The Ambient Air Precision and Accuracy Program

1995 Annual Report

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EXECUTIVE SUMMARY

Many important EPA decisions are based on the nationwide ambient air monitoring data obtained by the State and Local agencies. This data is collected by approximately 5,000 ambient air samplers which make up the State and Local Air Monitoring Stations (SLAMS) network. Data collected are used by the EPA to aid in planning the Nation's air pollution control strategy and to measure achievement toward meeting the national ambient air quality standards (NAAQS). Unfortunately, not all data are accompanied by estimates of its quality. To assure the most knowledgeable and effective use of the data, the quality of the national monitoring data should be determined and made known to all data users. The Code of Federal Regulations (CFR), Part 58, directed that precision and accuracy checks be incorporated by the State and Local agencies to verify the quality of the collected data.

Precision is used in the sense of "repeatability of measurement values under specified conditions." Accuracy is used in the sense of a measure of "closeness to the truth." The CFR requires that measures of data quality be reported on the basis of 'reporting organization.' A reporting organization is defined as a State or subordinate organization within a State which is responsible for a set of stations which monitor the same pollutant and for which precision and accuracy assessments can be. States must define one or more reporting organizations for each pollutant such that each monitoring station in the State SLAMS network is included in one, and only one, reporting organization. The quality assurance guidelines for precision is +/- 15 % and the guideline for accuracy is +/- 20 % (see the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, section 2.0.11).

A review of the yearly 1995 data for the six criteria pollutants:

Ozone (O_3)	Sulfur Dioxide (SO_2)
Carbon Monoxide (CO)	Nitrogen Dioxide (NO_2)
Particles (PM_{10})	Lead (Pb)

was performed on the precision and accuracy data for reporting organizations as reported to the EPA's Aerometric Information Retrieval System (AIRS) database. This review yielded a national average with upper and lower probability limits for each pollutant which holds 95% of the stations data (see Chapter 40 Code of Federal Regulations Part 58, Appendix A, Section 5 for exact specifications and formulas).

A national review revealed that the overall quality of the nation's ambient air is within acceptable guidelines. The national average of the precision probability limits is -7.0 and +7.5 and the national average of the accuracy probability limits for level I was -6.9 and +6.0 and level II was -5.6 and +4.4 respectfully. These

numbers were taken by averaging all reporting organizations yearly limits for the pollutants.

The national review can be further aggregated into specific pollutants. The precision results for the 150 reporting organizations sampling for ozone average -6.0 and +5.9. The precision results for the 134 reporting organizations sampling for sulfur dioxide average -7.3 and +6.7. The precision results for the 91 reporting organizations sampling for nitrogen dioxide average -8.7 and +8.8. The precision results for the 105 reporting organizations sampling for carbon monoxide average -4.5 and +6.2. The precision results for the 171 reporting organizations sampling for particulates average -8.4 and +9.8.

A Regional review on the 1995 yearly precision and accuracy data was also performed. The national percentage of Reporting Organizations submitting data within acceptable guidelines for ozone is 99.33 %. The national precision percentage for carbon monoxide is 97.14%. The national precision percentage of Reporting Organizations submitting acceptable precision data for nitrogen dioxide is 90.11%. The national precision percentage for sulfur dioxide is 91.79%. The national precision percentage for particulates with a diameter of ten microns or less is 78.95%.

The national percentage of Reporting Organizations submitting data within acceptable guidelines for ozone is 95.95 %. The national accuracy percentage for carbon monoxide is 98.27%. The national accuracy percentage for nitrogen dioxide is 89.13%. The national accuracy percentage for sulfur dioxide is 88.57%. The national accuracy percentage for particulates with a diameter of ten microns or less is 99.25%.

This document fulfills the requirement within the 40 CFR Part 58 Appendix A for an annual report concerning the precision and accuracy data submitted to the EPA from the State and Local Agencies.

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INTRODUCTION

Many important EPA decisions are based on the ambient air quality monitoring data obtained by the State and Local agencies. This data is collected by the approximately 5,000 ambient air samplers which make up the State and Local Air Monitoring Stations (SLAMS) network. Data collected and reported to the Aerometric Information Retrieval System (AIRS) are used by the EPA to aid in planning the Nation's air pollution control strategy and to measure achievement toward meeting national ambient air quality standards (NAAQS). Further, the data in AIRS are made available to numerous requestors, who may use the data for various research projects, special studies, or other purposes.

