MASTER

Annual Report (4.1-5)

Volume III

**ENVIRONMENTAL BASELINE MONITORING IN THE AREA OF GENERAL CRUDE OIL--
DEPARTMENT OF ENERGY PLEASANT BAYOU NUMBER 1--
A GEOPRESSURED-GEOTHERMAL TEST WELL--1978**

by

Thomas C. Gustavson

**APPENDIX II:
AIR QUALITY MONITORING
RADIAN CORPORATION
AUSTIN, TEXAS**

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Prepared for

**The U. S. Department of Energy, Division of Geothermal Energy
Provided by Contract Number DE-AS05-77ET27031
(formerly EG-77-S-05-5401)**

**Bureau of Economic Geology
The University of Texas at Austin
W. L. Fisher, Director**

1979

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RADIAN

CORPORATION

DCN 78-100-212-01

AIR MONITORING REPORT
FOR
THE UNIVERSITY OF TEXAS
BUREAU OF ECONOMIC GEOLOGY
MARCH 1978
Report No. 1

4 May 1978

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TABLE OF CONTENTS

	<u>Page</u>
I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM-----	1
II. DESCRIPTION OF INSTRUMENT SYSTEMS-----	4
A. Air Quality Instrumentation-----	4
1. Description-----	4
2. Calibration-----	5
B. Data Acquisition System-----	6
III. OPERATING TIME ANALYSIS-----	8
IV. DATA PRESENTATION AND SUMMARY-----	10

LIST OF TABLES

	<u>Page</u>
TABLE I DOWNTIME HOURS FOR CHOCOLATE BAYOU, TEXAS-----	9
TABLE II NATIONAL AMBIENT AIR QUALITY STANDARDS-----	14
TABLE III AVERAGES FOR MARCH 1 THRU 31, 1978-----	15
TABLE IV DAILY AVERAGES FOR MARCH 1 THRU 31, 1978-----	16
TABLE V MAXIMUM FIVE-MINUTE AVERAGES AND TIMES OF OCCURRENCE FOR MARCH 1 THRU 31, 1978-----	18
TABLE VI THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR MARCH 1 THRU 31, 1978-----	21
TABLE VII DIURNAL VARIATION OF RECORDED PARAMETERS-----	24

I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM

Radian Corporation is under contract to the University of Texas, Bureau of Economic Geology, to provide ambient air quality monitoring at one site near Chocolate Bayou, Texas. This site measures and records concentrations for sulfur dioxide, hydrogen sulfide, methane, and particulates. A bag sample is collected bi-weekly and returned to Radian's Austin facilities and analyzed for methane.

Figure 1 shows the configuration of this type of monitoring station. The trailer provides a sturdy and protective covering as well as mobility. Figure 2 shows the air monitoring site.

FIGURE I

AMBIENT AIR MONITORING SYSTEM I

FIGURE 2
AIR MONITORING SITE

II. DESCRIPTION OF INSTRUMENT SYSTEMS

The ambient air monitoring station is equipped to monitor the parameters shown below:

Sulfur Dioxide
Particulates
Methane
Hydrogen Sulfide

A. Air Quality Instrumentation

1. Description

Sulfur dioxide is measured with a Meloy Model SA185-2A sulfur analyzer, which is an EPA-approved analyzer. This automated analyzer utilizes the flame photometric principle to measure sulfur levels with a minimum detectable sensitivity of 5 ppb, and a linearity of $\pm 1\%$. The analyzer is operated with an H_2S scrubber to make it specific to SO_2 concentrations.

Hydrogen sulfide is measured using a Meloy Model SA185-2 analyzer equipped with an SO_x scrubber. Specifications for this analyzer are the same as for the SA185-2A.

Methane is monitored with a Bendix Model 8200 gas chromatograph. This instrument uses a flame ionization detector and has a minimum detectable sensitivity of 5 ppb. The Model 8200 works on a five-minute cycle, i.e., one air sample is analyzed every five minutes.

The air sample is drawn in through a glass cane and manifold supplied by the Ace Glass Company. The system has a 25 mm diameter, and a constant air flow through the system is

provided by an air pump rated at 60 cfm at 0" head pressure. The manifold has sampling ports to which $\frac{1}{4}$ " Teflon lines to the instruments are connected. All joints in the sampling system are secured by O-ring compression fittings. The manifold is contained in a heated (100°F) chamber to prevent condensation of moisture.

The trailer has two heavy duty high volume particulate samplers (Hi-Vols). Fiberglass filter paper is brought to a controlled humidity before weighing. Each Hi-Vol has a flow recorder to permit correction for changes in air flow runs for a 24-hour period (midnight to midnight), and is turned on and off by the computer. The Hi-Vols were designed following guidelines recommended by the Environmental Protection Agency and were manufactured by Radian.

2. Calibration

The trailer contains a Meloy Model RAD-1 calibration unit. This unit provides a zero air supply and SO₂ span gas from an SO₂ permeation tube. The calibration is automatically performed once a day, and is controlled by the computer. The SO₂ channel is first switched to zero. Then the computer monitors the output of each analyzer and takes a new zero reading after a stable zero signal has been reached. This zero reading is compared by the computer to the zero reading obtained 24 hours before, and if a drift in excess of 10 ppb has occurred, an excess zero drift light on the System Status Panel is turned on. The instruments are then returned to the monitor mode, and after two minutes the computer resumes data taking.

The SO₂ permeation tubes were manufactured by Metronics Association, Inc. These tubes were then individually calibrated for Radian by the National Bureau of Standards.

The Model 8200 methane analyzer is calibrated with undiluted span gas. This span gas contains methane in air. The Model 8200 is zeroed with air from a Bendix Model 8834 zero air unit. In addition, the instrument is electronically re-zeroed at the start of every five-minute cycle.

In addition to the daily instrument zero/spans, all instruments are multipoint calibrated monthly. Calibration standards and equipment used in the monthly multipoints is distinct from the equipment used for daily zero/span operations.

Quality assurance audits are performed on each instrument once a quarter. These audits are performed by Radian's Quality Assurance personnel using instrumentation and standards different from those used in the monthly multipoint calibrations.

A General Metals Calibration Kit is used to calibrate the Hi-Vol particulate samplers.

B. Data Acquisition System

The basis of the data acquisition system is a Data General NOVA 1200 minicomputer. The NOVA, which has a basic cycle time of 1.2 μ sec, is equipped with automatic program load and power fail/automatic restart features. The computer utilizes 8K 16-bit words of core memory. Analog-to-digital conversion is accomplished via an ADC built by Radian Corporation. The input/output unit for system 034 is Texas Instruments' KSR 733 keyboard/printer. This model provides keyboard entry and hard copy printed output. The data are also recorded on a cassette magnetic tape unit with three drives. The cassette unit is utilized for program storage and loading as well as recording. To reduce wear on mechanical parts, the power to the teletype and cassette units is turned on only when the

**RADIAN
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unit(s) is to be used. Several important functions in the instruments as well as in the computer and the trailer are monitored by means of lights on a System Status Panel. The information displayed by these lights is written onto cassette tape to monitor the complete status of the system every five minutes.

TABLE 1.
DOWNTIME HOURS FOR CHOCOLATE BAYOU

SITE 033

DIGITIZING						
DATE	SYSTEM	S02	H2S	VOLT	CH4	PART
3/ 1/78	24.	0.	0.	0.	0.	0.
3/ 2/78	24.	0.	0.	0.	0.	0.
3/ 3/78	9.	0.	1.	0.	0.	24.
3/ 4/78	0.	0.	0.	0.	0.	0.
3/ 5/78	0.	0.	0.	0.	0.	0.
3/ 6/78	0.	0.	0.	0.	0.	24.
3/ 7/78	1.	0.	0.	0.	0.	0.
3/ 8/78	0.	0.	3.	0.	3.	24.
3/ 9/78	0.	0.	0.	0.	1.	0.
3/10/78	6.	1.	1.	0.	1.	24.
3/11/78	0.	0.	0.	0.	1.	24.
3/12/78	0.	0.	0.	0.	1.	24.
3/13/78	0.	0.	0.	0.	1.	24.
3/14/78	0.	0.	0.	0.	0.	24.
3/15/78	0.	0.	0.	0.	0.	24.
3/16/78	0.	0.	0.	0.	0.	0.
3/17/78	1.	0.	0.	0.	0.	24.
3/18/78	24.	0.	0.	0.	0.	24.
3/19/78	24.	0.	0.	0.	0.	24.
3/20/78	12.	0.	0.	0.	0.	24.
3/21/78	0.	0.	0.	0.	0.	0.
3/22/78	0.	0.	0.	0.	0.	24.
3/23/78	0.	0.	0.	0.	0.	24.
3/24/78	0.	0.	0.	0.	0.	0.
3/25/78	0.	0.	0.	0.	0.	24.
3/26/78	0.	0.	0.	0.	0.	24.
3/27/78	0.	0.	0.	0.	0.	24.
3/28/78	0.	0.	0.	0.	0.	0.
3/29/78	0.	0.	0.	0.	0.	24.
3/30/78	0.	0.	0.	0.	0.	24.
3/31/78	0.	0.	0.	0.	0.	24.
CAL TIME		16.	12.	0.	13.	

IV. DATA PRESENTATION AND SUMMARY

This section includes summaries for various recorded data at the monitoring sites. The data presentations indicate the variability of pollutant concentrations and parameters with time. All parameters, except suspended particulates (24-hour samples), are sampled once each second, but recorded as five-minute arithmetic averages of the one-second samples. This averaging technique tends to smooth instantaneous maximum values.

Inherent in any data acquisition system is random noise, both from the recording instruments and quantization in the analog-to-digital conversion. The lower threshold for all analytical instruments is twice the maximum noise level generated by the instruments. This lower threshold is 5 ppb for all of these instruments. Therefore, any values appearing in the data presentations that are less than 5 ppb indicate only a trace of pollutant in question and should not be construed to be absolute levels. In addition, when concentration levels drop below the lower threshold, the recorded quantity is simply random noise and averages tend toward zero. If a zero concentration appears in the data presentation, this does not indicate absolute zero concentration.

All pollutant data (except for particulate data) are taken at the monitoring site in integer parts per billion (ppb) but are presented here in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) assuming standard temperature and pressure of 25°C and 760 mm Hg (1013.2 millibars), respectively. The scale factors required to convert $\mu\text{g}/\text{m}^3$ at standard conditions back to ppb for the various pollutants are given in the following table.

Pollutant

To Convert $\mu\text{g}/\text{m}^3$ at 25°C and
760 mm Hg to ppb Multiply by

SO_2	.384
H_2S	.723
CH_4	1.536

The units of the air quality parameters are given at the top of each table. It should be noted here that inside temperature is monitored and recorded as a functional part of the system but is not presented in this report.

It should be noted that during this period the H_2S analyzer was operating without an SO_x scrubber (replacement parts are on order but not yet received from the manufacturer). The H_2S values reported herein are actually total sulfur measurements.

Table II presents the national ambient air quality standards (NAAQS) for criteria pollutants.

Table III displays the monthly statistics for the monitoring station for the month. To insure statistical significance, and to reduce the possibility of introducing a bias in the presentation, averages are computed only when at least 50 percent of the samples are present. If less than the required samples are present for a particular parameter, that entry will be blank. The number of samples present for a particular parameter is defined as the total possible number of five-minute samples for the averaging time less the computer downtime less the channel downtime less the channel calibration time. The averages in Table III are arithmetic averages with the following exception:

- Particulate averages are computed as the geometric mean.

Table IV displays the daily averages. Again, 50 percent of the five-minute samples are required in order to compute an average. A blank entry indicates an insufficient number of five-minute samples present for that day. Particulate averages are computed the same was as described in Table III.

Table V presents the maximum daily five-minute averages retained in the data base as well as the times of occurrence. For each parameter, a five-minute maximum average is printed if any samples are present for that day. Therefore, the maximum five-minute average when a given channel has experienced considerable downtime or calibration time during the day in question may be misrepresentative of the maximum expected for that parameter on that day.

Table VI indicates the five largest averages for various averaging times. The table shows the period of time covered by the average. Maxima are chosen so that time segments are independent. The maximum averages reported are found using a 'sliding average' technique with the exception of the 24-hour particulate average, which is computed from midnight to midnight. For averaging times less than or equal to three hours, the sliding average is stepped one five-minute sample at a time. For longer averaging times, the step size is twelve samples or one hour. For averaging times less than or equal to one hour, 100 percent of the five-minute samples must be present to compute an average. Averaging times greater than one hour require 90 percent. Whether or not a sliding average is computed is solely determined by the number of samples present in that averaging time and is independent of daily or monthly averaging criteria.

Table VII demonstrates the diurnal variation of various recorded parameters. Hourly averages are determined by arithmetically averaging five-minute samples. For all parameters, a blank entry in the diurnal variation table indicates that less than half (i.e., less than 6) of the five-minute samples for that hour are present.

Times given in the data presentations correspond to the appropriate local times, i.e., Central Daylight Savings Time or Central Standard Time, depending on the time of the year.

TABLE II
NATIONAL AMBIENT AIR QUALITY STANDARDS

	<u>Primary</u>	<u>Secondary</u>
<u>Particulate</u>		
Annual G.M.**	75 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$
24 Hr. Max.*	260	150
<u>Sulfur Oxides</u>		
Annual	80 (.03 ppm)	
24 Hr. Max.*	365 (.14 ppm)	
3 Hr. Max.*	--	1300 (.5 ppm)
<u>Oxidant</u>		
1 Hr. Max.*	160* (.08 ppm)	160
<u>Hydrocarbons</u>		
3 Hr. Max.*	160 (.24 ppm)	160
6-9 a.m.		
<u>Carbon Monoxide</u>		
$\mu\text{g}/\text{m}^3$		
Max. 8 Hrs.*	10000 (9 ppm)	10000
Max. 1 Hr.*	40000 (35 ppm)	40000
<u>Nitrogen Dioxide</u>		
Annual	100 (.05 ppm)	100

Units are micrograms per cubic meter and ppm in parentheses.

*Not to be exceeded more than once per year.

**Geometric Mean.

TABLE III
AVERAGES FOR MARCH 1 THRU 31, 1978

TABLE III. AVERAGES FOR MAR 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT

SULFUR DIOXIDE(SO2)		HYDROGEN SULFIDE	METHANE
SITE	033	033	033
	3.1	4.6	1052.8

PARTICULATE	
SITE	033

TABLE IV
DAILY AVERAGES FOR MARCH 1 THRU 31, 1978

TABLE IV. DAILY AVERAGES FOR MAR 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

DATE	SULFUR DIOXIDE(SO2)		HYDROGEN SULFIDE		METHANE	
	SITE	033	033		033	
3/ 1						
3/ 2						
3/ 3		24.8	11.9		1169.1	
3/ 4		11.2	4.1		1098.5	
3/ 5		10.7	7.0		1309.0	
3/ 6		5.8	2.7		1008.2	
3/ 7		.6	.7		990.6	
3/ 8		1.4	9.1		1054.9	
3/ 9		.3	7.5		1084.8	
3/10		2.4	5.4		1035.6	
3/11		.4	.1		933.3	
3/12		1.5	5.8		1084.3	
3/13		.0	.0		920.0	
3/14		.0	10.4		1085.0	
3/15		.3	10.1		1105.6	
3/16		1.4	10.0		1004.6	
3/17		.0	6.9		1101.3	
3/18						
3/19						
3/20						
3/21		20.1	14.2		896.3	
3/22		1.7	.1		947.0	
3/23		.7	.6		905.6	
3/24		.0	.5		1048.3	
3/25		.6	2.4		1130.8	
3/26		.1	1.9		1151.6	
3/27		.9	5.9		1157.0	
3/28		.1	1.8		982.2	
3/29		.0	.5		1036.1	
3/30		.0	2.5		1133.8	
3/31		.0	.6		1093.8	

TABLE IV. DAILY AVERAGES FOR MAR 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

PARTICULATE

DATE	SITE 033
3/ 1	43.0
3/ 2	44.0
3/ 3	
3/ 4	47.0
3/ 5	53.0
3/ 6	
3/ 7	33.0
3/ 8	
3/ 9	44.0
3/10	
3/11	
3/12	
3/13	
3/14	
3/15	
3/16	61.0
3/17	
3/18	
3/19	
3/20	
3/21	54.0
3/22	
3/23	
3/24	50.0
3/25	
3/26	
3/27	
3/28	64.0
3/29	
3/30	
3/31	

TABLE V
MAXIMUM FIVE-MINUTE AVERAGES AND
TIMES OF OCCURRENCE FOR
MARCH 1 THRU 31, 1978

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR MAR 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

DATE	SITE	033
<hr/>		
3/ 1		
3/ 2		
3/ 3		445. 4(10: 15)
3/ 4		18. 2(9: 30)
3/ 5		23. 4(2: 20)
3/ 6		484. 5(12: 05)
3/ 7		2. 6(18: 55)
3/ 8		2. 6(0: 00)
3/ 9		2. 6(0: 00)
3/10		15. 6(11: 10)
<hr/>		
3/11		2. 6(0: 00)
3/12		39. 1(9: 40)
3/13		2. 6(10: 30)
3/14		. 0(0: 00)
3/15		18. 2(10: 30)
3/16		20. 8(9: 30)
3/17		2. 6(15: 40)
3/18		
3/19		
3/20		109. 4(15: 10)
<hr/>		
3/21		940. 4(3: 25)
3/22		5. 2(17: 25)
3/23		5. 2(0: 00)
3/24		. 0(0: 00)
3/25		23. 4(8: 35)
3/26		10. 4(8: 30)
3/27		26. 0(9: 10)
3/28		2. 6(3: 55)
3/29		2. 6(0: 15)
3/30		. 0(0: 00)
<hr/>		
3/31		2. 6(4: 15)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR MAR 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

