method 6 samples were collected in an integrated sampling train from a probe situated in the same cross-sectional centroidal area (<5% stack diameter) as the CEM probe tip. Reference Method 3 bag samples were collected from the same sampling point.

2. Nine conccurrent Reference Method 3 and 6 tests were performed to complete each set of system relative accuracy data. At any given sampling site (inlet or outlet of FGD system), no more than one test per hour was allowed. The tests were performed when the CEM was in the normal data collecting mode, without interference from 2-hour drift, calibration error, response

Data set no.	Date	Time		Zero	Rdg	Zero drift	Hi-level Rdg		Span drift	Calib. drift
		Begin	End	Init. A	Fin. B	C=B-A	Init. D	Fin. E	F=E-D	G=F-C
1										
2										
3										
4										
5										
6										
7										
Arithmetic Mean										
Confidence Interval										
Zero drift							Calibration drift			

Arithmetic Mean (AM) $= \frac{\Sigma x}{n}$

95% Confidence Interval (CI_{95}) $= \frac{t_{0.975}}{n\sqrt{n-1}} \sqrt{n\Sigma(x^2) - (\Sigma x)^2}$

Zero or Calibration Drift (SO_2 monitor) $= \frac{|AM| + CI_{95}}{RV} \times 100$

Zero or Calibration Drift (O_2 monitor) $= (|AM| + CI_{95}) \times 0.25$

where
- x = individual drift, %
- n = number of data points (7)
- Zero RV = total scale, % (100)
- Calibration RV = calibration gas assay multiplied by 100 and divided by the range, ppm
- $t_{0.975}$ = t value as shown below
- 0.25 = conversion of % scale to % O_2

n[a]	$t_{0.975}$	n[a]	$t_{0.975}$	n[a]	$t_{0.975}$
2	12.706	7	2.447	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

[a] Values are already corrected for n-1 degrees of freedom; use n equal to the number of individual values.

Figure 6-4. Sample data sheet and equations for determination of 24-hour zero and calibration drift.

time, or 24-hour calibration tests. Samples were synchronized with CEM 10-minute sampling cycles to allow three separate CEM measurements to be averaged for each test.

3. The CEM data were determined from recorded strip charts in terms of SO_2 and O_2 concentration on a wet basis. Three readings of each were averaged for each test. Reference Method 6 moisture data were used (after correction for CEM dewpoint) to convert CEM SO_2 and O_2 readings to a dry basis. Emission rates in terms of lb $SO_2/10^6$ Btu were then determined by Equation 6-1. The CEM and reference method data and calculated emission rates were recorded, and correlations were determined on data sheets. Figure 6-5 presents a sample data sheet and the equations used to determine system relative accuracy.

6.3 DETERMINATION OF FACTORS ACCOUNTING FOR DATA CAPTURE AND LOSS PERIODS

6.3.1 FGD Determinations

Operability, reliability, availability, and utilization represent different facets of FGD system operations, including excursions, in terms of percentages. The calculations used to determine them are presented below:

1. $$\text{Operability} = \frac{\text{hours FGD operated}}{\text{hours boiler operated}} \times 100$$

2. $$\text{Reliability} = \frac{\text{hours FGD operated}}{\text{hours called on to operate}} \times 100$$

3. $$\text{Availability} = \frac{\text{hours FGD capable of operation}}{\text{hours in period}} \times 100$$

4. $$\text{Utilization} = \frac{\text{hours FGD operated}}{\text{hours in period}} \times 100$$

For data capture, only normal operations were considered, and FGD excursions were excluded. Operability as determined by this limitation is calculated as follows:

$$\text{Normal operability} = \text{operability} - \left[\frac{\text{(hours of excursions)}}{\text{(boiler hours)}} \times 100\right]$$

Run no.	Date and time	SO_2			O_2		SO_2		
		RM	M	Diff	RM	M	RM	M	Diff
		ppm			%		mass/GCV		
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
Average									
Confidence Interval									
Accuracy									

RM - reference method result; M - monitoring system result; and mass/GVC - mass per gross caloric value, $lb/10^6$ Btu.

$$\text{Average (A)} = \frac{\Sigma x}{n}$$

$$\text{95\% Confidence Interval } (CI_{95}) = \frac{t_{0.975}}{\sqrt{n-1}} \sqrt{n\Sigma(x^2) - (\Sigma x)^2}$$

$$\text{Accuracy} = \frac{|A| + CI_{95}}{RV} \times 100$$

where

x = individual result
n = number of data points
RV = average of reference method results
$t_{0.975}$ = t value as shown below

n[a]	$t_{0.975}$	n[a]	$t_{0.975}$	n[a]	$t_{0.975}$
2	12.706	7	2.447	12	2.201
3	4.303	8	2.365	13	2.179
4	3.182	9	2.306	14	2.160
5	2.776	10	2.262	15	2.145
6	2.571	11	2.228	16	2.131

[a] Values are already corrected for n-1 degrees of freedom; use n equal to the number of individual values.

Figure 6-5. Sample data sheet and equations for determination of system relative accuracy.

6.3.2 CEM Operability Determinations

Inlet operability represents the capability of the CEM inlet sampling system to gather data. The determination includes data capture during periods of excursions and is calculated as follows:

$$\text{CEM inlet operability} = \frac{\text{(hours of inlet data)}}{\text{(hours FGD operated)}} \times 100$$

Outlet operability represents the capability of the CEM outlet sampling system to gather data. The determination does not consider FGD operation during excursions and is calculated as follows:

$$\text{CEM outlet operability} = \frac{\text{(hours of outlet data)}}{\text{(FGD hours - hours of excursions}} \times 100$$

6.4 QUALITY ASSURANCE

The QA procedures were designed to provide the most consistency with P/S procedures that was practicable. The 24-hour drift determinations and system relative accuracy tests were performed in the same manner as in P/S testing, but the reporting of QA system relative accuracy differed because of the abbreviated nature of the weekly data (only three tests per week for QA compared with nine for P/S). Moisture determinations were performed in the same manner as during P/S testing and, because of the wet gas CEM analysis system, provided a vital data parameter for final data listings. The QA tests are described below.

6.4.1 24-Hour Drift Tests

The 24-hour drift tests were performed in exactly the same manner as P/S tests; the results were based on daily calibration information collected from January 25 through March 18. Subsection 6.2.3 explains the procedures and calculations used. Weekly results are listed.

6.4.2 System Relative Accuracy Tests

The system relative accuracy tests were performed on a weekly basis by virtually the same test procedures outlined in Subsection 6.2.3. The only difference was in the reporting of data results. Because a relatively small (three-point) data base was provided for each test, averages of results were reported on a weekly basis, with no utilization of a 95 percent confidence interval.

6.4.3 Moisture Determinations

Manual Method 6 test moisture data gathered during P/S and QA testing provided the base for moisture determinations. Providing accurate values for use in correcting CEM data required assaying the mositure at the point of analysis; thus, removal of moisture between extraction from stack and analysis had to be accounted for. This was done according to the following equations:

$$\text{percent moisture} = \text{lowest of A or B} \qquad \text{(Eq. 6-3)}$$

where A = stack moisture, percent

B = dewpoint moisture, percent

$$\text{percent dewpoint moisture} = \frac{\text{partial pressure of } H_2O \text{ a+t}}{\text{pressure of system}} \times 100 \qquad \text{(Eq. 6-4)}$$

where t = lowest temperature of interface before analysis point

pressure of system = 25 in. Hg

Equations 6-3 and 6-4 had to be applied to each monitor as well as to each gas stream, because the monitor configuration resulted in different lowest-point temperatures in the O_2 and SO_2 sampling interfaces. In all cases the lowest calculated moisture value was reported. The lowest temperature of the O_2 monitor interface was room temperature (68°F) because unheated lines were used to transfer sample gas to the O_2 monitor. The lowest temperature of the SO_2 monitor interface was measured on a daily basis at the mist knockout traps provided with the DuPont 460 system and generally exceeded 100°F. System pressure was assumed to be 25 in. Hg for determining partial pressure of moisture, based on 5 in. Hg vacuum and 30 in. Hg average atmospheric pressure.

Special moisture determinations were performed downstream from the outdoors sample lines during a period when cold temperatures apparently cooled sample lines to below the DuPont 460 knockout trap temperature dewpoint, as evidenced by no condensate collection. These tests were performed by diverting sample gas from the analyzer and passing a measured volume of the gas through preweighed silica gel. Care was taken during these tests to approximate closely normal sampling flow rates and cycles to minimize variations that might cause different condensation rates in the sample lines.

6.5 DETERMINATION OF CEM OUTPUT IN THE FIELD

The values used to convert raw data to final output readings in terms of emission rates had to be determined in the field to provide data for performance specificaiton and QA. It was important that the field values be accurately determined and reflect the values transcribed for the final listings (Subsection 6.1) in order that field test data reflect the quality of the final data listings. The procedures used for reducing CEM data in the field are outlined below:

Reading of Raw Strip Charts--

Scale deflection percentages were read from strip charts and used without conversion to parts per million of SO_2 or percentages of O_2 for system response and drift tests. For calibration error and system relative accuracy tests, conversion of scale deflections (averages of three points for system relative accuracy) were multiplied by the appropriate span gas assay and divided by the last previous span gas reading to make this conversion, as indicated by the following equation:

$$\text{ppm } SO_2 \text{ or } \%\ O_2 = \text{reading, \% of scale} \times \frac{\text{assay of span gas}}{\text{span gas reading, \% of scale}} \qquad \text{(Eq. 6-5)}$$

Determination of Dry Concentrations--

Dry SO_2 and O_2 concentrations had to be determined to correlate CEM and manual methods data during system relative accuracy tests. This was accomplished by multiplying raw data

values by the factor 100/(100 - M), where M is the appropriate moisture content. The M values for inlet SO_2, inlet O_2, outlet SO_2, and outlet O_2 were determined separately, as discussed in Subsection 6.3.3.

6.6 DETERMINATION OF PARTICULATE AND NO_x CONCENTRATIONS

Particulate and NO_x concentrations were determined to characterize the effects of the FGD system on these two parameters. Approved sampling techniques and representative process operation were needed during the tests to obtain representative concentrations. The following procedures were followed to ensure this:

1. Plant personnel were consulted to ensure that the tests were not performed during process upsets (e.g., soot blowing, changing of boiler load, etc.).

2. Process operations were observed by field personnel during the tests to ensure that any unexpected upsets were noted.

3. The U.S. Environmental Protection Agency Reference Methods 5 and 7 were used to perform the particulate and NO_x tests.

4. Representative sampling locations were chosen, as discussed in Subsection 6.2 and illustrated in Figures 3-1 and 3-2.

5. Inlet and outlet samples were taken concurrently to ensure representativeness of samples to the same gas stream.

Procedures, apparatus, and calculations used during the tests are presented in Appendix C.

APPENDIX

CALIBRATION GAS CERTIFICATION AND FGD INFORMATION

CONTENTS

LIQUID CARBONIC
Subsidiary of Houston Natural Gas Corporation

SPECIALTY GAS and CHEMICAL PRODUCTS

CERTIFICATE OF ANALYSIS

Pedco Environmental

11499 Chester Road

Cincinnati, Ohio 45246

Attention: Steve Howie

Date: 3-6-80

Ref. #

Cust. P.O. # PEI79-169-333-X

Product Gas Mixture

Components	Requested	Cyl. Serial No. SGAL 2328 Actual	Cyl. Serial No. Actual	Cyl. Serial No. Actual
Sulfur Dioxide	425ppm	427ppm		
Nitrogen	Balance	Balance		

Cyl. Volume 150 cf.

CGA Valve No. 660

Total Cyl. Pressure 2000psi.

Method of Analysis:

Gas Chromatography

Using NBS Standards

486ppm SO_2/Bal. N_2

2521ppm SO_2/Bal. N_2

Certified By: John Edwards

John Edwards

A-3

It is recommended the above cylinders not be depleted below 50 psig unless otherwise indicated.

FORM St-02991 REV. 9/72

PRINTED IN U.S.A.

LIQUID CARBONIC
Subsidiary of Houston Natural Gas Corporation

SPECIALTY GAS and CHEMICAL PRODUCTS

CERTIFICATE OF ANALYSIS

To: Pedco Environmental
11499 Chester Road
Cincinnati, Ohio 45246
Attention: Steve Howie

Date: 3-6-80
Ref. #
Cust. P.O. # PEI 79-169-333-X

Product Gas Mixture

Components	Requested	Cyl. Serial No. SGAL 2312 Actual	Cyl. Serial No. Actual	Cyl. Serial No. Actual
Sulfur Dioxide	250ppm	254ppm		
Nitrogen	Balance	Balance		

Cyl. Volume 150 cf.

CGA Valve No. 660

Total Cyl. Pressure 2000psi.

Method of Analysis:

Gas Chromatography

Using NBS Standards
486ppm SO_2/Bal. N_2
2521ppm SO_2/Bal. N_2

Certified By: John Edwards

John Edwards

A-4

It is recommended the above cylinders not be depleted below 50 psig unless otherwise indicated.

FORM St-02991 REV. 9/72

PRINTED IN U.S.A.

LIQUID CARBONIC
Subsidiary of Houston Natural Gas Corporation

SPECIALTY GAS and CHEMICAL PRODUCTS

CERTIFICATE OF ANALYSIS

Pedco Environmental Inc.
11499 Chester Road
Cincinnati, Ohio 45246
Attention: Steve Howie

Date: 3-6-80
Ref. #
Cust. P.O. # PEI79-164-333-X

Product Gas Mixture

Components	Requested	Cyl. Serial No. SCAL 2331 Actual	Cyl. Serial No. Actual	Cyl. Serial No. Actual
Sulfur Dioxide	2000ppm	2000ppm		
Nitrogen	Balance	Balance		

Cyl. Volume 150 cf.

CGA Valve No. 660

Total Cyl. Pressure 2000psi.

Method of Analysis:

Gas Chromatography

Using NBS Standards
486ppm SO_2/Bal. N_2
2521ppm SO_2/Bal. N_2

Certified By: John Edwards

John Edwards

A-5

It is recommended the above cylinders not be depleted below 50 psig unless otherwise indicated.

FORM St-02991 REV. 9/72

PRINTED IN U.S.A.

LIQUID CARBONIC
Subsidiary of Houston Natural Gas Corporation

SPECIALTY GAS and CHEMICAL PRODUCTS

CERTIFICATE OF ANALYSIS

To: Pedco Environmental Inc.
11499 Chester Road
Cincinnati, Ohio 45246
Attention: Steve Howie

Date: 3-6-80
Ref. #
Cust. P.O. # PEI79-164-333-X

Product Gas Mixture

Components	Requested	Actual (Cyl. Serial No. SGAL 2330)	Actual (Cyl. Serial No.)	Actual (Cyl. Serial No.)
Sulfur Dioxide	4250ppm	4250ppm		
Nitrogen	Balance	Balance		

Cyl. Volume 150 cf.

CGA Valve No. 660

Total Cyl. Pressure 2000psi.

Method of Analysis:

Gas Chromatography

Using NBS Standards
486ppm SO_2/Bal. N_2
2521ppm SO_2/Bal. N_2

Certified By: John Edwards

John Edwards

A-6

It is recommended the above cylinders not be depleted below 50 psig unless otherwise indicated.

FORM St-02991 REV. 9/72

PRINTED IN U.S.A.

3353 AA

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Pt. Eq.
DATE 12-17-79 TEST NO 1
SAMPLING TIME (24-hr CLOCK)
SAMPLING LOCATION LAB
SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) BAG Sample
ANALYTICAL METHOD ORSAT
AMBIENT TEMPERATURE 70
OPERATOR Bill Scott
ORSAT LEAK CHECKED ✓

COMMENTS: Cylinder # N 33878
Contents: O_2 12%
N_2 BAL.

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	.10	.10	0.00	0.00	0.00	0.00	0.03	44/100	.01
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	12.70	12.60	12.60	12.60	12.60	12.60	12.60	32/100	4.032
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

DRY MOLECULAR WEIGHT DETERMINATION

3333 AA

PLANT Rio Bravo

DATE 12-17-79 TEST NO 3

SAMPLING TIME (24-hr CLOCK)

SAMPLING LOCATION LAB

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag Sample

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE 70

OPERATOR Don Schaffer

ORSAT LEAK CHECKED ✓

COMMENTS: Cylinder # N 33878

Contents: O_2 12%

N_2 Bal.

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44/100	0.00
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	12.50	12.50	12.60	12.60	12.50	12.50	12.53	32/100	4.01
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

DRY MOLECULAR WEIGHT DETERMINATION

3333 AA

PLANT Pt. Tom END.

DATE 12-12-79 TEST NO 3

SAMPLING TIME (24-hr CLOCK) _____

SAMPLING LOCATION LAB

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Bag Sample

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE 70

OPERATOR DAN SHEETS

ORSAT LEAK CHECKED ✓

COMMENTS: Cylinder # N 33878
Contents: O_2 12.7%
N_2 Bal.