Prior to the May 10, 1979 promulgation of the Regulations set forth in chapter 40 of the Code of Federal Regulations (40 CFR) Part 58 (Federal Register notice: 44 FR 27558-27604), the quality assurance and quality control practices of State and Local agencies were strictly voluntary; although many forms of guidance and assistance had been provided by the EPA Regional offices and the National Exposure Research Laboratory (formally the Environmental Monitoring Systems Laboratory), Research Triangle Park, North Carolina. Consequently, there was a wide diversity among the State and Local agencies in the scope and effectiveness of their QA program.

Unfortunately, not all data are accompanied by estimates of its quality. To assure the most knowledgeable and effective use of the data, the quality of the national monitoring data should be determined and made known to all data users. The Code of Federal Regulations, Part 58, directed that precision and accuracy checks be incorporated by the State and Local agencies to control and evaluate the quality of the collected data.

BACKGROUND

Precision is used in 40 CFR Part 58, Appendices A and B, in the sense of "repeatability of measurement values under specified conditions." Since specified conditions may vary considerably, there are many levels of repeatability or precision. For example, with an automated continuous air pollution sensor, the random fluctuations in response over a short time (e.g., within a minute) when an instrument is measuring a gas of constant pollutant concentration is a very 'local' measurement of precision. Another measure of repeatability would be the variation of one point precision checks made at biweekly intervals on the same instrument (Instrument Precision).

Accuracy is used in 40 CFR Part 58, Appendices A and B, in the sense of a measure of "closeness to the truth." Deviations from

the truth result from both random errors and systematic errors. Precision is associated with the random errors. The average inaccuracy, or bias, of a measurement process over some time or set of conditions is associated with the systematic error. For example, the systematic error of a given instrument is associated with average accuracy for that instrument over some specified period of time.

Although the ultimate truth cannot be known, the values of the standards determined by National Institute of Science and Technology (NIST) or other nationally recognized measurement standards body are accepted as 'truth'. In assessing the accuracy of measurements of an air pollution monitoring agency, measurements are made through the implementation of independent audits in which the measurement systems are challenged with standards (materials or devices) having traceability as directly as possible to NIST standards.

Section 3 of Appendix A in 40 CFR Part 58, requires that measures of data quality be reported on the basis of 'reporting organization.' A reporting organization is defined as a State or subordinate organization within a State which is responsible for a set of stations which monitor the same pollutant and for which precision and accuracy assessments can be. States must define one or more reporting organizations for each pollutant such that each monitoring station in the State SLAMS network is included in one, and only one, reporting organization. Agency precision and accuracy is the average values of all the instruments within a reporting organization during the calendar quarter or calendar year. Each reporting organization shall be defined such that precision or accuracy among all stations in the organization can be expected to be reasonably homogeneous, as a result of common factors. Common factors that should be considered by States in defining reporting organizations include: (1) operation by a common team of field operators, (2) common calibration facilities, and (3) support by a common laboratory or headquarters.

The precision and accuracy checks conducted by reporting organizations are one component of a quality assurance program. At the local level, the precision and accuracy data enable reporting organizations to identify aspects of their quality assurance programs that may need strengthening. They also enable the EPA to determine ways in which the quality of ambient data can be improved, such as additional research on measurement procedures, increased quality control for certain types of measurements, or technical assistance to areas of the country needing improved quality control.

There are other potential uses of the precision and accuracy data. First, when determining whether a site meets a National Ambient Air

Quality Standard (NAAQS), it may be useful for decision makers to know to what extent a concentration reported as either above or below the standard is the result of measurement error. Second, when setting NAAQS, policy makers must estimate the protection afforded by existing and revised ambient standards on either a national or regional basis. This judgment may be influenced by measurement uncertainties.

Finally, the 1990 Clean Air Act Amendments (CAAA) identified nonattainment areas for pollutants. These nonattainment areas were classified by levels of pollutant concentration in the atmosphere (marginal, moderate, serious, severe, and extreme). For an area or site to change its classification, it must show reductions in pollutant concentration levels. The monitoring data must be of acceptable quality to support the reclassification of nonattainment areas or for attainment areas to become classified as nonattainment.

