

2004
ANNUAL DATA QUALITY REPORT
AIR RESOURCES BOARD
MONITORING AND LABORATORY DIVISION

2004

Annual Data Quality Report

for the

Monitoring and Laboratory Division's
and
Local Districts' Air Monitoring Networks

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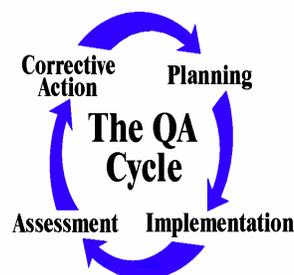
I. INTRODUCTION

The purpose of this report is to provide ambient air quality data users with a summary of the quality of the 2004 ambient data in quantifiable terms. This is the seventh edition of the report and presents an overview of various quality assurance and quality control activities. The tables included in this report provide summary data for ambient air monitoring stations in the statewide network.

The California Air Resources Board's (ARB) mission is to promote and protect public health, welfare, and ecological resources through effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy of the State. The Monitoring and Laboratory Division (MLD) provides a key element of that mission through collecting and reporting on quality information on a large number of pollutants and for a vast air monitoring network. MLD, directed by State law, conducts ambient air monitoring in support of ARB, local air pollution control and air quality management districts (Districts), and the United States Environmental Protection Agency (U.S. EPA). Monitoring programs include gaseous criteria and non-criteria pollutants, particulate matter, toxic air contaminants, non-methane hydrocarbons, pesticides, dioxins, asbestos, consumer products, meteorological parameters, and visibility. Data from these monitoring sources provide the means to determine the nature of the pollution problem and assess the effectiveness of the control measures and programs. MLD mission includes supporting the regulatory and assessment programs of the Board.

It is the goal of MLD to provide accurate, relevant, and timely measurements of air pollutants and their precursors to support California's Air Quality Management Program for the protection of public health. The Quality Assurance Section (QAS) conducts various quality assurance activities to ensure that data collected comply with procedures and regulations set forth by the U.S. EPA and can be considered good quality data and data-for-record.

What is quality assurance? Quality assurance is an integrated system of management activities that involves planning, implementing, assessing, and assuring data quality through a process, item, or service that meets users needs for quality, completeness, representativeness and usefulness. Known data quality enables users to make judgements about compliance with air quality standards, air quality trends and health effects based on sound data with a known level of confidence. The objective of quality assurance is to provide accurate and precise data, minimize data loss due to malfunctions, and to assess the validity of the air monitoring data to provide representative and comparable data of known precision and accuracy.



Quality assurance is composed of two activities: quality control and quality assessment. *Quality control* is composed of a set of internal tasks performed routinely at the instrument level that ensures accurate and precise measured ambient air quality data. *Quality control* tasks address sample collection, handling, analysis, and reporting. Examples include calibrations, routine service checks, chain-of-custody documentation,

duplicate analyses, development and maintenance of standard operating procedures, and routine preparation of quality control reports.

Quality assessment is a set of external, quantitative tasks that provide certainty that the quality control system is satisfactory and that the stated quantitative programmatic objectives for air quality data are indeed met. Staff independent of data generators performs these external tasks. Tasks include conducting regular performance audits, on-site system audits, interlaboratory comparisons, and periodic evaluations of internal quality control data. Table 1 illustrates the types of performance audits currently performed by ARB for each air monitoring program. Field and laboratory performance audits are the most common. System audits are performed on an as-need basis or by request. Whole air sample comparisons are conducted for the toxic air contaminants and non-methane hydrocarbon programs.

Table 1. Audits Performed for Each Air Monitoring Program in 2004

Air Monitoring Program	Field Performance Audit	Laboratory Performance Audit	System Audit	Whole Air Audit
Gaseous Pollutants	X	X	X	
Particulate Matter	X	X	X	
Toxic Air Contaminants		X		X
Non-Methane Hydrocarbons		X	X	X
Pesticides	X			
Dioxin/Furans and PCBs	X	X		
Asbestos	Future			
Meteorology	X		X	

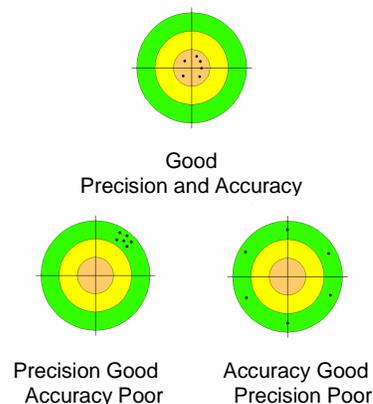
II. QUALITY CONTROL AND QUALITY ASSESSMENT

QAS supports all ambient monitoring programs undertaken by MLD, which in 2004 includes gaseous pollutants, particulate pollutants, toxic air contaminants, non-methane hydrocarbons, pesticides, dioxin/furans and PCBs, asbestos, consumer products, and meteorologic sensors run by ARB and local and private air monitoring agencies. There are approximately 230 air monitoring sites in 14 separate air basins operating in California.

Appendix A provides information about the air monitoring network (i.e., sampling schedules, number of instruments, collection/analysis method, etc.). The information in Appendix A is also available at the following Internet site under Air Monitoring Activities at <http://www.arb.ca.gov/aaqm/qmosqual/qmosqual.htm>.

Information about each air monitoring station audited by ARB is available at <http://www.arb.ca.gov/qaweb/>. The web site includes maps of each site, latitude and longitude coordinates as determined by GPS, site photos, precision and accuracy data, and a detailed survey of the physical parameters and conditions at each site. The site surveys list in-depth monitoring information such as traffic descriptions, calibration dates, distances to trees and obstacles, and residence times. This site also includes an area for District precision and accuracy reports. These reports are available on a limited basis to District staff.

The air quality monitors collect data in both real-time and on a time integrated basis. The data are used to define the nature, extent, and trends of air quality in the State; to support programs required by State and federal laws; and to track progress in attaining air quality standards. The precision and accuracy necessary depends on how the data will be used. The illustration to the right shows the relationship between precision and accuracy. From the figure, it is evident how important having good precision and accuracy is to ensuring good data quality. Data that must meet specific requirements (i.e., criteria pollutants) are referred to as *controlled data sets*. Criteria for the accuracy, precision, completeness, and sensitivity of the measurement in controlled data sets must be met and documented.



Air Quality Data Actions (AQDAs) are a key tool used by QAS to confirm the data set meets the established control limits. They are initiated generally by auditors upon a failed audit and resolved after a review of calibrations, precision checks, and audit results. The AQDA must confirm that an analyzer/sampler has operated within ARB’s control limits of $\pm 15\%$ ($\pm 10\%$ for PM10 and $\pm 4\%$ for PM2.5), or for siting or temperature conditions otherwise, further action is taken.

Data without formal data quality objectives (i.e., toxics) are called *descriptive data sets*. The data quality measurements are made as accurately as possible in consideration of how the data are being used. Quantified quality assessment results describe the measurement variability in standard terminology, but no effort is made to confine the data set to values within a predetermined quality limit.

ARB’s Quality Assurance Program is outlined in a six-volume *Quality Assurance Manual*. The volumes, listed below, guide the operation of the quality assurance programs used by ARB, local districts, and private industry in California.

- Volume I Quality Assurance Plan
- Volume II Standard Operating Procedures for Air Quality Monitoring
- Volume III Laboratory Standard Operating Procedures
- Volume IV Monitoring Methods for the State Ambient Air Quality Standards
- Volume V Audit Procedures for Air Quality Monitoring
- Volume VI Standard Operating Procedures for Stationary Source Emission Monitoring and Testing

The six-volume Quality Assurance Manual is available on the Internet at <http://www.arb.ca.gov/aaqm/qmosqual/qamanual/qamanual.htm>. Volume I lists the data quality objectives and describes quality control and quality assessment activities used to ensure that the data quality objectives are met. Volume II provides guidelines for maintaining and operating air monitoring stations and to provide detailed instructions for testing, maintaining, troubleshooting and calibrating specific analyzers or support

equipment. Volume III contains laboratory standard operating procedures (SOP). Volume IV provides the text of the methods that are used to measure air pollutants in the ambient air in order to determine whether the State ambient air quality standards have been met. Volume V lists the procedures for conducting system and performance audits of the State's air monitoring programs. Volume VI contains SOPs for Stationary Source Emission Monitoring and Testing.

A. Gaseous Pollutants

Ambient concentrations of carbon monoxide (CO), nitrogen dioxide (NO₂), ozone (O₃), sulfur dioxide (SO₂), and hydrogen sulfide (H₂S) are continuously monitored by an automated network of stations run by MLD and the Districts. Exposure to these pollutants cause adverse health effects which include respiratory impairment, fatigue, permanent lung damage, and increased susceptibility to infection in the general population. Gaseous criteria and non-criteria pollutant data are a controlled data set and are subject to meeting mandatory regulations.



Sampling Cane

Accuracy (field): Annually, QAS conducts field through-the-probe (TTP) performance audits for gaseous pollutants to verify the system accuracy of the automated methods and to ensure the integrity of the sampling system.

Accuracy is represented as an average percent difference. The average percent difference is the combined differences from the certified value of all the individual audit points. The upper and lower probability limits represent the expected accuracy of 95 percent of all the single analyzer's individual percent differences for all audit test levels at a single site. Audit results were not used in statistical analysis if the audit was invalidated due to an AQDA that resulted in data invalidation.

Overall, the responses of the individual analyzers indicate that as a whole, the network is providing accurate data. Ninety-five percent of the instruments audited in 2004 were found to be operating within ARB's control limits ($\pm 15\%$). The most common causes for audit failure are malfunctions within the instrument and leaks in the sampling system. Instruments operating outside of ARB's control limits resulted in 636 days of invalidated data. Table A1 summarizes the 2004 performance audit results for the criteria pollutants. Further information about the air monitoring systems and the audit procedures are available at:

http://www.arb.ca.gov/aaqm/qmosqual/sysaudit/criteria/qa_gas.htm

Table A1. 2004 Results for Criteria Pollutants Performance Audits Conducted by ARB

Pollutant	Number of Analyzers Audited	Number of AQDAs	Average % Difference	Probability Limits	
				95%UL	95%LL
CO	57	2	0.0	7.1	-7.1
NO ₂	78	2	-0.7	8.1	-9.5
O ₃	129	8	-0.8	6.3	-7.9
SO ₂	23	1	0.8	8.6	-7.0
H ₂ S	4	0	-4.8	7.0	-16.6

Source: Quality Assurance Section, Accuracy Estimates

In addition, a full system audit was conducted for the Ventura County Air Pollution Control District (VCAPCD). In general, the District satisfied the requirements of the U.S. EPA 40 CFR Part 58 and U.S. EPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, April 1998. Compliance with these regulations is necessary if the data are to be considered data-for-record per the California Code of Regulations (Title 17, Article 3, Section 70301). However, there were a number of areas where the District could improve its quality control program: 1) initiate an internal audit program, 2) review and update QA/QC Manuals on a regular basis, 3) review and update siting criteria and instrumentation listed in the U.S. EPA's AQS (Air Quality System) database, 4) utilize ARB's AQDA process when ambient data or quality control data show instrument malfunctions or shifts, and 5) initiate control charts and/or trends analyses on ambient data collected. The District's report is available upon request.

