United States
Environmental Protection
Agency

Environmental Monitoring and Support
Laboratory
Research Triangle Park NC 27711

EPA-600/4-79-041
June 1979

Research and Development

EPA

Air Quality Data for Nonmetallic Inorganic Ions

NH_4^+, NO_3^-, $SO_4^=$, 1976 from the National Air Surveillance Networks

RESEARCH REPORTING SERIES

Research reports of the Office of Research and Development, U.S. Environmental Protection Agency, have been grouped into nine series. These nine broad categories were established to facilitate further development and application of environmental technology. Elimination of traditional grouping was consciously planned to foster technology transfer and a maximum interface in related fields. The nine series are:

1. Environmental Health Effects Research
2. Environmental Protection Technology
3. Ecological Research
4. Environmental Monitoring
5. Socioeconomic Environmental Studies
6. Scientific and Technical Assessment Reports (STAR)
7. Interagency Energy-Environment Research and Development
8. "Special" Reports
9. Miscellaneous Reports

This report has been assigned to the ENVIRONMENTAL MONITORING series. This series describes research conducted to develop new or improved methods and instrumentation for the identification and quantification of environmental pollutants at the lowest conceivably significant concentrations. It also includes studies to determine the ambient concentrations of pollutants in the environment and/or the variance of pollutants as a function of time or meteorological factors.

This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

AIR QUALITY DATA FOR NONMETALLIC INORGANIC IONS: NH_4^+, NO_3^-, $SO_4^=$ 1976 FROM THE NATIONAL AIR SURVEILLANCE NETWORKS

by

Donald H. Fair, Raymond C. Rhodes, E. Gardner Evans
Statistical and Technical Analysis Branch

John C. Puzak
Quality Assurance Branch

Frank E. Butler, John E. Frazer and Allan Riley
Analytical Chemistry Branch

ENVIRONMENTAL MONITORING AND SUPPORT LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

DISCLAIMER

This report has been reviewed by the Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

FOREWORD

Measurement and monitoring research efforts are designed to anticipate potential environmental problems, to support regulatory actions by developing an in-depth understanding of the nature and processes that impact health and the ecology, to provide innovative means of monitoring compliance with regulations and to evaluate the effectiveness of health and environmental protection efforts through the monitoring of long-term trends. The Environmental Monitoring and Support Laboratory, Research Triangle Park, North Carolina is responsible for development of: environmental monitoring technology and systems; agency-wide quality assurance programs for air pollution measurement systems; and technical support to the Agency's operating functions including the Office of Air, Noise and Radiation, the Office of Toxic Substances and the Office of Enforcement.

Data concentrations of three nonmetallic inorganic ions in particulate matter from the National Air Surveillance Networks are presented in this report. It is anticipated that this report will be updated on an annual basis. Any changes in the introductory material (site descriptions, data table presentations, laboratory methodology, etc.) made by EPA will be included in future reports.

Thomas R. Hauser
Director
Environmental Monitoring and
Support Laboratory

ABSTRACT

Samples collected during 1976 by the cooperating stations of the National Air Surveillance Networks (NASN) provided the data for summarizing the annual urban and nonurban concentrations of three nonmetallic inorganic ions in suspended particulate matter. The ions are ammonium (NH_4^+), nitrate (NO_3^-), and sulfate ($SO_4^=$). Concentration data are presented as cumulative frequency distributions. The arithmetic and geometric means and standard deviations are also reported.

Four previous EPA publications, APTD-0978, APTD-1466, EPA-600/4-77-003, and EPA-600/4-78-035 list data collected during 1968, 1969-1970, 1971-1974, and 1975 respectively, for the three types of ions.

CONTENTS

Foreword iii
Abstract iv
Figures vi
Tables vi
Acknowledgments vii
1. Introduction 1
Organizational Structure 1
Sample Collection 3
Data Handling and Analysis 6
2. Quality Control 8
Introduction 8
Limits of Detection 9
Blank Filter Analysis and Limits of Discrimination 9
Precision 11
Bias 16
Analytical Quality Assessment 26
3. Laboratory Methods 29
Sampling Procedure 29
Nonmetallic Ion Analysis Procedure 30
4. National Summary of Air Quality Measurements 32
5. Data Tables 37
Appendices
A. Grubb's Statistic for the Detection of Outliers 63
B. Confidence Limits of Measured Values 65

FIGURES

Number		Page
1-1	EPA Regions and Regional Offices	5
2-1	Mean and Range Control Charts (Low Level $SO_4^=$)	19
2-2	Mean and Range Control Charts (Middle Level $SO_4^=$)	20
2-3	Mean and Range Control Charts (High Level $SO_4^=$)	21
2-4	Mean and Range Control Charts (Low Level NO_3^-)	22
2-5	Mean and Range Control Charts (Middle Level NO_3^-)	23
2-6	Mean and Range Control Charts (High Level NO_3^-)	24
B-1	Graphical Representation of Upper and Lower Confidence Limits.	67

TABLES

Number		Page
1-1	NASN Networks Modifications	2
1-2	EPA Regions and Locations of Regional Offices	4
2-1	Limits of Detection, Blank Filter Analyses and Limits of Discrimination	10
2-2	Measures of Precision for 1976 NASN Filters	13
2-3	Summary of Audit Sample Program for NO_3^- and $SO_4^=$	17
2-4	Analytical Precision and Bias 1976	28
4-1	Urban National Cumulative Frequency Distributions	34
4-2	Nonurban National Cumulative Frequency Distributions	35
5-1	Frequency Distributions of Nonmetallic Ions in Suspended Particulates	40
	Ammonium	
	Urban	40
	Nonurban	46
	Nitrates	
	Urban	48
	Nonurban	54
	Sulfates	
	Urban	55
	Nonurban	61

ACKNOWLEDGMENTS

The data in this publication were collected with the generous support of the many state and local air pollution control agencies that operate the NASN stations. Also, the 10 EPA Regions have participated in this program since 1973 by sending the high volume filters to the centralized laboratory of the Environmental Monitoring and Support Laboratory.

The authors also thank those who contributed their time and effort to publishing this document.

SECTION 1

INTRODUCTION

ORGANIZATIONAL STRUCTURE

The Environmental Protection Agency (EPA), with the assistance and cooperation of state and local agencies, conducts a variety of air sampling activities to obtain information about the air quality in the United States. One such program, the National Air Surveillance Networks (NASN), has existed for over 20 years. The networks have grown and undergone many modifications since their beginning, especially during the last 5 years. Table 1-1 catalogues these recent changes.

The first change, in sampling schedule, was brought about to encourage synoptic sampling with state/local ambient monitoring programs. In addition to assisting in the operation of the EPA sampling network, state and local air pollution control agencies administer their own air pollution control programs.

The second change, decentralization, was made to shift air monitoring responsibility from one centralized laboratory to the 10 EPA regional laboratories. This modification was implemented over the 14 month period from December 1972 through January 1974. Moreover, in January 1974, the responsibilities of the 10 EPA Regional Offices were extended further to the overall management of the NASN sites. Additional duties included weighing the sample filters and determining the concentrations of total

TABLE 1-1. NASN NETWORK MODIFICATIONS

Month/Year	Change	Impact*
January 1972	Sample schedule changed from random biweekly to 12-day systematic samples, first sample collected 1/10/72.	All sites
December 1972	Decentralization, Region II	NJ, NY, PR
April 1973	Decentralization, Region I	CT, ME, MA, NH, RI, VT
December 1973	Decentralization, Regions V, VII, VIII, IX, X	IL, IN, MS, MN, OH, WI, IA, KS, MO, NE, CO, MT, ND, SD, UT, WY, AZ, CA, HI, NV, AK, ID, OR, WA
January 1974	Decentralization, Regions III, IV, VI	DE, DC, MD, PA, VA, WV, AL, FL, GA, KY, MS, NC, SC, TN, AR, LA, NM, OK, TX

*Abbreviations coincide with standard U.S. mail code designations for states.

particulates (TSP). Table 1-2 and Figure 1-1 indicate the locations of the Regional Offices and the geographic areas of responsibility.

After completing their tasks, the EPA regional laboratories send the sample filters to the EPA Filter Bank for routine trace constituent[1] analyses. The filters were stored there for non-routine, special analyses as required.

Although pollutant monitoring was decentralized, the analysis and publication of the trace pollutant data remained the responsibility of one laboratory, the Environmental Monitoring and Support Laboratory (EMSL), Research Triangle Park, North Carolina. Prior to January 1974, sample filters also were weighed and analyzed for TSP by EMSL; however, after this date, the EPA regional laboratories performed these tasks as mentioned previously.

SAMPLE COLLECTION

Samples were collected at approximately 300 urban and 35 nonurban NASN sites located across the country. The urban sites are generally located within a city or town or adjacent suburbs. The nonurban sites were originally located in rural or remote areas, although with the passage of time, many of these rural areas, especially in the northeast, have become more heavily populated and thus are subject to increasing influences of spreading urbanization. Voluntary operation of each site is maintained through the generous assistance of local or state agencies and individuals such as park rangers, firemen, or policemen.

---

[1]Metals, nonmetallic inorganic ions, and BaP.

TABLE 1-2. EPA REGIONS AND LOCATIONS OF REGIONAL OFFICES

Region	Regional Office Location
I	Boston, Massachusetts
II	New York, New York
III	Philadelphia, Pennsylvania
IV	Atlanta, Georgia
V	Chicago, Illinois
VI	Dallas, Texas
VII	Kansas City, Missouri
VIII	Denver, Colorado
IX	San Francisco, California
X	Seattle, Washington

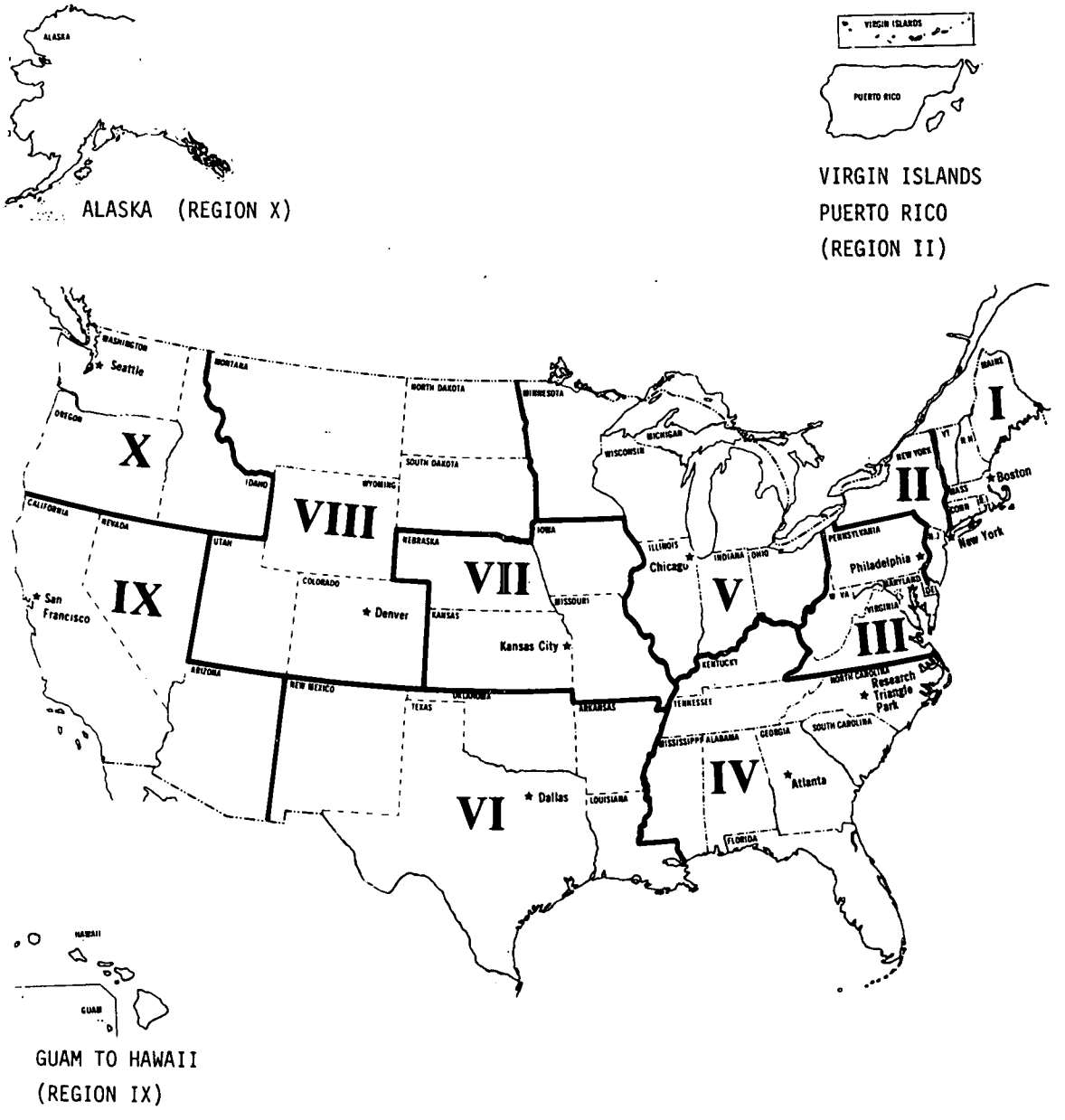

Figure 1-1. EPA Regions and Regional Offices

Prior to 1972, 24-hour samples (beginning at midnight) were collected according to a biweekly (26 samples per year) modified random sampling schedule. The schedule was modified to ensure equal representation for each of the seven days of the week. Since 1972, however, samples have been collected every 12th day (30 or 31 samples per year). The initial sampling date was January 10, 1972. This sampling schedule eliminates the need for redesigning a new sampling schedule each year. In addition, it is easily implemented in the field.

DATA HANDLING AND ANALYSIS

Beginning with the 1974 samples, the responsibility for managing the NASN was given to each of the 10 EPA Regions (Table 1-2). Prior to that time one centralized laboratory located at Research Triangle Park, North Carolina, weighed and analyzed the high volume filters. The Regions now send the total suspended particulate values to the National Aerometric Data Bank (NADB) and the weighed filters to the EPA Filter Bank (FB) for routine trace constituent analyses and storage in the Filter Bank for non-routine special analyses as needed. The resulting data are published by EMSL and are sent to the National Aerometric Data Bank (NADB) for archiving.

The sampling data were analyzed by EMSL to determine those data to exclude from data summaries because of anomalies. The precision and bias of the data were determined using statistical analyses. The overall accuracy of the sampling data was evaluated to assist with interpretation of the air quality summaries.

The air quality summaries include annual concentration data classified as urban and nonurban origin and compiled for the nation as a whole and

also for individual site locations. The data are presented as cumulative frequency distributions, and the arithmetic and geometric means and standard deviations also are tabulated.

SECTION 2

QUALITY CONTROL

INTRODUCTION

This section presents the quality control data from which analytical detection limits and analytical performance were determined. The assessment of analytical performance includes the estimation of precision and bias. These estimates are combined statistically to determine an overall measure of analytical quality assessment.

To ensure that only valid data were used, the data were subjected to a stringent test for outliers. A Grubb's statistical test for multiple outliers was used as described in Appendix A. The data were compared within a year and against the previous three years to determine whether the values were outliers. All outliers were reported to the laboratory for reanalysis of the sample filters.

Of the samples analyzed, there was only one (1) value for sulfate and none for nitrate that seemed to be an outlier. The sulfate value was reported to the laboratory for reanalysis and the new result was no different from the value originally reported.

LIMITS OF DETECTION

The "limit of detection" for an instrumental analytical method is the minimum concentration of the constituent or species of interest which can be observed by the instrument and distinguished from instrumental noise with a specified degree of probability.[1] The limits of detection were determined by fitting a linear equation to the instrumental noise level, expressed as a standard deviation, as a function of concentration and extrapolating to zero concentration. The limits of detection values given in Table 2-1 are 3.3 times the extrapolated standard deviation plus the intercept obtained from the response versus known concentration relationship. These limits, therefore, are the upper 97.5 percent tolerance limits, at 95 percent confidence,[2] for the instrumental noise at zero concentration.

It is noted from Table 2-1 that for the sulfate analysis, the limit of detection has decreased since 1973. This decrease has been attributed to the replacement of the Autoanalyzer, Technicon I with the Technicon II. Analyses for nitrate and ammonium ions have also been made with the Technicon II since 1973. However, the decreases have not been significant.

BLANK FILTER ANALYSES AND LIMITS OF DISCRIMINATION

Prior to the filters being distributed for sampling, at least twenty clean (unexposed) filters from the filter lot used by the NASN were

---

[1] "Trace Analysis, Physical Methods," G.H. Morrison, Ed., Interscience Publishers, (1965), pages 2-3.

[2] "Experimental Statistics," Mary Natrella, NBS Handbook 91, Table T-15.

TABLE 2-1. LIMITS OF DETECTION, BLANK FILTER ANALYSES AND LIMITS OF DISCRIMINATION

			Concentration, $\mu g/m^3$*		
			Blank Filter Analyses		
Ion	Year	Limits of Detection	Average	Standard Deviation	Limits of Discrimination
Ammonium	1971-1974	0.05	0.05		
	1975	0.10	0.02**		
	1976	0.04	0.04	0.05	0.12
Nitrate	1971-1974	0.06	0.06		
	1975	0.05	0.02**		
	1976	0.04	0.07	0.04	0.10
Sulfate	1971-1973	0.6	0.8		
	1974	0.2	0.5		
	1975	0.05	0.3**		
	1976	0.07	0.29	0.16	0.38

*The values were calculated assuming an air volume of 2500 cubic meters per filter.

**The corresponding values were incorrectly reported in the previous report, EPA-600/4-78-005.

analyzed for NH_4^+, NO_3^-, and $SO_4^=$. The average results of these analyses, given below, were used to correct the raw analyses for the exposed filters.

NH_4^+	0.02 $\mu g/m^3$
NO_3^-	0.02 $\mu g/m^3$
$SO_4^=$	0.30 $\mu g/m^3$

During the analysis of the exposed filters, blank filters were analyzed with each analysis run for quality control purposes. The averages and standard deviations of these quality control blanks are presented in Table 2-1.

The "limit of discrimination" is the minimum concentration unique to a given batch of filters and the measurement methods involved which can with a specified degree of probability be attributed to the particulate on the filter and not confused with the combined effect of the filter material itself and the measurement method.[3] The limit of discrimination is determined from the standard deviation of the analyses of blank filters, which includes measurement error associated with filter material and the analytical method. The limit of discrimination is the upper limit of the tolerance interval (95%-95%) centered at zero concentration (the average blank filter analysis is subtracted from all determinations). The calculated values for the limits of discrimination are presented in Table 2-1.

[3] "Assessment of Arsenic Losses During Ashing: A Comparison of Two Methods Applied to Atmospheric Particulates," J.F. Walling, et. al., JAPCA, Vol. 28, No. 11, November 1978.

In earlier reports, separate limits of discrimination were given for urban and nonurban samples because the portion of each filter used for analysis of nonurban samples was larger than that for urban samples in order to obtain enough particulate matter for analysis. Beginning with the samples for 1974, the portions of each filter used for analysis have been the same for both urban and nonurban samples, the portion being the same as previously used for urban samples. Therefore, the limits of discrimination values for 1974, 1975, and 1976 apply to both urban and nonurban samples.

PRECISION

Table 2-2 presents precision estimates for the various analyses. The measures of precision are expressed as percentages of concentration level because precision is generally concentration dependent.

Precision estimates are based upon the percent difference between analysis of extracts from two different filter strips from the same filter. Thus, the measure of precision includes variation caused by the cutting, extracting, and analytical processes as well as any actual variability between filter strips. Precision data were generated throughout the analysis period. Duplicate strips of every 10th sample were analyzed. For 1976 samples, approximately 200 pairs of duplicate strips were analyzed for each ion. From analyses of these duplicate strips, precision estimates have been obtained. In determining the estimates, a number of outlier values were omitted from consideration. These outlier values resulted when excessive percentage differences between the paired data were obtained. For each pair of data, percentage differences were computed by the following formula:

TABLE 2-2. MEASURES OF PRECISION FOR 1976 NASN FILTERS

Concentration Level (μg/m³)	Differences Between Duplicate Strip Analyses		Individual Analysis Values	
	Standard Deviation of Percent Differences $S_{\%d}$, (%)	99% Control Limits (±2.576 $S_{\%d}$) (%)	Coefficient of Variation, C_v (%)	Approximate 95% Confidence Limits (%)
		Ammonium		
Below 1.0	60	±155	42	±85
Above 1.0	37	± 95	26	±52
		Nitrates		
Below 3	24	± 62	17	±34
3→6	14	± 36	10	±20
Above 6	18	± 46	14	±28
		Sulfates		
Below 6	18.0	± 46	12	±25
6→20	9.4	± 24	6.7	±13
Above 20	5.8	± 15	4.1	± 8.2

$$\%d = [2(x_1-x_2) \div (x_1+x_2)](100) \qquad (1)$$

where %d = percentage difference between analyses of duplicate strips (difference between values divided by the average of the two values), percent

x_1, x_2 = concentration values of the two analyses of duplicate strips, $\mu g/m^3$

For each of the different pollutant concentration ranges as shown in Table 2-2, the average percent difference ($\overline{\%d}$) and the standard deviation of percent differences ($S_{\%d}$) were calculated. The standard deviation of percentages is calculated by the following equation:

$$S_{\%d} = \left[\frac{\Sigma\%d^2-(\Sigma\%d)^2/n}{n-1}\right]^{0.5} \qquad (2)$$

The above standard deviation applies to the percentage differences of the results from the duplicate strips, and provides a basis for control limits which can be applied to the results of future duplicate strip analyses. The standard deviations and the 99 percent control limits which are associated with the percentage differences between duplicate strips are shown in Table 2-2.