CURRENT REGULATIONS

Precision of Automated Methods

A one-point precision check must be carried out at least once every 2 weeks on each automated analyzer used to measure SO_2, NO_2, O_3, and CO. The precision check is made by challenging the analyzer with a precision check gas of known concentration between 0.08 and 0.10 parts per million (ppm) for SO_2, NO_2, O_3 analyzers and between 8 and 10 ppm for CO analyzers. To check the precision of SLAMS analyzers operating on ranges higher than 1.0 ppm for SO_2, NO_2, O_3 or 0 to 100 ppm for CO, precision check gases of appropriately higher concentration can be used once approved by the appropriate Regional Administrator or designee. However, the results of precision checks at concentration levels other than those stated need not be reported to EPA.

Except for certain CO analyzers (40 CFR Part 58), analyzers must operate in their normal sampling mode during the precision check, and the test atmosphere must pass through all filters, scrubbers, conditioners, and other components used during normal ambient sampling and as much of the ambient air inlet system as is practicable. If a precision check is made in conjunction with a zero or span adjustment, it must be made prior to such zero or span adjustments. Randomization of the precision check with respect to time of day, day of week, and routine service and adjustments is encouraged where possible. Report the actual concentrations of the precision check gas and the corresponding concentrations indicated by the analyzer. The percent differences between these concentrations are used to assess the precision of the monitoring data (Reference 3).

Accuracy of automated methods

Each calendar quarter (during which analyzers are operated), audit at least 25 percent of the SLAMS analyzers that monitor for SO_2, NO_2, O_3, or CO such that each analyzer is audited at least once per year. If there are fewer than four analyzers for a pollutant within a reporting organization, randomly reaudit one or more analyzers so that at least one analyzer for that pollutant is audited each calendar quarter. Where possible, if there are fewer than 4 analyzers, EPA strongly encourages more frequent auditing, up to an audit frequency of once per quarter for each SLAMS analyzer.

The audit is made by challenging the analyzer with at least one audit gas of known concentration from each of the following ranges that fall within the measurement range of the analyzer being audited:

	Concentration range, ppm		
Audit Level	SO_2, O_3	NO_2	CO
I.....	0.03-0.08	0.03-0.08	3 - 8
II.....	0.15-0.20	0.15-0.20	15 - 20
III.....	0.35-0.45	0.35-0.45	35 - 45
IV.....	0.80-0.90	---------	80 - 90

NO_2 audit gas for chemiluminescence-type NO_2 analyzers must also contain at least 0.08 ppm NO.

Precision of manual methods

For each network of manual methods, select one or more monitoring sites within the reporting organization for duplicate, collocated sampling as follows: for 1 to 5 sites, select 1 site; for 6 to 20 sites, select 2 sites, and for over 20 sites, select 3 sites. This selection should be reviewed periodically to ensure all new NAAQS updates are included (i.e., proposed $PM_{2.5}$ regulations). Where possible, additional collocated sampling is encouraged. For particulate matter, a network for measuring PM_{10} shall be separate from a TSP network. Sites having annual mean particulate matter concentrations among the highest 25 percent of the annual mean concentrations for all the sites in the network must be selected or, if such sites are impractical, alternate sites approved by the Regional Administrator may be selected.

In determining the number of collocated sites required, monitoring networks for Pb should be treated independently from networks for particulate matter, even though the separate networks may share one or more common samplers. However, a single pair of samplers collocated at a common-sampler monitoring site that meets the

requirements for both a collocated lead site and a collocated particulate matter site may serve as a collocated site for both networks. The two collocated samplers must be within 4 meters of each other, and particulate matter samplers must be at least 2 meters apart to preclude airflow interference. Calibration, sampling and analysis must be the same for both collocated samplers and the same as for all other samplers in the network. For each pair of collocated samplers, designate one sampler as the primary sampler whose samples will be used to report air quality for the site, and designate the other as the duplicate sampler. Each duplicate sampler must be operated concurrently with its associated routine sampler at least once per week. The operation schedule should be selected so that the sampling days are distributed evenly over the year and over the 7 days of the week. The every-6-day schedule used by many monitoring agencies is recommended. Report the measurements from both samplers at each collocated sampling site, including measurements falling below the specified limits. The percent differences in measured concentration ($\mu g/m^3$) between the two collocated samplers are used to calculate precision.