Precision (field): Precision checks (zero and span) are performed by site operators on a nightly basis to confirm the linear response of the instrument. The zero precision check confirms the instrument's ability to maintain a stable reading. The span precision check confirms the instrument's ability to respond to a known concentration of gas. The degree of variability in each of these nightly measurements is computed as the precision of that instrument's measurements.

Annually, QAS conducts a precision data analysis as an overall indicator of data quality. The analysis addresses three parameters: precision data submission, precision data validity, and a combination of the two referred to as data usability rates. The precision performance goal for all three parameters is 85%. The submission rate is the number of precision points submitted for a pollutant divided by the expected number of bi-weekly submissions. Data validity is the percent difference of the actual and indicated values of each precision check. These differences should not exceed $\pm 15\%$ for gaseous analyzers.

Usable data rates are determined by multiplying the data submission and data validity rates; and indicate the completeness of verifiable air quality data on the official database. Overall, the precision data showed that there was an overall increase in the amount of precision data submitted as well as corresponding improvements in the useable data rates. Table A2 shows the statewide submission, validity, and usable data rates for each pollutant. For a more detailed description of the usability data rates for each district, please refer to Appendix B.

Table A2. 2004 Criteria Pollutants Precision Analysis Results for California

Pollutant	Submission Rate	Validity Rate	Usable Rate
CO	95%	100%	94%
NO ₂	96%	99%	96%
O ₃	93%	100%	93%
SO ₂	92%	100%	92%
H ₂ S	74%	100%	74%

Source: Quality Assurance Section, Precision Data Analysis

The table above shows significant increases in both submission rate and usable rate over those in 2003. The usable rate increases are a direct result of the data submission improvements. QAS has worked closely with each agency to correct differences in the U.S. EPA's AQS database as well as with the reporting of data.

B. Particulate matter



Particulate matter is a mixture of substances that include elements such as carbon and metals; compounds such as nitrates, organic compounds, and sulfates; and complex mixtures such as diesel exhaust and soil. Particles with an aerodynamic diameter of 10 microns or smaller pose an increased health risk because they can deposit deep in the lung and contain substances that are particularly harmful to human health. Respirable particulate matter (PM10) and fine particulate matter (PM2.5) increase the chance of respiratory disease, lung damage, cancer, and premature death.



Particulate matter monitoring is conducted using both manual and continuous type samplers. Manual samplers are operated on a six-day sampling schedule for PM10, and a similar, or more frequent schedule, for PM2.5. ARB's particulate program also includes total suspended particulates (TSP) sulfate, mass and lead monitoring.

Particulate matter is a controlled data set and as such is subject to formal data quality objectives and federal and state regulations. For additional information about the Particulate Matter Monitoring program, visit the Particulate Matter home page at <http://www.arb.ca.gov/aaqm/partic.htm>.

Particulate Samplers

Accuracy (field): The accuracy of particulate samplers is determined by comparing the instrument's flow rate to a certified orifice (PM10, TSP, and PM2.5 samplers), or a calibrated mass flow meter (TEOM and BAM samplers) that is certified against a National Institute of Standards and Technology (NIST) traceable flow device or calibrator. Since an accurate measurement of particulate matter is dependent upon

flow rate, the ARB conducts annual flow rate audits at each site. The average percent difference between the sampler flow rates and the audit flow rates represents the combined differences from the certified value of all the individual audit points for each sampler. The upper and lower probability limits represent the expected flow rate accuracy for 95 percent of all the single analyzer's individual percent differences for all audit test levels at a single site. Audit results were not used in the statistical analysis shown here if the audit was invalidated due to an AQDA that resulted in data invalidation.

Overall, the 2004 flow audit results indicate that the flow rates of samplers in the network are almost all within bounds. Approximately ninety-five percent of the instruments audited in 2004 operated within ARB's control limits. Instruments operating outside of ARB's control limits resulted in 643 days of invalidated data. The 2004 performance audit results are listed below in Table B1. The TSP data accuracy estimates include samplers that analyze for mass and/or sulfates and/or lead.

Table B1. 2004 Results for Particulate Sampler Performance Audits Conducted by ARB

Pollutant	Number of Samplers Audited	Number of AQDAs	Average % Difference	Probability Limits	
				95%UL	95%LL
PM2.5	92	5	0.1	3.8	-3.6
PM10	117	4	0.0	6.5	-6.5
PM10 Partisol	24	0	1.4	6.3	-3.5
TEOM	20	3	-0.7	4.8	-6.2
BAM PM10	11	2	0.2	5.3	-4.9
BAM PM2.5	37	2	0.3	3.2	-2.6
TSP	4	0	-2.8	6.2	-11.8

Source: Quality Assurance Section, Accuracy Estimates

Precision (field): Precision data for non-continuous particulate samplers is obtained through collocated sampling whereby two identical samplers are operated side-by-side and the same laboratory conducts filter analyses. Collocated samplers are located at selected sites and are intended to represent overall network precision. Validity of the data is based on the percent difference of the mass concentrations of the two samplers. In 2004, collocated PM2.5 samplers were operated at: Atascadero, Bakersfield-California, Calexico-Ethel, Concord, Fresno-First, Indio, Keeler, Los Angeles-N. Main, Riverside-Rubidoux, Sacramento-Del Paso Manor, San Diego-Overland, Truckee, Victorville, and Yuba City sites. Collocated PM10 samplers were operated at : Bakersfield-California, Corcoran-Patterson, El Capitan, Nipomo-Guadalupe, Redwood City, Sacramento-Del Paso Manor, San Diego-Overland, Taft-College, and Visalia sites. There were no collocated TSP samplers during 2004.

Particulate samplers (collocated PM10 and TSP) must have mass concentrations greater than or equal to 20 µg/m³ to be used in data validity calculations. The difference between the mass concentrations must be no greater than 5 µg/m³. If the mass concentrations are greater than 80 µg/m³, the difference must be within ±7% of each other. TSP (Pb) samplers must have both mass concentrations greater than or equal to 0.15µg/m³ to be used in data validity calculations. For collocated PM2.5

samplers, data validity is based on the sampler's coefficient of variation, which cannot exceed 10%. Both sample masses must also be greater than 6µg/m³.

Continuous TEOM and BAM precision is based on the comparison of the sampler's/analyzer's indicated and actual flow rates. The differences between the flow rates must be within ±15%. The particulate sampler precision analysis results for 2004 are available in Table B2.

Overall, the precision data again showed an increase in the amount of precision data submitted as well as corresponding improvements in validity and useable data rates. However, there continues to be a problem with the submission of particulate matter precision data. For a more detailed description of the usability data rates for each district, please refer to Appendix B.

Table B2. 2004 Particulate Sampler Precision Analysis Results for California

Pollutant	Submission Rate	Validity Rate	Usable Rate
PM2.5	79%	87%	71%
PM10	89%	92%	82%
PM10 Partisol	65%	87%	54%
TEOM	44%	99%	43%
BAM PM10	39%	100%	39%

Source: Quality Assurance Section, Precision Data Analysis

Accuracy (lab): Annual performance audits for PM10 and PM2.5 mass analysis programs include an on-site check and assessment of the filter weighing balance, relative humidity and temperature sensors, and their documentation. The performance audits conducted in 2004 found that the district programs were operating in accordance with U.S. EPA guidelines and that the data were of good quality and should be considered data-for-record. Table B3 summarizes the performance audit findings.

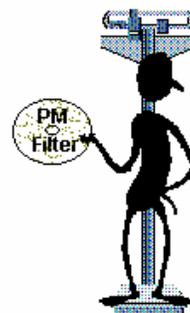


Table B3. 2004 PM10 and PM2.5 Particulate Matter Mass Analysis Performance Audits

District	Conducted	Pass/Fail
California Air Resources Board (PM10 and PM2.5)	04/26/04	Pass
Bay Area AQMD (PM 2.5 only)	10/14/04	Pass
Great Basin UAPCD (PM10 and PM2.5)	09/24/04	Pass
Lake County AQMD (PM10 and PM2.5)	04/21/04	Pass
Mojave Desert AQMD (PM10 and PM2.5)	02/04/04	Pass
Monterey Bay Unified APCD (PM10 only)	05/06/04	Pass
North Coast Unified AQMD (PM10 only)	05/25/04	Pass
No. Sonoma Co. APCD (PM10 only)	11/01/04	Pass
Sacramento Metropolitan AQMD (PM10 only)	12/07/04	Pass
San Luis Obispo Co. APCD (PM10 only)	05/20/04	Pass
San Diego County APCD (PM 2.5 only)	08/24/04	Pass
Santa Barbara Co. APCD (PM10 only)	07/12/04	Pass
Siskiyou Co. APCD (PM10 only)	05/26/04	Pass
South Coast AQMD (PM 2.5 only)	10/19/04	Pass
Ventura Co. APCD (PM10 and PM2.5)	07/15/04	Pass

Laboratory audits were also conducted for the PM10 ions program using NIST-traceable filter standards for nitrate (NO_3^-), sulfate (SO_4^{2-}), chloride (Cl^-), ammonium (NH_4^+), and potassium (K^+). Audit results for the NLB ions program (conducted in the 3rd quarter of 2004) were within the targeted $\pm 20\%$ control limit established for the audit procedure. Laboratory audits for the TSP (Pb) program were conducted during the 4th quarter of 2004 using NIST-traceable standards. The 2004 audit results for both ions and Pb were found to be within ARB's $\pm 20\%$ control limits indicating that NLB is accurately identifying ions and Pb.

Precision (lab): Laboratories perform various quality control tasks to ensure that quality data are produced. Tasks include duplicate weighings on exposed and unexposed filters, replicate analysis on every 10th filter, and a calibration of the balance before each weighing session. Upon receipt of particulate matter filters from the field, laboratory staff have up to 30 days to analyze the PM10 and PM2.5 samples. Filters are visually inspected for pinholes, loose material, poor workmanship, discoloration, non-uniformity, and irregularities, and are equilibrated in a controlled environment for a minimum of 24 hours prior to the filters are weighed. If room conditions are not within the established U.S. EPA control limits, weighings are done only after the proper environment is re-established and maintained for 24 hours.

In 2004, there were no occurrences in which ARB's laboratory balance room was outside of control limits. The analytical precision results indicate that ARB is providing precise particulate matter data. Tables B4 and B5 show the unexposed and exposed filter replicate results for ARB's laboratory in 2004.

