ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF ENFORCEMENT

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The Environmental Impact of Emissions from the National Zinc Company Bartlesville, Oklahoma

NATIONAL ENFORCEMENT INVESTIGATIONS CENTER

DENVER, COLORADO

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THE ENVIRONMENTAL IMPACT OF EMISSIONS FROM THE NATIONAL ZINC COMPANY

Bartlesville, Oklahoma

[July - September 1977]

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I. INTRODUCTION

During July 2-3, 1977, the National Zinc Company in Bartlesville, Oklahoma, experienced a malfunction during the start up of its sulfuric acid plant which caused the Company to cease operations temporarily. Residents north and northeast of the plant had frequently complained of these plant emissions. However, during the July 2-3 episode, these residents alleged that plant emissions caused damage to vegetation, death of cattle, and adverse health effects to people in the area. This incident resulted in a complaint to the Regional Administrator, Environmental Protection Agency (EPA), Region VI, and on July 22, Region VI requested that the National Enforcement Investigations Center (NEIC) set up an ambient air monitoring network in the vicinity of the plant as rapidly as possible to document peak 3-hour and 24-hour sulfur dioxide (SO_2) concentrations prior and subsequent to plant start up. NEIC began operating sulfur dioxide (SO_2) monitoring equipment near the northeast corner of the plant boundary on July 28, 1977. On August 2, 1977, the Company restarted the plant. By August 16, 1977, five stations [Figure 1] were in operation monitoring SO_2 and total suspended particulates (TSP). By September 2, 1977, samplers for ambient air metals were also operating at Stations 1, 3, 4 and 5. These sites were used to document peak 24-hour TSP concentrations and 24-hour sulfate (SO_4) concentrations, and to determine concentrations of selected metals in both soil and ambient air associated with the National Zinc Company operations. In addition, the NEIC began to assess the impact on surrounding vegetation of past and present emissions from the plant and to evaluate the plant operations to determine if improvements in operating procedures and/or air pollution control equipment were required.

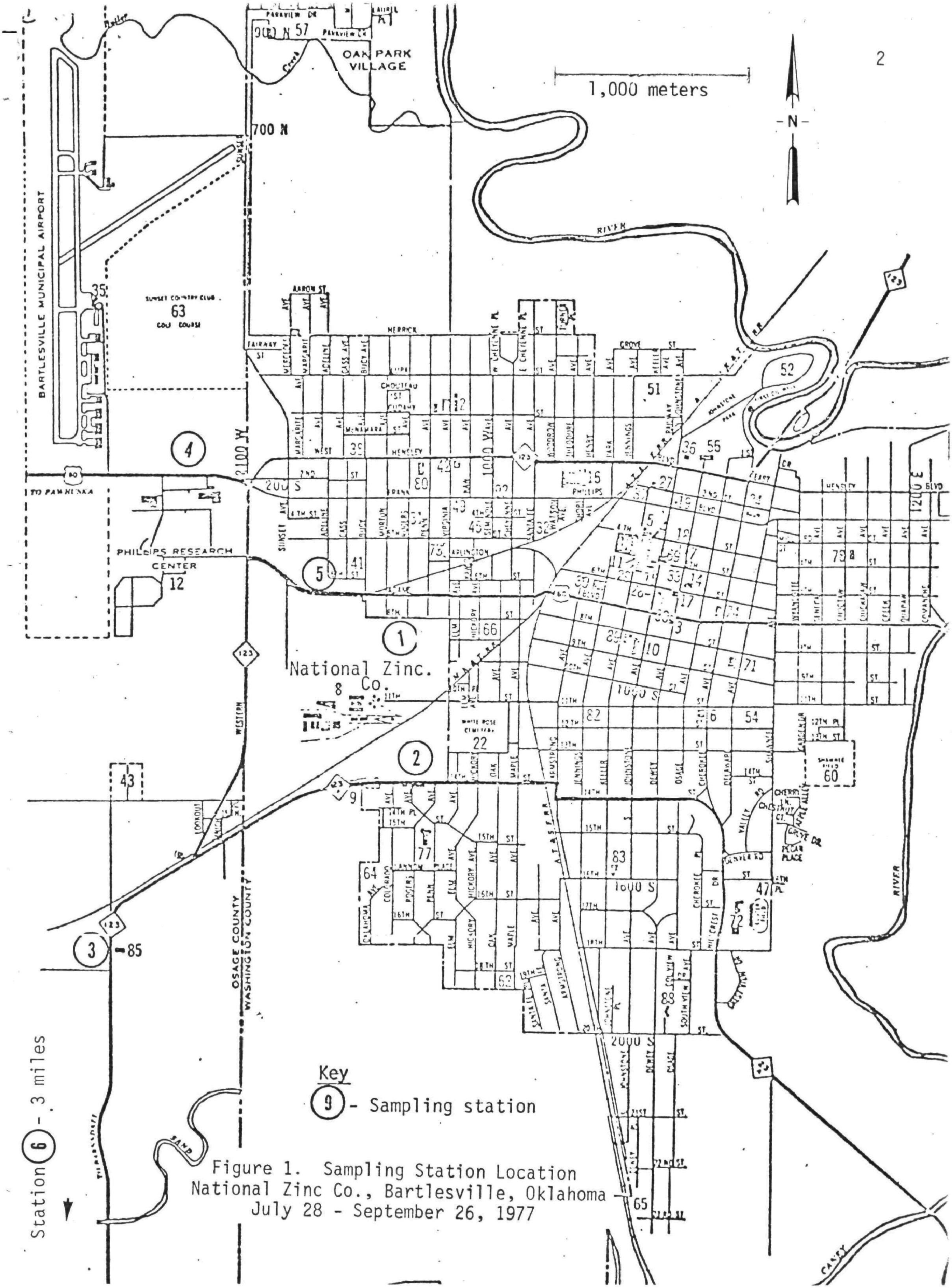


Figure 1. Sampling Station Location
National Zinc Co., Bartlesville, Oklahoma
July 28 - September 26, 1977

II. SUMMARY AND CONCLUSIONS

During the period August 2 to September 26, 1977, the National Enforcement Investigations Center (NEIC) conducted an investigation of the sulfur dioxide (SO_2), total suspended particulate (TSP), sulfate (SO_4), and metals emissions from the National Zinc Company plant in Bartlesville, Oklahoma, and the impact of these emissions on the ambient air quality, soils, and vegetation in the area. Air quality, meteorological, botanical, and soils data were collected from a six-station network located around the plant.

Data from these stations were evaluated to characterize ambient air quality in the area and to compare with National Ambient Air Quality Standards (NAAQS) [Table 1]. The primary criteria used in analyzing TSP data were 24-hour primary and secondary excursions; 24-hour primary and 3-hour secondary excursions were used for SO_2 data. A primary excursion is defined as any 24-hour concentration which exceeded the 24-hour primary standard for either TSP or SO_2. A secondary excursion is defined as either a 24-hour TSP concentration which exceeded the 24-hour secondary standard or a 3-hour SO_2 concentration which exceeded the 3-hour secondary standard.

Where possible, ambient metals data were compared with values measured by the National Air Surveillance Network (NASN) as reported in <u>National Trends in Trace Metals in Ambient Air,</u> 1965-1974.[1] Metals concentrations in soils were compared with the mean values found in the earth's crust as reported in <u>Origin and Distribution of the Elements</u>.[2] Sulfates data were compared with sulfates health effects research data as reported in <u>Statement of Sulfates Research</u>

Table 1

NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS FOR TOTAL SUSPENDED PARTICULATES (TSP) AND SULFUR DIOXIDE (SO_2)

Pollutant	Type of Standard	Averaging Time	Frequency Parameter	Concentration	
				$\mu g/m^3$	ppm
TSP	Primary	24 hr	Annual Maximum	260	
			Annual Geometric Mean	75	
	Secondary	24 hr	Annual Maximum	150	
SO_2	Primary	24 hr	Annual Maximum	365	0
		1 yr	Arithmetic Mean	80	0.03
	Secondary	3 hr	Annual Maximum	1,300	0.5

Approach.[3] Potted plants exposed to ambient SO_2 levels near the National Zinc Company plant were visually compared to similar potted plants grown at a reference station approximately four miles south of the plant. A similar comparison of trees in the area was made using false color infrared aerial photographs.

In addition, an in-plant investigation of the process and air pollution control operations was conducted by NEIC during the period July 30 to August 2, 1977.

The results of the NEIC survey are as follows:

1. The July 2-3 SO_2 incident was due to operator error in that one of the ore roasters was not maintained at a sufficiently high temperature. Because of this, the offgas from the roasters was not hot enough to allow for effective SO_2 removal when fed through the sulfuric acid plant.

2. The plant did not cause excursions of the 24-hour primary or 3-hour secondary SO_2 standard during the survey period.

3. The plant did not cause violations of the primary 24-hour TSP standard during the survey period. Although the results show there were five excursions of the secondary 24-hour standard of 150 $\mu g/m^3$ at Station 5, meteorological data indicate the plant likely could have contributed significantly to only one of these excursions (September 8, 1977).

4. Sulfate levels were found to exceed levels reported to be statistically associated with adverse health effects. However, as there are currently no national ambient air quality standards for sulfates, these levels cannot be considered as excursions or violations.

5. Since soil analysis showed the soil immediately downwind of the plant to have substantially higher metals concentrations than soil from a reference station several miles away, it is concluded that these high metals concentrations are probably a result of plant emissions. Of particular concern are the high levels of lead and cadmium.

6. Plants grown in soil taken from near the National Zinc Company plant were chlorotic, containing only 28% as much chlorophyll as similar plants grown in soil from the reference station. Since soil analysis showed soil near the plant had a lower pH as well as substantially higher metals concentrations than the reference station soil, it is concluded that reduced plant vigor may be the long-term result of National Zinc Company emissions influencing soil characteristics.

7. The botanical assay results are supported by false color infrared aerial photographs taken of the area surrounding the plant. These photographs indicate an increase in the chlorophyll stress of vegetation in the area immediately north of the plant. This is the area that, climatologically, is most often downwind from the plant.

III. BACKGROUND

PLANT HISTORY

National Zinc Company, a subsidiary of Engelhard Industries, New York, N. Y., produces zinc at their Bartlesville plant. The plant first began operations in 1907 using horizontal retort furnace smelters. From then until 1969, there were no emission controls on the plant. In that year, SO_2 emissions were reduced with the installation of a Monsanto design sulfuric acid plant which recovers SO_2 from plant exhaust gases and uses it in the production of technical grade sulfuric acid (H_2SO_4) and oleum ($H_2SO_4 + SO_3$). In 1973, the acid plant stack height was increased by 25% to aid in the dispersion of the remaining SO_2 in the exhaust gases. In 1976, the horizontal retort furnaces were replaced by an electrolytic smelter; according to the Oklahoma State Health Department, this process modification reduced TSP emissions by 99.7%.

PROCESS DESCRIPTION

Zinc sulfide (ZnS) ore is first roasted, resulting in dry zinc oxide ore solids and about 453 m^3 (16,000 ft^3)/min of exhaust gas containing 7% SO_2.

During normal operations, the zinc oxide (calcine) is fed into an electrolytic process to produce zinc metal. The sulfur dioxide-laden gas from the roasting process is routed to a sulfuric acid plant and both technical grade sulfuric acid and oleum are produced. The sulfuric acid plant is a standard contact sulfuric acid process that includes a four-stage converter and a single-stage absorber with a Brink mist eliminator. The unit receives all of the exhaust gas containing SO_2 and produces sulfuric acid and oleum. The offgas from the absorber is the only SO_2 emission point from the National Zinc roasters and sulfuric acid plant. Containing 1,000 to 1,600 ppm SO_2 during normal operation, these gases pass through the Brink high-efficiency mist eliminator for acid mist removal prior to being discharged into the atmosphere.

SURVEY AREA DESCRIPTION

The National Zinc plant is located on the western edge of Bartlesville in a broad and featureless valley of the Caney River in northeastern Oklahoma. A 61 m (200 ft) high mound rises about 1.6 km (1 mi) to the north-northwest of the plant and there are some 61 m (200 ft) high ridges rising about 3.2 km (2 mi) to the south and south-southwest, just south of Sand Creek. These topographical features do not have a significant effect on the meteorological conditions in the area.

The climate of the Bartlesville, Oklahoma, area is characterized by high mean surface wind speeds and good ventilation throughout the year. Air stagnation conditions, which can lead to high air pollution concentration levels, are infrequent.[4] The meteorological condition which would be most likely to lead to high air pollution levels in the area is wind direction persistence. A review of climatological data for the area indicated that, for the survey months of August and September, the predominant wind direction is southerly. Stability conditions show a wide diurnal variation, particularly in August, but are predominantly neutral. Based on this information and some Oklahoma State Health Department (OSHD) dispersion modeling results, the primary air quality monitoring stations were located north of and within 1.6 km (1 mi) of the plant.

IV. SURVEY METHODS

MONITORING NETWORK DESIGN

To measure ambient air quality and assess vegetation damage, a network of five ambient air quality monitoring stations was operated near the plant. A sixth background station for the botanical assay was located approximately four miles south of the National Zinc plant. Design of the network was based on the following:

1. Atmospheric dispersion modeling work conducted by the Oklahoma State Health Department (OSHD) which indicated that maximum ground level SO_2 concentrations from the 33 m (100 ft) high sulfuric acid plant stack would be encountered about 400 to 500 m (1,300 to 1,600 ft) downwind from the stack.

2. Climatological information obtained from OSHD and EPA Region VI which indicated that, during the late summer and early fall, the most frequent wind direction is southerly.

3. The alleged damage resulting from the July 2 to 3, 1977, incident, which was within a triangular area (apex at the plant) extending north for about 2 km (1.25 mi).

Based on the above information, a monitoring network of six stations was established as described in Tables 2 and 3 and illustrated in Figure 1.

Table 2

DESCRIPTION OF AIR QUALITY MONITORING STATIONS
NATIONAL ZINC COMPANY
BARTLESVILLE, OKLAHOMA
July 28 - September 26, 1977

Station No.	Location Description
1	The southeast corner of the Albert Jackson property (10th Street and Rogers Avenue) near the northeast corner of the plant property and about 400 meters northeast of the sulfuric acid plant stack.
2	About 100 meters north of 14th Street and 200 meters west of Virginia Avenue, across the railroad tracks from the southeast corner of the plant property and about 400 meters southeast of the sulfuric acid plant.
3	About 150 meters west southwest of the intersection of Oklahoma Highways 23A and 123, about 1,000 meters southwest of the sulfuric acid plant stack.
4	At the Osage Rural Water District pumping stations north of Highway 60, just across from Phillips Research Center building RB-1, about 2,000 meters northwest of the sulfuric acid plant stack.
5	At the northeast corner of the intersection of Adams Street and Adeline Blvd., about 750 meters north northwest of the sulfuric acid plant stack.
6	Four miles south of the plant just off Rt. 123. This site was a background station for bioassay only.

Table 3

MONITORING INSTRUMENTATION
NATIONAL ZINC CO. BARTLESVILLE, OKLAHOMA
August 5 - September 26, 1977

Sta. No.	SO_2 Monitor	Type of Recorder	High Volume Sampler	Membrane Sampler	Hourly Averager	Meteorology Data System	Rain Gage	Green-House	Sparg-ing unit
1	Lear Siegler SM 1000	Esterline-Angus	General Metal Works, Model GMWS-2310 Accu-Vol with Timer, Programmer and Transducer	Research Appliance Company (RAC) Total Particulate Membrane Sampler (#2349)	Monitor Labs	Climet Instruments	Weather-measure	NEIC	NEIC
2	Bendix Model 8300	Weather-measure	ACCu-Vol		Monitor Labs			NEIC	NEIC
3	Lear Siegler SM 1000	Weather-measure	ACCU-Vol	RAC	Monitor Labs			NEIC	NEIC
4	Bendix Model 8300	Weather-measure	ACCU-Vol	RAC	Monitor Labs			NEIC	NEIC
5	Bendix	Weather-measure	ACCU-Vol	RAC	Monitor Labs			NEIC	NEIC
6								NEIC	

MONITORING PROCEDURES

Ambient SO_2 Monitoring

Three types of sulfur dioxide ambient air monitors were used. At Stations 1 and 3, the Lear Siegler SM1000 Air Monitoring System was used. This system is a tuned, second derivative spectrometer which measures concentrations of SO_2 in complex ambient air mixtures. The instrument directly measures the narrow band absorption of ultraviolet radiation which is characteristic of and specific to the ambient air SO_2 molecule. Measurements are performed in real time without sample conditioning, secondary reactions, or sample destruction.

At Stations 2 and 4, the Bendix Model 8300TS Monitor was used and, at Station 5, the Bendix Model 8301 SO_2 Monitor was used. Both models are flame photometric detector systems with the Model 8300TS also incorporating a hydrogen sulfide (H_2S) scrubber.

The output signals of the SO_2 monitors were electronically time averaged, so that hourly averages were transmitted to the recorder charts.

A quality control program consisted of 1) daily visits (weather permitting) to the monitoring stations to service the SO_2 monitors, and 2) periodic calibrations of the monitors. On the Lear Siegler SM1000 SO_2 monitors (Stations 1 and 5), a check of the span and zero on the recorder was performed automatically every eight hours. On the Bendix instruments, the zero check was done weekly and the instrument was spanned during the quality control checks. The detector was checked manually everyday by a calibrated DC voltage source. For all SO_2 monitors, calibration curves were prepared at the beginning and end of the survey using a modified Bendix calibration system

[Figure 2] with National Bureau of Standards permeation tubes as the SO_2 source. A quality assurance audit [Appendix A] was also performed on September 1 to 2, 1977.

Particulate Sampling and Analysis

Ambient Particulate Monitoring - A set of three General Metals Works (GMW) high-volume (HiVol) particulate samplers was located at each of Stations 1 through 5. A set of two Research Appliance Company (RAC) membrane samplers was located at each of Stations 1, 3, 4 and 5. The HiVols were used for TSP and sulfates sampling and the membrane samplers were used for metals sampling. Soil samples were also taken at Stations 1, 3, 5 and 6 for metals analyses.

Both the GMW and RAC samplers were run sequentially for 24-hour periods beginning and ending at midnight. All pertinent data regarding the HiVol sample filters was recorded on a card [Appendix B]. Each 20 x 25 cm (8 x 10 in) glass fiber filter was folded and placed in the appropriate card which was, in turn, placed in an envelope and sealed. RAC membrane filter data were entered into a bound log book and the filters were placed in clean Petri dishes and sealed in aluminum foil. Filters were maintained under NEIC chain-of-custody procedures [Appendix C] and returned to NEIC.

Quality control was maintained by measuring the flow rate of each sampler at the beginning and end of each operating period. At least once weekly, calibration curves were checked for accuracy using standard calibrated orifice plates. Additionally, new calibration curves were developed in any case where changes were made in the sampling devices, such as head changes, motor replacements, etc. A quality assurance audit was also performed on September 1-2, 1977 [Appendix A].

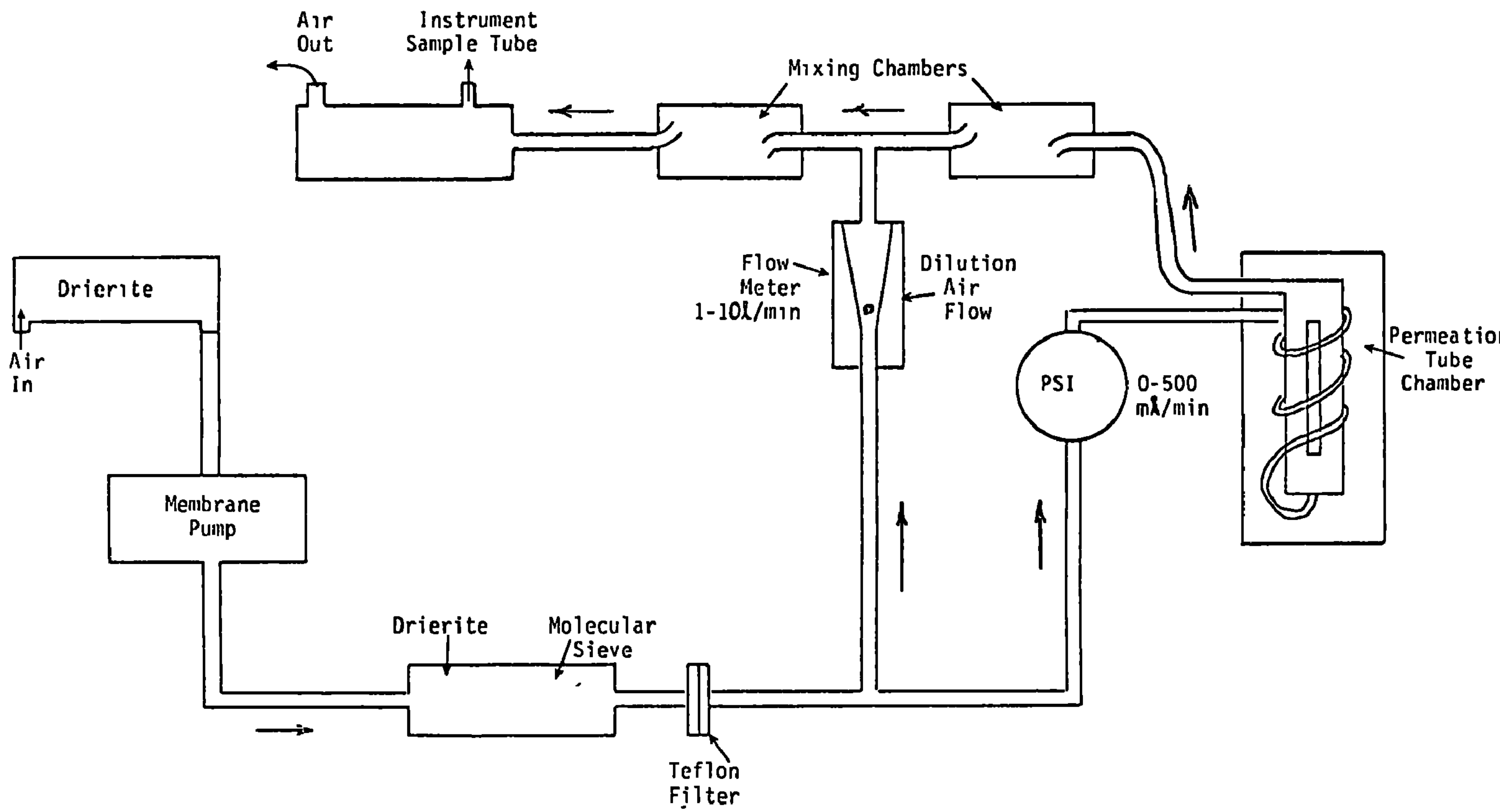


Figure 2. Modified Bendix SO_2 Calibration System

Laboratory Particulate Analyses - All HiVol and membrane filters were initially weighed in the NEIC laboratory to determine total suspended particulate concentrations [Appendix D]. Ten percent of the filters were randomly selected for reweighing as a quality control check. Thirty-one HiVol filters and nineteen membrane filters, mainly those associated with high TSP levels, were selected for further analyses for sulfates and metals, respectively.

Sulfate analyses were performed on the 31 glass fiber HiVol filters. Filters were selected so comparisons could be made between values measured at sampling stations located both upwind and downwind of the National Zinc Company plant on any given day. Quality control was maintained through replicate analyses of paired samples [Appendix D].

Metals analyses were performed on the 19 membrane filters. Five sampling dates were chosen and samples from Stations 1, 3, 4 and 5 were analyzed so as to include both upwind and downwind sampling locations. Metals analyses were also performed on a total of eight soil samples from four of the sampling stations, including one from the bioassay background station (Station 6). The accuracies of the analyses were verified by the analyses of standard spikes [Appendix D].

Remote Sensing

On September 19, 1977, aerial photographs were taken of the National Zinc Company plant and the surrounding area. The purpose of this photo survey was to detect and document the presence of trees displaying chlorophyllic stress. The trees in the area had purportedly been fumigated by SO_2 emissions from the National Zinc Company facility a few weeks prior to the photo survey.

The survey was conducted using an aerial camera with Eastman Kodak Anochrome Infrared Film (2443) which was exposed through a Wratten 12 (yellow) filter. This film has an emulsion layer that is sensitive to the near infrared region of the optical spectrum where chlorophyll is highly reflective. When foliage is stressed by disease, drought, air pollutants, etc., the chlorophyll levels withih the foliage are affected. Any change in chlorophyll levels can be qualitatively detected with the infrared film even though the change may not be detectable with the unaided eye or regular photographic emulsions.

The photographic overflight was carried out at an altitude of 762 m (2,500 ft) above mean ground level resulting in an image scale of 1:5000 on the infrared film. The flight lines were oriented in a north/south direction.

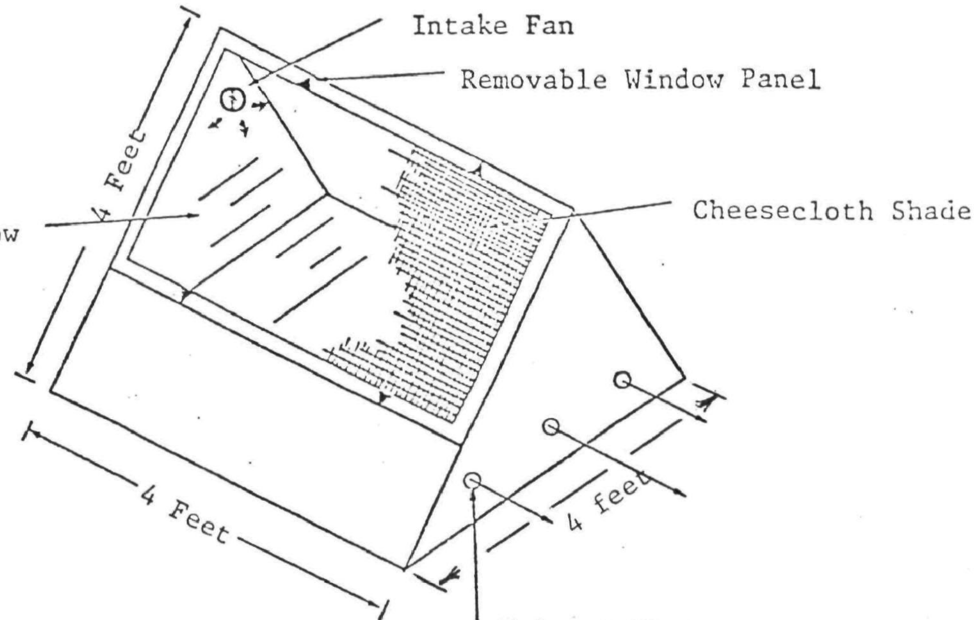
The exposed film was developed by Texas Instruments Company, Dallas, Texas, and photointerpreted by the NEIC's Technical Services Branch.

Botanical Assay

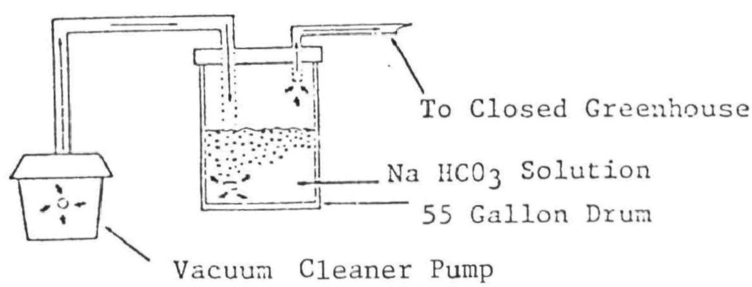
Two bioassays were performed to determine the effects of emissions from the National Zinc Company plant on selected vegetation.

An in-situ bioassay was conducted at all six monitoring stations from August 13 to September 24, 1977, using small portable greenhouses [Figure 3]. The prism-shaped plywood structures measured approximately 1.2 x 1.2 x 1.2 m (4 x 4 x 4 ft). A cheesecloth-shaped, plexiglas window allowed light for the plants.

Two types of greenhouses were placed at each station, exposure greenhouses and closed control greenhouses. Except during heavy



Greenhouse



Sparging Unit

Figure 3. Greenhouse and Sparging Units for Plant Bioassays
(Binkley, 1977)
National Zinc Company
July 28 - September 26, 1977

rains, the exposure greenhouses were left open at the top front by sliding the window down halfway. Small intake fans drew ambient air into the greenhouses through these openings and small screened vents allowed air to escape. The closed control greenhouses were constructed similarly, but without the intake fans. To control temperature and remove SO_2 the window was always closed and the air was pumped through a chilled sodium bicarbonate ($NaHCO_3$) water bath into the closed greenhouses.

Each greenhouse contained two Schefflera sp. and five Chrysanthemum sp. At Stations 1, 3 and 5, a single potted Schefflera sp. was also kept outside the greenhouses. The plants and potting soil were obtained from a local greenhouse. All plants were checked daily.

In addition to the in-situ bioassay, a laboratory bioassay was conducted at NEIC using soil samples collected from near the National Zinc plant (Station 1) and from the reference location (Station 6). The soil samples were tested for pH after the soil was mixed with distilled water on an equal-weight basis. Then the soil samples were used to grow Pilea sp. plants in controlled environment incubators from September 7 to October 21, 1977. The plants were randomly divided into two groups of 24 each and planted in the test soils. Test conditions were 30°C (86°F) ambient temperature and 18 hr/day of incandescent and fluorescent light. The plants were examined periodically and watered as necessary. At the end of the study period, selected test plants were pulverized with a manual tissue grinder and the chlorophyll was extracted in 90% acetone. The amount of chlorophyll in each plant was then measured using fluorometric techniques.

Meteorology

At Station 1, a 10-m (30-ft) meteorological tower was erected to collect data on wind speed, wind direction, temperature, dewpoint, and barometric pressure. The data were collected by a Climet meteorological data system in which the conditioned signals from the instrumentation were processed by an Esterline-Angus PD2064 minicomputer and recorded on cassette magnetic tapes. Data from these tapes were then processed by H. E. Cramer Co., Salt Lake City, Utah, into a format satisfactory for use in data analysis and reporting [Appendix E]. In addition to the cassette tapes, data were recorded in digital form on printed paper tapes and analog form on Leeds and Northrup strip charts. Rainfall was also recorded (on chart paper only) using a Weather Measure tipping bucket rain gage.

IN-PLANT EVALUATION

NEIC personnel met with officials of National Zinc Company from July 30 to August 3, 1977 to conduct an in-plant evaluation. During this visit, the circumstances surrounding the July 2 to 3, 1977, incident were reviewed and start up of the plant was observed.

The primary source of SO_2 at National Zinc is the offgas from the ore roasting process. Control of SO_2 emissions is affected by passing this gas through a standard contact sulfuric acid process where much of the SO_2 is used to produce H_2SO_4. A necessary part of this process is the conversion of SO_2 to SO_3. The converter beds in which this reaction takes place must be maintained in a specific range of elevated temperatures. During normal operations, the offgas temperature from the ore roaster is sufficient to maintain converter temperatures within this range. During process start up, however, preheaters must be used to maintain converter temperatures until the roaster bed temperatures are high enough. Since the roaster bed temperatures often fluctuate during process startup, it is necessary to monitor those temperatures and to turn the converter bed preheater back on whenever necessary. The July 2 to 3, 1977 incident was caused by a failure to operate the preheaters properly.