Accuracy of manual methods

The accuracy of manual sampling methods is assessed by auditing a portion of the measurement process. For particulate matter methods, the flow rate during sample collection is audited. For SO_2 and NO_2 methods, the analytical measurement is audited. For Pb methods, the flow rate and analytical measurement are audited.

Particulate matter methods. Each calendar quarter, audit the flow rate of at least 25 percent of the samplers such that each sampler is audited at least once per year. If there are fewer than four samplers within a reporting organization, randomly reaudit one or more samplers so that one sampler is audited each calendar quarter. Audit each sampler at its normal operating flow rate, using a flow rate transfer standard. The flow rate standard used for auditing must not be the same flow rate standard used to calibrate the sampler. However, both the calibration standard and the audit standard may be referenced to the same primary flow rate standard. The flow audit should be scheduled so as to avoid interference with a scheduled sampling period.

Report the audit flow rates and the corresponding flow rates indicated by the sampler's normally used flow indicator. The percent differences between these flow rates are used to calculate accuracy. Great care must be used in auditing high-volume particulate matter samplers having flow regulators because the introduction of resistance plates in the audit flow standard device can cause abnormal flow patterns at the point of flow sensing. For this reason, the flow audit standard should be used with a normal filter in place and without resistance plates in auditing

flow-regulated high-volume samplers, or other steps should be taken to assure that flow patterns are not perturbed at the point of flow sensing.

SO_2 Manual Methods. Prepare the audit solutions from a working sulfite-tetrachloromercurate (TCM) solution as described in section 10.2 of the SO_2 Reference Method (appendix A of part 50 of this chapter). These audit samples must be prepared independently from the standardized sulfite solutions used in the routine calibration procedure. Sulfite-TCM audit samples must be stored between 0 and 5 degrees Celsius and expire 30 days after preparation. Prepare audit samples in each of the concentration ranges of 0.2-0.3, 0.5-0.6, and 0.8-0.9 µg SO_2/ml. Analyze an audit sample in each of the three ranges at least once each day that samples are analyzed and at least twice per calendar quarter. Report the audit concentrations (in µg SO_2/ml) and the corresponding indicated concentrations (in µg SO_2/ml). The percent differences between these concentrations are used to calculate accuracy.

NO_2 Manual Methods. Prepare audit solutions from a working sodium nitrite solution as described in the appropriate equivalent method. These audit samples must be prepared independently from the standardized nitrite solutions used in the routine calibration procedure. Sodium nitrite audit samples expire in 3 months after preparation. Prepare audit samples in each of the concentration ranges of 0.2-0.3, 0.5-0.6, and 0.8-0.9 µg NO_2/ml. Analyze an audit sample in each of the three ranges at least once each day that samples are analyzed and at least twice per calendar quarter. Report the audit concentrations (in µg NO_2/ml) and the corresponding indicated concentrations (in µg NO_2/ml). The percent differences between these concentrations are used to calculate accuracy.

Pb Manual Methods. For the Pb Reference Method (appendix G of 40 CFR part 50, the flow rates of the high-volume Pb samplers shall be audited as part of the TSP network using the same procedures. For agencies operating both TSP and Pb networks, 25 percent of the total number of high-volume samplers are to be audited each quarter. Each calendar quarter, audit the Pb Reference Method analytical procedure using glass fiber filter strips containing a known quantity of Pb.

These audit sample strips are prepared by depositing a Pb solution on 1.9 cm by 20.3 cm (3/4 inch by 8 inch) unexposed glass fiber filter strips and allowing them to dry thoroughly. The audit samples must be prepared using batches of reagents different from those used to calibrate the Pb analytical equipment being audited.

Prepare audit samples in the following concentration ranges:

Range	Pb concentration µg/strip	Equivalent ambient Pb concentration {1} µg/m³
1	100- 300	0.5-1.5
2	600-1000	3.0-5.0

{1} Equivalent ambient Pb concentration in µg/m³ is based on sampling at 1.7 m³/min for 24 hours on a 20.3 cmX25.4 cm (8 inchX10 inch) glass fiber filter.