Table B4. 2004 Summary of ARB's Unexposed Filter Mass Replicates

QC Checks for Pre-weighed Filters	PM10	PM2.5
Total # samples analyzed	4784	3900
# of replicates	592	453
% replicated	12.4	11.6
# out-of-range	0	0

Source: Inorganics Laboratory Section, Quality Control Report

Table B5. 2004 Summary of ARB's Exposed Filter Mass Replicates

QC Checks for Post-weighed Filters	PM10	PM2.5
Total # samples analyzed	3947	3383
# of replicates	447	381
% replicated	11.3	11.2
# out-of-range	0	0

Source: Inorganics Laboratory Section, Quality Control Report

C. Toxic Air Contaminants

In 1985, ARB established an ambient volatile organic compound toxic monitoring network in major urban areas of the state to determine the average annual concentrations of toxic air contaminants (TAC). The program was established to assess the effectiveness of control measures in reducing air toxics exposures. Compounds identified as TACs vaporize at ambient temperatures, play a critical role in the formation of ozone, and have adverse chronic and acute health effects. Sources of TACs include motor vehicle exhaust, waste burning, gasoline marketing, industrial and consumer products, pesticides, industrial processes, degreasing operations, pharmaceutical manufacturing, and dry cleaning operations.



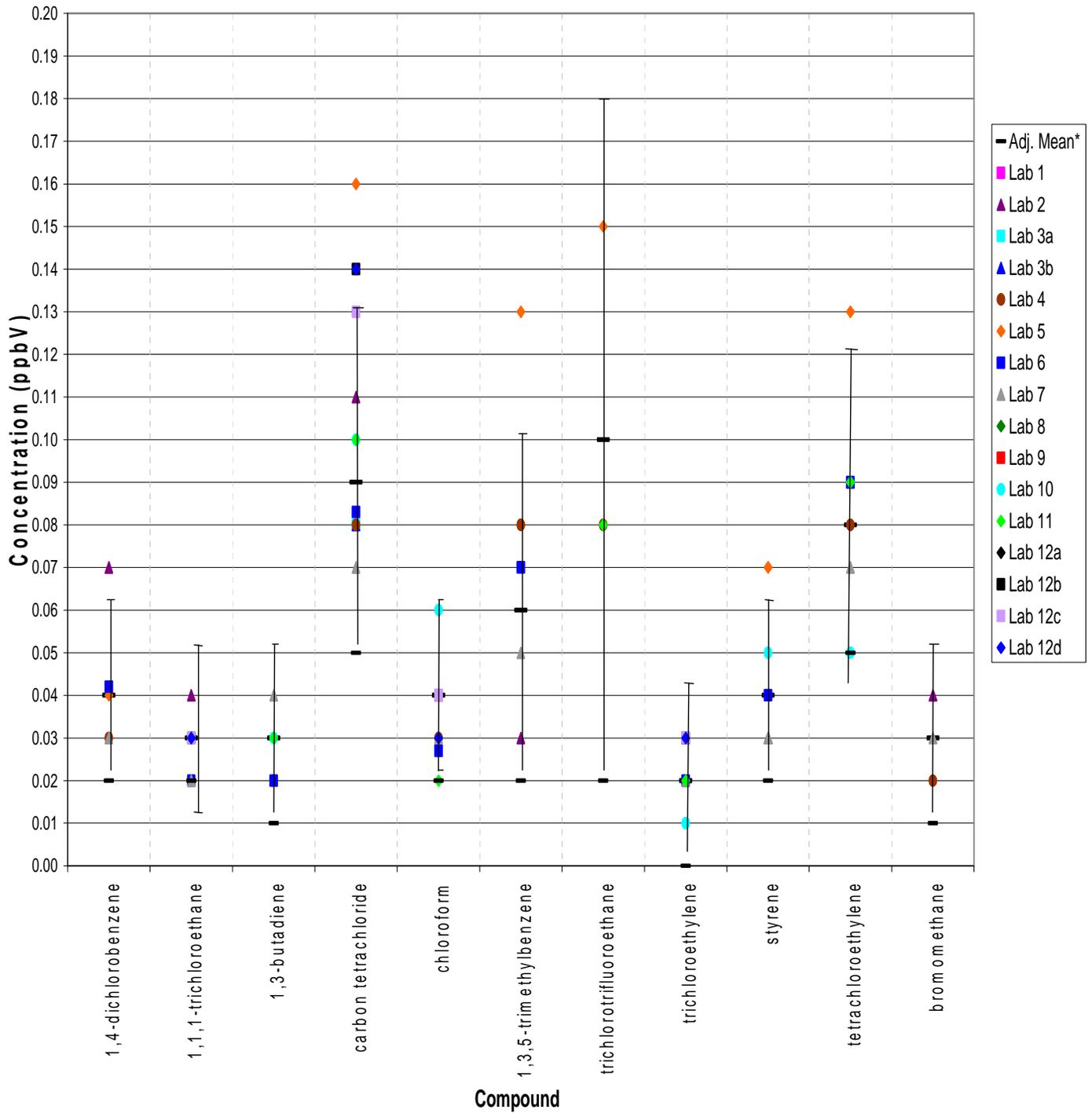
Stainless Steel Toxics Canister

Under the current ARB sampling schedule, ambient air is collected in a stainless steel canister (or cartridge) every 12 days over a 24 hour sampling period at each of the network stations. Toxic particulate samples are also collected and analyzed for toxic air contaminants to support the California Toxic Air Contaminant Identification and Control program. By using a low-flow multi-channel sampler capable of sampling onto filters or cartridges, ambient air is collected and analyzed for carbonyl and polycyclic aromatic hydrocarbons (PAH) compounds and toxic metals. The quality of the air toxic data set is governed by a series of quality assurance activities, including audits. However, because this is a descriptive data set, no mandatory corrections are made to the data based on audit results. The laboratory and monitoring staff are made aware of any exceedance found during an audit, and every effort is made to ensure that the data collected is as accurate as possible.

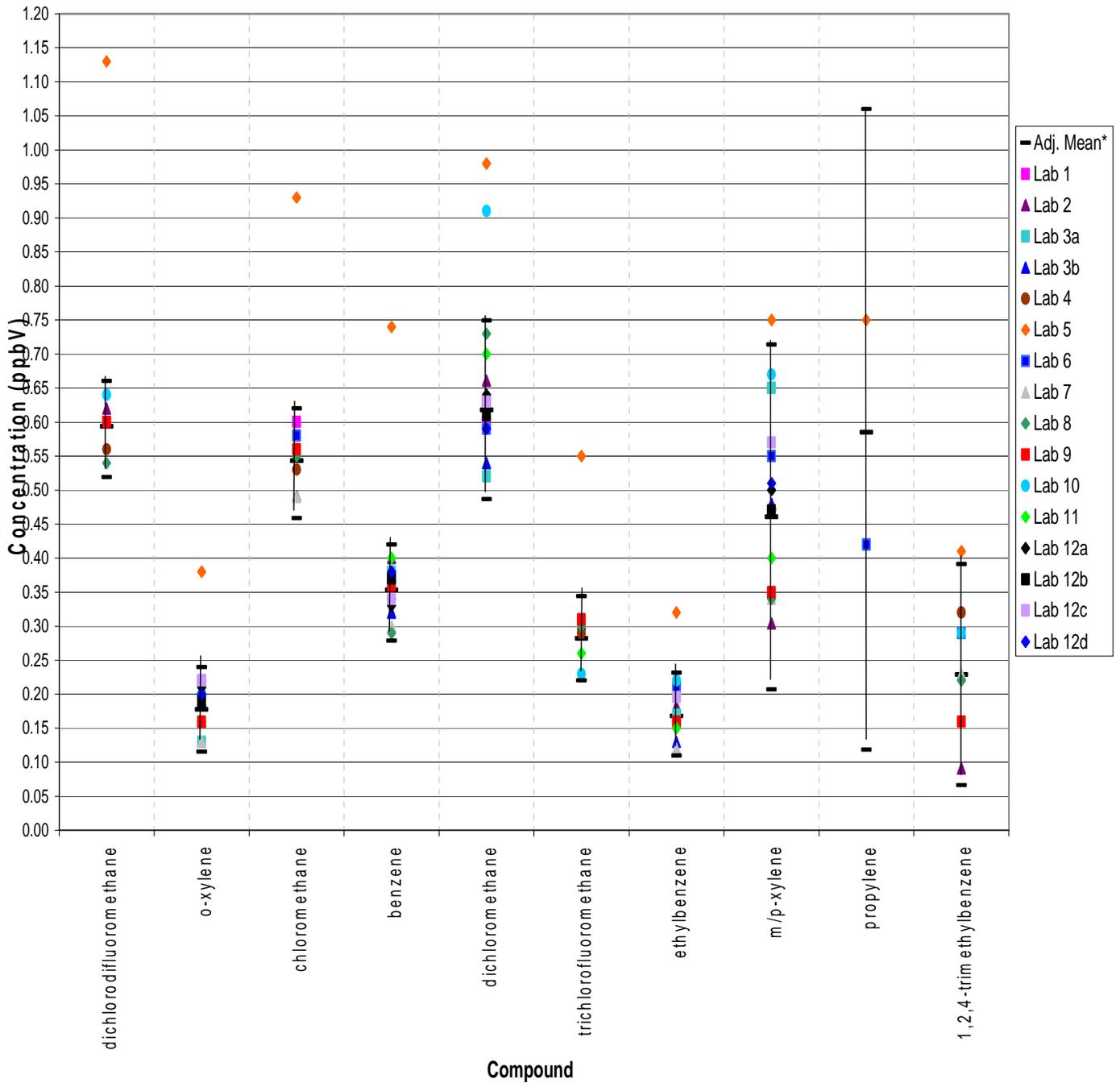
The audit programs contained two elements in 2004: laboratory audits and a whole air comparison check. The audit results and several papers that discuss these elements of the QA program in detail are available at <http://www.arb.ca.gov/aaqm/toxics.htm>.

Accuracy (field): In 2004, a whole air comparison check was conducted to compare the analytical methods used by all the laboratories that measure ambient concentrations of toxic compounds. The purpose of the comparison check is to verify the comparability of the analytical methods currently used by those laboratories measuring ambient concentrations of gaseous toxic compounds. A specially designed sampler draws ambient air for 3 hours, filling up to 12 canisters at a time, to an approximate pressure of 14 pounds per square inch gauge (psig) each. A canister is then sent to each participating laboratory for analysis. The laboratories follow their standard operating procedures in assaying the contents and report their results to QAS for comparison. As can be seen below in Figure C1, the twelve participating laboratories compared well for most compounds. If any laboratory's response for a compound was not consistent with the other laboratory's responses, it was notified of the discrepancy.