After observing and evaluating the plant start up, NEIC observations and recommendations were forwarded to Region VI in an August 19, 1977 report.

V. SURVEY RESULTS

SULFUR DIOXIDE

The principal criteria for sulfur dioxide data analyses were the primary 24-hour average and the secondary 3-hour average standards established by the national ambient air quality standards as follows:

Primary - 24-hour SO_2 concentrations shall not exceed 365 $\mu g/m^3$ more than once annually

Secondary - 3-hour SO_2 concentrations shall not exceed 1,300 $\mu g/m^3$ more than once annually

Appendix F contains the raw SO_2 data. Results [Table 4] show no excursions of the 24-hour primary standard. One excursion of the 3-hour standard was recorded on September 11, 1977 at Station 3, with an average of 2,325 $\mu g/m^3$. However, the value was recorded during a period of extremely heavy rainfall, and when the wind direction was not from the plant. It is believed that this value was caused by moisture from the heavy rain interfering with the instrumentation.

PARTICULATES

Ambient TSP

The principal criteria for TSP data analyses were the primary and secondary 24-hour average standards established by the national ambient air quality standards as follows:

Primary - 24-hour TSP concentrations shall not exceed 260 $\mu g/m^3$ more than once annually

Secondary - 24-hour TSP concentrations shall not exceed 150 $\mu g/m^3$ more than once annually

Table 4

SUMMARY OF SO_2 SAMPLING RESULTS
NATIONAL ZINC COMPANY
BARTLESVILLE, OKLAHOMA
July 28 - September 26, 1977

Station	Total hrs Sampled	No. hrs SO_2 Detected	Highest 1-hr Value $\mu g/m^3$	Number of 24-hour Standards Excursions	Number of 3-hour Standards Excursions
1	1,179	78	832	0	0
2	1,182	2	520	0	0
3	1,132	2	2,288	0	1
4	1,041	10	390	0	0
5	1,050	90	650	0	0

The TSP data are presented in Figures 4 through 8. The individual 24-hour values are plotted against the dates included in the survey, beginning with August 2, 1977 and ending September 26, 1977. Not all TSP sampling stations were on line as of August 2, so the length of the records for each station varies from 48 to 56 days. Lines indicating the primary and secondary 24-hour standards are also included. Table 5 is a statistical summary of the TSP data. Appendix G lists the raw TSP data.

From Table 5 it can be seen that no excursions of the primary 24-hour TSP standards (260 $\mu g/m^3$) were recorded during the two months of this survey. Six excursions above the secondary standard (150 μ/m^3) were recorded, one at Station 1 and five at Station 5.

Sulfates

Thirty-one of the glass fiber filters from the TSP sampling were selected for sulfate ($SO_4^=$) analysis. Filters from downwind sampling sites were analyzed along with the corresponding filters from upwind sites. Most of the downwind filters selected showed TSP levels exceeding 100 $\mu g/m^3$. The results of the analysis are presented in Appendix H. A statistical summary of those results appears in Table 6.

The identification of Stations 1, 4 and 5 (north of the plant) as "downwind" and Stations 2 and 3 (south of the plant) as "upwind" [Table 6] was based on the fact that the prevailing wind direction in Bartlesville is generally southerly during August and September. However, because of normal meteorological variability, "upwind" stations will not always be upwind and "downwind" stations will not always be downwind. A review of the meteorological data shows that for the days showing the greatest difference between upwind and

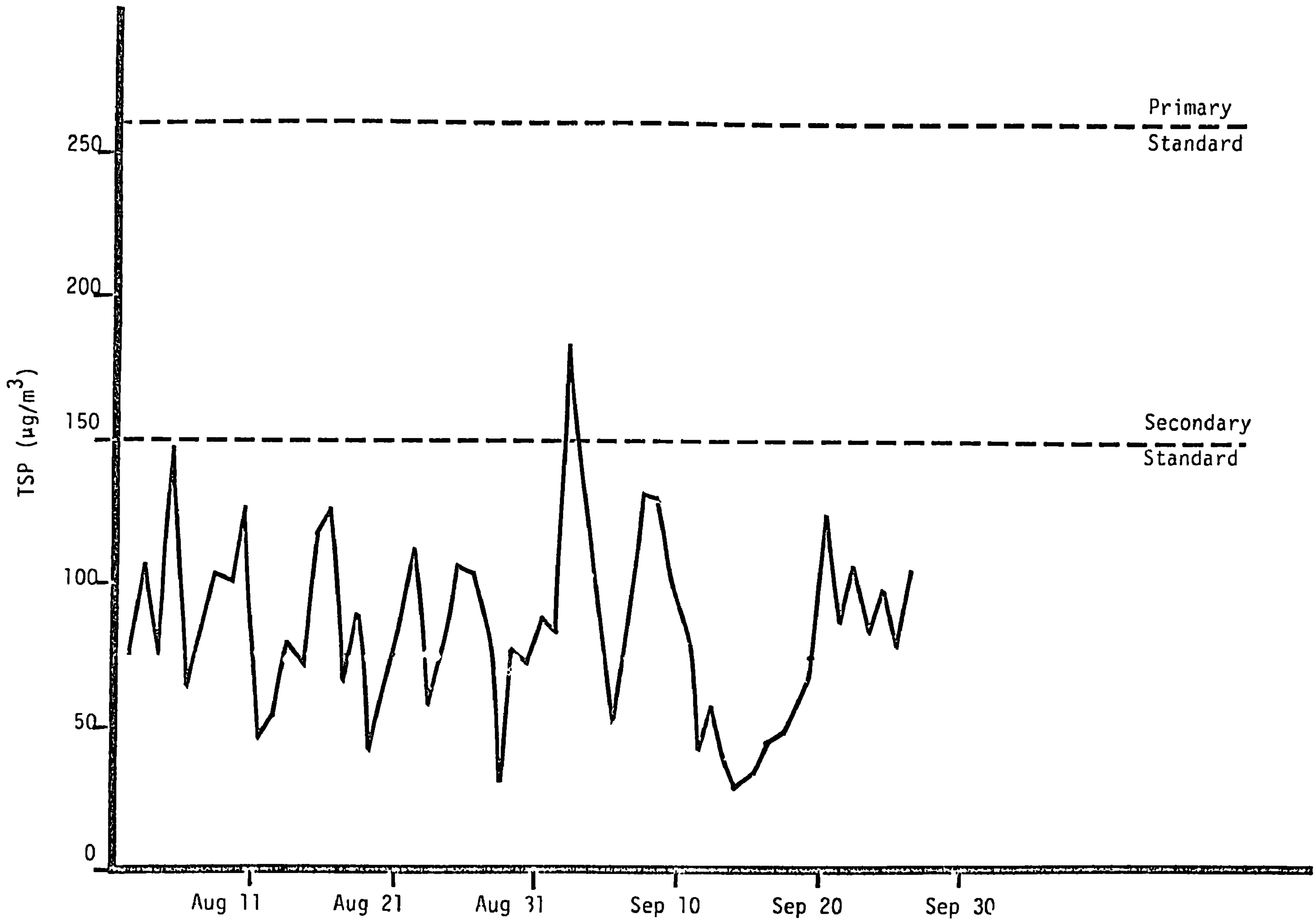


Figure 4. Daily Particulate Concentrations - Station 1
National Zinc Co., Bartlesville, Oklahoma
July 28 - September 26, 1977

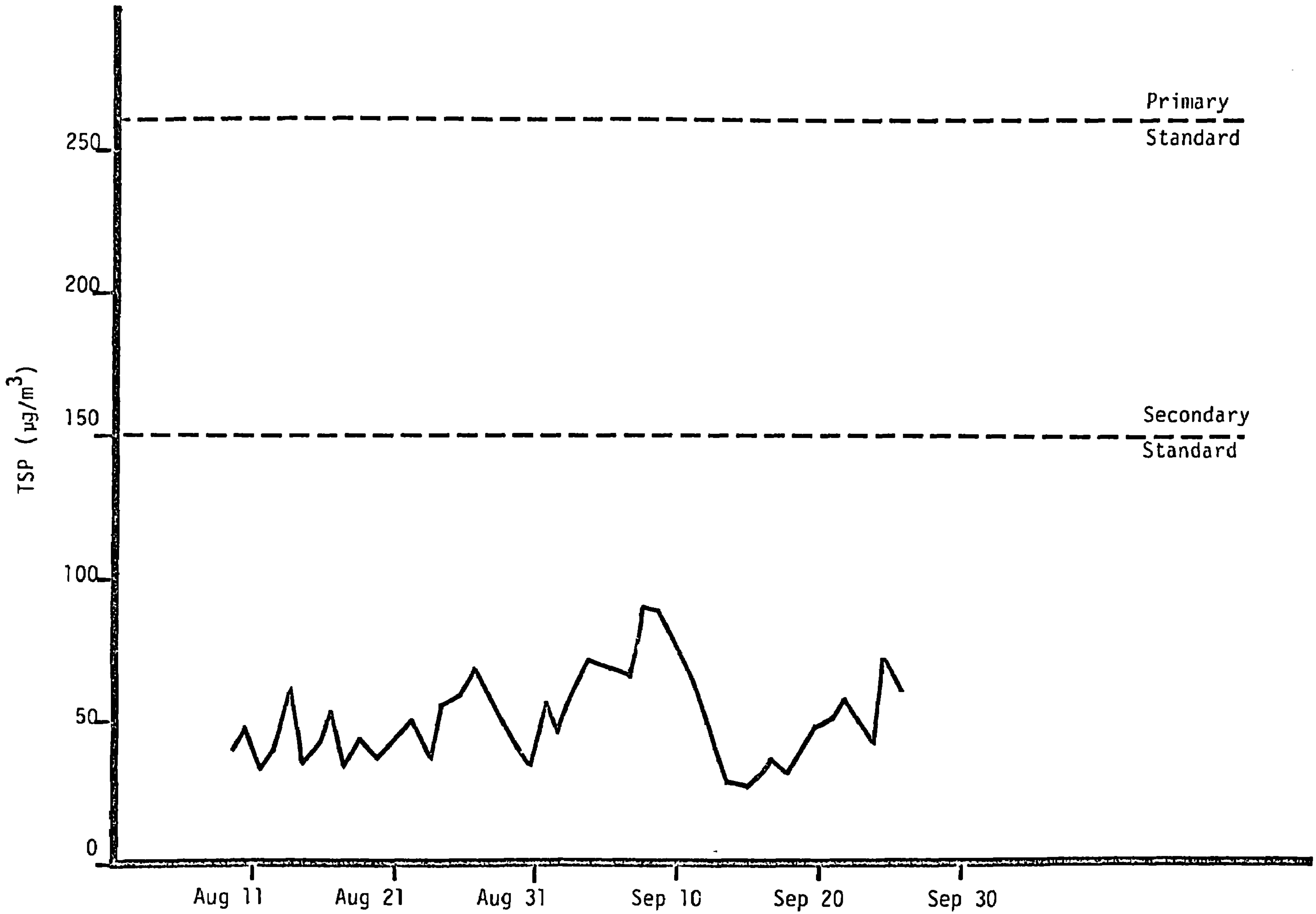


Figure 5. Daily Particulate Concentrations - Station 2
National Zinc Co., Bartlesville, Oklahoma
July 28 - September 26, 1977

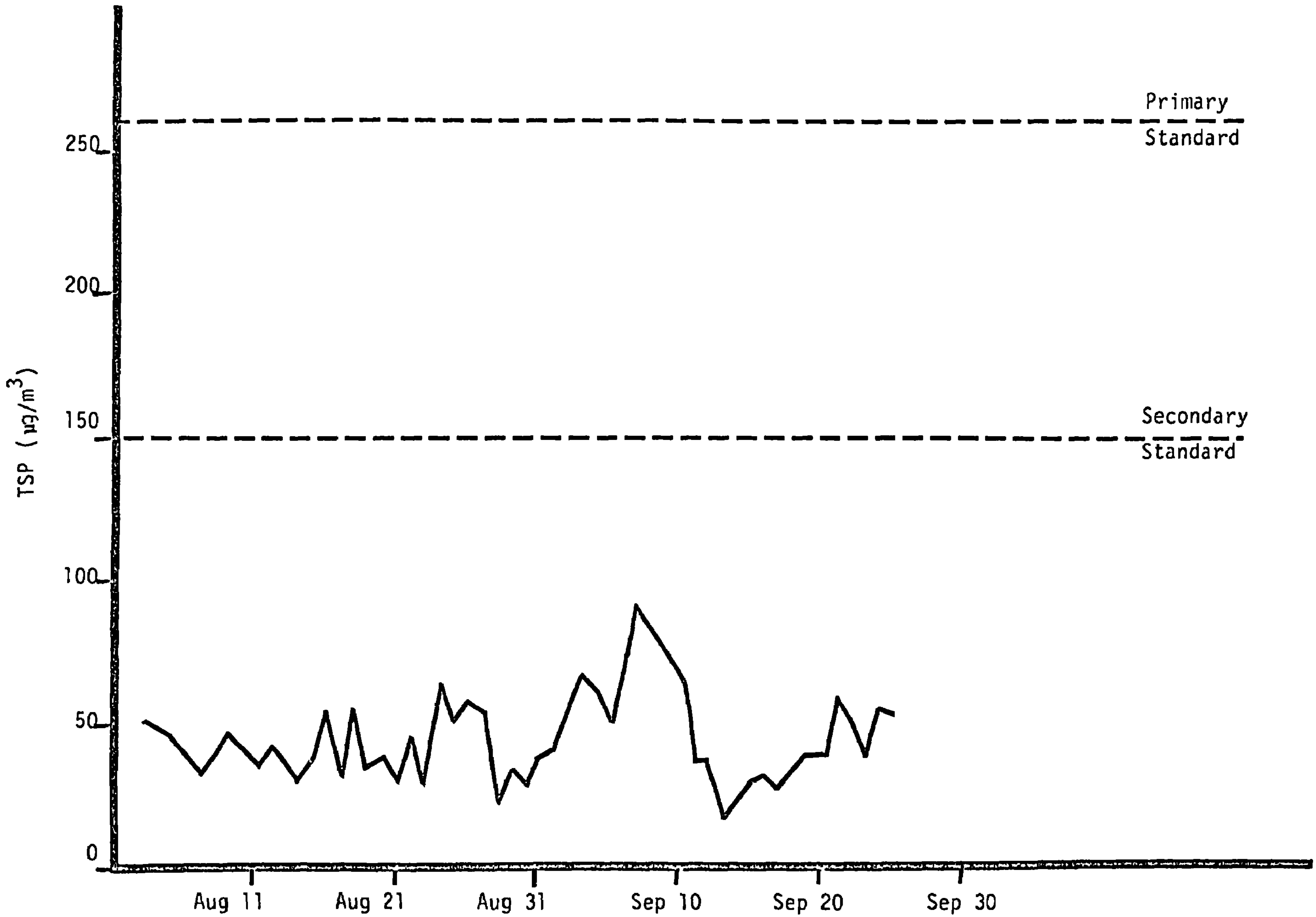


Figure 6. Daily Particulate Concentrations - Station 3
National Zinc Co., Bartlesville, Oklahoma
July 28 - September 26, 1977

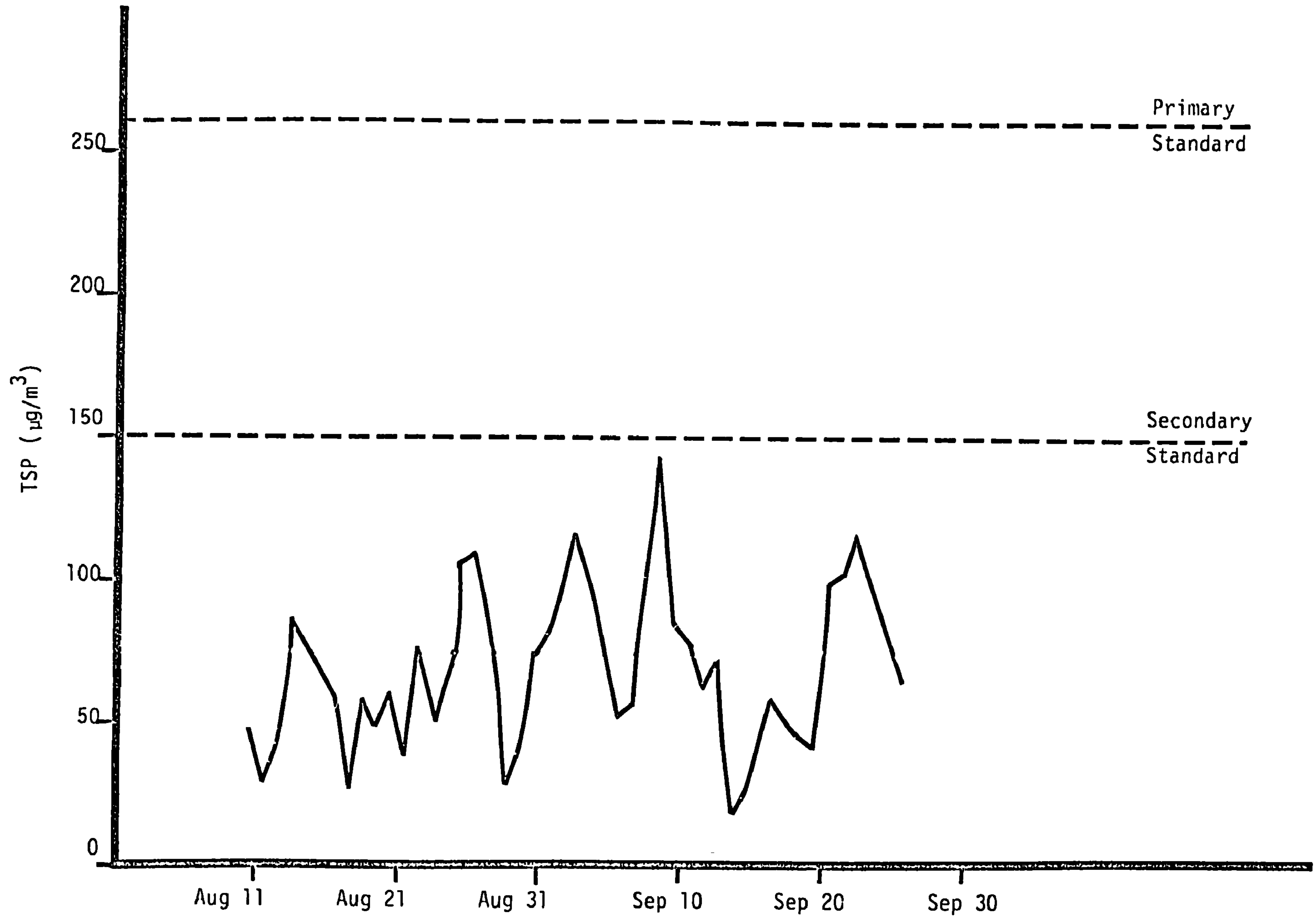


Figure 7. Daily Particulate Concentration - Station 4
National Zinc Co., Bartlesville, Oklahoma
July 28 - September 26, 1977

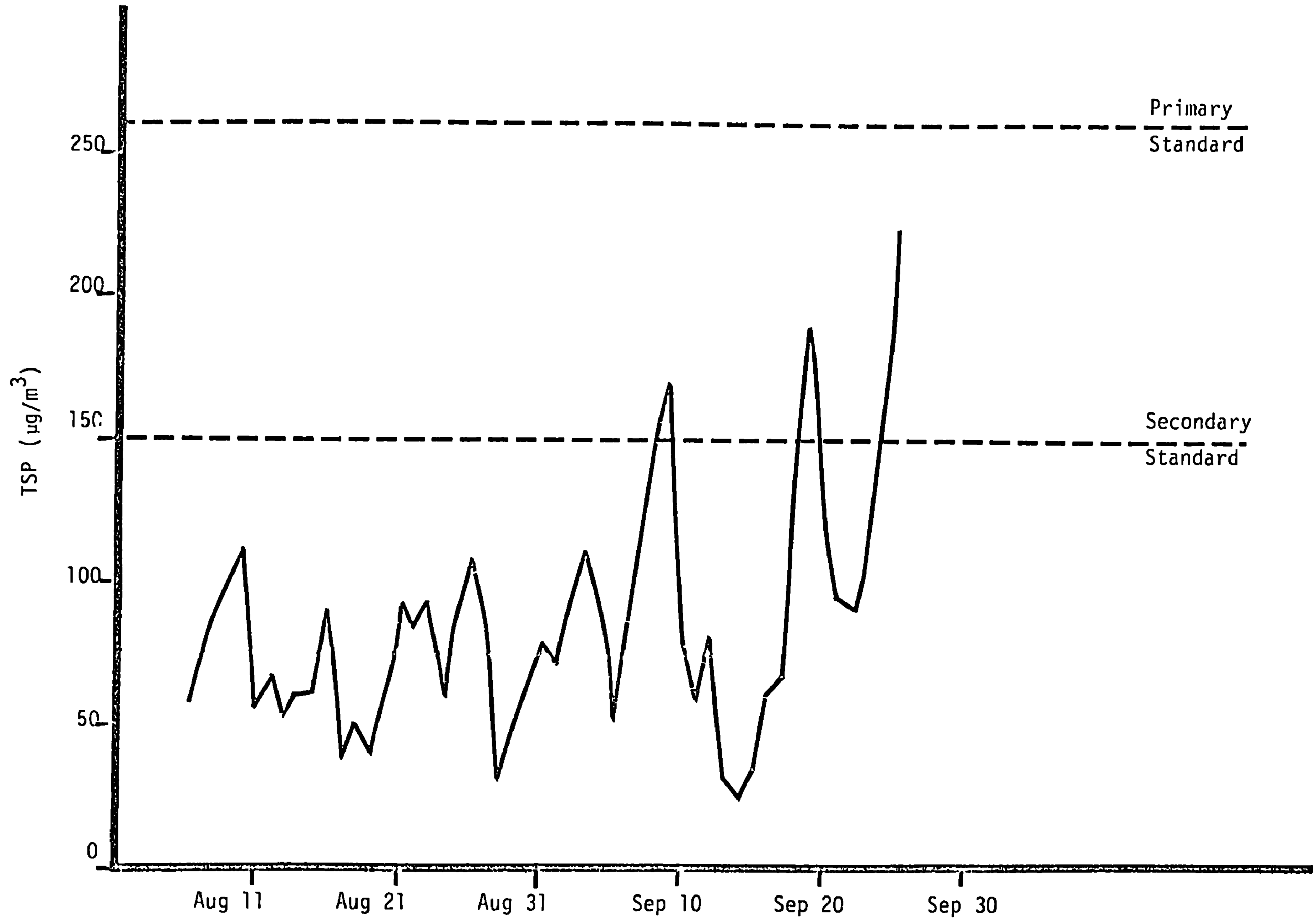


Figure 8. Daily Particulate Concentrations - Station 5
National Zinc Co., Bartlesville, Oklahoma
July 28 - September 26, 1977

Table 5

STATISTICAL SUMMARY OF TSP DATA
NATIONAL ZINC COMPANY
BARTLESVILLE, OKLAHOMA
July 28 - September 26, 1977

Statistical	Station				
	1	2	3	4	5
			μg/m^3		
Geometric Means	79.2	49.7	42.5	62.1	76.9
1st Maximum	184	91	92	144	224
2nd Maximum	149	89	72	117	188
Minimum	30	28	18	19	25
No. of Primary Standards Excursions	0	0	0	0	0
No. of Secondary Standards Excursions	1	0	0	0	5

Table 6

STATISTICAL SUMMARY OF SO_4 DATA
NATIONAL ZINC COMPANY
BARTLESVILLE, OKLAHOMA
July 28 - September 26, 1977

Station	$SO_4^=$	TSP
	$\mu g/m^3$	
Arithmetic mean for Stations 1, 4 5	11.0	89.5
Arithmetic mean for Stations 2, 3	7.3	44.7
Station 1 mean	8.65	95.6
Station 3 mean	7.1	43.4
Station 5 mean	14.3	81.0

downwind sulfate concentration (August 8, 9, 13, 22, 26, 27, and 30), there were persistent southerly winds. Also, although there is no strong positive correlation between absolute levels of TSP and $SO_4^=$, the results do show that in general an increase in TSP from upwind to downwind sites is accompanied by a corresponding increase in $SO_4^=$.

Results of some epidemiological studies on sulfates identify an association between ambient sulfate levels and adverse health effects.[3] However, such statistical associations do not permit a firm conclusion that a cause-effect relationship exists. Nevertheless, it should be noted that the $SO_4^=$ concentrations recorded during this survey are comparable to levels ranging from 1.7 to 17.0 $\mu g/m^3$, which in various studies have been associated with adverse health effects.

Metals

Ambient - The trace metals in air data are expressed as micrograms (μg) per filter [Appendix I]. The only metals found by emission spectroscopy to be consistently above the detection limits were zinc, lead, iron, and copper [Table 7]. There is a four- to six-fold enrichment in zinc values comparing the upwind Station 3 with the downwind Stations 1, 4 and 5. Lead enrichment ranged up to six-fold, iron up to twenty-five-fold, and copper up to two-fold.

Based on the average measured flowrates, the highest lead concentration was 2.5 $\mu g/m^3$ (September 8, 1977 at Station 4) and the mean concentration for all stations and sampling days was less than 1. $\mu g/m^3$. These values compare closely with an average value of 1 $\mu g/m^3$ determined at the National Air Surveillance Network (NASN) sites in other industrialized areas from 1965 through 1975.[1]

Table 7

AMBIENT AIR METALS ANALYSIS
NATIONAL ZINC COMPANY
BARTLESVILLE, OKLAHOMA
September 1977

Station No.	Metal	Dates 9/2	9/3	9/4	9/7	9/8	Mean
		μ/filter					
1	Zinc	350	770	260	260	940	520
	Lead	80	390	<D.L.†	120	160	160
	Iron	690	1,900	360	430	680	810
	Copper	9	23	9	16	19	15
3	Zinc	50	100	<D.L.	210	200	110
	Lead	<D.L.	<D.L.	<D.L.	110	140	90
	Iron	280	330	<D.L.	340	430	280
	Copper	11	16	16	23	25	18
4	Zinc	42		380	41	1,350	450
	Lead	<D.L.		78	<D.L.	260	120
	Iron	40		330	140	820	330
	Copper	<D.L.		33	8	32	20
5	Zinc	720	400	<D.L.	100	1,910	630
	Lead	140	130	85	98	150	120
	Iron	720	640	<D.L.	400	680	490
	Copper	32	16	22	13	47	26

† *<D.L. means the concentration was below the analytical detectable limit which were as follows:*
Zinc < 4
Lead <69
Iron <14
Copper < 7

The mean and maximum zinc concentrations for all stations were 3 and 13 μg/m^3, respectively. Unfortunately, the report of NASN trace metals data did not include zinc.

The highest and mean copper concentrations were 0.3 and 0.13 μ/m^3. This data is consistent with the NASN mean value for copper of approximately 0.1 μg/m^3. The highest and mean iron concentrations were 11.3 and 3.3 μg/m^3, respectively. The mean iron concentration is somewhat higher than the NASN value of 1 μg/m^3.

<u>Soils</u> - The analysis of the 7 soil samples showed very large enrichments of zinc, lead, cadmium, and copper at Stations 1 and 5 compared to Station 3 [Table 8]. The mean of the values from samples 3-02 and 3-03 were used as the upwind value as sample 3-01 was contaminated from the road nearby. The mean and maximum enrichment factors for zinc were 50 and 85 comparing Stations 1 and 5 with 3. The mean concentration of zinc in the earth's crust is 60 μg/g.[2] Station 3 (mean - 450 μg/g) had values 7 times the crustal value, but Stations 1 and 5 (mean - 22,500 μg/g) had values 375 times the crustal value.

The mean and maximum enrichment factors for lead at Stations 1 and 5 compared to Station 3 were 24 and 31, respectively. The mean crustal abundance of lead is 15 μg/g. The lead concentration at Station 3 (mean - 68 μg/g) was 4.5 times the crustal abundance, but Stations 1 and 5 (mean - 1,650 μg/g) had values 110 times the crustal abundance.

The mean and maximum enrichment factors for cadmium at Stations 1 and 5 compared to Station 3 were 305 and 500, respectively. The mean crustal abundance of cadmium is 0.1 μg/g. The cadmium concentration at Station 3 (mean - 1 μg/g) was about the same as the crustal abundance, but Stations 1 and 5 (mean - 350 μg/g) had values 3,500 times the crustal abundance.

Table 8

SOIL SAMPLES METALS ANALYSIS - STATIONS 1, 3, 5, 6
NATIONAL ZINC COMPANY
BARTLESVILLE, OKLAHOMA
July 28 - September 26, 1977

Metal Analyzed	Station - Sequence No.							
	1-01	1-02	3-01†	3-02	3-03	5-01	5-02	6-01
	μg/g							
Zinc	13,900	33,000	970	304	570	38,300	5,000	260
Lead	1,300	2,100	150	58	77	1,800	1,400	62
Iron	54,100	57,800	93,900	32,100	46,400	40,600	29,000	10,800
Copper	330	640	37	18	15	640	410	19
Cadmium	137	350	7	<1	<1	500	420	<1

† *Disregarded because probable contamination from nearby road elevated the concentration beyond expected value (see samples 3-02 and 3-03).*

The mean and maximum enrichment factors for copper at Stations 1 and 5 compared to Station 3 were 31 and 39, respectively. The mean crustal abundance of copper is 30 μg/g. The copper concentration at Station 3 (mean - 17 μg/g) was 0.6 times the crustal abundance, but Stations 1 and 5 (mean - 510 μg/g) had values 17 times the crustal abundance.

REMOTE SENSING

The false color infrared photographs that were taken during the September 19, 1977 aerial surveillance mission were photointerpreted tree-by-tree by NEIC personnel and the location of each tree exhibiting chlorophyllic stress was plotted on U. S. Geological Survey (USGS) 7.5 minute maps (Scale 1:24,000). Figure 9 shows the area covered by the photographs. The cross-hatched area displayed the greatest amount of chlorophyllic stress in the trees, having a stressed tree density from 2 to 10 times that for other areas within the photocoverage boundary. Since, climatologically, the most frequent wind direction in the Bartlesville, Oklahoma, area is southerly, this area is downwind of the National Zinc plant more frequently than any other area surrounding the plant.

BOTANICAL ASSAY

No morphological plant changes attributable to SO_2 were observed during the in situ bioassay. There were no observable differences among plants exposed to ambient air and plants grown in closed greenhouses supplied with sparged (SO_2 free) air, except for one exposed Schefflera sp. from Station 2, which exhibited brown spots with black rings on several leaves. However, no other plants exhibited spots, and detectable SO_2 levels were recorded at this station for only two hours during the entire survey (maximum level - 520 μg/m^3).