HYDROGEN SULFIDE

DATE	SITE	033
3/ 1		
3/ 2		
3/ 3		260. 2(10:00)
3/ 4		9. 7(9:50)
3/ 5		13. 8(11:05)
3/ 6		257. 4(12:10)
3/ 7		6. 9(19:00)
3/ 8		13. 8(16:00)
3/ 9		11. 1(0:00)
3/10		22. 1(11:00)
3/11		2. 8(23:15)
3/12		47. 1(9:40)
3/13		. 0(0:00)
3/14		15. 2(14:50)
3/15		52. 6(10:30)
3/16		22. 1(0:00)
3/17		13. 8(10:15)
3/18		
3/19		
3/20		83. 0(15:10)
3/21		470. 5(3:25)
3/22		8. 3(9:55)
3/23		2. 8(12:35)
3/24		2. 8(9:45)
3/25		15. 2(8:35)
3/26		11. 1(8:30)
3/27		34. 6(14:00)
3/28		4. 2(0:00)
3/29		9. 7(2:00)
3/30		8. 3(13:20)
3/31		2. 8(11:35)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR MAR 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

METHANE

DATE	SITE 033
3/ 1	
3/ 2	
3/ 3	3226. 2(10: 15)
3/ 4	1409. 3(23: 25)
3/ 5	2576. 9(8: 15)
3/ 6	3146. 1(12: 05)
3/ 7	1816. 3(18: 50)
3/ 8	1180. 0(18: 10)
3/ 9	2516. 4(19: 30)
3/10	1699. 1(2: 50)
3/11	1240. 6(23: 55)
3/12	1469. 8(19: 55)
3/13	1084. 9(0: 25)
3/14	1345. 4(6: 25)
3/15	2169. 9(11: 45)
3/16	1927. 6(21: 25)
3/17	2224. 0(10: 15)
3/18	
3/19	
3/20	951. 4(12: 40)
3/21	1034. 2(6: 05)
3/22	1081. 7(8: 45)
3/23	983. 4(1: 40)
3/24	1772. 0(21: 00)
3/25	1765. 5(7: 35)
3/26	1717. 9(4: 25)
3/27	1641. 8(2: 55)
3/28	1399. 5(2: 35)
3/29	1402. 7(5: 45)
3/30	1851. 4(7: 55)
3/31	1501. 7(6: 10)

TABLE VI
THE FIVE MAXIMUM INDEPENDENT
SLIDING AVERAGES FOR
MARCH 1 THRU 31, 1978

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR MAR 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

SITE		033	SULFUR DIOXIDE 30-MINUTE
1	3/ 3(9:45-10:15)	427.6	
2	3/21(1:45- 2:15)	324.7	
3	3/21(3:15- 3:45)	320.8	
4	3/ 6(11:50-12:20)	216.6	
5	3/21(0:20- 0:50)	150.2	

SITE		033	SULFUR DIOXIDE 3-HOUR
1	3/21(0:10- 3:10)	98.2	
2	3/ 3(9:15-12:15)	89.4	
3	3/21(3:15- 6:15)	53.5	
4	3/ 6(9:20-12:20)	38.3	
5	3/20(12:25-15:25)	27.7	

SITE		033	SULFUR DIOXIDE 24-HOUR
1	3/20- 3/21(11:00)	23.5	
2	3/ 3- 3/ 4(8:00)	17.1	
3	3/ 4- 3/ 5(10:00)	15.6	
4	3/ 5- 3/ 6(13:00)	7.9	
5	3/10- 3/11(9:00)	2.3	

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR MAR 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

HYDROGEN SULFIDE
1-HOUR

SITE	033	
1	3/ 3(9:35-10:35)	143.7
2	3/21(1:10- 2:10)	112.1
3	3/21(3:10- 4:10)	106.7
4	3/ 6(11:55-12:55)	61.8
5	3/20(14:25-15:25)	40.5

TABLE VI. THE FIVE MAXIMUM AVERAGES FOR MAR 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

METHANE
3-HOUR (6-9AM)

SITE

033

1	3/ 5(6:00- 9:00)	2200.6
2	3/30(6:00- 9:00)	1495.4
3	3/17(6:00- 9:00)	1480.0
4	3/26(6:00- 9:00)	1446.2
5	3/25(6:00- 9:00)	1436.4

TABLE VII
DIURNAL VARIATION OF RECORDED PARAMETERS

DIURNAL VARIATION OF SULFUR DIOXIDE(UG/M**3)
TRAILER NO. - 33 PERIOD(3/ 1/78 TO 3/31/78)

	HOUR																								
DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1																									
2																									
3											: 162	10	11	9	13	13	13	15	13	10	8	4	3	5	21
4	3	3	3	3	3	3	3	8	14	17	18	17	16	16	16	16	16	14	13	14	17	16	15	10	11
5	8	12	19	17	18	19	18	18	17	18	16	15	13	13	12	4	3	3	3	3	3	3	3	3	11
6	3	3	3	3	3	3	3	3	3	3	3	3	108	0	0	0	0	0	0	0	0	0	0	0	6
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1:	3	3	3	3	3	1
8	3	3	3	0:	0	0	0	0	0	0	0	0	0	:	:	:	3	3	3	3	3	3	3	3	2
9	3	3	3	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	1:	1						10	3	3	3	3	3	3	3	3	3	3	3	3	3	3
11	3	3	3	0:	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1
12	1	0	7	0:	0	0	0	0	0	23	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2
13	0	0	0	0:	0	0	0	0	0	0	1:	0:	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0:	0	0	0	0	0	2	2:	2:	0	0	0	0	0	0	0	0	0	0	0	2	0
16	9	0	0	0:	0	0	0	0	0	14	10	1	0	0	0	0	0	0	0	0	0	0	0	0	1
17	0	0	0	0:	0	0	0	0	0	0:	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18																									
19																									
20																									
21	75	83	112	241:	0	0	0	0	0	0	0	0	4	8	37	38	2	0	0	0	0	0	0	0	7
22	0	0	0	0:	0	0	0	0	0	0	0	0:	:	:	:	:	5	14	0	6	0	0	0	0	20
23	5	5	5	0:	0	0	0	0	0	0	0	0	1:	0	0	0	0	5:	5	5	5	5	5	5	2
24	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
25	0	0	0	0:	0	0	0	0	0	10	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0:	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0:	0	0	0	0	0	0	18	0	0	0	0	2	0	0	0	0	0	0	0	0	1
28	0	0	0	0:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN	5	5	6	11	1	1	1	1	2	4	9	2	6	2	3	3	2	2	2	2	2	1	1	1	0

TOTAL NUMBER OF OBSERVATIONS = 7201. MEAN = 3.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF HYDROGEN SULFIDE (UG/M**3)
TRAILER NO. - 33 PERIOD(3/ 1/78 TO 3/31/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1																									
2																									
3										78	102	1	0	0	1	1	2	3	3	1	1	1	1	2	12
4	1	1	1	1	2	3	3	4	5	7	7	7	7	6	5	4	4	4	3	4	7	6	5	3	4
5	3	4	9	7	8	9	9	8	9	7	6	12	11	10	10	8	7	7	6	5	4	4	4	3	7
6	2	1	0	0	0	0	0	0	0	0	0	0	62	0	0	0	0	0	0	0	0	0	0	1	3
7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	4	1
8	4	5	6	6	7	7	7	8	8	9	9	8	9				12	11	13	13	12	12	14	12	9
9	11	11	9	8	8	8	8	8	8	9	10	8	8	7	7	6	6	6	6	6	6	6	6	7	8
10	6	7	7	7	7						18	10	8	7	6	4	2	0	0	0	0	6	4	0	6
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
12	6	5	11	7	4	3	4	8	10	31	12	8	8	8	4	3	3	2	1	3	1	0	0	0	6
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	:	10	11	11	11	11	12	11	11	11	12	13	13	15	13	12	12	14	12	12	11	10
15	11	11	12	:	11	11	11	11	10	17	16	9	8	8	8	7	7	7	8	8	9	10	10	13	10
16	17	10	10	7:	8	11	9	9	11	18	17	13	9	8	7	7	8	8	8	8	9	9	10	10	10
17	9	10	10	8:	7	7	8	7	7	9:	11:	9	8	7	6	6	8	5	4	4	5	4	4		7
18																									
19																									
20													:	5	31	31	0	0	0	0	0	0	0	0	6
21	52	56	71	142:	1	0	0	0	0	0	0	0	4	9	2	10	5	15	0	6	0	0	0	0	14
22	0	0	0	0:	0	0	0	0	0	1	1	0:	:	0	0	:	:	0:	0	0	0	0	0	0	0
23	0	0	0	0:	0	0	0	0	0	0	0	0	1:	0	0	1	1	1	1	1	2	2	2	2	1
24	1	1	1	1:	0	1	1	1	1	1	1:	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	2:	1	1	1	4	10	9	6	6	5	1	1	1	1	1	1	1	1	1	1	1	2
26	1	3	4	5:	4	1	2	2	8	7	4	2	1	0	0	0	0	0	0	0	0	0	1	0	2
27	0	4	2	6:	5	6	6	7	8	16	9	6	7	7	7	6	6	6	6	5	6	5	6	5	6
28	4	4	4	2:	0	1	1	1	1	2	1	1	2	2	1	2	1	1	1	1	1	1	1	1	2
29	1	2	3	3:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
30	0	0	0	1:	0	1	1	1	2	4	4	4	4	6	5	4	4	5	4	3	3	1	1	1	3
31	1	1	1	1:	0	1	1	1	0	1	1	2	2	1	1	0	0	0	0	0	0	0	0	0	1
MEAN	5	5	6	9	3	3	3	4	5	8	9	5	7	4	4	5	4	4	3	3	3	3	3	3	3

TOTAL NUMBER OF OBSERVATIONS = 7210. MEAN = 5.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF METHANE(UG/M**3 X 10**-1)
TRAILER NO. - 33 PERIOD(3/ 1/78 TO 3/31/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1																									
2																									
3										153	201	110	109	110	111	109	109	109	110	109	109	107	107	107	117
4	109	108	110	109	108	106	106	107	109	112	112	112	108	109	107	106	105	107	117	111	106	119	109	124	110
5	119	143	150	151	180	191	221	242	197	119	106	102	102	101	101	100	100	100	108	106	104	103	97	98	131
6	98	101	98	98	98	98	97	96	97	99	100	100	175	100	100	103	99	97	96	95	96	96	93	93	101
7	93	93	92	92	92	111	96	95	94	95	97	97	97	101	99	91	97	106	122	108	105	104	104	104	99
8	105	106	105		105	104	104	106	106	105	107	105	106	106			106	105	106	107	106	105	104	104	105
9	105	105	107		125	126	124	121	112	105	100	99	99	99	99	99	98	98	109	137	109	104	106	117	109
10	116	124	150		141						103	100	97	97	95	95	95	97	95	95	93	93	91	91	104
11	93	93	93		91	94	93	96	95	93	91	91	91	91	90	91	93	91	91	92	92	92	101	118	94
12	116	107	110		104	113	109	112	109	103	98	98	98	100	102	101	103	105	109	118	123	126	121	111	109
13	106	106	102		90	90	90	89	88	88	86	87	87	87	90	88	88	88	90	92	96	97	96	95	92
14	99	106	106		111	116	129	133	130	129	114	105	100	99	98	95	95	96	98	100	107	108	111	111	109
15	130	139	125		123	116	116	123	114	124	119	122	98	97	96	97	97	101	104	95	99	103	104	108	111
16	117	99	102		95	98	103	113	96	93	93	93	91	92	94	95	92	93	97	107	112	135	103	99	101
17	104	127	133	123	126	145	145	154	145	127	114	95	93	92	93	92	92	91	89	90	92	94	95		110
18																									
19																									
20																									
21	93	94	92		88	89	95	90	89	88	89	90	91	90	90	90	87	88	86	88	87	88	92	89	90
22	91	91	91		96	97	102	105	104	104	100	98	96	96	92	94	92	89	90	84	92	92	91	92	95
23	96	97	95		93	91	92	91	90	90	90	90	89	89	89	90	89	89	89	90	89	88	88	89	91
24	91	90	91		96	98	95	98	97	100	99	99	98	98	98	97	98	101	110	109	111	152	159	132	105
25	109	110	124		130	148	159	155	117	110	112	111	104	101	100	96	94	93	97	101	99	102	106	117	113
26	114	114	147		162	147	146	149	138	113	102	104	96	94	93	95	94	96	106	98	98	103	118	108	115
27	119	143	154		140	140	149	148	134	124	112	108	108	108	101	97	96	95	95	96	96	96	96	99	115
28	99	99	112		99	98	98	108	102	98	97	96	95	94	95	95	96	97	96	102	96	96	96	98	98
29	98	100	98		123	129	121	119	102	95	95	94	94	95	96	96	97	97	100	102	104	106	105	114	104
30	102	104	103		112	129	141	156	152	117	118	109	104	104	102	100	102	106	104	106	113	106	108	114	113
31	120	119	118		136	144	136	130	117	106	104	100	99	99	99	100	100	101	100	98	97	96	97	97	109
MEAN	106	109	112	115	114	117	119	123	114	107	106	100	101	98	97	96	97	97	100	101	101	104	103	105	

TOTAL NUMBER OF OBSERVATIONS = 7119. MEAN = 105.

: INDICATES CALIBRATION DURING THE HOUR

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DCN 78-100-212-02

AIR MONITORING REPORT
FOR
THE UNIVERSITY OF TEXAS
BUREAU OF ECONOMIC GEOLOGY
APRIL 1978
Report No. 2

5 June 1978

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TABLE OF CONTENTS

	<u>Page</u>
I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM-----	1
II. DESCRIPTION OF INSTRUMENT SYSTEMS-----	4
A. Air Quality Instrumentation-----	4
1. Description-----	4
2. Calibration-----	5
B. Data Acquisition System-----	6
III. BAG SAMPLING PROGRAM-----	8
IV. OPERATING TIME ANALYSIS-----	9
V. DATA PRESENTATION AND SUMMARY-----	11

LIST OF TABLES

	<u>Page</u>
TABLE I DOWNTIME HOURS FOR CHOCOLATE BAYOU, TEXAS-----	10
TABLE II NATIONAL AMBIENT AIR QUALITY STANDARDS-----	15
TABLE III AVERAGES FOR APRIL 1 THRU 30, 1978-----	16
TABLE IV DAILY AVERAGES FOR APRIL 1 THRU 30, 1978-----	17
TABLE V MAXIMUM FIVE-MINUTE AVERAGES AND TIMES OF OCCURRENCE FOR APRIL 1 THRU 30, 1978-----	19
TABLE VI THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR APRIL 1 THRU 30, 1978-----	22
TABLE VII DIURNAL VARIATION OF RECORDED PARAMETERS-----	25

I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM

Radian Corporation is under contract to the University of Texas, Bureau of Economic Geology, to provide ambient air quality monitoring at one site near Chocolate Bayou, Texas. This site measures and records concentrations for sulfur dioxide, hydrogen sulfide, methane, and particulates. A bag sample is collected bi-weekly and returned to Radian's Austin facilities and analyzed for methane.

Figure I shows the configuration of this type of monitoring station. The trailer provides a sturdy and protective covering as well as mobility. Figure II shows the air monitoring site.

FIGURE I

AMBIENT AIR MONITORING SYSTEM I

FIGURE II
AIR MONITORING SITE

II. DESCRIPTION OF INSTRUMENT SYSTEMS

The ambient air monitoring station is equipped to monitor the parameters shown below:

Sulfur Dioxide
Particulates
Methane
Hydrogen Sulfide

A. Air Quality Instrumentation

1. Description

Sulfur dioxide is measured with a Meloy Model SA185-2A sulfur analyzer, which is an EPA-approved analyzer. This automated analyzer utilizes the flame photometric principle to measure sulfur levels with a minimum detectable sensitivity of 5 ppb, and a linearity of $\pm 1\%$. The analyzer is operated with an H_2S scrubber to make it specific to SO_2 concentrations.

Hydrogen sulfide is measured using a Meloy Model SA185-2 analyzer equipped with an SO_x scrubber. Specifications for this analyzer are the same as for the SA185-2A.

Methane is monitored with a Bendix Model 8200 gas chromatograph. This instrument uses a flame ionization detector and has a minimum detectable sensitivity of 5 ppb. The Model 8200 works on a five-minute cycle, i.e., one air sample is analyzed every five minutes.

The air sample is drawn in through a glass cane and manifold supplied by the Ace Glass Company. The system has a 25 mm diameter, and a constant air flow through the system is

provided by an air pump rated at 60 cfm at 0" head pressure. The manifold has sampling ports to which $\frac{1}{4}$ " Teflon lines to the instruments are connected. All joints in the sampling system are secured by O-ring compression fittings. The manifold is contained in a heated (100°F) chamber to prevent condensation of moisture.

The trailer has two heavy duty high volume particulate samplers (Hi-Vols). Fiberglass filter paper is brought to a controlled humidity before weighing. Each Hi-Vol has a flow recorder to permit correction for changes in air flow runs for a 24-hour period (midnight to midnight), and is turned on and off by the computer. The Hi-Vols were designed following guidelines recommended by the Environmental Protection Agency and were manufactured by Radian.

2. Calibration

The trailer contains a Meloy Model RAD-1 calibration unit. This unit provides a zero air supply and SO₂ span gas from an SO₂ permeation tube. The calibration is automatically performed once a day, and is controlled by the computer. The SO₂ channel is first switched to zero. Then the computer monitors the output of each analyzer and takes a new zero reading after a stable zero signal has been reached. This zero reading is compared by the computer to the zero reading obtained 24 hours before, and if a drift in excess of 10 ppb has occurred, an excess zero drift light on the System Status Panel is turned on. The instruments are then returned to the monitor mode, and after two minutes the computer resumes data taking.

The SO₂ permeation tubes were manufactured by Metronics Association, Inc. These tubes were then individually calibrated for Radian by the National Bureau of Standards.

The Model 8200 methane analyzer is calibrated with undiluted span gas. This span gas contains methane in air. The Model 8200 is zeroed with air from a Bendix Model 8834 zero air unit. In addition, the instrument is electronically re-zeroed at the start of every five-minute cycle.

In addition to the daily instrument zero/spans, all instruments are multipoint calibrated monthly. Calibration standards and equipment used in the monthly multipoints is distinct from the equipment used for daily zero/span operations.

Quality assurance audits are performed on each instrument once a quarter. These audits are performed by Radian's Quality Assurance personnel using instrumentation and standards different from those used in the monthly multipoint calibrations.

A General Metals Calibration Kit is used to calibrate the Hi-Vol particulate samplers.