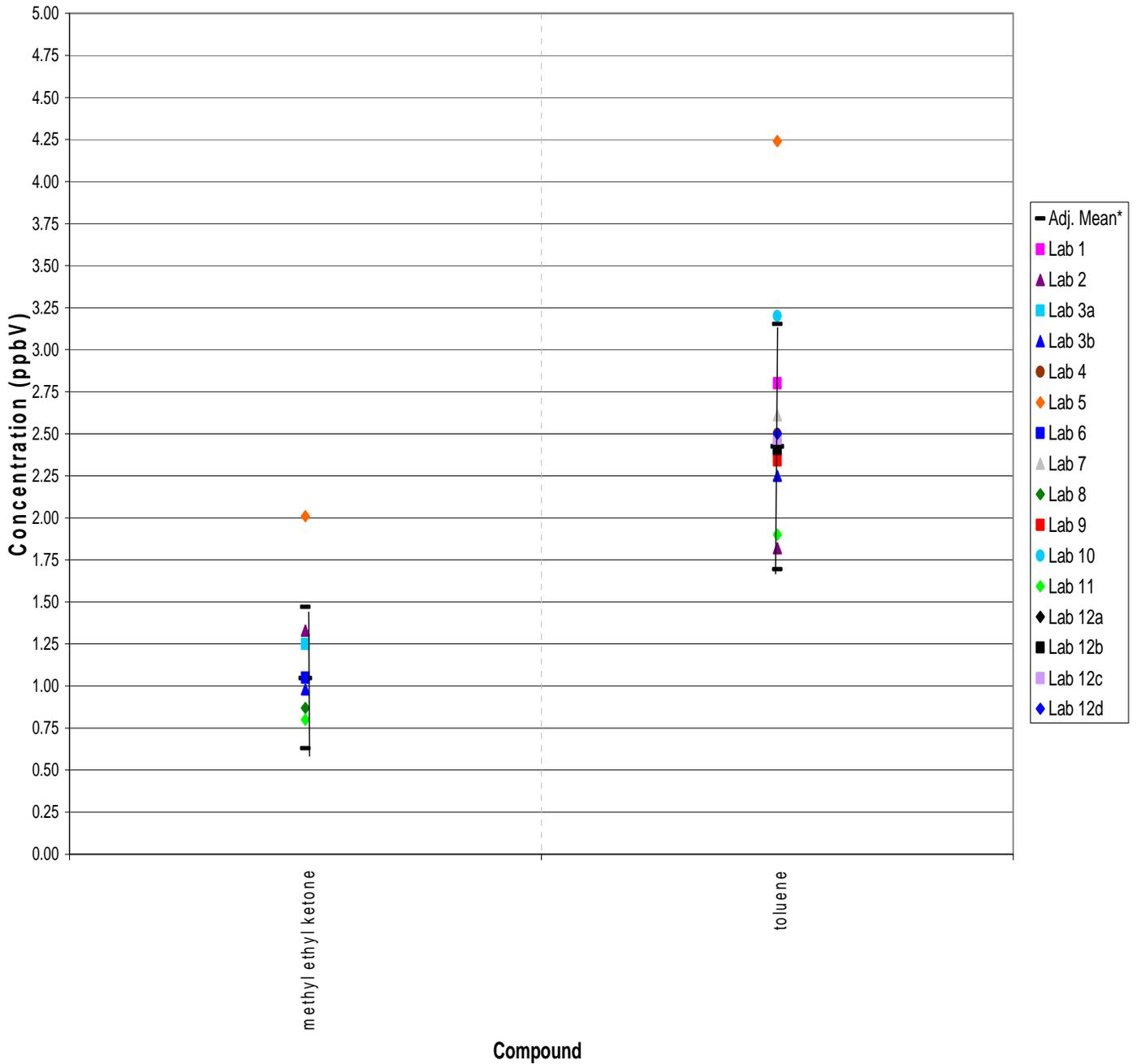
**Figure C1. 2004 Whole Air Comparison Check for Toxic Air Contaminants
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**Figure C1. 2004 Whole Air Comparison Check for Toxic Air Contaminants
(continued on next page)**



**Figure C1. 2004 Whole Air Comparison Check for Toxic Air Contaminants
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Flow audits of the toxic metal and carbonyl sampler (shown right) are typically conducted annually at each site to ensure the accuracy of measuring toxic metals and carbonyl compounds. Flow rates are a determining factor in calculating concentration and are included as part of the quality assurance program.



Toxic Metals and Carbonyl Sampler

Overall, the 2004 results indicate that the samplers maintained stable flows. Ninety-nine percent of the instruments audited operated within ARB’s control limits of $\pm 15\%$. Although toxics data are a descriptive data set, AQDAs are issued based on the operating parameters of the sampler. Corrections are made to the data if an audit is found to be outside ARB’s control limits. The instrument operating outside of ARB’s control limits resulted in 155 days of invalidated flow rate data.

Table C1 shows the differences from the certified value of the individual audit points for each pollutant. The upper and lower probability limits represent the expected accuracy of 95 percent of all the single analyzer’s individual percent differences for all audit test levels at a single site. If ambient data was invalidated due to an AQDA, the audit results would not be used in the statistical analysis shown below.

Table C1. 2004 Results for Toxic Air Sampler Flow Rate Performance Audits Conducted by ARB

Pollutant	Number of Samplers Audited	Number of AQDAs	Average % Difference	Probability Limits	
				95%UL	95%LL
Cr6+	30	1	1.0	8.1	-6.1
Total Metals	32	0	0.2	6.9	-6.5
Aldehydes	31	0	1.5	8.2	-5.2

Source: Quality Assurance Section, *Accuracy Estimates*

Accuracy (lab): Laboratory performance audits are conducted annually to determine the accuracy of a laboratory to measure ambient VOC concentrations. Summary statistics of ARB’s audit results are shown in Table C2. The percent difference presented in the table represents the average difference between the laboratory’s measured value and the National Institute of Standards and Technology (NIST) certified value. The 2004 audit results were within the audit criteria of $\pm 20\%$.

Table C2. ARB's 2004 Toxic Air Contaminants Laboratory Performance Audit Results

Compound	ARB Laboratory
	% Diff
Benzene	-4.3
1,3-Butadiene	-12.1
Carbon Tetrachloride	-5.9
Chloroform	-8.0
ortho-Dichlorobenzene	-10.7
Ethylbenzene	-5.4
Methyl Chloroform	-8.3
Methylene Chloride	-7.0
Perchloroethylene	-7.7
Styrene	-11.9
Toluene	-7.5
Trichloroethylene	-4.5
m/p-Xylene	-3.5
o-Xylene	-7.1

Precision (field and lab): As part of the TAC Program laboratory analyses, internal QC techniques such as blanks, control samples, and duplicate samples are applied to ensure the precision of the analytical methods and that the toxics data are within statistical control. Precision data for non-continuous toxics particulate samplers are obtained through collocated sampling whereby two identical samplers operate side-by-side simultaneously and the same laboratory conducts filter analyses. Collocated toxic samplers are located at selected sites and are intended to represent overall network precision. Collocated samplers, located at Bakersfield-California and Riverside-Rubidoux monitoring stations are intended to represent overall network precision.

In 2004, all compounds analyzed were within their respective control limits and results for blanks, spikes, and duplicate samples established in the Laboratory QC Manual. Duplicate analyses were performed on 10% of the toxic samples. In 2004, all duplicate results (concentrations must be greater than five times the published LODs) were within the established limits for all target analytes. Data exceeding duplicate criteria of three times the assigned percent relative standard deviation (from control samples collected during the control limit evaluation) are deleted from the toxics database and samples reanalyzed.

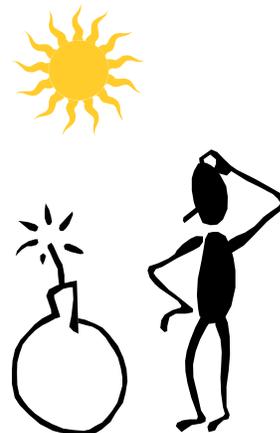
Stainless steel canisters used to collect ambient air samples are also checked for contamination. Canisters are analyzed for aromatic and halogenated hydrocarbons. One canister per batch of eight is assayed to ensure individual compound measurements fall below the limit of detection. In the event a compound exceeds canister cleanliness criteria, the canister and all other canisters represented in the batch are re-cleaned until compounds meet the cleanliness criteria. In addition, Xontech 910A air samplers are checked for cleanliness. Failed air collection media are re-cleaned and re-tested until they pass Xontech 910A cleanliness criteria (Xontech 910A checks are independent of canister batch checks). Overall, the network is providing precise toxic air contaminants data.

The toxics audit results audits, which serve to assure the validity of the toxics data, and several papers that discuss the elements of the QA program in detail are available at http://www.arb.ca.gov/aaqm/qmosqual/perfaudit/toxics/qa_toxic.htm.

D. Non-Methane Hydrocarbons

PHOTOCHEMICAL ASSESSMENT MONITORING STATIONS

In 1989, ARB began a routine seasonal sampling program to gather information about non-methane hydrocarbon (NMHC) species that were precursors to ozone formation in high ozone areas. In 1994, Federal regulations required states to establish photochemical assessment monitoring stations (PAMS) as part of their State Implementation Plan monitoring networks in areas designated as serious or higher for ozone. Monitoring is to continue until the ozone standard is reached. The PAMS program is intended to supplement ozone monitoring and add detailed sampling for its precursors. PAMS sites collect data on ozone, oxides of nitrogen, real-time total NMHC, speciated hydrocarbons, carbonyls, and various ground level and aloft meteorological parameters. As this is a descriptive data set, there are currently no mandatory data quality objectives or regulations for the data. However, efforts are made to ensure that accurate data are collected and that the analyzers are operating within ARB's audit standards. Due to limited resources, the Organic Laboratory Section's involvement in the PAMS program was suspended indefinitely.



Two types of ongoing hydrocarbon performance audits are conducted (laboratory and TTP continuous analyzer) that support the canister-type collection system and the real-time analyzers. A cross-check is also run by QAS that allows all laboratories to compare their results from a *whole air sample* representing an identical parcel of air. The whole air sample element of the QA was added after the 1997 South Coast Ozone Study and uses a system developed by QAS staff. Staff presented a paper on the program at the 2000 International Symposium on the Measurement of Toxic and Related Air Pollutants. A copy of the paper as well as other information about the PAMS quality assurance program is available at:

http://www.arb.ca.gov/aaqm/qmosqual/perfaudit/nmhc/qa_nmhc.htm

Accuracy (field and lab): Laboratory performance audits are conducted annually to assess the participating laboratory's ability to measure ambient levels of hydrocarbons. The 2004 laboratory performance audit results are shown in Table D1. The average percent difference represents the combined differences from the certified value for all the laboratories audited. The 2004 audit results were within ARB's control limits of $\pm 20\%$. There were no exceedances for any of the labs.