The standard deviations of Table 2-2 must be divided by $\sqrt{2}$ to obtain the standard deviation (actually coefficient of variation) which measures the precision of an individual reported pollutant concentration value. It has been shown that, for normal underlying parent distributions with coefficients of variation, τ, less than 0.35, the distribution of percent

differences is approximately normal with standard deviation, $\sqrt{2}\tau$. See "The Distribution of the Relative Difference of Paired Data," by J.C. Suggs, Proceedings, Quality Assurance in Air Pollution Measurement, March 11-14, 1979, New Orleans, LA. These coefficient of variation values are also shown in Table 2-2 and can be used for computing approximate confidence limits on individual reported pollutant concentration values, considering precision only, i.e., assuming no bias. Approximate confidence limits* are computed from the following formula:

$$L_u = X\,[1 + kC_v/100] \qquad (3a)$$

$$L_\ell = X\,[1 - kC_v/100] \qquad (3b)$$

where L_u = upper confidence limit, $\mu g/m^3$

L_ℓ = lower confidence limit, $\mu g/m^3$

X = single reported sample value, $\mu g/m^3$

k = standard normal deviate corresponding to the desired confidence level

C_v = coefficient of variation of individual analysis values, percent

As a sample calculation, assume that an individually reported concentration for nitrate is 5.3 $\mu g/m^3$. In Table 2-2 the corresponding value for the coefficient of variation is 10 percent. Assuming that 95 percent confidence limits of the true value are desired, the value of k is 1.96. Substituting these data in Equation 3:

---

*A more exact formula is presented in Appendix B.

$$L_u = 5.3\ [1 + 1.96(10)/100] = 6.3\ \mu g/m^3 \qquad (4a)$$

$$L_\ell = 5.3\ [1 - 1.96(10)/100] = 4.3\ \mu g/m^3 \qquad (4b)$$

These limits can also be given the following interpretation. If it were possible to analyze a large number of individual strips from the same filter having a true nitrate concentration of 5.3 $\mu g/m^3$, 95 percent of such results would fall within the stated limits.

BIAS

An independent estimate of bias is obtained for nitrate and sulfate analyses through an audit program involving the analysis of strips of blank high volume filters, identical to those used for ambient air sampling, but which have been spiked with known amounts of nitrate and sulfate. The percent recovery is calculated as follows:

Percent Recovery = Analyzed Value/Known Value x 100

Bias is equal to the percent recovery minus 100.

The samples used for audits have been developed by the Quality Assurance Branch (QAB) of EMSL as part of its program for assisting analytical laboratories to improve their inhouse analysis capabilities. Each lot of samples is analyzed by QAB and a corroborative laboratory before it is accepted for use in the audit program. The QAB analysis, the corroborative analysis and the attempted spike must agree to within 5 percent and the coefficient of variation for a spike level must be less than 2.5 percent or the samples are rejected. Table 2-3 presents the bias information.

The main use of the audit results is to document chronologically the precision and accuracy achieved by the analytical laboratory. QAB has found that a meaningful way to display the precision and accuracy is through mean and range control charts.

TABLE 2-3. SUMMARY OF AUDIT SAMPLE PROGRAM FOR NO_3^- and $SO_4^=$

Mean Concentration	Recovery (%)	Bias (%)	Standard Deviation of Recovery and Bias (%)	Number of Samples
		Nitrate		
Below 3 μg/m³	96.7	-3.3	6.3	59
3→6 μg/m³	95.5	-4.5	5.6	60
Above 6 μg/m³	97.6	-2.4	3.4	60
All Samples	96.6	-3.4	5.3	179
		Sulfate		
Below 6 μg/m³	95.7	-4.3	9.3	58
6→20 μg/m³	95.0	-5.0	3.3	60
Above 20 μg/m³	94.9	-5.1	3.0	60
All Samples	95.2	-4.8	5.9	178

Results of audit samples analyzed with 1976 NASN filters.

Every two weeks a set of 10 audit samples is given to the analytical laboratory to be analyzed with the ambient air samples. One blank and triplicates in a high, middle, and low range are included in each set. The analytical laboratory distributes the audit samples as evenly as possible among the analysis days during the audit period and intersperses the audit samples throughout their normal analyses of ambient air samples. Mean and range control charts are constructed and routinely used for the high level, mid-level, and low-level samples. These control charts for the analyses of the 1976 filters are presented in Figures 2-1 through 2-6. Figures 2-1, 2-2, and 2-3 show the results of SO_4 audit samples for the low, middle, and high levels, respectively. Figures 2-4, 2-5, and 2-6 show the results of NO_3 audit samples for the low, middle, and high levels, respectively. The low, middle, and high levels correspond to the concentration levels shown in Table 2-3. The means and the upper and lower control limits (UCL and LCL, respectively) were based on the results from similar audit samples for 1975 filters. The control limits are 3-sigma (3 standard deviation) limits representing the 99.7 percent probability limits. On the figures, the alphabetical designators along the abscissa scale (week) represent the set of audit samples given to the laboratory biweekly. Thus, the plotted values for the "Percent Accuracy" on the bottom figure of each page represent the average of the three audit samples at each level. The plotted values for "Percent Range" on the top figure of each page represents the percentage range of the three audit samples at each level, computed as follows:

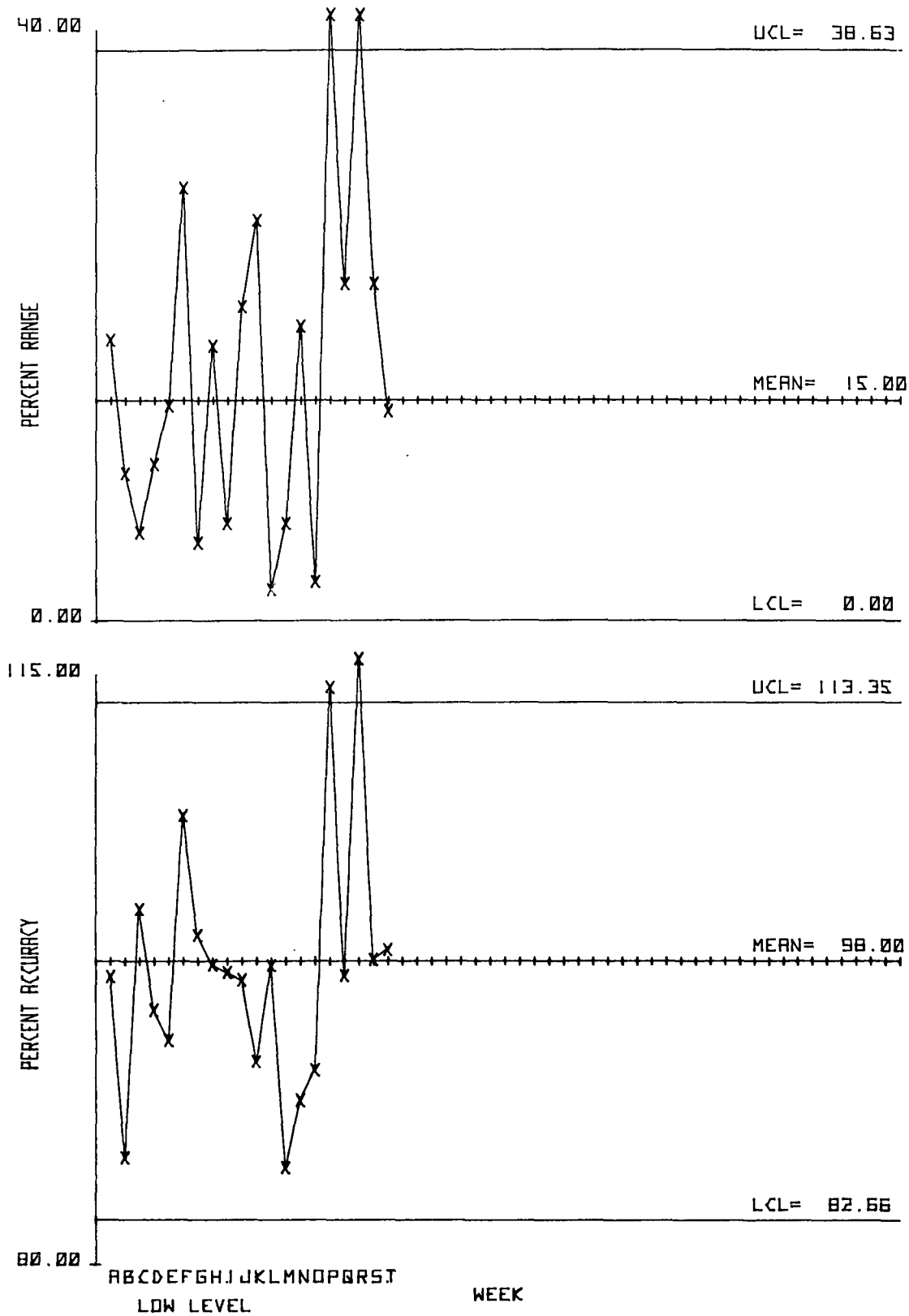

Figure 2-1. Mean and Range Control Charts (Low Level $SO_4^{=}$)

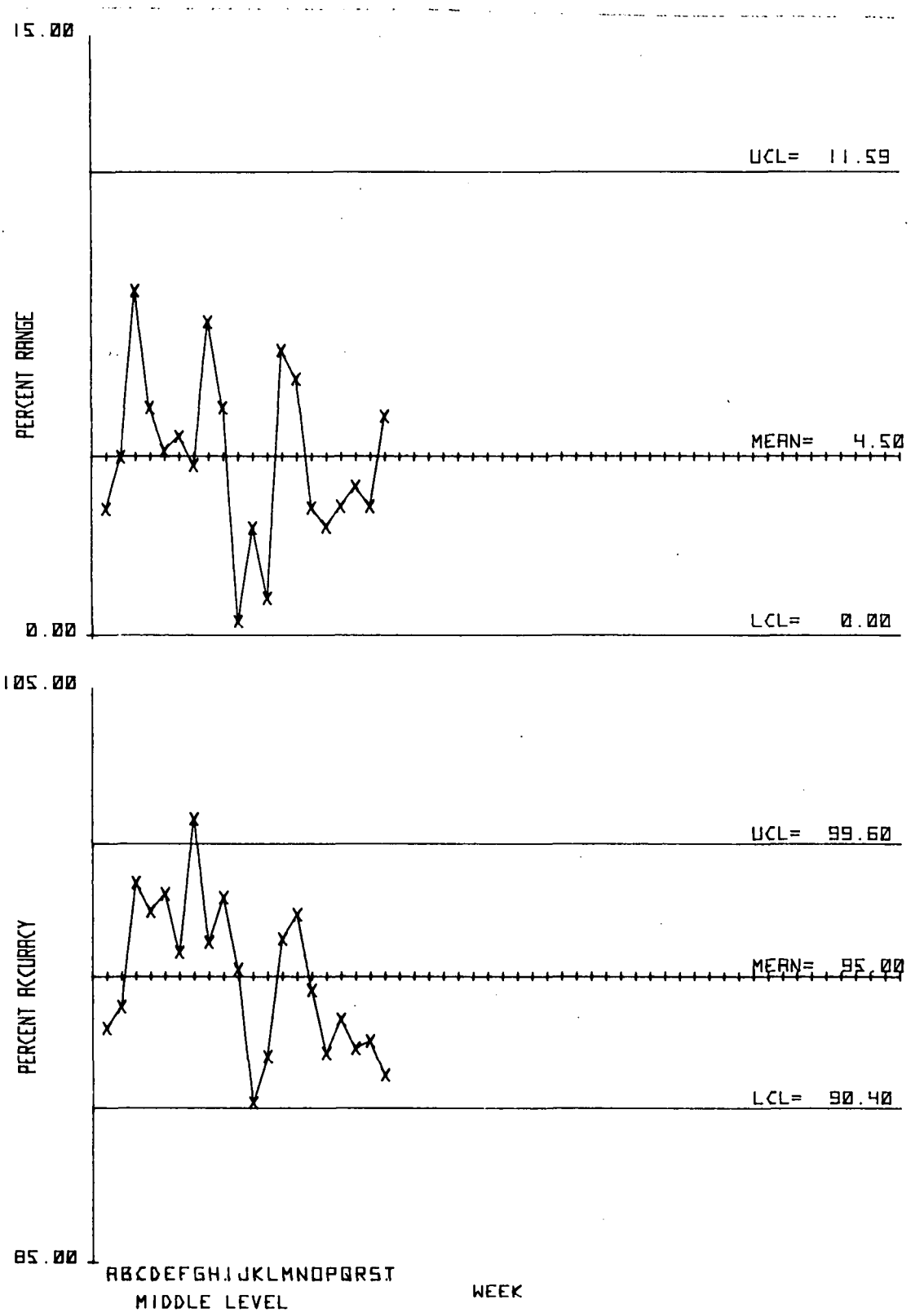

Figure 2-2. Mean and Range Control Charts (Middle Level $SO_4^=$)

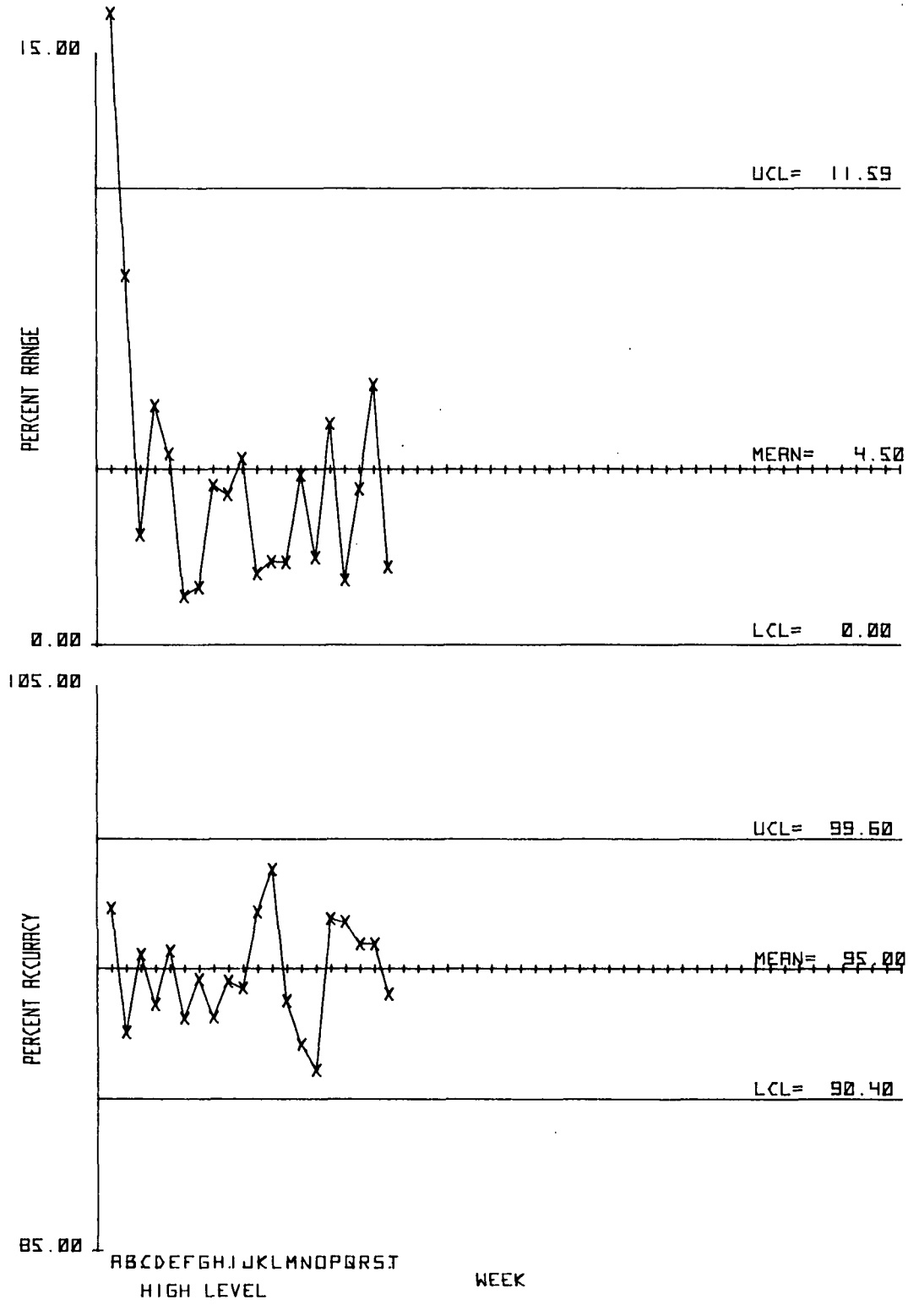

Figure 2-3. Mean and Range Control Charts (High Level $SO_4^{=}$)

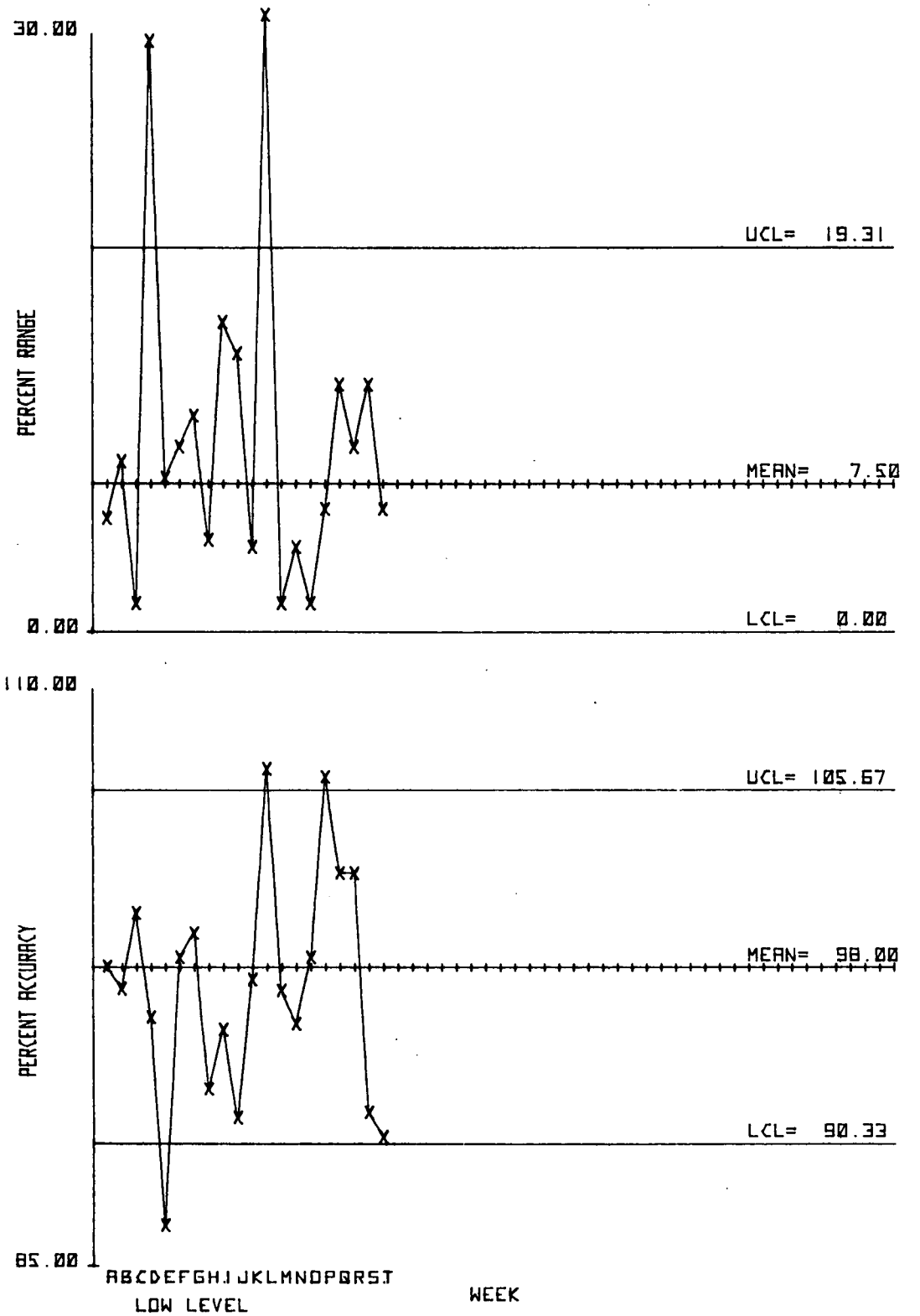

Figure 2-4. Mean and Range Control Charts (Low Level NO_3^-)