RUN / GAS	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	44/100	0.00
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	12.70	12.70	12.75	12.75	12.70	12.70	12.72	32/100	4.07
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

[illegible] DIVISION
COAL SAMPLING AND INSPECTION OFFICE
4800 FORBES AVENUE
PITTSBURGH, PENNSYLVANIA 15213

S. AIR FORCE
N ANTONIO ALC-SPSC
LLY AFB, TEXAS 78241

February 25, 1980

Gentlemen/Ladies:

The analysis of the sample submitted by Rickenbacker Air Force Base, Ohio covering 974.38 tons of 1¼ Inch by ¼ Inch coal delivered on your contract No. DLA-600-79-D-1676 and Item No. 9 by Yancey Minerals on 1/10-17, 1980 is as follows:

	AS RECEIVED	DRY COAL
Moisture	10.0	
Volatile matter		41.6
Fixed carbon		49.1
Ash		9.3
Total		100.0
Sulfur		2.9
British thermal units	11780	13080

This information is for the use of the Government and the dealer or operator furnishing the coal. It is confidential until it is published by the U. S. Government.

Sample No. 6 Lab. No. K99417 Mine Horizon, Ohio

Sampler No. 1 Ash-Softening temp. Degrees F. F.S.I.

RR car Nos. Truck Delivery

Remarks: Can #1484

Sincerely yours,

Analysis supervised by
FORREST E. WALKER
Chemist-in-charge, Coal Analysis

ROBERT A. WELSH
Coal Sampling and Inspection

[illegible] DIVISION
COAL SAMPLING AND INSPECTION OFFICE
4800 FORBES AVENUE
PITTSBURGH, PENNSYLVANIA 15213

AIR FORCE
[illegible] ALC-3PSC
AFB, TEXAS 78241

February 25, 1980

Gentlemen/Ladies:

The analysis of the sample submitted by Rickenbacker Air Force Base, Ohio

covering 977.68 tons of 1¼ Inch by ¼ Inch coal delivered on your

contract No. DLA-600-79-D-1676 and Item No. 9

by Yancey Minerals on 1/17-29 ,1980 is as follows:

	AS RECEIVED	DRY COAL
Moisture	8.5	
Volatile matter		41.6
Fixed carbon		49.1
Ash		9.3
Total		100.0
Sulfur		3.0
British thermal units	12030	13140

This information is for the use of the Government and the dealer or operator furnishing the coal. It is confidential until it is published by the U. S. Government.

Sample No. 7 Lab. No. K99418 Mine Horizon, Ohio

Sampler No. 1 Ash-Softening temp. Degrees F. F.S.I.

RR car Nos. Truck Delivery

Remarks. Can #2320

Sincerely yours,

Analysis supervised by
FORREST E. WALKER
Chemist in charge, Coal Analysis

ROBERT A. WELSH
Coal Sampling and Inspection

COAL PREPARATION DIVISION
COAL SAMPLING AND INSPECTION OFFICE
4800 FORBES AVENUE
PITTSBURGH, PENNSYLVANIA 15213

U.S. AIR FORCE
AF AL/MMID ALC-3FSC
KELLY AFB, TEXAS 78241

April 2, 1980

Gentlemen/Ladies:

The analysis of the sample submitted by Rickenbacker Air Force Base, Ohio

covering 989.15 tons of 1¼ Inch by ¾ Inch coal delivered on your

contract No. DLA-600-79-D-1663 and Item No. 4

by Peabody Coal Company on 2.7-15 ,19 80 is as follows:

	AS RECEIVED	DRY COAL
Moisture	6.9	
Volatile matter		45.8
Fixed carbon		47.7
Ash		6.5
Total		100.0
Sulfur		3.9
British thermal units	12610	13540

This information is for the use of the Government and the dealer or operator furnishing the coal. It is confidential until it is published by the U. S. Government.

Sample No. 7 Lab. No. L00268 Mine Broken Aro, Ohio

Sampler No. 1 Ash-Softening temp. Degrees F. F.S.I.

RR car Nos. Truck Delivery

Remarks: Can #2140

Sincerely yours,

Analysis supervised by
FORREST E. WALKER
Chemist in charge, Coal Analysis

A-12

ROBERT A. WELSH
Coal Sampling and Inspection

COAL PREPARATION DIVISION
COAL SAMPLING AND INSPECTION OFFICE
4800 FORBES AVENUE
PITTSBURGH, PENNSYLVANIA 15213

AIR FORCE
[redacted] AFLC-3PSC
[redacted]LY AFB, TEXAS 78241

April 2, 1980

Gentlemen/Ladies:

The analysis of the sample submitted by Rickenbacker Air Forse Base, Ohio

covering 981.54 tons of 1¼ Inch by ¼ Inch coal delivered on your

contract No. DLA-600-79-D-1663 and Item No. 4

by Peabody Coal Company on 2/15-28 ,1980 is as follows:

	AS RECEIVED	DRY COAL
Moisture	9.6	
Volatile matter		44.8
Fixed carbon		48.6
Ash		6.6
Total		100.0
Sulfur		3.7
British thermal units	12180	13470

This information is for the use of the Government and the dealer or operator furnishing the coal. It is confidential until it is published by the U. S. Government.

Sample No. 8 Lab. No. L00269 Mine Broken Aro., Ohio

Sampler No. 1 Ash-Softening temp. Degrees F. F.S.I.

RR car Nos. Truck Delivery

Remarks: Can #2473

Sincerely yours,

Analysis supervised by
FORREST E. WALKER
Chemist-in-charge, Coal Analysis

A-13

ROBERT A. WELSH
Coal Sampling and Inspection

PREPARATION DIVISION
COAL SAMPLING AND INSPECTION OFFICE
4800 FORBES AVENUE
PITTSBURGH, PENNSYLVANIA 15213

.S. AIR FORCE
AN ANTONIO ALC-SFSC
ELLY AFB, TEXAS 78241 -

April 21, 1980

Gentlemen/Ladies:

The analysis of the sample submitted by Rickenbacker AFB, Ohio

covering 979.80 tons of 1¼ Inch by 0 coal delivered on your

contract No. DLA-600-79-D-1676 and Item No. 9

by Yancy Minerals on 3/6-14 ,1980 is as follows:

	AS RECEIVED	DRY COAL
Moisture	9.3	
Volatile matter		44.8
Fixed carbon		47.0
Ash		8.2
Total		100.0
Sulfur		3.1
British thermal units	12030	13260

This information is for the use of the Government and the dealer or operator furnishing the coal. It is confidential until it is published by the U. S. Government.

Sample No. 9 Lab. No. L00671 Mine Horizon-Ohio

Sampler No. 1 Ash-Softening temp. Degrees F. F.S.I.

RR car Nos. Truck Delivery

Remarks: Can #2459

Sincerely yours,

Analysis supervised by
FORREST E. WALKER
Chemist-in-charge, Coal Analysis

A-14

ROBERT A. WELSH
Coal Sampling and Inspection

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80

TIME	LOAD	E IN	E OUT	EFF
0	#####	######	######	#####
100	99.	4.981	.505	89.9
200	99.	4.947	.401	91.9
300	105.	4.634	.307	93.4
400	105.	4.485	.318	92.9
500	105.	4.661	.306	93.4
600	99.	4.553	.226	95.0
700	99.	4.719	.243	94.8
800	116.	4.626	.260	94.4
900	109.	4.591	.222	95.2
1000	109.	4.465	.230	94.8
1100	115.	4.577	.360	92.1
1200	118.	4.402	.455	89.7
1300	118.	######	######	#####
1400	109.	4.569	.701	84.7
1500	109.	4.315	.459	89.4
1600	103.	######	######	#####
1700	103.	######	######	#####
1800	104.	4.751	.732	84.6
1900	104.	5.082	.818	83.9
2000	106.	4.926	.758	84.6
2100	106.	4.913	.866	82.4
2200	106.	4.949	.829	83.2
2300	106.	5.058	.831	83.6
# AVERAGES	23.	20.	20.	20.
% OF DATA	96.	83.	83.	83.
MINIMUM	99.	4.315	.222	82.382
MAXIMUM	118.	5.082	.866	95.165
MEAN	107.	4.710	.491	89.694
STD.DEV.	6.	.228	.241	4.734
% STD.DEV.	5.	4.843	49.023	5.278

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : 89.569\%$$

$$(\text{MEAN})\ {}^{Y}_{X}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 1-26-80

TIME	LOAD	E IN	E OUT	EFF
0	105.	4.841	.784	83.8
100	105.	5.060	.647	87.2
200	105.	5.003	.511	89.8
300	105.	4.994	.585	88.3
400	98.	4.960	.654	86.8
500	98.	4.905	.688	86.0
600	98.	4.932	.830	83.2
700	105.	4.917	.716	85.4
800	117.	4.897	.811	83.8
900	119.	4.864	.557	88.6
1000	117.	4.962	.519	89.5
1100	118.	4.953	.523	89.4
1200	119.	5.002	.499	90.0
1300	110.	4.964	.381	92.3
1400	109.	4.954	.398	92.0
1500	109.	5.142	.396	92.3
1600	106.	5.201	.364	93.0
1700	106.	5.269	.336	93.6
1800	99.	5.219	.419	92.0
1900	99.	5.118	.462	91.0
2000	99.	5.236	.448	91.5
2100	105.	5.314	.356	93.3
2200	105.	5.295	.446	91.6
2300	105.	5.201	.485	90.7
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	98.	4.841	.336	83.180
MAXIMUM	119.	5.314	.830	93.621
MEAN	107.	5.050	.534	89.364
STD.DEV.	7.	.148	.149	3.206
% STD.DEV.	6.	2.929	27.978	3.587

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)_1^Y \; E_{IN}, E_{OUT} : 89.431\%$$

NOTE: $(MEAN)_X^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LUCATION: RICKENBACKER AFB 1980
DATE: 1-27-80

TIME	LOAD	E IN	E OUT	EFF
0	114.	5.175	.461	91.1
100	119.	5.263	.337	93.6
200	111.	5.319	.320	94.0
300	103.	5.569	.353	93.7
400	105.	5.432	.374	93.1
500	102.	5.513	######	#####
600	108.	5.369	######	#####
700	106.	5.364	######	#####
800	115.	5.258	######	#####
900	115.	5.116	######	#####
1000	120.	5.273	######	#####
1100	119.	5.236	.567	89.2
1200	118.	5.142	.614	88.1
1300	118.	5.271	.664	87.4
1400	117.	5.210	.554	89.4
1500	117.	5.204	.369	92.9
1600	104.	5.424	.268	95.1
1700	104.	5.551	.197	96.4
1800	104.	5.494	.285	94.8
1900	106.	5.601	.304	94.6
2000	106.	5.627	.285	94.7
2100	106.	5.255	.249	95.3
2200	106.	5.375	.302	94.4
2300	106.	5.307	.208	96.1
# AVERAGES	24.	24.	18.	18.
% OF DATA	100.	100.	75.	75.
MINIMUM	102.	5.116	.197	87.395
MAXIMUM	120.	5.601	.664	96.446
MEAN	110.	5.340	.373	92.982
STD.DEV.	6.	.138	.140	2.771
% STD.DEV.	6.	2.586	37.661	2.980

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)\ {}^{1}_{1}E_{IN}, E_{OUT} : 93.015\%$$

$$(MEAN)^{Y}_{X}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 1-28-80

TIME	LOAD	E IN	E OUT	EFF
0	106.	5.189	.260	95.0
100	100.	5.274	.276	94.8
200	103.	5.212	.300	94.3
300	100.	5.376	.366	93.2
400	104.	5.420	.382	93.0
500	104.	5.427	.432	92.0
600	108.	5.540	.459	91.7
700	106.	5.453	.385	92.9
800	120.	5.598	.493	91.1
900	116.	######	######	#####
1000	109.	5.542	.710	87.2
1100	105.	5.584	.829	85.1
1200	111.	5.373	.824	84.7
1300	112.	5.416	.774	85.7
1400	108.	5.449	.634	88.4
1500	115.	5.489	.509	90.7
1600	104.	5.511	.491	91.1
1700	104.	4.993	.223	95.5
1800	108.	5.048	.208	95.9
1900	108.	4.992	.214	95.7
2000	108.	4.974	.170	96.6
2100	108.	4.901	.158	96.8
2200	108.	5.022	.221	95.6
2300	108.	5.011	.257	94.9

	LOAD	E IN	E OUT	EFF
# AVERAGES	24.	23.	23.	23.
% OF DATA	100.	96.	96.	96.
MINIMUM	100.	4.901	.158	84.671
MAXIMUM	120.	5.584	.829	96.769
MEAN	108.	5.293	.416	92.254
STD.DEV.	5.	.227	.213	3.752
% STD.DEV.	4.	4.296	51.102	4.067

24-HOUR REMOVAL EFICIENCY USING

```
          1
(MEAN)    E  , E       : 92.137%
          1  IN   OUT
```

```
                Y       1
NOTE: (MEAN)    IS DEFINED AS:
                X
```

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 1-29-80

TIME	LOAD	E IN	E OUT	EFF
0	105.	5.115	.365	92.9
100	105.	5.229	.390	92.6
200	105.	4.986	.351	93.0
300	105.	5.261	.344	93.5
400	105.	5.086	.400	92.1
500	105.	5.190	.335	93.6
600	105.	5.196	.341	93.4
700	105.	5.080	.400	92.1
800	111.	5.388	.578	89.2
900	117.	######	######	#####
1000	114.	5.259	.571	89.1
1100	112.	4.813	.529	89.0
1200	112.	5.430	.418	92.3
1300	103.	5.261	.434	91.8
1400	99.	######	######	#####
1500	107.	######	######	#####
1600	116.	5.150	.508	90.1
1700	110.	######	######	#####
1800	112.	######	######	#####
1900	112.	######	######	#####
2000	115.	######	######	#####
2100	115.	######	######	#####
2200	115.	######	######	#####
2300	115.	######	######	#####
# AVERAGES	24.	14.	14.	14.
% OF DATA	100.	58.	58.	58.
MINIMUM	99.	4.813	.335	89.002
MAXIMUM	117.	5.430	.578	93.552
MEAN	109.	######	######	######
STD.DEV.	5.	######	######	######
% STD.DEV.	5.	######	######	######

24-HOUR REMUVAL EFICIENCY USING

$$[MEAN]\ {}^{1}_{Y}E_{1\ IN}, E_{OUT} : .00\%$$

NOTE: $[MEAN]^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 1-30-80

TIME	LOAD	E IN	E OUT	EFF
0	112.	######	######	#####
100	112.	######	######	#####
200	112.	######	######	#####
300	112.	######	######	#####
400	112.	######	######	#####
500	112.	######	######	#####
600	112.	######	######	#####
700	112.	######	######	#####
800	120.	######	######	#####
900	122.	######	######	#####
1000	118.	4.583	.182	96.0
1100	120.	4.446	.241	94.6
1200	121.	4.923	.410	91.7
1300	118.	4.976	.511	89.7
1400	121.	4.982	.400	92.0
1500	117.	5.164	.422	91.8
1600	100.	5.217	.625	88.0
1700	103.	5.112	.738	85.6
1800	103.	######	######	#####
1900	103.	5.060	.563	88.9
2000	103.	5.581	.529	90.5
2100	103.	5.421	.514	90.5
2200	103.	5.491	.514	90.6
2300	101.	5.355	.503	90.6
# AVERAGES	24.	13.	13.	13.
% OF DATA	100.	54.	54.	54.
MINIMUM	100.	4.446	.182	85.572
MAXIMUM	122.	5.581	.738	96.022
MEAN	111.	######	######	######
STD.DEV.	7.	######	######	######
% STD.DEV.	7.	######	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : .000\%$$

$$(\text{MEAN})\ {}^{X}_{Y}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 1-31-80

TIME	LOAD	E IN	E OUT	EFF
0	104.	5.259	.475	91.0
100	104.	4.963	.536	89.2
200	108.	5.119	.582	88.6
300	104.	5.441	.492	91.0
400	104.	5.255	.394	92.5
500	112.	5.090	.386	92.4
600	117.	5.062	.582	88.5
700	117.	5.052	.438	91.3
800	121.	4.876	.490	90.0
900	125.	5.133	1.132	77.9
1000	118.	4.927	.552	88.8
1100	122.	5.260	.455	91.3
1200	119.	5.184	.391	92.5
1300	119.	5.027	.493	90.2
1400	119.	5.271	.370	93.0
1500	121.	5.431	.572	89.5
1600	108.	######	######	#####
1700	106.	######	######	#####
1800	106.	5.553	.985	82.3
1900	110.	5.445	.529	90.3
2000	108.	5.286	.499	90.6
2100	110.	5.429	.442	91.9
2200	115.	5.322	.550	89.7
2300	115.	5.249	.675	87.1
# AVERAGES	24.	22.	22.	22.
% OF DATA	100.	92.	92.	92.
MINIMUM	104.	4.876	.370	77.940
MAXIMUM	125.	5.553	1.132	92.982
MEAN	113.	5.211	.546	89.518
STD.DEV.	7.	.185	.184	3.459
% STD.DEV.	6.	3.544	33.590	3.864

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)\ E_{IN}, E_{OUT} : 89.514\%$$