B. Data Acquisition System

The basis of the data acquisition system is a Data General NOVA 1200 minicomputer. The NOVA, which has a basic cycle time of 1.2 μ sec, is equipped with automatic program load and power fail/automatic restart features. The computer utilizes 8K 16-bit words of core memory. Analog-to-digital conversion is accomplished via an ADC built by Radian Corporation. The input/output unit for system 034 is Texas Instruments' KSR 733 keyboard/printer. This model provides keyboard entry and hard copy printed output. The data are also recorded on a cassette magnetic tape unit with three drives. The cassette unit is utilized for program storage and loading as well as recording. To reduce wear on mechanical parts, the power to the teletype and cassette units is turned on only when the

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unit(s) is to be used. Several important functions in the instruments as well as in the computer and the trailer are monitored by means of lights on a System Status Panel. The information displayed by these lights is written onto cassette tape to monitor the complete status of the system every five minutes.

III. BAG SAMPLING PROGRAM

Grab-bag samples are collected bi-weekly and analyzed for methane. The ambient air samples are collected in tedlar bags using a metal bellows pump connected to the ambient sample manifold. Each bag sample is collected over a three-hour period.

The bag samples are returned to Austin for analysis for methane concentration. The analysis is done by gas chromatography using a flame ionization detector, a Porapak QS column and a 5 ppm methane standard. A 1 cc volume is used both for calibration and analysis. The samples are introduced by direct injection. The detection limit for methane with this method is 2 ppm.

Results of the bag sampling analyses are given below:

<u>Date</u>	<u>Time</u>	<u>Methane Concentration (ppm)</u>
3/28	1318-1618	<2
4/12	1400-1700	<2
4/27	1500-1800	<2

IV. OPERATING TIME ANALYSIS

This section presents the operating statistics for each of the major subsystems contained in the monitoring station. Table I shows the specific number of hours that each of these subsystems was inoperative for the month. The column labeled "DIGITIZING SYSTEM" refers to the entire data acquisition system, and downtime hours appearing in this column are hours of total data loss. These instances include, in addition to computer downtime, power failures, no power available, and self-automated shutdown periods such as during air conditioner malfunctions.

Calibration time is not considered to be downtime and is not included in the downtime figures. The amount of time used in calibrating the instruments is given at the bottom of the downtime analysis table and is reported as total calibration hours for each channel for the entire month. As is evident in the calibration figures, channels can be calibrated independently of one another. No calibration time is given for particulate monitoring since Hi-Vol calibration occurs infrequently and only during the off-duty cycle for each Hi-Vol while another Hi-Vol is taking data.

TABLE I.
DOWNTIME HOURS FOR CHOCOLATE BAYOU

SITE 033

DIGITIZING

DATE	SYSTEM	S02	H2S	VOLT	CH4	PART
4/ 1/78	0.	0.	0.	0.	0.	24.
4/ 2/78	0.	0.	0.	0.	0.	24.
4/ 3/78	0.	0.	0.	0.	0.	24.
4/ 4/78	0.	0.	0.	0.	0.	24.
4/ 5/78	0.	0.	0.	0.	0.	24.
4/ 6/78	4.	0.	0.	0.	0.	24.
4/ 7/78	0.	0.	0.	0.	0.	0.
4/ 8/78	1.	0.	0.	0.	0.	24.
4/ 9/78	24.	0.	0.	0.	0.	24.
4/10/78	15.	0.	0.	0.	0.	24.
4/11/78	0.	0.	0.	0.	0.	24.
4/12/78	0.	0.	0.	0.	0.	24.
4/13/78	0.	0.	0.	0.	0.	0.
4/14/78	0.	0.	0.	0.	0.	0.
4/15/78	0.	0.	0.	0.	0.	24.
4/16/78	0.	0.	0.	0.	0.	24.
4/17/78	0.	0.	0.	0.	0.	24.
4/18/78	0.	0.	0.	0.	0.	0.
4/19/78	0.	0.	0.	0.	0.	24.
4/20/78	0.	0.	0.	0.	0.	24.
4/21/78	0.	0.	0.	0.	0.	24.
4/22/78	0.	0.	0.	0.	0.	24.
4/23/78	0.	0.	0.	0.	0.	24.
4/24/78	0.	0.	0.	0.	0.	24.
4/25/78	0.	0.	0.	0.	0.	24.
4/26/78	0.	0.	0.	0.	0.	24.
4/27/78	0.	0.	0.	0.	0.	24.
4/28/78	0.	0.	0.	0.	0.	24.
4/29/78	0.	0.	0.	0.	0.	0.
4/30/78	0.	0.	0.	0.	0.	24.

CAL TIME 12. 12. 0. 22.

V. DATA PRESENTATION AND SUMMARY

This section includes summaries for various recorded data at the monitoring sites. The data presentations indicate the variability of pollutant concentrations and parameters with time. All parameters, except suspended particulates (24-hour samples), are sampled once each second, but recorded as five-minute arithmetic averages of the one-second samples. This averaging technique tends to smooth instantaneous maximum values.

Inherent in any data acquisition system is random noise, both from the recording instruments and quantization in the analog-to-digital conversion. The lower threshold for all analytical instruments is twice the maximum noise level generated by the instruments. This lower threshold is 5 ppb for all of these instruments. Therefore, any values appearing in the data presentations that are less than 5 ppb indicate only a trace of pollutant in question and should not be construed to be absolute levels. In addition, when concentration levels drop below the lower threshold, the recorded quantity is simply random noise and averages tend toward zero. If a zero concentration appears in the data presentation, this does not indicate absolute zero concentration.

All pollutant data (except for particulate data) are taken at the monitoring site in integer parts per billion (ppb) but are presented here in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) assuming standard temperature and pressure of 25°C and 760 mm Hg (1013.2 millibars), respectively. The scale factors required to convert $\mu\text{g}/\text{m}^3$ at standard conditions back to ppb for the various pollutants are given in the following table.

Pollutant

To Convert $\mu\text{g}/\text{m}^3$ at 25°C and
760 mm Hg to ppb Multiply by

SO_2	.384
H_2S	.723
CH_4	1.536

The units of the air quality parameters are given at the top of each table. It should be noted here that inside temperature is monitored and recorded as a functional part of the system but is not presented in this report.

It should be noted that during this period the H_2S analyzer was operating without an SO_x scrubber (replacement parts are on order but not yet received from the manufacturer). The H_2S values reported herein are actually total sulfur measurements.

Table II presents the national ambient air quality standards (NAAQS) for criteria pollutants.

Table III displays the monthly statistics for the monitoring station for the month. To insure statistical significance, and to reduce the possibility of introducing a bias in the presentation, averages are computed only when at least 50 percent of the samples are present. If less than the required samples are present for a particular parameter, that entry will be blank. The number of samples present for a particular parameter is defined as the total possible number of five-minute samples for the averaging time less the computer downtime less the channel downtime less the channel calibration time. The averages in Table III are arithmetic averages with the following exception:

- Particulate averages are computed as the geometric mean.

Table IV displays the daily averages. Again, 50 percent of the five-minute samples are required in order to compute an average. A blank entry indicates an insufficient number of five-minute samples present for that day. Particulate averages are computed the same way as described in Table III.

Table V presents the maximum daily five-minute averages retained in the data base as well as the times of occurrence. For each parameter, a five-minute maximum average is printed if any samples are present for that day. Therefore, the maximum five-minute average when a given channel has experienced considerable downtime or calibration time during the day in question may be misrepresentative of the maximum expected for that parameter on that day.

Table VI indicates the five largest averages for various averaging times. The table shows the period of time covered by the average. Maxima are chosen so that time segments are independent. The maximum averages reported are found using a 'sliding average' technique with the exception of the 24-hour particulate average, which is computed from midnight to midnight. For averaging times less than or equal to three hours, the sliding average is stepped one five-minute sample at a time. For longer averaging times, the step size is twelve samples or one hour. For averaging times less than or equal to one hour, 100 percent of the five-minute samples must be present to compute an average. Averaging times greater than one hour require 90 percent. Whether or not a sliding average is computed is solely determined by the number of samples present in that averaging time and is independent of daily or monthly averaging criteria.

Table VII demonstrates the diurnal variation of various recorded parameters. Hourly averages are determined by arithmetically averaging five-minute samples. For all parameters, a blank entry in the diurnal variation table indicates that less than half (i.e., less than 6) of the five-minute samples for that hour are present.

Times given in the data presentations correspond to the appropriate local times, i.e., Central Daylight Savings Time or Central Standard Time, depending on the time of the year.

TABLE II
NATIONAL AMBIENT AIR QUALITY STANDARDS

	<u>Primary</u>	<u>Secondary</u>
<u>Particulate</u>		
Annual G.M.**	75 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$
24 Hr. Max.*	260	150
<u>Sulfur Oxides</u>		
Annual	80 (.03 ppm)	
24 Hr. Max.*	365 (.14 ppm)	
3 Hr. Max.*	--	1300 (.5 ppm)
<u>Oxidant</u>		
1 Hr. Max.*	160* (.08 ppm)	160
<u>Hydrocarbons</u>		
3 Hr. Max.*	160 (.24 ppm)	160
6-9 a.m.		
<u>Carbon Monoxide</u>		
$\mu\text{g}/\text{m}^3$		
Max. 8 Hrs.*	10000 (9 ppm)	10000
Max. 1 Hr.*	40000 (35 ppm)	40000
<u>Nitrogen Dioxide</u>		
Annual	100 (.05 ppm)	100

Units are micrograms per cubic meter and ppm in parentheses.

*Not to be exceeded more than once per year.

**Geometric Mean.

TABLE III
AVERAGES FOR APRIL 1 THRU 30, 1978

CORPORATION

TABLE III. AVERAGES FOR APR 1 THRU 30 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

HYDROGEN SULFIDE

METHANE

SITE 033
.5

033
1.1

033
938.5

PARTICULATE

SITE 033
67.6

**TABLE IV
DAILY AVERAGES FOR APRIL 1 THRU 30, 1978**

TABLE IV. DAILY AVERAGES FOR APR 1 THRU 30 1978
 (UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
 TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

DATE	SULFUR DIOXIDE(SO2)		HYDROGEN SULFIDE		METHANE	
	SITE	033	033		033	
4/ 1		.0	.1		988.9	
4/ 2		.0	.1		945.5	
4/ 3		.1	.5		926.3	
4/ 4		.0	.2		907.4	
4/ 5		.0	.0		898.6	
4/ 6		.0	.7		893.0	
4/ 7		.1	.3		972.9	
4/ 8		.0	.1		962.8	
4/ 9						
4/10						
4/11		.0	1.6		1043.6	
4/12		.0	1.7		1071.6	
4/13		5.5	4.8		1031.4	
4/14		.2	1.3		967.3	
4/15		.0	.1		955.4	
4/16		.0	.0		846.9	
4/17		.7	.1		785.3	
4/18		.3	.0		828.2	
4/19		.6	2.0		998.3	
4/20		3.3	3.7		1029.3	
4/21		.1	1.2		988.9	
4/22		.0	.4		890.7	
4/23		.0	.9		926.3	
4/24		.0	1.3		845.9	
4/25		.0	2.9		1007.6	
4/26		.0	2.9		948.0	
4/27		2.4	2.9		1061.9	
4/28		.3	.4		855.5	
4/29		.2	.0		822.0	
4/30		.0	.0		846.2	

TABLE IV. DAILY AVERAGES FOR APR 1 THRU 30 1978

(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

PARTICULATE

SITE 033

DATE

4/ 1	
4/ 2	
4/ 3	
4/ 4	
4/ 5	
4/ 6	
4/ 7	91.0
4/ 8	
4/ 9	
4/10	

4/11	
4/12	
4/13	43.0
4/14	48.0
4/15	
4/16	
4/17	
4/18	125.0
4/19	
4/20	

4/21	
4/22	
4/23	
4/24	
4/25	
4/26	
4/27	
4/28	
4/29	60.0
4/30	

TABLE V
MAXIMUM FIVE-MINUTE AVERAGES AND
TIMES OF OCCURRENCE FOR
APRIL 1 THRU 30, 1978

CORPORATION

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR APR 1 THRU 30 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

DATE	SITE	033
4/ 1		2.6(4:20)
4/ 2		2.6(0:15)
4/ 3		5.2(11:50)
4/ 4		2.6(3:45)
4/ 5		.0(0:00)
4/ 6		2.6(4:15)
4/ 7		15.6(10:55)
4/ 8		2.6(4:15)
4/ 9		
4/10		.0(15:45)
4/11		.0(0:00)
4/12		2.6(1:25)
4/13		117.2(9:15)
4/14		2.6(0:00)
4/15		2.6(0:15)
4/16		.0(0:00)
4/17		13.0(10:40)
4/18		2.6(0:05)
4/19		23.4(23:45)
4/20		208.4(20:15)
4/21		2.6(0:10)
4/22		.0(0:00)
4/23		.0(0:00)
4/24		.0(0:00)
4/25		.0(0:00)
4/26		.0(0:00)
4/27		59.9(8:30)
4/28		20.8(9:50)
4/29		2.6(0:10)
4/30		.0(0:00)

CORPORATION

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR APR 1 THRU 30 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

HYDROGEN SULFIDE

DATE	SITE	033
4/ 1		2.8(3:15)
4/ 2		2.8(5:15)
4/ 3		4.2(11:50)
4/ 4		1.4(0:35)
4/ 5		.0(0:00)
4/ 6		1.4(3:20)
4/ 7		60.9(10:55)
4/ 8		1.4(3:15)
4/ 9		
4/10		2.8(19:55)
4/11		2.8(0:30)
4/12		5.5(1:20)
4/13		67.8(9:15)
4/14		2.8(3:20)
4/15		1.4(0:25)
4/16		1.4(3:20)
4/17		26.3(10:40)
4/18		.0(0:00)
4/19		12.5(9:35)
4/20		117.6(20:15)
4/21		4.2(6:00)
4/22		1.4(0:35)
4/23		8.3(7:55)
4/24		12.5(14:15)
4/25		8.3(22:50)
4/26		16.6(15:25)
4/27		42.9(8:35)
4/28		38.7(9:50)
4/29		1.4(3:20)
4/30		2.8(3:15)

CORPORATION

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR APR 1 THRU 30 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

METHANE

DATE	SITE	033
4/ 1	1218.5(4:05)	
4/ 2	1068.7(5:25)	
4/ 3	1174.2(11:50)	
4/ 4	960.6(19:15)	
4/ 5	973.6(19:15)	
4/ 6	989.2(19:30)	
4/ 7	1419.0(9:20)	
4/ 8	1234.1(18:20)	
4/ 9		
4/10	1234.1(19:35)	
4/11	1425.5(21:50)	
4/12	1498.5(5:40)	
4/13	1606.6(6:20)	
4/14	1514.1(7:30)	
4/15	3582.4(12:30)	
4/16	1422.3(5:35)	
4/17	830.3(0:00)	
4/18	922.8(16:35)	
4/19	1883.4(22:55)	
4/20	2274.7(2:45)	
4/21	1447.7(7:10)	
4/22	1778.5(21:30)	
4/23	1456.8(7:50)	
4/24	1024.4(23:05)	
4/25	1714.7(22:25)	
4/26	1896.4(6:55)	
4/27	2173.2(6:30)	
4/28	1062.8(3:45)	
4/29	1459.4(8:40)	
4/30	5637.7(16:50)	

**TABLE VI
THE FIVE MAXIMUM INDEPENDENT
SLIDING AVERAGES FOR
APRIL 1 THRU 30, 1978**

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR APR 1-30 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METERSULFUR DIOXIDE
30-MINUTE

SITE	033	
1	4/20(20:00-20:30)	113.7
2	4/13(8:50- 9:20)	106.8
3	4/27(8:15- 8:45)	54.7
4	4/13(9:25- 9:55)	51.7
5	4/27(8:50- 9:20)	38.2

SULFUR DIOXIDE
3-HOUR

SITE	033	
1	4/13(7:15-10:15)	38.3
2	4/27(8:00-11:00)	20.4
3	4/20(17:35-20:35)	19.7
4	4/19(23:20- 2:20)	8.5
5	4/18(0:00- 3:00)	2.5

SULFUR DIOXIDE
24-HOUR

SITE	033	
1	4/13- 4/14(4:00)	5.6
2	4/19- 4/20(21:00)	3.7
3	4/27- 4/28(5:00)	2.5
4	4/17- 4/18(4:00)	1.0
5	4/28- 4/29(6:00)	.4

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR APR 1-30 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

HYDROGEN SULFIDE*
1-HOUR

SITE	033	
1	4/13(8:40- 9:40)	51.5
2	4/20(19:55-20:55)	34.7
3	4/27(8:15- 9:15)	34.4
4	4/13(9:45-10:45)	14.8
5	4/20(1:30- 2:30)	12.3

*All hydrogen sulfide readings represent total sulfur during this reporting period.

TABLE VI. THE FIVE MAXIMUM AVERAGES FOR APR 1-30 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

METHANE
3-HOUR (6-9AM)

SITE

033

1	4/27(6:00- 9:00)	1604.7
2	4/23(6:00- 9:00)	1211.3
3	4/21(6:00- 9:00)	1207.4
4	4/15(6:00- 9:00)	1193.7
5	4/13(6:00- 9:00)	1186.4

TABLE VII
DIURNAL VARIATION OF RECORDED PARAMETERS

DIURNAL VARIATION OF SULFUR DIOXIDE(UG/M**3)

TRAILER NO. - 33 PERIOD(4/ 1/78 TO 4/30/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	0	0	0	0:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	1	1	0	0	0	0	0	0	1:	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0:	0	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0:	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9																									
10																	0	0	0	0	0	0	0	0	0
11	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	2	1	1	1	1	2	1	1	28	77	9	0	0	1	1	1	1	1	1	1	1	1	1	1	6
14	2	2	1	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0:	1	0	0	0	0	0	2	3	2	1	1	1	1	1	1	1	1	1	2	1	1
18	3	3	3	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0:	1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	11	0	1
20	1	6	10	1:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59	0	0	0	3
21	1	1	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0:	0	0	0	0	0	0	0	:	0:	0	0:	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0:	0	0	0	0:	52:	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
28	1	0	0	0:	0	0	0	0	0	2	1	1	0	1	1	1	0	1	0	0	0	0	0	0	0
29	1	2	2	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN	0	1	1	0	0	0	0	0	2	4	1	0	0	0	0	0	0	0	0	0	2	0	0	1	

TOTAL NUMBER OF OBSERVATIONS = 7939.