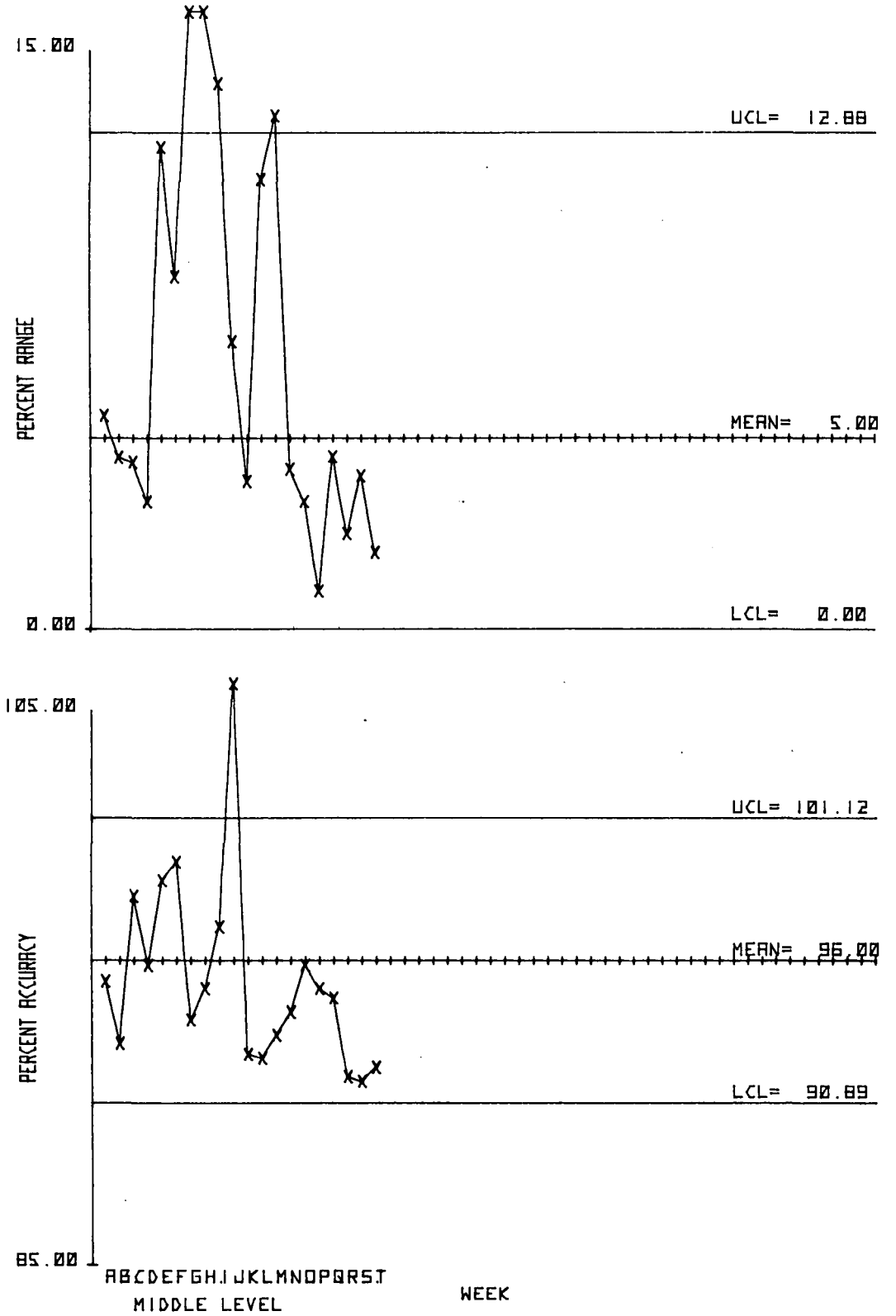

Figure 2-5. Mean and Range Control Charts (Middle Level NO_3^-)

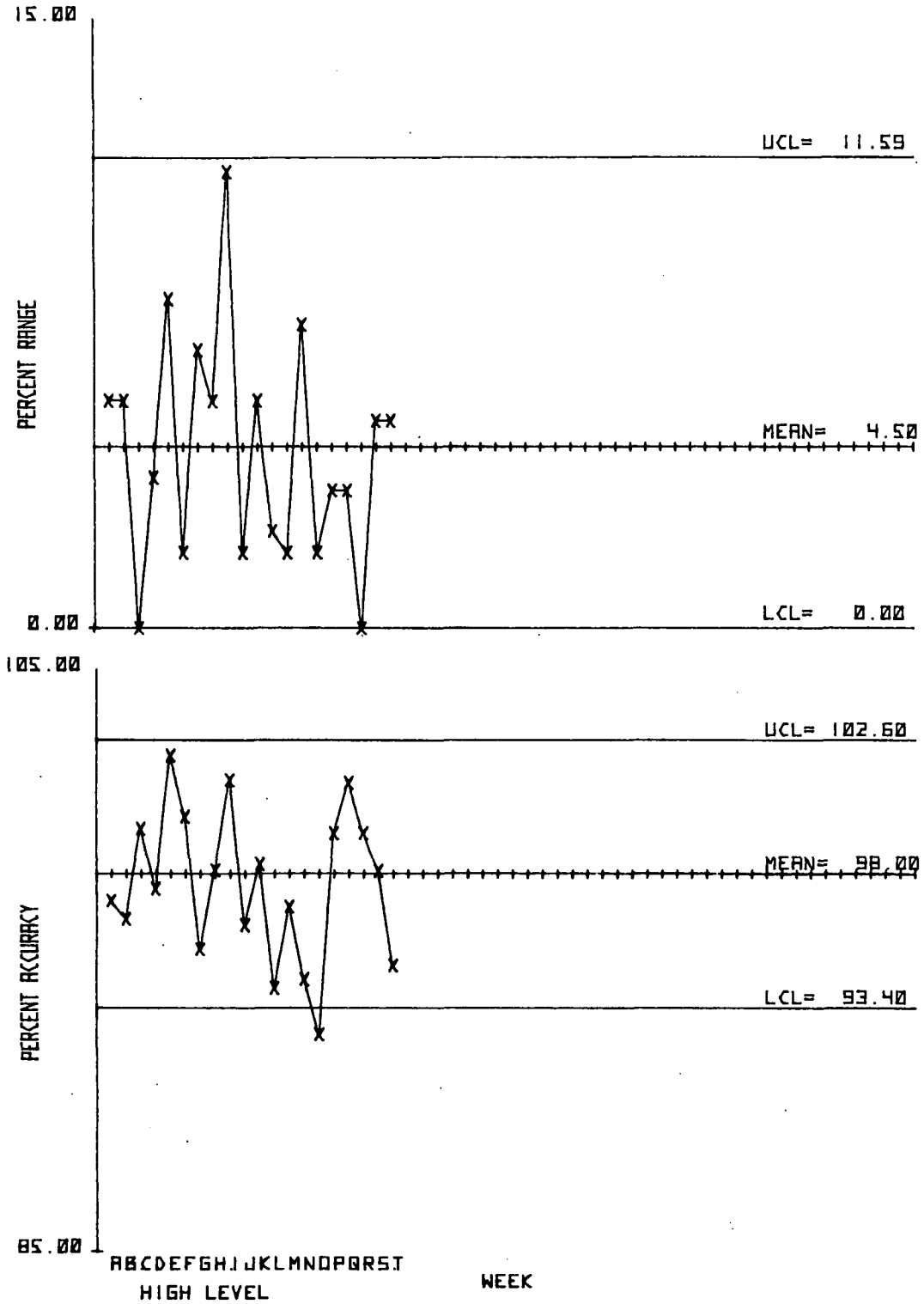

Figure 2-6. Mean and Range Control Charts (High Level NO_3^-)

$$\text{Percent Range} = [(X_H - X_L)/\bar{X}_3](100)$$

where X_H = the highest value of each set of 3

X_L = the lowest value of each set of 3

$\bar{X}_3$ = the average of the 3 values of each set

Observations from the control charts reveal that very few of the plotted points exceed the control limits and those exceeding the limits generally are isolated values. Hence with few exceptions, the laboratory results of the audit samples indicate that the analytical process was statistically as accurate as that determined from the 1975 analyses. The occurrence of out-of-control points triggered an investigation including re-analysis of filters for the period represented by the audit samples.

The standard deviation of the analytical results can be used to estimate the variability due to the extraction and analysis procedures. Nitrate analyses of audit filters had a standard deviation of 5.3 percent while the sulfate analyses had a standard deviation of 5.9 percent. These values are approximately 8.4 percent less for nitrate ion and 1.7 percent less for sulfate ion than corresponding average values of coefficient of variation of individual analyses in Table 2-2. These differences represent the variability of cutting the sample duplicate strips and of heterogenity across the filter because the cutting operations and actual variations from strip-to-strip within the same exposed filter were involved in the analysis of duplicate strips but were not involved in the analyses of the spiked audit strips.

It may be assumed that the bias estimates for nitrate and sulfate were no different during the earlier years when audits where not conducted.

ANALYTICAL QUALITY ASSESSMENT

The precision and bias estimates discussed previously have been combined into an overall estimate of "Analytical Quality." Based on the estimates of bias and precision, an individual pollutant value (minimum, maximum or percentile) appearing in the data tables is expected to be correct (from an analysis standpoint) within the stated interval with a 95 percent confidence.

The approximate upper and lower confidence limits* (L_u and L_ℓ, respectively) are calculated as follows:

$$L_u = X\ (1 - B/100 + 1.96\ C_v/100) \qquad (5a)$$

$$L_\ell = X\ (1 - B/100 - 1.96\ C_v/100) \qquad (5b)$$

where X = the individual analysis value

B = bias, percent

C_v = coefficient of variation of individual analysis

For example, the maximum sulfate value for Birmingham, Alabama for 1976 was 24.9 $\mu g/m^3$. Since from Table 2-4 the bias is -5.1% and the coefficient of variation for precision is 4.1%, the resulting confidence limits are:

$$L_u = 24.9[1-(-5.1)/100 + (1.96)(4.1)/100] = 28.2 \qquad (6a)$$

$$L_\ell = 24.9[1-(-5.1)/100 - (1.96)(4.1)/100] = 24.2 \qquad (6b)$$

It is emphasized that the estimates determined by the above formulas consider only variability from sample preparation (i.e., cutting, extraction) and analysis. Further, it is assumed that the bias is constant, and

---

*A more exact equation is presented in Appendix B.

that the inherent variability due to sample preparation and analysis remains unchanged. Furthermore, if additional information were known concerning variation due to factors such as the flow rate or other variables of sampling, then these confidence intervals would be wider. As a result, all confidence limits are under-estimates of the total variability of the total measurement process, including sampling and analysis.

Estimates of the bias and the precision for 1976 analytical results are summarized in Table 2-4. Corresponding values for previous years are presented in earlier reports.

TABLE 2-4. ANALYTICAL PRECISION AND BIAS, 1976

Ion	Concentration Range, $\mu g/m^3$	Bias Percent (from Table 2-3)	Precision C_v Percent (from Table 2-2)
Ammonium	<1.0	--	42
	>1.0	--	26
Nitrate	<3	-3.3	17
	3+6	-4.5	10
	>6	-2.4	14
Sulfate	<6.0	-4.3	12
	6+20	-5.0	6.7
	>20	-5.1	4.1

SECTION 3

LABORATORY METHODS

SAMPLING PROCEDURE

The mass of particulate matter per volume of air was determined by weighing a filter before and after sampling, and measuring the sample air flow rate. Air was drawn through a preweighed glass-fiber filter with a high volume air sampler.

The sample air flow rate was set at approximately 1.7 cubic meters per minute, or approximately 2500 cubic meters of air during the 24-hour sampling period. A calibrated rotameter was read at the beginning and end of the sampling period, and the average value was used to obtain the average sample flow rate. Using the sampling time (24 hours) and the measured flow rate the total sample volume of air was determined.

The filters, 20.3 by 25.4 cm, were made of flash-fired glass-fiber selected for low and uniform background concentrations of the pollutants to be measured. To eliminate filters having pinholes, creases, or other flaws that could affect air flow, the filters were visually screened for imperfections by placing each filter in front of a beam of light. Prior to the initial weighing, the filters were equilibrated for a minimum of 24 hours

at a temperature of 24° Centigrade and a relative humidity of 50 percent or less. A balance scale was used that permitted weighing the filters without bending them.

The filters were then distributed unfolded to the cooperating local agencies for the urban sites and to the designated participant responsible for operating the nonurban site. After sampling, the filters were folded in half with the collected particulate matter inside and returned to the laboratory. The filter with the collected particulates was again equilibrated for at least 24 hours at a temperature of 24° Centigrade and a relative humidity of 50 percent or less, and then weighed to determine the amount of particulate matter that was collected. These suspended particulate mass values were sent to the National Aerometric Data Bank (NADB) on a routine basis and the filters were sent to the Filter Bank for further analyses.

NONMETALLIC ION ANALYSIS PROCEDURE

The analysis for inorganic ions during 1976 was performed by Northrop Services, Incorporated, under contract no. 68-02-2566. This included the analysis of blank filters, duplicate strips, and the routine sample filters. Previously, the analytical work was performed by EMSL.

Analyses for ammonium, nitrate, and sulfate ions were performed with autoanalyzers on an aqueous extract of an 8.3 percent section of the particulate filter, i.e., a 1.9 cm strip was cut across the fold. The filter section was washed twice to obtain the final volume of 50 milliliters. This single solution was used for the three analyses. The most

effective wave length for determining color for each pollutant was used. Color values were converted to concentration values in units of $\mu g/m^3$.

The analysis procedure for each ion is as follows:

1. The ammonium ions extracted from the exposed filters are analyzed by reacting them with sodium phenolate and sodium hypochlorite to produce a blue-colored complex. The reaction is pH dependent; thus, below a pH of 7.0, no color is produced. The color of the complex is determined colorimetrically at a wavelength of 625-630 nanometers.

2. The extract with water is analyzed for nitrate ion by reduction of the nitrate to nitrite by a copperized-cadmium reduction column. The nitrite is reacted with sulfanilamide in acidic solution to form a diazo compound. This compound then couples with N-1-Naphthylenediamine dihydrochloride to form a reddish-purple azo dye which is determined colorimetrically at a wavelength of 520-540 nanometers.

3. The extract is analyzed for sulfate ion by the methylthymol blue (MTB) method using a single channel Technicon Autoanalyzer II system equipped with a linearizer. The MTB method is based on the spectral difference which exists in basic solution (pH 12.5-13.0), between the barium complex of MTB and the free MTB. At this pH the barium complex is blue and free MTB is brownish-red (absorbs light at 460 nm). Thus, the color of solutions containing both the free MTB and the complex appears as gray. The amount of free MTB, monitored colorimetrically at wavelengths of 460-480 nanometers, is the measure of the amount of sulfate in the sample.

SECTION 4

NATIONAL SUMMARY OF AIR QUALITY MEASUREMENTS

The data in Tables 4-1 and 4-2 are cumulative frequency distributions by ion of individual results by year for urban and nonurban locations, respectively. Consider, for example, the first line in Table 4-1. The number, 3909, is the number of valid 24-hour samples analyzed for ammonium in 1971. The next entry is the minimum value detected that year and "LD" means the minimum detectable level of the instrument. The next seven entries are the 10 through 99 percentile values. For example the 90 percentile value of 0.73 indicates that 90 percent of the 3909 values, i.e., 0.90 x 3909 = 3518, were equal to or less than 0.73 $\mu g/m^3$. The next entry is the maximum annual value. The arithmetic mean and standard deviation, and the geometric mean and geometric standard deviation are presented in the last four columns in the table. Comparison among years for a given pollutant provides a relative indication of trends.

Since typical levels of these pollutants, especially sulfates, may be geographically dependent, the national frequency distribution is not helpful for judging the localized contribution and relative severity of

these pollutants for an individual site. Therefore, local site analyses should be performed with data from surrounding sites within the same general geographical area. Data for each site are presented in Section 5. Also of consideration is that some of the variability from year to year in the national summary tables may be attributed to different sets of sites being used in the summarization depending upon the completeness criteria for valid data as described in Section 5.

TABLE 4-1. URBAN NATIONAL CUMULATIVE FREQUENCY DISTRIBUTIONS

Ion	Year	Number of Samples	Min.	Percent of time concentration (μg/m³) is equal to or less than 10	30	50	70	90	95	99	Max.	Arithmetic statistics Mean	Std. Dev.	Geometric statistics Mean	Std. Dev.
NH_4^+	1971	3909	LD	0.01	0.03	0.05	0.15	0.73	1.23	3.07	12.72	0.27	0.69	0.10	4.14
	1972	5512	LD	LD	0.01	0.03	0.09	0.59	1.20	3.28	13.91	0.24	0.72	0.08	4.57
	1973	4778	LD	0.01	0.01	0.06	0.17	0.73	1.37	3.82	15.50	0.30	0.79	0.11	4.23
	1974	4584	LD	0.01	0.02	0.09	0.34	1.36	2.26	5.79	15.30	0.49	1.12	0.20	3.85
	1975	4113	0.20	0.20	0.20	0.20	0.20	1.13	2.18	5.73	13.65	0.55	1.06	0.25	3.48
	1976	3824	LD	LD	LD	0.08	0.25	0.85	1.39	4.31	15.48	0.35	0.81	0.14	3.91
NO_3^-	1971	3900	LD	0.69	1.55	2.29	3.22	5.02	6.48	11.85	26.17	2.77	2.30	2.13	2.06
	1972	5519	LD	0.66	1.58	2.47	3.55	5.90	7.88	13.50	24.99	3.05	2.61	2.32	2.10
	1973	4775	LD	0.81	1.71	2.58	3.65	6.24	8.31	14.61	37.36	3.25	2.87	2.44	2.13
	1974	4562	LD	0.83	1.74	2.54	3.63	6.46	8.62	17.50	54.89	3.36	3.40	2.36	2.32
	1975	4113	0.20	0.96	2.00	2.91	4.12	7.18	9.90	17.07	33.71	3.73	3.31	2.79	2.15
	1976	3817	0.08	1.07	1.99	2.80	3.83	6.48	9.53	20.65	43.16	3.71	3.83	2.58	2.34
$SO_4^=$	1971	3916	LD	3.4	5.7	8.0	10.9	18.0	22.0	33.5	69.2	9.6	6.8	7.84	1.89
	1972	5519	LD	3.9	6.7	9.4	12.7	20.3	25.4	37.9	75.9	11.1	7.7	9.15	1.87
	1973	4774	LD	3.9	6.3	8.1	10.9	17.5	22.7	35.4	162.0	9.9	7.0	8.06	1.89
	1974	4564	LD	3.9	6.3	8.3	11.3	17.9	22.8	34.8	69.1	10.0	6.7	8.34	1.83
	1975	4110	0.2	3.5	6.1	8.3	11.5	18.1	23.8	35.8	72.6	10.0	7.0	8.22	1.88
	1976	3871	0.2	3.1	5.4	7.4	9.9	16.5	20.0	29.2	66.7	8.8	5.8	7.33	1.83

TABLE 4-2. NONURBAN NATIONAL CUMULATIVE FREQUENCY DISTRIBUTIONS

Ion	Year	Number of Samples	Min.	Percent of time concentration (μg/m³) is equal to or less than 10	30	50	70	90	95	99	Max.	Arithmetic statistics Mean	Std. Dev.	Geometric statistics Mean	Std. Dev.
NH_4^+	1971	569	LD	0.01	0.02	0.04	0.05	0.17	0.44	1.25	3.19	0.10	0.28	0.03	4.31
	1972	929	LD	LD	0.01	0.01	0.01	0.10	0.25	1.57	6.12	0.07	0.32	0.02	5.68
	1973	832	LD	0.01	0.01	0.01	0.03	0.23	0.80	3.16	7.80	0.17	0.65	0.04	5.28
	1974	706	LD	0.01	0.01	0.01	0.05	0.37	1.12	2.61	9.64	0.19	0.62	0.05	4.85
	1975	630	0.20	0.20	0.20	0.20	0.20	0.20	0.64	6.14	8.85	0.34	0.79	0.13	3.92
	1976	493	LD	LD	LD	LD	0.07	0.32	0.64	1.46	4.87				
NO_3^-	1971	671	LD	0.06	0.31	0.71	1.20	2.19	2.67	3.81	6.04	0.95	0.92	0.68	2.26
	1972	928	LD	LD	0.15	0.50	1.01	2.08	2.59	4.19	6.59	0.79	0.92	0.52	2.52
	1973	831	LD	0.04	0.28	0.71	1.26	2.35	2.83	4.47	6.67	0.99	1.02	0.69	2.34
	1974	706	LD	0.12	0.37	0.83	1.37	2.52	3.16	5.13	6.65	1.10	1.07	0.79	2.25
	1975	630	0.20	0.20	0.20	0.73	1.41	2.74	3.28	4.85	11.85	1.13	1.16	0.78	2.35
	1976	467	LD	0.10	0.36	0.82	1.51	2.82	3.54	4.73	6.15	1.18	1.16	0.84	2.27
$SO_4^=$	1971	686	0.4	1.5	3.0	4.7	7.2	11.8	15.5	23.6	35.4	6.0	4.9	4.7	2.03
	1972	929	LD	1.4	2.9	5.2	7.8	13.7	17.4	24.8	42.7	6.6	5.4	5.1	2.05
	1973	831	LD	1.3	2.7	4.4	6.3	12.0	17.0	29.8	53.2	6.0	5.9	4.2	2.29
	1974	706	0.1	1.4	2.6	4.8	7.2	12.2	16.6	27.0	90.0	6.2	6.2	4.4	2.30
	1975	630	0.2	0.7	2.1	4.0	6.4	11.6	15.2	28.7	48.3	5.5	5.7	3.8	2.36
	1976	493	0.2	0.9	1.8	4.0	6.5	11.3	13.9	21.3	36.3	5.3	4.9	3.8	2.22

SECTION 5

DATA TABLES

The data are arranged by urban and nonurban sites. Each monitoring site is assigned a unique code number as described in the SAROAD Station Coding Manual.*

The data are presented in the same format as that described previously for the national summaries. Values are expressed in micrograms of pollutant per cubic meter of air. Data are judged to be valid (representative) if there were at least five valid samples obtained each quarter of the year. In addition, when no samples were collected during a month of a quarter, at least two valid samples must have been collected during the other two months. In order to provide a more comprehensive data summary, some data which are not valid, as identified by an asterisk following the year, are presented if three conditions are satisfied, namely:

1. A total of at least 15 samples were collected that year
2. Data for at least two quarters were valid
3. At least one sample was obtained in each of the other two quarters

---

*Fair, D.H. SAROAD Station Coding Manual. U.S. Environmental Protection Agency, Office of Air Programs, Research Triangle Park, North Carolina. Publication No. APTD-0907. February 1972.