NOTE: $(MEAN)^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 1-80

TIME	LOAD	E IN	E OUT	EFF
0	110.	5.278	.496	90.6
100	108.	5.225	.413	92.1
200	108.	5.096	.395	92.2
300	108.	4.939	.343	93.1
400	108.	4.985	.405	91.9
500	112.	4.735	.358	92.4
600	112.	5.442	.445	91.8
700	112.	5.469	.414	92.4
800	121.	5.682	.407	92.8
900	127.	5.815	.425	92.7
1000	119.	6.012	.382	93.6
1100	116.	6.208	.369	94.1
1200	113.	5.365	.621	88.4
1300	113.	5.748	######	#####
1400	127.	5.307	.618	88.4
1500	119.	5.667	.535	90.6
1600	112.	5.402	######	#####
1700	106.	5.529	.479	91.0
1800	111.	5.477	.415	92.4
1900	113.	5.441	.432	92.1
2000	110.	5.585	.439	92.1
2100	111.	5.715	.487	91.5
2200	109.	5.569	.530	90.5
2300	109.	5.532	.540	90.2
# AVERAGES	24.	24.	22.	22.
% OF DATA	100.	100.	92.	92.
MINIMUM	106.	4.735	.343	88.427
MAXIMUM	127.	6.208	.621	94.051
MEAN	113.	5.456	.452	91.678
STD.DEV.	6.	.332	.077	1.443
% STD.DEV.	5.	6.086	17.069	1.574

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]^{1}_{1} E_{IN} , E_{OUT} : 91.715\%$$

NOTE: $[MEAN]^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 2-80

TIME	LOAD	E IN	E OUT	EFF
0	108.	5.687	.507	91.1
100	110.	5.847	######	#####
200	110.	5.817	######	#####
300	110.	6.178	######	#####
400	110.	6.630	######	#####
500	107.	6.935	######	#####
600	107.	5.665	######	#####
700	107.	5.419	######	#####
800	117.	5.291	######	#####
900	117.	5.625	######	#####
1000	118.	5.635	######	#####
1100	117.	5.564	######	#####
1200	116.	######	######	#####
1300	120.	######	######	#####
1400	124.	5.009	.528	89.5
1500	125.	4.909	.371	92.4
1600	113.	5.063	.301	94.1
1700	111.	4.975	.276	94.4
1800	109.	4.998	.355	92.9
1900	111.	5.398	.419	92.2
2000	111.	6.148	.482	92.2
2100	111.	6.333	.433	93.2
2200	114.	5.877	.330	94.4
2300	112.	6.624	.368	94.4
# AVERAGES	24.	22.	11.	11.
% OF DATA	100.	92.	46.	46.
MINIMUM	107.	4.909	.276	89.469
MAXIMUM	125.	6.935	.528	94.448
MEAN	113.	5.710	######	######
STD.DEV.	5.	.579	######	######
% STD.DEV.	5.	10.133	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)\ {}^{1}_{Y}E_{IN}, E_{OUT} : ######\%$$

NOTE: $(MEAN)^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 3-80

TIME	LOAD	E IN	E OUT	EFF
0	113.	######	######	#####
100	110.	######	######	#####
200	112.	######	######	#####
300	118.	5.426	.602	88.9
400	118.	5.029	.437	91.3
500	118.	4.884	.380	92.2
600	115.	5.081	.302	94.1
700	110.	5.138	.360	93.0
800	115.	5.327	.385	92.8
900	114.	5.322	.520	90.2
1000	115.	5.146	.631	87.7
1100	113.	5.187	.609	88.3
1200	113.	5.275	.444	91.6
1300	116.	5.250	.422	92.0
1400	116.	5.296	.628	88.1
1500	116.	5.345	.853	84.0
1600	115.	5.222	.582	88.9
1700	116.	5.271	######	#####
1800	114.	5.271	######	#####
1900	114.	5.236	######	#####
2000	116.	5.376	######	#####
2100	115.	5.298	.353	93.3
2200	111.	5.476	.412	92.5
2300	111.	5.502	.415	92.5
# AVERAGES	24.	21.	17.	17.
% OF DATA	100.	88.	71.	71.
MINIMUM	110.	4.884	.302	84.049
MAXIMUM	118.	5.502	.853	94.061
MEAN	114.	5.255	######	######
STD.DEV.	2.	.146	######	######
% STD.DEV.	2.	2.779	######	######

24-HOUR REMOVAL EFICIENCY USING

```
        1
 (MEAN)    E  , E       : ######%
        1  IN   OUT

          Y      I
```

NOTE: (MEAN) IS DEFINED AS:

```
          X
 THE MEAN FOR X DAYS USING Y-HOUR AVERAGES
```

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 4-80

TIME	LOAD	E IN	E OUT	EFF
0	104.	5.523	.500	91.0
100	103.	5.465	.484	91.1
200	109.	5.450	.571	89.5
300	109.	5.351	.617	88.5
400	113.	5.357	.624	88.4
500	110.	5.291	.604	88.6
600	111.	5.308	.586	89.0
700	115.	5.316	.642	87.9
800	122.	5.310	.724	86.4
900	123.	5.325	.814	84.7
1000	130.	5.126	.766	85.0
1100	131.	5.231	.842	83.9
1200	123.	5.529	.693	87.5
1300	124.	5.520	1.166	78.9
1400	118.	5.574	.715	87.2
1500	118.	######	######	#####
1600	114.	######	######	#####
1700	116.	5.476	.524	90.4
1800	116.	5.538	.414	92.5
1900	114.	5.505	.360	93.5
2000	113.	5.513	.458	91.8
2100	114.	5.535	.473	91.5
2200	116.	5.574	.357	93.6
2300	116.	5.477	.384	93.0
# AVERAGES	24.	22.	22.	22.
% OF DATA	100.	92.	92.	92.
MINIMUM	103.	5.126	.357	78.884
MAXIMUM	131.	5.574	1.166	93.591
MEAN	116.	5.422	.605	88.803
STD.DEV.	7.	.124	.190	3.586
% STD.DEV.	6.	2.290	31.376	4.038

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : 88.839\%$$

$$(\text{MEAN})\ {}^{X}_{Y}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 5-80

TIME	LOAD	E IN	E OUT	EFF
0	107.	5.633	.627	88.9
100	107.	5.547	.659	88.1
200	107.	5.490	.690	87.4
300	113.	5.472	.574	89.5
400	113.	5.549	.530	90.5
500	113.	5.411	.543	90.0
600	113.	5.401	.305	94.3
700	107.	5.411	.292	94.6
800	108.	5.360	.328	93.9
900	94.	5.503	.224	95.9
1000	97.	5.299	.386	92.7
1100	115.	5.194	.434	91.6
1200	107.	4.513	.327	92.8
1300	107.	4.821	.351	92.7
1400	105.	5.120	.385	94.0
1500	108.	5.090	.270	94.7
1600	118.	4.910	.321	93.5
1700	114.	5.031	.265	94.7
1800	114.	######	######	#####
1900	112.	5.915	.548	90.7
2000	110.	5.767	.492	91.5
2100	114.	5.875	.591	89.9
2200	115.	5.251	######	#####
2300	116.	6.057	######	#####
# AVERAGES	24.	23.	21.	21.
% OF DATA	100.	96.	88.	88.
MINIMUM	94.	4.513	.224	87.430
MAXIMUM	118.	6.057	.690	95.931
MEAN	110.	5.375	.432	92.000
STD.DEV.	6.	.364	.147	2.435
% STD.DEV.	5.	6.768	34.081	2.647

24-HOUR REMOVAL EFICIENCY USING

$$\overline{(MEAN)}_{1}^{Y} \quad E_{IN}, E_{OUT} : 91.971\%$$

NOTE: $\overline{(MEAN)}_{1}^{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 6-80

TIME	LOAD	E IN	E OUT	EFF
0	99.	######	######	#####
100	99.	######	######	#####
200	99.	######	######	#####
300	99.	######	######	#####
400	99.	######	######	#####
500	99.	######	######	#####
600	99.	######	######	#####
700	99.	######	######	#####
800	120.	######	######	#####
900	114.	######	######	#####
1000	116.	5.465	######	#####
1100	116.	5.390	######	#####
1200	114.	5.442	1.014	81.4
1300	112.	5.475	.942	82.8
1400	115.	5.661	.918	83.8
1500	114.	5.692	.735	87.1
1600	104.	5.791	.743	87.2
1700	97.	5.639	.665	88.2
1800	97.	######	######	#####
1900	97.	5.903	######	#####
2000	98.	5.662	######	#####
2100	98.	5.512	######	#####
2200	98.	5.716	######	#####
2300	98.	5.619	######	#####
# AVERAGES	24.	13.	6.	6.
% OF DATA	100.	54.	25.	25.
MINIMUM	97.	5.390	.665	81.376
MAXIMUM	120.	5.903	1.014	88.199
MEAN	104.	######	######	######
STD.DEV.	8.	######	######	######
% STD.DEV.	8.	######	######	######

24-HOUR REMOVAL EFICIENCY USING

$$\text{(MEAN)}\ E_1 : .00\%$$

(MEAN) $^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 7-80

TIME	LOAD	E IN	E OUT	EFF
0	112.	5.712	######	#####
100	112.	5.866	######	#####
200	112.	5.731	######	#####
300	112.	5.728	######	#####
400	112.	5.782	######	#####
500	112.	5.685	######	#####
600	112.	######	######	#####
700	112.	5.754	######	#####
800	119.	5.702	######	#####
900	119.	5.788	######	#####
1000	116.	5.751	######	#####
1100	107.	5.686	######	#####
1200	107.	5.728	######	#####
1300	107.	5.520	######	#####
1400	110.	5.269	######	#####
1500	112.	5.403	######	#####
1600	108.	5.480	######	#####
1700	108.	4.973	######	#####
1800	115.	5.143	######	#####
1900	118.	5.364	######	#####
2000	118.	5.250	######	#####
2100	118.	5.033	######	#####
2200	118.	5.210	######	#####
2300	118.	5.146	######	#####
# AVERAGES	24.	23.	0.	0.
% OF DATA	100.	96.	0.	0.
MINIMUM	107.	4.973	######	######
MAXIMUM	119.	5.866	.000	.000
MEAN	113.	5.511	######	######
STD.DEV.	4.	.280	######	######
% STD.DEV.	4.	5.086	######	######

24-HOUR REMOVAL EFICIENCY USING

$[MEAN]_1^{Y}$ E IN , E OUT : #######%

NOTE: $[MEAN]_1^{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 8-80

TIME	LOAD	E IN	E OUT	EFF
0	105.	5.190	######	#####
100	105.	5.137	######	#####
200	105.	5.164	######	#####
300	112.	5.276	######	#####
400	112.	5.280	######	#####
500	112.	5.310	######	#####
600	112.	5.329	######	#####
700	112.	5.435	######	#####
800	121.	5.514	######	#####
900	114.	5.448	######	#####
1000	112.	5.228	######	#####
1100	112.	5.213	######	#####
1200	112.	5.384	.376	93.0
1300	111.	######	######	#####
1400	111.	5.218	.427	91.8
1500	111.	5.296	.401	92.4
1600	105.	5.187	.314	93.9
1700	104.	5.279	.312	94.1
1800	108.	5.089	.309	93.9
1900	108.	5.037	.302	94.0
2000	102.	5.086	.296	94.2
2100	103.	5.111	.280	94.5
2200	98.	5.171	.295	94.3
2300	100.	5.127	.283	94.5
# AVERAGES	24.	23.	11.	11.
% OF DATA	100.	96.	46.	46.
MINIMUM	98.	5.037	.280	91.820
MAXIMUM	121.	5.514	.427	94.512
MEAN	109.	5.240	######	######
STD.DEV.	5.	.125	######	######
% STD.DEV.	5.	2.382	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)\ {}^{1}E_{IN}, E_{OUT} : ######X$$

$$Y$$

NOTE: $(MEAN)^{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2- 9-80

TIME	LOAD	E IN	E OUT	EFF
0	115.	5.082	.387	92.4
100	115.	5.215	.389	92.5
200	116.	5.279	.329	93.8
300	113.	5.283	.333	93.7
400	115.	5.342	.379	92.9
500	116.	5.409	.389	92.8
600	114.	5.393	.358	93.4
700	111.	5.374	.317	94.1
800	111.	5.398	.316	94.2
900	116.	5.503	.365	93.4
1000	116.	5.259	.311	94.1
1100	116.	5.303	.326	93.8
1200	118.	5.456	.357	93.5
1300	118.	5.563	.387	93.0
1400	119.	5.673	.375	93.4
1500	119.	5.831	.319	94.5
1600	104.	5.701	.281	95.1
1700	103.	5.641	.268	95.2
1800	103.	5.556	.326	94.1
1900	102.	5.538	.350	93.7
2000	105.	5.643	.300	94.7
2100	105.	5.653	.325	94.2
2200	105.	5.657	.324	94.3
2300	105.	5.703	.362	93.6
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	102.	5.082	.268	92.387
MAXIMUM	119.	5.831	.389	95.245
MEAN	112.	5.477	.341	93.767
STD.DEV.	6.	.190	.035	.735
% STD.DEV.	5.	3.462	10.143	.784

24-HOUR REMOVAL EFICIENCY USING

$$[\text{MEAN}]_1^Y \; E_{IN}, E_{OUT} : 93.782\%$$

NOTE: $[\text{MEAN}]_1^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-10-80

TIME	LOAD	E IN	E OUT	EFF
0	112.	5.659	.387	93.2
100	110.	5.600	.357	93.6
200	113.	5.644	.278	95.1
300	112.	5.623	######	#####
400	112.	5.532	######	#####
500	117.	5.496	######	#####
600	117.	5.415	######	#####
700	115.	5.449	######	#####
800	121.	5.526	######	#####
900	107.	5.527	######	#####
1000	104.	5.533	######	#####
1100	116.	5.484	######	#####
1200	115.	5.619	######	#####
1300	113.	5.445	.415	92.4
1400	118.	5.565	.281	94.9
1500	105.	5.595	.259	95.4
1600	107.	5.561	.319	94.3
1700	106.	5.576	.301	94.6
1800	108.	5.713	.317	94.5
1900	109.	5.545	.250	95.5
2000	110.	5.586	.211	96.2
2100	110.	5.494	.218	96.0
2200	109.	5.576	.275	94.9
2300	108.	5.508	.341	93.8
# AVERAGES	24.	24.	14.	14.
% OF DATA	100.	100.	58.	58.
MINIMUM	104.	5.376	.211	92.381
MAXIMUM	121.	5.713	.415	96.196
MEAN	111.	5.543	######	######
STD.DEV.	4.	.079	######	######
% STD.DEV.	4.	1.434	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)\ {}^{1}_{1}E_{IN}, E_{OUT} : \#\#\#\#\#\#\%$$

NOTE: $(MEAN)^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-11-80

TIME	LOAD	E IN	E OUT	EFF
0	116.	5.480	.417	92.4
100	114.	5.463	.362	93.4
200	113.	5.557	.315	94.3
300	114.	5.458	.337	93.8
400	116.	5.510	.439	92.0
500	121.	5.435	.485	91.1
600	119.	5.506	.479	91.3
700	118.	5.539	.398	92.8
800	121.	5.470	.395	92.8
900	119.	5.457	.382	93.0
1000	116.	5.532	.355	93.6
1100	120.	5.437	.414	92.4
1200	120.	5.152	.447	91.3
1300	120.	5.278	.446	91.5
1400	122.	5.205	.387	92.6
1500	120.	5.271	.412	92.2
1600	105.	5.186	.414	92.0
1700	104.	5.360	.459	91.4
1800	101.	5.226	.541	89.6
1900	99.	5.353	.530	90.1
2000	102.	5.393	.525	90.3
2100	103.	5.398	.529	90.2
2200	103.	5.576	.553	89.7
2300	102.	5.286	.523	90.1
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	99.	5.152	.315	89.647
MAXIMUM	122.	5.557	.553	94.328
MEAN	113.	5.389	.439	91.835
STD.DEV.	8.	.120	.069	1.349
% STD.DEV.	7.	2.224	15.693	1.469

24-HOUR REMOVAL EFICIENCY USING

$$[\text{MEAN}]_1^1 E_{IN}, E_{OUT} : 91.848\%$$

NOTE: $[\text{MEAN}]_Y^X$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-12-80

TIME	LOAD	E IN	E OUT	EFF
0	111.	5.173	.424	91.8
100	111.	5.134	.381	92.6
200	111.	5.235	.420	92.0
300	111.	5.267	.430	91.8
400	111.	5.262	.308	94.1
500	117.	5.252	.238	95.5
600	117.	5.122	.205	96.0
700	117.	5.344	.221	95.9
800	117.	5.243	.248	95.3
900	123.	5.215	.196	96.2
1000	123.	5.201	.228	95.6
1100	122.	5.180	.310	94.0
1200	123.	5.222	.344	93.4
1300	123.	5.182	.291	94.4
1400	115.	5.073	.187	96.3
1500	109.	5.056	.228	95.5
1600	99.	4.962	.259	94.8
1700	100.	5.088	.203	96.0
1800	103.	5.106	.283	94.5
1900	102.	5.106	.297	94.2
2000	107.	5.181	.298	94.3
2100	108.	5.158	.266	94.8
2200	108.	4.959	.342	93.1
2300	108.	5.090	.312	93.9
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	99.	4.959	.187	91.801
MAXIMUM	123.	5.344	.430	96.314
MEAN	112.	5.159	.288	94.417
STD.DEV.	7.	.094	.073	1.397
% STD.DEV.	7.	1.822	25.300	1.480

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : 94.415\%$$

$$(\text{MEAN})^{Y}_{X}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-13-80