Audit samples must be extracted using the same extraction procedure used for exposed filters. Analyze three audit samples in each of the two ranges each quarter samples are analyzed. The audit sample analyses shall be distributed as much as possible over the entire calendar quarter. Report the audit concentrations (in µg Pb/strip) and the corresponding measured concentrations (in µg Pb/strip) using unit code 77. The percent differences between the concentrations are used to calculate analytical accuracy.

The accuracy of an equivalent Pb method is assessed in the same manner as for the reference method. The flow auditing device and Pb analysis audit samples must be compatible with the specific requirements of the equivalent method.

QUALITY ASSURANCE GUIDELINE

The stated guideline for determining compliance to precision and accuracy guidelines is found is the Quality Assurance Handbook, Volume 2, Section 2.0.11 which states, “As a goal, the 95% probability limits for precision (all pollutants) and TSP accuracy should be less than +/- 15%. At 95% probability limits, the accuracy for all other pollutants should be less than +/- 20%.”

The collected data can be taken from the EPA Aerometric Information Retrieval System (AIRS), Air Quality Subsystem, precision/accuracy reporting organization summary report.

DATA RESULTS

National Review

Each Reporting Organization submitted data for 1995 into the EPA’s Aerometric Information Retrieval System (AIRS) database. AIRS calculated yearly average precision and accuracy acceptance limits for each Reporting Organization (Section 5, reference 3). The calculation was based upon data submitted from January 1, 1995 to

December 31, 1995. The percentages are based upon the yearly precision and accuracy (P&A) results. A reporting organization is said to be outside of the acceptable quality assurance limits if either of the upper probability limit or lower probability limit is outside of the acceptable quality assurance limit. All reporting organization acceptance limits were then averaged for a national results profile. The national results were aggregated into separate categories for automatic and manual methods of sampling.

The national results indicate the precision and accuracy data average well within the quality assurance guidelines. All of the criteria pollutant's precision acceptance limits average nationally at -7.0 and +7.5 respectfully. The criteria pollutant's accuracy acceptance limits average nationally for level I at -6.9 and +6.0 and level II at -5.6 and +4.4 respectfully. (Note: The precision and accuracy data for lead was excluded from these calculations. The standard for lead is 1.5 ug/m^3 but the national average concentration (the arithmetic mean of the maximum quarterly concentration as reported in the EPA National Trends Report) is 0.04 ug/m^3. This represents only 2.6 percent of the standard. These calculations and the lead program are being evaluated for revision to show a true representation of the lead samplers.

Automated Methods

Table 1.0 shows the national precision summary for automated methods. All of the automated methods averaged together nationally yield a precision average of -6.6 for the lower probability limit and +6.9 for the upper probability limit. Each of the four pollutants were also reviewed separately. There were 150 Reporting Organizations sampling for ozone (O_3) and the national precision average for ozone is -6.0 and +5.9. There were 134 Reporting Organizations sampling for sulfur dioxide (SO_2) and the national precision average for sulfur dioxide is -7.3 and +6.7. There were 91 Reporting Organizations sampling for nitrogen dioxide (NO_2) and the national precision average for nitrogen dioxide is -8.7 and +8.8. There were 105 Reporting Organizations sampling for carbon monoxide (CO) and the national precision average for carbon dioxide is -4.5 and +6.2.

The national accuracy averages are within the acceptable quality assurance limits. The accuracy averages are separated by concentration level. The national average for level I accuracy for automated methods is -7.7 and +6.4. The national average for level II accuracy for automated methods is -5.6 and +4.4. The national average for level III accuracy for automated methods is -5.6 and +4.2. Table 1.0 shows the national summary of accuracy for automated methods.

There were 73,986 precision audits for automated methods and 4,364

accuracy audits for automated methods in 1995 performed by a total of 2,356 analyzers.