The minimum detectable concentrations for the three nonmetallic inorganic ions are presented in Table 2-1. Values below this analytical limit of detection are reported as "LD's" in the data tables, and a yearly mean is calculated by replacing the LD's with a value equal to one-half the value of the LD. If more than 25 percent of the individual values during a year are below the analytical detection limit, the summary statistics are not calculated. When more than 50 percent of the individual results during a year are below the analytical detection limit, only the minimum, maximum and number of results below the LD are shown.

Data table headings present the bias and precision information from Table 2-4. For example, the headings for sulfate include the following:

ANALYTICAL QUALITY

Conc. Range ($\mu g/m^3$)	Bias (%)	Precision (%)
<6.0	-4.3	12
6→20	-5.0	6.7
>20	-5.1	4.1

The bias and precision values can be used in Equations (5a) and (5b) to compute approximate upper and lower 95 percent confidence limits on the true concentration for a given reported concentration. For example, the approximate confidence limits for a reported sulfate concentration of 8.4 $\mu g/m^3$ would be:

$$L_u = X(1-B/100 + 1.96\ C_v/100) \qquad (5a)$$

$$= 8.4[1-(-5.0)]/100 + 1.96(6.7)/100$$

$$= 9.9\ \mu g/m^3$$

$$L_\ell = X(1-B/100 - 1.96\ C_V/100) \qquad (5b)$$

$$= 8.4[1-(-5.0)]/100 - 1.96(6.7)/100$$

$$= 7.7\ \mu g/m^3$$

Thus, the interval between 7.7 $\mu g/m^3$ and 9.9 $\mu g/m^3$ would be expected to include the true value with a confidence of about 95 percent.

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N H 4

ANALYTICAL QUALITY		95% CONF.
CONC. RANGE (UG/M3)	BIAS (%)	PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ALABAMA																	
BIRMINGHAM																	
010380003A01	76	30	LD	LD	LD	LD	.05	.08	.18	.40	.47	.77	1.16				
GADSDEN																	
011480001A01	76*	22	LD	LD	LD	LD	.09	.14	.15	.17	.29	.51	2.16				
HUNTSVILLE																	
011860001A01	76*	26	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									.36				
MOBILE																	
012360001A01	76*	23	LD	NO. OF SAMPLES (12) BELOW MIN. DET. EXCEEDS 50%									.78				
MONTGOMERY																	
012460001A01	76	28	LD	LD	LD	LD	LD	.05	.07	.20	.25	.73	1.30				
ARIZONA																	
PHOENIX																	
030603102A01	76*	21	LD	NO. OF SAMPLES (12) BELOW MIN. DET. EXCEEDS 50%									.90				
TUCSON																	
030863001A01	76	27	LD	NO. OF SAMPLES (17) BELOW MIN. DET. EXCEEDS 50%									.83				
ARKANSAS																	
LITTLE ROCK																	
041440001A01	76	30	LD	LD	LD	.07	.07	.10	.18	.37	.75	.91	2.55	.391	.56	.156	4.11
TEXARKANA																	
042560001A01	76	30	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									1.09				
WEST MEMPHIS																	
042740001A01	76	27	LD	LD	.05	.06	.10	.16	.23	.52	.96	1.61	2.91	.532	.75	.198	4.48
CALIFORNIA																	
ANAHEIM																	
050230001A01	76	29	LD	LD	LD	LD	.07	.11	.17	.51	.83	1.04	1.65				
BERKELEY																	
050740001A01	76	29	LD	LD	LD	LD	LD	.06	.07	.19	.47	1.11	6.61				
BURBANK																	
050900002A01	76	28	LD	LD	.09	.14	.22	.31	.41	.57	.76	1.19	4.10	.599	.84	.275	3.96
FRESNO																	
052800002A01	76*	27	LD	LD	LD	.05	.09	.19	.22	.33	.88	2.52	6.11	.908	1.73	.194	6.01
LONG BEACH																	
054100001A01	76	28	LD	LD	LD	LD	.07	.14	.22	.38	.40	1.69	4.18				
LOS ANGELES																	
054180001A01	76	30	LD	LD	.05	.11	.28	.41	.54	.99	1.19	2.56	3.59	.861	1.04	.343	4.98
OAKLAND																	
055330001A01	76*	24	LD	LD	LD	LD	LD	.08	.09	.17	.37	.94	3.92				
ONTARIO																	
055380001A01	76*	25	LD	.07	.09	.10	.24	.29	.52	.85	.93	3.53	8.45	1.184	2.06	.386	4.59
PASADENA																	
055760002A01	76	28	LD	LD	.06	.12	.18	.26	.39	.50	.64	1.45	3.36	.602	.81	.252	4.33
SACRAMENTO																	
056580001A01	76	31	LD	LD	LD	LD	.05	.08	.11	.15	.29	.59	3.58				
SAN BERNARDINO																	
056680001A01	76	30	LD	LD	.07	.12	.15	.30	.74	.94	1.56	4.84	9.69	1.386	2.28	.388	5.67
SAN DIEGO																	
056800004A01	76	26	LD	LD	.07	.07	.16	.20	.36	.39	.42	.57	2.01	.332	.39	.192	3.07
SAN FRANCISCO																	
056860001A01	76	31	LD	LD	LD	LD	LD	.05	.10	.34	.71	1.20	9.40				
SAN JOSE																	
056980004A01	76	31	LD	LD	LD	LD	LD	.09	.12	.35	.68	2.61	6.66				
SANTA ANA																	
057180001A01	76	30	LD	LD	LD	LD	LD	.08	.09	.16	.39	.74	3.66				
TORRANCE																	
058260001A01	76	30	LD	LD	LD	LD	LD	.06	.11	.38	.65	1.30	3.03				
COLORADO																	
DENVER																	
050580001A01	76	29	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									.30				
CONNECTICUT																	
BRIDGEPORT																	
070060001A01	76	28	LD	LD	LD	.07	.10	.17	.29	.39	.43	.65	5.10	.446	.96	.161	4.13
HARTFORD																	
070420002A01	76	30	LD	LD	LD	LD	LD	.10	.23	.28	.40	.62	6.84				
NEW HAVEN																	
070700001A01	76	30	LD	LD	LD	LD	.09	.10	.16	.31	.47	.58	6.94				
WATERBURY																	
071240123A01	76*	23	LD	LD	LD	LD	LD	.09	.10	.10	.19	.46	5.18				

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N H 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

STTE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
DELAWARE																	
NEWARK																	
0901450001A01	76	25	LD	LD	LD	LD	.07	.24	.29	.42	.50	.98	3.03				
WILMINGTON																	
0902600024A01	76*	24	LD	LD	.05	.07	.15	.19	.20	.33	.57	2.03	2.32	.464	.67	.193	4.01
FLORIDA																	
JACKSONVILLE																	
1019600024A01	76*	22	LD	NO. OF SAMPLES (12) BELOW MIN. DET. EXCEEDS 50%									.52				
MIAMI																	
1027000024A01	76*	23	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									.29				
ST PETERSBURG																	
1039800024A01	76*	16	LD	NO. OF SAMPLES (10) BELOW MIN. DET. EXCEEDS 50%									.69				
GEORGIA																	
ATLANTA																	
1102000014A01	76*	25	LD	LD	LD	LD	.07	.10	.12	.24	.31	.45	3.09				
COLUMBUS																	
1112800014A01	76*	27	LD	NO. OF SAMPLES (15) BELOW MIN. DET. EXCEEDS 50%									1.86				
SAVANNAH																	
1145000014A01	76	27	LD	LD	LD	LD	.05	.05	.07	.08	.11	.18	.88				
IDAHO																	
BOISE CITY																	
1302200014A01	76*	16	LD	NO. OF SAMPLES (9) BELOW MIN. DET. EXCEEDS 50%									.16				
ILLINOIS																	
BLUE ISLAND																	
1405000014A01	76*	26	LD	LD	LD	LD	LD	.07	.07	.07	.15	.44	2.39				
CHICAGO																	
1412200014A01	76*	23	LD	LD	LD	LD	LD	.06	.07	.17	.22	.50	1.99				
MOLINE																	
1451200014A01	76	29	LD	NO. OF SAMPLES (23) BELOW MIN. DET. EXCEEDS 50%									.82				
NORTH CHICAGO																	
1456200024A01	76	29	LD	NO. OF SAMPLES (20) BELOW MIN. DET. EXCEEDS 50%									1.03				
PEORIA																	
1460800014A01	76	30	LD	NO. OF SAMPLES (23) BELOW MIN. DET. EXCEEDS 50%									.47				
ROCK ISLAND																	
1467000014A01	76	28	LD	NO. OF SAMPLES (25) BELOW MIN. DET. EXCEEDS 50%									LD				
SPRINGFIELD																	
1472800014A01	76*	24	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									.57				
INDIANA																	
EAST CHICAGO																	
1511800014A01	76	28	LD	LD	LD	LD	LD	.06	.07	.10	.13	.20	.54				
EVANSVILLE																	
1513000014A01	76	30	LD	LD	LD	LD	.05	.06	.08	.16	.26	.71	1.47				
GARY																	
1515200014A01	76	29	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									.57				
HAMMOND																	
1517800024A01	76	29	LD	LD	LD	LD	LD	.06	.08	.11	.14	.34	1.78				
INDIANAPOLIS																	
1520400014A01	76*	15	LD	LD	LD	LD	LD	.06	.06	.16	.57	.70	2.36				
NEW ALBANY																	
1529800024A01	76	28	LD	LD	LD	LD	.06	.07	.10	.15	.17	.25	.63				
SOUTH BEND																	
1538800024A01	76	30	LD	LD	LD	LD	LD	.06	.06	.10	.11	.16	.82				
TERRE HAUTE																	
1540800014A01	76	26	LD	LD	LD	.06	.08	.10	.17	.22	.48	.57	1.44	.267	.33	.131	3.45
IOWA																	
DUBUQUE																	
1612600084A01	76	28	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									.29				
KANSAS																	
KANSAS CITY																	
1718000124A01	76*	24	LD	LD	.05	.07	.10	.14	.15	.26	.46	.78	1.41	.297	.37	.147	3.42
LOUISIANA																	
BATON ROUGE																	
1902800024A01	76*	20	LD	LD	LD	LD	.06	.06	.06	.09	.17	.30	1.80				
IBERVILLE PAR																	
1912800024A01	76	28	LD	NO. OF SAMPLES (20) BELOW MIN. DET. EXCEEDS 50%									1.34				

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N H 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	95% CONF. BIAS (%)	PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
LOUISIANA																	
NEW ORLEANS																	
192020002A01	76	30	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									.99				
SHREVEPORT																	
192740001A01	76*	23	LD	NO. OF SAMPLES (15) BELOW MIN. DET. EXCEEDS 50%									.74				
MARYLAND																	
BALTIMORE																	
210120001A01	76*	22	LD	LD	LD	.09	.12	.22	.42	.46	.58	.92	4.66	.526	.97	.200	4.35
MASSACHUSETTS																	
CAMBRIDGE																	
220360001A01	76*	21	LD	LD	LD	.06	.06	.11	.18	.19	.33	.53	1.60	.240	.35	.120	3.31
FALL RIVER																	
220580001A01	76*	23	LD	LD	LD	LD	.07	.11	.12	.15	.24	.64	5.49				
NEW BEDFORD																	
221500002A01	76*	22	LD	LD	LD	.05	.07	.11	.17	.20	.32	.71	6.24	.495	1.32	.130	4.26
WORCHESTER																	
222440004A01	76*	24	LD	LD	LD	LD	LD	LD	.06	.16	.43	1.83	5.42				
MICHIGAN																	
DETROIT																	
231180001A01	76	29	LD	LD	LD	LD	LD	.06	.07	.09	.15	.17	2.10				
GRAND RAPIDS																	
231820001A01	76	30	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									1.27				
LANSING																	
232440001A01	76	26	LD	NO. OF SAMPLES (15) BELOW MIN. DET. EXCEEDS 50%									.76				
SAGINAW																	
234760001A01	76	28	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									1.57				
MINNESOTA																	
DULUTH																	
241040001A01	76	29	LD	NO. OF SAMPLES (21) BELOW MIN. DET. EXCEEDS 50%									.29				
ST PAUL																	
243300031A01	76*	20	LD	LD	LD	LD	.07	.07	.09	.12	.13	.15	1.69				
MISSISSIPPI																	
JACKSON																	
251260002A01	76	31	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									1.03				
MISSOURI																	
ST LOUIS																	
264280001A01	76*	25	LD	LD	LD	LD	LD	.05	.08	.18	.24	.53	2.06				
NEBRASKA																	
LINCOLN																	
281560002A01	76	31	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									1.26				
OMAHA																	
281880030A01	76*	25	LD	NO. OF SAMPLES (15) BELOW MIN. DET. EXCEEDS 50%									.55				
NEVADA																	
LAS VEGAS																	
290320031A01	76*	26	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									.62				
RENO																	
290480001A01	76*	24	LD	NO. OF SAMPLES (14) BELOW MIN. DET. EXCEEDS 50%									.82				
NEW JERSEY																	
CAMDEN																	
310720001A01	76*	21	LD	LD	.25	.33	.43	.57	.58	.61	1.31	2.08	6.94	1.045	1.55	.507	3.78
ELIZABETH																	
311300002A01	76*	23	LD	LD	.09	.25	.29	.34	.36	.49	.53	.65	1.00	.360	.23	.258	2.70
GLASSBORO																	
311700001A01	76*	21	LD	LD	.11	.17	.22	.28	.30	.37	.43	.56	1.34	.350	.32	.234	2.76
JERSEY CITY																	
312320001A01	76*	21	LD	LD	.05	.05	.07	.14	.40	.57	.96	1.19	3.47	.587	.87	.212	4.63
NEWARK																	
313480001A01	76*	23	LD	LD	LD	LD	LD	.06	.06	.06	.13	.94	1.07				
PATERSON																	
314140001A01	76*	21	LD	LD	.05	.08	.22	.35	.52	.56	.78	1.15	3.20	.587	.73	.273	4.18
PERTH AMBOY																	
314220001A01	76*	24	LD	LD	LD	.09	.19	.36	.50	.89	1.08	1.39	4.71	.764	1.10	.269	5.36
TRENTON																	
315400001A01	76*	24	.05	.05	.14	.17	.24	.36	.49	.61	.82	.93	1.81	.486	.41	.329	2.65

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N H 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
NEW MEXICO																	
ALBUQUERQUE 320040001A01	76*	20	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									LD				
NEW YORK																	
BUFFALO 330660301A01	76*	21	LD	.08	.19	.22	.31	.38	.42	.57	1.25	1.37	1.74	.577	.51	.380	2.79
NEW YORK CITY 334680014A01	76*	21	.06	.08	.16	.26	.32	.51	.57	.61	.64	.75	2.11	.506	.43	.378	2.27
NIAGARA FALLS 334740001A01	76*	25	.10	.14	.15	.27	.34	.42	.50	.60	.70	.94	3.34	.598	.68	.406	2.34
ROCHESTER 335760001A01	76*	26	LD	.07	.12	.15	.16	.27	.51	.67	.73	.94	1.29	.457	.39	.295	2.84
SYRACUSE 336620001A01	76*	21	LD	.05	.14	.23	.27	.33	.36	.48	.57	.74	1.16	.389	.28	.282	2.54
NORTH CAROLINA																	
CHARLOTTE 340700001A01	76	27	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									.67				
DURHAM 341160006A01	76*	27	LD	LD	LD	LD	LD	.12	.24	.47	.59	.74	5.30				
GREENSBORO 341740009A01	76	28	LD	LD	LD	.05	.07	.09	.17	.24	.50	.73	1.02	.254	.29	.123	3.59
WINSTON-SALEM 344460002A01	76*	24	LD	LD	LD	.09	.15	.19	.24	.31	.48	.73	.94	.289	.27	.165	3.37
OHIO																	
AKRON 360060014A01	76	29	LD	LD	.06	.09	.12	.21	.22	.52	.77	1.60	2.30	.529	.68	.213	4.38
CANTON 361000601A01	76	30	LD	LD	.06	.11	.11	.14	.22	.27	.45	2.07	2.69	.499	.79	.198	3.74
CINCINNATI 361220001A01	76*	21	LD	LD	LD	.06	.09	.18	.21	.28	.54	1.20	1.60	.389	.51	.169	3.93
CLEVELAND 361300001A01	76*	25	LD	LD	LD	LD	LD	.06	.09	.21	.41	1.14	2.03				
PORTSMOUTH 365620002A01	76*	17	LD	LD	LD	LD	.06	.17	.18	.24	.56	.91	.99				
STEUBENVILLE 366420012A01	76	27	LD	LD	LD	.08	.15	.17	.39	.60	.69	1.41	10.62	.920	2.16	.235	5.13
TOLEDO 366500001A01	76	30	LD	LD	.05	.05	.06	.08	.10	.16	.24	.45	1.78	.231	.37	.110	3.10
OKLAHOMA																	
TULSA 373000110A01	76*	22	LD	LD	LD	LD	.07	.08	.08	.11	.17	.19	.58				
PENNSYLVANIA																	
ALLENTOWN 390120001A01	76*	23	LD	LD	.10	.13	.18	.33	.37	.39	.59	.73	1.37	.373	.33	.229	3.17
ALTOONA 390140001A01	76*	24	LD	LD	.05	.11	.22	.37	.53	.64	1.09	1.69	3.36	.707	.85	.290	4.77
BETHLEHEM 390780002A01	76*	21	LD	LD	.10	.11	.18	.33	.46	.54	.75	.89	3.71	.551	.80	.265	3.77
ERIE 393060002A01	76*	24	LD	LD	LD	LD	.10	.13	.21	.36	.42	.88	4.31				
HARRISBURG 393880361A01	76*	22	LD	LD	LD	.05	.05	.05	.11	.17	.41	.76	4.67	.422	.99	.118	4.35
HAZLETON 393960001A01	76*	24	LD	LD	.09	.10	.17	.26	.52	.57	.64	1.11	2.38	.476	.54	.250	3.60
JOHNSTOWN 394460803A01	76*	21	LD	LD	.05	.05	.06	.28	.45	.53	1.01	1.11	2.73	.496	.69	.206	4.42
PHILADELPHIA 397140004A01	76	28	LD	LD	.07	.10	.14	.35	.46	.59	.80	1.17	6.20	.670	1.18	.273	4.07
PITTSBURGH 397260001A01	76	29	LD	LD	.07	.11	.19	.40	.43	.50	1.17	1.83	2.95	.672	.81	.278	4.60
READING 397620001A01	76	29	LD	.05	.08	.10	.21	.39	.41	.48	.81	1.04	2.29	.517	.55	.277	3.52
SCRANTON 398040001A01	76	30	LD	LD	LD	LD	.05	.06	.23	.37	.71	1.14	4.53				
WARRINGTON 399160002A01	76	26	LD	LD	LD	.18	.20	.33	.42	.64	1.30	2.62	5.58	.890	1.32	.299	5.29
WEST CHESTER 399280110A01	76*	24	LD	LD	.07	.08	.18	.32	.38	.56	.58	1.65	4.47	.626	.96	.256	4.25