TIME	LOAD	E IN	E OUT	EFF
0	106.	5.004	.274	94.5
100	106.	5.195	.189	96.4
200	106.	5.078	.212	95.8
300	106.	5.027	.147	97.1
400	112.	5.096	######	#####
500	112.	3.826	######	#####
600	112.	4.429	######	#####
700	112.	4.666	######	#####
800	111.	5.078	######	#####
900	118.	5.076	######	#####
1000	116.	5.198	.354	93.2
1100	116.	5.093	.288	94.3
1200	114.	5.335	.387	92.7
1300	120.	5.317	.391	92.7
1400	118.	5.338	.334	93.7
1500	110.	5.407	.302	94.4
1600	108.	5.186	.226	95.7
1700	103.	5.170	.229	95.6
1800	109.	5.355	.248	95.4
1900	112.	######	######	#####
2000	115.	5.523	.478	91.3
2100	110.	5.469	.271	95.0
2200	111.	5.475	.289	94.7
2300	110.	5.558	.261	95.3
# AVERAGES	24.	23.	17.	17.
% OF DATA	100.	96.	71.	71.
MINIMUM	103.	3.826	.147	91.340
MAXIMUM	120.	5.558	.478	97.069
MEAN	111.	5.126	######	######
STD.DEV.	4.	.386	######	######
% STD.DEV.	4.	7.525	######	######

24-HOUR REMOVAL EFICIENCY USING

$(MEAN)^{1}_{1}$ E IN , E OUT : ######%

NOTE: $(MEAN)^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1960
DATE: 2-14-80

TIME	LOAD	E IN	E OUT	EFF
0	106.	5.449	.241	95.6
100	106.	5.533	.194	96.5
200	106.	5.484	.156	97.2
300	106.	5.444	.173	96.8
400	112.	5.418	.200	96.3
500	112.	5.423	.245	95.5
600	112.	5.487	.202	96.3
700	112.	5.206	.128	97.5
800	109.	5.397	.177	96.7
900	110.	5.373	.160	97.0
1000	112.	5.218	.204	96.1
1100	112.	5.349	.229	95.7
1200	112.	5.311	.168	96.8
1300	113.	5.473	.221	96.0
1400	115.	5.373	.263	95.1
1500	118.	5.712	.232	95.9
1600	106.	5.564	.154	97.2
1700	97.	5.415	.116	97.9
1800	105.	5.456	.122	97.8
1900	108.	5.413	.097	98.2
2000	108.	5.319	.263	95.0
2100	109.	5.482	.624	88.6
2200	107.	5.604	.425	92.4
2300	106.	5.549	.271	95.1
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	97.	5.206	.097	88.612
MAXIMUM	118.	5.712	.624	98.207
MEAN	109.	5.435	.219	95.975
STD.DEV.	4.	.114	.110	1.988
% STD.DEV.	4.	2.103	50.206	2.071

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{Y}E_{IN}, E_{OUT} : 95.965\%$$

NOTE: $(\text{MEAN})^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LUCATION: RICKENBACKER AFB 1980
DATE: 2-15-80

TIME	LOAD	E IN	E OUT	EFF
0	103.	5.446	.176	96.8
100	103.	5.496	.105	98.1
200	103.	5.542	######	#####
300	103.	5.377	######	#####
400	103.	5.407	######	#####
500	103.	5.206	.027	99.5
600	103.	5.278	.399	92.4
700	103.	5.657	.470	91.7
800	117.	5.427	.475	91.2
900	117.	5.592	.713	87.3
1000	106.	######	######	#####
1100	108.	5.456	.612	88.8
1200	105.	5.720	.493	91.4
1300	106.	5.855	.697	88.1
1400	106.	5.874	.840	85.7
1500	106.	5.976	.467	92.2
1600	93.	6.018	.338	94.4
1700	100.	5.848	######	#####
1800	99.	5.809	######	#####
1900	97.	6.020	######	#####
2000	99.	5.874	######	#####
2100	101.	5.831	######	#####
2200	100.	5.937	######	#####
2300	96.	5.946	######	#####
# AVERAGES	24.	23.	13.	13.
% OF DATA	100.	96.	54.	54.
MINIMUM	93.	5.206	.027	85.701
MAXIMUM	117.	6.020	.840	99.474
MEAN	103.	5.678	######	######
STD.DEV.	5.	.253	######	######
% STD.DEV.	5.	4.463	######	######

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]_1^Y \quad E_{IN}, E_{OUT} : ######\%$$

NOTE: $[MEAN]_1^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-16-80

TIME	LOAD	E IN	E OUT	EFF
0	99.	5.860	######	#####
100	99.	5.857	######	#####
200	99.	5.898	######	#####
300	99.	5.880	######	#####
400	99.	5.873	######	#####
500	99.	5.841	######	#####
600	99.	5.651	######	#####
700	99.	5.706	######	#####
800	114.	5.674	######	#####
900	114.	5.643	######	#####
1000	110.	5.642	######	#####
1100	110.	5.728	######	#####
1200	121.	5.643	######	#####
1300	121.	5.715	######	#####
1400	119.	5.627	######	#####
1500	117.	5.575	.729	86.9
1600	97.	5.651	.805	85.8
1700	96.	5.729	.750	86.9
1800	101.	5.491	.718	86.9
1900	105.	5.547	.591	89.3
2000	106.	5.430	.416	92.3
2100	108.	5.681	.468	91.8
2200	108.	5.470	.470	91.4
2300	109.	4.974	.579	88.4
# AVERAGES	24.	24.	9.	9.
% OF DATA	100.	100.	38.	38.
MINIMUM	96.	4.974	.416	85.756
MAXIMUM	121.	5.894	.805	92.346
MEAN	106.	5.658	######	######
STD.DEV.	8.	.196	######	######
% STD.DEV.	8.	3.469	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)\ {}^{1}E_{IN}, E_{OUT} : \#\#\#\#\#\#\%$$

$$(MEAN)\ {}^{Y}_{X}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-17-80

TIME	LOAD	E IN	E OUT	EFF
0	118.	5.701	.747	86.9
100	129.	5.648	.614	89.1
200	122.	5.685	.586	89.7
300	121.	5.706	.513	91.0
400	121.	5.660	.516	90.9
500	118.	5.531	.486	91.2
600	116.	5.657	.531	90.6
700	114.	5.675	.408	92.8
800	114.	5.617	.455	91.9
900	114.	5.610	.514	90.8
1000	116.	5.591	.430	92.3
1100	118.	5.601	.451	91.9
1200	115.	5.776	.415	92.8
1300	109.	5.892	.298	94.9
1400	110.	5.776	.482	92.3
1500	122.	5.181	.449	91.3
1600	99.	5.391	.268	95.0
1700	101.	5.715	.289	94.9
1800	103.	5.654	.341	94.0
1900	103.	5.755	.382	93.4
2000	106.	5.630	.392	93.0
2100	106.	5.802	.383	93.4
2200	107.	5.733	.420	92.7
2300	107.	5.693	######	#####
# AVERAGES	24.	24.	23.	23.
% OF DATA	100.	100.	96.	96.
MINIMUM	99.	5.181	.268	86.891
MAXIMUM	129.	5.892	.747	95.026
MEAN	113.	5.655	.449	92.048
STD.DEV.	8.	.141	.110	1.948
% STD.DEV.	7.	2.487	24.444	2.116

24-HOUR REMOVAL EFICIENCY USING

$(MEAN)_1^1$ E_{IN} , E_{OUT} : 92.056%

NOTE: $(MEAN)_Y^X$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-18-80

TIME	LOAD	E IN	E OUT	EFF
0	115.	5.683	######	#####
100	126.	5.795	######	#####
200	128.	5.668	.507	91.0
300	123.	5.767	.488	91.5
400	121.	5.693	.453	92.0
500	121.	5.635	.404	92.8
600	121.	5.544	.420	92.4
700	122.	5.690	.420	92.6
800	113.	5.695	.401	93.0
900	117.	5.677	.357	93.7
1000	117.	5.496	.315	94.3
1100	119.	5.435	.308	94.3
1200	120.	5.486	.288	94.7
1300	115.	5.458	.275	95.0
1400	111.	5.481	.339	93.8
1500	117.	5.551	.231	95.8
1600	100.	5.551	.180	96.7
1700	101.	5.537	.168	97.0
1800	100.	5.732	.159	97.2
1900	78.	6.112	.172	97.2
2000	97.	5.607	.173	96.9
2100	100.	5.591	.152	97.3
2200	100.	5.512	.124	97.8
2300	100.	5.528	.151	97.3
# AVERAGES	24.	24.	22.	22.
% OF DATA	100.	100.	92.	92.
MINIMUM	78.	5.435	.124	91.048
MAXIMUM	126.	6.112	.507	97.756
MEAN	112.	5.620	.295	94.748
STD.DEV.	12.	.148	.124	2.176
% STD.DEV.	11.	2.627	41.954	2.296

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]\ {}^{1}_{1}E_{IN}, E_{OUT} : 94.755\%$$

$$[MEAN]\ {}^{Y}_{X}$$

NOTE: [MEAN] IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-19-80

TIME	LOAD	E IN	E OUT	EFF
0	103.	5.529	.131	97.6
100	103.	5.514	.148	97.3
200	103.	5.598	.145	97.4
300	103.	5.557	.162	97.1
400	103.	5.625	.202	96.4
500	103.	5.589	.174	96.9
600	103.	5.732	.188	96.7
700	103.	5.689	.146	97.4
800	104.	5.686	.145	97.4
900	104.	5.694	.112	98.0
1000	109.	5.582	.160	97.1
1100	108.	5.659	.230	95.9
1200	91.	5.594	.170	97.0
1300	90.	5.593	.148	97.3
1400	86.	5.766	.120	97.9
1500	87.	5.966	.239	96.0
1600	80.	5.623	.559	90.1
1700	77.	5.496	.611	88.7
1800	76.	5.507	.574	89.6
1900	72.	5.389	.432	92.0
2000	75.	5.492	.487	91.1
2100	78.	5.430	.508	90.6
2200	84.	4.900	.656	86.6
2300	85.	5.481	.623	88.6
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	72.	4.900	.112	86.615
MAXIMUM	109.	5.966	.656	98.034
MEAN	93.	5.565	.295	94.623
STD.DEV.	12.	.190	.196	3.732
% STD.DEV.	13.	3.408	66.415	3.944

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]_1^{24} \; E_{IN} \, , \, E_{OUT} \; : 94.705\%$$

NOTE: $[MEAN]_1^{24}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-20-80

TIME	LOAD	E IN	E OUT	EFF
0	87.	5.376	.648	88.0
100	87.	5.278	.588	88.9
200	87.	5.195	.680	86.9
300	87.	5.589	.449	92.0
400	87.	5.650	.416	92.6
500	92.	5.527	.445	91.9
600	92.	5.584	.468	91.6
700	92.	5.620	.439	92.2
800	93.	5.611	.451	92.2
900	100.	5.679	.451	92.1
1000	103.	5.683	.378	93.4
1100	106.	5.816	.328	94.4
1200	103.	######	.327	#####
1300	101.	######	.521	#####
1400	104.	######	.618	#####
1500	104.	######	.626	#####
1600	108.	######	.547	#####
1700	103.	######	.194	#####
1800	97.	######	.184	#####
1900	97.	######	.226	#####
2000	100.	######	.230	#####
2100	100.	######	.236	#####
2200	98.	######	.547	#####
2300	96.	######	.251	#####
# AVERAGES	24.	12.	24.	12.
% OF DATA	100.	50.	100.	50.
MINIMUM	87.	5.195	.184	86.911
MAXIMUM	108.	5.816	.680	94.354
MEAN	97.	######	.427	######
STD.DEV.	7.	######	.153	######
% STD.DEV.	7.	######	35.827	######

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{X}\,E_{IN}\,,\,E_{OUT} : \#\#\#\#\#\#\%$$

NOTE: $(\text{MEAN})^{1}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING 1-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-21-80

TIME	LOAD	E IN	E OUT	EFF
0	74.	######	.397	#####
100	74.	######	.496	#####
200	74.	######	.559	#####
300	79.	######	.686	#####
400	80.	######	.587	#####
500	85.	######	.469	#####
600	85.	######	.418	#####
700	85.	######	.419	#####
800	88.	######	.539	#####
900	97.	######	######	#####
1000	107.	4.609	.669	85.5
1100	107.	5.183	.688	86.7
1200	106.	5.162	.457	91.2
1300	98.	4.976	.247	95.0
1400	93.	4.948	.225	95.4
1500	89.	######	######	#####
1600	104.	5.307	.325	93.9
1700	100.	5.256	.255	95.2
1800	100.	5.250	.247	95.3
1900	100.	5.353	.261	95.1
2000	97.	5.162	.534	89.7
2100	100.	5.286	.315	94.0
2200	96.	5.238	.246	95.3
2300	23.	5.250	.255	95.1
# AVERAGES	24.	13.	22.	13.
% OF DATA	100.	58.	92.	54.
MINIMUM	23.	4.609	.225	85.485
MAXIMUM	107.	5.353	.688	95.444
MEAN	89.	######	.422	######
STD.DEV.	18.	######	.157	######
% STD.DEV.	20.	######	37.139	######

24-HOUR REMOVAL EFICIENCY USING
1
(MEAN) E , E : ######%
1 IN OUT

Y

NOTE: (MEAN) IS DEFINED AS:
X
THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-22-80

TIME	LOAD	E IN	E OUT	EFF
0	21.	5.286	.326	93.8
100	86.	5.264	.304	94.2
200	86.	5.427	.309	94.3
300	92.	5.364	.307	94.3
400	92.	5.410	.312	94.2
500	92.	5.715	.303	94.7
600	92.	5.467	.121	97.8
700	92.	5.255	.190	96.4
800	95.	5.420	.218	96.0
900	97.	5.535	.198	96.4
1000	94.	######	######	#####
1100	94.	######	######	#####
1200	94.	######	######	#####
1300	97.	######	######	#####
1400	97.	######	######	#####
1500	93.	######	######	#####
1600	83.	5.489	.185	96.6
1700	84.	5.483	.182	96.7
1800	85.	5.515	.195	96.5
1900	86.	5.614	.318	94.3
2000	87.	5.491	.384	93.0
2100	88.	######	######	#####
2200	89.	######	######	#####
2300	89.	######	######	#####
# AVERAGES	24.	15.	15.	15.
% OF DATA	100.	63.	63.	63.
MINIMUM	21.	5.255	.121	93.014
MAXIMUM	97.	5.715	.384	97.776
MEAN	88.	######	######	######
STD.DEV.	15.	######	######	######
% STD.DEV.	17.	######	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})_1^{24}\, E_{IN}, E_{OUT} : .000\%$$

NOTE: $(\text{MEAN})_1^{24}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-23-80

TIME	LOAD	E IN	E OUT	EFF
0	86.	######	######	#####
100	86.	######	######	#####
200	86.	######	######	#####
300	86.	######	######	#####
400	86.	######	######	#####
500	86.	######	######	#####
600	86.	######	######	#####
700	86.	######	######	#####
800	98.	######	######	#####
900	100.	######	######	#####
1000	97.	######	######	#####
1100	97.	######	######	#####
1200	97.	######	######	#####
1300	100.	######	######	#####
1400	103.	######	######	#####
1500	96.	5.366	.316	94.1
1600	83.	5.467	.281	94.9
1700	84.	5.572	.472	91.5
1800	85.	5.646	.155	97.3
1900	86.	######	######	#####
2000	87.	######	######	#####
2100	88.	######	######	#####
2200	87.	######	######	#####
2300	89.	######	######	#####
# AVERAGES	24.	4.	4.	4.
% OF DATA	100.	17.	17.	17.
MINIMUM	83.	5.368	.155	91.524
MAXIMUM	103.	5.646	.472	97.262
MEAN	90.	######	######	######
STD.DEV.	6.	######	######	######
% STD.DEV.	7.	######	######	######

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]_1^Y E_{IN}, E_{OUT} : .000\%$$

NOTE: $[MEAN]_1^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-24-80

TIME	LOAD	E IN	E OUT	EFF
0	102.	######	######	#####
100	102.	######	######	#####
200	108.	######	######	#####
300	102.	######	######	#####
400	107.	######	######	#####
500	106.	######	######	#####
600	106.	######	######	#####
700	100.	######	######	#####
800	95.	######	######	#####
900	102.	######	######	#####
1000	107.	######	######	#####
1100	104.	######	######	#####
1200	115.	######	######	#####
1300	115.	######	######	#####
1400	99.	######	######	#####
1500	99.	5.524	.446	91.9
1600	84.	5.406	.389	92.8
1700	83.	5.460	.341	93.8
1800	85.	5.191	.283	94.5
1900	87.	5.349	.359	93.3
2000	88.	5.736	.444	92.3
2100	89.	5.619	.347	93.8
2200	87.	5.464	.318	94.2
2300	89.	5.293	.360	93.2
# AVERAGES	24.	9.	9.	9.
% OF DATA	100.	38.	38.	38.
MINIMUM	83.	5.191	.283	91.919
MAXIMUM	115.	5.736	.446	94.544
MEAN	98.	######	######	######
STD.DEV.	10.	######	######	######
% STD.DEV.	10.	######	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}\ ,\ E_{OUT} : .000\%$$