Table D1. 2004 Laboratory NMHC Audit Results for California's PAMS Network

Compound	Laboratory	
	Avg %Diff	Std Dev
Ethane	-1.1	8.6
Propane	-2.8	6.7
Propene	-4.3	6.8
Isobutane	-4.3	6.3
Butane	0.3	7.7
Isobutylene	-5.6	10.0
Isopentane	-0.4	7.4
Pentane	2.0	8.6
Pentene	-6.0	9.3
Hexane	-1.3	7.8
Benzene	2.3	5.9
Octane	4.8	8.1
Toluene	0.1	7.1
o-Xylene	-4.0	4.0
Decane	-5.4	9.3

TTP continuous NMHC analyzer performance audits include audits of total NMHC analyzers (i.e., TECO 55). The 2004 TTP continuous analyzer NMHC PAMS audit results are shown in Table D2. The purpose of this table is to estimate the accuracy of the hydrocarbon data in the database. The upper and lower probability limits represent the expected accuracy of 95 percent of all the analyzer's individual percent differences for all audit test levels at a single site. Based on the audit results, ninety-five percent of the instruments audited were found to be operating within ARB's control limits of $\pm 15\%$. Audit results were not used in the statistical analysis if the audit was invalidated due to an AQDA that resulted in data invalidation. Out of control events are typically due to instruments that were inoperable at time of the audit, contamination of the analyzers clean air source, or inconsistent span check readings. The single AQDA issued for continuous NMHC was because of non-operation and resulted in 22 days of lost data.

Table D2. 2004 Results for TTP Continuous Analyzer NMHC PAMS Audits

Pollutant	Number of Analyzers Audited	Number of AQDAs	Average % Difference	Probability Limits	
				95%UL	95%LL
NMHC	20	1	1.5	8.4	-5.4

Source: Quality Assurance Section, Accuracy Estimates

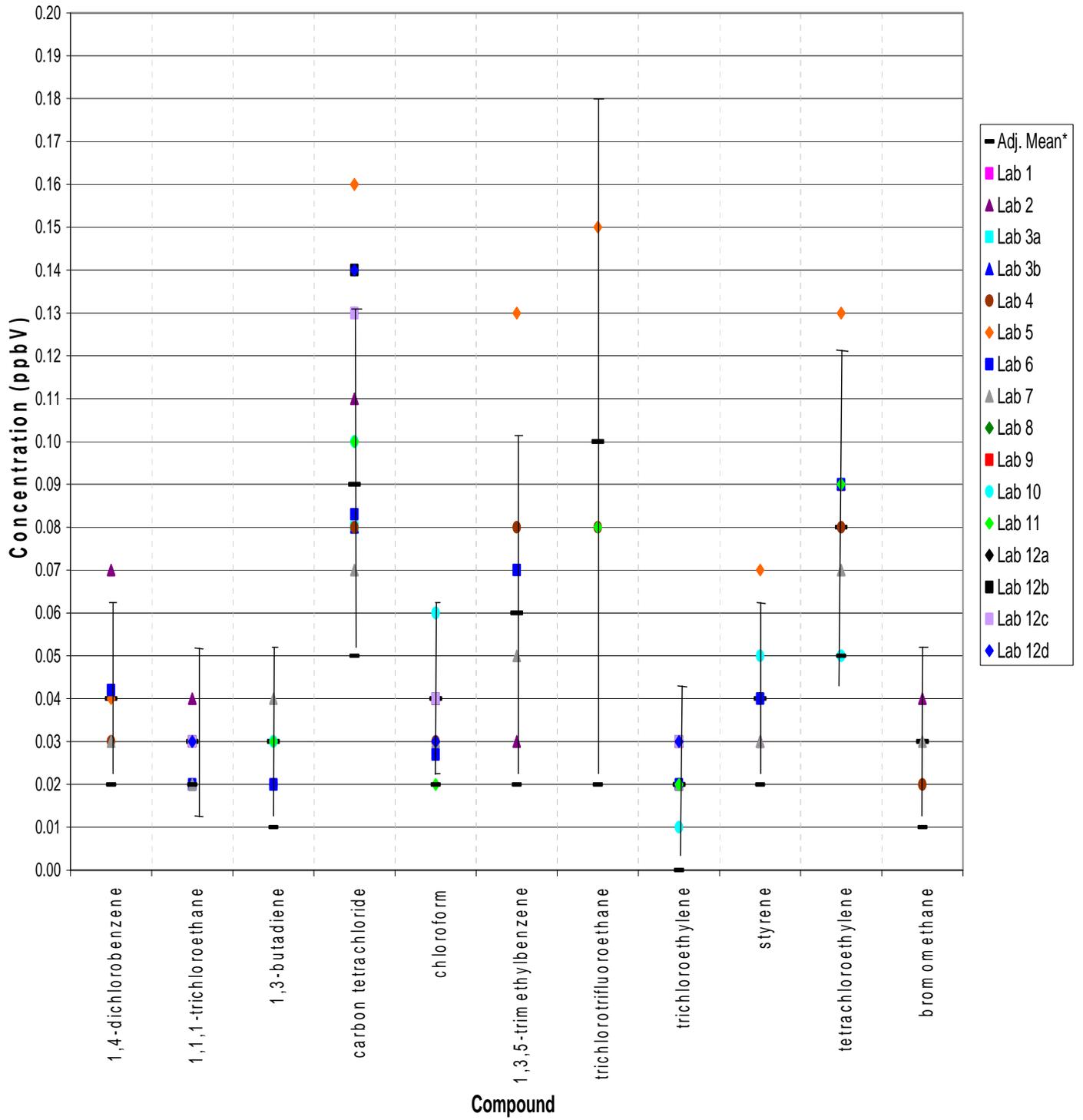
The *Whole Air Sampler* performance checks are a valuable complement to the TTP and laboratory audits. Specifically Whole Air Sampler performance checks are a means of assessing performance using a sample that includes non-target species and other aspects of a real world sample that could potentially affect sample results. It involves all California PAMS laboratories that measure ambient concentrations of hydrocarbons as well as others choosing to participate. The performance check uses a specially designed sampler that draws ambient air for 3 hours simultaneously into 12 canisters at

a time. Each canister reaches approximately 14 pounds per square inch gauge (psig) of pressure. This replicates a normal sample duration and pressure. A canister is sent to each participating laboratory for speciated NMHC analysis. The laboratories follow their standard operating procedures in assaying the contents and report their results to QAS.

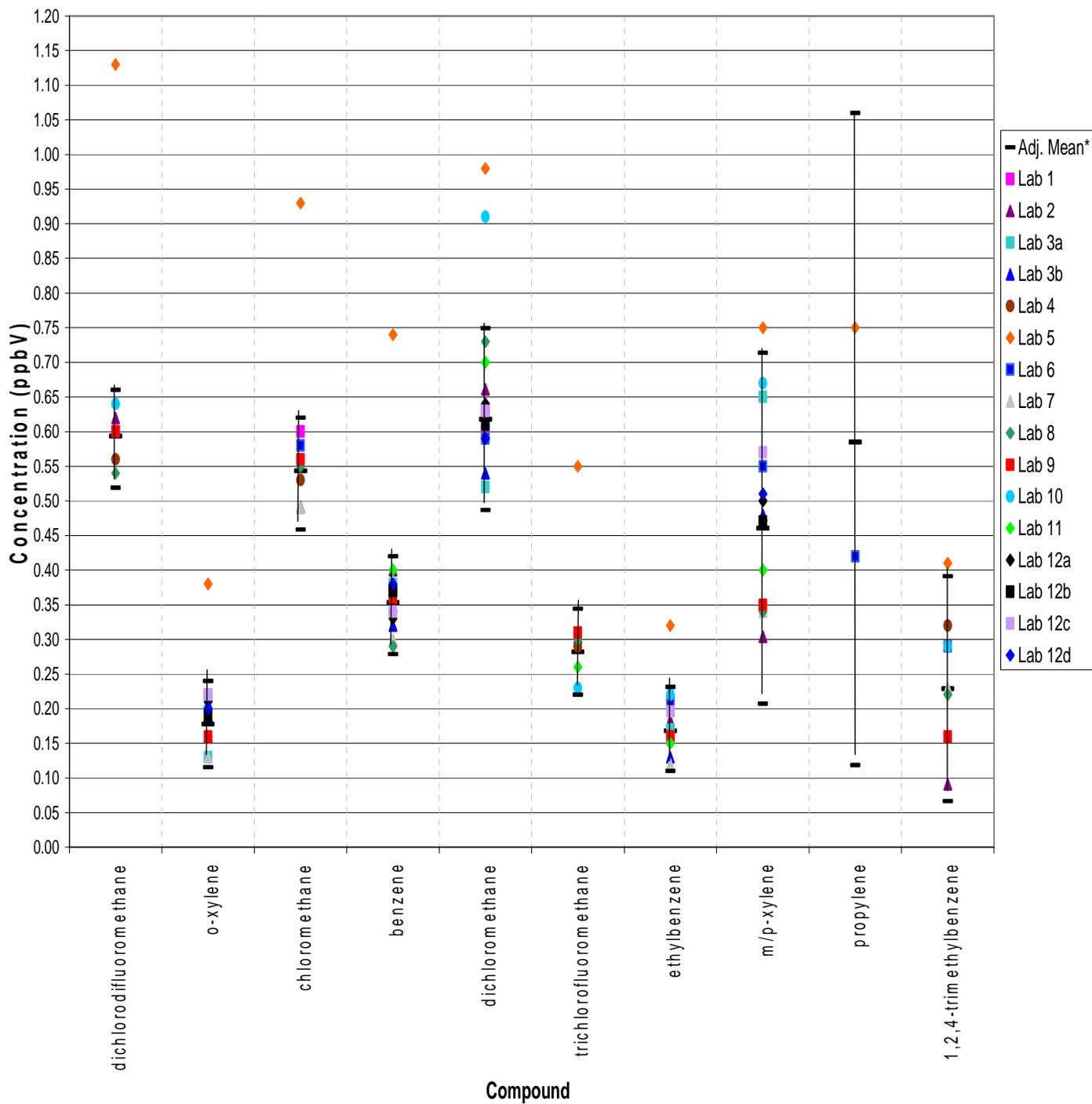
The 2004 Whole Air Comparison Check results are shown in Figure D3. Based on the results, the laboratory responses compared well for most compounds. If any laboratory's response for a compound was not consistent with all other participating laboratory responses, the laboratory was notified of the discrepancy. The whole air comparison check results are available at:

<http://www.arb.ca.gov/aaqm/qmosqual/perfaudit/nmhc/whole/wholetable.htm>

Figure D3. 2004 Whole Air Comparison Check for NMHC
(Continued on next page)