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N H 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	95% CONF. BIAS (%)	PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
PENNSYLVANIA																	
WILKES-BARRE																	
399435001A01	76*	24	LD	LD	.05	.12	.24	.28	.32	.51	.56	1.40	1.79	.452	.49	.227	3.85
YORK																	
399563322A01	76*	20	LD	LD	.05	.08	.18	.29	.67	.74	.93	.98	1.84	.524	.48	.265	4.16
PUERTO RICO																	
GUAYNABO CO																	
431140001A01	76*	25	LD	LD	LD	LD	LD	.05	.07	.12	.20	.44	.60				
PONCE																	
401920002A01	76	27	LD	LD	LD	LD	LD	.05	.06	.06	.08	.09	.15				
SAPANA SECA																	
402065001A01	76	26	LD	LD	LD	LD	LD	.05	.05	.05	.10	.11	.24				
RHODE ISLAND																	
EAST PROVIDENC																	
410120001A01	76	28	LD	LD	LD	.07	.22	.42	.59	.70	.80	1.06	2.40	.518	.54	.235	4.63
PROVIDENCE																	
410300001A01	76	28	LD	.07	.10	.17	.26	.57	.67	.77	.92	1.05	7.87	.791	1.43	.370	3.70
SOUTH CAROLINA																	
COLUMBIA																	
420760001A01	76	28	LD	.05	.09	.13	.14	.22	.32	.40	.52	.96	4.78	.622	1.11	.258	3.54
GREENVILLE																	
421160001A01	76	29	LD	LD	LD	.07	.14	.16	.18	.28	.52	.76	1.10	.281	.29	.145	3.59
SOUTH DAKOTA																	
SIOUX FALLS																	
431480001A11	76*	24	LD	NO. OF SAMPLES (14) BELOW MIN. DET. EXCEEDS 50%									.60				
TENNESSEE																	
CHATTANOOGA																	
440380001A01	76	26	LD	LD	LD	.07	.10	.24	.36	.48	.56	.84	1.75	.393	.45	.187	3.94
TEXAS																	
AUSTIN																	
450220010A01	76*	21	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									.39				
CORPUS CHRISTI																	
451150001A01	76	22	LD	NO. OF SAMPLES (17) BELOW MIN. DET. EXCEEDS 50%									.27				
DALLAS																	
451310002A01	76*	19	LD	NO. OF SAMPLES (13) BELOW MIN. DET. EXCEEDS 50%									.92				
FORT WORTH																	
451880001A01	76*	22	LD	NO. OF SAMPLES (16) BELOW MIN. DET. EXCEEDS 50%									.32				
LUBBOCK																	
453340001A01	76*	21	LD	NO. OF SAMPLES (21) BELOW MIN. DET. EXCEEDS 50%									LD				
PASADENA																	
454060002A01	76*	18	LD	NO. OF SAMPLES (14) BELOW MIN. DET. EXCEEDS 50%									.24				
WICHITA FALLS																	
455560002A01	76	27	LD	NO. OF SAMPLES (21) BELOW MIN. DET. EXCEEDS 50%									.45				
VIRGINIA																	
DANVILLE																	
480920001A01	76*	22	LD	LD	LD	LD	.21	.25	.34	.34	.62	.72	1.68				
FAIRFAX CO																	
481060001A01	76*	17	LD	LD	LD	.05	.16	.18	.25	.63	.88	1.27	3.07	.571	.81	.214	4.70
HAMPTON																	
481440001A01	76*	22	LD	LD	LD	LD	LD	.06	.10	.17	.21	.29	.96				
NORFOLK																	
482140301A01	76	24	LD	LD	LD	.08	.14	.24	.27	.39	.56	.66	2.45	.361	.50	.177	3.69
PORTSMOUTH																	
482440001A01	76	27	LD	.05	.05	.12	.15	.23	.29	.50	.78	.89	1.70	.418	.44	.225	3.39
RICHMOND																	
482660002A01	76*	25	LD	LD	.12	.20	.38	.57	.69	.80	1.19	2.02	3.24	.777	.81	.380	4.35
ROANOKE																	
482700003A01	76	27	LD	LD	LD	LD	LD	.07	.11	.14	.17	.39	1.13				
WASHINGTON																	
SEATTLE																	
491840001A01	76	28	LD	LD	LD	LD	LD	LD	.05	.07	.12	.17	.27				
SPOKANE																	
492040001A01	76*	20	LD	LD	LD	LD	LD	LD	.05	.05	.08	.10	.10				
WEST VIRGINIA																	
CHARLESTON																	
500280001A01	76	28	LD	LD	LD	LD	LD	.06	.12	.19	.24	.73	1.25				

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N H 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	95% CONF. BIAS (%)	PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
WEST VIRGINIA																	
HUNTINGTON																	
5007000054C1	76*	20	LD	LD	LD	LD	.09	.17	.29	.36	.45	.69	15.48				
SOUTH CHARLEST																	
5017600014C1	76	27	LD	LD	.05	.10	.16	.21	.26	.39	.50	.95	3.13	.452	.69	.208	3.57
WISCONSIN																	
EAU CLAIRE																	
5108400024C1	76*	22	LD	LD	LD	LD	.06	.07	.07	.08	.15	.22	.27				
KENOSHA																	
5115400014C1	76*	25	LD	LD	LD	LD	LD	.06	.08	.11	.11	.58	.96				
MADISON																	
5118600014C1	76	30	LD	LD	LD	LD	LD	.05	.06	.09	.11	.28	1.36				
SUPERIOR																	
5134800014C1	76*	20	LD	NO. OF SAMPLES (15) BELOW MIN. DET. EXCEEDS 50%									.16				

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

N O N U R B A N

N H 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ARIZONA																	
GRAND CANYON N																	
030370001A03	76*	21	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									.37				
ARKANSAS																	
MONTGOMERY CO																	
041760001A03	76	30	LD	NO. OF SAMPLES (22) BELOW MIN. DET. EXCEEDS 50%									.86				
COLORADO																	
MESA VERDE NAT																	
061530002A03	76*	22	LD	NO. OF SAMPLES (22) BELOW MIN. DET. EXCEEDS 50%									LD				
DELAWARE																	
KENT CO																	
090060001A03	76*	23	LD	LD	LD	LD	.07	.09	.11	.17	.25	.89	1.46				
HAWAII																	
HAWAII CO																	
120080101A03	76*	15	LD	NO. OF SAMPLES (13) BELOW MIN. DET. EXCEEDS 50%									.14				
INDIANA																	
MONROE CO																	
152800001A03	76*	24	LD	NO. OF SAMPLES (15) BELOW MIN. DET. EXCEEDS 50%									.64				
PARKE CO																	
153260001A03	76	28	LD	LD	LD	LD	LD	LD	.06	.07	.07	.16	.76				
MARYLAND																	
CALVERT CO																	
210280001A03	76*	16	LD	LD	LD	.05	.09	.27	.60	.62	.81	.85	4.02	.633	1.01	.209	5.34
MISSISSIPPI																	
JACKSON CO																	
251280001A03	76	27	LD	NO. OF SAMPLES (17) BELOW MIN. DET. EXCEEDS 50%									1.56				
MISSOURI																	
SHANNON CO																	
264480002A03	76	28	LD	LD	LD	LD	LD	.05	.09	.16	.24	.38	.92				
MONTANA																	
GLACIER NAT PA																	
270570001A03	76*	26	LD	NO. OF SAMPLES (21) BELOW MIN. DET. EXCEEDS 50%									.16				
ROSEBUD CO																	
271360026A03	76	27	LD	NO. OF SAMPLES (24) BELOW MIN. DET. EXCEEDS 50%									LD				
NEBRASKA																	
THOMAS CO																	
282480001A03	76*	19	LD	NO. OF SAMPLES (13) BELOW MIN. DET. EXCEEDS 50%									.29				
NEVADA																	
WHITE PINE CO																	
290560001A03	76	25	LD	NO. OF SAMPLES (17) BELOW MIN. DET. EXCEEDS 50%									.15				
PENNSYLVANIA																	
CLARION CO																	
391760001A03	76*	15	LD	NO. OF SAMPLES (8) BELOW MIN. DET. EXCEEDS 50%									.81				
RHODE ISLAND																	
WASHINGTON CO																	
410380002A03	76	26	LD	LD	LD	.07	.10	.12	.20	.30	.66	.81	4.87	.473	.96	.165	4.24
SOUTH CAROLINA																	
RICHLAND CO																	
421900002A03	76	25	LD	NO. OF SAMPLES (14) BELOW MIN. DET. EXCEEDS 50%									.50				
SOUTH DAKOTA																	
BLACK HILLS NA																	
430110001A03	76	29	LD	NO. OF SAMPLES (28) BELOW MIN. DET. EXCEEDS 50%									LD				
VERMONT																	
ORANGE CO																	
470360001A03	76*	21	LD	NO. OF SAMPLES (18) BELOW MIN. DET. EXCEEDS 50%									1.15				
VIRGINIA																	
SHENANDOAH NAT																	
482890001A03	76*	23	LD	LD	LD	LD	LD	.06	.09	.15	.17	.48	1.59				

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12301 - AMMONIUM
METHOD - 92 - HI-VOL SODIUM PHENOLATE
UNITS - 01 - UG/CU METER (25 C)

N O N U R B A N

N H 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 1.0		+-42.0
> 1.0		+-26.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
VIRGINIA WYTHE CO 493440001A03	76	23	LE	NO. OF SAMPLES (14) BELOW MIN. DET. EXCEEDS 50%									1.23				

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

URBAN
NO3

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 3	-3.3	+-17.0
3-6	-4.5	+- 10.0
> 6	-2.4	+- 14.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ALABAMA																	
BIRMINGHAM 010360003A01	76	30	1.06	1.59	2.15	2.54	2.86	3.10	3.35	3.58	3.96	4.36	4.69	3.075	.94	2.910	1.42
GADSDEN 011480001A01	76*	22	1.43	1.48	2.21	2.24	2.52	2.65	2.67	2.71	3.08	3.54	5.39	2.687	.81	2.584	1.32
HUNTSVILLE 011860001A01	76*	26	1.36	1.52	1.62	1.99	2.26	2.47	2.77	2.99	3.14	3.25	3.83	2.483	.70	2.381	1.35
MOBILE 012380001A01	76*	23	1.06	1.13	1.22	1.51	2.15	2.31	2.59	2.72	3.05	3.31	5.16	2.399	1.07	2.178	1.57
MONTGOMERY 012460001A01	76	28	.36	1.00	1.25	1.48	1.50	1.90	2.28	2.38	2.55	2.99	3.34	1.981	.77	1.801	1.62
ARIZONA																	
DOUGLAS 030240004A01	76*	22	.35	.58	.81	.98	1.08	1.12	1.14	1.20	1.50	2.11	2.32	1.213	.50	1.113	1.54
PHOENIX 030600302A01	76*	21	1.00	2.23	2.55	2.78	3.55	4.21	4.36	4.57	4.60	4.84	6.20	3.778	1.19	3.546	1.49
TUCSON 030860001A01	76	27	.76	1.30	1.47	1.66	2.04	2.31	2.42	2.91	3.10	3.40	5.07	2.422	1.03	2.210	1.56
ARKANSAS																	
LITTLE ROCK 041440001A01	76	30	.16	.49	1.08	1.80	2.08	2.16	2.28	3.13	3.28	3.95	6.08	2.419	1.42	1.920	2.23
TEXARKANA 042560001A01	76	30	.81	1.17	1.44	1.61	1.78	2.00	2.17	2.73	3.01	3.34	6.09	2.310	1.12	2.093	1.56
WEST MEMPHIS 042740001A01	76	27	.15	.22	.44	1.22	1.71	2.18	2.36	2.73	3.12	3.43	4.46	2.066	1.20	1.518	2.66
CALIFORNIA																	
ANAHEIM 050230001A01	76	29	1.75	3.74	5.03	6.93	7.96	8.85	9.41	13.19	16.88	18.37	25.52	10.819	6.34	9.027	1.89
BERKELEY 050740001A01	76	29	.66	1.35	1.96	2.29	2.83	3.46	4.72	6.25	7.56	16.41	31.03	6.991	8.13	4.313	2.62
BURBANK 050900002A01	76	28	1.17	2.69	4.23	5.46	7.34	7.86	9.89	12.56	13.48	14.89	22.83	9.258	5.20	7.630	2.00
FRESNO 052800002A01	76*	27	1.91	3.34	3.79	5.53	6.69	9.38	10.12	11.29	14.12	19.17	32.29	10.804	8.17	8.384	2.08
LONG BEACH 054100001A01	76	28	1.40	2.60	4.08	5.44	6.73	7.52	8.23	9.73	11.17	13.70	35.45	8.826	6.59	7.101	1.98
LOS ANGELES 054180001A01	76	30	2.93	5.25	6.15	9.22	10.98	11.57	14.09	15.83	20.35	21.86	33.79	13.875	7.63	11.867	1.80
OAKLAND 055300001A01	76*	24	.74	.97	1.92	2.14	2.61	2.61	3.70	5.10	8.08	11.26	24.87	5.283	5.46	3.600	2.39
ONTARIO 055380001A01	76*	25	2.23	6.98	10.96	13.90	14.50	18.41	19.06	19.39	22.07	25.33	42.11	17.416	8.12	15.232	1.81
PASADENA 055760002A01	76	28	2.12	2.72	5.74	6.61	7.15	7.64	10.00	10.75	11.48	15.13	20.43	9.403	4.92	8.120	1.79
SACRAMENTO 056580001A01	76	31	.09	.27	1.93	2.59	3.27	4.57	5.85	6.70	9.08	10.14	26.69	5.781	5.38	3.482	3.52
SAN BERNARDINO 056680001A01	76	30	.68	2.07	4.39	7.43	13.03	14.83	15.53	19.18	20.57	28.85	43.16	15.311	10.79	10.745	2.74
SAN DIEGO 056800004A01	76	28	1.62	1.93	3.28	3.59	4.88	7.13	7.78	10.75	11.34	15.72	17.22	7.721	4.95	6.149	2.06
SAN FRANCISCO 056860001A01	76	31	.56	.66	.96	1.43	1.77	2.63	3.45	4.89	6.13	15.72	34.41	6.069	8.71	3.045	3.12
SAN JOSE 056980004A01	76	31	1.53	1.60	2.08	3.82	4.35	6.45	8.02	9.11	12.07	30.26	38.91	9.745	10.18	6.272	2.58
SANTA ANA 057180001A01	76	30	2.66	3.29	5.42	6.54	6.95	7.35	8.68	11.26	16.77	18.53	30.45	10.190	6.41	8.541	1.83
COLORADO																	
DENVER 060580001A01	76	29	.68	.92	1.26	1.54	1.68	2.26	2.78	3.30	3.87	5.23	11.74	3.058	2.62	2.353	2.03
CONNECTICUT																	
BRIDGEPORT 070060001A01	76	28	1.16	1.25	2.04	2.39	2.45	2.67	4.00	4.90	5.10	7.71	9.17	3.961	2.47	3.289	1.87
HARTFORD 070420002A01	76	30	.52	.81	1.31	2.03	2.68	3.09	3.55	3.88	4.70	6.02	7.31	3.234	1.83	2.645	2.02
NEW HAVEN 070700001A01	76	30	.95	1.14	1.47	2.20	2.66	3.78	4.15	4.86	5.37	8.18	9.11	4.033	2.45	3.308	1.95
WATERBURY 071240123A01	76*	23	.67	.92	1.80	2.58	2.74	3.26	4.14	4.32	4.45	5.00	6.38	3.370	1.50	2.959	1.77

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N O 3

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 3	-3.3	+-17.0
3-6	-4.5	+- 10.0
> 6	-2.4	+- 14.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
DELAWARE																	
NEWARK																	
080140001A01	76	25	1.15	1.56	1.67	2.28	2.76	3.43	3.90	4.46	4.97	6.70	7.99	3.747	1.96	3.266	1.72
WILMINGTON																	
090260002A01	76*	24	.71	1.80	3.08	3.15	3.94	4.16	4.44	4.48	4.84	5.71	7.34	4.174	1.50	3.834	1.61
FLORIDA																	
JACKSONVILLE																	
131960002A01	76*	22	.96	1.35	1.81	1.97	2.05	2.11	2.31	2.37	2.65	3.47	4.20	2.326	.73	2.220	1.37
MIAMI																	
132700002A01	76*	23	.84	.87	1.02	1.23	1.35	1.57	1.82	2.25	2.77	3.40	3.95	1.922	.96	1.708	1.63
ST PETERSBURG																	
133980002A01	76*	16	1.48	1.48	1.52	2.19	2.28	2.67	3.17	3.38	4.64	5.05	10.62	3.679	2.70	3.049	1.81
GEORGIA																	
ATLANTA																	
110200001A01	76*	25	.39	1.30	1.34	1.56	1.69	2.06	2.28	2.52	3.07	3.66	5.05	2.275	1.15	1.976	1.79
COLUMBUS																	
111280001A01	76*	27	.37	1.03	1.19	1.31	1.65	1.88	2.04	2.18	2.48	2.78	4.24	1.908	.80	1.730	1.62
SAVANNAH																	
114500001A01	76	27	.37	.91	1.31	1.95	2.11	2.34	2.63	3.20	3.73	3.88	9.21	2.841	1.98	2.304	1.98
IDAHO																	
BOISE CITY																	
130220001A01	76*	16	.56	.63	.79	.82	.88	1.41	1.85	1.94	3.22	4.29	5.99	2.156	1.80	1.597	2.19
ILLINOIS																	
BLUE ISLAND																	
140500001A01	76*	26	1.16	1.67	2.29	3.15	3.49	3.94	4.58	5.08	5.91	6.27	7.73	4.223	1.84	3.778	1.66
CHICAGO																	
141220001A01	76*	23	.73	1.43	1.90	2.64	3.04	3.49	3.92	5.71	6.35	11.62	14.34	4.891	3.76	3.788	2.09
MOLINE																	
145120001A01	76	29	.63	1.22	1.69	2.13	2.68	3.01	3.11	3.46	4.01	5.74	7.17	3.182	1.66	2.764	1.75
NORTH CHICAGO																	
145620002A01	76	29	.58	1.42	1.82	2.26	2.62	2.94	3.08	3.91	4.85	6.05	8.56	3.472	1.93	2.959	1.82
PEORIA																	
146080001A01	76	30	1.81	2.01	2.45	2.65	3.81	4.19	4.29	5.14	6.27	7.04	8.38	4.357	1.87	3.964	1.56
ROCK ISLAND																	
146700001A01	76	28	.39	1.55	1.77	2.12	2.78	3.23	3.80	4.26	4.78	6.90	10.89	3.804	2.31	3.142	1.96
SPRINGFIELD																	
147280001A01	76*	24	1.03	1.11	1.78	2.03	3.16	3.54	3.58	4.79	5.21	6.89	8.64	3.782	2.08	3.227	1.82
INDIANA																	
EAST CHICAGO																	
151180001A01	76	28	.82	1.80	2.68	3.05	3.39	3.82	4.27	4.74	5.19	6.72	10.05	4.289	2.18	3.780	1.70
EVANSVILLE																	
151300001A01	76	30	2.14	2.22	2.54	2.83	3.13	3.25	3.32	3.60	3.95	4.88	8.95	3.559	1.41	3.362	1.38
GARY																	
151520001A01	76	29	.90	1.63	2.60	3.23	3.41	3.97	4.27	4.59	4.83	5.28	8.06	3.971	1.65	3.595	1.62
HAMMOND																	
151780002A01	76	29	1.01	1.50	2.39	2.91	3.35	3.77	4.00	4.43	4.77	5.37	12.23	3.991	2.19	3.499	1.70
INDIANAPOLIS																	
152040001A01	76*	15	1.77	3.06	3.12	4.26	4.46	4.58	4.84	5.81	6.10	7.05	9.06	4.982	1.79	4.661	1.48
NEW ALBANY																	
152980002A01	76	28	2.27	2.72	2.97	3.15	3.32	3.53	4.13	4.26	4.58	4.97	9.60	4.081	1.64	3.850	1.38
SOUTH BEND																	
153880002A01	76	30	1.56	1.98	2.07	2.21	2.83	3.58	4.00	4.24	4.86	5.51	7.07	3.684	1.60	3.360	1.55
TERRE HAUTE																	
154080001A01	76	26	2.28	2.68	2.79	3.07	3.52	4.10	4.78	5.26	5.79	6.69	11.01	4.793	2.36	4.344	1.54
IOWA																	
DUBUQUE																	
161260008A01	76	28	.48	1.18	1.96	2.05	2.56	2.91	3.25	3.88	4.21	4.71	8.73	3.109	1.62	2.706	1.77
KANSAS																	
KANSAS CITY																	
171800012A01	76*	24	1.20	1.45	1.97	2.23	2.66	3.04	3.20	3.83	3.94	4.95	10.85	3.376	1.97	2.985	1.63
LOUISIANA																	
BATON ROUGE																	
190280002A01	76*	20	.98	1.40	1.70	1.80	2.00	2.42	2.59	2.97	3.27	3.61	4.45	2.523	.92	2.359	1.46
IBERVILLE PAR																	
191280002A01	76	28	.96	1.09	1.66	1.73	2.07	2.37	2.54	2.81	2.90	3.68	5.94	2.489	1.10	2.276	1.54