MEAN = 1.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF HYDROGEN SULFIDE(UG/M**3) *
TRAILER NO. - 33 PERIOD(4/ 1/78 TO 4/30/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	0	0	0	1:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0:	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	1:	0	1	1	1	1	1	1	1	1	1	1	1	0
4	0	1	1	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
5	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0:	0	0					0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	0	0	1	0:	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
9																									
10																	0	0	1	1	2	2	2	3	1
11	2	2	3	1:	0	1	2	2	2	2	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	2	3	4	4	3	2	1	1	1	1	1	1	1	1	1	2	1	1	1	2
13	1	1	1	1	1	1	1	1	17	46	12	8	5	2	2	1	1	1	2	1	1	1	1	1	5
14	1	1	1	1:	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0:	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0:	0	0	0	0	0	8	6	6	3	1	1	1	1	1	1	1	1	1	2	10	2
20	7	11	12	3:	3	2	1	1	1	1	0	0	0	0	0	0	3	3	1	1	35	1	0	0	4
21	0	0	0	1:	0	1	3	3	3	2	3	3	1	1	1	0	0	0	0	1	1	0	1	1	1
22	0	1	0	0:	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
23	0	0	0	0:	0	0	0	3	6	4	2	1	0	0	0	0	0	0	1	1	1	1	0	0	1
24	0	0	0	0:	0	0	0	0	0	0	0	0			7:	3	3	2	3	2	2	3	3	3	1
25	2	3	3	0:	0	0	1	0	1	3	5	3	5	4	4	3	3	3	3	3	3	4	6	7	3
26	4	4	3	3:	2	3	3	5	5	3	3	3	3	3	4	5	3	2	2	3	2	1	1	1	3
27	1	1	1	1:	1	1	2	4:	37:	20	4	1	1	0	0	0	1	1	1	0	0	0	0	0	3
28	0	0	0	2:	0	1	1	1	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN	1	1	1	1	0	1	1	1	3	4	2	1	1	1	1	1	1	1	1	1	2	1	1	1	

TOTAL NUMBER OF OBSERVATIONS = 7935. MEAN = 1.

: INDICATES CALIBRATION DURING THE HOUR

*All hydrogen sulfide measurements represent total sulfur during this period.

DIURNAL VARIATION OF METHANE(UG/M**3 X 10**-1)
TRAILER NO. - 33 PERIOD(4/ 1/78 TO 4/30/78)

DAY	HOUR																								MEAN	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
1	97	98	102	:	106	101	100	99	99	99	98	97	97	97	97	97	98	98	99	99	98	98	98	98	99	
2	96	96	97	:	96	100	98	95	94	93	93	92	93	92	92	92	91	92	96	100	99	94	91	92	95	
3	92	93	93	93	93	93	92	91	92	92	91	:	93	92	94	94	94	96	94	94	91	91	91	91	93	
4	92	92	92	93:	92	92	92	91	91	91	91	89	89	89	89	89	90	92	92	92	89	91	91	89	91	
5	91	91	91	:	92	91	92	91	91	91	91	90	89	90	90	90	89	88	89	92	88	88	88	89	90	
6	90	90	91	:	91	90					86	88	88	88	87	88	88	91	91	94	90	87	88	89	89	
7	91	93	95	:	102	93	102	127	111	114	101	93	94	92	92	92	92	93	94	95	95	95	92	89	97	
8	91	91	91	:	97	96	97	96	96	96	95	94	93	93	95	95	98	98	108	105	98	99	97		96	
9																										
10																		100	100	102	108	99	102	104	106	103
11	105	104	103	:	113	111	111	101	98	100	96	97	96	100	100	100	99	100	101	103	105	119	123	119	104	
12	112	116	125	112	116	141	131	104	103	104	99:	:	:	95	95	95	97	97	101	105	107	112	98	95	107	
13	91	99	107	114	131	135	131	110	115	126	103	101	93	86:	89	88	90	89	87	97	97	97	96	98	103	
14	98	102	100	:	104	105	111	139	99	89	89	89	88	87	89	89	88	88	90	93	111	90	99	91	97	
15	91	94	102	:	105	108	131	123	104	92	86	85	109	86	86	84	84	86	90	95	91	90	90	84	95	
16	82	83	84	:	94	100	92	87	83	81	81	81	82	81	81	80	82	82	83	86	87	88	86	84	85	
17	80	79	78	:	79	79	79	79	78	79	77	78	78	78	78	78	79	78	78	78	78	78	78	80	78	
18	81	79	78	:	78	81	83	85	85	84	84	84	83	83	83	83	86	85	84	85	86	82	82	82	83	
19	84	86	87	:	85	86	93	98	104	103	93	94	90	88	87	88	91	91	98	118	100	116	171	152	100	
20	203	185	188	:	96	92	91	90	87	86	89	87	89	88	88	89	90	88	86	86	98	90	91	93	103	
21	110	115	107	:	118	115	125	132	106	93	95	86	85	86	87	86	87	87	90	91	91	92	96	96	99	
22	94	97	95	:	92	93	94	93	90	85	85	84	84	86	86	85	86	86	88	87	84	99	91	87	89	
23	85	84	82	:	90	108	118	134	112	94	92	89	85	84	83	83	86	88	91	93	93	94	84	83	93	
24	82	83	82	:	85	84	86	88	83	83	84	83	81	82	81	85	85	86	87	87	86	85	89	89	85	
25	87	87	89	:	108	90	94	94	90	104	95	90	89	89	96	91	89	90	95	107	125	148	146	119	100	
26	100	97	100	:	103	102	119	125	98	88	89	89	88	88	89	89	89	89	90	90	89	91	91	92	95	
27	100	119	108	:	114	166	195	154	133	119	96	91	88	86	86	87	87	86	86	86	89	91	89	89	106	
28	86	86	86	:	92	91	87	85	85	85	85	85	85	86	85	85	85	85	85	84	84	84	84	84	86	
29	83	82	82	:	83	83	84	82	87	82	82	82	82	82	82	81	81	81	81	83	83	82	82	82	82	
30	83	84	82	:	84	82	82	82	82	82	82	82	82	82	81	82	133	82	81	82	84	85	88	82	85	
MEAN	96	97	97	105	98	100	104	103	96	94	90	88	89	88	88	88	91	89	91	94	94	95	96	94		

TOTAL NUMBER OF OBSERVATIONS = 7743. MEAN = 94.

: INDICATES CALIBRATION DURING THE HOUR

RADIAN

CORPORATION

DCN 78-100-212-03

AIR MONITORING REPORT
FOR
THE UNIVERSITY OF TEXAS
BUREAU OF ECONOMIC GEOLOGY
MAY 1978
Report No. 3

6 July 1978

Presented to:
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TABLE OF CONTENTS

	<u>Page</u>
I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM-----	1
II. DESCRIPTION OF INSTRUMENT SYSTEMS-----	4
A. Air Quality Instrumentation-----	4
1. Description-----	4
2. Calibration-----	5
B. Data Acquisition System-----	6
III. BAG SAMPLING PROGRAM-----	8
IV. OPERATING TIME ANALYSIS-----	9
V. DATA PRESENTATION AND SUMMARY-----	11

LIST OF TABLES

		<u>Page</u>
TABLE I	DOWNTIME HOURS FOR CHOCOLATE BAYOU, TEXAS-----	10
TABLE II	NATIONAL AMBIENT AIR QUALITY STANDARDS-----	15
TABLE III	AVERAGES FOR MAY 1 THRU 31, 1978-----	16
TABLE IV	DAILY AVERAGES FOR MAY 1 THRU 31, 1978-----	17
TABLE V	MAXIMUM FIVE-MINUTE AVERAGES AND TIMES OF OCCURRENCE FOR MAY 1 THRU 31, 1978-----	19
TABLE VI	THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR MAY 1 THRU 31, 1978-----	22
TABLE VII	DIURNAL VARIATION OF RECORDED PARAMETERS-----	25

I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM

Radian Corporation is under contract to the University of Texas, Bureau of Economic Geology, to provide ambient air quality monitoring at one site near Chocolate Bayou, Texas. This site measures and records concentrations for sulfur dioxide, hydrogen sulfide, methane, and particulates. A bag sample is collected bi-weekly and returned to Radian's Austin facilities and analyzed for methane.

Figure I shows the configuration of this type of monitoring station. The trailer provides a sturdy and protective covering as well as mobility. Figure II shows the air monitoring site.

FIGURE I

AMBIENT AIR MONITORING SYSTEM I

FIGURE II
AIR MONITORING SITE

II. DESCRIPTION OF INSTRUMENT SYSTEMS

The ambient air monitoring station is equipped to monitor the parameters shown below:

Sulfur Dioxide
Particulates
Methane
Hydrogen Sulfide

A. Air Quality Instrumentation

1. Description

Sulfur dioxide is measured with a Meloy Model SA185-2A sulfur analyzer, which is an EPA-approved analyzer. This automated analyzer utilizes the flame photometric principle to measure sulfur levels with a minimum detectable sensitivity of 5 ppb, and a linearity of $\pm 1\%$. The analyzer is operated with an H_2S scrubber to make it specific to SO_2 concentrations.

Hydrogen sulfide is measured using a Meloy Model SA185-2 analyzer equipped with an SO_x scrubber. Specifications for this analyzer are the same as for the SA185-2A.

Methane is monitored with a Bendix Model 8200 gas chromatograph. This instrument uses a flame ionization detector and has a minimum detectable sensitivity of 5 ppb. The Model 8200 works on a five-minute cycle, i.e., one air sample is analyzed every five minutes.

The air sample is drawn in through a glass cane and manifold supplied by the Ace Glass Company. The system has a 25 mm diameter, and a constant air flow through the system is

provided by an air pump rated at 60 cfm at 0" head pressure. The manifold has sampling ports to which $\frac{1}{4}$ " Teflon lines to the instruments are connected. All joints in the sampling system are secured by O-ring compression fittings. The manifold is contained in a heated (100°F) chamber to prevent condensation of moisture.

The trailer has two heavy duty high volume particulate samplers (Hi-Vols). Fiberglass filter paper is brought to a controlled humidity before weighing. Each Hi-Vol has a flow recorder to permit correction for changes in air flow runs for a 24-hour period (midnight to midnight), and is turned on and off by the computer. The Hi-Vols were designed following guidelines recommended by the Environmental Protection Agency and were manufactured by Radian.

2. Calibration

The trailer contains a Meloy Model RAD-1 calibration unit. This unit provides a zero air supply and SO₂ span gas from an SO₂ permeation tube. The calibration is automatically performed once a day, and is controlled by the computer. The SO₂ channel is first switched to zero. Then the computer monitors the output of each analyzer and takes a new zero reading after a stable zero signal has been reached. This zero reading is compared by the computer to the zero reading obtained 24 hours before, and if a drift in excess of 10 ppb has occurred, an excess zero drift light on the System Status Panel is turned on. The instruments are then returned to the monitor mode, and after two minutes the computer resumes data taking.

The SO₂ permeation tubes were manufactured by Metronics Association, Inc. These tubes were then individually calibrated for Radian by the National Bureau of Standards.

The Model 8200 methane analyzer is calibrated with undiluted span gas. This span gas contains methane in air. The Model 8200 is zeroed with air from a Bendix Model 8834 zero air unit. In addition, the instrument is electronically re-zeroed at the start of every five-minute cycle.

In addition to the daily instrument zero/spans, all instruments are multipoint calibrated monthly. Calibration standards and equipment used in the monthly multipoints is distinct from the equipment used for daily zero/span operations.

Quality assurance audits are performed on each instrument once a quarter. These audits are performed by Radian's Quality Assurance personnel using instrumentation and standards different from those used in the monthly multipoint calibrations.

A General Metals Calibration Kit is used to calibrate the Hi-Vol particulate samplers.

B. Data Acquisition System

The basis of the data acquisition system is a Data General NOVA 1200 minicomputer. The NOVA, which has a basic cycle time of 1.2 μ sec, is equipped with automatic program load and power fail/automatic restart features. The computer utilizes 8K 16-bit words of core memory. Analog-to-digital conversion is accomplished via an ADC built by Radian Corporation. The input/output unit for system 034 is Texas Instruments' KSR 733 keyboard/printer. This model provides keyboard entry and hard copy printed output. The data are also recorded on a cassette magnetic tape unit with three drives. The cassette unit is utilized for program storage and loading as well as recording. To reduce wear on mechanical parts, the power to the teletype and cassette units is turned on only when the

unit(s) is to be used. Several important functions in the instruments as well as in the computer and the trailer are monitored by means of lights on a System Status Panel. The information displayed by these lights is written onto cassette tape to monitor the complete status of the system every five minutes.

III. BAG SAMPLING PROGRAM

Grab-bag samples are collected bi-weekly and analyzed for methane. The ambient air samples are collected in tedlar bags using a metal bellows pump connected to the ambient sample manifold. Each bag sample is collected over a three-hour period.

The bag samples are returned to Austin for analysis for methane concentration. The analysis is done by gas chromatography using a flame ionization detector, a Porapak QS column and a 5 ppm methane standard. A 1 cc volume is used both for calibration and analysis. The samples are introduced by direct injection. The detection limit for methane with this method is 2 ppm.

Results of the bag sampling analyses are given below:

<u>Date</u>	<u>Time</u>	<u>Methane Concentration (ppm)</u>
5/17	0600-0900	<2
5/24	0600-0900	<2

IV. OPERATING TIME ANALYSIS

This section presents the operating statistics for each of the major subsystems contained in the monitoring station. Table I shows the specific number of hours that each of these subsystems was inoperative for the month. The column labeled "DIGITIZING SYSTEM" refers to the entire data acquisition system, and downtime hours appearing in this column are hours of total data loss. These instances include, in addition to computer downtime, power failures, no power available, and self-automated shutdown periods such as during air conditioner malfunctions.

Calibration time is not considered to be downtime and is not included in the downtime figures. The amount of time used in calibrating the instruments is given at the bottom of the downtime analysis table and is reported as total calibration hours for each channel for the entire month. As is evident in the calibration figures, channels can be calibrated independently of one another. No calibration time is given for particulate monitoring since Hi-Vol calibration occurs infrequently and only during the off-duty cycle for each Hi-Vol while another Hi-Vol is taking data.

TABLE I.
DOWNTIME HOURS FOR CHOCOLATE BAYOU

SITE 033

DIGITIZING

DATE	SYSTEM	SO2	H2S	VOLT	CH4	PART
5/ 1/78	1.	0.	0.	0.	0.	24.
5/ 2/78	0.	0.	0.	0.	0.	24.
5/ 3/78	0.	0.	0.	0.	0.	24.
5/ 4/78	0.	0.	0.	0.	0.	24.
5/ 5/78	0.	0.	0.	0.	0.	0.
5/ 6/78	0.	0.	0.	0.	0.	24.
5/ 7/78	0.	0.	0.	0.	0.	24.
5/ 8/78	0.	0.	0.	0.	0.	24.
5/ 9/78	18.	0.	0.	0.	0.	24.
5/10/78	24.	0.	0.	0.	0.	24.
5/11/78	22.	0.	0.	0.	0.	24.
5/12/78	24.	0.	0.	0.	0.	24.
5/13/78	24.	0.	0.	0.	0.	24.
5/14/78	24.	0.	0.	0.	0.	24.
5/15/78	24.	0.	0.	0.	0.	24.
5/16/78	7.	0.	0.	0.	0.	24.
5/17/78	13.	0.	0.	0.	0.	24.
5/18/78	14.	0.	0.	0.	0.	24.
5/19/78	0.	0.	0.	0.	0.	24.
5/20/78	0.	0.	0.	0.	0.	24.
5/21/78	0.	0.	0.	0.	0.	24.
5/22/78	0.	0.	0.	0.	0.	24.
5/23/78	0.	0.	0.	0.	0.	0.
5/24/78	0.	0.	0.	0.	0.	24.
5/25/78	0.	0.	0.	0.	0.	24.
5/26/78	0.	0.	0.	0.	2.	24.
5/27/78	0.	0.	0.	0.	5.	0.
5/28/78	0.	0.	0.	0.	23.	24.
5/29/78	0.	0.	0.	0.	23.	24.
5/30/78	0.	0.	0.	0.	23.	24.
5/31/78	0.	0.	0.	0.	23.	24.

CAL TIME 10. 11. 0. 20.

V. DATA PRESENTATION AND SUMMARY

This section includes summaries for various recorded data at the monitoring sites. The data presentations indicate the variability of pollutant concentrations and parameters with time. All parameters, except suspended particulates (24-hour samples), are sampled once each second, but recorded as five-minute arithmetic averages of the one-second samples. This averaging technique tends to smooth instantaneous maximum values.

Inherent in any data acquisition system is random noise, both from the recording instruments and quantization in the analog-to-digital conversion. The lower threshold for all analytical instruments is twice the maximum noise level generated by the instruments. This lower threshold is 5 ppb for all of these instruments. Therefore, any values appearing in the data presentations that are less than 5 ppb indicate only a trace of pollutant in question and should not be construed to be absolute levels. In addition, when concentration levels drop below the lower threshold, the recorded quantity is simply random noise and averages tend toward zero. If a zero concentration appears in the data presentation, this does not indicate absolute zero concentration.

All pollutant data (except for particulate data) are taken at the monitoring site in integer parts per billion (ppb) but are presented here in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) assuming standard temperature and pressure of 25°C and 760 mm Hg (1013.2 millibars), respectively. The scale factors required to convert $\mu\text{g}/\text{m}^3$ at standard conditions back to ppb for the various pollutants are given in the following table.

PollutantTo Convert $\mu\text{g}/\text{m}^3$ at 25°C and
760 mm Hg to ppb Multiply by

SO_2	.384
H_2S	.723
CH_4	1.536

The units of the air quality parameters are given at the top of each table. It should be noted here that inside temperature is monitored and recorded as a functional part of the system but is not presented in this report.

It should be noted that during this period the H_2S analyzer was operating without an SO_x scrubber (replacement parts are on order but not yet received from the manufacturer). The H_2S values reported herein are actually total sulfur measurements.

Table II presents the national ambient air quality standards (NAAQS) for criteria pollutants.