**Figure D3. 2004 Whole Air Comparison Check for NMHC
(Continued on next page)**



**Figure D3. 2004 Whole Air Comparison Check for NMHC
(Continued on next page)**

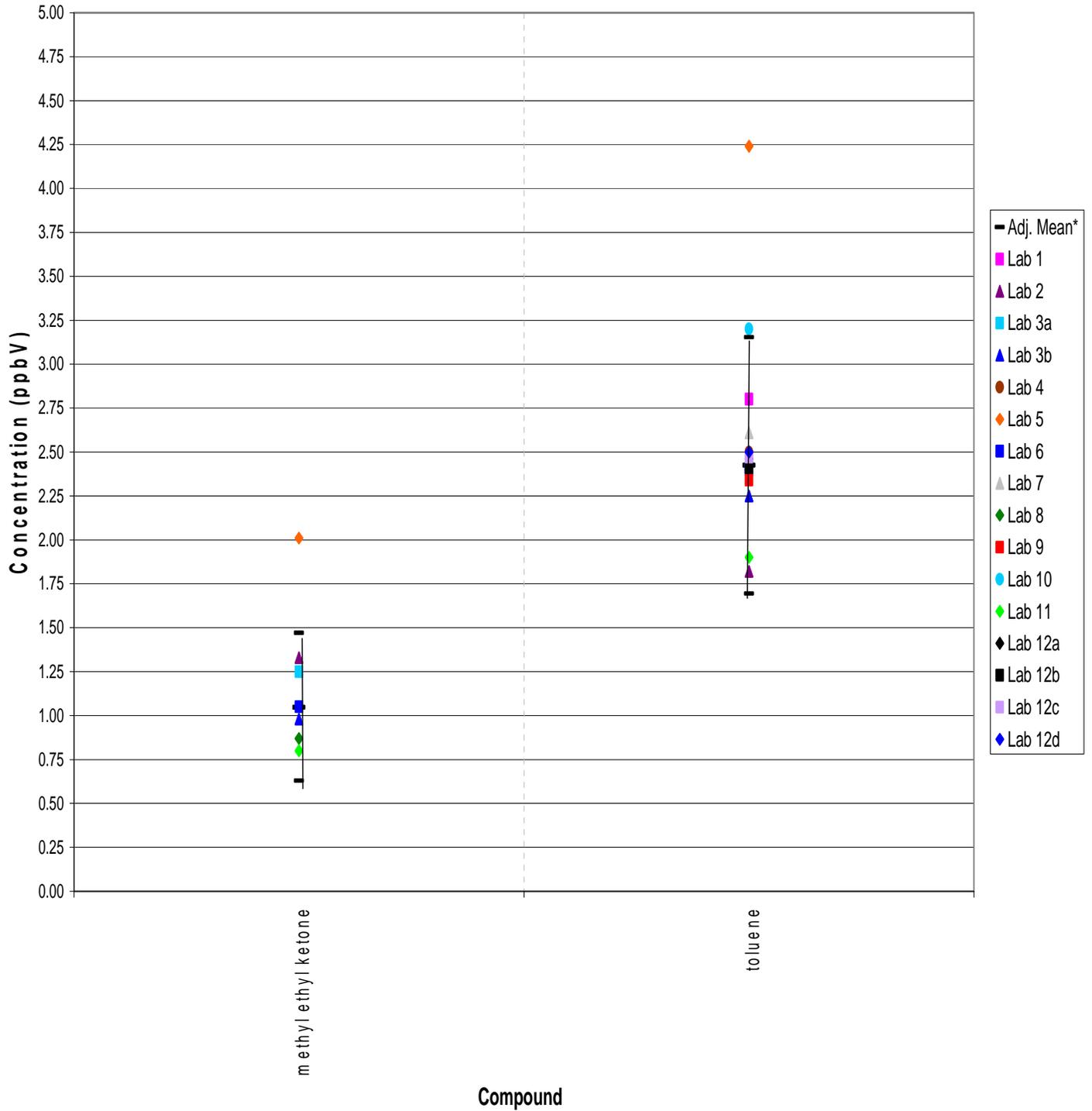
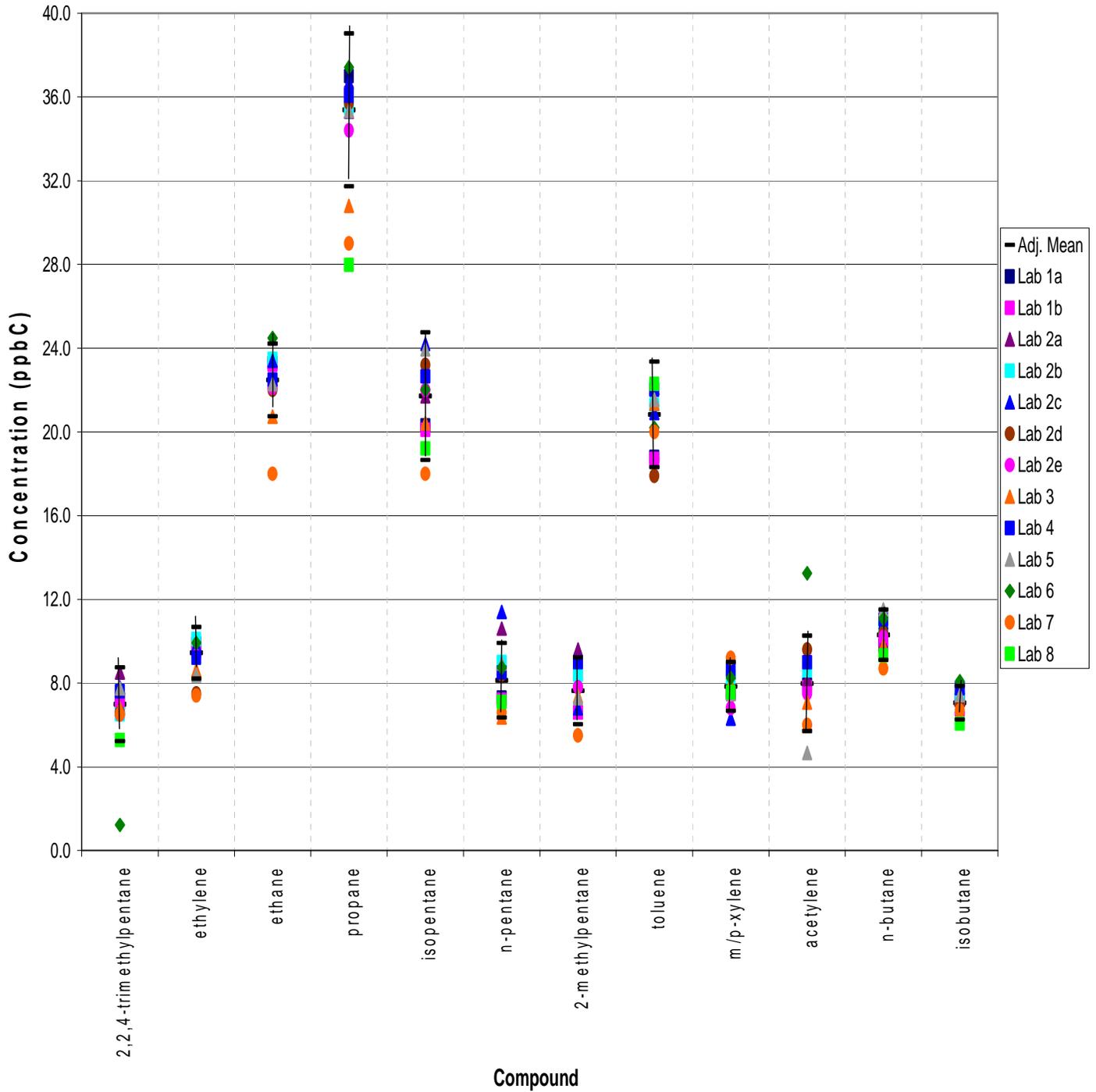


Figure D3. 2004 Whole Air Comparison Check for NMHC
(continued from previous pages)



MOTOR VEHICLE EXHAUST PROGRAM

QAS motor vehicle exhaust audit program supports ARB's efforts in determining the reactivity of fuel components found in automotive exhaust samples. The exhaust and fuels information can be compared to the regulatory standard for non-methane organic gases tail-pipe emissions, fuel composition, and a number of ozone precursors. Special studies are currently being conducted to determine emissions generated from vehicles operated under manufacturers recommendations.



Emissions Sampling

Accuracy: Laboratory performance audits are conducted annually of the Southern Laboratory Branch of ARB for components of motor vehicle exhaust collected while a vehicle was operated on a dynamometer. However, no audits were conducted during 2004 due to laboratory renovation. The laboratory audit program is expected to be re-instated in 2005.

E. Pesticides



Pesticides Sampler

Ambient and near field (application) pesticide monitoring is performed by the ARB at the request of the California Department of Pesticide Regulation (DPR) to determine the airborne concentration of pesticides at times and in areas of pesticide use. Some of the active ingredients found in pesticides are known to cause a wide range of adverse health effects in people, vegetation, and wildlife. The data are descriptive sets and are not subject to strict data quality objectives.

Two types of monitoring are conducted; ambient and application. During ambient, or community air measurements, ARB collects samples at approximately half a dozen locations (usually schools or other public buildings) in communities near agricultural areas expected to receive applications of the pesticide. Samples of 24 hours in duration are typically collected for four days per week for four or more consecutive weeks. Application-site monitoring (e.g., sampling before and after a specific application), samples are collected immediately before, during, and for approximately 72 hours following pesticide application.

Recently, pesticide monitoring projects have also involved air monitoring around buildings undergoing fumigation. In the summer of 2004, two important pesticide projects involved air monitoring during the structural application (i.e., house fumigation) of the pesticides sulfuryl fluoride and chloropicrin. During these studies, air monitoring outside the sealed structure is conducted at varying distances prior to fumigation, during fumigant introduction, during venting and aeration of the structure, and immediately following aeration. The purpose is to assess the ambient concentrations of fumigants

before, during, and following a structural application. Copies of the reports are available upon request.

F. Dioxins



Dioxins Sampler

Dioxins and furans are highly toxic chemicals that are formed as unwanted by-products during the combustion of materials and the manufacturing of certain chlorinated chemicals. Dioxins and furans are emitted into the atmosphere from a variety of sources including vehicles, waste incinerators, chemical manufacturing plants, and other industrial sources that burn fuel. Dioxins are highly persistent and can accumulate in the lungs and abdominal cavity for long periods of time. Studies have shown that exposure to dioxins can cause cancer and other health problems including birth defects and liver damage. Infants and children are especially susceptible to illness from dioxin exposure, which can cause immune and developmental system toxicity.