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N O 3

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 3	-3.3	+-17.0
3-6	-4.5	+- 10.0
> 6	-2.4	+- 14.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
LOUISIANA																	
NEW ORLEANS																	
192020002A01	76	30	1.53	1.97	2.08	2.40	2.89	3.33	3.77	4.96	5.36	6.09	9.53	3.908	1.93	3.495	1.61
SHREVEPORT																	
192740001A01	76*	23	.36	1.01	1.13	1.40	1.47	2.09	2.24	2.34	2.60	2.88	4.67	2.057	.99	1.815	1.73
MARYLAND																	
BALTIMORE																	
210120001A01	76*	22	1.32	1.61	2.02	2.55	2.91	3.27	3.48	4.17	4.74	4.92	12.09	3.744	2.23	3.308	1.62
MASSACHUSETTS																	
CAMBRIDGE																	
220360001A01	76*	21	.19	.39	.90	1.07	1.37	2.08	2.64	2.90	3.10	3.75	4.44	2.120	1.25	1.673	2.23
FALL RIVER																	
220580001A01	76*	23	.45	.81	1.34	1.29	1.57	1.80	1.92	3.00	3.42	4.07	5.16	2.213	1.29	1.859	1.86
NEW BEDFORD																	
221500002A01	76*	22	.21	.42	.81	1.18	1.27	1.35	1.66	1.73	2.11	3.48	4.69	1.712	1.10	1.392	2.02
WORCHESTER																	
222640004A01	76*	24	.31	.34	.76	.95	1.32	1.60	2.04	2.26	2.64	2.95	4.53	1.805	1.10	1.440	2.11
MICHIGAN																	
DETROIT																	
231180001A01	76	29	1.04	1.55	1.66	2.66	2.95	3.68	4.65	5.23	6.06	7.25	8.89	4.202	2.30	3.556	1.84
GRAND RAPIDS																	
231820001A01	76	30	.61	1.35	1.54	1.92	2.13	2.85	3.54	3.89	3.99	5.27	8.56	3.249	1.98	2.736	1.83
LANSING																	
232840001A01	76	26	.75	.95	1.61	2.19	2.38	3.22	3.65	3.68	4.43	5.49	7.06	3.250	1.67	2.791	1.82
SAGINAW																	
234760001A01	76	28	.61	1.00	1.39	1.61	1.96	2.71	3.23	4.39	4.48	5.23	6.49	3.030	1.72	2.503	1.96
MINNESOTA																	
DULUTH																	
241040001A01	76	29	.29	.40	.58	.75	.89	1.38	1.44	1.68	1.95	2.56	2.99	1.374	.81	1.129	1.96
ST PAUL																	
243300031A01	76*	20	.86	1.00	1.17	1.53	1.71	1.91	2.10	2.54	3.26	4.50	5.87	2.411	1.40	2.089	1.71
MISSISSIPPI																	
JACKSON																	
251260002A01	76	31	.17	1.48	1.72	2.03	2.19	2.26	2.38	2.61	2.82	3.06	4.04	2.346	.76	2.146	1.71
MISSOURI																	
ST LOUIS																	
264280001A01	76*	25	.97	1.57	1.67	1.98	2.08	2.67	3.38	3.83	4.63	5.55	8.52	3.311	2.00	2.830	1.76
NEBRASKA																	
LINCOLN																	
281560002A01	76	31	.56	.94	1.26	1.35	1.52	1.95	2.24	2.60	3.08	3.67	5.54	2.222	1.21	1.932	1.71
OMAHA																	
291880030A01	76*	25	.55	1.53	1.68	1.90	2.06	2.55	2.69	3.19	3.38	4.38	5.31	2.650	1.14	2.396	1.62
NEVADA																	
LAS VEGAS																	
290320001A01	76*	26	.64	.73	1.08	2.28	2.65	3.14	3.65	4.32	4.58	5.18	5.66	3.152	1.63	2.608	2.01
RENO																	
290480001A01	76*	24	.32	.45	1.20	1.55	1.97	2.06	2.46	2.77	3.53	5.30	7.35	2.573	1.76	2.006	2.18
NEW JERSEY																	
CAMDEN																	
310720001A01	76*	21	.83	1.08	1.51	2.88	3.62	4.10	4.34	4.84	5.17	5.74	8.68	4.085	2.07	3.491	1.87
ELIZABETH																	
311300002A01	76*	23	.94	1.13	2.27	2.53	2.86	3.14	3.17	3.58	4.00	4.88	5.29	3.166	1.22	2.891	1.59
GLASSBORO																	
311700001A01	76*	21	.45	.94	1.43	1.84	1.99	2.12	2.29	2.53	2.75	2.86	4.80	2.232	.90	2.032	1.62
JERSEY CITY																	
312320001A01	76*	21	1.23	1.94	2.29	2.60	2.70	3.03	3.39	4.08	4.66	4.78	5.67	3.307	1.15	3.106	1.45
NEWARK																	
313480001A01	76*	23	.70	1.65	2.40	2.71	2.77	3.22	3.30	3.45	3.51	4.66	4.85	3.073	1.00	2.866	1.52
PATERSON																	
314140001A01	76*	21	.67	1.18	1.42	1.53	2.92	3.55	3.80	3.88	4.44	4.68	9.72	3.355	1.95	2.842	1.86
PERTH AMBOY																	
314220001A01	76*	24	.37	.66	1.24	2.07	2.68	2.79	2.95	4.23	4.51	4.93	7.00	3.082	1.70	2.509	2.09
TRENTON																	
315400301A01	76*	24	.87	.99	1.39	2.01	2.81	2.88	2.93	3.37	3.62	5.26	6.11	2.947	1.46	2.573	1.75

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

URBAN
NO 3

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 3	-3.3	+-17.0
3-6	-4.5	+- 10.0
> 6	-2.4	+- 14.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
NEW MEXICO																	
ALBUQUERQUE																	
320040001A01	76*	20	.76	.78	1.16	1.35	1.54	1.78	1.82	1.93	2.37	2.55	4.01	1.876	.85	1.707	1.56
NEW YORK																	
BUFFALO																	
330660001A01	76*	21	.42	1.61	2.04	2.59	2.69	2.93	3.16	3.34	4.52	5.46	7.34	3.304	1.63	2.887	1.80
NEW YORK CITY																	
330660014A01	76*	21	1.13	1.40	2.72	2.80	2.92	3.77	3.97	4.51	5.06	5.66	7.41	3.767	1.53	3.440	1.58
NIAGARA FALLS																	
334740001A01	76*	25	.30	1.38	1.45	1.62	1.94	2.30	2.63	3.92	4.21	5.60	6.88	2.901	1.74	2.365	2.03
ROCHESTER																	
335760001A01	76*	26	.26	1.03	1.56	2.16	2.28	2.88	3.34	3.70	4.13	4.27	5.92	2.953	1.37	2.524	1.94
SYRACUSE																	
336620001A01	76*	21	.27	.69	1.35	1.69	2.26	2.52	2.78	2.95	3.08	3.64	5.48	2.489	1.22	2.107	1.98
NORTH CAROLINA																	
CHARLOTTE																	
340703001A01	76	27	.13	.96	1.27	1.58	1.77	1.86	2.27	2.36	2.55	3.00	3.46	1.968	.80	1.720	1.91
DURHAM																	
341160006A01	76*	27	.22	1.23	1.34	1.75	1.85	2.27	2.52	2.87	3.00	3.01	3.47	2.242	.81	2.023	1.73
GREENSBORO																	
341740009A01	76	28	.06	.62	1.30	1.75	2.07	2.36	2.55	2.77	2.91	3.48	4.00	2.227	1.01	1.832	2.25
WINSTON-SALEM																	
344460002A01	76*	24	.85	1.30	1.47	1.94	2.12	2.48	2.55	2.90	3.42	3.73	4.88	2.531	.97	2.346	1.50
OHIO																	
AKRON																	
360060014A01	76	29	.19	.98	1.73	2.16	2.36	2.92	3.11	3.30	3.85	4.45	5.87	2.874	1.33	2.445	1.99
CANTON																	
351000001A01	76	30	.45	1.94	2.76	2.99	3.18	3.64	3.92	4.77	5.17	6.48	10.44	4.014	1.91	3.548	1.74
CINCINNATI																	
361220001A01	76*	21	2.14	2.24	2.92	2.95	3.30	3.72	3.83	4.35	4.53	5.66	6.36	3.849	1.16	3.689	1.34
CLEVELAND																	
361300001A01	76*	25	1.29	1.54	2.12	2.37	3.01	3.07	3.19	3.91	4.24	4.85	5.15	3.206	1.16	2.984	1.49
PORTSMOUTH																	
365620002A01	76*	17	.74	1.19	1.89	1.97	2.05	2.13	2.30	2.72	3.99	4.11	4.90	2.632	1.19	2.375	1.62
STEUBENVILLE																	
366420012A01	76	27	.52	1.33	1.57	2.13	2.49	2.87	2.96	3.64	3.91	4.68	6.05	2.949	1.37	2.598	1.74
TOLEDO																	
366600001A01	76	30	.59	1.49	2.00	2.62	3.07	3.18	3.63	3.90	4.26	5.51	9.08	3.455	1.69	3.032	1.75
OKLAHOMA																	
TULSA																	
373000110A01	76*	22	1.64	1.75	2.55	2.99	3.02	3.08	3.26	3.49	4.13	4.63	5.44	3.334	.95	3.198	1.35
PENNSYLVANIA																	
ALLENTOWN																	
390120001A01	76*	23	.99	1.07	2.22	2.66	3.00	3.58	4.37	4.44	5.29	6.80	7.77	3.889	1.88	3.401	1.75
ALTOONA																	
390140001A01	76*	24	.39	1.47	2.04	2.62	3.38	3.61	4.04	4.60	5.85	6.66	8.02	3.939	1.97	3.342	1.94
BETHLEHEM																	
390780002A01	76*	21	1.44	2.03	2.17	2.30	2.70	2.87	3.12	3.60	3.79	4.54	6.63	3.185	1.16	3.004	1.41
ERIE																	
393060002A01	76*	24	.66	.71	1.25	1.45	1.97	3.14	3.15	4.61	4.90	5.22	7.43	3.176	1.97	2.551	2.04
HARRISBURG																	
393880361A01	76*	22	.89	1.28	1.54	2.14	2.16	2.66	3.01	3.48	4.12	5.32	6.47	3.041	1.55	2.681	1.68
HAZLETON																	
393960001A01	76*	24	.13	.25	.94	1.17	1.34	1.73	2.07	2.51	2.93	3.03	12.51	2.239	2.37	1.572	2.48
JOHNSTOWN																	
394460803A01	76*	21	.64	.72	1.02	1.59	1.66	1.91	2.13	2.83	3.40	3.93	15.24	2.791	3.08	2.067	2.06
PHILADELPHIA																	
397140004A01	76	28	1.07	1.35	2.79	3.19	3.92	4.17	4.78	5.21	5.79	6.26	9.30	4.437	1.95	3.948	1.70
PITTSBURGH																	
397260001A01	76	29	1.23	1.42	2.45	2.83	3.01	3.64	3.90	4.57	5.36	6.07	8.96	3.960	1.92	3.511	1.67
READING																	
397620001A01	76	29	.20	.91	1.39	1.71	2.05	2.81	3.12	3.43	3.69	4.36	6.70	2.760	1.49	2.253	2.13
SCRANTON																	
398040001A01	76	30	.50	1.29	1.81	2.17	2.53	2.70	3.23	3.37	3.55	3.80	5.41	2.844	1.16	2.565	1.66
WARMINSTER																	
399160002A01	76	26	.13	.48	.84	1.27	1.70	2.03	2.84	3.25	3.63	3.81	6.83	2.490	1.75	1.799	2.58
WEST CHESTER																	
399280110A01	76*	24	.56	.64	1.87	2.24	2.76	3.16	3.31	4.01	4.17	5.65	6.58	3.271	1.59	2.814	1.86

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

U R B A N

N O 3

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 3	-3.3	+-17.0
3-6	-4.5	+- 10.0
> 6	-2.4	+- 14.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
PENNSYLVANIA																	
WILKES-BARRE																	
399430001A01	76*	24	.35	.78	1.85	2.02	2.25	2.38	2.85	3.18	3.39	3.82	5.99	2.614	1.19	2.285	1.82
YORK																	
399560322A01	76*	20	1.10	1.36	2.51	3.23	3.65	3.70	4.06	4.19	4.77	7.64	12.26	4.403	2.74	3.748	1.79
PUERTO RICO																	
GUAYNABO CO																	
401140001A01	76*	25	.38	.44	.62	.77	.82	.89	.95	1.00	1.16	1.36	2.32	.933	.40	.862	1.50
PONCE																	
401920002A01	76	27	.51	.56	.60	.64	.77	.83	.90	.93	1.00	1.06	1.52	.844	.23	.814	1.31
SABANA SECA																	
402065001A01	76	26	.45	.54	.57	.81	.84	.95	1.00	1.07	1.33	1.56	2.35	1.028	.45	.942	1.52
RHODE ISLAND																	
EAST PROVIDENC																	
410120001A01	76	28	.90	1.07	1.56	1.76	2.03	2.26	2.47	3.06	3.46	4.06	5.63	2.595	1.23	2.324	1.62
PROVIDENCE																	
410300001A01	76	28	.63	.94	1.56	1.87	2.31	2.60	2.92	3.39	4.14	4.64	6.92	2.961	1.64	2.507	1.85
SOUTH CAROLINA																	
COLUMBIA																	
420760001A01	76	28	.58	1.28	1.82	1.93	2.36	2.74	3.01	3.22	3.32	3.93	4.84	2.697	1.04	2.460	1.61
GREENVILLE																	
421180001A01	76	29	.21	1.47	1.51	1.65	1.67	1.97	2.12	2.29	2.36	2.77	3.91	1.967	.73	1.744	1.84
SOUTH DAKOTA																	
SIOUX FALLS																	
431480001A01	76*	29	.16	.60	.90	.99	1.61	1.82	1.84	2.24	2.81	3.42	5.14	1.981	1.27	1.576	2.14
TENNESSEE																	
CHATTANOOGA																	
440380001A01	76	26	.16	1.74	2.24	2.56	2.98	3.00	3.11	3.36	3.86	4.31	5.85	3.070	1.13	2.713	1.93
TEXAS																	
AUSTIN																	
450220010A01	76*	21	.75	1.21	1.52	1.57	1.78	2.22	2.53	2.54	2.68	3.18	5.14	2.282	.95	2.107	1.51
CORPUS CHRISTI																	
451150001A01	76	22	.75	.87	1.04	1.53	1.62	2.15	2.43	2.56	4.17	5.80	9.72	2.800	2.20	2.203	1.99
DALLAS																	
451310002A01	76*	19	1.56	1.92	2.26	2.94	3.14	3.49	3.64	3.83	4.23	5.55	7.39	3.715	1.62	3.410	1.52
FORT WORTH																	
451880001A01	76*	22	1.28	2.20	2.33	2.82	2.85	3.10	3.51	3.92	4.87	5.67	7.16	3.685	1.50	3.408	1.50
LUBBOCK																	
453340001A01	76*	21	.11	.67	.79	.91	.96	1.23	1.34	1.63	1.80	3.16	3.99	1.523	1.00	1.219	2.13
PASADENA																	
454060002A01	76*	18	1.73	1.76	1.98	2.13	2.35	2.49	2.69	3.53	3.65	5.63	11.22	3.576	2.51	3.045	1.70
SAN ANTONIO																	
454570034A01	76	25	1.47	1.61	1.69	2.06	2.14	2.43	2.68	3.67	3.84	4.56	5.37	2.869	1.17	2.652	1.49
WICHITA FALLS																	
455560002A01	76	27	.78	1.00	1.23	1.34	1.47	1.73	1.95	2.45	2.71	2.95	5.45	2.043	1.04	1.827	1.61
VIRGINIA																	
DANVILLE																	
480920001A01	76*	22	.34	.36	2.04	2.41	2.53	2.98	3.04	3.70	3.83	4.20	5.01	2.923	1.21	2.505	2.01
FAIRFAX CO																	
481060001A01	76*	17	.59	.84	1.08	1.40	1.64	2.38	2.45	2.90	2.99	3.48	3.81	2.175	.99	1.925	1.71
HAMPTON																	
481440001A01	76*	22	.23	1.28	1.38	2.01	2.19	2.29	2.67	2.86	3.75	4.63	5.29	2.694	1.32	2.304	1.94
PORTSMOUTH																	
482440001A01	76	27	.30	1.18	1.68	1.97	2.31	2.67	3.00	3.39	3.45	4.11	6.09	2.797	1.30	2.451	1.80
RICHMOND																	
482660002A01	76*	25	1.07	1.49	1.65	1.85	2.24	2.51	3.44	3.95	4.10	5.21	5.93	3.008	1.43	2.685	1.63
ROANOKE																	
482700003A01	76	27	.70	1.24	1.63	1.86	2.04	2.44	2.53	2.77	3.02	3.63	4.85	2.445	.93	2.268	1.51
WASHINGTON																	
SEATTLE																	
491840001A01	76	28	.51	.64	1.20	1.27	1.78	1.91	2.29	2.68	3.24	3.94	5.91	2.331	1.41	1.936	1.90
SPOKANE																	
492040001A01	76*	20	.43	.47	1.12	1.33	1.70	1.79	2.11	2.55	2.74	3.01	4.23	1.990	.98	1.714	1.85
WEST VIRGINIA																	
CHARLESTON																	
530280001A01	76	28	.18	.47	.90	1.10	1.88	2.14	2.74	3.16	3.27	3.61	5.44	2.243	1.32	1.739	2.31

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

URBAN

N O 3

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
< 3	-3.3	+-17.0
3-6	-4.5	+- 10.0
> 6	-2.4	+- 14.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
WEST VIRGINIA																	
HUNTINGTON																	
5007000054A01	76*	20	2.16	2.33	2.66	2.85	2.94	3.14	3.50	3.85	4.26	5.86	6.71	3.675	1.29	3.492	1.37
SOUTH CHARLEST																	
5017600014A01	76	27	.27	.84	1.00	1.13	1.51	1.69	1.85	1.99	2.30	2.48	4.54	1.789	.94	1.546	1.80
WISCONSIN																	
EAU CLAIRE																	
5108400024A01	76*	22	.46	.75	.89	1.09	1.47	2.14	2.48	3.48	3.86	4.15	4.60	2.397	1.39	1.953	2.01
KENOSHA																	
5115400014A01	76*	25	.46	1.34	1.51	1.92	2.28	2.82	3.51	5.16	5.81	6.49	9.05	3.603	2.21	2.928	2.01
MADISON																	
5118600014A01	76	30	.47	1.06	1.17	1.23	1.57	2.51	2.69	3.24	4.12	4.84	5.59	2.661	1.51	2.217	1.90
SUPERIOR																	
5134600014A01	76*	20	.15	.30	.41	.52	.80	1.24	1.52	1.71	1.87	2.14	3.19	1.274	.82	.977	2.28

POLLUTANT - 12306 - NITRATE
METHOD - 92 - HI-VOL REDUCTION-DIAZO COUPLING
UNITS - 01 - UG/CU METER (25 C)

N O N U R B A N

N O 3

ANALYTICAL QUALITY 95% CONF.

CONC. RANGE (UG/M3)	BIAS (%)	PRECISION (%)
< 3	-3.3	+-17.0
3-6	-4.5	+- 10.0
> 6	-2.4	+- 14.0

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ARIZONA																	
GRAND CANYON N																	
030370001A03	76*	21	.07	.11	.31	.33	.35	.41	.70	.78	1.09	1.47	1.87	.672	.50	.501	2.30
ARKANSAS																	
MONTGOMERY CO																	
041760001A03	76	30	.06	.23	.48	.69	.77	.87	.92	1.00	1.07	1.49	2.48	.922	.53	.742	2.18
COLORADO																	
MESA VERDE NAT																	
061530002A03	76*	22	LD	LD	LD	.08	.10	.12	.21	.25	.41	.46	.79	.225	.22	.136	3.01
DELAWARE																	
KENT CO																	
090063001A03	76*	23	.38	.47	1.88	2.14	2.17	2.47	2.92	3.21	3.41	4.54	4.88	2.719	1.21	2.360	1.88
HAWAII																	
HAWAII CO																	
120080101A03	76*	15	LD	LD	LD	.08	.13	.15	.16	.20	.22	.30	.36	.156	.10	.113	2.53
INDIANA																	
MONROE CO																	
152800001A03	76*	24	.52	1.34	2.21	2.34	2.65	2.87	3.29	3.41	3.84	4.62	5.57	3.072	1.23	2.780	1.66
PARKE CO																	
153263001A03	76	28	.20	1.10	1.28	1.53	1.58	2.03	2.51	2.85	3.30	4.09	6.15	2.362	1.35	1.908	2.16
MARYLAND																	
CALVERT CO																	
210283001A03	76*	16	.07	.20	.94	1.27	1.91	2.15	2.22	2.23	2.82	2.87	3.38	1.931	.98	1.435	2.88
MISSISSIPPI																	
JACKSON CO																	
251280001A03	76	27	LD	.58	.89	.95	1.05	1.35	1.56	1.94	2.14	2.56	4.40	1.568	.94	1.208	2.60
MISSOURI																	
SHANNON CO																	
264480002A03	76	28	.06	.42	.70	.72	.87	1.18	1.43	1.62	1.74	2.07	3.54	1.311	.84	1.014	2.34
MONTANA																	
GLACIER NAT PA																	
270570001A03	76*	26	LD	LD	.06	.10	.10	.20	.27	.37	.49	.49	1.49	.320	.36	.181	3.19
ROSEBUD CO																	
271360026A03	76	27	LD	.08	.10	.17	.24	.29	.36	.42	.47	.51	1.02	.349	.26	.258	2.36
NEBRASKA																	
THOMAS CO																	
292480001A03	76*	19	.15	.20	.33	.38	.47	.55	.66	.70	.82	1.75	2.78	.801	.69	.595	2.18
NEVADA																	
WHITE PINE CO																	
290560001A03	76	25	LD	.07	.11	.13	.16	.23	.43	.52	.88	1.10	1.66	.452	.44	.270	3.00
PENNSYLVANIA																	
CLARION CO																	
391760001A03	76*	15	.16	.20	.53	.77	.77	.98	1.13	1.72	1.73	4.35	4.35	1.476	1.30	1.026	2.55
SOUTH CAROLINA																	
RICHLAND CO																	
421900002A03	76	25	.36	.42	.70	1.01	1.14	1.33	1.44	1.56	1.59	2.01	2.05	1.268	.49	1.147	1.64
SOUTH DAKOTA																	
BLACK HILLS NA																	
430110001A03	76	29	LD	LD	LD	.06	.12	.17	.18	.23	.32	.49	1.41	.233	.28	.132	3.10
VERMONT																	
ORANGE CO																	
470360001A03	76*	21	.07	.20	.52	.60	.70	1.13	1.37	1.55	1.66	3.01	5.57	1.414	1.35	.943	2.72
VIRGINIA																	
SHENANDOAH NAT																	
482890001A03	76*	23	.13	.28	.49	.56	.82	1.13	1.38	1.51	1.64	1.79	3.82	1.227	.86	.951	2.20
WYTHE CO																	
483440001A03	76	23	LD	.32	.56	.59	.63	1.18	1.26	1.39	1.74	2.37	3.52	1.199	.82	.873	2.75

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN

S O 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-4.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 4.1