Manual Methods

Table 2.0 shows the national summary of precision for manual methods. The national precision average for particulates with diameters under 10 microns (PM_{10}) is -8.4 for the lower probability limit and +9.8 for the upper probability limit. The national precision average for lead (Pb) reflect the current monitoring procedures which are currently under revision. The standard for lead is 1.5 ug/m^3 but the national average concentration (the arithmetic mean of the maximum quarterly concentration as reported in the EPA National Trends Report) is 0.04 ug/m^3. This represents only 2.6 percent of the standard. The low numbers on the table represent precision and accuracy calculations which are based upon these very low concentrations which in turn lead to a high number of reporting organizations submitting precision results outside of the acceptable limits. These calculations are being revised to show a true representation of the precision of lead samplers.

The national accuracy averages are within the acceptable quality assurance guidelines. The accuracy averages are separated by concentration level. The national average for level I accuracy for manual methods is -5.5 and +5.0. The national average for level II accuracy for manual methods is -6.2 and +4.5. The national average for level III accuracy for manual methods is -9.8 and +6.6. It is noted that there are two separate accuracy audits for lead. One audit concerns the analytical chemical analysis and the other concern a flow check.

Regional Review

Table 3.0 summarizes the regional precision results. For automated methods, the precision percentages ranged from 90% to 99% of the Reporting Organizations submitting data within acceptable quality assurance limits. The percentages are based upon the yearly precision results for the reporting organizations. A reporting organization is said to be outside of the acceptable quality assurance limits if either the upper limit or lower limit is outside of the acceptable quality assurance guideline.

The table shows the total number of Reporting Organizations sampling for each specific pollutant as well as how many submitted data within acceptable quality assurance guidelines. For example, of the 150 reporting organizations sampling for ozone, 149 submitted yearly data within acceptable quality assurance limits which is 99.33 %. The national percentage for carbon monoxide is 97.14%. The national percentage for nitrogen dioxide is 90.11%. The national percentage for sulfur dioxide is 91.79%. The national

percentage for particulates with a diameter of ten microns or less is 78.95%.

Table 4.0 summarizes the regional accuracy results. For automated methods, the accuracy percentages ranged from 88% to 98% of the reporting organizations submitting data within acceptable quality assurance limits. The percentages are based upon the yearly accuracy results for the reporting organizations.

The national percentage of reporting organizations submitting acceptable data of ozone is 95.95 %. The national percentage for carbon monoxide is 98.27%. The national percentage for nitrogen dioxide is 89.13%. The national percentage for sulfur dioxide is 88.57%. The national percentage for particulates with a diameter of ten microns or less is 99.25%. The national percentage for lead is separated into two distinct accuracy audit categories. The national percentage of reporting organizations submitting acceptable data of lead from an analytical laboratory audit is 83.33%. The national percentage of reporting organizations submitting acceptable data of lead from an annual flow audit is 100% respectfully. Table 5.0 offers an explanation of the terminology used in the tables.

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Table 1.0 National Results for Precision and Accuracy Data for Automated Methods												
Pollutant	*Number Reporting Organizations*	*Precision Lower Limit*	*Precision Upper Limit*	*Number Precision Checks*	*Number Analyzers*	*Number Accuracy Audits*	*Audit Level 1 Lower Limit*	*Audit Level 1 Upper Limit*	*Audit Level 2 Lower Limit*	*Audit Level 2 Upper Limit*	*Audit Level 3 Lower Limit*	*Audit Level 3 Upper Limit*
O3	150	- 6.0	5.9	26,431	933	1,727	- 6.2	5.7	- 4.6	3.8	- 4.5	3.6
SO2	134	- 7.3	6.7	19,271	559	1,037	- 9.1	5.2	- 7.2	4.3	- 7.3	4.3
NO2	91	- 8.7	8.8	10,546	370	697	- 9.8	7.7	- 6.9	5.1	- 6.3	4.5
CO	105	- 4.5	6.2	17,738	494	903	- 5.6	7.0	- 3.9	4.5	- 4.2	4.3
National Totals and Average	**n/a**	**- 6.6**	**6.9**	**73,986**	**2,356**	**4,364**	**- 7.7**	**6.4**	**- 5.6**	**4.4**	**- 5.6**	**4.2**

Note: The Upper and Lower Limits represent national averages of the 95% probability limits for the yearly data. For example: The value 5.9 is the national yearly average for the upper precision limit of all the data submitted by the 150 reporting organizations sampling for ozone; 95% of the ozone data would be defined between the upper and lower probability limit of -6.0 and +5.9.