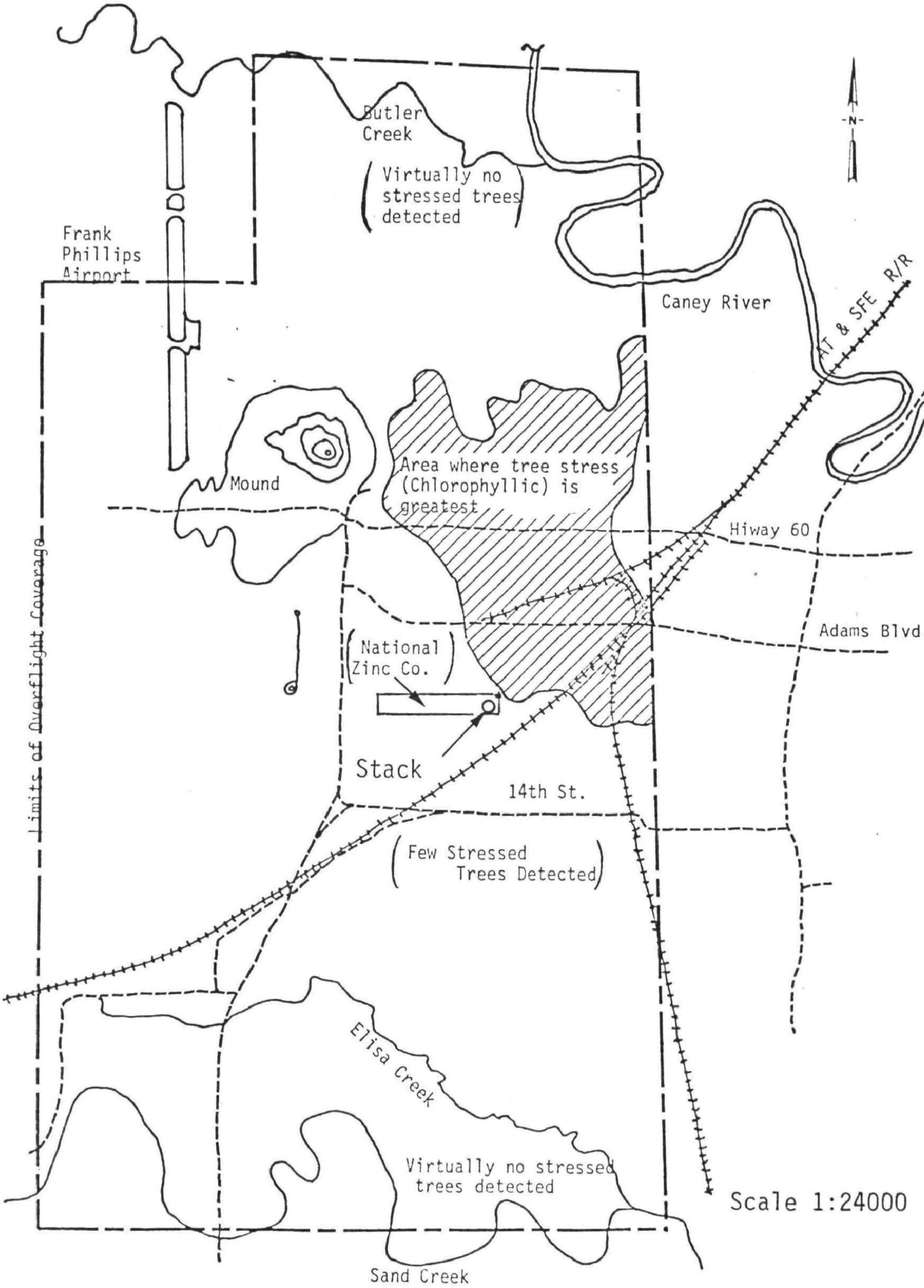


Figure 9. Aerial Infrared Photography Coverage
National Zinc Co., Bartlesville, Oklahoma
July 28 - September 26, 1977

The effect of emissions from National Zinc Company on area soil characteristics was investigated. Soil samples collected downwind of the National Zinc plant at Stations 1 and 5 contained metals concentrations averaging 22,500 μg/g for zinc, 1,650 μg/g for lead, 350 μg/g for cadmium, and 510 μg/g for copper. The average soil pH for these stations was 7.90 [Table 9]. Upwind of National Zinc, at Stations 3 and 6, metals concentrations were lower and pH higher -- 355 μg/g for zinc, 65 μg/g for lead, <1 μg/g for cadmium, 18 μg/g for copper, and a pH of 9.33. Pilea sp. grown in soil with a pH of 7.16, from near Station 1 responded differently than similar plants grown in soil from Station 6, which had a soil pH of 9.15. Pilea sp. grown in soil from Station 1 averaged 0.5 cm taller in height than Pilea sp. grown in soil from Station 6. However, the plants grown in soil from Station 1 were chlorotic and contained only 28% as much chlorophyll as did similar plants grown in soil from Station 6. In summary, as Table 5 shows, the two soils had different pH values and Station 1 had a much higher concentration of metals.

Table 9

SOIL pH AND AVERAGE METAL CONCENTRATIONS
NATIONAL ZINC COMPANY
BARTLESVILLE, OKLAHOMA
July 28 - September 26, 1977

Station	pH	Zinc	Lead	Cadmium	Copper
		µg/g			
1 NNE of National Zinc	7.16	23,450	1,700	244	485
3 SSW of National Zinc	9.40	437	68	<1	17
5 North of National Zinc	8.65	21,650	1,600	460	525
6 4 mi. south of National Zinc	9.15	260	62	<1	19

REFERENCES

1. National Trends in Trace Metals in Ambient Air, 1965-1974, EPA-450/1-77-003, February 1977.

2. Wedepohl, K. H., "Origin and Distribution of the Elements," p 999, L. H. Ahrens, Ed., Pergamon Press, London, England, 1968.

3. Statement of Sulfates Research Approach, EPA-600/8-77-004, February 1977.

4. Holzworth, G.C., "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the Contiguous United States," EPA-AP-101, January 1972.

APPENDICES

A QUALITY ASSURANCE AUDIT REPORT
B TSP FILTER CARD SAMPLE
C CHAIN-OF-CUSTODY PROCEDURES
D ANALYTICAL PROCEDURES
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APPENDIX A

QUALITY ASSURANCE AUDIT REPORT

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
BUILDING 53, BOX 25227, DENVER FEDERAL CENTER
DENVER, COLORADO 80225

TO Quality Assurance Officer DATE October 31, 1977

FROM Technical Coordinator
Inorganics and Air

SUBJECT Quality Assurance Support for the Ambient Air Quality Study in Bartlesville, Oklahoma, September 1 and 2, 1977

I. Purpose

Sulfur dioxide and total suspended particulates were measured by continuous instrumental and Hi-Volume sampling methods, respectively. An auditing program was conducted to estimate data quality. The audit was conducted independently of the routine operation of the sampling and testing network. That is, checks were made by individuals other than the regular operators.

II. Approach

Six sets of samples were collected from the SO_2 calibration system utilizing a bubbler box. See Table I. Prior to the sampling, the critical orifices of the hypodermic needles were calibrated so that flow in l/min could be calculated. See Table II. The sampling was performed in order to verify the calibration of the continuous sulfur dioxide monitors.

An orifice calibration unit with five different resistance plates was calibrated against a positive displacement primary standard (rootsmeter). See Table III. This was done because a calibrated orifice unit is the specified unit for calibrating the flow rate of both rotameter and flow-rate recorder equipped samplers.

III. Results

The data in Tables IV and V show a slight positive bias of the values obtained using the Pararosaniline Method compared to the SO_2 calibration system values (mean, +5.2%) and between the NEIC and RTP simulated values (mean, +6.6%). The samples collected for Pararosaniline analysis were collected in duplicate and the standard deviation of the duplicate values in five out of the six sets of samples collected was quite small.

After the orifice calibration unit was calibrated against a positive displacement primary standard (rootsmeter), the orifice assembly and field water manometer was then used to measure the static pressure of two different hi-volume samplers, Table VI.

TABLE I - Sampling Data

Set Run No.	Tube/Sample No. with TCM	ml TCM	Tube/Sample No. with H_2O_2	ml H_2O_2	Critical Orifice No.	Expected Conc. Range	Sample Times
1	QA1	10			1	0.1-0.2 ppm	60 min
1	QA2	10			2	0.1-0.2 ppm	60 min
1			QA3	50	3	0.1-0.2 ppm	60 min
2	QA4	10			1	0.2-0.3 ppm	60 min
2	QA5	10			2	0.2-0.3 ppm	60 min
2			QA6	50	3	0.2-0.3 ppm	60 min
3	QA7	10			1	0.3-0.4 ppm	60 min
3	QA8	10			2	0.3-0.4 ppm	60 min
3			QA9	50	3	0.3-0.4 ppm	60 min
4	QA10	10			1	0.4-0.5 ppm	30 min
4	QA11	10			2	0.4-0.5 ppm	30 min
4			QA12	50	3	0.4-0.5 ppm	30 min
5	QA13	50			1	0.1-0.2 ppm	72.5 min
5	QA14	50			2	0.1-0.2 ppm	72.5 min
6	QA15	50			2	0.2-0.3 ppm	72 min
6	QA16	50			1	0.2-0.3 ppm	72 min

TABLE II - Needle (Critical Orifice) Calibration Data

Needle No.	Date & Time		Flow Time/0.1 1	Flow, 1/min	Ave. Flow 1/min
1	9/1/77	AM	0.169	0.592	
1	9/1/77	AM	0.172	0.582	
1	9/1/77	AM	0.169	0.592	
1	9/1/77	PM	0.169	0.592	
1	9/1/77	PM	0.170	0.589	0.589 = V_2
2	9/1/77	AM	0.168	0.595	
2	9/1/77	AM	0.168	0.595	
2	9/1/77	PM	0.165	0.696	
2	9/1/77	PM	0.165	0.606	0.600 = V_2
3	9/1/77	AM	0.181	0.552	
3	9/1/77	AM	0.180	0.556	
3	9/1/77	PM	0.172	0.581	
3	9/1/77	PM	0.172	0.581	0.568 = V_3

TABLE III - Calibration of the Orifice Against the Rootsmeter Data

Resistance Plate No.	True Air Flow Rate (m^3/min)
18	1.78
13	1.64
10	1.42
7	1.15
5	0.86

TABLE IV - Pararosaniline Method vs SO_2 Calibration System Values

Samples	Pararosaniline Method Values	Pararosanaline Average Values	SO_2 Calibration System Values	Percentage Difference
QA1	0.171 ppm			
QA2	0.180 ppm	0.176 ppm	0.150 ppm	+14.8%
QA4	0.179 ppm			
QA5	--	0.179 ppm	0.201 ppm	-12.3%
QA7	0.273 ppm			
QA8	0.284 ppm	0.278 ppm	0.299 ppm	- 7.6%
QA10	0.628 ppm			
QA11	0.588 ppm	0.608 ppm	0.486 ppm	+20.0%
QA13	0.168 ppm			
QA14	0.151 ppm	0.160 ppm	0.153 ppm	+ 4.4%
QA15	0.296 ppm			
QA16	0.273 ppm	0.284 ppm	0.250 ppm	+12.0%

TABLE V - RTP vs NEIC Simulated Values

SO_2 Quality Assurance Material Samples	RTP Values	NEIC Values	Percentage Difference
10627	21.90 ug/m^3	18.52 ug/m^3	-15.4%
20694	48.23 ug/m^3	52.46 ug/m^3	+ 8.8%
30876	80.17 ug/m^3	98.75 ug/m^3	+23.2%
40346	114.70 ug/m^3	129.64 ug/m^3	+13.0%
50055	155.40 ug/m^3	160.40 ug/m^3	+ 3.2%

TABLE VI - Orifice #5 vs Field Orifice Air Flow Rates

Hi-Volume Sampler No.	Manometer Reading, in. H_2O	True Air Flow Rate m^3/min, Orifice #5	Air Flow Rate m^3/min, Field Orifice
43	6.0	1.23	1.20
65	5.9	1.22	1.19

The true air flow rate versus the air flow rate measured via the field orifice agreed very closely. A difference of 0.03 m^3/min was detected for Hi-Volume Sampler No. 43 and the same difference for sampler No. 65. The results show that the flow rates that are being measured on the hi-volume samplers are correct values.

IV. Discussion

The results from the six sets of samples collected for the sulfur dioxide analysis, utilizing the Pararosaniline Method corresponded statistically well with the values obtained through the SO_2 calibration system. Also, the NEIC values for the SO_2 Quality Assurance Samples compared very well to the known values obtained from the EPA Quality Assurance Laboratory in Research Triangle Park, North Carolina.

Percentage difference values of less than $\pm$20% for SO_2 Quality Assurance Samples are considered acceptable values. Since only one sample exceeded 20%, the level of confidence of analysis for the quality assurance samples was good. None of the percentage difference values for the samples collected for Pararosaniline Analysis as compared to the SO_2 Calibration System Values exceeded $\pm$20%. The level of confidence comparing the two sets was well within experimental error.

The zero and span were checked every eight hours on the Lear Siegler SO_2 monitors and the zero was checked once a day on the Bendix instruments. A standard curve was run once in August before the start-up and once in September after the start-up.

The flow of the Hi-Volume samplers was measured before and after changing the filters. The calibration orifice unit with five different resistance plates should have been calibrated against a positive displacement primary standard (rootsmeter) prior to the beginning of the survey.

V. Attachments - Methods Description

Sampling

Samples were collected using an absorber assembled set-up and sampling train. Three 23 gauge hypodermic needles 1 inch long were used as critical orifices that produced a flow of approximately 5 liter/minute each. Six sets of samples were collected with the first four sets being collected in triplicate and the last two in duplicate. A soap-bubble meter was used to measure the flow of the critical orifices of the hypodermic needles.

The respective milliliters of each absorbing solution were added to the impingers. Aluminum foil was wrapped around the impinger tubes in order to prevent deterioration from direct sunlight during and after sampling. The volume of air sampled was determined by multiplying the flow rate by the time in minutes and recording the atmospheric pressure and temperature. The samples were removed from the impingers, stoppered, and iced at 4^oC.

Calculations of Volume of Air @25°C and 760 mm Hg, liters

$$V_R = V \times \frac{P}{760} \times \frac{298}{t+273}$$

V_R = flow rate corrected to STP
P = barometric pressure, mm Hg = 753.11
t = temperature of air sample, °C = 24
V = volume of air samples, liters = V_1 = 0.589
V_2 = 0.600
V_3 = 0.568

$$V_{R1} = V_1 \times \frac{P}{760} \times \frac{298}{t+273}$$

$$V_{R1} = 0.589 \frac{1}{min} \times \frac{753.11}{760} \times \frac{298}{24+273}$$

$$V_{R1} = 0.589 \times 0.991 \times 1.003$$

V_{R1} = 0.585 l/min

V_{R2} = 0.597 l/min

V_{R3} = 0.564 l/min

Analysis

The reagents and solutions were prepared as is outlined in Part 6, pp. 6 and 7 of the Federal Register, App. A, Title 40 - Protection of Environment. The stock sodium thiosulfate solution was standardized with the primary standard potassium iodate as shown below:

$$N = \frac{W}{M} \times 2.80$$

N = normality of stock thiosulfate solution
M = volume of thiosulfate required, ml = 41.58 and 41.55, Avg. = 41.56
W = weight of potassium iodate, grams = 2.000

$$2.80 = \frac{10^3 \text{ (conversion of g to mg)} \times 0.1 \text{ (fraction iodate used)}}{35.67 \text{ (equivalent weight of potassium iodate)}}$$

$$N = \frac{2.000}{41.56} \times 2.80$$

N = 0.1347

The sulfite solution was standardized by adding excess 0.01 N iodine solution and back-titrating with 0.0135 N sodium thiosulfate solution. The working sulfite-TCM solution was prepared at the same time the iodine solution was added to the flasks. The concentration of sulfur dioxide in the working solution was calculated as follows:

$$\text{ug}SO_2/\text{ml} = \frac{(A-B)(N)(32{,}000)}{25} \times 0.02$$

A = volume thiosulfate for blank, ml = 47.36 and 47.29, Avg. 47.32
B = volume thiosulfate for sample, ml = 21.10 and 20.90, Avg. 21.00
N = normality of thiosulfate titrant = 0.0135
32,000 = milliequivalents wt. of SO_2, ug
25 = volume standard sulfite solution
0.02 = silution factor

$$\text{ug } SO_2/\text{ml} = \frac{(47.32 - 21.00)(0.0135)(32{,}000)}{25} \times 0.02$$

ug SO_2/ml = 9.10

Graduated amounts of the working sulfite-TCM solution were pipetted in a series of 25 ml volumetric flasks (0, 0.5, 1, 2, 3, and 4 ml). Sufficient TCM solution was added to each flask to bring the volume to approximately 10 ml. The total ug SO_2 in the solutions equalled the concentration of the working sulfite-TCM solution in ug SO_2/ml times the ml working sulfite solution added.
(ug SO_2 = ug SO_2/ml x ml added)

0 ug SO_2 = 9.1 ug SO_2/ml x 0 added
4.6 ug SO_2 = 9.1 ug SO_2/ml x 0.5 added
9.1 ug SO_2 = 9.1 ug SO_2/ml x 1.0 added
18.2 ug SO_2 = 9.1 ug SO_2/ml x 2.0 added
27.3 ug SO_2 = 9.1 ug SO_2/ml x 3.0 added
36.4 ug SO_2 = 9.1 ug SO_2/ml x 4.0 added

The contents of the 30 minute and 1 hour samples were transferred quantitatively to 25 ml volumetric flasks and rinsed with absorbing solution. Analyses were delayed for 20 minutes to allow any ozone to decompose.

The samples that were collected in 50 ml of absorbing solution were transferred quantitatively to 50 ml volumetric flasks and diluted with absorbing solution. 5 ml of the samples were then pipetted into 25 ml volumetric flasks for chemical analyses. The volume was brought up to 10 ml with absorbing reagent and analyses was delayed for 20 minutes to allow any ozone to decompose.

A reagent blank was prepared by adding 10 ml unexposed TCM solution to a 25 ml volumetric flask. A control solution was prepared by adding 2 ml of working sulfite-TCM solution and 8 ml TCM solution to a 25 ml volumetric flask.

To each flask containing either working sulfite-TCM solution sample, control solution, or reagent blank, 1 ml of 0.6 percent sulfamic acid was added and allowed to react 10 minutes in order to destroy the nitrite from oxides of nitrogen. 2 ml of 0.2 percent formaldehyde solution, followed by 5 ml pararosaniline solution was then added. All flasks were brought to volume with distilled water and mixed thoroughly.

After 30 minutes and before 60 minutes, the absorbances of the working sulfite-TCM solutions, samples (denoted asA), reagent blank (denoted as Ao) and the control solution were read at 548 nm using a 1 cm optical path length cell. Distilled water, not the reagent blank was used as the reference.

Five SO_2 Quality Assurance Material Samples were requested and received from Quality Assurance Laboratory in Research Triangle Park, North Carolina. They were prepared by Polysciences, Inc. and were analyzed along with the working sulfite-TCM solutions, samples, control solution, and reagent blank. The SO_2 Quality Assurance Samples were diluted to 50 ml with absorbing solution and prepared for analysis in the same manner as the field samples collected in 50 ml of absorbing solution.

Standards (Working Sulfite-TCM Solutions)	Absorbance
0 ug SO_2/25 ml	0.124
4.6 ug SO_2/25 ml	0.222
9.1 ug SO_2/25 ml	0.324
18.2 ug SO_2/25 ml	0.545
27.3 ug SO_2/25 ml	0.714
36.4 ug SO_2/25 ml	0.911
Reagent Blank/25 ml	0.125
Control Sol'n/25 ml	0.562

Samples	Absorbance
QA1	0.463
QA2	0.488
QA4	0.480
QA5	0.111
QA7	0.666
QA8	0.703
QA10	0.744
QA11	0.720
QA13	0.164
QA14	0.161
QA15	0.196
QA16	0.189

SO_2 Quality Assurance Material	Absorbance
10627	0.136
20694	0.158
30876	0.188
40346	0.208
50055	0.228

$$\text{ug } SO_2/m^3 = \frac{(A-Ao) \times (10)^3\ l/m^3 \times (Ba)ug/l \times D}{(V_R)}$$

A = sample absorbance
Ao = reagent blank absorbance
10^3 = conversion of liters to cubic meters
Ba = calibration factor, 1/slope
D = dilution factor
For 30 minute and 1 hour samples, D = 1
For 24 hour samples, D = 10
V_R = the sample volume corrected to 25°C and 760 mm Hg
S_t = sample time

Example: Sample Calculation (Sample QA1)

$$\text{ug } SO_2/m^3 = \frac{(0.463 - 0.124)(10^3)(46.29)}{(0.585)(60)} \times 1$$

ug SO_2/m^3 = 447
ppm SO_2 = 447 ug/m^3 (3.82×10^{-4})
ppm SO_2 = 0.171

Example: SO_2 Quality Assurance Material (10627)

$$\text{ug } SO_2/m^3 = \frac{(0.136 - 0.124)(10^3)(46.29)}{300} \times 10$$

300 = sample volume per time value provided by the EPA Quality Assurance Laboratory in Research Triangle Park, North Carolina
ug SO_2/m^3 = 18.52

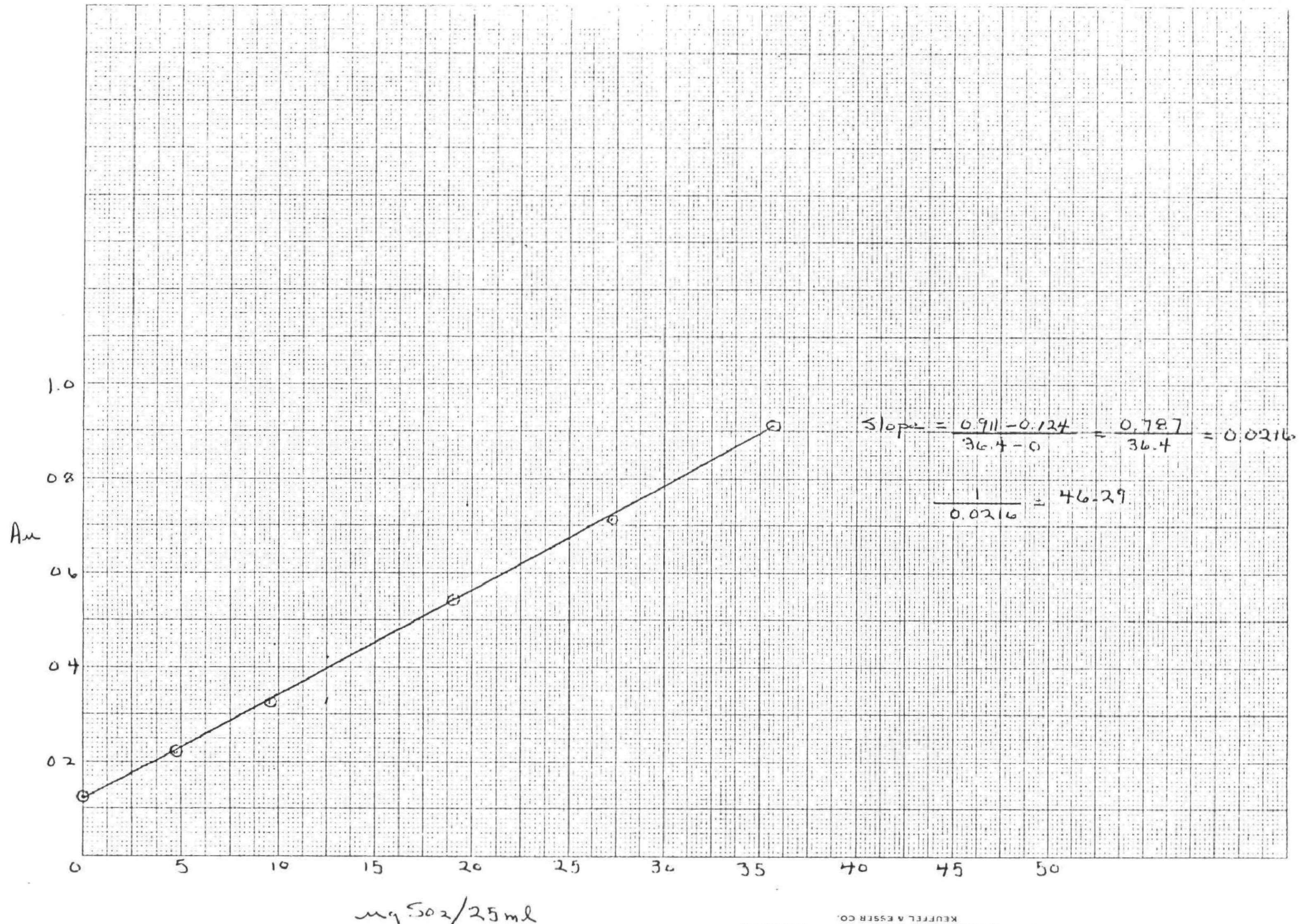
Calibration of the Orifice

The true air volume measured by the positive displacement primary standard was calculated using the five resistance plates as shown below:

$$Va = \frac{(Pa - Pm)}{(Pa)(T)} \times Vm$$

Va = true air volume at atmospheric pressure, m^3/min
Pa = barometric pressure, mm Hg
Pm = pressure drop at inlet of primary standard, mm Hg
Vm = volume measured by primary standard, m^3
T = time, min

Ambient Air Survey - Bartlesville, Oklahoma   Absorbance vs. µg SO_2/25 ml



$$Q = \frac{(Pa - Pm)}{PaT} \times V_m$$

10

ORIFICE CALIBRATION

In H_2O X .07348 = ~~mm~~ in Hg
In Hg X 25.4 = mm Hg
(0.07348)(25.4) = 1.866

Orifice Calibration Unit Number 5

Roots Meter Number 7507303

29.65 in Hg

Laboratory Temperature 24 °C Pressure 753.11 mmHg Pa

Motor Number 5 Voltage 115 vac

DATE 9-1-77 OPERATOR D. Dial Vtt

Verified by

Plate No.	Volume of Air Passed ft^3	Volume of Air Passed m^3 V_m	Time of Total Airflow (min.) T	Manometer Reading on Primary Standard inches of H_2O	Manometer Reading on Primary Standard mm. Hg P_m	Manometer Reading on Orifice inches of H_2O	Manometer Reading on Orifice mm. Hg	True Air Flow Rate (m^3/min.)
18		5.00	2.649	23.6	44.0	12.4		1.78
13		5.00	2.831	29.5	55.0	10.5		1.64
10		5.00	3.199	35.5	66.2	7.7		1.42
7		5.00	3.846	43.6	81.3	5.3		1.15
5		5.00	4.892	52.9	98.7	3.1		0.86

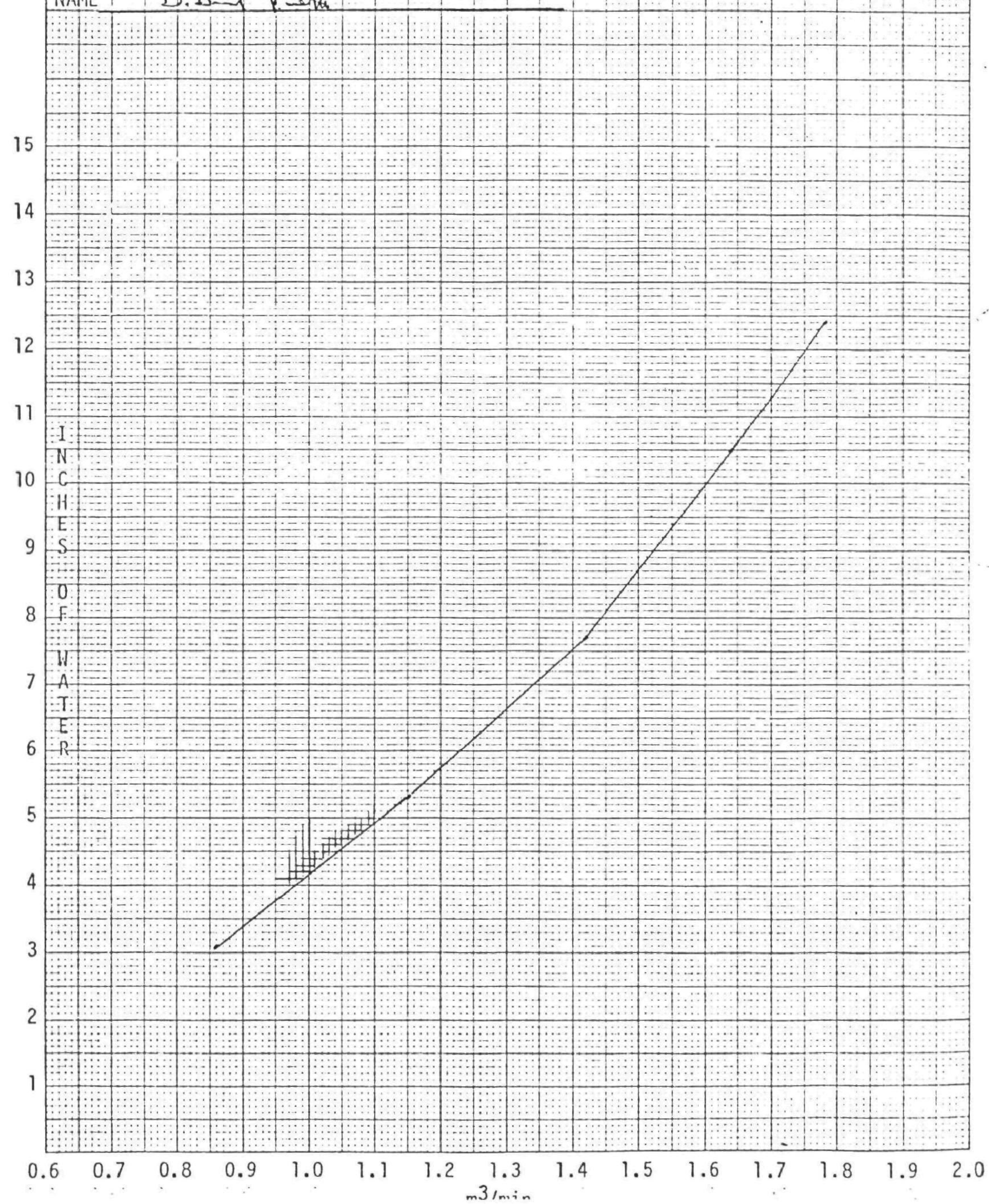
ORIFICE CALIBRATION CURVE

ORIFICE # 5 ROOTSMETER # 7507303 DATE 9-1-77

TEMP. 24°C °C BAROMETER 753.11 mm Hg

VOLTS 115 AC

NAME D. David V[illegible]



For resistance plate no. 18:

$$Va = \frac{(753.11 - 44.0)}{(753.11)(2.649 \text{ min})} \times 5.00 \text{ m}^3$$

$\underline{Va = 1.78 \text{ m}^3/\text{min}}$

D. David Vietti

APPENDIX B

TSP FILTER CARD SAMPLE

HI-VOL DATA RECORD
(Continued)

PARTICULATE DATA – For Lab Use Only

Filter Gross Wgt ________________ grams

Filter Tare Wgt ________________ grams

Net Particulate Wgt ________________ grams

Initial m min ________

Final m min ________

Air Volume ________________ m3

Particulate Concentration ________________ µg m3

Total Sampling Time ________ hours ________ minutes

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
Bldg 53 Box 25227, Denver Federal Center
Denver, Colorado 80225

HI-VOL DATA RECORD

STATION LOCATION
CITY & STATE ________________

SAMPLE COLLECTOR ________ STATION NUMBER ________

SAMPLER IDENTIFICATION NO ________

FILTER NUMBER ________

START SAMPLING ____ mo ____ day ____ yr ____ hr ____ min ____

CLOCK READING ________ in

STOP SAMPLING ____ mo ____ day ____ yr ____ hr ____ min ____

CLOCK READING ________

WIND [illegible]

VISIBILITY [illegible]

[illegible]

HUMIDITY [illegible]

TEMPERATURE [illegible]

REMARKS

APPENDIX C

CHAIN-OF-CUSTODY PROCEDURES AND RECORDS

ENVIRONMENTAL PROTECTION AGENCY
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER

CHAIN OF CUSTODY PROCEDURES
June 1, 1975

GENERAL

The evidence gathering portion of a survey should be characterized by the minimum number of samples required to give a fair representation of the water, air or solid waste sampled. To the extent possible, the quantity of samples and sample locations will be determined prior to the survey.