ARB established the California Ambient Dioxin Air Monitoring Program (CADAMP) to provide information on ambient levels of dioxins and dioxin-like compounds (furans, polychlorinated biphenyls and polybrominated diphenyl ethers) in populated urban areas.

On December 20, 2001, ARB began conducting ambient air monitoring for dioxins, furans and dioxin-like polychlorinated biphenyls (PCBs) at CADAMP sites. From December 2001 through December 2004, ten sampling sites made up the CADAMP network, five in the San Francisco Bay area, an additional site in Sacramento, and four in the Los Angeles basin. Several of the dioxin monitors operated in parallel with air monitoring stations in ARB's Children's Environmental Health Protection Program network.

The CADAMP monitoring schedule consists of thirteen sampling periods in which samplers are operated continuously for six days followed by one day of inactivity, totaling twenty-four days of sample (or 576 hours of sample) per sampling period. Ambient air samples are sent to a contract laboratory for dioxins/furans, PCBs, and PBDEs analysis.

Accuracy (lab): Performance evaluation standards (PES) were started in 2003 and completed in 2004. The objective of the California Ambient Dioxin Air Monitoring Program's (CADAMP) Laboratory Performance Audit was to assess the accuracy and precision of a laboratory's analytical process as well as comparing the performance between the CADAMP and National Dioxin Air Monitoring Network (NDAMN) programs.

The report represents the final evaluation of the accuracy, precision, and data comparability between ARB's contract laboratory, AXYS Analytical Laboratory, LTD., (CADAMP laboratory) and the U.S. EPA Environmental Chemistry Laboratory at Stennis Space Center (NDAMN laboratory). The PES sample set consisted of three ampoules containing varying concentrations ((PES-1 (low), PES-2 (mid), PES-3 (high))

of dioxins, furans, and PCBs. The PES was prepared by Wellington Isotope Laboratory and is NIST traceable. The PES sample sets were sent to the CADAMP and NDAMN laboratories. Each PES ampoule was spiked into a polyurethane foam (PUF) and XAD resin matrix by the laboratory for extraction and analysis in duplicate. The PES sample set was extracted and analyzed between May 2003 and June 2004.

The criteria used to evaluate the audit results for each individual congener were developed for the CADAMP program and are contained in the CADAMP Quality Assurance Project Plan. The criteria were based on the U.S. EPA's analytical methods. For the dioxins and furans, the precision ($\pm 30\%$) and accuracy ($\pm 30\%$) criteria were based on Method TO-9A, Section 15.9. For the PCBs, the accuracy ($\pm 50\%$) criteria were based on Method 1668A, Table 6. Since no specific precision criteria were available for PCBs, the precision criteria ($\pm 30\%$) were based on Method TO-9A.

The CADAMP laboratory did not exceed the accuracy criteria for any congener except the 2,3,7,8-TCDD in PES-1. In addition, the CADAMP laboratory did not exceed the precision criteria for any congener

The NDAMN laboratory exceeded the accuracy and precision criteria for some furan and PCB congeners in PES-1 and PES-2. The NDAMN laboratory experienced method blank and control PUF contamination. The laboratory also reported some congeners in PES-1 were below their limit of detection.

For data comparability purposes, the PES concentrations from both labs were converted to Toxic Equivalency (TEQ), calculated by multiplying the concentration of each congener by its associated Toxic Equivalency Factors 2 (TEF). For each PES and its duplicate, both the NDAMN laboratory and the CADAMP laboratory were within $\pm 10\%$ of the standard's TEQ.

Information about the California Ambient Dioxin Air Monitoring Program (CADAMP) is available at <http://www.arb.ca.gov/aqgm/qmosopas/dioxins/dioxins.htm>.

Information about the ambient air monitoring that supports measuring children's exposure to air pollution in our communities is at <http://www.arb.ca.gov/ch/ch.htm>.

G. Asbestos

Asbestos is a term used for several types of asbestiform fibers that include naturally occurring fibrous minerals commonly found in serpentine in many parts of California. Naturally Occurring Asbestos (NOA) is released when ultramafic and serpentine rock is



broken or crushed. Once released from the rock, asbestos can become airborne and may remain for long periods of time in the air. Asbestos is a known carcinogen and inhalation of asbestos may result in the development of lung cancer or mesothelioma. Emissions sources may include unpaved roads or driveways with ultramafic rock surfaces, construction activities in ultramafic rock deposits, or rock quarrying activities where ultramafic rock is present. Other sources of asbestos are in man-made products. It also released naturally through weathering and erosion.



In 1986, ARB identified naturally-occurring asbestos as a TAC and subsequently adopted two Airborne Toxic Control Measures (ATCMs) to address some of the health concerns associated with asbestos exposure caused by these activities. The measures prohibit the use of serpentine or ultramafic rock for unpaved surfacing and controls dust emissions from construction, grading, and surface mining in areas where ultramafic and serpentine rock is present.

Asbestos samplers

ARB conducts short term air monitoring to determine the concentrations of asbestos in ambient air to help evaluate the extent of the public's exposure to asbestos. ARB has conducted asbestos air monitoring projects since 1998 and retains a contract with an analytical laboratory to perform asbestos analyses.

Information about naturally occurring asbestos is available at:

<http://www.arb.ca.gov/toxics/asbestos/asbestos.htm>

H. Consumer Products



Consumer products are chemically formulated products used by the public in homes and businesses. These compounds are reported to emit approximately 260 tons per day of smog-forming VOCs. Monitoring VOC levels in consumer products and finding ways to reduce VOC emissions they contain facilitates ARB's effort to reduce smog in the State.

Consumer products are descriptive data sets. Informal data quality objectives have been established and staff ensure the accuracy and precision for data quality are met. Information about the Consumer Products Program is available at <http://www.arb.ca.gov/consprod/consprod.htm>.

Accuracy (lab): QAS does not conduct performance audits on the Consumer Product Program at this time. The Special Analysis Section of the Consumer Products Laboratory performs internal quality control activities such as limits of detection, duplicates/replicates, calibrations, control samples, blanks, and trip standards to verify statistical control among analytical methods and ensure valid data are generated.

Precision (lab): Analytical precision is derived from duplicate analysis performed on a minimum of 10% of the samples. The results from the analyses are compared, and the difference should be less than $\pm 3\%$. A sample outside the acceptance criteria prompts staff to investigate quality control activities to verify data generated are valid. However, the accuracy of the method is only $\pm 3\%$ so data are not necessarily deleted when the sample is in a difficult matrix and has low percentage of volatile organic compounds (VOC). Following an investigation of the problem, samples are re-analyzed when required. Table H1 shows the duplicate data for the first quarter of 2004. Further data is available upon request.

Table H1. Duplicate Final %VOC Results for First Quarter 2004.

Sample #	Dup 1 %VOC	Dup 2 %VOC	Diff
1	4.97	4.99	0.02
2	50.09	50.42	0.33
3	1.40	1.02	0.38
4	7.83	9.24	1.41
5	<0.1	<0.1	0.00
6	30.96	29.72	1.24
7	22.19	23.11	0.92
8	<0.1	<0.1	0.00
9	61.52	62.87	1.34
10	10.56	10.56	0.00
11	<0.1	<0.1	0.00
12	74.01	74.37	0.37
13	52.13	52.13	0.00
14	10.48	6.46	4.02
15	8.08	8.85	0.76
16	53.92	53.56	0.36
17	<0.1	<0.1	0.00
18	10.45	11.06	0.60
19	4.74	4.77	0.03
20	0.20	2.40	2.19
21	2.17	1.99	0.19
22	3.89	4.00	0.12
23	3.18	3.74	0.56
24	42.88	38.77	4.11
25	57.12	57.04	0.08
26	12.67	12.15	0.52
27	31.62	32.35	0.73
28	11.75	10.36	1.39
29	41.09	41.89	0.80
30	4.90	5.63	0.73
31	10.80	10.80	0.00
32	3.64	3.38	0.26
33	6.65	4.88	1.77
34	3.47	3.59	0.12
35	68.17	69.35	1.19
36	10.91	9.71	1.20

Note: Diff = ABS (Dup 1 – Dup 2)

The Consumer Product laboratory analyzes known standards (trip standards) to establish control limits and limits of detection, runs system blanks to confirm the system is not contaminated, and conducts yearly multi-point calibrations to assess the instrument linearity. Presently, trip standards should meet the established acceptance criteria of $\pm 3\%$ difference. A sample outside the acceptance criteria prompts staff to investigate quality control activities to verify data generated are valid. However, the accuracy of the method is only $\pm 3\%$ so data are not necessarily deleted when the sample is in a difficult matrix and has low percentage of VOC. Overall, the analytical precision results indicate that the laboratory is providing precise consumer product data.

Table H2 represents the trip standard results for the first quarter of 2004. Further data is available upon request.

Table H2. Trip Standard Results for First Quarter 2004.

Sample #	% Difference *						
	Total Volatile Material wt. fraction	Water (KFO) wt. fraction	Water (GC/TCD) wt. fraction	Acetone wt. fraction	Ethanol wt. fraction	Methanol wt. fraction	% VOC** (Total-Exempt)
1	0.900	0.609	0.600	0.098	0.094	0.100	19.704
2	0.900	0.609	0.606	0.097	0.093	0.098	19.553
3	0.899	0.619	0.600	0.100	0.096	0.101	18.943
4	0.900	0.593	0.591	0.096	0.092	0.097	21.189
5	0.900	0.633	0.619	0.096	0.093	0.098	17.790
6	0.900	0.622	0.596	0.102	0.096	0.102	18.900
7	0.900	0.609	0.621	0.098	0.094	0.099	18.676
8	0.900	0.631	0.600	0.102	0.098	0.104	18.228
9	0.900	0.618	0.601	0.104	0.098	0.104	18.682
10	0.900	0.616	0.628	0.099	0.096	0.101	17.882
11	0.900	0.633	0.605	0.098	0.095	0.095	18.249
12	0.900	0.603	0.636	0.092	0.095	0.099	18.801
13	0.899	0.603	0.626	0.109	0.096	0.106	17.516
14	0.900	0.615	0.603	0.099	0.095	0.100	19.181
15	0.899	0.638	0.609	0.099	0.096	0.100	17.751
16	0.900	0.618	0.608	0.101	0.096	0.102	18.588
17	0.899	0.594	0.642	0.098	0.094	0.099	18.369
18	0.900	0.595	0.597	0.096	0.092	0.097	20.750
19	0.899	0.637	0.607	0.100	0.098	0.103	17.713
20	0.900	0.609	0.612	0.097	0.094	0.099	19.267
21	0.899	0.599	0.602	0.098	0.095	0.099	20.181
22	0.900	0.614	0.610	0.097	0.093	0.098	19.132
23	0.900	0.618	0.610	0.095	0.091	0.096	19.082
24	0.900	0.620	0.606	0.097	0.093	0.098	18.967
25	0.900	0.590	0.600	0.096	0.093	0.098	20.883
26	0.900	0.634	0.593	0.099	0.095	0.100	18.671
27	0.899	0.628	0.623	0.099	0.096	0.100	17.451
28	0.899	0.588	0.602	0.106	0.101	0.106	19.853
29	0.900	0.566	0.606	0.102	0.097	0.102	21.225
30	0.900	0.610	0.607	0.104	0.100	0.105	18.672
31	0.902	0.620	0.638	0.098	0.094	0.099	17.547
32	0.899	0.599	0.618	0.098	0.095	0.100	19.324
33	0.900	0.611	0.616	0.096	0.092	0.097	19.039
34	0.899	0.621	0.578	0.098	0.096	0.101	20.125
35	0.900	0.594	0.599	0.099	0.094	0.099	20.476
36	0.900	0.593	0.602	0.102	0.096	0.102	20.055
37	0.899	0.605	0.606	0.096	0.094	0.099	19.714