Table 2.0 National Results for Precision and Accuracy Data for Manual Methods												
Pollutant	*Number Reporting Organizations*	*Precision Lower Limit*	*Precision Upper Limit*	*Number Collocated Sites*	*Number Collocated Samples*	*Number Accuracy Audits*	*Audit Level 1 Lower Limit*	*Audit Level 1 Upper Limit*	*Audit Level 2 Lower Limit*	*Audit Level 2 Upper Limit*	*Audit Level 3 Lower Limit*	*Audit Level 3 Upper Limit*
PM10	171	- 8.4	9.8	338	12,863	4,377	- 3.8	4.4	-	-	-	-
Pb Class A	55	- 21.0	16.4	73	3,122	452	- 8.8	6.0	- 9.0	6.1	- 9.8	6.6
Pb Class F	58	n/a	n/a	n/a	n/a	272	- 3.8	4.5	- 3.4	3.0	-	-
National Totals and Average	**n/a**	**- 14.7**	**13.1**	**411**	**15,985**	**5,101**	**- 5.5**	**5.0**	**- 6.2**	**4.5**	**- 9.8**	**6.6**

Note: The Upper and Lower Limits represent national averages of the 95% probability limits for the yearly data. For example: The value 9.8 is the national yearly average for the upper precision limit of all the data submitted by the 171 reporting organizations sampling for PM10; 95% of the data is defined by the upper and lower probability limits of -8.4 and +9.8.

Table 3.0 Percentage of Regional Reporting Organizations Submitting Data Within the Acceptable Quality Assurance Precision Limits						
Region	*Ozone*	*CO*	*NO2*	*SO2*	*PM10*	*Pb (A)*
I	100	100	100	100	85	NR
II	100	100	100	75	0 ***	50
III	100	100	100	100	71	50
IV	100	95	82	92	82	0
V	100	100	92	96	82	0
VI	100	100	80	70	71	0
VII	100	88	83	100	60	0
VIII	100	100	100	100	85	0
IX	100	93	90	82	73	NR
X	87.5	100	100	80	100	0
**Note 1*	**149/150**	**102/105**	**82/91**	**123/134**	**135/171**	**2/17**
NAT. AVG.	**99.33 %**	**97.14 %**	**90.11 %**	**91.79 %**	**78.95 %**	**11.76 %** ****Note 2**
	Automated Methods				**Manual Methods**	

* Note 1: The percentages are based upon the yearly P&A results. A reporting organization is said to be outside of the acceptable quality assurance limits if either and/or both of the upper limit or lower limit is outside of the acceptable quality assurance limit. The national average represents the number of reporting organizations submitted data within acceptable limits divided by the toal number of reporting organizations submitting data.

**Note 2: The percentages for Lead (Pb) are due to the current procedures for monitoring which are under revision and will be corrected. The standard for Lead is 1.5 *u*g/m^3 but the national average concentration (the arithmetic mean of the maximum quarterly concentration as reported in the EPA National Trends Report) is 0.04 *u*g/m^3. This represents only 2.6 percent of the standard. The low numbers on the table represent precision calculations which are based upon these very low concentrations which in turn lead to a high number of reporting organizations submitting P&A results outside of the acceptable limits. This is evident in the fact that only 17 reporting organizations had valid data to report and only two were within acceptable guidelines. These calculations are being revised to show a true representation of the precision of Lead samplers.

*** There were three reporting organizations and each submitted data outside the stated guidelines.

Table 4.0 Percentage of Regional Reporting Organizations Submitting Data Within the Acceptable Quality Assurance Accuracy Limits							
Region	*Ozone*	*CO*	*NO2*	*SO2*	*PM10*	*Pb (A)*	*Pb (F)*
I	100	100	100	100	100	NR	NR
II	100	100	100	100	100	100	100
III	100	100	75	100	100	100	100
IV	100	100	80	89	100	0	100
V	100	89	60	69	100	100	100
VI	100	100	100	86	100	66	100
VII	66	100	100	100	89	100	100
VIII	100	100	100	100	100	100	100
IX	75	100	100	80	100	NR	NR
X	100	100	100	100	100	100	100
** Note 1*	**71/74**	**57/58**	**41/46**	**62/70**	**133/134**	**15/18**	**22/22**
NAT. AVG.	**95.95 %**	**98.27 %**	**89.13 %**	**88.57 %**	**99.25 %**	**83.33 %** **** Note 2**	**100 %**
	Automated Methods				**Manual Methods**		