Chain of Custody procedures must be followed to maintain the documentation necessary to trace sample possession from the time taken until the evidence is introduced into court. A sample is in your "custody" if:

1. It is in your actual physical possession, or

2. It is in your view, after being in your physical possession, or

3. It was in your physical possession and then you locked it up in a manner so that no one could tamper with it.

All survey participants will receive a copy of the survey study plan and will be knowledgeable of its contents prior to the survey. A pre-survey briefing will be held to re-appraise all participants of the survey objectives, sample locations and Chain of Custody procedures. After all Chain of Custody samples are collected, a de-briefing will be held in the field to determine adherence to Chain of Custody procedures and whether additional evidence type samples are required.

SAMPLE COLLECTION

1. To the maximum extent achievable, as few people as possible should handle the sample.

2. Water, air, or solid waste samples shall be obtained, using standard field sampling techniques.

3. Sample tags (Exhibit I) shall be securely attached to the sample container at the time the complete sample is collected and shall contain, at a minimum, the following information: station number, station location, data taken, time taken, type of sample, sequence number (first sample of the day - sequence No. 1, second sample - sequence No. 2, etc.), analyses required and samplers. The tags must be legibly filled out in ballpoint (waterproof ink).

4. Blank samples shall also be taken with preservatives which will be analyzed by the laboratory to exclude the possibility of container or preservative contamination.

5. A pre-printed, bound Field Data Record logbook shall be maintained to record field measurements and other pertinent information necessary to refresh the sampler's memory in the event he later takes the stand to testify regarding his actions during the evidence gathering activity. A separate set of field notebooks shall be maintained for each survey and stored in a safe place where they could be protected and accounted for at all times. Standard formats (Exhibits II and III) have been established to minimize field entries and include the date, time, survey, type of samples taken, volume of each sample, type of analysis, sample numbers, preservatives, sample location and field measurements such as temperature, conductivity,

DO, pH, flow and any other pertinent information or observations. The entries shall be signed by the field sampler. The preparation and conservation of the field logbooks during the survey will be the responsibility of the survey coordinator. Once the survey is complete, field logs will be retained by the survey coordinator, or his designated representative, as a part of the permanent record.

6. The field sampler is responsible for the care and custody of the samples collected until properly dispatched to the receiving laboratory or turned over to an assigned custodian. He must assure that each container is in his physical possession or in his view at all times, or locked in such a place and manner that no one can tamper with it.

7. Colored slides or photographs should be taken which would visually show the outfall sample location and any water pollution to substantiate any conclusions of the investigation. Written documentation on the back of the photo should include the signature of the photographer, time, date and site location. Photographs of this nature, which may be used as evidence, shall be handled recognizing Chain of Custody procedures to prevent alteration.

TRANSFER OF CUSTODY AND SHIPMENT

1. Samples will be accompanied by a Chain of Custody Record which includes the name of the survey, samplers' signatures, station number, station location, date, time, type of sample, sequence number, number of containers and analyses required (Fig. IV). When turning over the possession of samples, the transferor and transferee will sign, date and time the sheet. This record sheet allows transfer of custody of a group of samples in the field, to the mobile laboratory or when samples are dispatched to the NEIC - Denver laboratory. When transferring a portion of the samples identified on the sheet to the field mobile laboratory, the individual samples must be noted in the column with the signature of the person relinquishing the samples. The field laboratory person receiving the samples will acknowledge receipt by signing in the appropriate column.

2. The field custodian or field sampler, if a custodian has not been assigned, will have the responsibility of properly packaging and dispatching samples to the proper laboratory for analysis. The "Dispatch" portion of the "Chain of Custody Record shall be properly filled out, dated, and signed.

3. Samples will be properly packed in shipment containers such as ice chests, to avoid breakage. The shipping containers will be padlocked for shipment to the receiving laboratory.

4. All packages will be accompanied by the Chain of Custody Record showing identification of the contents. The original will accompany the shipment, and a copy will be retained by the survey coordinator.

5. If sent by mail, register the package with return receipt requested. If sent by common carrier, a Government Bill of Lading should be obtained. Receipts from post offices, and bills of lading will be retained as part of the permanent Chain of Custody documentation.

6. If samples are delivered to the laboratory when appropriate personnel are not there to receive them, the samples must be locked in a designated area within the laboratory in a manner so that no one can tamper with them. The same person must then return to the laboratory and unlock the samples and deliver custody to the appropriate custodian.

LABORATORY CUSTODY PROCEDURES

1. The laboratory shall designate a "sample custodian." An alternate will be designated in his absence. In addition, the laboratory shall set aside a "sample storage security area." This should be a clean, dry, isolated room which can be securely locked from the outside.

2. All samples should be handled by the minimum possible number of persons.

3. All incoming samples shall be received only by the custodian, who will indicate receipt by signing the Chain of Custody Sheet accompanying the samples and retaining the sheet as permanent records. Couriers picking up samples at the airport, post office, etc. shall sign jointly with the laboratory custodian.

4. Immediately upon receipt, the custodian will place the sample in the sample room, which will be locked at all times except when samples are removed or replaced by the custodian. To the maximum extent possible, only the custodian should be permitted in the sample room.

5. The custodian shall ensure that heat-sensitive or light-sensitive samples, or other sample materials having unusual physical characteristics, or requiring special handling, are properly stored and maintained.

6. Only the custodian will distribute samples to personnel who are to perform tests.

7. The analyst will record in his laboratory notebook or analytical worksheet, identifying information describing the sample, the procedures performed and the results of the testing. The notes shall be dated and indicate who performed the tests. The notes shall be retained as a permanent record in the laboratory and should note any abnormalties which occurred during the testing procedure. In the event that the person who performed the tests is not available as a witness at time of trial, the government may be able to introduce the notes in evidence under the Federal Business Records Act.

8. Standard methods of laboratory analyses shall be used as described in the "Guidelines Establishing Test Procedures for Analysis of Pollutants," 38 F.R. 28758, October 16, 1973. If laboratory personnel deviate from standard procedures, they should be prepared to justify their decision during cross-examination.

9. Laboratory personnel are responsible for the care and custody of the sample once it is handed over to them and should be prepared to testify that the sample was in their possession and view or secured in the laboratory at all times from the moment it was received from the custodian until the tests were run.

10. Once the sample testing is completed, the unused portion of the sample together with all identifying tags and laboratory records, should be returned to the custodian. The returned tagged sample will be retained in the sample room until it is required for trial. Strip charts and other documentation of work will also be turned over to the custodian.

11. Samples, tags and laboratory records of tests may be destroyed only upon the order of the laboratory director, who will first confer with the Chief, Enforcement Specialist Office, to make certain that the information is no longer required or the samples have deteriorated.

EXHIBIT I

EPA, NATIONAL ENFORCEMENT INVESTIGATIONS CENTER

Station No.	Date	Time	Sequence No.

Station Location

________Grab
________Comp.

________BOD
________Solids
________COD
________Nutrients
________Metals
________Oil and Grease
________D.O.
________Bact.
________Other

Remarks/Preservative:

Samplers:

* GPO IMPRINT

Front

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
BUILDING 53, BOX 25227, DENVER FEDERAL CENTER
DENVER, COLORADO 80225

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Back

EXHIBIT II

_______________ SURVEY, PHASE_____, DATE _______________

E OF SAMPLE_______________

					ANALYSES REQUIRED																				
ATION UMBER	STATION DESCRIPTION	TOTAL VOLUME	TYPE CONTAINER	PRESERVATIVE	NUTRIENTS	BOD	COD	TOC	TOTAL SOLIDS	SUSPENDED SOLIDS	ALKALINITY	DO	pH*	CONDUCTIVITY*	TEMPERATURE*	TOTAL COLIFORM	FECAL COLIFORM	TURBIDITY	OIL AND GREASE	METALS	BACTI	PESTICIDES	HERB	TRACE ORGANICS	PHENOL

ARKS

XH II

Samplers: ______________________

____

____

____

FIELD DATA RECORD

STATION	NUMBER	DATE	TIME	TEMPERATURE °C	CONDUCTIVITY μmhos/cm	pH S.U.	D.O. mg/l	Gage Ht. or Flow Ft. or CFS

ENVIRONMENTAL PROTECTION AGENCY
Office Of Enforcement
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
Building 53, Box 25227, Denver Federal Center
Denver, Colorado 80225

CHAIN OF CUSTODY RECORD

SURVEY	SAMPLERS: (Signature)
Douglas Oil	[illegible]

STATION NUMBER	STATION LOCATION	DATE	TIME	SAMPLE TYPE Water Comp	Water Grab.	Air	SEQ NO	NO OF CONTAINERS	ANALYSIS REQUIRED
5001	Incinerator Stack	9/13/77				X	01	1	Acetone Wash - Sulfate
5001	Incinerator Stack	9/13/77				X	02	1	Acetone Wash Sulfate
5001	"	9/13/77				X	03	1	Acetone Wash Sulfate
5001	"	9/13/77				✓	01	1	Impinger Catch Sulfate
5001	"	9/13/77				✓	02	1	Impinger Catch Sulfate
5001	"	9/13/77				✓	03	1	Impinger Catch Sulfate
5001	"	9/13/77				X		1	Distilled H_2O Blank

Relinquished by: (Signature)	Received by: (Signature)	Date/Time
[illegible]		
Relinquished by: (Signature)	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Received by Mobile Laboratory for field analysis: (Signature)	Date/Time

Dispatched by: (Signature)	Date/Time	Received for Laboratory by:	Date/Time
		[illegible]	[illegible]

Method of Shipment:

Distribution: Orig. – Accompany Shipment
1 Copy – Survey Coordinator Field Files

APPENDIX D

ANALYTICAL PROCEDURES

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
NATIONAL ENFORCEMENT INVESTIGATIONS CENTER
BUILDING 53, BOX 25227, DENVER FEDERAL CENTER
DENVER, COLORADO 80225

TO Deputy Chief
Chemistry Branch

DATE October 31, 1977

FROM Trace Elements Coordinator

SUBJECT National Zinc, Bartlesville, Oklahoma

Low-Vol Filters

Fifteen membrane filters representing three subject air sampling stations from each of five days were selected for analysis. In addition, a fourth station yielded two samples plus two blanks for four of the same five days. One fourth of each of these samples and blanks were prepared per APHA Methods of Air Particulate Sampling and Analysis. That method was to digest one quarter portions of the filters with 3 mls of concentrated nitric acid, heat to fuming, add 3 mls of 70% perchloric acid, and heat again to white fumes, cool and dilute to 25 ml. One ml of each of the resulting solutions was then diluted to 10 ml with deionized water and analyzed by inductively-coupled argon-plasma (ICAP) emission spectroscopy. One ml of each of the solutions was also used for selenium analysis by graphite furnace atomic absorption using the method of standard additions. In addition, nine other quarter portions (three stations for three days each) were analyzed by x-ray fluorescence (XRF).

Other observations can be made using the ICAP data attached (Table I); however, without flow data to calculate total masses, I will attempt no interpretation. Note that mercury data are not included since the method of sample collection and preparation makes any results questionable. By way of quality assurance, three blank filter quarters were spiked with known amounts of each of the twenty elements programmed into the ICAP emission spectrometer. Table 2 lists the percent recoveries following the nitric/perchloric acid digestion and subsequent analysis. All recoveries were reasonable save those for tin, mercury, and selenium, which is not surprising considering the volatility of some of the salts of these metals. MQDC values also appear in Table 1.

Soil Samples

Seven soil samples were collected, two from the vicinity of the station 1 air sampler, three from station 3, and two from station 5. Those samples were dried at room temperature, strained through a number 20 sieve, and mixed well. A representative portion of each was then ground to less than 300 mesh using a rotary mill. Approximately 250 mg portions were then digested using the same nitric/perchloric digestion procedures as used for the membrane filters and diluted to 25 ml. Analysis was done on 1:10 dilutions of these solutions using ICAP only; the results appear in Table 3. Note the relatively high zinc values for stations 1 and 5 compared to the upwind station 3 values. The MQDL values listed differ from those for the membrane filter samples because of the difference in matrices in addition to the possible changes in operating conditions since the soil samples were analyzed at a later date than the membrane filters.

Bill Abbott (WZ)

William L. Abbott

Attachments

TABLE 1

ANALYTICAL DATA REPORTING SHEET

Name of Survey BARTLESVILLE AIR FILTERS Project Number 494

Station Number 1 Station Description 10^{th} & RODGERS

Analyses Performed	Units		Dates 9/2/77	9/3/77	9/4/77	9/7/77	9/8/77			Mean
Sn	μg/FILTER		<8	<8	<8	<8	<8			
As	"		<65	<65	<65	<65	<65			
Sb	"		<59	<59	<59	<59	<59			
Zn	"		350	770	260	260	940			520
Pb	"		80	390	<69	120	160			160
Cd	"		<6	<6	<6	<6	8			
B	"		<12	50	<12	<12	<12			
Fe	"		690	1900	360	430	650			810
Mn	"		<21	32	<21	24	25			
V	"		<17	<17	<17	<17	<17			
Cu	"		9	23	9	16	19			15
Ag	"		<13	<13	<13	<13	<13			
Ni	"		<75	<75	<75	<75	<75			
Cr	"		<28	<28	<28	<28	<28			
Y	"		2	2	2	2	2			
Mo	"		<74	<74	<74	<74	<74			
Se	"		<6	<6	<6	<6	<6			
W	"		<110	<110	<110	<110	<110			
FILTER #			21	25	33	45	51			
SIDUE WT	μg		23400	19800	11800	15600	13600			

Remarks:

TABLE 1

ANALYTICAL DATA REPORTING SHEET

Name of Survey BARTLESVILLE AIR FILTERS Project Number 494

Station Number 3 Station Description HWY 23A & 132

Analyses Performed	Units		9/2/77	9/3/77	9/4/77	9/7/77	9/8/77			Mean
Sn	μg/FILTER		<8	<8	<8	<8	18			
As	"		<65	<65	<65	<65	<65			
Sb	"		<59	<59	<59	<59	<59			
Zn	"		50	100	<4	210	200			110
Pb	"		<69	<69	<69	110	140			90
Cd	"		<6	<6	6	<6	<6			
B	"		<12	<12	<12	<12	<12			
Fe	"		280	330	<14	340	430			[illegible]
Mn	"		<21	<21	60	<21	26			
V	"		<17	<17	18	<17	<17			
Cu	"		11	16	16	23	25			17
Ag	"		<13	<13	44	<13	<13			
Ni	"		<75	<75	220	<75	<75			
Cr	"		<28	<28	96	<28	37			
Y	"		2	3	10	<1	3			
Mo	"		<74	<74	320	<74	90			
Se	"		<6	<6	<6	<6	<6			
W	"		<110	<110	<110	<110	<110			
FILTER #			24	26	34	44	55			
RESIDUE WT	μg		6700	10300	8500	10200	9400			

Remarks:

TABLE

ANALYTICAL DATA REPORTING SHEET

ame of Survey BARTLESVILLE AIR FILTERS Project Number 494

station Number 4 Station Description PUMPING STATION

Analyses Performed	Units		9/2/77		9/4/77	9/7/77	9/8/77		Mean	MQDL
					Dates					
Sn	µg/filter		<8		<8	<8	<8			8
As	"		<65		<65	<65	<65			65
Sb	"		<59		<59	<59	<59			59
Zn	"		42		380	41	1350		450	4
Pb	"		<69		78	<69	360		130	69
Cd	"		<6		<6	<6	13			6
B	"		<12		<12	<12	16			12
Fe	"		40		330	140	820		330	14
Mn	"		<21		<21	<21	28			21
V	"		<17		<17	<17	<17			17
Cu	"		<7		33	8	32		20	7
Ag	"		<13		<13	<13	15			13
Ni	"		<75		<75	<75	80			75
Cr	"		<28		<28	<28	39			28
Y	"		2		4	<1	4			1
Mo	"		<74		<74	<74	97			74
Se	"		<6		<6	<6	<6			6
W	"		<110		<110	<110	<110			110
FILTER #			31 *		30	48 *	49			
RESIDUE WT. mg					9100		12700			

Remarks: * FILTER BLANK

MQDL = MINIMUM QUANTIFIABLE DETECTION LIMIT = 10 σ BACKGROUND NOISE

TABLE 1
ANALYTICAL DATA REPORTING SHEET

Name of Survey BARTLESVILLE AIR FILTERS Project Number 494

Station Number 5 Station Description ADAMS & ADELINE BLVD

Dates

Analyses Performed	Units		9/2/77	9/3/77	9/4/77	9/7/77	9/8/77			mean
Sn	μg/Filter		<8	<8	<8	<8	<8			
As	"		<65	<65	<65	<65	<65			
Sb	"		<59	<59	<59	<59	<59			
Zn	"		720	400	<4	100	1910			630
Pb	"		140	130	85	98	150			120
Cd	"		<6	<6	12	<6	16			
B	"		<12	<12	<12	<12	<12			
Fe	"		720	640	<14	400	630			[illegible]
Mn	"		<21	<21	74	<21	28			
V	"		<17	<17	<17	<17	<17			
Cu	"		32	16	22	13	47			25
Ag	"		<13	<13	52	<13	<13			
Ni	"		<75	<75	270	<75	<75			
Cr	"		<28	<28	116	<28	<28			
Y	"		2	3	12	<1	3			
Mo	"		<74	<74	370	<74	<74			
Se	"		<6	<6	<6	<6	<6			
W	"		<110	<110	<110	<110	<110			
FILTER #			23	27	32	42	50			
RESIDUE WT	Mg		13600	16100	12900	12900	17500			

Remarks: ______

TABLE 2

ANALYTICAL DATA REPORTING SHEET

Name of Survey BARTLESVILLE Project Number 494

Station Number Station Description % Recovery Data AIR FILTERS Nitric /Perchloric Digestion

Analyses Performed	Units		Replicate 1	Replicate 2	Replicate 3					
Sn	% Rec.		80	65	80					
As	"		102	102	102					
Sb	"		95	75	85					
Zn	"		120	110	120					
Pb	"		115	92	115					
Cd	"		105	110	110					
B	"		100	130	100					
Hg	"		55	60	55					
Fe	"		120	90	120					
Mn	"		110	100	110					
V	"		105	100	105					
Cu	"		105	115	110					
Ag	"		95	95	85					
Ni	"		95	99	97					
Cr	"		102	108	102					
Y	"		100	100	100					
Mo	"		95	101	95					
Se	"		60	52	60					
W	"		80	72	80					
U	"		100	90	100					

marks:

TABLE 3

ANALYTICAL DATA REPORTING SHEET

Name of Survey BARTLESVILLE Project Number 10.2

Station Number 1 3 5 Station Description Soil Samples

STATION & SEQ #

Analyses Performed	Units		1-01	1-02	3-01	3-02	3-03	5-01	5-02	MQDL*
Sn	µg/g		13	17	16	<10	<10	17	10	2
As	"		130	150	120	34	42	190	98	30
Sb	"		47	65	48	14	17	76	<10	10
Zn	"		13,900	33 000	970	540	570	35 300	5000	2
Pb	"		1300	2100	150	58	77	1500	1400	3
Cd	"		137	350	7	<1	<1	500	420	1
B	"		74	<7	43	76	140	24	51	7
Hg	"		—	—	—	—	—	—	—	—
Fe	"		54 100	57 800	[illegible]	33,100	[illegible]	[illegible]	24 000	2
Mn	"		860	920	530	320	[illegible]	[illegible]	500	3
V	"		116	88	130	65	58	103	73	1
Cu	"		330	640	27	18	15	640	410	1
Ag	"		10	17	<2	<2	12	16	4	2
Ni	"		26	40	64	<5	<8	70	9	3
Cr	"		66	64	50	41	42	49	41	3
Y	"		6	4	9	1	<.2	4	2	0.2
Mo	"		53	100	<50	<50	<50	70	<50	50
Se	"		<220	620	<220	<220	<220	<220	<220	220
W	"		<80	94	<80	<80	<80	102	<80	80
U	"		<71	<71	<71	<71	<71	<71	<71	71

Remarks: * MINIMUM QUANTIFIABLE DETECTION LIMIT = 10σ BACKGROUND NOISE plus the interelement correction.

FIG. 1

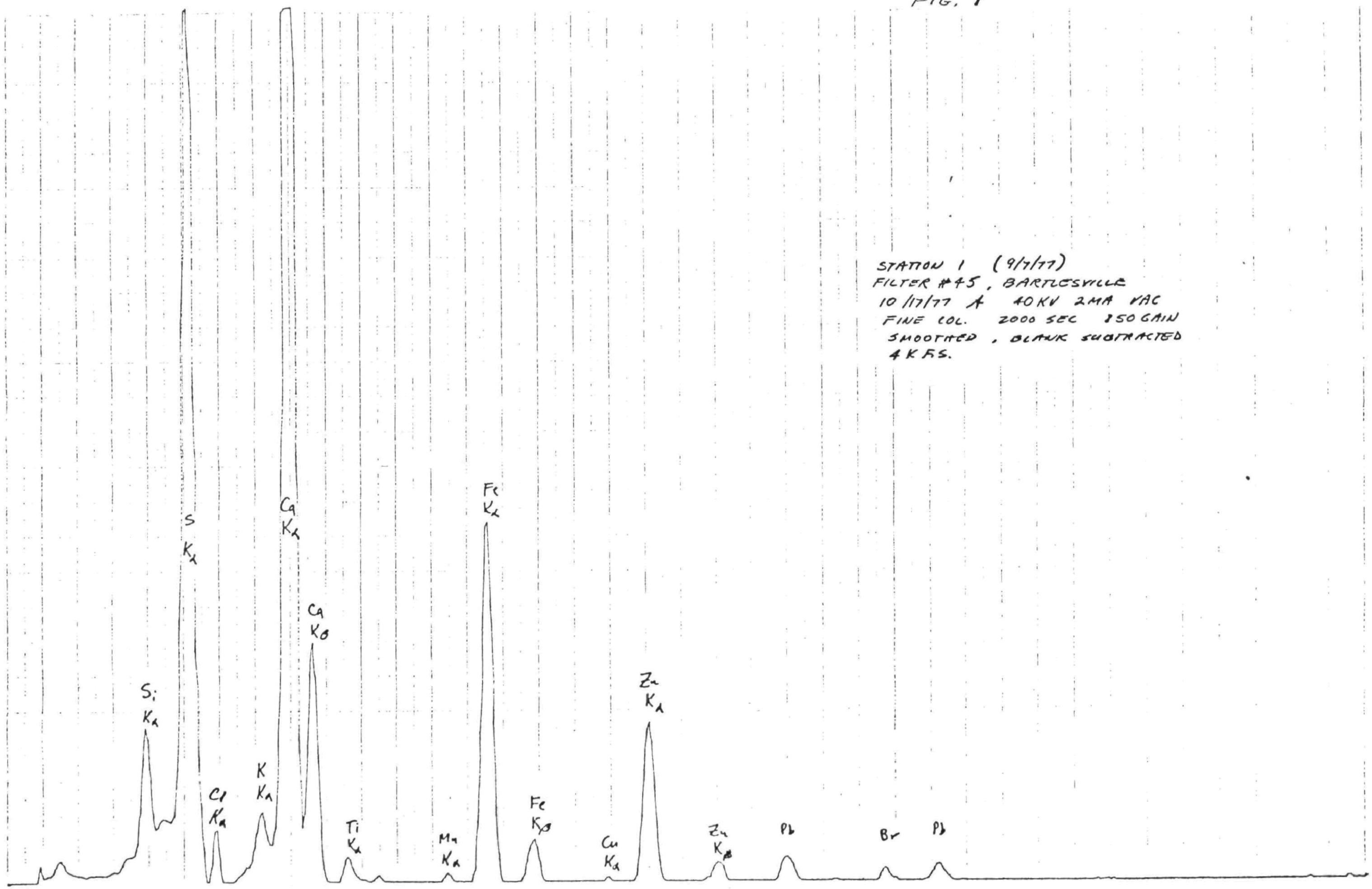

STATION 1 (9/7/77)
FILTER #45, BARTLESVILLE
10/17/77 A 40KV 2MA VAC
FINE COL. 2000 SEC 350 GAIN
SMOOTHED, BLANK SUBTRACTED
4K FS.
Si Kα
S Kα
Cl Kα
K Kα
Ca Kα
Ca Kβ
Ti Kα
Mn Kα
Fe Kα
Fe Kβ
Cu Kα
Zn Kα
Zn Kβ
Pb
Br
Pb

FIG. 2

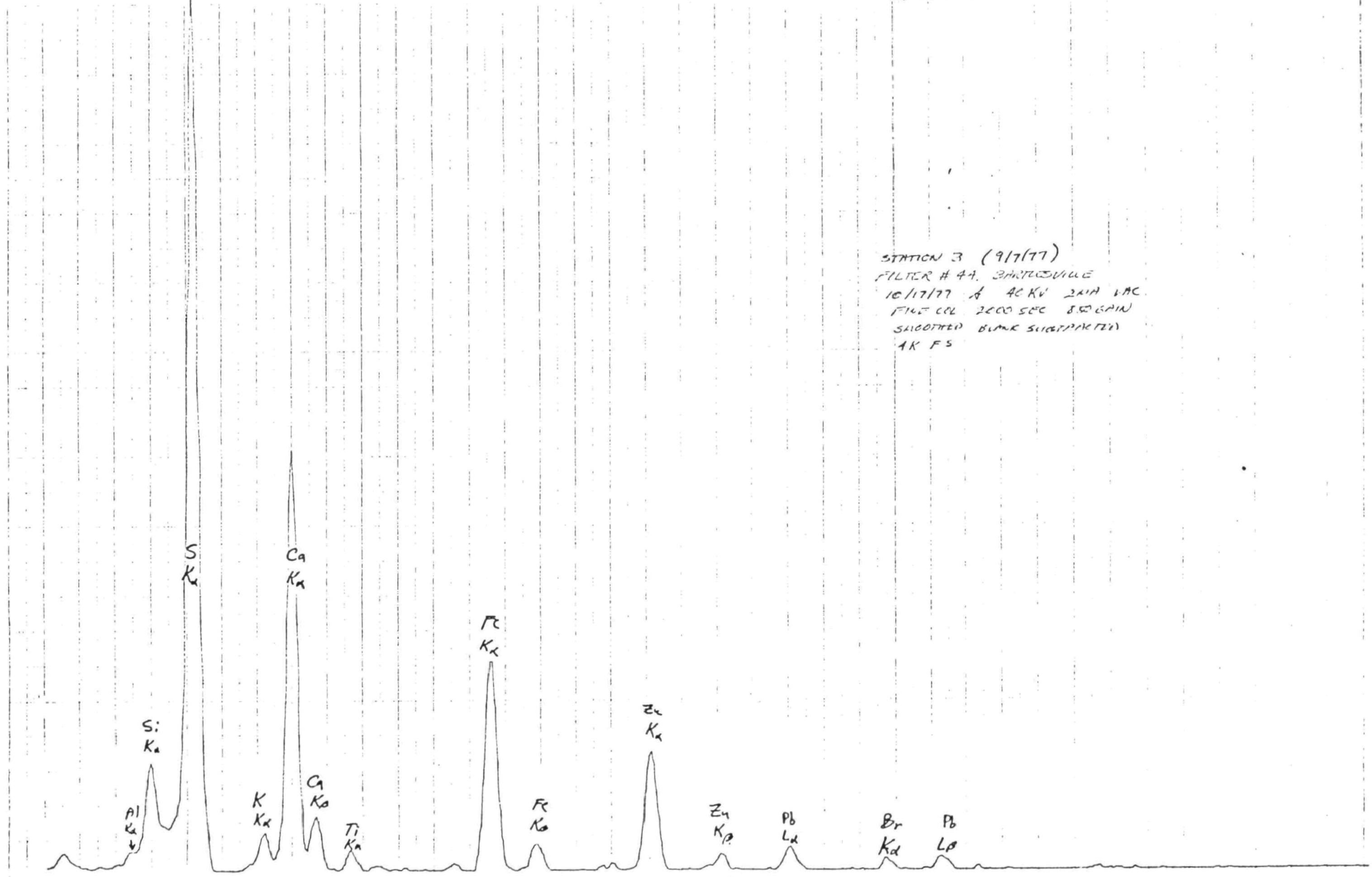
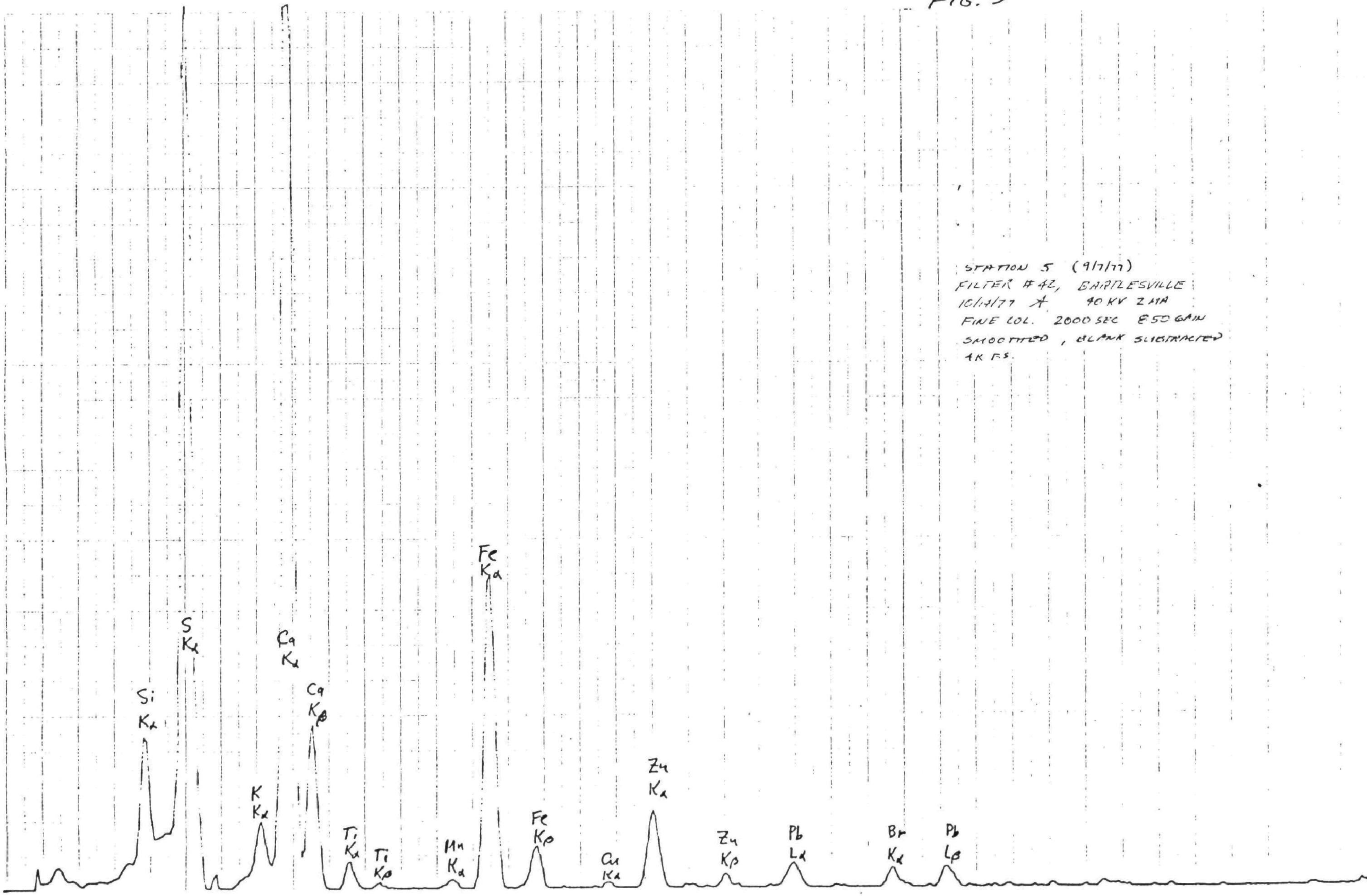