NOTE: $(\text{MEAN})^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-25-80

TIME	LOAD	E IN	E OUT	EFF
0	104.	5.734	.353	93.8
100	102.	5.794	.339	94.1
200	102.	5.387	.304	94.4
300	102.	5.512	.320	94.2
400	108.	5.308	.358	93.3
500	108.	######	######	#####
600	105.	######	######	#####
700	104.	######	######	#####
800	106.	######	######	#####
900	108.	######	######	#####
1000	109.	######	######	#####
1100	116.	######	######	#####
1200	116.	######	######	#####
1300	106.	######	######	#####
1400	106.	5.743	.141	97.5
1500	111.	5.605	.376	93.3
1600	81.	5.577	.483	91.3
1700	83.	5.683	.325	94.3
1800	83.	5.626	.372	93.4
1900	86.	5.598	.224	96.0
2000	86.	5.483	.459	91.6
2100	85.	5.401	.466	91.4
2200	85.	5.423	.498	90.8
2300	87.	5.462	.541	90.1
# AVERAGES	24.	15.	15.	15.
% OF DATA	100.	63.	63.	63.
MINIMUM	81.	5.308	.141	90.097
MAXIMUM	116.	5.794	.541	97.545
MEAN	100.	######	######	######
STD.DEV.	11.	######	######	######
% STD.DEV.	12.	######	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : .000\%$$

NOTE: (MEAN) IS DEFINED AS:

$$(\text{MEAN})\ {}^{X}_{Y}$$

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-26-80

TIME	LOAD	E IN	E OUT	EFF
0	98.	5.263	.619	88.2
100	98.	5.694	.617	89.2
200	98.	5.730	.640	88.8
300	98.	######	.733	#####
400	98.	######	.425	#####
500	104.	######	.589	#####
600	104.	######	.559	#####
700	104.	######	.728	#####
800	122.	######	.821	#####
900	118.	######	.877	#####
1000	122.	5.669	.953	83.2
1100	129.	5.674	.817	85.6
1200	115.	5.557	.546	90.2
1300	114.	5.706	.309	94.6
1400	116.	5.387	.339	93.7
1500	121.	5.530	.441	92.0
1600	105.	5.428	.435	92.0
1700	102.	5.508	.576	89.5
1800	102.	5.369	.564	89.5
1900	104.	5.418	.663	87.8
2000	107.	5.453	.662	87.9
2100	108.	5.469	.576	89.5
2200	102.	5.377	.774	85.6
2300	113.	5.385	.818	84.8
# AVERAGES	24.	17.	24.	17.
% OF DATA	100.	71.	100.	71.
MINIMUM	98.	5.263	.309	83.195
MAXIMUM	129.	5.730	.953	94.576
MEAN	108.	######	.628	######
STD.DEV.	9.	######	.167	######
% STD.DEV.	9.	######	26.580	######

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)\ {}^{1}_{X}E_{IN}, E_{OUT} : ######\%$$

$$(MEAN)\ {}^{Y}_{X}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-27-80

TIME	LOAD	E IN	E OUT	EFF
0	116.	5.274	.917	82.6
100	116.	5.397	.748	86.1
200	116.	5.114	.483	90.6
300	116.	5.250	.489	90.7
400	122.	5.282	.194	96.3
500	122.	5.055	.294	94.2
600	122.	5.586	.501	91.0
700	122.	5.412	.492	90.9
800	115.	5.381	.448	91.8
900	124.	5.320	.556	89.5
1000	124.	######	######	#####
1100	124.	######	######	#####
1200	125.	5.170	.250	95.2
1300	120.	5.292	.431	91.9
1400	126.	5.054	.590	88.3
1500	129.	5.106	.667	86.9
1600	125.	5.111	.467	90.9
1700	132.	5.106	.451	91.2
1800	120.	5.016	.279	94.4
1900	111.	5.124	.271	94.7
2000	111.	5.145	.315	93.9
2100	111.	5.324	.290	94.6
2200	114.	5.523	.510	90.8
2300	114.	5.500	.858	84.4
# AVERAGES	24.	22.	22.	22.
% OF DATA	100.	92.	92.	92.
MINIMUM	111.	5.016	.194	82.614
MAXIMUM	132.	5.586	.917	96.329
MEAN	120.	5.252	.477	90.943
STD.DEV.	6.	.165	.193	3.569
% STD.DEV.	5.	3.143	40.429	3.925

24-HOUR REMOVAL EFICIENCY USING

$$[\text{MEAN}]\ {}^{1}_{1}E_{IN},E_{OUT} : 90.912\%$$

$$[\text{MEAN}]\ {}^{X}_{Y}$$

NOTE: [MEAN] IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-28-80

TIME	LOAD	E IN	E OUT	EFF
0	108.	5.297	.516	90.3
100	108.	5.062	.452	91.1
200	108.	5.438	.584	89.3
300	108.	5.276	.383	92.7
400	108.	5.409	.461	91.5
500	115.	5.164	.379	92.7
600	115.	4.976	.372	92.5
700	115.	5.313	.482	90.9
800	124.	5.175	.458	91.1
900	127.	5.202	.470	91.0
1000	127.	5.467	.417	92.4
1100	123.	5.198	.307	94.1
1200	123.	5.324	.334	93.7
1300	123.	5.417	.314	94.2
1400	116.	4.995	.266	94.7
1500	116.	5.043	.349	93.1
1600	96.	5.183	.437	91.6
1700	110.	4.904	.476	90.3
1800	115.	5.368	.657	87.8
1900	110.	5.315	.652	87.7
2000	110.	5.396	.639	88.1
2100	114.	5.595	.569	89.8
2200	119.	5.585	.612	89.0
2300	119.	5.656	.595	89.5
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	96.	4.904	.266	87.729
MAXIMUM	127.	5.656	.657	94.682
MEAN	115.	5.282	.466	91.210
STD.DEV.	7.	.200	.117	2.038
% STD.DEV.	6.	3.790	25.037	2.235

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{Y}E_{IN}, E_{OUT} : 91.179\%$$

NOTE: $(\text{MEAN})^{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 2-29-80

TIME	LOAD	E IN	E OUT	EFF
0	98.	5.719	.657	88.5
100	98.	5.381	.442	91.8
200	98.	5.561	.420	92.4
300	98.	5.575	.528	90.5
400	98.	5.574	.399	92.8
500	98.	5.643	.398	93.0
600	98.	5.361	.346	93.6
700	98.	5.074	.320	93.7
800	119.	5.359	.354	93.4
900	118.	5.203	.517	90.1
1000	132.	5.394	.605	88.8
1100	128.	5.356	.598	88.8
1200	128.	5.405	.581	89.2
1300	120.	5.382	.562	89.6
1400	120.	5.390	.597	88.9
1500	120.	5.282	.450	91.5
1600	109.	5.152	.415	91.9
1700	113.	5.307	.425	92.0
1800	112.	5.277	.561	89.4
1900	118.	5.282	.602	88.6
2000	116.	5.326	.649	87.8
2100	122.	5.308	.561	89.4
2200	120.	5.385	.563	89.5
2300	123.	5.541	.656	88.2
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	98.	5.074	.320	87.806
MAXIMUM	132.	5.719	.657	95.696
MEAN	113.	5.385	.509	90.561
STD.DEV.	12.	.153	.106	1.916
% STD.DEV.	10.	2.846	20.756	2.116

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : 90.556\%$$

$$(\text{MEAN})^{X}_{Y}$$

NOTE: $(\text{MEAN})^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKEN AFB 1980
DATE: 3- 1-80

TIME	LOAD	E IN	E OUT	EFF
0	108.	5.830	.557	90.4
100	106.	5.233	.414	92.1
200	106.	5.317	.383	92.8
300	106.	5.298	.428	91.9
400	110.	5.350	.557	89.6
500	111.	5.385	.549	89.8
600	111.	5.430	.548	89.9
700	111.	5.262	.482	90.8
800	138.	5.401	.481	91.1
900	134.	5.500	.535	90.3
1000	134.	######	######	#####
1100	131.	######	######	#####
1200	131.	######	######	#####
1300	131.	######	######	#####
1400	117.	######	######	#####
1500	127.	5.260	.332	93.7
1600	117.	5.248	.254	95.2
1700	119.	5.221	.244	95.3
1800	122.	5.240	.313	94.0
1900	123.	5.323	.370	93.1
2000	124.	5.307	.479	91.0
2100	126.	5.260	1.053	80.0
2200	128.	5.254	1.071	79.6
2300	130.	5.309	.491	90.7
# AVERAGES	24.	19.	19.	19.
% OF DATA	100.	79.	79.	79.
MINIMUM	106.	5.221	.244	79.620
MAXIMUM	134.	5.830	1.071	95.321
MEAN	121.	5.338	.502	90.597
STD.DEV.	10.	.140	.221	4.185
% STD.DEV.	8.	2.629	43.974	4.619

24-HOUR REMOVAL EFICIENCY USING

$$[\text{MEAN}]_1^X E_{IN}, E_{OUT} : 90.595\%$$

NOTE: $[\text{MEAN}]_1^X$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

30 OPERATING DAYS
SUMMARY OF RESULTS
USING 1-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80

	LOAD	E IN	E OUT	EFF
# AVERAGES	719.	622.	496.	426.
% OF DATA	100.	86.	69.	59.
MINIMUM	23.	3.628	.097	77.940
MAXIMUM	134.	6.935	1.166	98.207
MEAN	110.	5.380	.436	91.988
STD.DEV.	10.	.308	.181	3.412
% STD.DEV.	9.	5.725	41.433	3.710

30-DAY REMOVAL EFICIENCY USING

$$[MEAN]^{1}_{30} E_{IN}, E_{OUT} : 91.902\%$$

NOTE: $[MEAN]^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

30 OPERATING DAYS
SUMMARY OF RESULTS
USING 24-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80

DATE	LOAD	E IN	E OUT	EFF
1-25-80	107.	4.710	.491	89.7
1-26-80	107.	5.050	.534	89.4
1-27-80	110.	5.340	.373	93.0
1-28-80	108.	5.293	.416	92.3
1-31-80	113.	5.211	.546	89.5
2- 1-80	113.	5.456	.452	91.7
2- 2-80	113.	5.710	######	#####
2- 3-80	114.	5.255	######	#####
2- 4-80	116.	5.422	.605	88.8
2- 5-80	110.	5.375	.432	92.0
2- 7-80	113.	5.511	######	#####
2- 8-80	109.	5.240	######	#####
2- 9-80	112.	5.477	.341	93.8
2-10-80	111.	5.543	######	#####
2-11-80	113.	5.389	.439	91.8
2-12-80	112.	5.159	.288	94.4
2-13-80	111.	5.126	######	#####
2-14-80	109.	5.435	.219	96.0
2-15-80	103.	5.678	######	#####
2-16-80	106.	5.658	######	#####
2-17-80	113.	5.653	.449	92.0
2-18-80	112.	5.620	.295	94.7
2-19-80	93.	5.565	.295	94.6
2-20-80	97.	######	.427	#####
2-21-80	89.	######	.422	#####
2-26-80	108.	######	.628	#####
2-27-80	120.	5.252	.477	90.9
2-28-80	115.	5.282	.466	91.2
2-29-80	113.	5.385	.509	90.6
3- 1-80	121.	5.338	.502	90.6
# AVERAGES	30.	27.	22.	19.
% OF DATA	97.	87.	71.	61.
MINIMUM	89.	4.710	.219	88.803
MAXIMUM	121.	5.710	.628	95.975
MEAN	110.	5.375	.437	91.948
STD.DEV.	7.	.222	.104	2.036
% STD.DEV.	6.	4.123	23.738	2.216

30-DAY REMOVAL EFICIENCY USING

$$(\text{MEAN})^{24}_{30}\ E_{IN}, E_{OUT} : 91.876\%$$

NOTE: $(\text{MEAN})^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.400 - 3.800	0.	0.	
3.800 - 4.200	1.	0.	
4.200 - 4.600	12.	2.	*
4.600 - 5.000	55.	7.	****
5.000 - 5.400	306.	41.	**********
5.400 - 5.800	331.	44.	**********
5.800 - 6.200	37.	5.	**
6.200 - 6.600	2.	0.	
6.600 - 7.000	0.	0.	

BEYOND MIN/MAX RANGE 3.
TOTAL POPULATION 747.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.000 - 3.800	0.	0.	
3.000 - 4.200	1.	0.	
3.000 - 4.600	13.	2.	*
3.000 - 5.000	68.	9.	*****
3.000 - 5.400	374.	50.	**********
3.000 - 5.800	705.	94.	**********
3.000 - 6.200	742.	99.	**********
3.000 - 6.600	744.	100.	**********
3.000 - 7.000	744.	100.	**********

BEYOND MIN/MAX RANGE 3.
TOTAL POPULATION 747.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.535 - .570	0.	0.	
.570 - .605	1.	0.	
.605 - .640	1.	0.	
.640 - .675	17.	2.	*
.675 - .710	110.	15.	*******
.710 - .745	425.	57.	**********
.745 - .780	188.	25.	**********
.780 - .815	6.	1.	
.815 - .850	0.	0.	

BEYOND MIN/MAX RANGE 3.
TOTAL POPULATION 747.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.500 - .570	0.	0.	
.500 - .605	1.	0.	
.500 - .640	2.	0.	
.500 - .675	19.	3.	*
.500 - .710	129.	17.	*********
.500 - .745	554.	74.	**********
.500 - .780	738.	99.	**********
.500 - .815	744.	100.	**********
.500 - .850	744.	100.	**********

BEYOND MIN/MAX RANGE 3.
TOTAL POPULATION 747.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	25.	4.	**
.159 - .308	150.	23.	**********
.308 - .457	237.	36.	**********
.457 - .606	154.	23.	**********
.606 - .755	65.	10.	*****
.755 - .904	23.	3.	**
.904 - 1.053	6.	1.	
1.053 - 1.202	8.	1.	
1.202 - 1.351	0.	0.	
1.351 - 1.500	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 664.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	25.	4.	**
.010 - .308	175.	26.	**********
.010 - .457	412.	62.	**********
.010 - .606	566.	85.	**********
.010 - .755	631.	95.	**********
.010 - .904	654.	98.	**********
.010 - 1.053	660.	99.	**********
.010 - 1.202	664.	100.	**********
.010 - 1.351	664.	100.	**********
.010 - 1.500	664.	100.	**********

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 664.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-1.782 - -1.564	0.	0.	
-1.564 - -1.346	1.	0.	
-1.346 - -1.128	0.	0.	
-1.128 - -.910	7.	1.	*
-.910 - -.692	50.	8.	****
-.692 - -.474	163.	25.	**********
-.474 - -.256	300.	45.	**********
-.256 - -.038	133.	20.	**********
-.038 - .180	0.	0.	
BEYOND MIN/MAX RANGE	10.		
TOTAL POPULATION	664.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-2.000 - -1.564	0.	0.	
-2.000 - -1.346	1.	0.	
-2.000 - -1.128	1.	0.	
-2.000 - -.910	8.	1.	*
-2.000 - -.692	58.	9.	****
-2.000 - -.474	221.	33.	**********
-2.000 - -.256	521.	78.	**********
-2.000 - -.038	654.	98.	**********
-2.000 - .180	654.	98.	**********
BEYOND MIN/MAX RANGE	10.		
TOTAL POPULATION	664.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	0.	0.	
63.990 - 67.980	0.	0.	
67.980 - 71.970	0.	0.	
71.970 - 75.960	0.	0.	
75.960 - 79.950	3.	0.	
79.950 - 83.940	15.	2.	*
83.940 - 87.930	47.	7.	****
87.930 - 91.920	200.	31.	******************
91.920 - 95.910	303.	48.	**************************
95.910 - 99.900	0.	0.	
BEYOND MIN/MAX RANGE	68.		
TOTAL POPULATION	636.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	0.	0.	
60.000 - 67.980	0.	0.	
60.000 - 71.970	0.	0.	
60.000 - 75.960	0.	0.	
60.000 - 79.950	3.	0.	
60.000 - 83.940	18.	3.	*
60.000 - 87.930	65.	10.	*****
60.000 - 91.920	265.	42.	**********************
60.000 - 95.910	568.	89.	**
60.000 - 99.900	568.	89.	**
BEYOND MIN/MAX RANGE	68.		
TOTAL POPULATION	636.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKEN AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	0.	0.	
1.730 - 1.760	0.	0.	
1.760 - 1.790	0.	0.	
1.790 - 1.820	0.	0.	
1.820 - 1.850	0.	0.	
1.850 - 1.880	0.	0.	
1.880 - 1.910	4.	1.	
1.910 - 1.940	45.	7.	****
1.940 - 1.970	337.	53.	**********
1.970 - 2.000	0.	0.	
BEYOND MIN/MAX RANGE	250.		
TOTAL POPULATION	636.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	0.	0.	
1.700 - 1.760	0.	0.	
1.700 - 1.790	0.	0.	
1.700 - 1.820	0.	0.	
1.700 - 1.850	0.	0.	
1.700 - 1.880	0.	0.	
1.700 - 1.910	4.	1.	
1.700 - 1.940	49.	8.	****
1.700 - 1.970	386.	61.	**********
1.700 - 2.000	386.	61.	**********
BEYOND MIN/MAX RANGE	250.		
TOTAL POPULATION	636.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	63.	10.	*****
4.009 - 8.008	296.	47.	************************
8.008 - 12.007	211.	33.	*****************
12.007 - 16.006	48.	8.	****
16.006 - 20.005	14.	2.	*
20.005 - 24.004	4.	1.	
24.004 - 28.003	0.	0.	
28.003 - 32.002	0.	0.	
32.002 - 36.001	0.	0.	
36.001 - 40.000	0.	0.	
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	636.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	63.	10.	*****
.010 - 8.008	359.	56.	*****************************
.010 - 12.007	570.	90.	**
.010 - 16.006	618.	97.	**
.010 - 20.005	632.	99.	**
.010 - 24.004	636.	100.	**
.010 - 28.003	636.	100.	**
.010 - 32.002	636.	100.	**
.010 - 36.001	636.	100.	**
.010 - 40.000	636.	100.	**
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	636.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 1-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-1.640 - -1.280	0.	0.	
-1.280 - -.920	0.	0.	
-.920 - -.560	0.	0.	
-.560 - -.200	1.	0.	
-.200 - .160	0.	0.	
.160 - .520	38.	6.	***
.520 - .880	285.	45.	**********
.880 - 1.240	304.	48.	**********
1.240 - 1.600	0.	0.	