Table III displays the monthly statistics for the monitoring station for the month. To insure statistical significance, and to reduce the possibility of introducing a bias in the presentation, averages are computed only when at least 50 percent of the samples are present. If less than the required samples are present for a particular parameter, that entry will be blank. The number of samples present for a particular parameter is defined as the total possible number of five-minute samples for the averaging time less the computer downtime less the channel downtime less the channel calibration time. The averages in Table III are arithmetic averages with the following exception:

- Particulate averages are computed as the geometric mean.

Table IV displays the daily averages. Again, 50 percent of the five-minute samples are required in order to compute an average. A blank entry indicates an insufficient number of five-minute samples present for that day. Particulate averages are computed the same way as described in Table III.

Table V presents the maximum daily five-minute averages retained in the data base as well as the times of occurrence. For each parameter, a five-minute maximum average is printed if any samples are present for that day. Therefore, the maximum five-minute average when a given channel has experienced considerable downtime or calibration time during the day in question may be misrepresentative of the maximum expected for that parameter on that day.

Table VI indicates the five largest averages for various averaging times. The table shows the period of time covered by the average. Maxima are chosen so that time segments are independent. The maximum averages reported are found using a 'sliding average' technique with the exception of the 24-hour particulate average, which is computed from midnight to midnight. For averaging times less than or equal to three hours, the sliding average is stepped one five-minute sample at a time. For longer averaging times, the step size is twelve samples or one hour. For averaging times less than or equal to one hour, 100 percent of the five-minute samples must be present to compute an average. Averaging times greater than one hour require 90 percent. Whether or not a sliding average is computed is solely determined by the number of samples present in that averaging time and is independent of daily or monthly averaging criteria.

Table VII demonstrates the diurnal variation of various recorded parameters. Hourly averages are determined by arithmetically averaging five-minute samples. For all parameters, a blank entry in the diurnal variation table indicates that less than half (i.e., less than 6) of the five-minute samples for that hour are present.

Times given in the data presentations correspond to the appropriate local times, i.e., Central Daylight Savings Time or Central Standard Time, depending on the time of the year.

TABLE II
NATIONAL AMBIENT AIR QUALITY STANDARDS

	<u>Primary</u>	<u>Secondary</u>
<u>Particulate</u>		
Annual G.M.**	75 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$
24 Hr. Max.*	260	150
<u>Sulfur Oxides</u>		
Annual	80 (.03 ppm)	
24 Hr. Max.*	365 (.14 ppm)	
3 Hr. Max.*	--	1300 (.5 ppm)
<u>Oxidant</u>		
1 Hr. Max.*	160* (.08 ppm)	160
<u>Hydrocarbons</u>		
3 Hr. Max.*	160 (.24 ppm)	160
6-9 a.m.		
<u>Carbon Monoxide</u>		
$\mu\text{g}/\text{m}^3$		
Max. 8 Hrs.*	10000 (9 ppm)	10000
Max. 1 Hr.*	40000 (35 ppm)	40000
<u>Nitrogen Dioxide</u>		
Annual	100 (.05 ppm)	100

Units are micrograms per cubic meter and ppm in parentheses.

*Not to be exceeded more than once per year.

**Geometric Mean.

**TABLE III
AVERAGES FOR MAY 1 THRU 31, 1978**

TABLE III. AVERAGES FOR MAY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

	SULFUR DIOXIDE(SO2)	HYDROGEN SULFIDE	METHANE
SITE	033	033	033
	3	4	826.1

	PARTICULATE
SITE	033
	53.6

TABLE IV. DAILY AVERAGES FOR MAY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

DATE	SULFUR DIOXIDE(SO2)	HYDROGEN SULFIDE	METHANE
	SITE 033	033	033
5/ 1	.0	.1	846.5
5/ 2	.0	.0	912.9
5/ 3	.5	1.8	962.1
5/ 4	.1	3.0	1224.0
5/ 5	.1	.8	867.4
5/ 6	.0	.0	858.4
5/ 7	.0	.0	794.4
5/ 8	1.4	.1	798.4
5/ 9			
5/10			
5/11			
5/12			
5/13			
5/14			
5/15			
5/16	.0	2.9	784.0
5/17			
5/18			
5/19	.0	.0	752.7
5/20	.0	.0	744.1
5/21	.0	.0	771.1
5/22	.3	.5	746.9
5/23	.2	.3	819.2
5/24	.2	.0	740.1
5/25	.1	.0	716.1
5/26	1.2	.0	727.2
5/27	.5	.2	746.1
5/28	.9	.5	
5/29	.2	.0	
5/30	.0	.2	
5/31	.0	.0	

TABLE IV. DAILY AVERAGES FOR MAY 1 THRU 31 1978
 (UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
 TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

PARTICULATE

SITE 033

DATE

5/ 1	
5/ 2	
5/ 3	
5/ 4	
5/ 5	58.0
5/ 6	
5/ 7	
5/ 8	
5/ 9	
5/10	

5/11	
5/12	
5/13	
5/14	
5/15	
5/16	
5/17	
5/18	
5/19	
5/20	

5/21	
5/22	
5/23	51.0
5/24	
5/25	
5/26	
5/27	52.0
5/28	
5/29	
5/30	

5/31

**TABLE V
MAXIMUM FIVE-MINUTE AVERAGES AND
TIMES OF OCCURRENCE FOR
MAY 1 THRU 31, 1978**

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR MAY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

DATE	SITE	033
5/ 1		. 0(0:00)
5/ 2		2. 6(3:55)
5/ 3		28. 7(10:55)
5/ 4		2. 6(0:10)
5/ 5		18. 2(9:05)
5/ 6		. 0(0:00)
5/ 7		. 0(0:00)
5/ 8		2. 6(10:55)
5/ 9		2. 6(0:00)
5/10		
5/11		7. 8(13:55)
5/12		
5/13		
5/14		
5/15		
5/16		. 0(8:15)
5/17		2. 6(4:10)
5/18		. 0(13:45)
5/19		. 0(0:00)
5/20		. 0(0:00)
5/21		. 0(0:00)
5/22		2. 6(3:55)
5/23		2. 6(0:00)
5/24		2. 6(4:10)
5/25		2. 6(0:10)
5/26		18. 2(11:40)
5/27		31. 3(10:10)
5/28		2. 6(3:40)
5/29		2. 6(0:00)
5/30		. 0(0:00)
5/31		. 0(0:00)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR MAY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

HYDROGEN SULFIDE

DATE	SITE	033
5/ 1		1.4(3:20)
5/ 2		1.4(11:40)
5/ 3		20.8(10:55)
5/ 4		9.7(8:10)
5/ 5		36.0(9:05)
5/ 6		1.4(0:50)
5/ 7		.0(0:00)
5/ 8		1.4(11:55)
5/ 9		1.4(1:55)
5/10		
5/11		15.2(13:05)
5/12		
5/13		
5/14		
5/15		
5/16		4.2(9:55)
5/17		2.8(0:20)
5/18		.0(13:45)
5/19		.0(0:00)
5/20		.0(0:00)
5/21		2.8(3:15)
5/22		2.8(20:55)
5/23		5.5(3:15)
5/24		.0(0:00)
5/25		.0(0:00)
5/26		5.5(11:40)
5/27		67.8(10:10)
5/28		4.2(3:15)
5/29		1.4(2:50)
5/30		2.8(3:20)
5/31		1.4(3:20)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR MAY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

METHANE

DATE	SITE	033
5/ 1	1260.1	(20:35)
5/ 2	1262.7	(9:50)
5/ 3	1250.4	(21:05)
5/ 4	2983.9	(5:35)
5/ 5	992.5	(20:20)
5/ 6	1021.1	(5:50)
5/ 7	1002.2	(7:20)
5/ 8	944.9	(17:15)
5/ 9	1667.1	(4:55)
5/10		
5/11	2341.8	(13:05)
5/12		
5/13		
5/14		
5/15		
5/16	849.2	(16:55)
5/17	789.3	(8:35)
5/18	1966.1	(13:45)
5/19	913.0	(17:55)
5/20	928.7	(7:15)
5/21	1097.3	(8:35)
5/22	1113.6	(5:15)
5/23	1657.4	(10:50)
5/24	6181.5	(13:20)
5/25	906.5	(14:45)
5/26	782.8	(7:30)
5/27	320.5	(6:35)
5/28		
5/29		
5/30		
5/31	1645.0	(13:20)

TABLE VI
THE FIVE MAXIMUM INDEPENDENT
SLIDING AVERAGES FOR
MAY 1 THRU 31, 1978

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR MAY 1-31 1978
 UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

 SULFUR DIOXIDE
 30-MINUTE

SITE	033	
1	5/ 3(10:35-11:05)	15.6
2	5/11(14:05-14:35)	7.8
3	5/27(9:50-10:20)	7.4
4	5/26(11:35-12:05)	3.9
5	5/ 5(8:40- 9:10)	3.5

 SULFUR DIOXIDE
 3-HOUR

SITE	033	
1	5/ 3(8:05-11:05)	2.7
2	5/ 8(21:00- 0:00)	2.6
3	5/ 9(0:05- 3:05)	2.6
4	5/26(23:55- 2:55)	2.6
5	5/ 8(11:00-14:00)	2.5

 SULFUR DIOXIDE
 24-HOUR

SITE	033	
1	5/ 8- 5/ 9(7:00)	1.9
2	5/26- 5/27(11:00)	1.7
3	5/28- 5/29(3:00)	1.0
4	5/ 3- 5/ 4(3:00)	.6
5	5/22- 5/23(3:00)	.5

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR MAY 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

HYDROGEN SULFIDE
1-HOUR

SITE	033	
1	5/ 3(10:10-11:10)	10.3
2	5/ 4(7:55- 8:55)	9.0
3	5/27(9:10-10:10)	5.7
4	5/ 4(9:00-10:00)	4.5
5	5/16(11:10-12:10)	4.2

TABLE VI. THE FIVE MAXIMUM AVERAGES FOR MAY 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

METHANE
3-HOUR (6-9AM)

SITE	033
1	5/ 4(6:00- 9:00) 1787.5
2	5/23(6:00- 9:00) 1119.4
3	5/ 3(6:00- 9:00) 990.1
4	5/ 6(6:00- 9:00) 943.8
5	5/21(6:00- 9:00) 905.8

TABLE VII
DIURNAL VARIATION OF RECORDED PARAMETERS

DIURNAL VARIATION OF SULFUR DIOXIDE (UG/M**3)
TRAILER NO - 33 PERIOD(5/ 1/78 TO 5/31/78)

	HOUR																								MEAN
DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1	0	0	0	0:	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	1	0	1:	1	1	0	0	0	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	1	1	0:	0	0	0	0	0	0	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0:	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0:	0	0	0	0	0	0	0	3	3	3	3	3	3	3	3	3	3	3	3	3	2
9	3	3	3	0:	0		2																		2
10														5	8										6
11																									
12																									
13																									
14																									
15									0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16				0:	0	0	0	0	0	0	0														0
17	0	0	0	0:	0	0	0	0	0	0	0				0	0	0	0	0	0	0	0	0	0	0
18															0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0
23	2	2	2	0:	0	0	0	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0:	1	0	1	0	0	0	0	0	0	0	1	0	1	0	1	1	0	1	1	0	0
25	1	0	1	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0:	0	0	0	0	0	0	0	2	2	2	3	3	3	3	3	3	3	3	3	3	1
27	3	3	3	0:	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1
28	0	0	0	2:	1	1	1	1	0	1	1	1	1	1	1	1	1	2	2	2	2	2	1	2	1
29	2	2	1	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN	1	1	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0

TOTAL NUMBER OF OBSERVATIONS = 6451. MEAN = 0.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF HYDROGEN SULFIDE (UG/M*H3)
 TRAILER NO. - 33 PERIOD(5/ 1/78 TO 5/31/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	0	0	0	0:	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0:	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0:	1	1	3	1	1	1	8	4	1	1	1	1	1	0	0	0	0	0	0	0	0
4	2	2	2	3:	3	3	3	3	9	5	3	3	3	4:	3	3	3	1	1	2	2	2	2	3	3
5	1	1	1	1:	0	1	1	0	0	3	0	1	1	1	0	1	3	3	3	2	3	2	3	2	2
6	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
7	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
10																									
11																									
12														1	0										
13																									
14																									
15																									
16																									
17	2	3	3	0:	0	0	0	0	0	0	4	4	4	4	4	4	4	4	3	3	3	3	3	3	3
18																									
19	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	1	1	1	1:	0	0	0	0	0	0	1:	0	1	1	0	0	1	1	1	1	1	1	1	2	2
25	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0:	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	1:	0	0	1	1	1	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0:	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1
30	0	0	0	2:	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1

TOTAL NUMBER OF OBSERVATIONS = 6447. MEAN = 0.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF METHANE(UG/M**3 X 10**-1)
TRAILER NO. - 33 PERIOD(5/ 1/78 TO 5/31/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	85	85	84	:	83	85	83	84	84	85		83	75	85	83	84	82	81	82	83	92	91	99	87	8
2	88	87	89	:	89	86	87	85	89	100	99	102	94	92	92	92	93	92	94	93	102	87	83	85	9
3	94	96	94	93:	95	103	114	93	91	93	101	96	92	91	90	90	89	91	90	95	95	115	106	103	9
4	105	108	191	:	233	270	241	173	122	94	92	90	89	87	88	88	89	90	90	89	88	89	89	87	12
5	85	85	84	:	86	87	90	88	86	85	85	85	86	84	86	87	86	86	86	91	89	89	90	92	8
6	92	92	90	:	93	92	94	97	92	91	88	85	84	84	83	81	80	80	80	80	79	79	79	79	8
7	79	79	78	:	79	79	80	90	87	80	78	78	78	78	78	79	79	78	78	78	79	78	78	78	7
8	77	78	78	:	80	79	78	79	79	80	80	80	82	83	82	85	82	83	80	79	79	78	78	79	8
9	81	108	95	:	103		111																		10
10																									
11													103	72											8
12																									
13																									
14																									
15																									
16										79	78	78	78	78	78	79	79	79	79	79	78	78	78	78	7
17	78	77	77	:	77	77	77	76	76	74	71														7
18															74	74	74	75	80	84	96	85	92	87	8
19	79	75	73	:	74	75	73	74	74	74	74	75	76:	73	73	74	76	83	76	75	75	80	76	76	7
20	75	75	74	:	74	74	75	79	75	75	74	74	74	74	74	75	75	73	73	74	73	73	75	76	7
21	75	74	74	:	80	78	78	88	106	85	77	74	74	73	74	74	74	73	73	75	76	73	73	73	7
22	73	74	77	:	76	87	82	73	74	73	73	75	73	72	66	72	72	72	73	73	74	75	80	81	7
23	80	79	80	:	91	92	125	124	87	73:		74	74	76	76	74	73	73	73	73	73	73	73	73	8
24	73	73	73	:	73	75	73	72	71	71	72	71	71	121	71	71	71	72	71	71	72	73	72	71	7
25	69	72	72	:	70	70	71	70	70	70	71	71	71	72	75	72	71	71	71	72	77	72	75	75	7
26	71	71	71	74:	75	74	74	75			73	73	72	72	72	72	72	74	74	73	73	74	73	73	7
27	73	74	74	:	78	76	77	75	73	75	74	74	74	74	74	74	75	75	74						7
28				:																					
29				:																					
30				:																					
31				:																					
MEAN	81	82	86	83	90	92	94	89	85	81	80	80	79	83	78	79	79	79	79	80	82	81	82	81	

TOTAL NUMBER OF OBSERVATIONS = 5080. MEAN = 82.

: INDICATES CALIBRATION DURING THE HOUR

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DCN 78-100-212-04

AIR MONITORING REPORT
FOR
THE UNIVERSITY OF TEXAS
BUREAU OF ECONOMIC GEOLOGY
JUNE 1978
REPORT NO. 4

4 August 1978

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TABLE OF CONTENTS

	<u>Page</u>
I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM-----	1
II. DESCRIPTION OF INSTRUMENT SYSTEMS-----	4
A. Air Quality Instrumentation-----	4
1. Description-----	4
2. Calibration-----	5
B. Data Acquisition System-----	6
III. BAG SAMPLING PROGRAM-----	8
IV. OPERATING TIME ANALYSIS-----	9
V. DATA PRESENTATION AND SUMMARY-----	11

LIST OF TABLES

	<u>Page</u>
TABLE I DOWNTIME HOURS FOR CHOCOLATE BAYOU, TEXAS-----	10
TABLE II NATIONAL AMBIENT AIR QUALITY STANDARDS-----	15
TABLE III AVERAGES FOR JUNE 1 THRU 30, 1978-----	16
TABLE IV DAILY AVERAGES FOR JUNE 1 THRU 30, 1978-----	17
TABLE V MAXIMUM FIVE-MINUTE AVERAGES AND TIMES OF OCCURRENCE FOR JUNE 1 THRU 30, 1978-----	19
TABLE VI THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR JUNE 1 THRU 30, 1978-----	22
TABLE VII DIURNAL VARIATION OF RECORDED PARAMETERS-----	25

I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM

Radian Corporation is under contract to the University of Texas, Bureau of Economic Geology, to provide ambient air quality monitoring at one site near Chocolate Bayou, Texas. This site measures and records concentrations for sulfur dioxide, hydrogen sulfide, methane, and particulates. A bag sample is collected bi-weekly and returned to Radian's Austin facilities and analyzed for methane.

Figure I shows the configuration of this type of monitoring station. The trailer provides a sturdy and protective covering as well as mobility. Figure II shows the air monitoring site.

FIGURE I

AMBIENT AIR MONITORING SYSTEM I

FIGURE II
AIR MONITORING SITE

II. DESCRIPTION OF INSTRUMENT SYSTEMS

The ambient air monitoring station is equipped to monitor the parameters shown below:

Sulfur Dioxide
Particulates
Methane
Hydrogen Sulfide

A. Air Quality Instrumentation

1. Description

Sulfur dioxide is measured with a Meloy Model SA185-2A sulfur analyzer, which is an EPA-approved analyzer. This automated analyzer utilizes the flame photometric principle to measure sulfur levels with a minimum detectable sensitivity of 5 ppb, and a linearity of $\pm 1\%$. The analyzer is operated with an H_2S scrubber to make it specific to SO_2 concentrations.