STATION 3 (9/7/77)
FILTER # 44. BARTLESVILLE
10/17/77 Ag 40 KV 2 MA VAC
2000 SEC
SMOOTHED BLANK SUBTRACTED
4K FS
Al Kα
Si Kα
S Kα
K Kα
Ca Kα
Ca Kβ
Ti Kα
Fe Kα
Fe Kβ
Zn Kα
Zn Kβ
Pb Lα
Br Kα
Pb Lβ

FIG. 3



STATION 5 (9/7/77)
FILTER #42, BARTLESVILLE
10/4/77 40 KV 2 MA
FINE COL. 2000 SEC E50 GAIN
SMOOTHED, BLANK SUBTRACTED
4K FS.
Si Kα
S Kα
K Kα
Ca Kα
Ca Kβ
Ti Kα
Ti Kβ
Mn Kα
Fe Kα
Fe Kβ
Cu Kα
Zn Kα
Zn Kβ
Pb Lα
Br Kα
Pb Lβ

APPENDIX E

METEOROLOGICAL DATA

CODE FOR FOLLOWING TABLES:

WS - Wind Speed (meters/sec)
T - Temperature (°F)
DP - Dew Point (°F)
WD - Wind Direction (°)
SG - Sigma (°)
P - Pressure (inches of Hg)

Station ID of 6011 is the same as Station 1

	Day	Hour	Min	Sec	
Time -	00	00	00	00	(Day 01 is July 28, 1977)

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SC			P
01 10:05:00 HR##C00	1.40	-29 97	-39.87	.05	04	.00	00	27 00
6011 01 11:00:00 HR	3 25	83 12	72 75	2.78	45.11	.00	00	29 51
6011 01 12:00:00 HR	4.91	86.06	72.70	34.60	31.45	.00	.00	29.51
6011 01 13:00:00 HR	4.77	88.23	70.28	31.67	36.33	.00	.00	29 51
6011 01 14:00:00 HR	4.48	90.38	69 38	43.89	42.27	.00	00	29 50
6011 01 15:00:00 HR	4.26	92.44	66.40	341.51	36.35	.00	.00	29.49
6011 01 16:00:00 HR	4.27	92.40	63.68	18.34	45.79	.00	.00	29 46
6011 01 17:00:00 HR	4 08	93.43	63.45	4 12	35.82	.00	.00	29 43
6011 01 18:00:00 HR	4.65	94.23	63.32	72.75	36.17	.00	.00	29.43
6011 01 19:00:00 HR	4.75	93 76	62.87	25 28	30.27	00	.00	29 43
6011 01 20:00:00 HR	4.67	91 83	64 13	99.85	22.69	00	.00	29 42
6011 01 21:00:00 HR	4.24	87.83	67.17	130.42	14.29	.00	.00	29 42
6011 01 22:00:00 HR	3 98	84.97	68.12	151.97	11.53	.00	.00	29 43
6011 01 23:00:00 HR	6.21	82.48	70.31	164.70	12.53	.00	.00	29 44
6011 02 00:00:00 HR	6.27	80.44	71.23	172.26	12.71	.00	.00	29.45
6011 02 01:00:00 HR	4 71	78.66	70.38	167.92	15.87	.00	.00	29 45
6011 02 02:00:00 HR	4.98	77 12	70 03	161.00	13.81	.00	.00	29 45
6011 02 03:00:00 HR	6.29	75.80	69.10	173.41	10.63	.00	.00	29.43
6011 02 04:00:00 HR	6.64	74.28	68.22	178 48	9.00	.00	.00	29.42
6011 02 05:00:00 HR	6 76	73.13	67.80	175.06	8.67	.00	.00	29 42
6011 02 06:00:00 HR	5.91	72.12	67.62	167.43	10.27	.00	.00	29.41
6011 02 07:00:00 HR	6 77	71.41	67.68	175.87	8 28	.00	00	29 42
6011 02 08:00:00 HR	8.05	72 63	68.23	178 42	7 45	.00	.00	29 42
6011 02 09:00:00 HR	6.67	76.35	69.40	170.79	11.19	.00	.00	29.43
6011 02 10:00:00 HR	8 30	80.70	70.10	187 50	10.81	.00	00	29.44
6011 02 11:00:00 HR	6.50	84.56	71.14	171.12	17 77	.00	.00	29.43
6011 02 12:00:00 HR	7.58	87.96	71.42	181.94	15.44	.00	.00	29.43
6011 02 13:00:00 HR	9.58	92 26	67.98	196 52	13.48	.00	.00	29.42
6011 02 14:00:00 HR	10 63	94.99	63 50	201.24	14.55	.00	.00	29.40
6011 02 15:00:00 HR	11.20	96.56	59.55	199.04	13.40	.00	.00	29.37
6011 02 16:00:00 HR	11.23	97.48	60.96	200.15	15.49	.00	.00	29 34
6011 02 17:00:00 HR	10 44	96.99	63.17	190 97	14.41	.00	.00	29 33
6011 02 18:00:00 HR	13.59	96.13	65.62	177.64	10.18	.00	.00	29.31
6011 02 19:00:00 HR	11.25	95 02	66.23	178.28	10 38	.00	.00	29 30
6011 02 20:00:00 HR	7 05	93.04	66.79	175 32	11.21	.00	00	29 32
6011 02 21:00:00 HR	10.09	85.85	62.81	63.02	22.84	.00	.00	29.36
6011 02 22:00:00 HR	11.87	74 07	60.81	31 76	20.31	00	.00	29 41
6011 02 23:00:00 HR	6 83	70 08	61 67	43.91	32.46	00	.00	29 46
6011 03 00:00:00 HR	9.52	68.91	63.13	186.26	16.42	.00	.00	29.44
6011 03 01:00:00 HR	12 80	69 68	63 14	182 70	9 52	00	.00	29 34
6011 03 02:00:00 HR	5 74	71.64	63.11	231 07	22 56	00	00	29 34
6011 03 03:00:00 HR	3.44	70.63	63.82	225.00	24.65	.00	.00	29.35
6011 03 04:00:00 HR	4 80	70.58	63.96	264 81	26.74	00	.00	29 37
6011 03 05:00:00 HR	3.44	69.51	63.68	352.93	19.30	.00	00	29 37
6011 03 06:00:00 HR	3.15	68.44	63.65	21.75	13.12	.00	.00	29.37
6011 03 07:00:00 HR	3.15	68.10	63.62	119.96	27.88	.00	00	29 40
6011 03 08:00:00 HR	4 01	69 57	64 50	126 78	16 34	00	.00	29 43
6011 03 09:00:00 HR	3.52	73.36	65.35	129.52	31.07	.00	.00	29.45
6011 03 10:00:00 HR	3.73	77.28	65.97	161.62	32.86	.00	.00	29 47
6011 03 11:00:00 HR	3.68	81.18	66.55	287.02	33.79	.00	.00	29.48
6011 03 12:00:00 HR	3.90	84.99	66.00	12.56	33.41	.00	.00	29.47
6011 03 13:00:00 HR	6.53	87.65	64 92	42.28	26.44	00	.00	29.47
6011 03 14:00:00 HR	8.08	90.05	64.49	28.89	21.44	.00	.00	29 47
6011 03 15:00:00 HR	9.07	88.89	63.64	31.02	18.44	.00	.00	29.46
6011 03 16:00:00 HR	8.97	82.69	64.07	4 99	15.44	.00	00	29 47
6011 06 08:00:00 HR	4.63	76.08	67.23	312.76	16.25	00	.00	29 49
6011 06 09:00:00 HR	2.75	72.52	66.56	164.28	15.08	.00	.00	29.50
6011 06 10:00:00 HR	6.16	72.98	66.47	357.81	17.33	.00	.00	29 54

6011	06	11:00:00 HR	8.80	69.54	63.52	97.45	20.95	.00	.00	29.51
6011	06	12:00:00 HR	7.23	73.47	64.46	165.78	25.26	.00	.00	29.49
6011	06	13:00:00 HR	7.42	81.78	65.45	176.29	12.69	.00	.00	29.40
6011	06	14:00:00 HR	10.72	88.91	64.91	188.23	14.01	.00	.00	29.46
6011	06	15:00:00 HR	14.36	90.98	64.48	203.65	13.74	.00	.00	29.44
6011	06	16:00:00 HR	11.61	93.29	62.00	217.54	14.73	.00	.00	29.43
6011	06	17:00:00 HR	9.08	93.05	64.42	194.02	16.26	.00	.00	29.42
6011	06	18:00:00 HR	5.92	90.08	67.10	153.65	16.10	.00	.00	29.41
6011	06	19:00:00 HR	5.89	87.20	67.99	131.61	17.02	.00	.00	29.40
6011	06	20:00:00 HR	5.10	86.13	68.87	146.61	13.21	.00	.00	29.39
6011	06	21:00:00 HR	4.73	85.65	66.19	155.96	11.96	.00	.00	29.39
6011	06	22:00:00 HR	4.90	82.91	65.72	161.99	13.45	.00	.00	29.41
6011	06	23:00:00 HR	5.28	80.63	66.88	153.84	14.34	.00	.00	29.42
6011	07	00:00:00 HR	7.46	79.46	66.84	171.06	13.35	.00	.00	29.42
6011	07	01:00:00 HR	9.32	78.50	65.67	171.42	11.10	.00	.00	29.42
6011	07	02:00:00 HR	10.41	77.18	64.45	179.24	9.45	.00	.00	29.39
6011	07	03:00:00 HR	10.10	77.51	63.41	180.19	8.28	.00	.00	29.38
6011	07	04:00:00 HR	8.45	73.66	62.82	195.63	8.94	.00	.00	29.38
6011	07	05:00:00 HR	10.13	78.35	62.39	180.52	9.43	.00	.00	29.39
6011	07	06:00:00 HR	9.62	76.81	62.90	109.64	21.75	.00	.00	29.44
6011	07	07:00:00 HR	9.21	73.78	64.69	22.05	20.14	.00	.00	29.53
6011	07	08:00:00 HR	5.26	71.22	63.46	64.19	27.79	.00	.00	29.53
6011	07	09:00:00 HR	5.72	68.96	62.89	44.01	31.48	.00	.00	29.57
6011	07	10:00:00 HR	4.80	68.00	61.97	58.66	37.02	.00	.00	29.55
6011	07	11:00:00 HR	5.83	70.62	61.80	166.37	23.27	.00	.00	29.53
6011	07	12:00:00 HR	8.89	74.88	63.98	157.09	14.92	.00	.00	29.49
6011	07	13:00:00 HR	9.06	80.17	65.65	162.15	14.54	.00	.00	29.47
6011	07	14:00:00 HR	12.35	80.89	65.07	178.56	13.01	.00	.00	29.42
6011	07	15:00:00 HR	15.62	84.58	67.00	176.31	12.47	.00	.00	29.40
6011	07	16:00:00 HR	15.14	89.58	65.02	173.41	11.11	.00	.00	29.38
6011	07	17:00:00 HR	17.31	91.51	62.82	186.21	10.27	.00	.00	29.37
6011	07	18:00:00 HR	15.31	91.75	62.79	184.93	10.03	.00	.00	29.37
6011	07	19:00:00 HR	12.57	91.00	62.99	166.48	11.10	.00	.00	29.37
6011	07	20:00:00 HR	8.97	88.55	62.68	167.07	13.61	.00	.00	29.38
6011	07	21:00:00 HR	8.82	85.95	61.28	163.88	13.93	.00	.00	29.39
6011	07	22:00:00 HR	9.94	84.02	62.19	174.83	11.36	.00	.00	29.41
6011	07	23:00:00 HR	10.61	82.82	59.86	170.81	12.13	.00	.00	29.42
6011	08	00:00:00 HR	10.47	81.60	59.42	177.84	11.85	.00	.00	29.47
6011	08	01:00:00 HR	11.93	80.01	60.14	178.50	11.61	.00	.00	29.44
6011	08	02:00:00 HR	9.04	78.22	61.50	173.22	11.34	.00	.00	29.42
6011	08	03:00:00 HR	8.05	76.80	62.78	171.32	12.54	.00	.00	29.41
6011	08	04:00:00 HR	7.55	76.02	64.13	184.44	9.56	.00	.00	29.41
6011	08	05:00:00 HR	7.32	75.40	64.47	186.19	12.15	.00	.00	29.44
6011	08	06:00:00 HR	3.33	75.15	64.69	198.19	15.89	.00	.00	29.49
6011	08	07:00:00 HR	3.15	74.39	64.62	150.26	11.22	.00	.00	29.49
6011	08	08:00:00 HR	3.49	74.25	65.18	152.6[illegible]	13.18	.00	.00	29.51
6011	08	09:00:00 HR	4.45	75.61	65.56	141.46	14.79	.00	.00	29.50
6011	08	10:00:00 HR	10.56	79.50	66.53	174.00	13.36	.00	.00	29.48
6011	08	11:00:00 HR	13.50	82.48	67.61	175.60	10.04	.00	.00	29.48
6011	08	12:00:00 HR	13.26	85.93	67.67	185.20	10.99	.00	.00	29.47
6011	08	13:00:00 HR	13.68	89.78	67.77	191.13	12.63	.00	.00	29.48
6011	08	14:00:00 HR	14.38	92.66	65.68	201.88	12.89	.00	.00	29.47
6011	08	15:00:00 HR	14.54	93.76	64.30	194.27	11.22	.00	.00	29.45
6011	08	16:00:00 HR	13.14	95.81	64.88	192.73	11.93	.00	.00	29.45
6011	08	17:00:00 HR	12.03	93.79	64.98	188.77	9.54	.00	.00	29.45
6011	08	18:00:00 HR	14.47	92.78	65.94	182.16	9.63	.00	.00	29.45
6011	08	19:00:00 HR	11.83	91.46	64.60	180.30	9.74	.00	.00	29.44
6011	08	20:00:00 HR	8.73	89.46	66.35	165.15	12.98	.00	.00	29.44
6011	08	21:00:00 HR	6.46	87.00	67.59	155.07	15.21	.00	.00	29.44
6011	08	22:00:00 HR	7.08	84.96	66.00	167.42	14.04	.00	.00	29.45

6011	08 23:00:00 HR	8.65	83.53	64.24	174.11	12.67	.00	.00	29.46
6011	09 00:00:00 HR	10.26	82.13	64.51	173.39	9.56	.00	.00	29.45
6011	09 01:00:00 HR	10.82	80.62	65.18	179.53	8.48	.00	.00	29.46
6011	09 02:00:00 HR	9.88	81.04	67.39	187.89	9.39	.00	.00	29.49
6011	09 03:00:00 HR	10.31	80.64	68.22	190.73	9.73	.00	.00	29.49
6011	09 04:00:00 HR	7.57	80.12	68.53	198.20	11.39	.00	.00	29.50
6011	09 05:00:00 HR	7.71	79.27	68.24	186.18	9.81	.00	.00	29.49
6011	09 06:00:00 HR	6.67	77.77	68.41	175.93	8.70	.00	.00	29.49
6011	09 07:00:00 HR	6.20	76.48	68.75	183.85	9.24	.00	.00	29.50
6011	09 08:00:00 HR	6.12	75.92	68.76	174.24	9.26	.00	.00	29.51
6011	09 09:00:00 HR	10.49	77.33	68.70	190.50	9.93	.00	.00	29.52
6011	09 10:00:00 HR	10.41	78.85	68.64	194.69	11.34	.00	.00	29.53
6011	09 11:00:00 HR	10.41	81.23	69.56	202.34	11.74	.00	.00	29.53
6011	09 12:00:00 HR	13.52	84.45	69.71	199.94	11.84	.00	.00	29.52
6011	09 13:00:00 HR	9.73	88.19	70.63	187.89	14.88	.00	.00	29.51
6011	09 14:00:00 HR	11.98	92.15	69.48	202.96	16.11	.00	.00	29.50
6011	09 15:00:00 HR	11.29	94.49	68.10	213.08	14.72	.00	.00	29.49
6011	09 16:00:00 HR	12.27	95.78	67.36	203.41	14.38	.00	.00	29.47
6011	09 17:00:00 HR	13.94	95.53	67.54	186.45	13.47	.00	.00	29.45
6011	09 18:00:00 HR	13.74	95.26	68.20	181.96	10.53	.00	.00	29.43
6011	09 19:00:00 HR	13.64	94.28	67.14	182.19	9.52	.00	.00	29.42
6011	09 20:00:00 HR	10.83	92.81	65.37	185.60	8.80	.00	.00	29.41
6011	09 21:00:00 HR	10.48	90.04	65.71	176.10	10.95	.00	.00	29.43
6011	09 22:00:00 HR	10.15	86.46	67.65	168.65	11.76	.00	.00	29.44
6011	09 23:00:00 HR	11.13	84.21	67.23	177.85	8.92	.00	.00	29.46
6011	10 00:00:00 HR	9.78	82.68	66.64	179.98	8.32	.00	.00	29.46
6011	10 01:00:00 HR	10.08	81.99	66.40	182.10	8.53	.00	.00	29.47
6011	10 02:00:00 HR	12.96	82.46	66.52	184.56	9.31	.00	.00	29.46
6011	10 03:00:00 HR	11.36	81.75	66.14	195.07	8.87	.00	.00	29.46
6011	10 04:00:00 HR	10.96	80.99	66.20	188.22	9.80	.00	.00	29.46
6011	10 05:00:00 HR	7.94	79.61	66.09	181.19	11.41	.00	.00	29.47
6011	10 06:00:00 HR	4.47	77.62	65.81	160.20	12.64	.00	.00	29.48
6011	10 07:00:00 HR	5.41	76.50	65.75	170.35	12.01	.00	.00	29.48
6011	10 08:00:00 HR	6.84	77.72	66.18	183.46	11.37	.00	.00	29.49
6011	10 09:00:00 HR	10.78	82.06	67.19	199.42	10.94	.00	.00	29.49
6011	10 10:00:00 HR	13.33	86.57	67.27	207.33	11.30	.00	.00	29.50

END OF FILE

AVERAGE TIME 60 MINUTES

ID		US	T	DP	VD	SG			
6011	10 11:00:00 HR	13 51	91 46	67 18	216 62	11 87	00	00	29 50
6011	10 12:00:00 HR	14 20	93 79	66 13	205 79	12 06	00	00	29 49
6011	10 13:00:00 HR	14.75	95 67	65 76	211.55	13 20	00	00	29 48
6011	10 14:00:00 HR	12 95	97 66	64 87	210 05	12 77	00	00	29 47
6011	10 15 00:00 HR	12 87	98 62	64 19	207 80	13 31	00	00	29 46
6011	10 16:00:00 HR	14 12	99 01	64 17	190.86	11 83	00	00	29 44
6011	10 17:00:00 HR	15 04	98 80	64 95	189 39	11 75	00	00	29 42
6011	10 18:00:00 HR	14 81	98 24	65 09	186 40	11 43	00	00	29 40
6011	10 19:00:00 HR	14 07	96 72	64 15	177 48	10 23	00	00	29 39
6011	10 20:00:00 HR	12 22	95 26	62 57	186 23	9 28	00	00	29 40
6011	10 21:00:00 HR	9 60	91 86	63 20	174 20	10 06	00	00	29 40
6011	10 22:00:00 HR	7 59	88.03	65.99	171 34	11.59	00	00	29 42
6011	10 23:00:00 HR	8 90	85 78	66 19	172 82	10 42	00	00	29 44
6011	11 00:00:00 HR	10 14	83 87	65 74	179 82	9 01	00	00	29 44
6011	11 01:00:00 HR	9 66	82 18	65 93	178.63	7 96	00	00	29 44
6011	11 02:00:00 HR	8 38	80 78	66 01	178 20	8 19	00	00	29 44
6011	11 03:00:00 HR	9 12	80 18	66 06	176 26	8 21	.00	00	29 44
6011	11 04:00:00 HR	7 77	79 64	65 96	175.20	9 41	00	00	29 44
6011	11 05:00:00 HR	7 40	78 39	65 93	171 32	11 90	00	00	29 44
6011	11 06:00:00 HR	7 04	77 79	66 10	172 01	12 32	00	00	29 44
6011	11 07:00:00 HR	5 44	77 21	66 40	157.85	16 20	00	00	29 44
HR8BCOOO	0075 2 M	16669 82	78 35	42 60	167 17	2 24	00	00	29 45
6011	11 08:00:00 HR	4 86	78 18	67 46	155 75	14 86	00	00	29 46
6011	11 09:00:00 HR	7 48	82 26	68.12	178 45	11 47	00	00	29.46
6011	11 10:00:00 HR	13 68	87 97	67.75	212 39	11 40	00	00	29 46
6011	11 11:00:00 HR	13 94	91 92	66 90	211 77	11 52	00	00	29 45
6011	11 12:00:00 HR	15 39	94 68	65 93	224 57	11 56	00	00	29 45
6011	11 13:00:00 HR	13 33	97 00	65 68	228 83	14 37	00	00	29 44
6011	11 14:00:00 HR	12 61	98 29	65 18	215 49	14 02	00	00	29 42
6011	11 15:00:00 HR	13 99	98.96	64.43	214.51	13 07	00	00	29 41
6011	11 16:00:00 HR	14 85	98 73	64 58	196 75	11 98	.00	00	29 39
6011	11 17:00:00 HR	14 14	98 19	63 76	190 54	11 72	00	00	29 37
6011	11 18:00:00 HR	13 67	98 79	62 74	192 21	12 00	00	00	29 35
6011	11 19:00:00 HR	13 19	97 77	61 99	185 59	9 97	00	00	29 34
6011	11 20:00:00 HR	10 76	95 66	61 76	179 22	9 46	00	00	29 34
6011	11 21:00:00 HR	11 46	93.05	60 97	183 37	8.53	00	00	29 35
6011	11 22:00:00 HR	9 10	90 08	60 09	177 42	9 93	00	00	29 36
6011	11 23:00:00 HR	6 86	85 96	61 76	166 23	12.47	00	.00	29 39
6011	12 00:00:00 HR	7 30	83 74	63 29	164 03	13 10	00	00	29 41
6011	12 01:00:00 HR	12 08	82 88	64 04	177 73	9 33	00	00	29 41
6011	12 02:00:00 HR	11 33	82 60	64 55	178 19	9 11	.00	00	29 41
6011	12 03:00:00 HR	10 36	81 68	64.24	183 11	8 70	00	00	29 39
6011	12 04:00:00 HR	9 61	79 08	64 36	177 84	9 08	00	00	29 38
6011	12 05:00:00 HR	9 20	77 43	64 80	180 28	8.39	.00	00	29 37
6011	12 06:00:00 HR	8 12	77 23	65 27	173 87	8 91	00	00	29 36
6011	12 07:00:00 HR	3 92	76 14	65 78	169 75	12 22	00	00	29 38
6011	12 08:00:00 HR	6 68	76 75	66 62	163 54	11 00	.00	00	29 39
6011	12 09:00:00 HR	10 19	82 19	67 90	181 91	10 95	00	00	29 41
6011	12 10:00:00 HR	13 66	87 95	67 22	213 00	10.79	00	00	29 40
6011	12 11:00:00 HR	12 09	92 08	66 84	212 25	10.96	.00	..00	29.40
6011	12 12:00:00 HR	15 37	95 27	65.83	214 39	13 69	00	00	29 40
6011	12 13:00:00 HR	14 53	97 00	65 07	215 55	11 66	00	00	29 38
6011	12 14:00:00 HR	14 53	98 71	64 85	204 40	13 02	00	00	29 35
6011	12 15:00:00 HR	15 20	99 33	64 12	207 23	11 15	00	00	29 34
6011	12 16:00:00 HR	15 15	100 37	63 73	209 39	12 34	00	00	29 32
6011	12 17:00:00 HR	11 57	100 50	63 08	207 51	11 57	00	00	29 31
6011	12 18:00:00 HR	11 23	100 28	62 40	217 68	11 15	00	00	29 31
6011	12 19:00:00 HR	14 48	99 37	61 82	213.42	10 49	00	00	29 30

6011	12 20:00:00	HR	9 80	97 36	61 11	200 17	9 46	00	00	29 30
6011	12 21:00:00	HR	10 13	94 64	60 76	181 22	8 51	00	00	29 32
6011	12 22:00:00	HR	4 73	91 81	60 67	210 75	17 72	00	00	29 33
6011	12 23:00:00	HR	2 75	86 40	64 08	145 81	26 97	00	00	29 36
6011	13 00:00:00	HR	6.95	86 78	60.62	198.18	10 73	00	00	29 37
6011	13 01:00:00	HR	8 47	86 10	61 72	198 92	9 57	00	00	29 38
6011	13 02:00:00	HR	8 46	84 50	62 79	202 40	8 60	00	00	29 39
6011	13 03:00:00	HR	6 33	83 62	63 60	202.59	9 81	00	00	29 40
6011	13 04:00:00	HR	4 99	82 71	63 89	213 36	12 44	00	00	29 40
6011	13 05:00:00	HR	4 77	81 48	64 32	212 43	14 28	00	.00	29 40
6011	13 06:00:00	HR	4 62	80 17	64 34	206 80	13 83	00	.00	29 42
6011	13 07:00:00	HR	4 54	78 88	64 65	177 45	7 48	00	00	29 43
6011	13 08:00:00	HR	2 34	78 68	65 86	116 93	14 46	00	00	29 45
6011	13 09:00:00	HR	3 94	81 52	67 08	358 19	20 52	00	00	29 47
6011	13 10:00:00	HR	5 92	85 99	66 31	251 55	23 49	00	00	29 48
6011	13 11:00:00	HR	8 20	89 75	64 91	257 48	18 85	00	00	29 48
6011	13 12:00:00	HR	7 38	92 76	65 34	265 48	21 10	00	00	29 48
6011	13 13:00:00	HR	6 30	95 88	65 24	269 10	30.52	00	00	29 47
6011	13 14:00:00	HR	6 01	97 95	64 11	223 79	35 41	00	00	29 45
6011	13 15:00:00	HR	6 87	98 58	62 52	216 47	27 56	00	00	29 43
6011	13 16:00:00	HR	5 99	99 80	61 81	185 29	32 57	.00	00	29 41
6011	13 17:00:00	HR	6 57	99 25	60 62	168 60	21 78	.00	00	29 38
6011	13 18:00:00	HR	7 43	97 42	61 51	162 01	14 03	00	00	29 37
6011	13 19:00:00	HR	7 82	91 83	64 07	188 40	28 17	00	00	29 36
6011	13 20:00:00	HR	4 70	83 45	64 75	357 74	23 26	00	00	29 39
6011	13 21:00:00	HR	7 89	85 82	65 89	185 56	21 97	00	00	29 41
6011	13 22:00:00	HR	6 22	86 62	64 82	205 21	12 96	.00	00	29 43
6011	13 23:00:00	HR	4 64	84 69	63 26	174 81	15 24	.00	00	29 45
6011	14 00:00:00	HR	3 08	82 83	63 67	170 43	22 47	00	00	29 46
6011	14 01:00:00	HR	3 60	80 53	65 13	149 30	18 52	00	00	29 46
6011	14 02:00:00	HR	3 38	78 71	63 97	143 63	26 08	00	00	29 46
6011	14 03:00:00	HR	4 40	76 78	67 43	34 03	14 59	00	00	29 46
6011	14 04:00:00	HR	5 85	75 68	68 78	46 61	16.06	00	00	29 46
6011	14 05:00:00	HR	5 65	74 73	67 18	63 77	36 75	00	.00	29 45
6011	14 06:00:00	HR	5 81	74 53	65 85	48 19	22 67	00	.00	29 45
6011	14 07:00:00	HR	8 10	73 43	65 35	22 87	13 96	00	.00	29 48
6011	14 08:00:00	HR	9 50	72 01	65 20	2 13	12 96	00	00	29 52
6011	14 09:00:00	HR	13 16	69 89	64 19	77	13 19	00	00	29 54
6011	14 10:00:00	HR	9 05	65 71	60 62	26 22	15 30	00	00	29 55
6011	14 11:00:00	HR	8 33	67 56	62 16	35 27	17 72	00	00	29 56
6011	14 12:00:00	HR	6 93	71 20	64 49	29 16	18 10	00	00	29 58
6011	14 13:00:00	HR	8 08	74 19	65 64	22 48	17 77	00	00	29 58
6011	14 14:00:00	HR	9 25	75 39	65 70	4 33	15 54	00	00	29 57
6011	14 15:00:00	HR	10 42	75 25	65 86	6 90	13 26	00	00	29 57
6011	14 16:00:00	HR	11 52	69 93	63 18	6 21	13 09	00	00	29 56
6011	14 17:00:00	HR	10 88	66 27	60 27	11 84	13 51	00	00	29 56
6011	14 18:00:00	HR	9 94	67 10	60 53	14 16	13 61	00	00	29 56
6011	14 19:00:00	HR	10 01	67 94	60 76	14 14	13 15	00	00	29 55
6011	14 20:00:00	HR	7 74	68 11	60 84	19 39	15 63	00	00	29 57
6011	14 21:00:00	HR	7 80	68 11	60 71	13 01	13 37	00	00	29 57
6011	14 22:00:00	HR	7 81	67 54	60 54	12 99	13 45	00	00	29 58
6011	14 23:00:00	HR	5 30	67 41	61 07	34 17	17.18	00	00	29 60
6011	15 00:00:00	HR	5 44	67 43	61 10	14 79	13 59	00	00	29 60
6011	15 01:00:00	HR	5 66	67 10	61 05	4 15	11 76	00	00	29 60
6011	15 02:00:00	HR	6 47	67 01	60 99	8 97	12 02	00	00	29 59
6011	15 03:00:00	HR	5.97	66 77	61 15	4 91	10.93	00	00	29.57
6011	15 04:00:00	HR	7 08	66 67	61 27	16 62	12 26	00	00	29 56
6011	15 05:00:00	HR	4 58	66 41	61 38	19 53	15 69	00	00	29 56
6011	15 06:00:00	HR	5 60	66 21	60 94	22 76	15.50	00	00	29 56
6011	15 07:00:00	HR	4 43	65 93	60 73	24 96	16 70	00	00	29 56