STTE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ALABAMA																	
BIRMINGHAM 010380003A01	76	30	4.6	4.8	6.2	6.6	7.1	8.4	8.8	10.8	11.3	12.7	24.9	9.31	4.3	8.55	1.49
GADSDEN 011460001A01	76*	22	2.6	3.2	4.2	5.1	5.8	7.1	8.0	9.0	10.3	15.7	20.7	8.40	4.8	7.28	1.71
HUNTSVILLE 011860001A01	76*	26	2.0	4.9	5.8	6.5	7.0	7.6	8.0	9.1	10.4	11.4	14.3	7.95	2.6	7.44	1.49
MOBILE 012380001A01	76*	23	3.2	3.5	5.0	6.2	6.2	7.1	7.4	9.1	9.9	11.1	13.0	7.50	2.7	6.98	1.48
MONTGOMERY 012460001A01	76	28	2.4	3.1	3.7	4.0	5.5	6.0	6.7	9.8	11.8	13.8	26.4	8.17	5.6	6.74	1.85
ARIZONA																	
DOUGLAS 030240004A01	76*	22	1.6	2.9	3.4	3.7	3.9	4.1	4.4	6.2	7.5	11.3	14.9	5.65	3.3	4.91	1.69
PHOENIX 030600002A01	76*	21	1.3	1.5	1.7	1.8	2.0	3.2	3.4	3.7	4.7	5.5	6.4	3.23	1.5	2.88	1.64
TUCSON 030860001A01	76	27	1.5	2.1	2.4	2.4	2.9	3.6	3.9	4.1	5.4	5.7	8.2	3.76	1.6	3.45	1.52
ARKANSAS																	
LITTLE ROCK 041440001A01	76	30	1.0	1.8	3.5	4.1	5.1	5.8	6.1	7.0	9.0	10.8	14.8	6.32	3.4	5.36	1.88
TEXARKANA 042560001A01	76	30	1.3	3.0	4.1	4.9	5.9	6.4	7.6	9.3	10.9	12.5	22.3	7.81	4.5	6.66	1.81
WEST MEMPHIS 042740001A01	76	27	1.1	4.1	4.5	5.3	5.9	7.8	8.2	9.5	10.1	11.2	21.1	7.84	3.8	6.94	1.72
CALIFORNIA																	
ANAHEIM 050233001A01	76	29	2.2	2.6	4.3	6.4	7.4	9.0	10.1	10.7	12.7	17.4	24.9	9.71	6.0	7.97	1.94
BERKELEY 050740001A01	76	29	1.6	2.3	2.8	3.3	3.9	4.2	4.3	5.3	6.0	8.5	11.3	4.80	2.4	4.28	1.62
BURBANK 050900002A01	76	28	1.7	2.7	4.1	5.3	6.0	7.9	10.6	11.8	12.6	19.5	23.7	9.63	6.0	7.77	2.01
FRESNO 052800002A01	76*	27	.7	1.7	2.2	2.9	3.1	3.6	8.9	4.3	5.5	6.2	16.1	4.24	2.9	3.56	1.83
LONG BEACH 054100001A01	76	28	1.6	3.5	4.3	5.1	6.4	7.6	8.8	11.2	13.2	14.4	33.9	9.79	7.2	7.85	1.97
LOS ANGELES 054180001A01	76	30	1.7	3.0	4.0	5.8	6.8	8.9	10.6	12.5	15.7	20.5	23.3	10.30	6.3	8.38	1.98
OAKLAND 055300001A01	76*	24	2.1	2.2	3.2	3.9	4.3	4.5	5.1	5.4	6.1	9.2	9.5	5.04	2.1	4.61	1.55
ONTARIO 055380001A01	76*	25	2.2	3.8	4.3	5.7	7.3	8.0	10.6	12.0	14.5	20.0	28.1	10.19	6.4	8.43	1.89
PASADENA 055760002A01	76	28	.9	2.3	2.7	2.8	4.1	5.5	8.6	9.7	10.1	18.3	23.2	7.91	6.0	5.85	2.29
SACRAMENTO 056580001A01	76	31	LD	LD	1.2	1.7	1.9	2.5	2.6	3.2	3.7	5.1	6.4	2.62	1.5	2.04	2.32
SAN BERNARDINO 056680001A01	76	30	.7	1.7	2.5	3.4	5.7	6.0	7.6	10.9	12.6	18.2	28.7	8.59	7.0	5.95	2.58
SAN DIEGO 056800004A01	76	28	1.7	2.3	3.6	4.6	5.8	7.3	7.9	9.6	11.0	11.5	18.0	7.62	4.2	6.45	1.86
SAN FRANCISCO 056860001A01	76	31	LD	2.0	2.4	3.3	3.5	3.9	4.9	5.5	5.6	7.2	13.2	4.73	2.8	3.93	2.01
SAN JOSE 056980004A01	76	31	1.3	1.8	2.0	2.3	2.6	3.1	3.3	3.7	5.0	6.5	9.4	3.61	1.9	3.20	1.62
SANTA ANA 057180001A01	76	30	2.1	2.8	4.1	5.0	6.3	7.3	8.7	9.4	13.9	16.7	23.8	8.85	5.5	7.36	1.87
TORRANCE 058260001A01	76	30	2.5	3.8	4.1	5.3	6.6	7.3	9.0	10.9	13.5	16.2	28.3	9.45	6.1	7.88	1.83
COLORADO																	
DENVER 060580001A01	76	29	1.5	1.8	2.1	2.2	2.6	2.9	2.9	3.3	3.8	6.1	9.7	3.48	2.0	3.07	1.59
CONNECTICUT																	
BRIDGEPORT 070060001A01	76	28	4.8	6.2	7.8	7.9	8.3	9.0	11.3	12.0	14.7	17.2	29.8	11.49	5.6	10.44	1.53
HARTFORD 070420002A01	76	30	3.8	6.1	6.5	6.9	7.4	8.2	9.8	10.9	16.3	19.7	30.0	11.15	6.7	9.70	1.67
NEW HAVEN 070700001A01	76	30	3.4	5.7	7.8	8.3	8.4	8.8	9.5	10.6	14.1	19.0	32.0	11.35	6.3	10.08	1.61

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12403 - SULFATE
METHOD - 51 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN

SO4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-4.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 4.1

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
CONNECTICUT																	
WATERBURY 071240123A01	76*	23	4.3	5.0	5.6	6.9	7.6	8.4	8.6	9.2	9.4	19.5	35.8	10.76	8.0	9.06	1.72
DELAWARE																	
NEWARK 080140001A01	76	25	5.3	5.8	6.9	7.7	8.5	10.5	11.4	14.9	17.7	19.9	25.2	12.10	5.9	10.85	1.60
WILMINGTON 080260002A01	76*	24	5.5	6.0	7.4	8.2	9.6	10.4	10.9	12.3	14.5	16.4	28.6	11.56	5.2	10.67	1.48
FLORIDA																	
JACKSONVILLE 103960002A01	76*	22	3.7	4.3	5.2	6.6	6.8	7.1	8.3	8.8	10.9	12.1	13.2	8.01	2.7	7.58	1.41
MIAMI 102700002A01	76*	23	2.8	3.3	4.2	4.4	4.5	4.8	4.8	5.1	5.9	6.5	14.9	5.37	2.4	5.04	1.39
ST PETERSBURG 103980002A01	76*	16	5.2	5.3	5.4	6.2	8.1	9.6	10.8	10.8	11.2	11.7	22.7	10.21	4.8	9.29	1.54
GEORGIA																	
ATLANTA 110200001A01	76*	25	4.2	4.5	5.1	5.4	6.0	6.5	9.5	11.6	12.3	14.9	26.4	9.48	6.0	8.16	1.69
COLUMBUS 111280001A01	76*	27	2.8	3.8	4.3	4.5	5.2	6.3	6.9	7.8	9.9	12.1	17.7	7.31	3.8	6.52	1.60
SAVANNAH 114500001A01	76	27	4.6	5.6	5.9	7.3	9.9	10.6	10.7	14.1	16.6	18.6	28.3	11.88	5.8	10.63	1.61
IDAHO																	
BOISE CITY 130220001A01	76*	16	1.2	1.5	1.6	1.6	1.8	1.9	2.1	2.2	2.5	3.2	3.5	2.15	.6	2.06	1.35
ILLINOIS																	
BLUE ISLAND 140500001A01	76*	26	5.0	5.6	6.6	7.3	7.4	9.5	11.2	12.4	13.0	15.5	25.7	10.78	5.2	9.78	1.54
CHICAGO 141220001A01	76*	23	3.2	3.7	5.1	6.7	7.1	8.8	9.0	11.2	12.0	14.7	20.9	9.37	4.5	8.38	1.63
MOLINE 145120001A01	76	29	2.9	3.6	4.3	5.0	5.4	5.6	6.1	7.1	8.2	10.5	12.3	6.49	2.5	6.06	1.45
NORTH CHICAGO 145620002A01	76	29	2.9	3.2	4.2	4.6	5.9	6.3	6.7	7.3	9.3	10.2	14.9	6.99	3.2	6.34	1.56
PEORIA 146030001A01	76	30	4.9	5.9	7.0	7.7	8.9	10.0	10.9	11.9	13.2	15.4	20.0	10.53	3.7	9.91	1.42
ROCK ISLAND 146730101A01	76	28	2.6	3.7	4.5	4.9	5.7	6.2	7.4	8.9	9.1	10.2	14.8	7.07	2.9	6.51	1.52
SPRINGFIELD 147280001A01	76*	24	3.0	3.8	4.7	4.9	5.9	6.2	6.7	8.0	9.1	11.7	12.0	7.04	2.6	6.57	1.46
INDIANA																	
EAST CHICAGO 151180001A01	76	28	7.9	8.2	9.2	9.8	11.0	11.9	12.6	13.9	15.0	16.8	20.4	12.53	3.4	12.09	1.30
EVANSVILLE 151300001A01	76	30	4.3	5.4	5.9	6.7	7.5	7.8	8.8	9.8	11.6	13.8	18.7	8.99	3.5	8.39	1.44
GARY 151520001A01	76	29	6.3	6.5	7.6	7.8	9.1	9.6	11.2	12.3	12.6	14.4	21.2	10.72	3.7	10.16	1.38
HAMMOND 151780002A01	76	29	4.8	5.6	6.1	6.8	7.6	7.9	8.3	9.4	11.5	16.2	28.2	9.73	5.2	8.78	1.54
INDIANAPOLIS 152040001A01	76*	15	4.1	4.4	6.8	8.5	8.8	10.9	11.8	16.5	16.6	19.8	22.6	11.90	5.5	10.64	1.66
NEW ALBANY 152980002A01	76	28	3.6	4.6	5.4	6.2	7.1	8.9	9.7	11.1	11.4	13.0	19.6	9.20	4.0	8.39	1.55
SOUTH BEND 153880002A01	76	30	3.9	5.1	5.4	5.9	6.7	7.2	7.8	8.1	9.9	10.4	12.8	7.64	2.2	7.32	1.34
TERRE HAUTE 154080001A01	76	26	4.4	6.2	6.3	7.8	8.0	9.2	10.4	11.1	13.4	13.5	20.5	10.19	3.9	9.52	1.45
IOWA																	
DUBUQUE 161260008A01	76	28	1.1	2.1	3.4	3.6	4.3	4.5	4.9	6.1	6.6	7.4	9.5	4.95	2.0	4.48	1.62
KANSAS																	
KANSAS CITY 171800012A01	76*	24	3.0	3.1	3.8	4.8	7.0	7.4	9.6	11.0	12.6	18.8	21.5	9.15	5.3	7.74	1.82
LOUISIANA																	
BATON ROUGE 190280002A01	76*	20	2.9	3.7	4.3	6.4	8.3	9.3	10.2	10.9	12.2	14.9	22.5	9.51	4.8	8.37	1.71

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

U R B A N

S O 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-4.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 4.1

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
LOUISIANA																	
IBERVILLE PAR																	
191283002A01	76	28	1.9	3.0	4.1	4.2	5.2	6.9	8.1	8.6	10.3	11.5	23.4	7.47	4.3	6.46	1.73
NEW ORLEANS																	
192023002A01	76	30	4.7	5.4	6.4	7.0	7.7	8.7	9.2	11.0	12.1	14.7	17.6	9.53	3.6	8.92	1.44
SHREVEPORT																	
192740001A01	76*	23	3.2	3.5	4.9	5.8	6.3	7.4	7.8	10.3	11.9	17.1	19.1	9.05	4.9	7.89	1.70
MARYLAND																	
BALTIMORE																	
210120001A01	76*	22	4.2	4.3	5.3	6.1	6.6	7.5	8.4	8.8	10.3	16.5	27.6	9.51	6.3	8.20	1.67
MASSACHUSETTS																	
CAMBRIDGE																	
220360001A01	76*	21	3.5	4.2	5.0	5.3	6.3	7.3	7.8	8.3	9.6	14.0	24.7	8.56	5.0	7.58	1.61
FALL RIVER																	
220580001A01	76*	23	2.6	3.8	4.8	5.6	5.8	7.0	7.6	8.3	9.6	19.5	26.6	9.30	6.4	7.75	1.80
NEW BEDFORD																	
221500002A01	76*	22	2.1	3.4	4.2	4.6	4.9	5.5	7.0	7.2	13.3	18.1	33.2	8.90	7.3	7.00	1.95
WORCHESTER																	
222643004A01	76*	24	3.6	4.2	5.4	5.6	6.0	6.6	7.4	8.3	13.2	20.0	28.0	9.46	6.4	8.02	1.73
MICHIGAN																	
DETROIT																	
231180101A01	76	29	4.5	5.0	5.4	5.6	6.5	7.8	8.7	10.2	12.7	15.5	23.9	9.58	5.3	8.45	1.63
GRAND RAPIDS																	
231820001A01	76	30	2.8	3.5	4.2	4.7	4.9	5.5	6.7	7.9	8.3	9.8	17.6	6.89	3.6	6.16	1.59
LANSING																	
232840001A01	76	26	2.1	3.8	4.4	5.0	5.2	6.3	7.8	7.9	9.8	12.4	18.5	7.67	4.2	6.75	1.66
SAGINAW																	
234760001A01	76	28	2.7	3.0	3.1	3.9	4.9	5.4	6.7	8.4	9.4	12.9	23.2	7.27	4.8	6.11	1.79
MINNESOTA																	
DULUTH																	
241090001A01	76	29	1.4	1.8	2.0	3.3	3.5	3.9	4.5	4.7	5.0	5.7	7.6	3.97	1.6	3.62	1.57
ST PAUL																	
243300031A01	76*	20	1.8	2.3	2.4	3.4	4.4	4.5	7.1	7.5	7.7	8.2	14.1	5.91	3.2	5.10	1.77
MISSISSIPPI																	
JACKSON																	
251260002A01	76	31	2.9	3.2	4.2	5.2	5.9	6.5	6.9	7.4	10.3	11.4	18.9	7.27	3.5	6.57	1.57
MISSOURI																	
ST LOUIS																	
264280001A01	76*	25	3.6	4.5	5.1	6.5	6.8	7.7	8.7	11.1	13.0	15.9	18.1	9.20	4.2	8.30	1.59
NEBRASKA																	
LINCOLN																	
281560002A01	76	31	1.0	1.6	1.9	2.0	2.3	2.9	3.2	3.5	5.6	7.2	20.7	4.06	3.7	3.21	1.88
OMAHA																	
281880030A01	76*	25	1.3	2.2	2.3	2.8	3.0	3.6	4.0	4.9	5.5	10.0	19.0	4.86	3.8	3.96	1.83
NEVADA																	
LAS VEGAS																	
290320001A01	76*	26	1.5	1.5	1.9	2.1	2.2	2.4	2.6	2.9	3.4	3.7	5.0	2.63	.9	2.50	1.39
RENO																	
290480001A01	76*	24	1.1	1.1	1.3	1.7	1.9	2.0	2.7	3.0	3.2	4.6	5.6	2.54	1.2	2.28	1.60
NEW JERSEY																	
CAMDEN																	
310720001A01	76*	21	4.8	5.3	7.1	7.5	8.7	13.2	14.6	15.0	18.8	27.4	30.6	13.94	7.6	12.12	1.73
ELIZABETH																	
311300002A01	76*	23	5.5	6.0	6.8	7.6	8.5	9.2	10.7	11.5	17.4	18.7	28.9	11.55	5.8	10.40	1.57
GLASSBORO																	
311700001A01	76*	21	4.2	5.4	5.7	6.1	6.9	8.1	9.0	10.4	11.9	13.2	16.2	8.90	3.4	8.33	1.45
JERSEY CITY																	
312320001A01	76*	21	5.3	5.6	6.5	7.3	8.4	10.1	11.6	14.1	17.3	18.3	31.9	12.25	6.5	10.88	1.62
NEWARK																	
313460001A01	76*	23	4.2	4.5	5.2	5.8	6.5	7.2	8.5	9.2	10.2	16.7	17.2	8.73	4.1	7.93	1.55
PATERSON																	
314140001A01	76*	21	2.6	5.2	7.4	7.8	9.0	9.9	11.6	15.7	17.6	23.9	33.1	12.83	7.5	10.96	1.79
PERTH AMBOY																	
314220001A01	76*	24	6.3	7.2	8.6	9.5	10.2	10.7	11.0	15.3	17.9	18.7	31.5	13.12	5.8	12.10	1.48

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

U R B A N

S O 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-4.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 4.1

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
NEW JERSEY																	
TRENTON																	
315400301A01	76*	24	2.7	3.4	5.9	6.5	7.5	8.6	9.3	10.0	11.9	15.5	24.3	9.37	4.6	8.36	1.64
NEW MEXICO																	
ALBUQUERQUE																	
320040001A01	76*	20	1.3	1.4	1.8	2.2	2.5	2.7	2.8	3.2	3.3	3.8	4.1	2.72	.8	2.59	1.39
NEW YORK																	
BUFFALO																	
330660001A01	76*	21	4.6	5.8	6.9	7.7	9.5	10.6	12.4	16.5	18.9	29.1	30.8	13.84	7.9	11.95	1.73
NEW YORK CITY																	
334680014A01	76*	21	4.7	4.9	6.3	7.5	8.2	10.1	10.7	13.2	15.1	16.6	28.3	11.40	5.7	10.23	1.60
NIAGARA FALLS																	
334740001A01	76*	25	4.4	5.0	5.8	7.0	8.3	8.5	11.2	15.1	15.8	20.8	33.6	11.96	7.4	10.16	1.77
ROCHESTER																	
335760001A01	76*	26	4.4	5.9	6.2	7.2	7.5	8.7	10.3	12.5	14.7	18.2	28.9	10.83	5.7	9.65	1.60
SYRACUSE																	
336620001A01	76*	21	4.1	4.4	5.1	5.8	5.8	7.0	8.6	8.8	9.9	11.5	29.8	8.59	5.4	7.63	1.57
NORTH CAROLINA																	
CHARLOTTE																	
340700001A01	76	27	4.2	4.3	4.8	5.3	6.5	7.3	7.8	8.3	10.5	12.8	23.1	8.27	4.2	7.49	1.53
DURHAM																	
341160006A01	76*	27	3.6	4.7	4.9	5.4	6.1	7.2	8.2	9.5	11.8	16.3	36.3	9.59	7.0	8.11	1.72
GREENSBORO																	
341740009A01	76	28	4.3	5.1	5.4	5.9	6.5	7.1	7.8	9.7	11.0	12.2	23.3	8.55	4.1	7.83	1.50
WINSTON-SALEM																	
344460002A01	76*	24	4.1	5.0	5.4	6.0	6.9	7.8	7.9	8.7	10.5	11.6	19.0	8.26	3.2	7.74	1.43
OHIO																	
AKRON																	
360060014A01	76	29	5.3	6.2	7.7	8.3	9.0	9.8	10.7	13.4	16.6	18.2	23.6	11.76	5.1	10.80	1.51
CANTON																	
361000001A01	76	30	4.9	5.6	6.9	7.5	8.5	9.3	10.2	12.0	13.8	18.5	26.9	11.32	5.9	10.11	1.59
CINCINNATI																	
361220001A01	76*	21	4.5	6.4	6.8	8.1	8.8	9.6	11.7	12.0	14.3	14.9	21.4	10.79	4.0	10.11	1.45
CLEVELAND																	
361300001A01	76*	25	5.0	6.5	7.1	8.0	8.5	9.0	10.5	11.5	14.2	18.2	21.4	10.67	4.3	9.94	1.45
PORTSMOUTH																	
365520002A01	76*	17	5.4	5.7	5.9	7.0	8.1	12.8	13.2	14.2	18.1	18.8	19.8	11.62	5.3	10.66	1.61
STEUBENVILLE																	
366420012A01	76	27	5.3	6.2	6.4	7.6	9.1	10.1	11.2	15.8	18.2	24.1	58.2	14.85	12.1	11.92	1.87
TOLEDO																	
366600001A01	76	30	2.1	4.1	5.8	6.3	7.2	8.3	9.3	11.0	11.5	15.8	25.0	9.44	5.0	8.29	1.69
OKLAHOMA																	
TULSA																	
373000110A01	76*	22	1.8	2.1	2.8	3.4	3.9	4.7	4.9	6.2	8.4	13.1	17.7	6.15	4.1	5.13	1.82
PENNSYLVANIA																	
ALLENTOWN																	
390120001A01	76*	23	6.8	7.0	8.4	9.2	9.6	10.8	11.7	12.2	13.5	19.5	27.6	12.20	5.1	11.35	1.45
ALTOONA																	
390140001A01	76*	24	3.4	3.8	6.8	6.8	8.4	9.1	11.5	16.5	17.3	21.6	30.1	12.25	7.1	10.39	1.81
BETHLEHEM																	
390780002A01	76*	21	7.0	7.4	7.9	8.6	9.5	11.5	14.4	16.6	18.3	22.0	32.8	13.88	6.5	12.64	1.54
ERIE																	
393060002A01	76*	24	3.7	4.5	5.5	6.1	8.1	8.4	9.4	13.6	16.6	22.2	31.8	11.83	7.9	9.80	1.84
HARRISBURG																	
393880361A01	76*	22	4.8	5.2	5.5	7.4	7.9	8.9	10.6	11.3	14.7	17.4	31.3	11.13	6.5	9.76	1.65
HAZLETON																	
393960001A01	76*	24	4.3	4.8	6.0	7.2	7.4	7.8	8.3	9.3	12.9	21.5	30.6	10.45	6.6	9.10	1.65
JOHNSTOWN																	
394460803A01	76*	21	8.9	9.1	10.3	10.8	11.6	13.8	15.5	17.2	17.8	23.8	29.2	15.17	5.7	14.27	1.41
PHILADELPHIA																	
397140004A01	76	28	4.8	7.0	8.2	9.7	9.9	11.6	12.8	13.6	17.6	18.4	29.2	13.00	5.7	11.93	1.52
PITTSBURGH																	
397260001A01	76	29	6.1	7.5	9.0	9.6	11.5	12.3	12.8	15.2	17.6	20.6	34.0	14.13	6.3	12.99	1.50
READING																	
397620001A01	76	29	5.7	6.5	7.3	8.0	8.3	8.6	9.0	12.1	13.0	15.7	26.7	10.84	5.2	9.96	1.48
SCRANTON																	
398040001A01	76	30	6.0	6.3	6.6	7.1	7.7	8.2	8.4	8.9	12.0	18.0	45.7	11.43	8.9	9.70	1.66