Hydrogen sulfide is measured using a Meloy Model SA185-2 analyzer equipped with an SO_x scrubber. Specifications for this analyzer are the same as for the SA185-2A.

Methane is monitored with a Bendix Model 8200 gas chromatograph. This instrument uses a flame ionization detector and has a minimum detectable sensitivity of 5 ppb. The Model 8200 works on a five-minute cycle, i.e., one air sample is analyzed every five minutes.

The air sample is drawn in through a glass cane and manifold supplied by the Ace Glass Company. The system has a 25 mm diameter, and a constant air flow through the system is

provided by an air pump rated at 60 cfm at 0" head pressure. The manifold has sampling ports to which $\frac{1}{4}$ " Teflon lines to the instruments are connected. All joints in the sampling system are secured by O-ring compression fittings. The manifold is contained in a heated (100°F) chamber to prevent condensation of moisture.

The trailer has two heavy duty high volume particulate samplers (Hi-Vols). Fiberglass filter paper is brought to a controlled humidity before weighing. Each Hi-Vol has a flow recorder to permit correction for changes in air flow runs for a 24-hour period (midnight to midnight), and is turned on and off by the computer. The Hi-Vols were designed following guidelines recommended by the Environmental Protection Agency and were manufactured by Radian.

2. Calibration

The trailer contains a Meloy Model RAD-1 calibration unit. This unit provides a zero air supply and SO₂ span gas from an SO₂ permeation tube. The calibration is automatically performed once a day, and is controlled by the computer. The SO₂ channel is first switched to zero. Then the computer monitors the output of each analyzer and takes a new zero reading after a stable zero signal has been reached. This zero reading is compared by the computer to the zero reading obtained 24 hours before, and if a drift in excess of 10 ppb has occurred, an excess zero drift light on the System Status Panel is turned on. The instruments are then returned to the monitor mode, and after two minutes the computer resumes data taking.

The SO₂ permeation tubes were manufactured by Metronics Association, Inc. These tubes were then individually calibrated for Radian by the National Bureau of Standards.

The Model 8200 methane analyzer is calibrated with undiluted span gas. This span gas contains methane in air. The Model 8200 is zeroed with air from a Bendix Model 8834 zero air unit. In addition, the instrument is electronically re-zeroed at the start of every five-minute cycle.

In addition to the daily instrument zero/spans, all instruments are multipoint calibrated monthly. Calibration standards and equipment used in the monthly multipoints is distinct from the equipment used for daily zero/span operations.

Quality assurance audits are performed on each instrument once a quarter. These audits are performed by Radian's Quality Assurance personnel using instrumentation and standards different from those used in the monthly multipoint calibrations.

A General Metals Calibration Kit is used to calibrate the Hi-Vol particulate samplers.

B. Data Acquisition System

The basis of the data acquisition system is a Data General NOVA 1200 minicomputer. The NOVA, which has a basic cycle time of 1.2 μ sec, is equipped with automatic program load and power fail/automatic restart features. The computer utilizes 8K 16-bit words of core memory. Analog-to-digital conversion is accomplished via an ADC built by Radian Corporation. The input/output unit for system 034 is Texas Instruments' KSR 733 keyboard/printer. This model provides keyboard entry and hard copy printed output. The data are also recorded on a cassette magnetic tape unit with three drives. The cassette unit is utilized for program storage and loading as well as recording. To reduce wear on mechanical parts, the power to the teletype and cassette units is turned on only when the

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unit(s) is to be used. Several important functions in the instruments as well as in the computer and the trailer are monitored by means of lights on a System Status Panel. The information displayed by these lights is written onto cassette tape to monitor the complete status of the system every five minutes.

III. BAG SAMPLING PROGRAM

Grab-bag samples are collected bi-weekly and analyzed for methane. The ambient air samples are collected in tedlar bags using a metal bellows pump connected to the ambient sample manifold. Each bag sample is collected over a three-hour period.

The bag samples are returned to Austin for analysis for methane concentration. The analysis is performed on either a Bendix 8202 or a Baseline Industries Model 1030 gas chromatograph using a flame ionization detector. The minimum detectable limit using this technique is less than 1 ppm.

Results of the bag sampling analyses are given below:

<u>Date</u>	<u>Time</u>	<u>Methane Concentration (ppm)</u>
6/8	0600-0900	2.06
6/22	0600-0900	1.62

IV. OPERATING TIME ANALYSIS

This section presents the operating statistics for each of the major subsystems contained in the monitoring station. Table I shows the specific number of hours that each of these subsystems was inoperative for the month. The column labeled "DIGITIZING SYSTEM" refers to the entire data acquisition system, and downtime hours appearing in this column are hours of total data loss. These instances include, in addition to computer downtime, power failures, no power available, and self-automated shutdown periods such as during air conditioner malfunctions.

Calibration time is not considered to be downtime and is not included in the downtime figures. The amount of time used in calibrating the instruments is given at the bottom of the downtime analysis table and is reported as total calibration hours for each channel for the entire month. As is evident in the calibration figures, channels can be calibrated independently of one another. No calibration time is given for particulate monitoring since Hi-Vol calibration occurs infrequently and only during the off-duty cycle for each Hi-Vol while another Hi-Vol is taking data.

TABLE 1.
DOWNTIME HOURS FOR CHOCOLATE BAYOU

SITE 033

DIGITIZING

DATE	SYSTEM	S02	H2S	VOLT	CH4	PART
6/ 1/78	16.	0.	0.	0.	8.	24.
6/ 2/78	9.	0.	0.	0.	0.	24.
6/ 3/78	0.	0.	0.	0.	0.	24.
6/ 4/78	0.	0.	0.	0.	0.	24.
6/ 5/78	0.	0.	0.	0.	0.	24.
6/ 6/78	0.	0.	0.	0.	0.	24.
6/ 7/78	0.	0.	0.	0.	0.	24.
6/ 8/78	11.	0.	0.	0.	0.	24.
6/ 9/78	0.	0.	0.	0.	0.	24.
6/10/78	0.	0.	0.	0.	0.	24.
6/11/78	0.	0.	0.	0.	0.	24.
6/12/78	0.	0.	0.	0.	0.	24.
6/13/78	0.	0.	0.	0.	0.	24.
6/14/78	0.	0.	0.	0.	0.	24.
6/15/78	0.	0.	0.	0.	0.	24.
6/16/78	0.	0.	0.	0.	13.	24.
6/17/78	0.	0.	0.	0.	0.	24.
6/18/78	0.	0.	0.	0.	0.	24.
6/19/78	0.	0.	0.	0.	0.	24.
6/20/78	7.	0.	0.	0.	0.	24.
6/21/78	10.	0.	0.	0.	0.	24.
6/22/78	0.	0.	0.	0.	0.	0.
6/23/78	4.	0.	0.	0.	0.	0.
6/24/78	0.	0.	0.	0.	0.	0.
6/25/78	0.	0.	0.	0.	0.	24.
6/26/78	0.	0.	0.	0.	0.	24.
6/27/78	0.	0.	0.	0.	0.	24.
6/28/78	0.	0.	0.	0.	0.	24.
6/29/78	0.	0.	0.	0.	0.	24.
6/30/78	0.	0.	0.	0.	0.	24.
CAL TIME		11.	12.	0.	22.	

V. DATA PRESENTATION AND SUMMARY

This section includes summaries for various recorded data at the monitoring sites. The data presentations indicate the variability of pollutant concentrations and parameters with time. All parameters, except suspended particulates (24-hour samples), are sampled once each second, but recorded as five-minute arithmetic averages of the one-second samples. This averaging technique tends to smooth instantaneous maximum values.

Inherent in any data acquisition system is random noise, both from the recording instruments and quantization in the analog-to-digital conversion. The lower threshold for all analytical instruments is twice the maximum noise level generated by the instruments. This lower threshold is 5 ppb for all of these instruments. Therefore, any values appearing in the data presentations that are less than 5 ppb indicate only a trace of pollutant in question and should not be construed to be absolute levels. In addition, when concentration levels drop below the lower threshold, the recorded quantity is simply random noise and averages tend toward zero. If a zero concentration appears in the data presentation, this does not indicate absolute zero concentration.

All pollutant data (except for particulate data) are taken at the monitoring site in integer parts per billion (ppb) but are presented here in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) assuming standard temperature and pressure of 25°C and 760 mm Hg (1013.2 millibars), respectively. The scale factors required to convert $\mu\text{g}/\text{m}^3$ at standard conditions back to ppb for the various pollutants are given in the following table.

PollutantTo Convert $\mu\text{g}/\text{m}^3$ at 25°C and
760 mm Hg to ppb Multiply by

SO ₂	.384
H ₂ S	.723
CH ₄	1.536

The units of the air quality parameters are given at the top of each table. It should be noted here that inside temperature is monitored and recorded as a functional part of the system but is not presented in this report.

It should be noted that during this period the H₂S analyzer was operating without an SO_x scrubber (replacement parts are on order but not yet received from the manufacturer). The H₂S values reported herein are actually total sulfur measurements.

Table II presents the national ambient air quality standards (NAAQS) for criteria pollutants.

Table III displays the monthly statistics for the monitoring station for the month. To insure statistical significance, and to reduce the possibility of introducing a bias in the presentation, averages are computed only when at least 50 percent of the samples are present. If less than the required samples are present for a particular parameter, that entry will be blank. The number of samples present for a particular parameter is defined as the total possible number of five-minute samples for the averaging time less the computer downtime less the channel downtime less the channel calibration time. The averages in Table III are arithmetic averages with the following exception:

- Particulate averages are computed as the geometric mean.

Table IV displays the daily averages. Again, 50 percent of the five-minute samples are required in order to compute an average. A blank entry indicates an insufficient number of five-minute samples present for that day. Particulate averages are computed the same way as described in Table III.

Table V presents the maximum daily five-minute averages retained in the data base as well as the times of occurrence. For each parameter, a five-minute maximum average is printed if any samples are present for that day. Therefore, the maximum five-minute average when a given channel has experienced considerable downtime or calibration time during the day in question may be misrepresentative of the maximum expected for that parameter on that day.

Table VI indicates the five largest averages for various averaging times. The table shows the period of time covered by the average. Maxima are chosen so that time segments are independent. The maximum averages reported are found using a 'sliding average' technique with the exception of the 24-hour particulate average, which is computed from midnight to midnight. For averaging times less than or equal to three hours, the sliding average is stepped one five-minute sample at a time. For longer averaging times, the step size is twelve samples or one hour. For averaging times less than or equal to one hour, 100 percent of the five-minute samples must be present to compute an average. Averaging times greater than one hour require 90 percent. Whether or not a sliding average is computed is solely determined by the number of samples present in that averaging time and is independent of daily or monthly averaging criteria.

Table VII demonstrates the diurnal variation of various recorded parameters. Hourly averages are determined by arithmetically averaging five-minute samples. For all parameters, a blank entry in the diurnal variation table indicates that less than half (i.e., less than 6) of the five-minute samples for that hour are present.

Times given in the data presentations correspond to the appropriate local times, i.e., Central Daylight Savings Time or Central Standard Time, depending on the time of the year.

TABLE II
NATIONAL AMBIENT AIR QUALITY STANDARDS

	<u>Primary</u>	<u>Secondary</u>
<u>Particulate</u>		
Annual G.M.**	75 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$
24 Hr. Max.*	260	150
<u>Sulfur Oxides</u>		
Annual	80 (.03 ppm)	
24 Hr. Max.*	365 (.14 ppm)	
3 Hr. Max.*	--	1300 (.5 ppm)
<u>Oxidant</u>		
1 Hr. Max.*	160* (.08 ppm)	160
<u>Hydrocarbons</u>		
3 Hr. Max.*	160 (.24 ppm)	160
6-9 a.m.		
<u>Carbon Monoxide</u>		
$\mu\text{g}/\text{m}^3$		
Max. 8 Hrs.*	10000 (9 ppm)	10000
Max. 1 Hr.*	40000 (35 ppm)	40000
<u>Nitrogen Dioxide</u>		
Annual	100 (.05 ppm)	100

Units are micrograms per cubic meter and ppm in parentheses.

*Not to be exceeded more than once per year.

**Geometric Mean.

TABLE III
AVERAGES FOR JUNE 1 THRU 30, 1978

TABLE III. AVERAGES FOR JUNE 1 THRU 30 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

HYDROGEN SULFIDE

METHANE

SITE 033
.2

033
1.0

033
936.1

PARTICULATE

SITE 033
38.4

TABLE IV
DAILY AVERAGES FOR JUNE 1 THRU 30, 1978

TABLE IV. DAILY AVERAGES FOR JUNE 1 THRU 30 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

DATE	SULFUR DIOXIDE(SO2)		HYDROGEN SULFIDE		METHANE	
	SITE	033	033		033	
<hr/>						
6/ 1						
6/ 2		.1	.0		816.0	
6/ 3		.1	.5		882.9	
6/ 4		.0	2.2		952.3	
6/ 5		.0	.0		898.6	
6/ 6		.0	.0		821.9	
6/ 7		.8	3.6		952.5	
6/ 8		2.6	.1		922.2	
6/ 9		.3	2.3		1020.3	
6/10		.0	.0		1034.4	
<hr/>						
6/11		.0	.1		824.1	
6/12		.0	2.6		873.2	
6/13		.0	1.9		1001.0	
6/14		.7	2.0		1138.9	
6/15		.0	3.4		951.8	
6/16		.0	.3			
6/17		.0	.8		848.0	
6/18		.0	1.1		861.4	
6/19		.1	.3		915.9	
6/20		.0	.2		963.3	
<hr/>						
6/21		.0	.0		1005.6	
6/22		.0	.3		970.4	
6/23		.0	.0		831.9	
6/24		.0	.0		831.5	
6/25		.0	.0		835.8	
6/26		.0	.0		810.0	
6/27		.9	.0		832.1	
6/28		.3	.3		892.8	
6/29		1.3	1.7		1122.6	
6/30		.2	3.6		1399.3	

TABLE IV. DAILY AVERAGES FOR JUNE 1 THRU 30 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

PARTICULATE

SITE 033
DATE

6/ 1
6/ 2
6/ 3
6/ 4
6/ 5
6/ 6
6/ 7
6/ 8
6/ 9
6/10

6/11
6/12
6/13
6/14
6/15
6/16
6/17
6/18
6/19
6/20

6/21
6/22 31.0
6/23 48.0
6/24 27.0
6/25
6/26
6/27
6/28
6/29
6/30

TABLE V
MAXIMUM FIVE-MINUTE AVERAGES AND
TIMES OF OCCURRENCE FOR
JUNE 1 THRU 30, 1978

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR JUNE 1 THRU 30 1978
 (UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
 TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

DATE	SITE	033
6/ 1		. 0(0:05)
6/ 2		7. 8(8:15)
6/ 3		2. 6(7:40)
6/ 4		2. 6(8:55)
6/ 5		. 0(0:00)
6/ 6		. 0(0:00)
6/ 7		20. 8(13:35)
6/ 8		5. 2(11:05)
6/ 9		2. 6(0:00)
6/10		. 0(0:00)
6/11		. 0(0:00)
6/12		2. 6(15:20)
6/13		. 0(0:00)
6/14		57. 3(11:40)
6/15		. 0(0:00)
6/16		. 0(0:00)
6/17		. 0(0:00)
6/18		2. 6(0:10)
6/19		33. 9(13:10)
6/20		. 0(0:00)
6/21		. 0(10:40)
6/22		. 0(0:00)
6/23		2. 6(15:40)
6/24		. 0(0:00)
6/25		. 0(0:00)
6/26		. 0(0:00)
6/27		2. 6(3:50)
6/28		20. 8(13:30)
6/29		2. 6(3:55)
6/30		2. 6(0:00)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR JUNE 1 THRU 30 1978
 (UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
 TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

HYDROGEN SULFIDE

DATE	SITE	033
6/ 1		.0(0:05)
6/ 2		.0(8:15)
6/ 3		9.7(14:40)
6/ 4		15.2(9:00)
6/ 5		1.4(3:25)
6/ 6		.0(0:00)
6/ 7		38.7(13:35)
6/ 8		1.4(20:45)
6/ 9		11.1(16:25)
6/10		2.8(3:15)
6/11		6.9(18:45)
6/12		13.8(17:25)
6/13		11.1(1:25)
6/14		19.4(11:40)
6/15		22.1(7:10)
6/16		11.1(0:05)
6/17		9.7(8:05)
6/18		15.2(0:20)
6/19		74.7(13:10)
6/20		9.7(6:50)
6/21		.0(10:40)
6/22		5.5(9:25)
6/23		.0(0:00)
6/24		1.4(3:20)
6/25		.0(0:00)
6/26		.0(0:00)
6/27		1.4(3:20)
6/28		49.8(13:30)
6/29		22.1(12:35)
6/30		31.8(10:30)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR JUNE 1 THRU 30 1978
 (UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
 TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

METHANE

DATE	SITE	033
<hr/>		
6/ 1		
6/ 2	2045.5	(9:55)
6/ 3	1056.3	(6:50)
6/ 4	2061.8	(23:45)
6/ 5	1476.3	(2:35)
6/ 6	922.8	(4:30)
6/ 7	2338.6	(20:45)
6/ 8	1062.8	(23:50)
6/ 9	1826.0	(5:40)
6/10	1908.8	(6:00)
<hr/>		
6/11	1005.5	(20:30)
6/12	1368.2	(6:45)
6/13	2659.6	(14:15)
6/14	2230.5	(4:20)
6/15	1301.2	(7:10)
6/16	3012.6	(14:10)
6/17	1148.8	(5:10)
6/18	1301.2	(5:35)
6/19	1695.8	(7:10)
6/20	4097.5	(11:55)
<hr/>		
6/21	1708.2	(23:45)
6/22	1488.7	(7:50)
6/23	1005.5	(6:40)
6/24	992.5	(2:50)
6/25	919.5	(1:15)
6/26	951.4	(7:20)
6/27	903.3	(16:10)
6/28	1316.8	(23:50)
6/29	1854.7	(7:15)
6/30	2726.7	(7:50)

**TABLE VI
THE FIVE MAXIMUM INDEPENDENT
SLIDING AVERAGES FOR
JUNE 1 THRU 30, 1978**

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR JUN 1-30 1978
 UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