6011 15 08:00:00 HR	5.16	65.96	60.74	9.42	13.11	.00	.00	29.57
6011 15 09:00:00 HR	5.11	68.59	60.91	35.38	17.82	.00	.00	29.57
6011 15 10:00:00 HR	6.21	67.60	61.14	20.93	15.78	.00	.00	29.57
6011 15 11:00:00 HR	6.19	68.69	61.91	16.86	16.69	.00	.00	29.57
6011 15 12:00:00 HR	5.10	70.44	63.09	20.67	18.67	.00	.00	29.57
6011 15 13:00:00 HR	5.87	74.99	64.66	17.05	24.27	.00	.00	29.55
6011 15 14:00:00 HR	4.93	79.19	64.98	341.28	35.40	.00	.00	29.54
6011 15 15:00:00 HR	5.02	81.13	64.75	315.40	32.02	.00	.00	29.52
6011 15 16:00:00 HR	4.78	82.03	64.75	334.80	19.72	.00	.00	29.49
6011 15 17:00:00 HR	5.96	81.78	64.87	347.85	19.12	.00	.00	29.46
6011 15 18:00:00 HR	6.50	81.95	64.59	338.29	17.33	.00	.00	29.45
6011 15 19:00:00 HR	4.85	81.73	64.55	357.10	24.56	.00	.00	29.44
6011 15 20:00:00 HR	4.55	79.98	64.31	39.92	14.14	.00	.00	29.42
6011 15 21:00:00 HR	4.34	79.09	64.18	51.68	15.04	.00	.00	29.41
6011 15 22:00:00 HR	3.46	76.62	64.97	79.16	21.35	.00	.00	29.42
6011 15 23:00:00 HR	2.15	74.78	65.35	103.70	15.11	.00	.00	29.43
6011 16 00:00:00 HR	2.00	72.34	65.03	357.95	6.13	.00	.00	29.43
6011 16 01:00:00 HR	2.16	71.21	64.77	16.29	8.06	.00	.00	29.43
6011 16 02:00:00 HR	1.24	70.72	65.01	355.39	16.38	.00	.00	29.41
6011 16 03:00:00 HR	.95	70.56	65.10	227.44	8.42	.00	.00	29.41
6011 16 04:00:00 HR	1.97	70.04	64.83	134.04	20.54	.00	.00	29.39
6011 16 05:00:00 HR	1.88	69.98	64.95	145.60	8.39	.00	.00	29.38
6011 16 06:00:00 HR	1.95	71.15	66.07	156.32	10.52	.00	.00	29.38
6011 16 07:00:00 HR	3.01	71.47	66.81	136.26	13.06	.00	.00	29.38
6011 16 08:00:00 HR	5.61	72.10	67.43	174.98	10.56	.00	.00	29.39
6011 16 09:00:00 HR	5.40	74.17	69.15	162.33	13.93	.00	.00	29.39
6011 16 10:00:00 HR	6.25	77.96	70.82	180.17	15.34	.00	.00	29.39
6011 16 11:00:00 HR	3.58	78.50	71.59	165.65	19.62	.00	.00	29.40
6011 16 12:00:00 HR	8.70	75.09	70.77	328.81	12.04	.00	.00	29.41
6011 16 13:00:00 HR	5.58	73.68	70.01	355.74	15.39	.00	.00	29.41
6011 16 14:00:00 HR	4.74	73.71	69.55	90.02	21.24	.00	.00	29.42
6011 16 15:00:00 HR	4.27	73.17	69.54	138.84	23.93	.00	.00	29.40
6011 16 16:00:00 HR	5.35	74.65	68.85	106.74	30.09	.00	.00	29.38
6011 16 17:00:00 HR	5.29	77.72	68.79	141.59	30.76	.00	.00	29.37

END OF FILE

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SG			P
6011 16 18:00:00 HR	6.26	79.59	67.84	181.90	16.22	.00	.00	29.36
6011 16 19:00:00 HR	6.01	80.06	67.63	176.77	17.73	.00	.00	29.35
6011 16 20:00:00 HR	4.07	78.68	68.00	164.20	12.70	.00	.00	29.35
6011 16 21:00:00 HR	1.24	76.21	67.59	140.27	10.46	.00	.00	29.36
6011 16 22:00:00 HR	1.57	74.14	70.59	144.47	11.64	.00	.00	29.38
6011 16 23:00:00 HR	.95	72.15	70.33	154.03	11.84	.00	.00	29.39
6011 17 00:00:00 HR	.95	70.75	69.63	140.78	9.59	.00	.00	29.40
6011 17 01:00:00 HR	.95	72.02	69.29	108.07	10.89	.00	.00	29.41
6011 17 02:00:00 HR	.95	70.21	68.94	111.30	9.86	.00	.00	29.41
6011 17 03:00:00 HR	.95	73.72	68.28	33.15	15.88	.00	.00	29.41
6011 17 04:00:00 HR	.94	70.97	67.87	102.47	10.17	.00	.00	29.41
6011 17 05:00:00 HR	.95	69.01	67.82	141.59	15.80	.00	.00	29.41
6011 17 06:00:00 HR	.94	71.39	67.96	101.30	10.04	.00	.00	29.42
6011 17 07:00:00 HR	.95	71.81	67.63	43.54	8.50	.00	.00	29.43
6011 17 08:00:00 HR	1.71	73.07	68.46	92.04	16.99	.00	.00	29.44
6011 17 09:00:00 HR	2.77	74.13	69.89	147.65	19.37	.00	.00	29.45
6011 17 10:00:00 HR	4.65	76.73	70.32	159.97	16.50	.00	.00	29.45
6011 17 11:00:00 HR	4.76	81.02	72.11	153.71	18.89	.00	.00	29.45
6011 17 12:00:00 HR	4.92	84.75	73.07	161.62	19.52	.00	.00	29.46
6011 17 13:00:00 HR	5.89	88.00	73.78	167.36	18.92	.00	.00	29.45
6011 17 14:00:00 HR	5.50	91.76	73.03	180.99	28.48	.00	.00	29.45
6011 17 15:00:00 HR	4.80	93.43	73.50	168.70	24.48	.00	.00	29.44
6011 17 16:00:00 HR	5.92	92.02	73.78	162.23	16.23	.00	.00	29.41

6011	17 17:00:00	HR	11 10	78 39	68 09	276 46	16 46	00	00	29 40
6011	17 18 00 00	HR	5 12	72 86	68 02	203 94	19.38	00	.00	29 39
6011	17 19:00 00	HR	9 47	73 97	69 36	219 2[illegible]	14 27	00	00	29 40
6011	17 20:00:00	HR	10 29	79 11	67 74	8 45	16 84	00	00	29 47
6011	17 21:00 00	HR	7 78	78 23	68 40	67 59	28.63	.00	.00	29 50
6011	17 22 00:00	HR	9 77	73 35	69 08	119 12	28 76	00	00	29 49
6011	17 23:00 00	HR	8 05	71 57	67 70	123 73	15 59	00	00	29 49
6011	18 00:00:00	HR	2 94	70 10	68 41	167 56	14.22	.00	00	29.48
6011	18 01:00:00	HR	4 74	69 97	67 68	193 92	8 81	00	00	29 48
6011	18 02:00 00	HR	2 33	69 34	68 52	200 23	16 98	00	00	29 48
6011	18 03:00:00	HR	1.51	68.12	68.70	200.34	15.17	.00	.00	29.48
6011	18 04:00:00	HR	3 17	73 92	67 64	31 35	20 56	00	00	29 49
6011	18 05:00:00	HR	4 30	79 90	66 47	39 00	9 23	00	00	29 50
6011	18 06:00:00	HR	3 26	77.35	66.07	45 76	12.38	.00	00	29.51
6011	18 07:00:00	HR	1 31	67 80	67 01	110 29	18 77	00	00	29 52
6011	18 08:00:00	HR	1 53	68 91	68 09	127 96	19 56	00	00	29 54
6011	18 09:00:00	HR	4.68	72.90	67.86	150 16	17.77	.00	.00	29.55
6011	18 10:00:00	HR	5 53	76 83	69 81	160 53	17 08	00	00	29 56
6011	18 11:00:00	HR	5 36	81 00	72 05	182 23	16 80	00	00	29 56
6011	18 12:00:00	HR	6.48	85 29	73 49	169 81	16.05	.00	.00	29.56
6011	18 13:00:00	HR	7 30	88 40	73 59	179 94	16 25	.00	00	29 55
6011	18 14:00:00	HR	7 55	90 35	73 26	175 35	16 15	.00	00	29 53
6011	18 15:00:00	HR	7 64	91 74	72 36	172 30	17 32	.00	.00	29.52
6011	18 16:00:00	HR	7 74	92 73	71 76	172 23	16 15	00	00	29 50
6011	18 17:00:00	HR	6 83	92 99	70 43	177 42	17 48	00	00	29 48
6011	18 18:00:00	HR	8 22	92 08	70 85	174 21	14.26	.00	.00	29.47
6011	18 19:00:00	HR	9 27	90 65	71 32	174 52	11 64	00	00	29 45
6011	18 20:00:00	HR	5 72	88 60	71 46	169 20	14 15	00	00	29 43
6011	18 21:00:00	HR	6 11	85 17	71 25	169 87	11 99	.00	.00	29 42
6011	18 22:00:00	HR	6 39	83 06	71 75	163 05	13 24	00	00	29 43
6011	18 23:00 00	HR	5 70	81 08	72 53	167 69	11 54	00	00	29 44
6011	19 00:00:00	HR	5 60	79 45	72 99	176.22	10.83	.00	.00	29.42
6011	19 01:00:00	HR	4 48	78 66	72 17	172 35	11 04	.00	00	29 45
6011	19 02:00:00	HR	3 00	77 25	71 54	186 06	7.31	00	.00	29 45
6011	19 03:00:00	HR	3 86	76 80	70 75	184 93	10.01	.00	.00	29.45
6011	19 04:00 00	HR	3 40	76 45	70 91	186 49	9 02	00	00	29 44
6011	19 12:00:00	HR	5 42	83 31	72 61	176 14	15.64	00	00	29 48
6011	19 13:00:00	HR	8 78	89.38	74.33	187.64	14.14	.00	.00	29.49
6011	19 14:00:00	HR	9 58	93 17	73 46	209 64	16 81	00	00	29 48
6011	19 15:00:00	HR	7 13	97 16	72 29	225 70	18 52	.00	00	29 47
6011	19 16:00:00	HR	7.33	97.29	71.92	223.91	15.93	.00	.00	29.46
6011	19 17:00:00	HR	6 01	98 82	72 00	225 81	22 28	00	00	29 44
6011	19 18 00:00	HR	3 90	99 19	72 18	137 52	23 59	.00	.00	29 43
6011	19 19:00:00	HR	5.15	103.36	72.59	72 44	26.48	.00	00	29.42
6011	19 20:00:00	HR	10 25	85 33	71 65	128 71	21 54	00	00	29 42
6011	19 21:00:00	HR	10 62	76 30	72 28	171 61	14 87	00	.00	29 45
6011	19 22:00:00	HR	4.67	77.28	71.79	52.11	20.52	.00	.00	29.46
6011	19 23:00:00	HR	3 50	81 76	73 25	33 16	16 90	00	00	29 48
6011	20 00:00:00	HR	2 86	75 21	73 68	147 73	20 90	00	00	29 47
6011	20 01:00:00	HR	3 97	80 08	73 66	8 34	14.55	.00	.00	29.48
6011	20 02:00:00	HR	4 18	84 86	73 37	40 61	15 52	00	00	29 49
6011	20 03:00:00	HR	4 25	84 69	73 85	22 07	13 85	00	.00	29 48
6011	20 04:00:00	HR	6 51	84 62	72 80	11.83	13.58	.00	.00	29 49
6011	20 05:00 00	HR	8 50	81 66	73 70	37 83	18 95	00	00	29 51
6011	20 06:00:00	HR	6 53	78 72	72 92	30 24	15 91	00	00	29 52
6011	20 07:00:00	HR	7 49	77 02	71 91	15 02	16.84	.00	.00	29 53
6011	20 08:00:00	HR	5 35	77 18	71 99	34 11	15 51	00	00	29 56
6011	20 09:00:00	HR	7 53	79 62	71 14	.43 56	17 15	00	00	29 55
6011	20 10:00:00	HR	7.06	80.14	71.36	48 36	18.31	.00	.00	29.56
6011	20 11:00:00	HR	5 97	81 02	72 35	25 26	17 01	00	00	29 58

6011	20 12:00:00 HR	7 47	81 32	70 44	14 41	17 50	00	00	[illegible]
6011	20 13:00:00 HR	9 54	81 51	67 47	12 04	14 18	00	00	[illegible]
6011	20 14:00:00 HR	9 85	82 75	67 27	5 50	13 99	00	00	29 60
6011	20 15:00:00 HR	7 67	86 38	67 07	15 60	14 50	00	00	29 60
6011	20 16:00:00 HR	9 57	87 97	66 16	14 64	14 87	00	00	29 58
6011	20 17:00:00 HR	8 10	90 67	65 55	11 42	16 54	00	00	29 57
6011	20 18:00:00 HR	6 95	91 64	65 11	15 48	17 09	00	00	29 57
6011	20 19:00:00 HR	7 13	92 28	64 01	36 79	17 25	00	00	29 56
6011	20 20:00:00 HR	5 59	90 28	63 75	34 98	14 77	00	00	29 55
6011	20 21:00:00 HR	3 25	81 76	64 25	23 62	10 54	00	00	29 56
6011	20 22:00:00 HR	3 01	76 38	64 40	23 83	10 58	00	00	29 58
6011	20 23:00:00 HR	3 45	76 34	63 22	23 58	10 48	.00	00	29 60
6011	21 00:00:00 HR	4 29	78 18	61 78	33 86	12 76	00	00	29 60
6011	21 01:00:00 HR	3 85	74 37	60 56	28 34	11 07	00	00	29 61
6011	21 02:00:00 HR	3 56	73 24	59 60	16 90	9 54	00	00	29 62
6011	21 03:00:00 HR	3 68	72 40	59 18	26 73	9 50	.00	00	29 61
6011	21 04:00:00 HR	4 52	73 07	58 85	33 13	10 90	00	00	29 60
6011	21 05:00:00 HR	4 15	72 90	58 51	24 33	11 35	00	00	29 59
6011	21 06:00:00 HR	2 82	68 78	58 31	11 19	8 57	.00	00	29 58
6011	21 07:00:00 HR	3 82	70 52	58 40	19 99	9 62	00	00	29 58
6011	21 08:00:00 HR	4 50	74 22	58 66	24 55	13 03	00	00	29 60
6011	21 09:00:00 HR	4 50	77 20	59 93	65 74	20 06	00	00	29 62
6011	21 10:00:00 HR	4 86	75 02	59 85	103 50	26 99	.00	00	29 62
6011	21 11:00:00 HR	5 57	78 30	59 06	107 06	30 18	.00	00	29 62
6011	21 12:00:00 HR	5 51	79 82	57 72	121 36	26 68	.00	00	29 62
6011	21 13:00:00 HR	6.16	82 02	58.46	111 75	35 52	.00	00	29 61
6011	21 14:00:00 HR	5 29	83 13	58 53	98 68	36 99	.00	00	29 59
6011	21 15:00:00 HR	5 30	81 90	57 99	110 41	27 30	00	00	29 57
6011	21 16:00:00 HR	2 27	80 04	58 21	103 89	37 54	00	00	29 55
6011	21 17:00:00 HR	3 04	79 02	59 26	60 13	30 42	00	00	29 54
6011	21 18:00:00 HR	4 06	78 12	60 05	56 41	18 87	00	00	29 53
6011	21 19:00:00 HR	4 23	77 18	60 89	49 54	15 43	00	00	29 52
6011	21 20:00:00 HR	3 71	75 40	62 48	35 17	14 16	.00	00	29 51
6011	21 21:00:00 HR	3 42	74 33	63 21	47 43	14 24	00	00	29 51
6011	21 22:00:00 HR	4 49	73 74	62 23	60 46	26 51	00	00	29 51
6011	21 23:00:00 HR	2 47	71 46	62 08	26 56	18 42	00	00	29 53
6011	22 00:00:00 HR	3 98	69 78	62 11	56 06	18 69	00	00	29 53
6011	22 01:00:00 HR	4 03	66 67	62 07	67 13	22 08	00	00	29 52
6011	22 02:00:00 HR	5 31	66 85	62 16	109 30	28 60	.00	00	29 51
6011	22 03:00:00 HR	4 60	66 36	61 52	46 68	19 74	.00	00	29 50
6011	22 04:00:00 HR	5 15	65 26	61 74	45 18	17 09	00	00	29 48
6011	22 05:00:00 HR	3 53	64 83	61 95	31 89	34 60	00	00	29 48
6011	22 06:00:00 HR	4 93	64 18	61 54	39 77	16 25	00	00	29 49
6011	22 07:00:00 HR	4 95	64 26	61 92	55.16	10015 69	00	.00	3404 29
6011	22 09:00:00 HR	5 91	65 75	63 49	128 70	17.98	00	00	29 51
6011	22 10:00:00 HR	3 84	66 54	63 74	84 22	20 92	00	00	29 51
6011	22 11:00:00 HR	3 63	66 48	64 43	97 28	21 21	00	.00	29 52
6011	22 12:00:00 HR	5 02	66 69	64 34	137 34	14 77	.00	00	29 53
6011	22 13:00:00 HR	5 02	66 83	64 28	153 64	19 90	00	00	29 51
6011	22 14:00:00 HR	3 65	67 36	64 72	150 03	19 31	00	00	29 51
6011	22 15:00:00 HR	4 63	67 43	64 98	150 77	16 28	00	00	29 50
6011	22 16:00:00 HR	5 02	68 58	66 53	134 20	16 20	00	00	29 49
6011	22 17:00:00 HR	4 89	69 79	67 72	130 65	18 19	00	00	29 48
6011	22 18:00:00 HR	3 23	70 59	68 94	119 84	18 40	00	00	29 48
6011	22 19:00:00 HR	3 49	70 51	68 48	116 31	15 42	00	00	29 48
6011	22 20:00:00 HR	2.83	69.98	68 52	98 16	15 68	00	00	29.48
6011	22 21:00:00 HR	2 15	69 32	67 99	93 37	14 56	00	00	29 48
6011	22 22:00:00 HR	2 60	69 70	67 64	52 29	10 21	.00	00	29 50
6011	22 23:00:00 HR	2 17	69 43	67 57	29 09	12 07	00	00	29 50
6011	23 00:00:00 HR	1 97	69 16	68 01	66 46	10 82	00	00	29 51

6011 23 01:00:00 HR	2.52	69.02	66.82	36.97	6.87	.00	.00	29.51
6011 23 02:00:00 HR	1.62	69.72	67.46	77.86	7.81	.00	.00	29.51
6011 23 03:00:00 HR	2.31	68.89	67.31	49.14	18.96	.00	.00	29.50
6011 23 04:00:00 HR	2.10	68.86	67.38	106.14	21.13	.00	.00	29.50
6011 23 05:00:00 HR	2.25	68.95	67.30	106.10	15.63	.00	.00	29.50
6011 23 06:00:00 HR	2.57	68.86	66.52	78.01	9.25	.00	.00	29.50
6011 23 07:00:00 HR	3.73	69.15	65.30	181.40	6.36	.00	.00	29.51

END OF FILE.

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SG			P
6011 23 08:00:00 HR	5.54	68.94	64.56	192.70	8.48	.00	.00	29.51
6011 23 09:00:00 HR	4.37	70.65	63.47	179.39	13.12	.00	.00	29.52
6011 23 10:00:00 HR	4.80	74.21	63.84	174.78	15.08	.00	.00	29.52
6011 23 11:00:00 HR	5.06	77.49	62.31	173.9	16.94	.00	.00	29.54
6011 23 12:00:00 HR	3.79	80.45	63.46	190.40	27.59	.00	.00	29.55
6011 23 13:00:00 HR	4.35	82.32	63.98	190.74	38.55	.00	.00	29.54
6011 23 14:00:00 HR	4.15	82.61	63.74	153.26	36.35	.00	.00	29.52
6011 23 15:00:00 HR	5.81	82.59	64.58	190.76	23.25	.00	.00	29.51
6011 23 16:00:00 HR	4.95	82.79	64.67	179.04	23.79	.00	.00	29.49
6011 23 17:00:00 HR	5.33	82.36	64.50	190.29	18.28	.00	.00	29.47
6011 23 18:00:00 HR	6.97	82.26	64.88	174.65	12.70	.00	.00	29.45
6011 23 19:00:00 HR	6.83	81.16	64.62	176.45	12.13	.00	.00	29.44
6011 23 20:00:00 HR	5.46	78.49	65.23	171.28	11.19	.00	.00	29.42
6011 23 21:00:00 HR	4.36	74.74	65.84	169.66	11.56	.00	.00	29.43
6011 23 22:00:00 HR	4.08	72.65	66.45	187.76	5.73	.00	.00	29.45
6011 23 23:00:00 HR	3.22	71.39	66.22	177.48	6.27	.00	.00	29.45
6011 24 00:00:00 HR	3.06	69.93	65.54	157.33	6.80	.00	.00	29.45
6011 24 01:00:00 HR	2.98	68.81	65.30	155.70	9.43	.00	.00	29.44
6011 24 02:00:00 HR	3.85	69.50	65.67	189.30	6.08	.00	.00	29.42
6011 24 03:00:00 HR	2.67	69.26	66.11	225.60	15.48	.00	.00	29.41
6011 24 04:00:00 HR	3.50	68.43	65.45	199.64	11.56	.00	.00	29.42
6011 24 05:00:00 HR	3.54	68.02	65.31	161.27	16.36	.00	.00	29.41
6011 24 06:00:00 HR	2.61	67.00	64.81	69.99	17.75	.00	.00	29.41
6011 24 07:00:00 HR	2.98	66.34	64.25	66.77	11.32	.00	.00	29.42
6011 24 08:00:00 HR	3.27	66.53	64.47	194.60	10.41	.00	.00	29.42
6011 24 11:40:00 HR	4.86	77.90	69.05	247.04	22.54	.00	.00	29.44
6011 24 12:00:00 HR	4.51	84.07	69.23	244.64	22.00	.00	.00	29.45
6011 24 13:00:00 HR	5.01	85.72	69.43	216.47	23.12	.00	.00	29.43
6011 24 14:00:00 HR	4.31	87.46	68.36	245.78	30.12	.00	.00	29.42
6011 24 15:00:00 HR	5.24	89.08	67.95	210.32	31.72	.00	.00	29.40
6011 24 16:00:00 HR	4.45	89.84	66.75	299.88	30.33	.00	.00	29.39
6011 24 17:00:00 HR	5.20	90.31	66.48	314.46	22.90	.00	.00	29.38
6011 24 18:00:00 HR	4.90	90.44	65.70	337.98	20.92	.00	.00	29.38
6011 24 19:00:00 HR	4.02	88.50	65.42	23.68	19.38	.00	.00	29.36
6011 24 20:00:00 HR	1.98	86.06	65.29	341.80	21.32	.00	.00	29.37
6011 24 21:00:00 HR	2.40	79.56	66.23	127.11	15.36	.00	.00	29.37
6011 24 22:00:00 HR	1.95	75.80	69.46	191.47	6.35	.00	.00	29.39
6011 24 23:00:00 HR	1.34	73.24	69.26	192.48	12.76	.00	.00	29.40
6011 25 00:00:00 HR	2.11	71.85	68.60	334.33	10.14	.00	.00	29.40
6011 25 01:00:00 HR	1.75	70.75	67.75	121.29	11.93	.00	.00	29.40
6011 25 02:00:00 HR	2.80	70.29	67.47	237.85	11.17	.00	.00	29.40
6011 25 03:00:00 HR	2.22	69.51	67.42	296.90	23.56	.00	.00	29.40
6011 25 04:00:00 HR	2.68	68.89	66.58	286.84	9.54	.00	.00	29.40
6011 25 05:00:00 HR	2.42	67.93	65.82	154.59	15.98	.00	.00	29.40
6011 25 06:00:00 HR	1.61	67.36	65.70	316.74	9.35	.00	.00	29.40
6011 25 07:00:00 HR	1.85	66.84	64.77	195.78	9.15	.00	.00	29.40
6011 25 08:00:00 HR	2.26	67.93	66.07	49.43	18.65	.00	.00	29.41
6011 25 09:00:00 HR	3.69	72.01	67.79	25.02	16.69	.00	.00	29.41
6011 25 10:00:00 HR	3.04	77.47	69.62	134.96	26.18	.00	.00	29.43
6011 25 11:00:00 HR	3.36	83.61	71.61	163.79	29.11	.00	.00	29.43

6011	25 12:00:00 HR	6.78	84.81	70.60	173.31	15.90	.00	.00	29.42
6011	25 13:00:00 HR	9.11	86.41	69.54	167.96	17.21	.00	.00	29.40
6011	25 14:00:00 HR	7.49	87.22	69.28	181.90	14.94	.00	.00	29.39
6011	25 15:00:00 HR	7.36	87.97	69.62	155.23	17.14	.00	.00	29.37
6011	25 16:00:00 HR	7.89	88.25	69.49	157.87	18.96	.00	.00	29.35
6011	25 17:00:00 HR	7.83	87.97	68.80	169.15	15.68	.00	.00	29.32
6011	25 18:00:00 HR	7.42	88.21	68.98	155.41	16.29	.00	.00	29.30
6011	25 19:00:00 HR	7.32	87.15	67.76	147.28	15.65	.00	.00	29.28
6011	25 20:00:00 HR	5.35	84.31	67.82	142.89	13.87	.00	.00	29.28
6011	25 21:00:00 HR	4.68	80.74	67.99	143.67	13.59	.00	.00	29.28
6011	25 22:00:00 HR	5.37	78.62	68.67	158.17	11.37	.00	.00	29.27
6011	25 23:00:00 HR	4.64	77.64	68.82	152.54	14.14	.00	.00	29.28
6011	26 00:00:00 HR	2.60	78.01	69.12	137.93	19.00	.00	.00	29.30
6011	26 01:00:00 HR	8.03	74.80	66.31	16.32	22.23	.00	.00	29.33
6011	26 02:00:00 HR	5.76	69.23	66.02	92.32	21.12	.00	.00	29.33
6011	26 03:00:00 HR	9.72	70.30	67.39	144.32	20.37	.00	.00	29.24
6011	26 04:00:00 HR	6.33	71.14	68.57	161.6	29.61	.00	.00	29.26
6011	26 05:00:00 HR	3.11	70.46	68.65	117.62	15.48	.00	.00	29.27
6011	26 06:00:00 HR	3.46	69.87	67.86	163.46	10.30	.00	.00	29.28
6011	26 07:00:00 HR	1.72	69.20	67.72	148.94	11.01	.00	.00	29.28
6011	26 08:00:00 HR	3.48	69.56	68.42	176.87	9.96	.00	.00	29.30
6011	26 09:00:00 HR	4.40	72.26	69.47	151.48	19.59	.00	.00	29.33
6011	26 10:00:00 HR	4.01	75.46	68.71	173.64	16.83	.00	.00	29.35
6011	26 11:00:00 HR	4.37	78.70	68.17	253.05	21.90	.00	.00	29.36
6011	26 12:00:00 HR	5.27	81.00	69.32	257.85	26.39	.00	.00	29.34
6011	26 13:00:00 HR	4.34	83.30	70.01	257.63	25.60	.00	.00	29.33
6011	26 14:00:00 HR	4.05	84.95	70.16	237.30	30.24	.00	.00	29.32
6011	26 15:00:00 HR	4.54	86.25	70.61	195.36	33.65	.00	.00	29.31
6011	26 16:00:00 HR	3.85	87.34	71.58	150.16	38.48	.00	.00	29.30
6011	26 17:00:00 HR	4.56	88.53	71.55	6.37	25.19	.00	.00	29.30
6011	26 18:00:00 HR	5.75	89.71	70.53	349.93	16.78	.00	.00	29.31
6011	26 19:00:00 HR	4.81	88.59	71.10	24.46	15.32	.00	.00	29.31
6011	26 20:00:00 HR	3.77	86.56	71.32	48.94	14.76	.00	.00	29.31
6011	26 21:00:00 HR	3.12	84.19	71.34	71.86	15.50	.00	.00	29.31
6011	26 22:00:00 HR	2.23	81.80	72.22	107.68	18.63	.00	.00	29.34
6011	26 23:00:00 HR	2.01	79.49	72.55	353.60	12.91	.00	.00	29.36
6011	27 00:00:00 HR	4.17	77.48	71.91	20.33	9.80	.00	.00	29.37
6011	27 01:00:00 HR	5.00	75.48	70.30	28.95	14.50	.00	.00	29.38
6011	27 02:00:00 HR	5.30	74.18	68.74	30.14	13.73	.00	.00	29.38
6011	27 03:00:00 HR	3.59	73.39	68.44	10.75	10.80	.00	.00	29.39
6011	27 04:00:00 HR	3.35	72.80	67.97	27.25	13.58	.00	.00	29.39
6011	27 05:00:00 HR	4.95	72.95	67.92	13.58	11.42	.00	.00	29.41
6011	27 06:00:00 HR	5.12	72.33	67.40	19.12	13.14	.00	.00	29.42
6011	27 07:00:00 HR	4.70	71.32	67.04	34.09	14.83	.00	.00	29.42
6011	27 08:00:00 HR	4.91	71.87	67.02	18.59	14.00	.00	.00	29.44
6011	27 09:00:00 HR	5.09	73.68	67.73	23.23	17.48	.00	.00	29.46
6011	30 15:35:00 HR	12.81	83.00	68.68	110.03	13.71	.00	.00	29.39
6011	30 16:00:00 HR	14.42	90.38	68.28	168.53	9.58	.00	.00	29.30
6011	30 17:00:00 HR	15.45	91.38	68.29	187.00	10.10	.00	.00	29.29
6011	30 18:00:00 HR	14.59	91.29	68.32	182.74	9.67	.00	.00	29.28
6011	30 19:00:00 HR	14.52	89.43	68.61	173.42	10.37	.00	.00	29.28
6011	30 20:00:00 HR	11.39	87.40	68.54	173.05	10.98	.00	.00	29.28
6011	30 21:00:00 HR	8.86	85.95	67.42	176.00	9.32	.00	.00	29.32
6011	30 22:00:00 HR	8.77	84.10	67.65	158.47	13.03	.00	.00	29.35
6011	30 23:00:00 HR	12.37	82.62	68.46	170.26	11.85	.00	.00	29.36
6011	31 00:00:00 HR	13.54	81.06	68.59	176.32	11.40	.00	.00	29.35
6011	31 01:00:00 HR	16.50	80.43	68.30	181.86	9.47	.00	.00	29.36
6011	31 02:00:00 HR	12.37	79.61	66.81	184.29	8.64	.00	.00	29.38
6011	31 03:00:00 HR	13.86	77.78	66.93	183.68	9.34	.00	.00	29.37
6011	31 04:00:00 HR	13.45	76.70	67.48	169.56	11.38	.00	.00	29.34