BEYOND MIN/MAX RANGE 8.
TOTAL POPULATION 636.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 1-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-2.000 - -1.280	0.	0.	
-2.000 - -.920	0.	0.	
-2.000 - -.560	0.	0.	
-2.000 - -.200	1.	0.	
-2.000 - .160	1.	0.	
-2.000 - .520	39.	6.	***
-2.000 - .880	324.	51.	**********
-2.000 - 1.240	628.	99.	**********
-2.000 - 1.600	628.	99.	**********

BEYOND MIN/MAX RANGE 8.
TOTAL POPULATION 636.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.400 - 3.800	0.	0.	
3.800 - 4.200	0.	0.	
4.200 - 4.600	0.	0.	
4.600 - 5.000	1.	4.	**
5.000 - 5.400	14.	52.	**************************
5.400 - 5.800	12.	44.	**********************
5.800 - 6.200	0.	0.	
6.200 - 6.600	0.	0.	
6.600 - 7.000	0.	0.	
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	27.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.000 - 3.800	0.	0.	
3.000 - 4.200	0.	0.	
3.000 - 4.600	0.	0.	
3.000 - 5.000	1.	4.	**
3.000 - 5.400	15.	56.	*****************************
3.000 - 5.800	27.	100.	**
3.000 - 6.200	27.	100.	**
3.000 - 6.600	27.	100.	**
3.000 - 7.000	27.	100.	**
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	27.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.535 - .570	0.	0.	
.570 - .605	0.	0.	
.605 - .640	0.	0.	
.640 - .675	1.	4.	**
.675 - .710	2.	7.	****
.710 - .745	18.	67.	**********
.745 - .780	6.	22.	**********
.780 - .815	0.	0.	
.815 - .850	0.	0.	
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	27.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.500 - .570	0.	0.	
.500 - .605	0.	0.	
.500 - .640	0.	0.	
.500 - .675	1.	4.	**
.500 - .710	3.	11.	******
.500 - .745	21.	78.	**********
.500 - .780	27.	100.	**********
.500 - .815	27.	100.	**********
.500 - .850	27.	100.	**********
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	27.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	0.	0.	
.159 - .308	4.	18.	*********
.308 - .457	9.	41.	*********************
.457 - .606	8.	36.	******************
.606 - .755	1.	5.	**
.755 - .904	0.	0.	
.904 - 1.053	0.	0.	
1.053 - 1.202	0.	0.	
1.202 - 1.351	0.	0.	
1.351 - 1.500	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 22.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	0.	0.	
.010 - .308	4.	18.	*********
.010 - .457	13.	59.	*********************************
.010 - .606	21.	95.	**
.010 - .755	22.	100.	**
.010 - .904	22.	100.	**
.010 - 1.053	22.	100.	**
.010 - 1.202	22.	100.	**
.010 - 1.351	22.	100.	**
.010 - 1.500	22.	100.	**

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 22.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-1.782 - -1.564	0.	0.	
-1.564 - -1.346	0.	0.	
-1.346 - -1.128	0.	0.	
-1.128 - -.910	0.	0.	
-.910 - -.692	0.	0.	
-.692 - -.474	4.	18.	*********
-.474 - -.256	16.	73.	**
-.256 - -.038	2.	9.	*****
-.038 - .180	0.	0.	
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	22.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-2.000 - -1.564	0.	0.	
-2.000 - -1.346	0.	0.	
-2.000 - -1.128	0.	0.	
-2.000 - -.910	0.	0.	
-2.000 - -.692	0.	0.	
-2.000 - -.474	4.	18.	*********
-2.000 - -.256	20.	91.	**
-2.000 - -.038	22.	100.	**
-2.000 - .180	22.	100.	**
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	22.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	0.	0.	
63.990 - 67.980	0.	0.	
67.980 - 71.970	0.	0.	
71.970 - 75.960	0.	0.	
75.960 - 79.950	0.	0.	
79.950 - 83.940	0.	0.	
83.940 - 87.930	0.	0.	
87.930 - 91.920	10.	53.	**********
91.920 - 95.910	8.	42.	********
95.910 - 99.900	0.	0.	
BEYOND MIN/MAX RANGE	1.		
TOTAL POPULATION	19.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	0.	0.	
60.000 - 67.980	0.	0.	
60.000 - 71.970	0.	0.	
60.000 - 75.960	0.	0.	
60.000 - 79.950	0.	0.	
60.000 - 83.940	0.	0.	
60.000 - 87.930	0.	0.	
60.000 - 91.920	10.	53.	**********
60.000 - 95.910	18.	95.	**********
60.000 - 99.900	18.	95.	**********
BEYOND MIN/MAX RANGE	1.		
TOTAL POPULATION	19.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	0.	0.	
1.730 - 1.760	0.	0.	
1.760 - 1.790	0.	0.	
1.790 - 1.820	0.	0.	
1.820 - 1.850	0.	0.	
1.850 - 1.880	0.	0.	
1.880 - 1.910	0.	0.	
1.910 - 1.940	0.	0.	
1.940 - 1.970	14.	74.	**********
1.970 - 2.000	0.	0.	
BEYOND MIN/MAX RANGE	5.		
TOTAL POPULATION	19.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	0.	0.	
1.700 - 1.760	0.	0.	
1.700 - 1.790	0.	0.	
1.700 - 1.820	0.	0.	
1.700 - 1.850	0.	0.	
1.700 - 1.880	0.	0.	
1.700 - 1.910	0.	0.	
1.700 - 1.940	0.	0.	
1.700 - 1.970	14.	74.	**********
1.700 - 2.000	14.	74.	**********
BEYOND MIN/MAX RANGE	5.		
TOTAL POPULATION	19.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	0.	0.	
4.009 - 8.008	9.	47.	**********
8.008 - 12.007	10.	53.	**********
12.007 - 16.006	0.	0.	
16.006 - 20.005	0.	0.	
20.005 - 24.004	0.	0.	
24.004 - 28.003	0.	0.	
28.003 - 32.002	0.	0.	
32.002 - 36.001	0.	0.	
36.001 - 40.000	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 19.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	0.	0.	
.010 - 8.008	9.	47.	**********
.010 - 12.007	19.	100.	**********
.010 - 16.006	19.	100.	**********
.010 - 20.005	19.	100.	**********
.010 - 24.004	19.	100.	**********
.010 - 28.003	19.	100.	**********
.010 - 32.002	19.	100.	**********
.010 - 36.001	19.	100.	**********
.010 - 40.000	19.	100.	**********

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 19.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 1-25-80
PARAMETER: 24-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-1.640 - -1.280	0.	0.	
-1.280 - -.920	0.	0.	
-.920 - -.560	0.	0.	
-.560 - -.200	0.	0.	
-.200 - .160	0.	0.	
.160 - .520	0.	0.	
.520 - .880	6.	32.	******************
.880 - 1.240	13.	68.	**********
1.240 - 1.600	0.	0.	
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	19.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 1-25-80
PARAMETER: 24-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-2.000 - -1.280	0.	0.	
-2.000 - -.920	0.	0.	
-2.000 - -.560	0.	0.	
-2.000 - -.200	0.	0.	
-2.000 - .160	0.	0.	
-2.000 - .520	0.	0.	
-2.000 - .880	6.	32.	******************
-2.000 - 1.240	19.	100.	**********
-2.000 - 1.600	19.	100.	**********
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	19.		

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80

TIME	LOAD	E IN	E OUT	EFF
0	140.	5.221	.432	91.7
100	140.	5.326	.425	92.0
200	140.	5.283	.423	91.9
300	140.	5.193	.193	96.3
400	140.	5.154	.264	94.9
500	140.	5.054	.416	91.8
600	140.	5.171	.413	92.0
700	140.	5.133	.342	93.3
800	145.	5.133	.268	94.8
900	133.	5.174	.205	96.0
1000	137.	5.183	.267	94.8
1100	135.	5.195	.420	91.9
1200	127.	5.077	.299	94.1
1300	127.	5.000	.283	94.3
1400	125.	4.781	.146	97.0
1500	125.	4.813	.206	95.7
1600	114.	4.857	.274	94.4
1700	113.	4.943	######	#####
1800	116.	4.949	######	#####
1900	117.	4.985	######	#####
2000	119.	5.027	######	#####
2100	120.	5.004	######	#####
2200	123.	4.990	######	#####
2300	125.	5.086	######	#####
# AVERAGES	24.	24.	17.	17.
% OF DATA	100.	100.	71.	71.
MINIMUM	113.	4.781	.146	91.731
MAXIMUM	145.	5.326	.432	96.956
MEAN	130.	5.070	######	######
STD.DEV.	10.	.140	######	######
% STD.DEV.	8.	2.752	######	######

24-HOUR REMOVAL EFICIENCY USING
1
(MEAN) E , E : #######%
1 IN OUT

Y

NOTE: (MEAN) IS DEFINED AS:
X
THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 3-80

TIME	LOAD	E IN	E OUT	EFF
0	131.	5.063	######	#####
100	132.	4.971	######	#####
200	136.	5.819	######	#####
300	136.	5.190	.171	96.7
400	136.	5.147	.354	93.1
500	136.	5.255	.387	92.6
600	134.	5.180	.392	92.4
700	134.	5.163	.433	91.6
800	122.	5.166	.441	91.5
900	124.	5.218	.452	91.3
1000	109.	5.186	.444	91.4
1100	126.	5.585	.551	89.8
1200	128.	5.476	.699	87.2
1300	128.	5.492	.697	87.3
1400	117.	5.488	.468	91.5
1500	117.	5.424	.522	90.4
1600	115.	5.221	.481	90.8
1700	117.	5.140	.451	91.2
1800	118.	5.244	.367	93.0
1900	120.	5.275	.458	91.3
2000	121.	5.214	.507	90.3
2100	122.	5.317	.467	91.2
2200	124.	5.543	.474	91.4
2300	125.	5.459	.500	90.8
# AVERAGES	24.	24.	21.	21.
% OF DATA	100.	100.	88.	88.
MINIMUM	109.	4.971	.171	87.230
MAXIMUM	136.	5.543	.699	96.696
MEAN	125.	5.259	.462	91.291
STD.DEV.	8.	.156	.111	1.948
% STD.DEV.	6.	2.969	23.919	2.134

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})_1^{24}\ E_{IN}, E_{OUT} : 91.208\%$$

$$(\text{MEAN})_X^Y$$

NOTE: $(\text{MEAN})_X^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 4-80

TIME	LOAD	E IN	E OUT	EFF
0	122.	5.127	.480	90.6
100	122.	5.019	.437	91.3
200	122.	5.037	.447	91.1
300	122.	5.022	.263	94.8
400	122.	5.014	.330	93.4
500	122.	5.050	.322	93.6
600	122.	5.056	.389	92.3
700	122.	4.971	.386	92.2
800	125.	4.792	.409	91.6
900	128.	4.719	.362	92.3
1000	121.	4.628	.376	91.9
1100	117.	4.491	.326	92.7
1200	110.	5.142	.273	94.7
1300	110.	5.124	.205	96.0
1400	106.	5.052	.235	95.3
1500	106.	5.027	.229	95.5
1600	93.	5.047	.195	96.1
1700	92.	5.040	.207	95.9
1800	90.	5.133	.268	94.8
1900	92.	5.115	.225	95.6
2000	93.	5.063	.202	96.0
2100	94.	4.928	.264	94.6
2200	95.	5.006	.313	93.7
2300	96.	5.061	.266	94.7
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	90.	4.491	.195	90.629
MAXIMUM	128.	5.142	.480	96.138
MEAN	110.	4.986	.308	93.790
STD.DEV.	14.	.165	.085	1.773
% STD.DEV.	12.	3.310	27.694	1.890

24-HOUR REMOVAL EFICIENCY USING

$[MEAN]_1^{X}\ E_{IN}, E_{OUT}^{Y}$: 93.815%

NOTE: $[MEAN]_1^{X}$ IS DEFINED AS:

THE MEAN FOR x DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 5-80

TIME	LOAD	E IN	E OUT	EFF
0	87.	4.859	.210	95.7
100	87.	4.873	.198	95.9
200	87.	5.015	.312	93.8
300	87.	5.011	.355	92.9
400	87.	5.051	.340	93.3
500	81.	5.079	.338	93.4
600	81.	5.021	.308	93.9
700	81.	5.006	.310	93.8
800	113.	5.104	.321	93.7
900	108.	5.143	.300	94.2
1000	106.	5.063	.569	88.8
1100	104.	4.938	.469	90.5
1200	108.	5.206	.370	92.9
1300	105.	5.290	.454	91.4
1400	111.	5.343	.365	93.2
1500	111.	5.768	.743	87.1
1600	111.	5.493	.874	84.1
1700	111.	5.547	.610	89.0
1800	110.	5.461	.429	92.1
1900	117.	5.584	.560	90.0
2000	116.	5.635	.453	92.0
2100	110.	5.727	.460	92.0
2200	117.	5.774	.469	91.9
2300	117.	5.757	.498	91.4
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	81.	4.859	.198	84.084
MAXIMUM	117.	5.774	.874	95.931
MEAN	102.	5.281	.430	91.947
STD.DEV.	13.	.311	.159	2.688
% STD.DEV.	13.	5.885	36.891	2.923

24-HOUR REMOVAL EFICIENCY USING

$$[\text{MEAN}]^{1}_{1}\,E_{IN}, E_{OUT} : 91.863\%$$

$$[\text{MEAN}]^{X}_{Y}$$

NOTE: $[\text{MEAN}]^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 6-80

TIME	LOAD	E IN	E OUT	EFF
0	105.	5.462	.459	91.6
100	105.	5.578	.300	94.6
200	105.	5.598	.399	92.9
300	105.	5.570	.424	92.4
400	105.	5.439	.459	91.6
500	105.	5.488	.481	91.2
600	105.	5.566	.462	91.7
700	105.	5.642	.491	91.3
800	119.	5.621	.507	91.0
900	121.	5.786	.550	90.5
1000	121.	5.655	.389	93.1
1100	121.	6.229	.188	97.0
1200	115.	5.895	.208	96.5
1300	131.	5.609	.755	86.5
1400	131.	5.332	.735	86.2
1500	131.	5.212	.700	86.6
1600	134.	5.195	.634	87.8
1700	125.	5.302	.435	91.8
1800	115.	5.300	.531	90.0
1900	115.	5.359	.639	88.1
2000	113.	5.358	.583	89.1
2100	112.	5.309	.540	89.8
2200	119.	5.321	.495	90.7
2300	119.	5.229	.510	90.3
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	105.	5.195	.188	86.225
MAXIMUM	134.	6.229	.755	96.985
MEAN	116.	5.502	.495	90.924
STD.DEV.	10.	.241	.143	2.787
% STD.DEV.	8.	4.377	28.878	3.065

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : 91.008\%$$

NOTE: $(\text{MEAN})^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 7-80

TIME	LOAD	E IN	E OUT	EFF
0	92.	5.371	.455	91.5
100	92.	5.697	.576	89.9
200	92.	5.521	.571	89.7
300	92.	5.376	.624	88.4
400	92.	5.334	.511	90.4
500	90.	5.546	.636	88.5
600	90.	5.644	.563	90.0
700	90.	5.790	.500	91.4
800	120.	5.679	.600	89.4
900	120.	5.791	.526	90.9
1000	127.	5.691	.545	90.4
1100	125.	5.360	.621	88.4
1200	122.	4.938	.465	90.6
1300	122.	4.816	.205	95.8
1400	118.	4.633	.193	95.8
1500	118.	4.507	.160	96.5
1600	105.	4.278	.093	97.8
1700	103.	4.076	.133	96.7
1800	100.	4.055	.063	98.4
1900	99.	4.014	.074	98.1
2000	97.	4.038	.077	98.1
2100	96.	3.959	.050	98.7
2200	94.	3.945	.085	97.9
2300	95.	3.938	.068	98.3
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	90.	3.938	.050	88.402
MAXIMUM	127.	5.791	.636	98.741
MEAN	104.	4.916	.350	93.407
STD.DEV.	13.	.720	.233	3.959
% STD.DEV.	13.	14.641	66.621	4.238

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]_{1}^{1}\ E_{IN}\ ,\ E_{OUT} : 92.888\%$$

$$[MEAN]_{X}^{Y}$$

NOTE: $[MEAN]_{X}^{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 8-80

TIME	LOAD	E IN	E OUT	EFF
0	89.	4.059	.066	98.4
100	82.	4.178	.076	98.2
200	82.	4.076	.059	98.5
300	82.	3.944	######	#####
400	82.	3.970	######	#####
500	89.	4.055	######	#####
600	89.	4.275	######	#####
700	89.	4.566	######	#####
800	122.	4.731	######	#####
900	122.	4.747	######	#####
1000	122.	4.834	######	#####
1100	126.	4.912	######	#####
1200	126.	4.969	######	#####
1300	115.	4.845	######	#####
1400	115.	4.865	######	#####
1500	115.	5.168	.067	98.7
1600	104.	5.168	.026	99.5
1700	105.	5.028	.033	99.3
1800	106.	4.943	.141	97.1
1900	108.	4.765	.221	95.4
2000	109.	4.628	.204	95.6
2100	111.	4.584	.298	93.5
2200	112.	4.444	.248	94.4
2300	113.	4.452	.241	94.6
# AVERAGES	24.	24.	12.	12.
% OF DATA	100.	100.	50.	50.
MINIMUM	82.	3.944	.026	93.498
MAXIMUM	126.	5.168	.298	99.502
MEAN	105.	4.592	######	######
STD.DEV.	15.	.387	######	######
% STD.DEV.	15.	8.438	######	######