SITE		033	SULFUR DIOXIDE 30-MINUTE
1	6/14(11:35-12:05)	21.3	
2	6/14(5:20- 5:50)	10.4	
3	6/ 7(13:20-13:50)	5.6	
4	6/19(12:40-13:10)	5.6	
5	6/28(13:05-13:35)	3.9	

SITE		033	SULFUR DIOXIDE 3-HOUR
1	6/14(11:20-14:20)	3.9	
2	6/ 8(10:45-13:45)	2.8	
3	6/ 8(13:50-16:50)	2.6	
4	6/ 8(16:55-19:55)	2.6	
5	6/ 8(20:00-23:00)	2.6	

SITE		033	SULFUR DIOXIDE 24-HOUR
1	6/ 8- 6/ 9(10:00)	1.8	
2	6/29- 6/30(3:00)	1.5	
3	6/27- 6/28(3:00)	1.1	
4	6/ 7- 6/ 8(2:00)	.9	
5	6/13- 6/14(13:00)	.7	

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR JUN 1-30 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METERHYDROGEN SULFIDE
1-HOUR

SITE

033

1	6/30(10:15-11:15)	28.9
2	6/30(11:20-12:20)	20.8
3	6/29(11:40-12:40)	19.0
4	6/15(6:55- 7:55)	18.5
5	6/15(22:20-23:20)	15.2

TABLE VI. THE FIVE MAXIMUM AVERAGES FOR JUN 1-30 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

METHANE
3-HOUR (6-9AM)

SITE	033
1	6/30(6:00- 9:00) 2246.9
2	6/29(6:00- 9:00) 1562.2
3	6/10(6:00- 9:00) 1313.6
4	6/14(6:00- 9:00) 1283.6
5	6/22(6:00- 9:00) 1259.2

TABLE VII
DIURNAL VARIATION OF RECORDED PARAMETERS

DIURNAL VARIATION OF SULFUR DIOXIDE(UG/M**3)
TRAILER NO. - 33 PERIOD(6/ 1/78 TO 6/30/78)

	HOUR																									
DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN	
1	0	0	0	0	0	0	0	0																	0	
2											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	2	1	2	2	2	2	2	2	2	3	1
8												3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	5	0	0	0	0				0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21																										
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	1	2	1	1	2	1	1	1	1	1	1	1	1	1	1	2	1	2	2	1	2	2	1
28	2	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
30	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MEAN	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL NUMBER OF OBSERVATIONS = 7774. MEAN = 0.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF HYDROGEN SULFIDE(UG/M**3)
TRAILER NO. - 33 PERIOD(6/ 1/78 TO 6/30/78)

DAY	HOUR																								MEAN	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
1	0	0	0	0	0	0	0	0																	0	
2											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	4	5	1	0	0	0	0	0	0	0	1	1	0
4	7	4	4	5	1	0	1	2	11	7	2	0	0	0	0	0	3	4	1	0	0	0	0	0	0	2
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	4	6	9	9	8	8	7	8	9	10	6	0	0	0	0	0	0	0	0	1	1	4	0
8												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	0	1	1	0	0	3	5	6	7	6	3	3	1	0	1	7	7	2	1	1	0	0	0	0	0	2
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
12	0	0	0	3	3	4	4	3	2	2	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3
13	2	3	3	3	3	3	3	4	4	4	3	4	4	1	0	0	0	0	0	0	0	0	0	0	0	2
14	0	0	0	0	1	8	6	6	3	0			4	3	5	3	1	0	0	0	0	0	0	0	0	2
15	0	0	1	4	0	0	6	18	4	1	0	0	0	0	0	0	0	0	0	2	9	11	11	13	3	0
16	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0
17	0	0	0	0	0	0	1	0	4	2	0	0	0	0	0	0	0	0	0	0	1	1	1	8	1	0
18	9	9	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
19	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	2	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	4	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	1	15	19	6	0	0	0	0	0	0	0	0	0	0	0	2
30	0	0	0	0	0	0	1	1	1	3	26	25	16	9	3	0	0	0	0	0	0	0	0	0	0	4
MEAN	1	1	1	1	1	1	1	2	2	1	2	2	2	2	1	1	1	0	0	0	1	1	1	1		

TOTAL NUMBER OF OBSERVATIONS = 7754. MEAN = 1.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF METHANE(UG/M**3 X 10**-1)
TRAILER NO. - 33 PERIOD(6/ 1/78 TO 6/30/78)

	HOUR																								
DAY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	MEAN
1				:																					
2											99:	78:	81	80	77	77	81	81	83	79	79	79	78	82	81
3	85	93	91	:	83	88	90	79	88	88	91	89	88	95	92	89	86	87	85	88	90	88	89	91	88
4	99	98	102	:	100	98	98	100	100	91	89	89	91	90	88	86	91	88	88	88	90	100	101	126	95
5	95	98	110	:	106	111	111	103	104	89	82	88	85	82	81	81	81	82	82	81	79	78	80	79	90
6	79	80	80	:	86	84	86	84	82	83	82	82	83	82	82	83	82	82	82	81	81	82	81	82	82
7	81	83	82	:	88	91	91	90	94	95	93	95	92	87	88	89	89	88	89	101	139	101	105	144	95
8												91	92	90	89	89	90	92	91	96	92	93	94	99	92
9	104	118	112	:	106	156	146	108	98	97	93	90	89	87	88	91	88	86	86	95	106	104	100	100	102
10	108	139	118	:	110	151	164	123	107	104	98	98	90	87	91	92	90	90	92	95	85	84	82	78	103
11	78	79	81	:	86	83	85	86	86	83	81	81	81	80	80	80	80	80	80	84	90	84	84	87	83
12	88	83	82	:	87	93	98	95	86	85	84	84	84	84	88	84	82	82	82	86	95	90	88	102	87
13	105	106	110	:	154	139	121	120	102	89	91	87	86	85	102	85	88	93	85	91	93	86	86	99	100
14	94	95	126	:	215	183	148	134	104	94	:	101	94	97	96	95	93	95	97	100	105	110	119	100	113
15	95	102	102	:	96	95	105	123	98	90	89	89	91	92	92	92	91	91	90	91	95	96	92	92	95
16	77			:											108	86	86	86	86	88	91	91	94	83	89
17	82	82	81	:	82	101	96	85	83	84	83	83	83	82	82	82	81	82	84	85	87	91	87	86	85
18	85	85	86	96	90	100	94	100	94	83	84	83	82	81	84	82	82	82	83	83	85	83	82	83	86
19	83	85	90	:	93	90	115	156	105	90	89	87	86	86	87	85	85	84	84	84	85	84	87	88	92
20	93	91	93	:	141	122	115	87	84	84	83	110	108	83	83	83	83								96
21				:							:	90	92	89	90	90	89	92	93	94	106	115	129	143	101
22	130	133	109	:	113	130	123	129	125	84	81	83	82	82	81	88	85	82	82	82	82	82	81		97
23	81	81	82	:	89	85	95	89	84	83	82	81						81	81	81	81	82	82	81	83
24	82	83	93	:	85	83	83	84	82	83	82	81	81	81	81	82	80	81	81	81	83	87	83	93	83
25	87	85	82	:	89	89	89	88	86	82	82	82	82	82	81	82	82	81	82	83	83	82	83	82	84
26	83	86	87	:	81	80	82	91	81	80	79	79	79	81	79	79	79	79	80	80	80	79	80	80	81
27	80	80	81	:	83	84	84	86	84	83	83	83	84	83	84	84	85	84	84	85	84	83	84	84	83
28	84	84	84	:	89	91	90	103	101	97	91	86	85	84	85	85	86	86	85	86	88	91	90	104	89
29	102	104	98	:	136	146	162	173	134	106	114	108	102	99	94	91	95	100	97	93	96	98	105	129	112
30	180	209	195	:	225	204	209	246	219	133	122	110	101	97	96	93	94	95	93	94	97	107	93	94	139
MEAN	94	98	98		96	109	111	111	111	100	90	89	89	88	86	87	86	86	86	86	88	91	90	91	96

TOTAL NUMBER OF OBSERVATIONS = 7350. MEAN = 94.

: INDICATES CALIBRATION DURING THE HOUR

RADIAN

CORPORATION

DCN 78-100-212-05

AIR MONITORING REPORT
FOR
THE UNIVERSITY OF TEXAS
BUREAU OF ECONOMIC GEOLOGY
JULY 1978
REPORT NO. 5

30 August 1978

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TABLE OF CONTENTS

	<u>Page</u>
I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM-----	1
II. DESCRIPTION OF INSTRUMENT SYSTEMS-----	4
A. Air Quality Instrumentation-----	4
1. Description-----	4
2. Calibration-----	5
B. Data Acquisition System-----	6
III. BAG SAMPLING PROGRAM-----	8
IV. OPERATING TIME ANALYSIS-----	9
V. DATA PRESENTATION AND SUMMARY-----	11

LIST OF TABLES

	<u>Page</u>
TABLE I DOWNTIME HOURS FOR CHOCOLATE BAYOU, TEXAS----	10
TABLE II NATIONAL AMBIENT AIR QUALITY STANDARDS-----	15
TABLE III AVERAGES FOR JULY 1 THRU 31, 1978-----	16
TABLE IV DAILY AVERAGES FOR JULY 1 THRU 31, 1978-----	17
TABLE V MAXIMUM FIVE-MINUTE AVERAGES AND TIMES OF OCCURRENCE FOR JULY 1 THRU 31, 1978-----	19
TABLE VI THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR JULY 1 THRU 31, 1978-----	22
TABLE VII DIURNAL VARIATION OF RECORDED PARAMETERS-----	25

I. GENERAL DESCRIPTION OF AIR MONITORING PROGRAM

Radian Corporation is under contract to the University of Texas, Bureau of Economic Geology, to provide ambient air quality monitoring at one site near Chocolate Bayou, Texas. This site measures and records concentrations for sulfur dioxide, hydrogen sulfide, methane, and particulates. A bag sample is collected bi-weekly and returned to Radian's Austin facilities and analyzed for methane.

Figure I shows the configuration of this type of monitoring station. The trailer provides a sturdy and protective covering as well as mobility. Figure II shows the air monitoring site.

FIGURE I

AMBIENT AIR MONITORING SYSTEM I

FIGURE II
AIR MONITORING SITE

II. DESCRIPTION OF INSTRUMENT SYSTEMS

The ambient air monitoring station is equipped to monitor the parameters shown below:

Sulfur Dioxide
Particulates
Methane
Hydrogen Sulfide

A. Air Quality Instrumentation

1. Description

Sulfur dioxide is measured with a Meloy Model SA185-2A sulfur analyzer, which is an EPA-approved analyzer. This automated analyzer utilizes the flame photometric principle to measure sulfur levels with a minimum detectable sensitivity of 5 ppb, and a linearity of $\pm 1\%$. The analyzer is operated with an H_2S scrubber to make it specific to SO_2 concentrations.

Hydrogen sulfide is measured using a Meloy Model SA185-2 analyzer equipped with an SO_x scrubber. Specifications for this analyzer are the same as for the SA185-2A.

Methane is monitored with a Bendix Model 8200 gas chromatograph. This instrument uses a flame ionization detector and has a minimum detectable sensitivity of 5 ppb. The Model 8200 works on a five-minute cycle, i.e., one air sample is analyzed every five minutes.

The air sample is drawn in through a glass cane and manifold supplied by the Ace Glass Company. The system has a 25 mm diameter, and a constant air flow through the system is

provided by an air pump rated at 60 cfm at 0" head pressure. The manifold has sampling ports to which $\frac{1}{4}$ " Teflon lines to the instruments are connected. All joints in the sampling system are secured by O-ring compression fittings. The manifold is contained in a heated (100°F) chamber to prevent condensation of moisture.

The trailer has two heavy duty high volume particulate samplers (Hi-Vols). Fiberglass filter paper is brought to a controlled humidity before weighing. Each Hi-Vol has a flow recorder to permit correction for changes in air flow runs for a 24-hour period (midnight to midnight), and is turned on and off by the computer. The Hi-Vols were designed following guidelines recommended by the Environmental Protection Agency and were manufactured by Radian.

2. Calibration

The trailer contains a Meloy Model RAD-1 calibration unit. This unit provides a zero air supply and SO₂ span gas from an SO₂ permeation tube. The calibration is automatically performed once a day, and is controlled by the computer. The SO₂ channel is first switched to zero. Then the computer monitors the output of each analyzer and takes a new zero reading after a stable zero signal has been reached. This zero reading is compared by the computer to the zero reading obtained 24 hours before, and if a drift in excess of 10 ppb has occurred, an excess zero drift light on the System Status Panel is turned on. The instruments are then returned to the monitor mode, and after two minutes the computer resumes data taking.

The SO₂ permeation tubes were manufactured by Metronics Association, Inc. These tubes were then individually calibrated for Radian by the National Bureau of Standards.

The Model 8200 methane analyzer is calibrated with undiluted span gas. This span gas contains methane in air. The Model 8200 is zeroed with air from a Bendix Model 8834 zero air unit. In addition, the instrument is electronically re-zeroed at the start of every five-minute cycle.

In addition to the daily instrument zero/spans, all instruments are multipoint calibrated monthly. Calibration standards and equipment used in the monthly multipoints is distinct from the equipment used for daily zero/span operations.

Quality assurance audits are performed on each instrument once a quarter. These audits are performed by Radian's Quality Assurance personnel using instrumentation and standards different from those used in the monthly multipoint calibrations.

A General Metals Calibration Kit is used to calibrate the Hi-Vol particulate samplers.

B. Data Acquisition System

The basis of the data acquisition system is a Data General NOVA 1200 minicomputer. The NOVA, which has a basic cycle time of 1.2 μ sec, is equipped with automatic program load and power fail/automatic restart features. The computer utilizes 8K 16-bit words of core memory. Analog-to-digital conversion is accomplished via an ADC built by Radian Corporation. The input/output unit for system 034 is Texas Instruments' KSR 733 keyboard/printer. This model provides keyboard entry and hard copy printed output. The data are also recorded on a cassette magnetic tape unit with three drives. The cassette unit is utilized for program storage and loading as well as recording. To reduce wear on mechanical parts, the power to the teletype and cassette units is turned on only when the

unit(s) is to be used. Several important functions in the instruments as well as in the computer and the trailer are monitored by means of lights on a System Status Panel. The information displayed by these lights is written onto cassette tape to monitor the complete status of the system every five minutes.

III. BAG SAMPLING PROGRAM

Grab-bag samples are collected bi-weekly and analyzed for methane. The ambient air samples are collected in tedlar bags using a metal bellows pump connected to the ambient sample manifold. Each bag sample is collected over a three-hour period.

The bag samples are returned to Austin for analysis for methane concentration. The analysis is performed on either a Bendix 8202 or a Baseline Industries Model 1030 gas chromatograph using a flame ionization detector. The minimum detectable limit using this technique is less than 1 ppm.

Results of the bag sampling analyses are given below:

<u>Date</u>	<u>Time</u>	<u>Methane Concentration (ppm)</u>
7/6	0600-0900	1.70
7/19	0740-1040	1.65

IV. OPERATING TIME ANALYSIS

This section presents the operating statistics for each of the major subsystems contained in the monitoring station. Table I shows the specific number of hours that each of these subsystems was inoperative for the month. The column labeled "DIGITIZING SYSTEM" refers to the entire data acquisition system, and downtime hours appearing in this column are hours of total data loss. These instances include, in addition to computer downtime, power failures, no power available, and self-automated shutdown periods such as during air conditioner malfunctions.

Calibration time is not considered to be downtime and is not included in the downtime figures. The amount of time used in calibrating the instruments is given at the bottom of the downtime analysis table and is reported as total calibration hours for each channel for the entire month. As is evident in the calibration figures, channels can be calibrated independently of one another. No calibration time is given for particulate monitoring since Hi-Vol calibration occurs infrequently and only during the off-duty cycle for each Hi-Vol while another Hi-Vol is taking data.

TABLE 1.
DOWNTIME HOURS FOR HOUSTON LIGHTING AND POWER COMPANY

SITE 033

DIGITIZING

DATE	SYSTEM	TIN	CO	03	WSD	PART
7/ 1/78	0.	0.	0.	0.	0.	24.
7/ 2/78	1.	0.	19.	0.	0.	24.
7/ 3/78	1.	0.	23.	0.	0.	24.
7/ 4/78	0.	0.	3.	0.	0.	0.
7/ 5/78	0.	0.	0.	0.	0.	24.
7/ 6/78	0.	0.	0.	0.	0.	24.
7/ 7/78	0.	0.	0.	0.	0.	24.
7/ 8/78	4.	0.	0.	0.	0.	24.
7/ 9/78	24.	0.	0.	0.	0.	24.
7/10/78	10.	0.	0.	0.	0.	24.
7/11/78	0.	0.	0.	0.	0.	0.
7/12/78	0.	0.	0.	0.	0.	24.
7/13/78	0.	0.	0.	0.	0.	24.
7/14/78	0.	0.	0.	0.	0.	24.
7/15/78	0.	0.	0.	0.	0.	0.
7/16/78	1.	0.	0.	0.	0.	24.
7/17/78	9.	0.	0.	0.	0.	24.
7/18/78	1.	0.	0.	0.	0.	0.
7/19/78	5.	1.	0.	0.	0.	24.
7/20/78	7.	0.	0.	0.	1.	24.
7/21/78	0.	0.	0.	0.	0.	0.
7/22/78	0.	0.	0.	0.	0.	24.
7/23/78	1.	0.	0.	0.	0.	24.
7/24/78	0.	0.	0.	0.	0.	24.
7/25/78	0.	0.	0.	0.	0.	0.
7/26/78	0.	0.	0.	0.	0.	24.
7/27/78	9.	0.	0.	0.	0.	24.
7/28/78	22.	0.	0.	0.	0.	24.
7/29/78	24.	0.	0.	0.	0.	24.
7/30/78	24.	0.	0.	0.	0.	24.
7/31/78	14.	0.	0.	0.	0.	24.

AL TIME 12. 14. 0. 13.

V. DATA PRESENTATION AND SUMMARY

This section includes summaries for various recorded data at the monitoring sites. The data presentations indicate the variability of pollutant concentrations and parameters with time. All parameters, except suspended particulates (24-hour samples), are sampled once each second, but recorded as five-minute arithmetic averages of the one-second samples. This averaging technique tends to smooth instantaneous maximum values.