6011 31 05:00:00 HR	12 20	76 24	67 69	177 39	9 97	00	00	29 36
6011 31 06:00:00 HR	8.63	76.17	67.69	178.29	9.79	.00	.00	29 38
6011 31 07:00:00 HR	6 08	76 10	67 89	175 66	10 26	00	00	29 42
6011 31 08:00:00 HR	5 22	75 50	68 55	169 10	12 70	00	00	29 44
6011 31 09:00:00 HR	15.60	65.72	60 85	8.52	20.74	.00	00	29 50
6011 31 10:00:00 HR	10 90	62 34	57 90	32 76	16 29	00	00	29 52
6011 31 11:00:00 HR	11 07	62 47	58 23	40 00	18 15	00	00	29 53
6011 31 12:00:00 HR	6 16	62 30	58 33	51.74	19.41	.00	00	29 56
6011 31 13:00:00 HR	6 24	62 18	58 27	39 85	18 02	00	00	29 55
6011 31 14:00:00 HR	5 67	63 11	59 08	90 99	25 31	.00	00	29 53
6011 31 15:00:00 HR	3.45	64.57	60.70	116.04	23.35	.00	.00	29.53
6011 31 16:00:00 HR	3 96	66 13	62 24	29 85	22.65	00	00	29 53
6011 31 17:00:00 HR	3 64	66 11	62 27	45 37	20.52	00	00	29 53
6011 31 18:00:00 HR	4.65	66.84	62.75	39.77	17.54	.00	.00	29 53
6011 31 19:00:00 HR	3 58	67 60	63 17	31 6	17 84	00	00	29 54
6011 31 20:00:00 HR	4 55	67 75	63 49	3 48	13 24	00	00	29 56
6011 31 21:00:00 HR	4.56	67.20	62.99	9.17	14.76	.00	.00	29.58
6011 31 22:00:00 HR	5 16	67 20	62 87	25 51	15 39	00	00	29 61
6011 31 23:00:00 HR	4 26	66 89	62 36	29 66	17 21	.00	00	29 62
6011 32 00:00:00 HR	3.60	66.74	62 38	24 10	14.27	.00	.00	29 63
6011 32 01:00:00 HR	2 23	66 09	62 19	27 28	13 52	00	00	29 62
6011 32 02:00:00 HR	3 00	65 84	61 94	28 94	15 19	00	.00	29 61
6011 32 03:00:00 HR	4.30	65.67	61.60	36.17	15.94	.00	.00	29.61
6011 32 04:00:00 HR	3 59	65 59	61 35	45 78	16 07	00	00	29 61
6011 32 05:00:00 HR	3 32	65 73	61 50	26 19	15 39	00	00	29 61
6011 32 06:00:00 HR	3.69	65.55	61.13	14.45	15.46	.00	.00	29.61
6011 32 07:00:00 HR	4 28	64 93	60 87	17 29	13 59	00	00	29 61
6011 32 08:00:00 HR	5 38	64 51	60 42	20 02	15 80	00	00	29 63
6011 32 09:00:00 HR	4.93	65.17	60.72	24.62	15.59	.00	.00	29.63
6011 32 10:00:00 HR	5 21	66 90	62 34	37 48	18 09	00	00	29 64
6011 32 11:00:00 HR	4 08	68 41	63 78	33 10	20 07	00	00	29 65
6011 32 12:00:00 HR	6.51	70.40	64.66	45.37	16.92	.00	.00	29.66
6011 32 13:00:00 HR	4 16	72 74	66 13	55 78	25 61	00	00	29 65
6011 32 14:00:00 HR	3 48	74 69	67 19	73 48	30 78	00	00	29 64
6011 32 15:00:00 HR	3.18	77.41	68.02	82 18	48.43	.00	.00	29.62
6011 32 16:00:00 HR	2 97	79 49	68 71	127 88	42 20	00	.00	29 60
6011 32 17:00:00 HR	3 99	79 41	68 37	127 76	25 69	00	00	29 58
6011 32 18:00:00 HR	2.82	79.72	68.87	70.62	37.23	.00	.00	29.57
6011 32 19:00:00 HR	3 30	79 88	69 41	111 83	31.53	00	00	29 57
6011 32 20:00:00 HR	2 45	78 45	69 19	147 68	10 22	.00	.00	29 56
6011 32 21:00:00 HR	2.51	76.54	69.05	139.11	4.04	.00	.00	29.56

END OF FILE

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SC			P
6011 32 22:00:00 HR	2 56	73 23	69 63	26 31	6.26	.00	.00	29 56
6011 32 23:00:00 HR	.95	72 41	69 47	26 61	2 51	00	00	29 57
6011 33 00:00:00 HR	1.22	71.18	68.49	29.82	5.05	.00	.00	29.56
6011 33 01:00:00 HR	1 02	70 65	67 69	52 64	3 40	00	00	29 56
6011 33 02:00:00 HR	95	70 28	67 38	82 05	12 05	00	00	29 55
6011 33 03:00:00 HR	95	70 01	67.20	157 42	6.09	.00	.00	29.54
6011 33 04:00:00 HR	95	70 16	67 35	148 40	6 22	.00	00	29 53
6011 33 05:00:00 HR	1 58	69.85	67 06	163 43	7.13	.00	.00	29 52
6011 33 06:00:00 HR	2.60	69.88	67.06	176.85	8.18	.00	.00	29.52
6011 33 07:00:00 HR	1 72	70 12	67 71	178 37	12 91	00	00	29 53
(++$2++"(+E((J(J",++	3 43	30360 11	57 82	176 58	9 01	.00	00	29 54
DE"*(A*&+DIUEE*EURDJ	.00	302970.6	-44.36	00	7.04	.00	.00	29.54
U+(EBUE+LB+++J"++"08	00	45415 59	-40 00	21 60	80000 00	00	00	29 54
+J"++"+4R+(+E((J+(+4	16 28	44 64	1645 70	152 98	4 12	00	00	29 19
((J+L(++R+(+E((J+(+4	100.00	-34.88	2840.00	163.89	.00	.00	.00	29.50
(+,++$2+"K"++"+4"+J2	5.00	-35.23	368 96	88 50	00	.00	.00	29 50

[illegible]	[illegible]	[illegible]	[illegible]	-35.28	13.13	47.79	.00	.00	.00	29.50
*KRC*JC(JCJ4J*2CCJC4			6667.33	-31.50	-43.38	13.25	26666.67	.00	[illegible]	28.[illegible]
6011	41	00:00:00 HR	.95	69.00	64.61	359.05	7.58	.00	.00	29.57
6011	41	09:00:00 HR	3.56	70.26	65.24	27.69	13.21	.00	.00	29.58
6011	41	10:00:00 HR	5.20	73.71	66.89	42.68	19.11	.00	.00	29.60
6011	41	11:00:00 HR	5.26	77.47	68.91	46.26	25.46	.00	.00	29.62
6011	41	12:00:00 HR	4.85	80.81	69.77	57.16	43.60	.00	.00	29.62
6011	41	13:00:00 HR	5.49	82.75	69.14	84.15	39.67	.00	.00	29.62
6011	41	14:00:00 HR	5.53	83.96	68.12	60.79	32.14	.00	.00	29.60
6011	41	15:00:00 HR	5.30	85.05	67.01	81.24	38.06	.00	.00	29.59
6011	41	16:00:00 HR	5.98	85.66	67.06	79.03	36.26	.00	.00	29.57
6011	41	17:00:00 HR	4.98	85.65	66.42	113.75	37.69	.00	.00	29.56
6011	41	18:00:00 HR	4.15	84.99	66.52	113.78	24.74	.00	.00	29.55
6011	41	19:00:00 HR	3.38	83.67	66.88	129.24	15.90	.00	.00	29.55
6011	41	20:00:00 HR	1.14	81.24	67.24	142.22	8.59	.00	.00	29.55
6011	41	21:00:00 HR	.94	77.99	67.83	107.13	10.90	.00	.00	29.55
6011	41	22:00:00 HR	.95	75.26	68.18	295.72	10.86	.00	.00	29.56
6011	41	23:00:00 HR	.95	73.09	67.96	202.59	3.34	.00	.00	29.56
6011	42	00:00:00 HR	1.15	71.38	67.32	189.63	7.62	.00	.00	29.56
6011	42	01:00:00 HR	.95	70.61	66.57	327.50	12.65	.00	.00	29.55
6011	42	02:00:00 HR	.94	69.42	65.44	215.39	6.91	.00	.00	29.55
6011	42	03:00:00 HR	1.17	68.26	64.71	191.39	7.71	.00	.00	29.54
6011	42	04:00:00 HR	.94	67.92	64.44	223.66	13.13	.00	.00	29.53
6011	42	05:00:00 HR	.94	66.72	63.89	15.85	12.53	.00	.00	29.53
6011	42	06:00:00 HR	1.85	65.58	62.76	165.21	19.48	.00	.00	29.53
6011	42	07:00:00 HR	1.01	65.54	62.72	15.32	5.93	.00	.00	29.54
6011	42	08:00:00 HR	.93	65.46	62.54	49.44	6.35	.00	.00	29.55
6011	42	09:00:00 HR	1.92	67.45	64.38	172.53	18.22	.00	.00	29.54
6011	42	10:00:00 HR	2.93	72.57	68.28	148.86	24.51	.00	.00	29.55
6011	42	11:00:00 HR	3.61	78.34	70.47	169.21	20.35	.00	.00	29.56
6011	42	12:00:00 HR	5.83	81.68	70.91	171.53	16.10	.00	.00	29.55
6011	42	13:00:00 HR	5.98	83.60	68.76	192.42	14.15	.00	.00	29.53
6011	42	14:00:00 HR	6.59	85.17	69.19	179.59	14.36	.00	.00	29.51
6011	42	15:00:00 HR	7.53	85.18	68.52	176.25	12.78	.00	.00	29.49
6011	42	16:00:00 HR	7.53	86.09	68.71	173.59	15.21	.00	.00	29.46
6011	42	17:00:00 HR	7.07	85.98	69.17	166.29	13.99	.00	.00	29.44
6011	42	18:00:00 HR	6.97	85.33	69.75	159.95	15.87	.00	.00	29.42
6011	42	19:00:00 HR	5.21	83.81	70.29	149.89	16.57	.00	.00	29.40
6011	42	20:00:00 HR	5.57	81.09	69.60	162.85	13.63	.00	.00	29.39
6011	42	21:00:00 HR	7.00	78.79	68.75	165.18	13.00	.00	.00	29.38
6011	42	22:00:00 HR	7.92	77.47	68.21	170.45	12.84	.00	.00	29.39
6011	42	23:00:00 HR	10.38	76.31	68.84	173.49	10.61	.00	.00	29.39
6011	43	00:00:00 HR	7.09	75.79	68.76	177.23	9.70	.00	.00	29.39
6011	43	01:00:00 HR	7.63	76.06	68.24	178.89	8.58	.00	.00	29.39
6011	43	02:00:00 HR	4.80	74.95	68.12	179.27	10.12	.00	.00	29.39
6011	43	03:00:00 HR	2.75	73.50	67.46	201.80	15.04	.00	.00	29.40
6011	43	04:00:00 HR	2.13	71.86	66.91	322.40	27.34	.00	.00	29.44
6011	43	05:00:00 HR	4.31	70.24	66.14	167.18	8.60	.00	.00	29.44
6011	43	06:00:00 HR	3.18	69.62	65.75	203.32	16.01	.00	.00	29.43
6011	43	07:00:00 HR	2.80	69.24	65.23	170.96	13.96	.00	.00	29.45
6011	43	08:00:00 HR	1.71	69.47	65.59	65.05	27.30	.00	.00	29.46
6011	43	09:00:00 HR	2.10	72.78	66.81	19.61	28.74	.00	.00	29.48
6011	43	10:00:00 HR	2.32	75.86	66.98	283.83	31.08	.00	.00	29.49
6011	43	11:00:00 HR	4.15	77.98	66.56	321.61	23.60	.00	.00	29.51
6011	43	12:00:00 HR	10.06	75.21	66.38	4.37	12.97	.00	.00	29.51
6011	43	13:00:00 HR	11.31	70.00	59.55	8.43	13.85	.00	.00	29.52
6011	43	14:00:00 HR	10.78	70.14	56.66	4.79	13.05	.00	.00	29.52
6011	43	15:00:00 HR	10.85	70.81	54.40	10.78	13.01	.00	.00	29.52
6011	43	16:00:00 HR	11.64	70.47	53.35	7.77	13.90	.00	.00	29.52
6011	43	17:00:00 HR	10.57	69.00	51.35	15.41	14.06	.00	.00	29.53

6011 43 18:00:00 HR	9 43	67 82	50 77	10 09	13 15	00	00	29 53
6011 44 11:00 00 HR	7.09	71 42	50.43	65 24	31.82	.00	00	29 61
6011 44 12:00:00 HR	8 20	73 35	49 30	95 01	35 97	00	00	29 66
6011 44 13:00.00 HR	5 52	74 62	49 01	124 20	35 42	00	00	29 66
6011 44 14.00.00 HR	6.33	76 39	50.05	118 16	22 23	00	.00	29 61
6011 44 15:00 00 HR	6 15	77 51	50 74	113 96	35 22	00	00	29 62
6011 44 16.00:00 HR	4 78	78 67	51 85	99 98	49 07	00	00	29 60
6011 44 17:00.00 HR	4.70	78.35	52.62	74 25	52.04	.00	00	29 59
6011 44 18:00:00 HR	4 52	76 41	52 34	119 66	23 08	00	00	29 58
6011 44 19:00:00 HR	3 40	75 12	52 91	117 18	22 45	00	00	29 57
6011 44 20.00.00 HR	4 12	73 61	52 22	107 15	31 03	00	00	29.56
6011 44 21:00:00 HR	3 51	71 56	52 30	82 29	29 58	00	00	29 56
6011 44 22:00:00 HR	3 13	70 21	51 73	86 95	34 29	00	00	29 57
6011 44 23:00:00 HR	3.11	70.17	53.12	118 86	25 05	00	00	29 58
6011 45 00:00:00 HR	1 98	69 70	55 07	103 93	18 17	00	00	29 59
6011 45 01:00:00 HR	1.12	69 27	56 18	122 04	19.46	00	00	29 58
6011 45 02:00:00 HR	1 08	68 57	57 03	93 18	17 68	.00	.00	29 57
6011 45 03 00:00 HR	1 09	69 02	57 71	58 26	21 35	00	00	29 56
6011 45 04:00 00 HR	1 42	67 23	58 27	96 51	25 68	00	00	29 54
6011 45 05:00:00 HR	1.38	66.96	58.97	128 74	24.60	.00	.00	29.53
6011 45 06:00.00 HR	3 37	66 22	60 27	72 46	35 41	00	00	29 53
6011 45 07:00.00 HR	3 89	66 76	62.23	141 15	22 15	00	00	29 52
6011 45 08:00:00 HR	6 56	69 43	63 70	152 56	15 44	00	00	29 52
6011 45 09:00:00 HR	7 23	69.16	63 61	241 92	21 32	00	00	29 57
6011 45 10:00.00 HR	8 28	67 14	63 76	157 90	13 99	00	00	29 57
6011 45 11.00:00 HR	10 70	66 86	63.39	143 45	14 75	.00	00	29 56
6011 45 12:00:00 HR	10 08	67 16	63 71	169 12	14 98	00	.00	29 56
6011 45 13:00.00 HR	9 19	67 49	63.91	156 10	14 25	00	.00	29 55
6011 45 14:00:00 HR	12 68	67 08	63 74	127 01	11 51	.00	.00	29 54
6011 45 15:00:00 HR	12 77	69 51	65 72	170 00	13 50	00	00	29 51
6011 45 16:00:00 HR	8 10	70 16	65 44	158 87	16 56	00	00	29 49
6011 45 17:00.00 HR	9.41	72 79	66.16	159.88	15 77	00	00	29 47
6011 45 18:00:00 HR	6 67	74 21	66 89	167 29	17 11	00	00	29 44
6011 45 19:00:00 HR	10 21	74 73	66 50	170 98	13 70	00	00	29 44
6011 45 20:00:00 HR	8.51	72 20	63 58	175.60	11 33	.00	.00	29 43
6011 45 21:00:00 HR	7 97	70 46	62 62	165 49	13 85	00	00	29 42
6011 45 22.00:00 HR	6 39	69 30	62 21	164 80	16 09	00	00	29 42
6011 45 23:00:00 HR	8 39	68 46	61 95	170 99	15 72	.00	.00	29 41
6011 46 00:00.00 HR	7 78	67 73	61 72	161 22	15 66	00	00	29 40
6011 46 01:00:00 HR	9 18	67 64	61 32	165 86	14 46	00	00	29 38
6011 46 02:00:00 HR	10 84	68 45	61 86	183 34	10 12	00	.00	29 37
6011 46 03:00:00 HR	9 78	68 23	62 30	178 52	8 58	00	00	29 37
6011 46 04.00:00 HR	9 88	67 87	62 84	177 26	9 22	00	00	29 37
6011 46 05:00:00 HR	9 22	68.04	63 55	183 40	8 97	.00	.00	29 36
6011 46 06:00:00 HR	8 82	68 07	63 88	169 05	11 53	00	00	29 36
6011 46 07:00:00 HR	7 55	67 82	63 84	180 81	11 09	00	00	29 36
6011 46 08:00:00 HR	9 06	67 78	63 63	166 69	10 51	00	00	29 36
6011 46 09:00:00 HR	11 21	69 40	64 60	173 12	9 93	00	00	29 36
6011 46 10:00:00 HR	10 10	73 78	67 44	165 91	11 04	00	00	29 35
6011 46 11:00:00 HR	11.55	79.88	70.83	181 35	11 92	.00	.00	29.34
6011 46 12:00:00 HR	14 33	84 33	72 01	201 67	11 34	00	.00	29 33
6011 46 13:00:00 HR	15 95	86 47	71 89	200 57	10 79	00	00	29 31
6011 46 14:00:00 HR	14 94	88 45	72 16	203 37	11 43	00	00	29 29
6011 46 15:00:00 HR	15 86	88 92	72 05	198 95	11 34	00	00	29 27
6011 46 16 00:00 HR	15 88	88 70	72 38	190 13	9 91	00	00	29 25
6011 46 17.00:00 HR	13.22	87 29	71 27	183.87	9 58	00	00	29 22
6011 46 18.00.00 HR	12 86	85 74	70 42	180 22	8 83	00	.00	29 20
6011 46 19:00:00 HR	15 79	79 74	67 13	198 69	9 87	.00	00	29 19
6011 46 20:00:00 HR	6.86	75 63	67 12	208 60	15 17	.00	.00	29 18
6011 46 21:00:00 HR	7 58	76 94	68 98	174 13	12 18	00	00	29 19

6011 46 22:00 00 HR	12 49	76 32	64 08	194 25	9 68	00	00	29 19
6011 46 23:00.00 HR	8 92	73 86	61 56	195 07	10.28	00	00	29 18
6011 47 00.00.00 HR	9 10	73 43	60 88	184 55	10 10	00	00	29 12
6011 47 01.00:00 HR	11 10	72 57	62 32	181 22	10 17	00	00	29 17
6011 47 02.00:00 HR	8.15	71.25	63.12	186.60	10.60	.00	00	29 17
6011 47 03:00.00 HR	9 37	70 87	63 64	236 50	14 22	00	00	29 20
6011 47 04.00:00 HR	5 82	69 33	64 26	183 69	10 34	00	00	29 17
6011 47 05.00 00 HR	6 80	69.53	61 26	226 61	14 35	.00	.00	29 19
6011 47 06 00:00 HR	6 88	67 82	63 60	211 22	11 43	00	00	29 20
6011 47 15:43.01 HR	4 35	67 13	62 82	217 00	11 35	00	00	29 20
6011 47 16:00:00 HR	10 52	68 96	60 56	10.27	12.28	.00	00	29 28
6011 47 17:00:00 HR	11 75	68 35	59 55	6 21	13 33	00	00	29 29
6011 47 18:00:00 HR	12 08	68 56	58 08	7 50	12 38	00	00	29 31
6011 47 19:00:00 HR	12.04	68 35	57.88	9 82	12.69	.00	00	29 31
6011 47 20:00:00 HR	10 02	67 40	58 40	17 95	11 67	00	00	29 33
6011 47 21:00:00 HR	8 65	67 11	58 74	6.23	11.96	00	00	29 34
6011 47 22:00:00 HR	7 47	67 16	58 78	4 32	11.74	.00	.00	29 36
6011 47 23:00:00 HR	9 30	66 47	58 67	358 99	12 74	00	00	29 37
6011 48 00.00.00 HR	8 85	65 90	58 37	357 60	13 61	00	00	29 39
6011 48 01.00:00 HR	10.10	65 46	58 19	358.95	12 28	.00	00	29 39
6011 48 02:00.00 HR	9 49	64 98	58 47	9 00	12 10	00	00	29 38
6011 48 03:00.00 HR	10 04	64 74	58 23	10 98	12 07	00	00	29 39

END OF FILE

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SG			P
6011 48 04.00:00 HR	9.05	63 74	57 62	18.02	12 44	.00	.00	29 38
6011 48 05:00:00 HR	9 58	62 56	57 12	10.49	11 11	.00	00	29 38
6011 48 06:00:00 HR	10 59	62 07	56 71	9 71	11 81	00	00	29 38
6011 48 07 00.00 HR	8 22	61 30	56 36	12.31	12 00	.00	.00	29 38
6011 48 08:00:00 HR	11 48	61 58	56 04	15 78	12 92	00	00	29 39
6011 48 09:00.00 HR	9 94	61 71	55 84	9 81	13 40	00	00	29 40
6011 48 10.00:00 HR	8 13	61 07	56 00	5.64	13 70	.00	.00	29 41
6011 48 11.00:00 HR	8 50	60 84	56 60	60	11 69	00	.00	29 43
6011 48 12:00:00 HR	9 07	60 82	56 98	7 80	13.02	.00	00	29 43
6011 48 13:00:00 HR	9 53	61 35	57 25	3 19	12 82	.00	.00	29 42
6011 48 14:00:00 HR	10 60	61 39	57 59	13 53	12 46	00	00	29 40
6011 48 15:00 00 HR	9 14	61 03	57 24	9 96	14 41	00	00	29 39
6011 48 16:00:00 HR	9 87	61 01	57 20	11 09	12 88	.00	.00	29 37
6011 48 17:00:00 HR	10.18	60 83	57 20	12 07	12 78	00	.00	29 37
6011 48 18:00:00 HR	10 60	60 39	56 82	8 27	13 58	.00	.00	29 36
6011 48 19:00:00 HR	7 83	60 18	56 59	13 50	12 13	.00	.00	29 36
6011 48 20:00:00 HR	7 20	59 92	56 19	7 08	11 44	00	00	29 36
6011 48 21 00:00 HR	7 72	59 80	56 10	10 81	12 39	00	00	29 35
6011 48 22:00:00 HR	6 28	59 68	55 93	10 53	14 61	.00	.00	29 36
6011 48 23:00:00 HR	5 20	59 46	56 08	24 82	14 85	00	00	29 36
6011 49 00.00:00 HR	5 32	59 56	56 09	20 19	13 61	00	00	29 36
6011 49 01:00 00 HR	3 35	59 48	56 18	19 98	14 40	.00	.00	29 35
6011 49 02.00:00 HR	3 08	59 66	56 74	15 09	11 57	00	00	29 35
6011 49 03:00.00 HR	3 81	59 67	56 71	345 19	11 23	.00	00	29 35
6011 49 04:00:00 HR	3.63	59 60	56 57	346 18	12 27	.00	.00	29 35
6011 49 05:00:00 HR	3 52	59 35	56 21	348 45	11 74	00	00	29 35
6011 49 06:00:00 HR	3 65	59 25	56 07	2 96	15.54	00	.00	29 34
6011 49 07:00:00 HR	4 03	59 41	56 20	355 84	11 15	.00	.00	29.35
6011 49 08:00:00 HR	3 40	59 43	55 96	11 20	11 52	00	00	29 36
6011 49 09:00:00 HR	2 14	59 51	56 08	346 78	15 39	00	00	29 38
6011 49 10:00:00 HR	2.30	60 01	56 39	321 68	9 75	.00	.00	29 40
6011 49 11:00:00 HR	1 25	60 73	56 99	335 03	13 81	.00	00	29 41
6011 49 12:00:00 HR	3 82	61 61	57 45	304 95	11 57	.00	00	29 42
6011 49 13:00:00 HR	4 02	62 24	58 01	239 17	15 36	.00	.00	29 42
6011 49 14:00:00 HR	5 08	63.43	58 37	252 23	15 25	00	00	29 42

END OF FILE
-- AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SG			P
6011 53 15:00:00 HR	8 94	75 17	52 42	330 03	16 22	00	00	29 51
6011 53 16 00:00 HR	6 75	76 06	51 60	4 22	17 74	00	00	29 49
6011 53 17 00:00 HR	5 80	76 94	50 83	4 42	20 58	00	00	29 4[illegible]
6011 53 18 00:00 HR	5 66	76 35	50 94	22 97	18 64	00	00	29 48
6011 53 19:00:00 HR	4 34	74 64	51 83	1 96	13 97	00	.00	29 47
6011 53 20 00:00 HR	2 91	70 39	52 63	18 95	8 36	00	00	29 46
6011 53 21:00:00 HR	1 88	65 95	53 96	111 49	9 25	00	00	29 45
6011 53 22:00:00 HR	1 44	62 94	55 06	274 54	15 91	00	00	29 45
6011 53 23:00:00 HR	2 56	60 59	55 14	190 11	8 36	00	00	29 46
6011 54 00:00.00 HR	1 32	59 74	54 86	253 15	9 25	00	00	29 46
6011 54 01:00.00 HR	1 65	59 10	53 34	156 80	19 57	00	00	29 47
6011 54 02:00:00 HR	1 55	57 78	52 97	342 30	7 00	00	00	29 47
6011 54 03:00:00 HR	1 87	56 49	51 95	351 83	7 71	00	00	29 47
6011 54 04:00:00 HR	2 60	54 94	51 00	241 26	10 17	00	00	29 47
6011 54 05:00:00 HR	1 18	54 65	50 83	139 20	16 25	00	00	29 47
6011 54 06:00:00 HR	1 96	53 78	49 97	347 59	7 29	00	00	29 48
6011 54 07:00:00 HR	1 87	52 96	49 24	150 39	16 31	00	00	29 49
6011 54 08:00:00 HR	95	52 98	49 35	268 62	8 87	00	00	29 50
6011 54 09:00:00 HR	1 77	56 31	51 77	179 87	8 81	00	00	29 51
6011 54 10:00:00 HR	5 68	62 71	54 66	164 25	12 91	00	00	29 51
6011 54 11:00:00 HR	7 10	67 44	55 93	165 99	13 76	00	00	29 50
6011 54 12:00:00 HR	8 50	71 33	55 96	165 16	15 44	00	00	29 50
6011 54 13:00:00 HR	8 12	74 37	56 58	156 37	16 23	00	00	29 48
6011 54 14:00:00 HR	7 30	73 96	56 80	168 75	12 45	00	00	29 47
6011 54 15:00 00 HR	7 17	74 65	57 77	159 05	16 09	00	00	29 44
6011 54 16:00:00 HR	6 15	75 24	58 33	153 16	16 30	00	00	29 42
6011 54 17:00 00 HR	7 71	77 33	58 12	165 64	16 45	00	00	29 40
6011 54 18:00.00 HR	7 98	76 84	58 04	158 94	16 66	00	00	29 39
6011 54 19:00.00 HR	6 16	75 66	59 95	150 30	16 61	00	00	29 38
6011 54 20:00.00 HR	6 27	72 57	59 67	143 86	14 92	00	00	29 37
6011 54 21:00:00 HR	6 35	70 35	59 33	151 19	15 11	00	.00	29 36
6011 54 22:00.00 HR	4 50	68 17	59 16	156 54	13 33	00	00	29 36
6011 54 23:00:00 HR	3 82	66 31	58 56	160 60	13 46	00	00	29 36
6011 55 00:00.00 HR	3 00	65 63	57 81	148 99	13 64	00	00	29 37
6011 55 01:00.00 HR	3 71	64 60	57 49	139 75	18 96	00	00	29 35
6011 55 02:00:00 HR	2 60	65 17	57 80	156 18	18 26	00	.00	29 35
6011 55 03:00:00 HR	6 93	65 73	57 97	155 13	15 95	00	00	29 34
6011 55 04:00:00 HR	10 15	66 29	58 31	175 90	12 71	00	00	29 33
6011 55 05:00:00 HR	8 76	65 65	58 18	185 73	8 57	00	00	29 33
6011 55 06:00:00 HR	10 48	65 78	58 04	177 10	9 65	00	00	29 33
6011 55 07:00:00 HR	7 74	65 33	58 01	168.70	11 95	00	00	29 35
6011 55 08:00 00 HR	9 50	65 67	58 51	169 47	13 31	00	.00	29 35
6011 55 09:00:00 HR	9 70	66 91	58 93	167 74	14 46	00	00	29 36
6011 55 10:00.00 HR	15.27	69 74	60.24	174 60	11 94	00	00	29.35
6011 55 11:00:00 HR	13 36	72 70	61 09	170 48	13 64	00	00	29 36
6011 55 12:00:00 HR	11 65	75 73	62 46	155 63	14 99	00	00	29 35
6011 55 13:00:00 HR	14 10	77 60	63 88	165 21	15 07	00	00	29 34
6011 55 14 00:00 HR	18 74	80 70	64 42	169 10	13 73	00	00	29 32
6011 55 15:00.00 HR	16 84	82 53	64 73	181 48	10 88	00	.00	29 31
6011 55 16:00.00 HR	18 10	83 63	65 17	179 04	9 86	00	00	29 30
6011 55 17:00.00 HR	15 50	84 29	64 84	171 90	10 38	00	00	29 30
6011 55 18:00 00 HR	13 81	83 69	64 52	182 74	9 99	00	00	29 30
6011 55 19:00 00 HR	15 04	81 07	63 48	181.98	11 30	00	00	29 30
6011 55 20:00:00 HR	8 97	79 40	62 87	166 15	13 74	00	00	29 31
6011 55 21:00.00 HR	8 85	77 62	61 71	174 63	14 88	00	00	29 33
601004 02000 026	11.08	76.07	51.55	178.07	15.50	00	00	29 35
60.1 5604 C2CHH21	30 00	75 21	-40 00	243 59	20 98	00	00	29 35