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]_1^Y \; E_{IN}, E_{OUT} : \#\#\#\#\#\#\%$$

NOTE: $[MEAN]_1^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 9-80

TIME	LOAD	E IN	E OUT	EFF
0	110.	4.425	.252	94.3
100	118.	4.448	.198	95.6
200	126.	4.560	.277	93.9
300	125.	4.790	.287	94.0
400	122.	4.918	.221	95.5
500	118.	4.769	.198	95.9
600	120.	4.626	.192	95.9
700	118.	4.786	######	#####
800	117.	4.958	######	#####
900	119.	5.059	######	#####
1000	120.	5.188	######	#####
1100	123.	5.296	######	#####
1200	124.	5.165	######	#####
1300	124.	5.283	######	#####
1400	111.	5.246	######	#####
1500	110.	5.202	.264	94.9
1600	103.	5.115	.230	95.5
1700	102.	5.018	.133	97.4
1800	98.	4.886	######	#####
1900	103.	4.862	######	#####
2000	103.	4.629	######	#####
2100	107.	4.644	######	#####
2200	104.	4.615	######	#####
2300	105.	4.637	######	#####
# AVERAGES	24.	24.	10.	10.
% OF DATA	100.	100.	42.	42.
MINIMUM	98.	4.425	.133	93.915
MAXIMUM	126.	5.296	.287	97.356
MEAN	114.	4.880	######	######
STD.DEV.	9.	.272	######	######
% STD.DEV.	8.	5.572	######	######

24-HOUR REMOVAL EFICIENCY USING

$$(MEAN)_{1}^{Y} \; E_{IN}, E_{OUT} : \#\#\#\#\#\#\%$$

NOTE: $(MEAN)_{1}^{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-10-80

TIME	LOAD	E IN	E OUT	EFF
0	116.	4.565	######	#####
100	118.	4.600	######	#####
200	126.	4.523	######	#####
300	125.	4.506	######	#####
400	122.	4.572	######	#####
500	118.	4.708	######	#####
600	120.	5.017	######	#####
700	118.	5.049	######	#####
800	117.	5.063	######	#####
900	114.	5.275	.052	99.0
1000	111.	5.048	.066	98.7
1100	92.	4.647	.111	97.6
1200	92.	4.303	.079	98.2
1300	92.	4.334	.074	98.3
1400	96.	4.257	.077	98.2
1500	96.	4.307	.077	98.2
1600	96.	4.204	.075	98.2
1700	97.	4.216	.091	97.8
1800	97.	4.258	.079	98.1
1900	99.	4.268	.119	97.2
2000	97.	4.407	.191	95.7
2100	98.	4.529	.256	94.4
2200	100.	4.657	.303	93.5
2300	102.	4.631	.362	92.2
# AVERAGES	24.	24.	15.	15.
% OF DATA	100.	100.	63.	63.
MINIMUM	92.	4.204	.052	92.190
MAXIMUM	126.	5.275	.362	99.021
MEAN	107.	4.581	######	######
STD.DEV.	12.	.310	######	######
% STD.DEV.	11.	6.765	######	######

24-HOUR REMOVAL EFICIENCY USING

$[MEAN]_1^1$ E_{IN} , E_{OUT} : ######%

$[MEAN]_1^Y$

NOTE: $[MEAN]_1^X$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-11-80

TIME	LOAD	E IN	E OUT	EFF
0	75.	4.682	.368	92.1
100	75.	4.699	.429	90.9
200	75.	4.699	.428	91.0
300	75.	4.704	.409	91.3
400	80.	4.763	.264	94.5
500	80.	4.850	.156	96.8
600	80.	5.043	.124	97.5
700	80.	5.002	######	#####
800	112.	5.225	######	#####
900	115.	5.399	######	#####
1000	114.	5.199	######	#####
1100	115.	5.069	.514	89.9
1200	131.	5.184	.224	95.7
1300	127.	5.329	.122	97.7
1400	131.	5.129	.218	95.7
1500	131.	5.249	.186	96.5
1600	113.	######	######	#####
1700	110.	######	######	#####
1800	112.	4.991	######	#####
1900	113.	5.465	######	#####
2000	118.	5.384	######	#####
2100	113.	4.993	######	#####
2200	109.	4.854	######	#####
2300	110.	4.670	######	#####
# AVERAGES	24.	22.	12.	12.
% OF DATA	100.	92.	50.	50.
MINIMUM	75.	4.670	.122	89.865
MAXIMUM	131.	5.465	.514	97.716
MEAN	104.	5.026	######	######
STD.DEV.	20.	.259	######	######
% STD.DEV.	19.	5.145	######	######

24-HOUR REMOVAL EFICIENCY USING
1
(MEAN) E , E : ######%
1 IN OUT

Y

NOTE: (MEAN) IS DEFINED AS:
X
THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-12-80

TIME	LOAD	E IN	E OUT	EFF
0	106.	######	######	#####
100	106.	######	######	#####
200	106.	######	######	#####
300	106.	######	######	#####
400	106.	######	######	#####
500	106.	######	######	#####
600	106.	######	######	#####
700	106.	######	######	#####
800	123.	2.506	######	#####
900	137.	3.540	######	#####
1000	142.	4.267	######	#####
1100	142.	4.282	######	#####
1200	132.	4.551	######	#####
1300	132.	######	######	#####
1400	122.	######	######	#####
1500	127.	######	######	#####
1600	136.	######	######	#####
1700	136.	5.214	######	#####
1800	129.	5.678	######	#####
1900	122.	5.926	######	#####
2000	123.	5.776	######	#####
2100	125.	5.734	######	#####
2200	129.	5.841	######	#####
2300	124.	5.893	######	#####
# AVERAGES	24.	12.	0.	0.
% OF DATA	100.	50.	0.	0.
MINIMUM	106.	2.506	######	######
MAXIMUM	142.	5.926	.000	.000
MEAN	122.	######	######	######
STD.DEV.	13.	######	######	######
% STD.DEV.	11.	######	######	######

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]_1^Y \; E_{IN}, E_{OUT} : .000\%$$

NOTE: $[MEAN]_1^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-13-80

TIME	LOAD	E IN	E OUT	EFF
0	108.	5.659	######	#####
100	108.	5.696	######	#####
200	108.	5.306	######	#####
300	108.	4.908	######	#####
400	108.	4.645	######	#####
500	108.	4.288	######	#####
600	108.	4.308	.231	94.6
700	108.	4.606	.354	92.3
800	131.	4.490	.326	92.7
900	129.	4.481	.045	99.0
1000	125.	4.823	.128	97.3
1100	127.	######	######	#####
1200	128.	5.082	.565	88.9
1300	128.	5.011	.574	88.5
1400	121.	5.113	.550	89.2
1500	118.	5.097	.561	89.0
1600	120.	5.017	.502	90.0
1700	120.	4.970	.505	89.8
1800	123.	5.035	.461	90.8
1900	123.	4.949	.421	91.5
2000	121.	4.870	.506	89.6
2100	130.	4.975	.505	89.8
2200	131.	4.928	.634	87.1
2300	131.	4.999	.548	89.0
# AVERAGES	24.	23.	17.	17.
% OF DATA	100.	96.	71.	71.
MINIMUM	108.	4.288	.045	87.132
MAXIMUM	131.	5.696	.634	98.996
MEAN	120.	4.924	######	######
STD.DEV.	9.	.355	######	######
% STD.DEV.	8.	7.205	######	######

24-HOUR REMOVAL EFICIENCY USING

$(MEAN)^{1}_{Y}$ E_{IN} , E_{OUT} : ######%

NOTE: $(MEAN)^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-14-80

TIME	LOAD	E IN	E OUT	EFF
0	109.	5.074	.692	86.4
100	109.	######	.570	#####
200	109.	######	.414	#####
300	109.	######	.373	#####
400	109.	######	.354	#####
500	109.	######	.419	#####
600	109.	######	.336	#####
700	109.	######	.256	#####
800	141.	######	.290	#####
900	141.	######	.339	#####
1000	139.	######	.378	#####
1100	134.	5.368	.531	90.1
1200	132.	5.219	.501	90.4
1300	132.	5.168	.355	93.1
1400	130.	5.237	.338	93.6
1500	130.	5.168	.247	95.2
1600	112.	5.149	.183	96.4
1700	111.	4.998	.155	96.9
1800	111.	5.095	.147	97.1
1900	109.	5.177	.142	97.2
2000	110.	5.162	.118	97.7
2100	112.	5.233	.117	97.8
2200	134.	5.234	.064	98.8
2300	114.	5.254	.108	97.9
# AVERAGES	24.	14.	24.	14.
% OF DATA	100.	58.	100.	58.
MINIMUM	109.	4.998	.064	86.361
MAXIMUM	141.	5.368	.692	98.782
MEAN	119.	######	.309	######
STD.DEV.	13.	######	.163	######
% STD.DEV.	11.	######	52.784	######

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]_1^Y E_{IN}, E_{OUT} : ######\%$$

NOTE: $[MEAN]_1^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-15-80

TIME	LOAD	E IN	E OUT	EFF
0	109.	5.251	.211	96.0
100	109.	5.338	.290	94.6
200	109.	5.258	.488	90.7
300	113.	5.161	.778	84.9
400	113.	5.028	1.929	61.6
500	111.	5.017	2.358	53.0
600	112.	4.974	.772	84.5
700	112.	4.937	.363	92.6
800	121.	5.113	.347	93.2
900	121.	5.263	.401	92.4
1000	127.	5.195	.386	92.6
1100	127.	4.957	.302	93.9
1200	123.	4.907	.186	96.2
1300	123.	4.881	.132	97.3
1400	120.	5.019	.232	95.4
1500	120.	5.106	.635	87.6
1600	90.	5.215	.744	85.7
1700	88.	5.382	.634	88.2
1800	87.	5.293	.710	86.6
1900	90.	5.355	.766	85.7
2000	91.	5.286	.930	82.4
2100	88.	5.234	1.014	80.6
2200	86.	5.221	.989	81.1
2300	87.	5.128	.896	82.5
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	86.	4.881	.132	53.005
MAXIMUM	127.	5.382	2.358	97.298
MEAN	107.	5.147	.687	86.638
STD.DEV.	15.	.151	.527	10.466
% STD.DEV.	14.	2.926	76.731	12.081

24-HOUR REMOVAL EFICIENCY USING

$$(\text{MEAN})\ {}^{1}_{1}E_{IN}, E_{OUT} : 86.647\%$$

$$(\text{MEAN})\ {}^{X}_{Y}$$

NOTE: (MEAN) IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-16-80

TIME	LOAD	E IN	E OUT	EFF
0	101.	5.093	.831	83.7
100	109.	5.143	1.117	78.3
200	105.	5.280	1.090	79.3
300	98.	5.407	.717	86.7
400	101.	5.281	.762	85.6
500	103.	5.235	.637	87.8
600	103.	5.184	.459	91.1
700	103.	5.225	.525	89.9
800	105.	5.215	.309	94.1
900	105.	5.200	.374	92.8
1000	105.	5.294	.399	92.5
1100	103.	5.245	.314	94.0
1200	103.	5.255	.385	92.7
1300	104.	5.284	.259	95.1
1400	106.	5.245	.691	86.8
1500	106.	5.145	.880	82.9
1600	90.	5.180	.863	83.3
1700	89.	5.280	.689	87.0
1800	88.	5.280	.852	83.9
1900	92.	5.325	.948	82.2
2000	90.	5.225	1.039	80.1
2100	89.	5.170	.930	82.0
2200	89.	5.125	.306	94.0
2300	90.	5.137	.190	96.3
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	88.	5.093	.190	78.289
MAXIMUM	109.	5.407	1.117	96.296
MEAN	99.	5.227	.649	87.591
STD.DEV.	7.	.072	.287	5.506
% STD.DEV.	7.	1.387	44.249	6.287

24-HOUR REMOVAL EFICIENCY USING

$$[MEAN]^{1}_{Y} E_{IN}, E_{OUT} : 87.590\%$$

NOTE: $[MEAN]^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-17-80

TIME	LOAD	E IN	E OUT	EFF
0	90.	5.011	.209	95.8
100	94.	5.113	.502	90.2
200	99.	5.133	.711	86.2
300	98.	5.168	.996	80.7
400	99.	5.111	1.036	79.7
500	98.	5.086	1.004	80.3
600	100.	5.345	1.170	78.1
700	100.	5.386	1.024	81.0
800	106.	5.287	1.067	79.8
900	106.	5.265	.569	89.2
1000	100.	4.922	.327	93.4
1100	100.	4.716	.182	96.1
1200	99.	4.967	.249	95.0
1300	93.	5.185	.213	95.9
1400	93.	5.230	.717	86.3
1500	91.	5.067	2.323	54.2
1600	95.	4.832	.767	84.1
1700	91.	4.693	.239	94.9
1800	92.	4.385	.173	96.0
1900	93.	4.461	.226	94.9
2000	97.	4.467	.554	87.6
2100	96.	4.562	.730	84.0
2200	92.	4.583	.569	87.6
2300	93.	4.502	.309	93.1
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	90.	4.385	.173	54.159
MAXIMUM	106.	5.386	2.323	96.143
MEAN	96.	4.935	.661	86.840
STD.DEV.	4.	.316	.485	9.337
% STD.DEV.	5.	6.408	73.357	10.752

24-HOUR REMOVAL EFICIENCY USING

$(MEAN)^{1}_{Y}$ E_{IN} , E_{OUT} : 86.606%

NOTE: $(MEAN)^{X}_{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-18-80

TIME	LOAD	E IN	E OUT	EFF
0	72.	4.481	.222	95.0
100	72.	4.439	.173	96.1
200	72.	4.376	.147	96.6
300	72.	4.379	.540	87.7
400	72.	4.421	.170	96.1
500	72.	4.566	.110	97.6
600	72.	4.631	.039	99.2
700	72.	4.825	.110	97.7
800	77.	4.598	.291	93.7
900	82.	4.673	.263	94.4
1000	82.	4.756	.272	94.3
1100	82.	5.048	.300	94.1
1200	82.	4.965	.239	95.2
1300	74.	4.794	.136	97.2
1400	80.	4.696	.352	92.5
1500	80.	4.664	.354	92.4
1600	95.	4.555	1.850	59.4
1700	94.	4.621	1.426	69.1
1800	93.	4.701	.141	97.0
1900	91.	4.470	.661	85.2
2000	95.	4.428	.119	97.3
2100	93.	4.600	.048	99.0
2200	94.	4.647	.144	96.9
2300	94.	4.738	.234	95.1
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	72.	4.376	.039	59.383
MAXIMUM	95.	5.048	1.850	99.168
MEAN	82.	4.628	.398	92.446
STD.DEV.	9.	.174	.427	9.364
% STD.DEV.	11.	3.769	######	10.129

24-HOUR REMOVAL EFICIENCY USING

$$[\text{MEAN}]^{1}_{1}\,E_{IN}\,,E_{OUT} : 92.490\%$$

NOTE: $[\text{MEAN}]^{Y}_{X}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

DAILY SUMMARY OF RESULTS

LOCATION: RICKENBACKER AFB 1980
DATE: 3-19-80

TIME	LOAD	E IN	E OUT	EFF
0	78.	5.102	1.041	79.6
100	78.	5.124	2.009	60.8
200	78.	5.184	.815	84.0
300	78.	5.075	.513	89.9
400	78.	4.970	.529	89.4
500	78.	4.838	.348	92.8
600	78.	4.812	.256	94.7
700	78.	4.789	.250	94.8
800	102.	4.612	.237	94.9
900	100.	4.726	.705	85.1
1000	99.	4.535	.760	83.2
1100	104.	4.361	.505	88.4
1200	100.	4.327	.387	91.1
1300	99.	4.357	.248	94.3
1400	95.	4.214	.191	95.5
1500	91.	4.077	.117	97.1
1600	99.	4.173	.098	97.6
1700	99.	4.113	.068	98.4
1800	105.	4.123	.090	97.8
1900	105.	4.270	.141	96.7
2000	105.	4.247	.549	87.1
2100	105.	4.255	.471	88.9
2200	105.	3.772	.136	96.4
2300	105.	3.598	.117	96.7
# AVERAGES	24.	24.	24.	24.
% OF DATA	100.	100.	100.	100.
MINIMUM	78.	3.598	.068	60.801
MAXIMUM	105.	5.124	2.009	98.353
MEAN	93.	4.482	.441	90.632
STD.DEV.	12.	.431	.425	8.251
% STD.DEV.	12.	9.614	96.398	9.104