Note 1: The percentages are based upon the yearly P&A results. A reporting organization is said to be outside of the acceptable quality assurance limits is either and/or both of the upper limit or lower limit is outside of the acceptable quality assurance limit. The national average represents the number of reporting organizations submitted data within acceptable limits divided by the toal number of reporting organizations submitting data.

Note 2: The percentages for Lead (Pb) are due to the current procedures for monitoring which are under revision and will be corrected. The standard for Lead is 1.5 ug/m^3 but the national average concentration (the arithmetic mean of the maximum quarterly concentration as reported in the EPA National Trends Report) is 0.04 ug/m^3. This represents only 2.6 percent of the standard. The low numbers on the table represent precision calculations which are based upon these very low concentrations which in turn lead to a high number of reporting organizations submitting P&A results outside of the acceptable limits. These calculations are being revised to show a true representation of the accuracy of Lead samplers.

Table 5.0 Explanations of the terms for Tables 1, 2, 3, and 4	
Title	*Explanation*
Pollutant	**This will be one of the six criteria pollutants - Ozone, Sulfur Dioxide, Carbon Monoxide, Nitrogen Dioxide, Particles, Lead**
Number Reporting Organizations	**This is the total number of reporting organizations that submitted data into the EPA's Aerometric Information Retrieval System (AIRS) database for that particular pollutant**
Precision Lower Limit	**This is the lower limit for precision checks which represent the lower boundary of the 95% probability limits**
Precision Upper Limit	**This is the upper limit for precision checks which represent the upper boundary of the 95% probability limits**
Number Precision Checks	**This is the total number of precision checks performed on that particular pollutant within that specific year**
Number Analyzers	**The total number of analyzers that monitored that particular pollutant within that specific year**
Number Accuracy Audits	**The total number of accuracy audits performed during that specific year**
Audit Level I Lower Limit	**This is the lower boundary of the 95% probability limits for the level one audit as defined by 40CFR58, Appendix A**
Audit Level I Upper Limit	**This is the upper boundary of the 95% probability limits for the level one audit as defined by 40CFR58, Appendix A**
Audit Level 2 Lower Limit	**This is the lower boundary of the 95% probability limits for the level two audit as defined by 40CFR58, Appendix A**
Audit Level 2 Upper Limit	**This is the upper boundary of the 95% probability limits for the level two audit as defined by 40CFR58, Appendix A**
Audit Level 3 Lower Limit	**This is the lower boundary of the 95% probability limits for the level three audit as defined by 40CFR58, Appendix A**
Audit Level 3 Upper Limit	**This is the upper boundary of the 95% probability limits for the level three audit as defined by 40CFR58, Appendix A**
Number Collocated Sites	**This is the total number of collocated sites within the pollutants network of monitors**

Table 5.0 Explanations of the terms for Tables 1, 2, 3, and 4	
Title	*Explanation*
Number Collocated Samples	**This is the total number of valid collocated samples that was submitted to the EPA's AIRS database**

Table 6.0 Explanations of the terms of Table 3.0 and 4.0	
Title	*Explanation*
Region	**This will specify one of the ten EPA regions**
Percentages	**The percentages are based upon the total number of reporting organizations that submitted data into EPA's AIRS database and the total number of reporting organizations that submitted data within acceptable guidelines. For example, 149 reporting organizations submitted data within acceptable guidelines and 150 reporting organizations submitted data. The percentage is then 149/150 or 99.33%**
PM10 Precision	**This is based upon the percent differences between two collocated samplers**
PM10 Accuracy	**This is the annual flow check**
Lead Precision	**This is based upon the percent differences between two collocated samplers**
Lead (A) Accuracy	**This is a quarterly audit of the laboratory**
Lead (F) Accuracy	**This is an annual flow check**