[illegible]	[illegible]	04	-30 00	3 20	00	280002 1	00	00	29 35
6011	#205 #V##C003#	04	-30 00	3 20	00	280002 1	00	00	29 35
6011	56 015#004 0	00	-29 91	-40 00	00	1 20	00	00	29 35
6011	56 ..52004 0	05	-28 98	-40 00	00	1 20	00	00	29 35
6011	56 018004 -#	05	-28 98	-40 00	00	1 20	00	00	29 35
/TIPTO . 05	OP #410150								
/TIFTD . 05	UP @410260								
6011	56 0 V004 01	1 23	443 59	-40 00	174 02	00	00	00	29 3.
6011	56 14:00:00 HR	8 97	82 43	67 16	173 17	15 69	00	00	29 4.
6011	56 15:00:00 HR	9 83	84 44	68 03	174 39	14 46	00	00	29 4.
6011	56 16:00:00 HR	13 30	85 42	68 18	172 43	13 62	00	00	29 40
6011	56 17:00:00 HR	10 97	85 39	69 33	170 37	13 24	00	00	29 38
6011	56 18:00:00 HR	9 50	85 26	69 71	167 83	13 33	00	.00	29 38
6011	56 19:00:00 HR	6 57	82 97	69 64	156 27	15 60	00	00	29 38
6011	56 20:00:00 HR	5 71	80 43	67 77	152 10	14 90	00	00	29 38
6011	56 21:00:00 HR	6 00	77 75	68 10	142 98	13 36	00	00	29 38
6011	56 22:00:00 HR	4 71	76 00	68 77	152 21	15 16	00	00	29 39
6011	56 23:00:00 HR	4 59	74 82	68 09	146 68	14 19	00	.00	29 40
6011	57 00:00:00 HR	5 91	73 58	67 04	162 06	13 13	00	00	29 39
6011	57 01:00:00 HR	8 32	73 04	65 05	165 02	13 18	00	00	29 38
6011	57 02:00:00 HR	9 46	72 27	63 95	163 24	12 60	00	00	29 37
6011	57 03:00:00 HR	8 63	71 22	62 90	173 40	10 83	00	00	29 36
6011	57 04:00:00 HR	9 73	70 40	62 36	170 16	11 59	00	00	29 35
6011	57 05:00:00 HR	10 32	69 58	61 89	172 43	11 14	00	00	29 34
6011	57 06:00:00 HR	11 41	68 91	61 71	177 43	9 67	00	00	29 32
6011	57 07:00:00 HR	11.07	68 94	61 58	174.08	8 89	00	00	29 33
6011	57 08:00:00 HR	9 77	69 39	62 12	171 03	9 95	00	00	29 32
6011	57 09:00:00 HR	10 45	70 54	63 13	180 79	11 08	00	00	29 31
6011	57 10:00:00 HR	8.49	73 62	65 03	190 80	12 13	00	00	29 32
6011	57 11:00:00 HR	13 43	76 69	66 78	199 53	10 12	00	00	29 32
6011	57 12:00:00 HR	12 16	76 74	67 16	191 38	10 77	00	00	29 30
6011	57 13:00:00 HR	11 65	76 24	67 42	175.26	12 24	00	00	29 25
6011	57 14:00:00 HR	11 65	77 72	67 63	189 90	10.99	00	.00	29 24
6011	57 15:00:00 HR	14 86	79 34	68 36	193 83	9 41	00	.00	29 21
6011	57 16:00:00 HR	14 77	80 00	69 46	186 69	9 82	00	00	29 20
6011	57 17:00:00 HR	14 58	80 29	69 58	189 07	9 57	00	00	29 19
6011	57 18:00:00 HR	13 55	80 61	69 63	194 15	10 50	00	00	29 18
6011	57 19:00:00 HR	13 95	80 12	69.38	184 42	9 40	00	00	29 18
6011	57 20:00:00 HR	10 46	78 34	68 90	169 57	10 35	00	00	29 18
6011	57 21:00:00 HR	9 83	76 84	69 10	177 07	11 04	.00	00	29 17
6011	57 22:00:00 HR	10 88	75 91	69 10	176 54	9 62	00	00	29 17
6011	57 23:00:00 HR	10 79	74 98	69 35	179 39	10 26	00	00	29 17
6011	58 00:00:00 HR	9 32	74 29	68 95	178 93	10 21	00	00	29 16
6011	58 01:00:00 HR	12 58	76 66	68 31	191 65	9 21	00	00	29 15
6011	58 02:00:00 HR	12 50	73 08	64 58	325 07	17 06	00	00	29 19
6011	58 03:00:00 HR	8 84	65 13	57 19	23 89	15 69	00	.00	29 22
6011	58 04:00:00 HR	5 30	63 28	54 51	65 40	39 32	00	00	29 23
6011	58 05:00:00 HR	5 40	61 53	51 19	50 35	21 17	00	.00	29 24
6011	58 06:00:00 HR	3 12	61 42	51 83	26 12	24 47	00	00	29 25
6011	58 07:00:00 HR	2.09	61 44	52 44	56 24	18 49	00	00	29 26
6011	58 08:00:00 HR	1 34	61 51	53 17	350 41	10 99	00	00	29 28
6011	58 09:00:00 HR	2 29	63 62	53 09	48 63	21.12	.00	00	29 28
6011	58 10:00:00 HR	3 64	66 94	52 69	109 67	34 81	00	00	29 30
6011	58 11:00:00 HR	2 47	71 17	53 09	99 34	48 41	00	.00	29 31
6011	58 12:00:00 HR	3 39	74 75	51 31	61 46	48 87	00	00	29 31
6011	58 13:00:00 HR	3.92	76 80	48 50	124 86	35 40	00	00	29 30
6011	58 14:00:00 HR	4 41	79.04	46 59	123 66	43 04	00	00	29 29
6011	58 15:00:00 HR	4 70	80 33	46 20	114 98	45 94	00	00	29 27
6011	58 16:00:00 HR	4 68	80 97	47 38	129 20	38 51	00	00	29 26
6011	52 07:50:00 HR	8 40	74 44	62 27	163 66	19 44	00	00	29 26

6011 52 08:00 00 HR	8 62	72 89	67 91	174 91	6 80	00	00	29 26
6011 52 09:00:00 HR	9 25	75 31	68 64	188 49	9 87	.00	00	29 28
6011 52 10 00:00 HR	11 31	79 14	69 88	203 59	11 25	00	00	29 27
6011 5004 +F000 8	19 80	59 28	69 70	203 99	3 83	00	00	28 55
6011 5V004 0 000	02	-29 40	69 79	194 13	00	00	00	27 43
6011 [illegible]004 N.0430	3 00	-29 40	69 79	194 13	00	00	00	27 43
6011 [illegible]004 0:[illegible]000	2 40	-30 00	69 79	194 13	00	00	00	27 43
6011 R5N004 000OYO	3 87	-30 00	69 79	194.13	00	00	.00	27 43
6011 5N004 E06[illegible]00	10024 00	-30 00	719960 0	1 62	120 00	00	00	27 43
6011[illegible]F004 0425 5	4 14	-30 00	336027 2	1 10	86 40	00	00	27 33
6011 52 17:V[illegible] MV[illegible]	25.45	-34 50	6872 09	05	19 20	00	.00	27 12
---- 52 17:V[illegible] MV[illegible]	25 45	-35 18	6872 09	05	19 20	00	00	27 12
---- 52 17:V[illegible] MV[illegible]	25 45	-35 28	6872 09	05	19 20	.00	00	27 12

END OF FILE

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SG			P
[illegible]	.00	-30 00	-40 00	.00	.00	00	00	27 00
---- [illegible]	00	-30 00	-40 00	00	00	00	00	27 00
---- [illegible]	00	-30 00	-40 00	00	00	00	00	27 00
6011 58 18:00:00 HR	5 88	79 87	47.72	137.62	24.54	00	00	29 23
6011 58 19:00:00 HR	3 11	77 43	50 26	124 34	13 15	00	00	29 23
6011 58 20:00:00 HR	2 36	72 85	50 87	98 77	11.02	00	00	29 22
6011 58 21:00:00 HR	1 46	66 41	54 08	337 59	20 12	00	00	29 21
6011 58 22:00:00 HR	1 18	63 52	55 41	282 33	12 38	00	00	29 21
6011 58 23:00:00 HR	94	62 35	54 07	327 34	9 34	00	00	29 22
6011 59 00:00:00 HR	95	61 64	54 64	310 22	14 19	00	00	29 21
6011 59 01:00:00 HR	95	61 15	54 06	357 42	4 35	00	00	29 19
6011 59 02:00.00 HR	1 70	60 08	54 05	165 02	10 23	.00	00	29 16
6011 59 03:00:00 HR	2 39	59 72	54 73	23 47	9 32	00	00	29 15
6011 59 04:00:00 HR	3 05	60 32	54 69	40 79	5 90	00	.00	29 14
6011 59 05:00:00 HR	2 70	60 02	55 22	31 63	8 66	00	00	29 12
6011 59 06:00.00 HR	2 34	59 82	55 48	22 59	7 88	00	00	29 11
6011 59 07:00.00 HR	1 23	61 10	56 81	29 61	8 66	.00	00	29 11
6011 59 08.00.00 HR	95	61 59	57 65	201 34	19 10	.00	00	29 11
6011 59 09:00.00 HR	1 99	65 58	62 06	171 25	14 96	00	00	29 12
6011 59 10:00:00 HR	4 57	71 97	66 93	185 98	17 34	00	00	29 13
6011 59 11:00:00 HR	5 38	79 00	68 92	219 30	23 15	00	00	29 15
6011 59 12:00:00 HR	6 04	82 78	66 38	233 27	17 31	00	00	29 16
6011 59 13:00:00 HR	5 20	84 71	64 92	9 24	29 74	00	00	29 17
6011 59 14:00:00 HR	5 52	85 90	64 64	6 83	25 51	.00	00	29 18
6011 59 15:00:00 HR	4 86	87 54	66 08	10 26	27 59	00	00	29 18
6011 59 16:00:00 HR	5 13	89 75	65 72	346 52	20 87	00	00	29 17
6011 59 17:00.00 HR	4 49	89 29	65 86	357 05	25 81	00	00	29 17
6011 59 18:00:00 HR	3 71	89 05	65 29	354 72	17 53	00	00	29 18
6011 59 19:00:00 HR	4 46	86 23	67 13	358 10	12 73	00	00	29 19
6011 59 20:00:00 HR	5 12	81 01	66 14	359 80	9 45	00	00	29 20
6011 59 21:00:00 HR	3 05	76 73	61 08	8 47	10 90	00	00	29 23
6011 59 22:00:00 HR	3 43	73 13	60 39	24 70	9 81	00	00	29 25
6011 59 23:00:00 HR	3 87	69 50	57 78	18 33	9 78	00	00	29 26
6011 60 00.00:00 HR	3.37	66 49	55.52	19 60	8.76	00	00	29.27
6011 60 01:00:00 HR	1 86	64 91	53 54	19 04	10 57	00	.00	29 27
6011 60 02:00:00 HR	1 23	63 61	52 75	31 62	13 79	.00	00	29 29
6011 60 03:00.00 HR	2 00	61 10	52 94	21 25	12 67	00	00	29 29
6011 60 04:00:00 HR	1 47	59 56	52 74	26 11	10 03	00	00	29 28
6011 60 05:00:00 HR	2 40	59 16	52 35	30 80	9 86	00	00	29 28
6011 60 06:00:00 HR	1 02	58 32	52 18	3 57	7 79	00	00	29 27
6011 60 07:00:00 HR	1 02	58 11	52 24	356 54	6 04	00	00	29 27
6011 60 08:00.00 HR	94	59 33	52 86	354 71	4 42	.00	.00	29.28
6011 60 09:00:00 HR	1.73	64 10	55 28	107.55	24 29	00	.00	29 28
6011 60 10:00.00 HR	4 40	69.16	59 87	180 85	20 86	00	.00	29 29

6011	60 11:00:00 HR	8.09	75.21	65.83	162.46	15.76	.00	.00	29.26
6011	60 12:00:00 HR	8.93	90.85	71.31	183.74	12.59	.00	.00	29.28
6011	60 13:00:00 HR	10.40	84.97	73.98	172.46	12.14	.00	.00	29.27
6011	60 14:00:00 HR	10.86	87.69	75.06	176.66	13.23	.00	.00	29.24
6011	60 15:00:00 HR	11.60	89.92	74.83	187.09	13.23	.00	.00	29.21
6011	60 16:00:00 HR	10.47	90.84	74.41	184.12	11.42	.00	.00	29.19
6011	60 17:00:00 HR	9.86	90.11	73.95	180.96	11.17	.00	.00	29.19
6011	60 18:00:00 HR	10.11	89.84	74.50	180.30	10.63	.00	.00	29.18
6011	60 19:00:00 HR	7.06	87.24	73.96	169.79	10.16	.00	.00	29.18
6011	60 20:00:00 HR	5.12	84.12	73.63	166.94	12.01	.00	.00	29.18
6011	60 21:00:00 HR	4.20	81.84	73.67	144.04	14.69	.00	.00	29.19
6011	60 22:00:00 HR	3.36	80.25	73.70	155.85	14.58	.00	.00	29.20
6011	60 23:00:00 HR	2.87	78.88	73.49	150.89	11.62	.00	.00	29.20
6011	61 00:00:00 HR	4.42	77.96	73.20	170.64	11.70	.00	.00	29.20
6011	61 01:00:00 HR	3.65	77.31	72.49	156.65	13.08	.00	.00	29.19
6011	61 02:00:00 HR	4.12	77.65	71.99	174.51	8.87	.00	.00	29.19
6011	61 03:00:00 HR	4.03	77.58	71.37	220.08	11.33	.00	.00	29.19
6011	61 04:00:00 HR	7.78	75.18	70.81	35.55	21.91	.00	.00	29.23
6011	61 05:00:00 HR	7.80	73.23	66.40	74.58	28.97	.00	.00	29.26
6011	61 06:00:00 HR	5.30	71.70	64.67	122.25	32.94	.00	.00	29.27
6011	61 07:00:00 HR	2.83	70.27	64.07	118.39	27.45	.00	.00	29.28
6011	61 08:00:00 HR	3.22	69.75	64.02	72.42	25.49	.00	.00	29.30

END OF FILE

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SG	P

END OF FILE

AVERAGE TIME 60 MINUTES

ID	WS	T	DP	WD	SG	P

END OF FILE

Rainfall Measurements from Tipping Bucket Rain Gage at Station #1:

Date	Amount (inches)	Date	Amount (inches)
8/1/77	.18	8/30	0
8/2	0	8/31	0
8/3	0	9/1/77	0
8/4	.07	9/2	0
8/5	.07	9/3	0
8/6	0	9/4	0
8/7	0	9/5	.01
8/8	0	9/6	.04
8/9	0	9/7	0
8/10	0	9/8	0
8/11	.13	9/9	0
8/12	.09	9/10	.12
8/13	0	9/11	1.51
8/14	1.13	9/12	0
8/15	.16	9/13	.37
8/16	0	9/14	.94
8/17	1.34	9/15	.38
8/18	.19	9/16	.33
8/19	1.72	9/17	0
8/20	0	9/18	0
8/21	0	9/19	0
8/22	0	9/20	0
8/23	.31	9/21	0
8/24	0	9/22	0
8/25	0	9/23	0
8/26	0	9/24	0
8/27	0	9/25	0
8/28	1.63	9/26	0
8/29	0	9/27	0

APPENDIX F

RAW SO_2 DATA

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station No.	Hour 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
													August 1, 1977											
1																			<0.05[a]	<.05	<.05	<.05	<.05	<.05
2																								
3																								
4																								
5																								
													August 2, 1977											
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4																								
5																								
													August 3, 1977											
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2																								
3																								
4																								
5																								
													August 4, 1977											
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2																								
3																								
4																								
5																								
													August 5, 1977											
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05
2																								
3													<0.05									<0.05	<0.05	<0.05
4																								
5																								
													August 6, 1977											
1	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2																								
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4																								
5																								
													August 7, 1977											
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.1	<0.07	<0.1	<0.07	<0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2																								
3	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4																								
5																								
													August 8, 1977											
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.13	0.1[illegible]	0.09	0 07	0.06	0.09	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2																								
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4																								
5																								

a Values shown with "<" are minimum quantifiable detection limits.

Table F-1 (Continued)

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station No.	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
												August 9, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.11	0.1	0.13	0.23	0 09	0.07	0.11	0.32	0.27	0.2	0.08	<0.05	<0.05	<0.05	<0.05	<0.05
2																								
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4																								
5																								
												August 10, 1977												
1	0.15	0.08	0.19	0.19	0.15	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.11	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	0.15	0.09	<0.05
2																								
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4																								
5																								
												August 11, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05												<0.05	<0.05	<0.05	<0.05
2																								
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4																								
5																								
												August 12, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05													
2	<0 05	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05															
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4																								
5																								
												August 13, 1977												
1																								
2												<0.5			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4															<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.12	0.09	0.08
5																								
												August 14, 1977												
1	<0 05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	<0.05	<0.05	<0.05	0.06	0.11	0.09	<0.05	<0.05	<0.05	<0.05
2	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5																								
												August 15, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	<0.05	<0.05	<0.05	<0.05						
2	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05
4	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	<0.05
5																								

Table F-1 (Continued)

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station	Hour																							
No.	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
												August 16, 1977												
1	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05						0.14	0.09	0.11								
2	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												August 17, 1977												
1									<0.05															
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												August 18, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												August 19, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.01	0.02	<0.05	<0.05	<0.05	<0.05
												August 20, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	0.06	0.12	0.07	0.06	<0.05	<0.05	<0.05	<0.05				<0.05
2	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												August 21, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	0.09						0.07	<0.05	<0.05	<0.05	<0.05	<0.05				
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05															
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												August 22, 1977												
1																								
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0 05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table F-1 (Continued)

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station No.	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
August 23, 1977																								
1	<0 05	<0.05	<0.05																					
2	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
August 24, 1977																								
1																				<0.05				
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
August 25, 1977																								
1																			<0.05					
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.04	<0.05	0.04	0.03
August 26, 1977																								
1																<0.05								
2	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	0.04	0.04	0.03								<0.05	0.12	0.12	0.12	0.12	0.12	<0.05	<0.05	<0.05
August 27, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05															
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																	<0.05							
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	0.08	0.12	0.10	0.13	0.12	0.07	<0.05
August 28, 1977																								
1																								
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
August 29, 1977																								
1																								
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05										<0.05							
4	<0.05	<0 05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table F-1 (Continued)

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station No.	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
August 30, 1977																								
1									<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0 05	<0.05	<0 05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05								<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	0.14	0.19	0.10	0.07	0.07	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	0 09	0.12	0.10	0.08	0.10	0.17	0.12	0.10
August 31, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	<0.05	0.08	<0.05					<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05									<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05
3	<0.05																	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5																								
September 1, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05								<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5													<0.05	<0.05	0.07	0.07	0.07	<0.05	0.12	0.12	0.07	0.07	0.08	0.09
September 2, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.17	0.21	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08
5	0.07	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	0.09	0.06	0.06	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 3, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	0.06	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 4, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.19	0.19	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	0.07	0.13	0.13	<0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 5, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table F-1 (Continued)

SO_2 DATA

NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY

Bartlesville, Oklahoma

Station No.	Hour 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
												September 6, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 7, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 8, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	0.13	0.08	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.07	<0.05	<0.05	<0.05	<0.05	<0.05	0.15	0.08	0.07	<0.05	<0.05	0.21	0.25	0.07	<0.05
												September 9, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 10, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 11, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.88	0.65	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	0.14	0.11	<0.05	0.07	0.08
												September 12, 1977												
1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.09	0.10	0.20	0.18	<0.05	<0.05	<0.05	0.13	0.13	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	0.13	<0.05	0.11	0.09	<0.05	0.08	0.11	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Table F-1 (Continued)

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station No.	Hour 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
September 13, 1977																								
1	<0.05	0.06	0.10	<0 05	0 06	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05											
3	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 14, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 15, 1977																								
1	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0 05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 16, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0 05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0 05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 17, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05			<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 18, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	0.10	0.12	0.20	0.19	0.13	0.11	0.12	0.10	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.20	<0.05	<0.05	0.15	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0:05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
September 19, 1977																								
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05					<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0 05	<0.05	<0 05	<0.05	<0.05	<0 05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0:05	<0.05	<0.05	<0.05

Table F-1 (Continued)

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station No.	Hour 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
												September 20, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 21, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05
												September 22, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.06	0.17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 23, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	0.15	0.16	0.06	0.17	0.16	0.11	0.19	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	0.08	<0.05	<0.05	<0.05
												September 24, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 25, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 26, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05															
4	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05																
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05					<0.05	0.06	0.07	<0.05	<0.05	<0.05	<0.05

Table F-1 (Continued)

SO_2 DATA
NATIONAL ZINC COMPANY AMBIENT AIR QUALITY SURVEY
Bartlesville, Oklahoma

Station No.	Hour 0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
												September 27, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05															
3																								
4																								
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 28, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4																								
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 29, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
3																								
4																								
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
												September 30, 1977												
1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05														
2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05															
3																								
4																								
5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05														

APPENDIX G

RAW TSP_2 DATA

Table G-1

TSP DATA
NATIONAL ZINC COMPANY AIR QUALITY MONITORING SURVEY
Bartlesville, Oklahoma

Sampling Date (1977)	Station 1	2	3 ($\mu g/m^3$)	4	5
Aug.					
2	76				
3	107		52		
4	78		48		
5	149		46		
6	65		41		58
7			33		
8	103		41		94
9	101	41	47		104
10	126	49	41	48	112
11	47	36	37	29	57
12	55	42	42	40	67
13	80	63	37	86	57
14	74	37	30		61
15	117	44	38		61
16	126	55	54	61	90
17	68	36	34	25	40
18	88	44	55	59	51
19	44	38	37	50	44
20	67	43	38	60	61
21			32	38	92
22	113	51	45	76	85
23	59	38	31	50	93
24		57	64	66	61
25	106	60	52	107	89
26	104	69	57	109	109
27	88	57	54	82	90
28	32		23	28	28
29	77	41	34	41	51
30	74	37	30	74	64
31	89	56	38	81	78
Sept.					
1	84	49	42	100	73
2	184	63	56	117	97
3	140	72	65	101	112
4		70	62	75	93
5	55		52	51	54
6	83	66	66	57	80
7	132	91	92	91	122

Table G-1 (Continued)

TSP DATA
NATIONAL ZINC COMPANY AIR QUALITY MONITORING SURVEY
Bartlesville, Oklahoma

Sampling Date (1977)	Station				
	1	2	3	4	5
			μg/m^3		
Sept.					
8	131	89		144	151
9	105	81	72	85	170
10	86	71	65	78	76
11	44		38	62	60
12	59		37	72	81
13	39	29	18	19	32
14	30	28	23	24	25
15	34	32	30	44	35
16	46	38	31	59	61
17	48	33	28	49	67
18		40	34	44	103
19	70	49	38	42	188
20	124	51	40	98	115
21	85	58	59	101	94
22	107		53	117	92
23	86	44	41	96	108
24	98	74	55	77	155
25	84	62	53	64	224
26	105				

APPENDIX H

RAW SO_2 DATA

Table H-1

SULFATE DATA
NATIONAL ZINC COMPANY AIR QUALITY MONITORING SURVEY
Bartlesville, Oklahoma

Date (1977)	Station No.	TSP $\mu g/m^3$	$SO_4^=$ $\mu g/m^3$
		Aug.	
3	1	107	5.8
	3	52	4.4
5	1	149	12.2
	3	46	11.8
8	1	103	9.9
	3	41	5.8
	5	94	13.5
9	1	101	10.5
	3	47	6.1
13	4	86	12.2
	2	63	8.1
14	1	74	5.2
	3	30	3.5
16	1	126	7.4
	3	54	5.3
19	5	44	12.8
	3	37	12.1
20	1	67	13.1
	3	38	13.0
22	5	85	14.6
	3	45	8.7
26	5	109	17.8
	3	57	6.7
27	5	90	12.3
	3	54	4.4
30	5	64	14.8
	3	30	3.0
31	1	89	3.7
	3	38	5.5
		Sept.	
11	1	44	10.1
	3	38	11.2

APPENDIX I

RAW METALS DATA

Table I-1

METALS DATA
NATIONAL ZINC COMPANY AIR QUALITY MONITORING SURVEY
Bartlesville, Oklahoma

Analyses Performed	September 1977 2	3	4	7	8
	µg/filter				
			Station No. 1		
Sn	<8[a]	<8	<8	<8	<8
As	<65	<65	<65	<65	<65
Sb	<59	<59	<59	<59	<59
Zn	350	770	260	260	940
Pb	80	390	69	120	160
Cd	<6	<6	<6	<6	8
B	<12	<50	<12	<12	<12
Fe	690	1,900	360	430	680
Mn	<21	32	<21	24	25
V	<17	<17	<17	<17	<17
Cu	9	23	9	16	19
Ag	<13	<13	<13	<13	<13
Ni	<75	<75	<75	<75	<75
Cr	<28	<28	<28	<28	<28
Y	2	2	2	2	2
Mo	<74	<74	<74	<74	<74
Se	<6	<6	<6	<6	<6
W	<110	<110	<110	<110	<110
Filter #	21	25	33	45	51
Residue Wt	23,400	19,800	11,800	15,600	13,600
			Station No. 3		
Sn	<8	<8	<8	<8	<8
As	<65	<65	<65	<65	<65
Sb	<59	<59	<59	<59	<59
Zn	50	100	4	210	200
Pb	<69	<69	<69	110	140
Cd	<6	<6	<6	<6	<6
B	<12	<12	<12	<12	<12
Fe	280	330	<14	340	430
Mn	<21	<21	60	<21	26
V	<17	<17	18	<17	<17
Cu	11	16	16	23	25
Ag	<13	<13	44	<13	<13
Ni	<75	<75	220	<75	<75
Cr	<28	<28	96	<28	37
Y	2	3	10	<1	3
Mo	<74	<74	320	<74	90
Se	<6	<6	<6	<6	<6
W	<110	<110	<110	<110	<110
Filter #	24	26	34	44	55
Residue Wt	6,700	10,300	8,500	10,200	9,400

Table I-1 (Continued)

METALS DATA
NATIONAL ZINC COMPANY AIR QUALITY MONITORING SURVEY
Bartlesville, Oklahoma

Analyses Performed	September 1977: 2	3	4	7	8
	µg/filter				
			Station No. 4		
Sn	<8		<8	<8	<8
As	<65		<65	<65	<65
Sb	<59		<59	<59	<59
Zn	42		380	41	1,350
Pb	<69		76	<69	260
Cd	<6		<6	<6	13
B	<12		<12	<12	16
Fe	40		330	140	820
Mn	<21		<21	<21	38
V	<17		<17	<17	<17
Cu	<7		33	8	32
Ag	<13		<13	<13	15
Ni	<75		<75	<75	80
Cr	<28		<28	<28	39
Y	2		4	<1	4
Mo	<74		<74	<74	97
Se	<6		<6	<6	<6
W	<110		<110	<110	<110
Filter #	31[b]		30	48[b]	49
Residue Wt.			9,100		12,700
			Station No. 5		
Sn	<8	<8	<8	<8	<8
As	<65	<65	<65	<65	<65
Sb	<59	<59	<59	<59	<59
Zn	720	400	<4	100	1,910
Pb	140	130	85	98	150
Cd	<6	<6	12	<6	16
B	<12	<12	<12	<12	<12
Fe	720	640	<14	400	680
Mn	<21	<21	74	<21	28
V	<17	<17	<17	<17	<17
Cu	32	16	22	13	47
Ag	<13	<13	52	<13	<13
Ni	<75	<75	270	<75	<75
Cr	<28	<28	116	<28	<28
Y	2	3	12	<1	3
Mo	<74	<74	370	<74	<74
Se	<6	<6	<6	<6	<6
W	<110	<110	<110	<110	<110
Filter #	23	27	32	42	50
Residue Wt	13,600	16,100	12,900	12,900	17,500

a Values shown with "<" are minimum quantifiable detection limits.
b Filter Blank.

Table I-2

METALS DATA (SOIL SAMPLES)
NATIONAL ZINC COMPANY AIR QUALITY MONITORING SURVEY
Bartlesville, Oklahoma

Analyses Performed	Station Number - Sequence No.								
	1-01	1-02	3-01	3-02	3-03 µg/g	5-01	5-02	6-01	MQDL[a]
Sn	13	17	16	<10[b]	<10	17	10	<10	10
As	130	150	120	34	42	190	98	<30	30
Sb	47	65	48	14	17	76	<10	<10	10
Zn	13,900	33,000	970	340	570	38,300	5,000	260	2
Pb	1,300	2,100	150	58	77	1,800	1,400	62	8
Cd	137	350	7	<1	<1	500	420	<1	1
B	74	<7	43	76	140	24	51	140	7
Hg	-	-	-	-	-	-	-	-	-
Fe	54,100	57,800	93,900	32,100	46,400	40,600	29.000	10,800	2
Mn	820	930	830	380	650	580	500	420	3
V	108	83	130	65	88	103	73	74	1
Cu	330	640	37	18	15	640	410	19	1
Ag	10	17	<2	<2	12	16	4	<2	2
Ni	26	40	64	<8	8	70	9	<8	8
Cr	66	64	50	41	42	49	41	67	3
Y	6	4	9	1	<.2	4	2	6	0.2
Mo	53	100	<50	<50	<50	70	<50	<50	50
Se	<220	620	<220	<220	<220	<220	<220	<220	220
W	<80	94	<80	<80	<80	102	<80	<80	80
U	<71	<71	<71	<71	<71	<71	<71	<71	71

a Minimum Quantifiable Detection Limit = 10σ background noise plus the inter-element correction.
b Values shown with "<" are minimum quantifiable detection limits.