24-HOUR REMOVAL EFICIENCY USING

$(\text{MEAN})_1^{24}\ E_{IN}, E_{OUT} : 90.165\%$

NOTE: $(\text{MEAN})_X^Y$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

17 OPERATING DAYS
SUMMARY OF RESULTS
USING 1-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80

	LOAD	E IN	E OUT	EFF
# AVERAGES	408.	381.	261.	237.
% OF DATA	100.	93.	64.	58.
MINIMUM	72.	3.598	.039	53.005
MAXIMUM	145.	6.229	2.358	99.168
MEAN	108.	4.965	.467	90.541
STD.DEV.	17.	.818	.541	6.877
% STD.DEV.	15.	8.410	72.894	7.596

30-DAY REMOVAL EFICIENCY USING

$(MEAN)_{30}^{1}$ E IN , E OUT : 90.587%

NOTE: $(MEAN)_{X}^{Y}$ IS DEFINED AS:

THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

17 OPERATING DAYS
SUMMARY OF RESULTS
USING 24-HOUR AVERAGES

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80

DATE	LOAD	E IN	E OUT	EFF
3- 2-80	130.	5.070	######	#####
3- 3-80	125.	5.259	.462	91.3
3- 4-80	110.	4.986	.308	93.8
3- 5-80	102.	5.281	.430	91.9
3- 6-80	116.	5.502	.495	90.9
3- 7-80	104.	4.916	.350	93.4
3- 8-80	105.	4.592	######	#####
3- 9-80	114.	4.880	######	#####
3-10-80	107.	4.581	######	#####
3-11-80	104.	5.026	######	#####
3-13-80	120.	4.924	######	#####
3-14-80	119.	######	.309	#####
3-15-80	107.	5.187	.687	86.6
3-16-80	99.	5.227	.649	87.6
3-17-80	96.	4.935	.661	86.8
3-18-80	82.	4.628	.348	92.4
3-19-80	93.	4.482	.441	90.6
# AVERAGES	17.	16.	11.	10.
% OF DATA	55.	52.	35.	32.
MINIMUM	82.	4.482	.308	86.638
MAXIMUM	130.	5.502	.687	93.790
MEAN	108.	4.965	.467	90.551
STD.DEV.	12.	.287	.141	2.640
% STD.DEV.	11.	5.785	30.265	2.916

30-DAY REMOVAL EFICIENCY USING
24
(MEAN) E , E : 90.589%
30 IN OUT

Y
NOTE: (MEAN) IS DEFINED AS:
X
THE MEAN FOR X DAYS USING Y-HOUR AVERAGES

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.400 - 3.800	1.	1.	
3.800 - 4.200	17.	4.	**
4.200 - 4.600	58.	14.	*******
4.600 - 5.000	94.	23.	**********
5.000 - 5.400	187.	46.	************************
5.400 - 5.800	42.	10.	*****
5.800 - 6.200	4.	1.	
6.200 - 6.600	1.	0.	
6.600 - 7.000	0.	0.	
BEYOND MIN/MAX RANGE	1.		
TOTAL POPULATION	407.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.000 - 3.800	3.	1.	
3.000 - 4.200	20.	5.	**
3.000 - 4.600	78.	19.	**********
3.000 - 5.000	172.	42.	**********
3.000 - 5.400	359.	88.	**********
3.000 - 5.800	401.	99.	**********
3.000 - 6.200	405.	100.	**********
3.000 - 6.600	406.	100.	**********
3.000 - 7.000	406.	100.	**********
BEYOND MIN/MAX RANGE	1.		
TOTAL POPULATION	407.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.535 - .570	2.	0.	
.570 - .605	7.	2.	*
.605 - .640	32.	8.	****
.640 - .675	69.	17.	********
.675 - .710	131.	32.	**********
.710 - .745	134.	33.	**********
.745 - .780	30.	7.	****
.780 - .815	1.	0.	
.815 - .850	0.	0.	

BEYOND MIN/MAX RANGE 1.
TOTAL POPULATION 407.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.500 - .570	2.	0.	
.500 - .605	9.	2.	*
.500 - .640	41.	10.	*****
.500 - .675	110.	27.	**********
.500 - .710	241.	59.	**********
.500 - .745	375.	92.	**********
.500 - .780	405.	100.	**********
.500 - .815	406.	100.	**********
.500 - .850	406.	100.	**********

BEYOND MIN/MAX RANGE 1.
TOTAL POPULATION 407.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	57.	17.	********
.159 - .308	87.	25.	**********
.308 - .457	75.	22.	**********
.457 - .606	64.	19.	*********
.606 - .755	26.	8.	****
.755 - .904	14.	4.	**
.904 - 1.053	11.	3.	**
1.053 - 1.202	4.	1.	*
1.202 - 1.351	0.	0.	
1.351 - 1.500	0.	0.	

BEYOND MIN/MAX RANGE 6.
TOTAL POPULATION 344.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	57.	17.	********
.010 - .308	144.	42.	**********
.010 - .457	219.	64.	**********
.010 - .606	283.	82.	**********
.010 - .755	309.	90.	**********
.010 - .904	323.	94.	**********
.010 - 1.053	334.	97.	**********
.010 - 1.202	338.	98.	**********
.010 - 1.351	338.	98.	**********
.010 - 1.500	338.	98.	**********

BEYOND MIN/MAX RANGE 6.
TOTAL POPULATION 344.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-1.782 - -1.564	1.	0.	
-1.564 - -1.346	3.	1.	
-1.346 - -1.128	13.	4.	**
-1.128 - -.910	23.	7.	***
-.910 - -.692	38.	11.	******
-.692 - -.474	79.	23.	**********
-.474 - -.256	113.	33.	**********
-.256 - -.038	53.	15.	********
-.038 - .180	0.	0.	
BEYOND MIN/MAX RANGE	21.		
TOTAL POPULATION	344.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-2.000 - -1.564	1.	0.	
-2.000 - -1.346	4.	1.	*
-2.000 - -1.128	17.	5.	**
-2.000 - -.910	40.	12.	******
-2.000 - -.692	78.	23.	**********
-2.000 - -.474	157.	46.	**********
-2.000 - -.256	270.	78.	**********
-2.000 - -.038	323.	94.	**********
-2.000 - .180	323.	94.	**********
BEYOND MIN/MAX RANGE	21.		
TOTAL POPULATION	344.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	2.	1.	
63.990 - 67.980	0.	0.	
67.980 - 71.970	1.	0.	
71.970 - 75.960	0.	0.	
75.960 - 79.950	6.	2.	*
79.950 - 83.940	15.	4.	**
83.940 - 87.930	32.	10.	*****
87.930 - 91.920	84.	25.	**********
91.920 - 95.910	115.	34.	**********
95.910 - 99.900	0.	0.	
BEYOND MIN/MAX RANGE	79.		
TOTAL POPULATION	334.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	2.	1.	
60.000 - 67.980	2.	1.	
60.000 - 71.970	3.	1.	
60.000 - 75.960	3.	1.	
60.000 - 79.950	9.	3.	*
60.000 - 83.940	24.	7.	****
60.000 - 87.930	56.	17.	********
60.000 - 91.920	140.	42.	**********
60.000 - 95.910	255.	76.	**********
60.000 - 99.900	255.	76.	**********
BEYOND MIN/MAX RANGE	79.		
TOTAL POPULATION	334.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	1.	0.	
1.730 - 1.760	1.	0.	
1.760 - 1.790	3.	1.	
1.790 - 1.820	0.	0.	
1.820 - 1.850	1.	0.	
1.850 - 1.880	0.	0.	
1.880 - 1.910	12.	4.	**
1.910 - 1.940	31.	9.	*****
1.940 - 1.970	131.	39.	**********
1.970 - 2.000	0.	0.	
BEYOND MIN/MAX RANGE	154.		
TOTAL POPULATION	334.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	1.	0.	
1.700 - 1.760	2.	1.	
1.700 - 1.790	5.	1.	*
1.700 - 1.820	5.	1.	*
1.700 - 1.850	6.	2.	*
1.700 - 1.880	6.	2.	*
1.700 - 1.910	18.	5.	***
1.700 - 1.940	49.	15.	*******
1.700 - 1.970	180.	54.	**********
1.700 - 2.000	180.	54.	**********
BEYOND MIN/MAX RANGE	154.		
TOTAL POPULATION	334.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	74.	22.	**********
4.009 - 8.008	114.	34.	**********
8.008 - 12.007	87.	26.	**********
12.007 - 16.006	32.	10.	*****
16.006 - 20.005	15.	4.	**
20.005 - 24.004	6.	2.	*
24.004 - 28.003	0.	0.	
28.003 - 32.002	1.	0.	
32.002 - 36.001	0.	0.	
36.001 - 40.000	0.	0.	
BEYOND MIN/MAX RANGE	5.		
TOTAL POPULATION	334.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	74.	22.	**********
.010 - 8.008	188.	56.	**********
.010 - 12.007	275.	82.	**********
.010 - 16.006	307.	92.	**********
.010 - 20.005	322.	96.	**********
.010 - 24.004	328.	98.	**********
.010 - 28.003	328.	98.	**********
.010 - 32.002	329.	99.	**********
.010 - 36.001	329.	99.	**********
.010 - 40.000	329.	99.	**********
BEYOND MIN/MAX RANGE	5.		
TOTAL POPULATION	334.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 1-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-1.640 - -1.280	0.	0.	
-1.280 - -.920	0.	0.	
-.920 - -.560	0.	0.	
-.560 - -.200	1.	0.	
-.200 - .160	9.	3.	*
.160 - .520	47.	14.	*******
.520 - .880	120.	36.	**********
.880 - 1.240	135.	40.	**********
1.240 - 1.600	0.	0.	
BEYOND MIN/MAX RANGE	22.		
TOTAL POPULATION	334.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 1-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-2.000 - -1.280	0.	0.	
-2.000 - -.920	0.	0.	
-2.000 - -.560	0.	0.	
-2.000 - -.200	1.	0.	
-2.000 - .160	10.	3.	*
-2.000 - .520	57.	17.	*********
-2.000 - .880	177.	53.	**********
-2.000 - 1.240	312.	93.	**********
-2.000 - 1.600	312.	93.	**********
BEYOND MIN/MAX RANGE	22.		
TOTAL POPULATION	334.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.400 - 3.800	0.	0.	
3.800 - 4.200	0.	0.	
4.200 - 4.600	3.	19.	*********
4.600 - 5.000	6.	38.	**********
5.000 - 5.400	6.	38.	**********
5.400 - 5.800	1.	6.	***
5.800 - 6.200	0.	0.	
6.200 - 6.600	0.	0.	
6.600 - 7.000	0.	0.	
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	16.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR EIN, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
3.000 - 3.400	0.	0.	
3.000 - 3.800	0.	0.	
3.000 - 4.200	0.	0.	
3.000 - 4.600	3.	19.	*********
3.000 - 5.000	9.	56.	**********
3.000 - 5.400	15.	94.	**********
3.000 - 5.800	16.	100.	**********
3.000 - 6.200	16.	100.	**********
3.000 - 6.600	16.	100.	**********
3.000 - 7.000	16.	100.	**********
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	16.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.535 - .570	0.	0.	
.570 - .605	0.	0.	
.605 - .640	0.	0.	
.640 - .675	4.	25.	**********
.675 - .710	7.	44.	**********
.710 - .745	5.	31.	**********
.745 - .780	0.	0.	
.780 - .815	0.	0.	
.815 - .850	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 16.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR LOG EIN

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.500 - .535	0.	0.	
.500 - .570	0.	0.	
.500 - .605	0.	0.	
.500 - .640	0.	0.	
.500 - .675	4.	25.	**********
.500 - .710	11.	69.	**********
.500 - .745	16.	100.	**********
.500 - .780	16.	100.	**********
.500 - .815	16.	100.	**********
.500 - .850	16.	100.	**********

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 16.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	0.	0.	
.159 - .308	0.	0.	
.308 - .457	6.	55.	**********
.457 - .606	2.	18.	**********
.606 - .755	3.	27.	**********
.755 - .904	0.	0.	
.904 - 1.053	0.	0.	
1.053 - 1.202	0.	0.	
1.202 - 1.351	0.	0.	
1.351 - 1.500	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 11.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR EOUT, LB/MMBTU

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - .159	0.	0.	
.010 - .308	0.	0.	
.010 - .457	6.	55.	**********
.010 - .606	8.	73.	**********
.010 - .755	11.	100.	**********
.010 - .904	11.	100.	**********
.010 - 1.053	11.	100.	**********
.010 - 1.202	11.	100.	**********
.010 - 1.351	11.	100.	**********
.010 - 1.500	11.	100.	**********

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 11.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-1.782 - -1.564	0.	0.	
-1.564 - -1.346	0.	0.	
-1.346 - -1.128	0.	0.	
-1.128 - -.910	0.	0.	
-.910 - -.692	0.	0.	
-.692 - -.474	2.	18.	*********
-.474 - -.256	6.	55.	**********
-.256 - -.038	3.	27.	***************
-.038 - .180	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 11.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR LOG EOUT

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.782	0.	0.	
-2.000 - -1.564	0.	0.	
-2.000 - -1.346	0.	0.	
-2.000 - -1.128	0.	0.	
-2.000 - -.910	0.	0.	
-2.000 - -.692	0.	0.	
-2.000 - -.474	2.	18.	*********
-2.000 - -.256	8.	73.	**********
-2.000 - -.038	11.	100.	**********
-2.000 - .180	11.	100.	**********

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 11.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	0.	0.	
63.990 - 67.980	0.	0.	
67.980 - 71.970	0.	0.	
71.970 - 75.960	0.	0.	
75.960 - 79.950	0.	0.	
79.950 - 83.940	0.	0.	
83.940 - 87.930	3.	30.	**********
87.930 - 91.920	3.	30.	**********
91.920 - 95.910	4.	40.	**********
95.910 - 99.900	0.	0.	
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	10.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR % EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
60.000 - 63.990	0.	0.	
60.000 - 67.980	0.	0.	
60.000 - 71.970	0.	0.	
60.000 - 75.960	0.	0.	
60.000 - 79.950	0.	0.	
60.000 - 83.940	0.	0.	
60.000 - 87.930	3.	30.	**********
60.000 - 91.920	6.	60.	**********
60.000 - 95.910	10.	100.	**********
60.000 - 99.900	10.	100.	**********
BEYOND MIN/MAX RANGE	0.		
TOTAL POPULATION	10.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	0.	0.	
1.730 - 1.760	0.	0.	
1.760 - 1.790	0.	0.	
1.790 - 1.820	0.	0.	
1.820 - 1.850	0.	0.	
1.850 - 1.880	0.	0.	
1.880 - 1.910	0.	0.	
1.910 - 1.940	2.	20.	**********
1.940 - 1.970	6.	60.	**********
1.970 - 2.000	0.	0.	
BEYOND MIN/MAX RANGE	2.		
TOTAL POPULATION	10.		

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR LOG(% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
1.700 - 1.730	0.	0.	
1.700 - 1.760	0.	0.	
1.700 - 1.790	0.	0.	
1.700 - 1.820	0.	0.	
1.700 - 1.850	0.	0.	
1.700 - 1.880	0.	0.	
1.700 - 1.910	0.	0.	
1.700 - 1.940	2.	20.	**********
1.700 - 1.970	8.	80.	**********
1.700 - 2.000	8.	80.	**********
BEYOND MIN/MAX RANGE	2.		
TOTAL POPULATION	10.		

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	0.	0.	
4.009 - 8.008	3.	30.	******************
8.008 - 12.007	4.	40.	**********************
12.007 - 16.006	3.	30.	******************
16.006 - 20.005	0.	0.	
20.005 - 24.004	0.	0.	
24.004 - 28.003	0.	0.	
28.003 - 32.002	0.	0.	
32.002 - 36.001	0.	0.	
36.001 - 40.000	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 10.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR 100-% EFFICIENCY

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
.010 - 4.009	0.	0.	
.010 - 8.008	3.	30.	******************
.010 - 12.007	7.	70.	**
.010 - 16.006	10.	100.	**
.010 - 20.005	10.	100.	**
.010 - 24.004	10.	100.	**
.010 - 28.003	10.	100.	**
.010 - 32.002	10.	100.	**
.010 - 36.001	10.	100.	**
.010 - 40.000	10.	100.	**

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 10.

FREQUENCY DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
STARTING DATE: 3- 2-80
PARAMETER: 24-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-1.640 - -1.280	0.	0.	
-1.280 - -.920	0.	0.	
-.920 - -.560	0.	0.	
-.560 - -.200	0.	0.	
-.200 - .160	0.	0.	
.160 - .520	0.	0.	
.520 - .880	3.	30.	**********
.880 - 1.240	7.	70.	**********
1.240 - 1.600	0.	0.	

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 10.

CUMULATIVE DISTRIBUTION

LOCATION: RICKENBACKER AFB 1980
DATE: 3- 2-80
PARAMETER: 24-HOUR LOG(100-% EFFICIENCY)

PARAMETER RANGE	OCCURRENCE FREQUENCY	PERCENTAGE	HISTOGRAM
-2.000 - -1.640	0.	0.	
-2.000 - -1.280	0.	0.	
-2.000 - -.920	0.	0.	
-2.000 - -.560	0.	0.	
-2.000 - -.200	0.	0.	
-2.000 - .160	0.	0.	
-2.000 - .520	0.	0.	
-2.000 - .880	3.	30.	**********
-2.000 - 1.240	10.	100.	**********
-2.000 - 1.600	10.	100.	**********

BEYOND MIN/MAX RANGE 0.
TOTAL POPULATION 10.