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12403 - SULFATE
METHOD - 01 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

U R B A N

S O 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	95% CONF. BIAS (%)	PRECISION (%)
<6.0	-9.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 9.1

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
PENNSYLVANIA																	
WARMINSTER 399160002A01	76	26	4.6	5.5	7.0	8.1	8.3	11.9	14.7	17.4	21.4	24.1	34.3	14.50	8.3	12.35	1.79
WEST CHESTER 399260110A01	76*	24	5.1	5.2	6.3	7.1	7.9	8.4	9.3	10.1	14.2	15.8	24.4	10.19	4.9	9.26	1.53
WILKES-BARRE 399430001A01	76*	24	3.6	4.9	5.9	6.7	7.0	7.8	8.2	8.7	9.9	17.6	22.2	9.37	4.7	8.45	1.56
YORK 399560322A01	76*	20	4.6	6.5	8.0	8.7	10.1	14.5	16.3	16.5	20.5	27.5	33.0	15.32	8.1	13.40	1.71
PUERTO RICO																	
GUAYNABO CO 401140001A01	76*	25	5.5	6.1	6.3	6.6	6.7	7.0	7.3	7.7	8.1	9.1	11.6	7.36	1.3	7.26	1.18
PONCE 401920002A01	76	27	2.0	2.3	3.1	3.8	4.1	4.3	4.4	5.2	5.2	5.5	7.1	4.34	1.2	4.13	1.38
SABANA SECA 402065001A01	76	26	2.4	4.0	5.1	5.6	6.5	7.0	8.0	8.2	8.8	9.8	12.2	7.16	2.3	6.72	1.46
RHODE ISLAND																	
EAST PROVIDENC 410120001A01	76	28	5.2	5.3	6.6	6.9	7.3	8.0	8.9	9.3	10.0	19.1	24.4	9.98	5.3	8.99	1.54
PROVIDENCE 410300001A01	76	28	6.4	6.7	7.2	7.5	7.7	8.6	9.6	10.4	12.1	18.4	32.9	11.18	6.3	10.03	1.54
SOUTH CAROLINA																	
COLUMBIA 420760001A01	76	28	2.2	3.8	5.0	5.4	6.1	7.1	7.7	8.7	10.3	13.4	35.7	9.05	6.8	7.53	1.78
GREENVILLE 421180001A01	76	29	4.0	4.5	5.0	5.5	6.0	7.1	8.0	8.8	10.8	12.0	20.7	8.30	4.1	7.52	1.54
SOUTH DAKOTA																	
SIOUX FALLS 431480011A01	76*	24	LD	1.0	1.6	1.7	2.5	3.0	3.3	4.4	4.6	6.2	13.8	3.77	3.0	2.82	2.30
TENNESSEE																	
CHATTANOOGA 440380001A01	76	26	6.1	6.2	7.9	8.5	9.1	9.4	9.9	10.8	13.8	14.5	23.8	10.61	3.9	10.03	1.39
TEXAS																	
AUSTIN 450220010A01	76*	21	LD	1.3	1.8	2.8	3.5	3.9	4.3	4.7	5.3	8.4	13.4	4.45	2.9	3.49	2.27
CORPUS CHRISTI 451150001A01	76	22	1.9	2.3	3.2	3.8	4.4	5.6	6.6	6.9	9.4	12.3	17.9	6.74	4.3	5.62	1.84
DALLAS 451310002A01	76*	19	1.9	2.6	3.5	4.6	5.2	6.0	6.1	7.7	8.9	12.8	17.8	6.95	4.1	5.95	1.78
FORT WORTH 451880001A01	76*	22	1.8	2.9	4.0	4.2	4.5	4.9	5.0	5.3	7.1	10.1	16.9	5.94	3.5	5.23	1.63
LUBBOCK 453340001A01	76*	21	1.1	1.7	2.2	2.3	2.4	2.9	3.4	3.6	4.1	4.9	5.3	3.11	1.1	2.90	1.48
PASADENA 454060002A01	76*	18	4.8	4.8	6.7	6.7	7.4	9.0	10.0	11.4	11.7	16.9	21.3	10.41	4.8	9.44	1.57
SAN ANTONIO 454570034A01	76	25	1.7	2.8	3.6	3.9	4.2	4.8	4.9	6.8	8.6	11.0	17.9	5.99	3.5	5.19	1.70
WICHITA FALLS 455560002A01	76	27	1.5	1.9	2.0	2.5	2.9	3.6	3.6	3.9	4.9	8.0	16.7	4.50	3.7	3.63	1.83
VIRGINIA																	
DANVILLE 480920001A01	76*	22	1.4	5.0	5.7	8.4	9.8	11.2	11.4	13.2	15.0	18.2	26.4	11.45	5.4	9.98	1.83
FAIRFAX CO 481060001A01	76*	17	5.3	6.5	6.8	7.0	9.4	9.9	12.9	13.9	18.2	19.1	24.6	12.16	5.7	10.96	1.59
HAMPTON 481440001A01	76*	22	3.5	5.0	6.2	6.9	7.1	8.2	8.8	9.4	11.2	15.1	20.3	9.18	3.9	8.48	1.49
NORFOLK 482140331A01	76	24	6.4	7.7	8.5	9.2	9.4	11.3	12.7	14.5	14.8	21.9	24.6	13.04	5.3	12.10	1.47
PORTSMOUTH 482440001A01	76	27	4.6	5.0	5.2	6.4	8.5	9.0	10.1	12.1	12.8	13.1	17.7	9.53	3.6	8.84	1.49
RICHMOND 482660002A01	76*	25	4.0	5.6	6.1	7.1	7.9	9.7	10.8	12.8	14.1	16.3	20.8	10.46	4.6	9.53	1.55
ROANOKE 482700003A01	76	27	1.8	2.2	3.3	4.6	5.1	5.9	6.2	8.0	10.8	12.1	19.1	7.15	4.1	6.07	1.81
WASHINGTON																	
SEATTLE 491840001A01	76	28	3.2	3.9	4.4	4.6	5.0	5.8	6.1	6.4	6.5	7.5	14.3	5.93	2.2	5.62	1.37

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12403 - SULFATE
METHOD - 01 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

URBAN

S O 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-8.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 4.1

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
WASHINGTON																	
SPOKANE																	
492040001A01	76*	20	1.7	1.8	2.4	2.5	2.9	3.3	4.1	4.8	5.4	6.5	8.8	4.11	2.0	3.66	1.63
WEST VIRGINIA																	
CHARLESTON																	
5200280001A01	76	28	5.4	5.8	9.5	10.5	11.2	12.6	16.0	17.3	18.8	24.2	35.3	15.49	8.0	13.73	1.65
HUNTINGTON																	
5300700054A01	76*	20	5.5	6.2	7.2	8.1	9.3	10.8	11.8	12.3	16.7	19.2	66.7	18.44	13.5	11.67	1.79
SOUTH CHARLEST																	
5317630001A01	76	27	4.6	6.3	7.3	8.2	9.3	11.4	11.7	13.1	19.3	21.1	24.0	12.51	5.8	11.31	1.57
WISCONSIN																	
EAU CLAIRE																	
5108430002A01	76*	22	1.5	1.8	2.1	4.3	4.6	4.7	5.0	5.4	5.7	7.1	8.4	4.71	1.8	4.28	1.61
KENOSHA																	
5115430001A01	76*	25	2.5	3.3	3.7	4.4	5.1	5.9	6.5	8.7	9.5	11.3	15.4	6.84	3.4	6.08	1.64
MADISON																	
5118630001A01	76	30	2.5	2.6	3.3	3.6	4.3	4.7	4.9	5.7	7.1	10.3	12.8	5.64	2.9	5.03	1.60
SUPERIOR																	
5134830001A01	76*	20	2.8	3.9	4.2	4.5	4.8	5.0	5.8	6.1	6.2	8.7	10.7	5.73	1.9	5.45	1.37

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 03 - UG/CU METER (25 C)

N O N U R B A N

S O 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-9.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 9.1

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
ARIZONA																	
GRAND CANYON N 030370001A03	76*	21	LD	LD	.7	1.0	1.1	1.4	1.8	1.8	2.0	2.7	3.2	1.51	.8	1.20	2.17
ARKANSAS																	
MONTGOMERY CO 041760001A03	76	30	.6	1.1	2.0	3.1	3.6	3.8	4.2	4.5	6.9	10.2	15.4	4.85	3.5	3.71	2.20
COLORADO																	
MESA VERDE NAT 061530002A03	76*	22	LD	LD	.8	.9	.9	1.0	1.2	1.2	1.4	1.5	1.7	1.04	.4	.92	1.78
DELAWARE																	
KENT CO 090060001A03	76*	23	6.0	6.2	7.0	7.3	7.8	8.4	8.6	9.0	12.7	17.7	30.0	10.51	5.7	9.51	1.52
HAWAII																	
HAWAII CO 1700830001A03	76*	15	LD	NO. OF SAMPLES (		8) BELOW MIN. DET. EXCEEDS 50%							2.6				
INDIANA																	
MONROE CO 152800001A03	76*	24	3.9	4.3	6.4	6.7	7.6	8.4	9.2	11.8	12.6	16.0	18.5	9.42	3.9	8.64	1.53
PARKE CO 153260001A03	76	28	2.6	3.3	3.5	4.1	4.4	4.6	6.5	7.8	8.8	10.7	15.8	6.54	3.7	5.72	1.66
MARYLAND																	
CALVERT CO 210280001A03	76*	16	4.6	5.2	5.4	6.5	6.9	8.1	8.8	9.3	11.3	12.9	25.1	9.80	5.6	8.71	1.60
MISSISSIPPI																	
JACKSON CO 251280001A03	76	27	.9	2.0	3.5	5.1	6.2	7.3	8.0	9.9	11.2	12.7	16.4	7.74	4.1	6.40	2.03
MISSOURI																	
SHANNON CO 264480002A03	76	28	.9	1.8	2.0	2.2	3.4	4.4	5.8	7.5	8.2	10.6	13.3	5.47	3.5	4.34	2.06
MONTANA																	
GLACIER NAT PA 270570001A03	76*	26	LD	1.2	1.2	1.5	1.5	1.6	1.7	1.8	2.1	2.5	5.4	1.81	.9	1.62	1.66
ROSEBUD CO 271360026A03	76	27	.7	1.3	1.2	1.5	1.5	1.7	2.2	2.5	2.6	2.6	3.6	1.90	.7	1.75	1.52
NEBRASKA																	
THOMAS CO 292480001A03	76*	19	.9	.9	1.1	1.1	1.2	1.4	1.4	2.4	2.5	2.8	11.2	2.20	2.3	1.70	1.88
NEVADA																	
WHITE PINE CO 290560001A03	76	25	LD	LD	LD	LD	.8	1.3	1.3	1.8	2.1	2.4	4.0				
PENNSYLVANIA																	
CLARION CO 391760001A03	76*	15	5.2	5.3	5.6	6.4	7.0	9.1	11.5	13.3	13.3	30.3	36.3	12.33	9.1	10.19	1.82
RHODE ISLAND																	
WASHINGTON CO 410030002A03	76	26	2.9	4.1	4.7	5.1	5.4	5.7	7.1	7.7	10.2	11.5	29.0	8.18	5.8	6.96	1.70
SOUTH CAROLINA																	
RICHLAND CO 421900002A03	76	25	2.7	2.9	3.3	4.4	4.6	5.0	5.7	6.9	8.0	9.4	10.3	5.78	2.3	5.33	1.50
SOUTH DAKOTA																	
BLACK HILLS NA 430110001A03	76	29	LD	LD	.6	.8	.9	1.1	1.1	1.3	1.5	1.7	2.9	1.09	.5	.92	1.90
VERMONT																	
ORANGE CO 470360001A03	76*	21	1.4	2.5	3.3	3.6	4.0	4.6	5.9	7.0	9.6	11.2	21.3	6.38	4.4	5.28	1.85
VIRGINIA																	
SHENANDOAH NAT 482890001A03	76*	23	2.3	3.5	5.0	5.3	5.3	6.5	7.4	7.6	9.5	11.6	18.6	7.51	3.6	6.78	1.58

* INDICATES YEARLY CRITERIA NOT MET

POLLUTANT - 12403 - SULFATE
METHOD - 91 - HI-VOL COLORIMETRIC
UNITS - 01 - UG/CU METER (25 C)

N O N U R B A N

S O 4

ANALYTICAL QUALITY CONC. RANGE (UG/M3)	BIAS (%)	95% CONF. PRECISION (%)
<6.0	-8.3	+- 12.0
6.0-20.0	-5.0	+- 6.7
>20.0	-5.1	+- 4.1

SITE:	YR	NO.	MIN	10	20	30	40	50	60	70	80	90	MAX	ARITHMETIC MEAN	ARITHMETIC STDEV	GEOMETRIC MEAN	GEOMETRIC STD
VIRGINIA WYTHE CO 483440001403	76	23	2.1	3.0	4.0	4.2	4.4	4.8	6.3	6.3	11.0	12.7	19.4	6.90	4.3	5.86	1.76

APPENDIX A

GRUBB'S STATISTIC FOR THE DETECTION OF OUTLIERS

As a final test before data were summarized and released for publication, Grubb's test* was used to indicate outliers, i.e., questionable values that seemed to be excessively great. A computer program compiled the statistics and performed the tests for outliers. As many as three outliers were rejected for each pollutant at each site.

The procedure is to calculate the variance using all the data in the data set for a site, then repeat the calculation by eliminating the maximum value in succession. The calculation of variances continues until a total of four values of variance have been calculated, i.e., until the three highest concentration values have been temporarily eliminated from the data set. Whether to identify any of the maximum values from the data set as outliers was determined by calculating three ratios of variances and comparing these with F statistics in standard texts. The procedure is explained further by the equations that follow.

---

*Technometrics, 14(3), August 1972.

Values of variance were calculated as follows:

$$S^2 = [\Sigma X^2-(\Sigma X)^2/n]/(n-1) \qquad \text{(A-1)}$$

where S^2 = variance of data set about its mean value using all the data

X = individual concentration values

n = total number of data in the data set

Successive values of variance, labeled S^2_n, $S^2_{n,n-1}$, and $S^2_{n,n-1,n-2}$, were calculated by eliminating the maximum value in succession. Thus, the last value was calculated as follows:

$$S^2_{n,n-1,n-2} = [\Sigma Y^2-(\Sigma Y)^2/N]/(N-1) \qquad \text{(A-2)}$$

where $S^2_{n,n-1,n-2}$ = variance of data set formed by eliminating the highest three concentrations

Y = individual concentration values of the new data set ($Y_i = X_i$ to $i = N$)

N = n-3, three less than the number of data in the original data set

The three ratios of variance were calculated as follows:

$$L_1 = (S^2_n)/(S^2) \qquad \text{(A-3)}$$

$$L_2 = (S^2_{n,n-1})/(S^2) \qquad \text{(A-4)}$$

$$L_3 = (S^2_{n,n-1,n-2})/(S^2) \qquad \text{(A-5)}$$

APPENDIX B

CONFIDENCE LIMITS OF MEASURED VALUES

The usual formula for computing approximate confidence limits of individual values when the precision is measured as the coefficient of variation is:

$$L_u = X[1 + t_{\alpha/2}\, C_v/100] \qquad \text{(B-1a)}$$

$$L_\ell = X[1 - t_{\alpha/2}\, C_v/100] \qquad \text{(B-1b)}$$

where L_u = upper limit

X = the measured value

$t_{\alpha/2}$ = the t statistic for the desired confidence

C_v = the coefficient of variation expressed as a percentage

L_ℓ = lower limit

As an example, assume that the precision of an air pollution measurement system as measured by the coefficient of variation is 5.1 percent. An individually measured value of 47.5 $\mu g/m^3$ was observed. Assuming a 95 percent confidence interval (α=0.05) and a large number of degrees of freedom, $t_{0.025}$=1.96. Therefore, the approximate 95 percent confidence limits for the true value are:

$$L_u = 47.5[1 + (1.96)(5.1)/100] \qquad \text{(B-2a)}$$

$$= 52.3\ \mu g/m^3$$

$$L_\ell = 47.5[1 - (1.96)(5.1)/100] \qquad \text{(B-2b)}$$

$$= 42.8\ \mu g/m^3$$

These limits are symmetric about the observed value.

Since use of the coefficient of variation implies that the precision is a function of the concentration level, a more correct formula for computing the confidence limits is:

$$L_u = X/(1 - t_{\alpha/2}\ C_v/100) \qquad \text{(B-3a)}$$

$$L_\ell = X/(1 + t_{\alpha/2}\ C_v/100) \qquad \text{(B-3b)}$$

Using the data in the previous example the upper and lower 95 percent confidence limits are:

$$L_u = 47.5/[1-(1.96)(5.1)/100] = 52.8\ \mu g/m^3 \qquad \text{(B-4a)}$$

$$L_\ell = 47.5/[1+(1.96)(5.1)/100] = 43.2 \text{ percent} \qquad \text{(B-4b)}$$

These limits are asymmetric (as they should be) about the observed value and they result in a slightly wider confidence interval than given by B-2a and B-2b.

The graphical representation of the procedure is shown in Figure B-1.

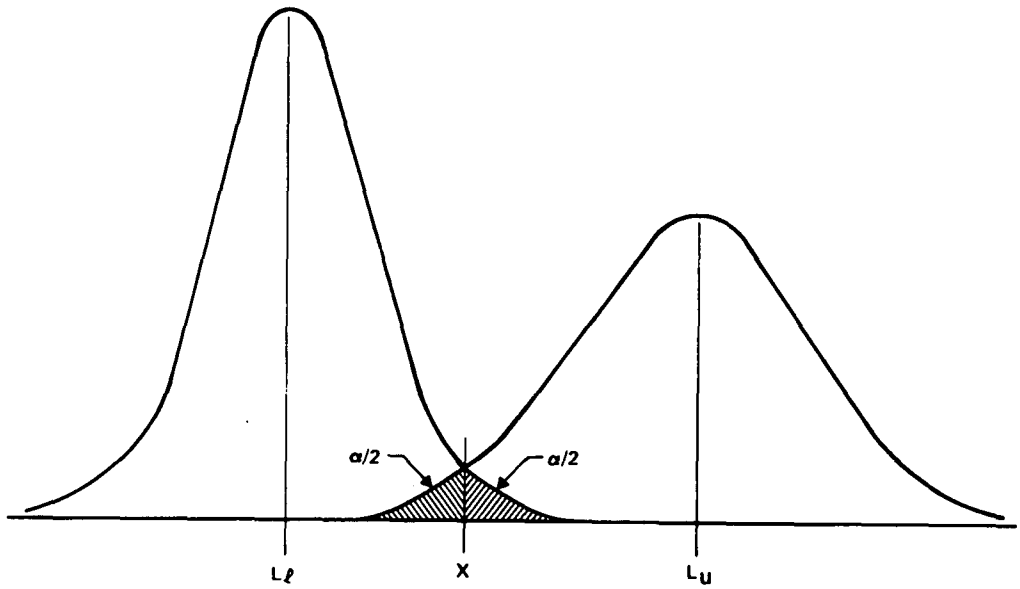

Figure B-1. Graphical representation of upper and lower confidence intervals of an individually-measured concentration value when precision is evaluated over a range of concentration levels.

The more exact confidence limits in Equation B-3 were derived from Figure B-1 as follows:

$$X = L_u(1-t_{\alpha/2}\ C_v/100) \qquad \text{(B-5a)}$$

$$X = L_\ell(1+t_{\alpha/2}\ C_v/100) \qquad \text{(B-5b)}$$

Therefore,

$$L_u = X/(1-t_{\alpha/2}\ C_v/100) \qquad \text{(B-6a)}$$

$$L_\ell = X/(1-t_{\alpha/2}\ C_v/100) \qquad \text{(B-6b)}$$

The general formula for computing these confidence intervals when both bias and precision are in percentage of concentration level, and when the bias varies from time to time in random manner, is as follows:

$$L_u = [X(1-B/100)]/[1-k\sqrt{S_B^2+C_V^2}/100] \qquad \text{(B-7a)}$$

$$L_\ell = [X(1-B/100)]/[1+k\sqrt{S_B^2+C_V^2}/100] \qquad \text{(B-7b)}$$

where L_u = upper confidence limit

L_ℓ = lower confidence limit

X = measured value

B = average percentage bias

S_B = standard deviation of percentage bias

C_V = coefficient of variation for precision, percent

k = standard normal deviate for desired confidence level