Inherent in any data acquisition system is random noise, both from the recording instruments and quantization in the analog-to-digital conversion. The lower threshold for all analytical instruments is twice the maximum noise level generated by the instruments. This lower threshold is 5 ppb for all of these instruments. Therefore, any values appearing in the data presentations that are less than 5 ppb indicate only a trace of pollutant in question and should not be construed to be absolute levels. In addition, when concentration levels drop below the lower threshold, the recorded quantity is simply random noise and averages tend toward zero. If a zero concentration appears in the data presentation, this does not indicate absolute zero concentration.

All pollutant data (except for particulate data) are taken at the monitoring site in integer parts per billion (ppb) but are presented here in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) assuming standard temperature and pressure of 25°C and 760 mm Hg (1013.2 millibars), respectively. The scale factors required to convert $\mu\text{g}/\text{m}^3$ at standard conditions back to ppb for the various pollutants are given in the following table.

PollutantTo Convert $\mu\text{g}/\text{m}^3$ at 25°C and
760 mm Hg to ppb Multiply by

SO_2	.384
H_2S	.723
CH_4	1.536

The units of the air quality parameters are given at the top of each table. It should be noted here that inside temperature is monitored and recorded as a functional part of the system but is not presented in this report.

It should be noted that during this period the H_2S analyzer was operating without an SO_x scrubber (replacement parts are on order but not yet received from the manufacturer). The H_2S values reported herein are actually total sulfur measurements.

Table II presents the national ambient air quality standards (NAAQS) for criteria pollutants.

Table III displays the monthly statistics for the monitoring station for the month. To insure statistical significance, and to reduce the possibility of introducing a bias in the presentation, averages are computed only when at least 50 percent of the samples are present. If less than the required samples are present for a particular parameter, that entry will be blank. The number of samples present for a particular parameter is defined as the total possible number of five-minute samples for the averaging time less the computer downtime less the channel downtime less the channel calibration time. The averages in Table III are arithmetic averages with the following exception:

- Particulate averages are computed as the geometric mean.

Table IV displays the daily averages. Again, 50 percent of the five-minute samples are required in order to compute an average. A blank entry indicates an insufficient number of five-minute samples present for that day. Particulate averages are computed the same way as described in Table III.

Table V presents the maximum daily five-minute averages retained in the data base as well as the times of occurrence. For each parameter, a five-minute maximum average is printed if any samples are present for that day. Therefore, the maximum five-minute average when a given channel has experienced considerable downtime or calibration time during the day in question may be misrepresentative of the maximum expected for that parameter on that day.

Table VI indicates the five largest averages for various averaging times. The table shows the period of time covered by the average. Maxima are chosen so that time segments are independent. The maximum averages reported are found using a 'sliding average' technique with the exception of the 24-hour particulate average, which is computed from midnight to midnight. For averaging times less than or equal to three hours, the sliding average is stepped one five-minute sample at a time. For longer averaging times, the step size is twelve samples or one hour. For averaging times less than or equal to one hour, 100 percent of the five-minute samples must be present to compute an average. Averaging times greater than one hour require 90 percent. Whether or not a sliding average is computed is solely determined by the number of samples present in that averaging time and is independent of daily or monthly averaging criteria.

Table VII demonstrates the diurnal variation of various recorded parameters. Hourly averages are determined by arithmetically averaging five-minute samples. For all parameters, a blank entry in the diurnal variation table indicates that less than half (i.e., less than 6) of the five-minute samples for that hour are present.

Times given in the data presentations correspond to the appropriate local times, i.e., Central Daylight Savings Time or Central Standard Time, depending on the time of the year.

TABLE II
NATIONAL AMBIENT AIR QUALITY STANDARDS

	<u>Primary</u>	<u>Secondary</u>
<u>Particulate</u>		
Annual G.M.**	75 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$
24 Hr. Max.*	260	150
<u>Sulfur Oxides</u>		
Annual	80 (.03 ppm)	
24 Hr. Max.*	365 (.14 ppm)	
3 Hr. Max.*	--	1300 (.5 ppm)
<u>Oxidant</u>		
1 Hr. Max.*	160* (.08 ppm)	160
<u>Hydrocarbons</u>		
3 Hr. Max.*	160 (.24 ppm)	160
6-9 a.m.		
<u>Carbon Monoxide</u>		
$\mu\text{g}/\text{m}^3$		
Max. 8 Hrs.*	10000 (9 ppm)	10000
Max. 1 Hr.*	40000 (35 ppm)	40000
<u>Nitrogen Dioxide</u>		
Annual	100 (.05 ppm)	100

Units are micrograms per cubic meter and ppm in parentheses.

*Not to be exceeded more than once per year.

**Geometric Mean.

**TABLE III
AVERAGES FOR JULY 1 THRU 31, 1978**

TABLE III. AVERAGES FOR JULY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

HYDROGEN SULFIDE

METHANE

SITE 033
.2

033
.1

033
907.1

PARTICULATE

SITE 033

**TABLE IV
DAILY AVERAGES FOR JULY 1 THRU 31, 1978**

TABLE IV. DAILY AVERAGES FOR JULY 1 THRU 31 1978
 (UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
 TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

DATE	SULFUR DIOXIDE(SO ₂)	HYDROGEN SULFIDE	METHANE
	SITE 033	033	033
7/ 1	.0	.1	914.5
7/ 2	.1		872.1
7/ 3	.0		906.4
7/ 4	.0	.0	844.0
7/ 5	.0	.0	851.9
7/ 6	.0	.0	852.2
7/ 7	.0	.0	859.9
7/ 8	.0	.0	939.2
7/ 9			
7/10	.2	.5	867.5
7/11	.2	.0	928.7
7/12	.1	.0	891.9
7/13	.0	.0	843.7
7/14	.3	.0	859.6
7/15	.2	.0	923.4
7/16	.6	.0	863.8
7/17	1.0	.3	902.3
7/18	1.6	.3	1047.7
7/19	.8	.0	859.9
7/20	.0	.1	822.0
7/21	.1	.4	1064.6
7/22	.0	.4	964.9
7/23	.0	.1	994.2
7/24	.0	.1	1040.1
7/25	.0	.0	870.4
7/26	.0	.1	861.3
7/27	.0	.0	858.4
7/28			
7/29			
7/30			
7/31			

TABLE IV. DAILY AVERAGES FOR JULY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

PARTICULATE

DATE	SITE 033
7/ 1	
7/ 2	
7/ 3	
7/ 4	29.0
7/ 5	
7/ 6	
7/ 7	
7/ 8	
7/ 9	
7/10	
7/11	21.0
7/12	
7/13	
7/14	
7/15	32.0
7/16	
7/17	
7/18	58.0
7/19	
7/20	
7/21	25.0
7/22	
7/23	
7/24	
7/25	20.0
7/26	
7/27	
7/28	
7/29	
7/30	
7/31	

TABLE V
MAXIMUM FIVE-MINUTE AVERAGES AND
TIMES OF OCCURRENCE FOR
JULY 1 THRU 31, 1978

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR JULY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

SULFUR DIOXIDE(SO2)

DATE	SITE	033
7/ 1		.0(0:00)
7/ 2		2.6(0:40)
7/ 3		.0(0:00)
7/ 4		.0(0:00)
7/ 5		.0(0:00)
7/ 6		.0(0:00)
7/ 7		.0(0:00)
7/ 8		.0(0:00)
7/ 9		
7/10		18.2(10:25)
7/11		2.6(3:50)
7/12		2.6(0:05)
7/13		2.6(0:05)
7/14		2.6(10:10)
7/15		2.6(0:10)
7/16		2.6(3:25)
7/17		2.6(9:20)
7/18		2.6(0:00)
7/19		5.2(12:05)
7/20		.0(8:40)
7/21		18.2(10:40)
7/22		2.6(4:10)
7/23		.0(0:00)
7/24		.0(0:00)
7/25		.0(0:00)
7/26		.0(0:00)
7/27		.0(0:00)
7/28		5.2(11:55)
7/29		
7/30		
7/31		.0(14:05)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR JULY 1 THRU 31 1978
 (UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
 TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

HYDROGEN SULFIDE

DATE	SITE	033
7/ 1	1.4(	0:45)
7/ 2	2.8(	3:40)
7/ 3		
7/ 4	.0(	3:20)
7/ 5	1.4(	2:50)
7/ 6	.0(	0:00)
7/ 7	.0(	0:00)
7/ 8	1.4(	1:50)
7/ 9		
7/10	60.9(	10:25)
7/11	1.4(	3:20)
7/12	1.4(	3:20)
7/13	.0(	0:00)
7/14	1.4(	3:20)
7/15	1.4(	3:25)
7/16	.0(	0:00)
7/17	2.8(	18:50)
7/18	2.8(	10:30)
7/19	.0(	0:00)
7/20	2.8(	15:45)
7/21	60.9(	10:40)
7/22	5.5(	10:30)
7/23	2.8(	0:50)
7/24	1.4(	3:30)
7/25	1.4(	3:20)
7/26	1.4(	3:20)
7/27	.0(	0:00)
7/28	1.4(	12:00)
7/29		
7/30		
7/31	.0(	14:05)

TABLE V. MAXIMUM FIVE MINUTE AVERAGES AND TIME OF OCCURRENCE FOR JULY 1 THRU 31 1978
(UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER; WIND SPEED-MILES PER HOUR;
TEMPERATURE-DEGREES FAHRENHEIT; WIND DIRECTION-DEGREES WITH RESPECT TO THE NORTH;)

METHANE

DATE	SITE	033
7/ 1	1622.2	(1:15)
7/ 2	1269.2	(4:00)
7/ 3	1415.8	(2:40)
7/ 4	1059.6	(5:20)
7/ 5	1120.1	(5:25)
7/ 6	1120.1	(4:50)
7/ 7	1068.7	(23:55)
7/ 8	1294.6	(5:45)
7/ 9		
7/10	1498.5	(23:30)
7/11	1660.6	(8:00)
7/12	1568.2	(5:40)
7/13	1481.5	(8:45)
7/14	1240.6	(4:00)
7/15	1517.4	(5:35)
7/16	1011.4	(9:20)
7/17	1008.8	(14:25)
7/18	1577.9	(8:15)
7/19	1205.4	(0:40)
7/20	1030.9	(19:15)
7/21	2904.5	(7:25)
7/22	1790.9	(1:50)
7/23	5469.0	(15:25)
7/24	4205.6	(0:30)
7/25	1218.5	(6:10)
7/26	1348.7	(7:15)
7/27	1021.1	(2:25)
7/28	2681.8	(12:00)
7/29		
7/30		
7/31	1237.3	(21:55)

**TABLE VI
THE FIVE MAXIMUM INDEPENDENT
SLIDING AVERAGES FOR
JULY 1 THRU 31, 1978**

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR JUL 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

SITE		033	SULFUR DIOXIDE 30-MINUTE
1	7/21(10:20-10:50)	5.6	
2	7/10(10:05-10:35)	5.2	
3	7/ 2(0:35- 1:05)	2.6	
4	7/15(12:30-13:00)	2.6	
5	7/16(3:20- 3:50)	2.6	

SITE		033	SULFUR DIOXIDE 3-HOUR
1	7/18(16:00-19:00)	2.6	
2	7/18(19:05-22:05)	2.6	
3	7/18(22:10- 1:10)	2.6	
4	7/17(9:10-12:10)	1.9	
5	7/17(23:45- 2:45)	1.4	

SITE		033	SULFUR DIOXIDE 24-HOUR
1	7/18- 7/19(5:00)	1.8	
2	7/16- 7/17(1:00)	.6	
3	7/14- 7/15(14:00)	.5	
4	7/11- 7/12(3:00)	.2	
5	7/21- 7/22(5:00)	.1	

TABLE VI. THE FIVE MAXIMUM INDEPENDENT SLIDING AVERAGES FOR JUL 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METER

SITE		033		HYDROGEN SULFIDE 1-HOUR	
1	7/21(9:45-10:45)			8.4	
2	7/10(10:05-11:05)			7.5	
3	7/22(10:25-11:25)			2.1	
4	7/18(10:45-11:45)			1.4	
5	7/ 1(1:25- 2:25)			1.3	

TABLE VI. THE FIVE MAXIMUM AVERAGES FOR JUL 1-31 1978
UNITS: CONCENTRATIONS-MICROGRAMS PER CUBIC METERMETHANE
3-HOUR (6-9AM)

SITE

033

1	7/21(6:00- 9:00)	1858.9
2	7/18(6:00- 9:00)	1366.2
3	7/11(6:00- 9:00)	1259.1
4	7/15(6:00- 9:00)	1183.7
5	7/ 8(6:00- 9:00)	1089.4

TABLE VII
DIURNAL VARIATION OF RECORDED PARAMETERS

DIURNAL VARIATION OF SULFUR DIOXIDE(UG/M**3)
TRAILER NO. - 33 PERIOD(7/ 1/78 TO 7/31/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	1	1	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9																									
10											3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0
12	1	0	0	0:	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
13	1	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0:	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
15	2	1	1	0:	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0
16	0	0		2	2	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1
17										3	3	1	1	1	1	1	2	1	1	2	1	1	1	0	1
18	2	2	2	0:	0	0	0	0	0	0	2	2	3	3	3	3	3	3	3	3	3	3	3	3	2
19	3	3	3	0:					3	:	:	0:	1:	:	0	0	0	0	0	0	0	0			1
20										0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0:	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0:	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0:	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0									0
28													0	0											0
29																									
30																									
31																0	0	0	0	0	0	0	0	0	0
MEAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL NUMBER OF OBSERVATIONS = 6839. MEAN = 0.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF HYDROGEN SULFIDE (UG/M**3)
TRAILER NO. - 33 PERIOD(7/ 1/78 TO 7/31/78)

DAY	HOUR																								MEAN
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
1	0	1	1	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	1:																					0
3				:																					0
4				0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9																									
10											9	0	0	0	0	0	0	0	0	0	0	0	0	0	1
11	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17										0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0
18	0	0	0	0:	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0
19	0	0	0	0:				:	:	:	0	0:	:	:	0	0	0	0	0	0	0	0	0	0	0
20										1:	:	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0:	0	0	0	0	0	1	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	1:	0	1	0	0	1	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
23	1	1	1	0:	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28													0	0											0
29													0	0											0
30																									
31																									
MEAN	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL NUMBER OF OBSERVATIONS = 6286. MEAN = 0.

: INDICATES CALIBRATION DURING THE HOUR

DIURNAL VARIATION OF METHANE(UG/M**3 X 10**-1)
TRAILER NO. - 33 PERIOD(7/ 1/78 TO 7/31/78)

DAY	HOUR																								MEAN	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
1	108	126	111	:	89	89	107	107	87	82	83	83	82	83	84	83	82	83	84	83	85	92	99	94	91	
2	88	94	93	:	95	88	96	102	96	86	84	82	83	83	84	83	83	81	83	82	86	86	85	86	87	
3	95	110	120	:	93	100	98	111	101		83	83	82	82	83	82	83	82	83	82	87	84	88	93	91	
4	86	85	92	:	89	99	89	86	86	81	80	81	80	80	80	80	80	80	81	82	84	83	85	92	84	
5	91	96	89	:	92	105	101	96	80	81	80	81	80	80	81	81	79	79	80	81	84	81	81	80	85	
6	85	91	86	:	92	101	96	89	85	81	81	80	80	81	82	81	81	80	81	82	82	85	96	85	85	
7	84	83	91	:	89	94	95	93	85	81	82	82	82	82	82	85	82	82	82	85	87	85	87	99	86	
8	108	107	108	:	101	112	108	120	99	91	88	84	85	85	82	82	80	79	80	80					94	
9																										
10											85	86	86	89	89	84	83	83	86	83	85	87	93	95	87	
11	89	111	108	:	96	100	116	144	119	85	82	82	81	86	82	82	89	81	80	85	80	82	89	90	93	
12	90	90	92	:	108	118	100	100	110	100	87	81	81	80	82	80	79	79	81	81	82	83	84	82	89	
13	83	89	84	:	87	89	90	89	88	81	82	81	84	81	80	81	80	81	80	81	84	84	94	88	84	
14	86	84	89	:	106	99	99	97	87	74	81	82	81	81	80	80	80	82	80	82	83	83	83	89	86	
15	82	85	98	:	111	118	123	128	104	88	88	85	83	83	85	84	83	81	82	85	83	86	87	88	92	
16	83	86		87	93	90	91	95	90	94	88	87	86	86	85	84	81	80	80	81	85	87	86		87	
17										92	88	86	89	90	91	91	90	90	90	90	92	94	90	93	90	
18	96	113	120	:	122	132	131	139	139	107	:	101	101	101	94	93	90	89	87	85	87	90	93	92	105	
19	103	107	109	:					85	89	83	83	81	78	79	78	77	78	81	81	80	81			85	
20				:					82	79	80	82	81	82	81	80	80	81	88	81	83	85	87		82	
21	100	92	95	:	100	131	140	257	161	85	89	88	87	89	91	91	91	91	88	88	91	96	104	108	107	
22	133	155	149	:	104	89	89	87	92	90	94	85	85	86	90	86	84	84	84	88	95	89	88	92	96	
23	89	85	85	:	96	95	97	100	97	89		84	85	87	87	224	86	85	100	93	90	99	119	122	100	
24	258	130	169	:	90	97	94	96	126	94	100	96	88	86	89	85	88	85	83	98	87	87	83	83	104	
25	84	87	105	:	88	100	107	94	90	85	83	83	83	82	82	83	82	82	81	83	84	85	86	84	87	
26	84	84	86	:	97	99	93	106	86	82	82	83	75	83	83	84	84	83	84	84	85	84	86	85	86	
27	84	91	93	:	86	88	89	86	84	83	82	83	82	83	84	87									86	
28													127	95											111	
29																										
30																										
31																82	84	87	88	89	86	89	96	88	92	88
MEAN	99	99	103	87	97	102	102	110	99	87	85	84	85	85	84	89	83	83	84	85	85	87	90	91		

TOTAL NUMBER OF OBSERVATIONS = 6702. MEAN = 91.

: INDICATES CALIBRATION DURING THE HOUR