N/A = analysis not run

*ABS (Measured - Target)(100)

**ABS (Measured - Target)

I. Meteorology



Meteorological Tower

ARB monitors meteorological parameters such as wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, and total solar radiation. Real-time meteorological data are generated to characterize meteorological processes such as transport and diffusion, and to make air quality forecasts and burn-day decisions. The data are also used for control strategy modeling and urban airshed modeling. A State/local meteorology subcommittee of the Air Monitoring Technical Advisory Committee (AMTAC) agreed to define the level of acceptability for meteorological data as those used by the U.S. EPA for both the Prevention of Significant Deterioration (PSD) and Photochemical Assessment Monitoring Stations (PAMS) programs. QAS audits to those levels.

The data variability collected by this element of the monitoring program are generally described as meeting or not meeting the PSD requirements. No mandatory corrections are made to the data. However, station operators are notified whether they passed the audit or not. Most operators make the effort to meet the audit standards. The wind speed, wind direction and outside temperature data sets are controlled data sets, and subject to meeting PAMS objectives. Since the inception of the meteorological audit program, the data quality have improved significantly.

Accuracy (field): The accuracy of meteorological sensors are checked by annual performance audits. Table I1 summarizes the 2004 audit results. The average difference (average degree difference with respect to ambient temperature) represents the combined differences from the certified value of all the individual audit points for each sensor. The upper and lower probability limits represent the expected accuracy of 95 percent of all the single sensor's individual percent differences for all audit test levels at a single site. Based on the audit results, over ninety-nine percent of the instruments audited were found to be operating within ARB's control limits. The Instrument operating outside of ARB's control limits resulted in 138 days of invalidated data. Audit results were not used in statistical analysis if the audit was invalidated due to an AQDA that resulted in data invalidation. AQDAs do not apply to relative humidity, solar radiation, and vertical wind speed audit results. The high average difference and probability limits for solar radiation are due to two audits that greatly exceeded ARB's control limits, but no AQDAs were issued. Information about the meteorological monitoring program is available at <http://www.arb.ca.gov/aaqm/met.htm>.

Table 11. 2004 Results for Meteorological Sensor Performance Audits Conducted by ARB

Sensor	Number of Sensors Audited	Number of AQDAs	Avg Diff or Avg % Diff	Probability Limits	
				95%UL	95%LL
Ambient Temp	81	0	-0.2	0.2	-0.6
Relative Humidity	28	NA	-0.5	5.2	-6.2
Wind Direction	89	0	-0.1	3.2	-3.4
Horizontal Wind Speed	88	1	0.2	3.1	-2.7
Barometric Pressure	34	NA	-0.9	2.6	-4.4
Solar Radiation	16	NA	2.3	11.5	-6.9

NA= Not applicable

Source: Quality Assurance Section, Accuracy Estimates

III. QUALITY CONTROL REPORTS

Quality Control (QC) reports are summaries of the quality control activities conducted by all MLD laboratories to support accurate and precise measurements. These activities include: blanks, duplicates, controls, spiked samples, limits of detection, calibrations, and audit results. Currently, all MLD QC reports are reviewed by the Operations Planning and Assessment Section (OPAS) to verify that good laboratory practices are followed and to identify opportunities for data quality or process improvement. The OPAS Section makes recommendations, where appropriate, to help improve the overall quality and/or effectiveness of the data. Depending on the program, QC reports are typically prepared quarterly. Table 1 lists the QC reports submitted for review in 2004.

Table 1. Quality Control Reports Submitted to OPAS Section for Review in 2004

Submittal Frequency	Title of QC Report	Program (s) Supported
Quarterly	Special Analysis Section, QC Report	Consumer Products
Quarterly	QC Report for the Analysis of Motor Vehicle Exhaust	Motor Vehicle Exhaust
Quarterly	QC Report for the Analysis of Motor Vehicle Fuel	Motor Vehicle Fuel Specifications
Quarterly	NLB Inorganics Laboratory Section QC Report	Particulate Matter
Quarterly	QC Report for Organic Toxics Program	Toxics
Quarterly	QC Report for Standards Laboratory	Ambient Air Monitoring and Source Testing

IV. STANDARDS LABORATORY



Cylinder Bay



Instrument Rack

The Standards Laboratory performs technical support and certification and verification services of calibration instruments, gases, and devices. Clients include ARB divisions, air districts, and U.S. EPA Region 9 (California, Nevada, Arizona, and Hawaii). Calibrations and certifications are performed for ozone and flow rate transfer standards, certifications of compressed gas cylinders, and verifications of ozone and flow rate primary standards, to ensure that all are traceable to standards of the NIST. A calibration establishes a correction factor to adjust or correct the output of an instrument, a certification establishes traceability of a transfer standard to a NIST-traceable standard, and a verification establishes comparability of a standard to a NIST-traceable standard of equal rank.

The Standards Laboratory also certifies and calibrates on a quarterly basis the instruments used by ARB's QAS auditors. Table 1 shows the types of services and volume for 2004. Information about the Standards Laboratory and the services that they provide is available at <http://www.arb.ca.gov/aaqm/qmosprog/stdslab/stdslab.htm>.

Table 1. Standards Laboratory Services Provided for 2004

Service Provided	Number Conducted
Ozone Certifications	39
Ozone Verifications	23
Ozone Calibrations	0
Low Flow Certifications	292
Low Flow Verifications	0
Low Flow Calibrations	25
High Flow Certifications	55
Ambient Gas Cylinders Certified	129
Source Gas Cylinders Certified	113



V. LABORATORY AND FIELD STANDARD OPERATING PROCEDURES

Laboratory and field standard operating procedures (SOPs) are guidance documents for the operation of quality assurance programs used by ARB, local districts and private industry. The SOPs are intended for field operators and supervisors; laboratory, data processing and engineering personnel; and program managers responsible for implementing, designing, and coordinating air quality monitoring projects. Each SOP has a specific method that must be followed to produce data-for-record. The SOPs are developed and published to ensure that, regardless of the person performing the operation, the results will be consistent. Most of the SOPs are available on the Internet at <http://www.arb.ca.gov/aaqm/qmosqual/qamannual/qamannual.htm>.



VI. SITING EVALUATIONS

To generate accurate and representative data, air monitoring stations should meet specific siting requirements and conditions. It is assumed that the stations met the siting criteria in place at the time initial operation began. As such, non-conformance today is the result of changing regulations, or changes in surrounding conditions and land use. The siting requirements of ARB's Quality Assurance Manual Volume II; 40 CFR 58, Appendix E; U.S. EPA's Quality Assurance Handbook Volume IV: U.S. EPA's Prevention of Significant Deterioration (PSD); and U.S. EPA's PAMS guidelines, present siting criteria to ensure the collection of accurate and representative data.

The siting criterion for each pollutant varies depending on the pollutant's properties, monitoring objective and intended spatial scale. U.S. EPA's siting criteria are stated as either "must meet" or "should meet". According to 40 CFR 58, Appendix E, the "must meet" requirements are necessary for high quality data. Any exception from the "must meet" requirements must be formally approved through the Appendix E waiver provision. The "should meet" criteria establish a goal for data consistency.

Siting criteria are requirements for locating and establishing stations and samplers to meet selected monitoring objectives, and to help ensure that the data from each site are collected uniformly. There are four main monitoring objectives: to determine highest concentrations expected to occur in the area covered by the network; to determine representative concentrations in areas of high population density; to determine the impact on ambient pollution levels of significant sources or source categories; and to determine general background concentration levels. Typical siting designations are: micro, middle, neighborhood, and regional. These designations represent the size of the area surrounding the monitoring site which experiences relatively uniform pollutant concentrations. Typical considerations for each of these site designations are, for example, the terrain, climate, population, existing emission sources, and distances from trees and roadways.

Siting evaluations are conducted annually by QAS. Physical measurements and observations include probe/sensor height above ground level, distance from trees, type

of ground cover, residence time, obstructions to air flow, and distance to local sources, are taken to determine compliance with 40 CFR Part 58, Appendix E requirements. If a criteria deficiency is found during a site evaluation, the site operator will be informed and an AQDA may be issued. For siting criteria distances, please refer to Appendix C.

VII. SPECIAL STUDIES/PROJECTS

During the course of the year, in-house studies as well as studies abroad are conducted to further the information available about the trends of pollutants and to support regulations to promote the welfare of the public. Descriptions of the special studies conducted by MLD are available in the Division Report at http://www.arb.ca.gov/aaqm/qmosprog/papers_studies/mission.pdf. The QAS often summarizes air monitoring information as an assessment of the monitoring activities in a specific area. The report "Review of Current Ambient Air Monitoring Activities Related to California Bay Area and South Coast Refineries" is an example of a QAS special study. A copy of the paper as well as other QAS special studies is available at <http://www.arb.ca.gov/aaqm/qmosqual/special/specialprojects.htm>.

In addition, QAS initiated a web based audit software program to streamline and improve the efficiency of the entire audit process. It allows QAS staff to generate statistical reports, perform trends analyses, distribute air quality reports to staff electronically, and make air quality data available on the World Wide Web.

DEVELOPMENT OF ERT VEHICLE

The Emergency Response Team (ERT) has developed a vehicle that can serve as a mobile command post for significant emergency response situations throughout the state. The vehicle, which was previously used to perform audits of air monitoring stations, was acquired from ARB's QAS, has been renovated and configured to provide a "Field Information Center" during emergency response events. This "self sufficient, mobile laboratory" was custom built with all necessary equipment (12 kW generator, UPS backup power, air conditioning/heating, lavatory, fresh water tanks, refrigerator, microwave, storage shelves, staff seating, computer and media hookups, etc.) to perform a variety of field related air pollution monitoring procedures. The mobile command post provides a warm, dry environment with small meeting areas that can be used for compiling data, calibrating response equipment and developing incident-specific action plans.

Two separate distinct capabilities comprise ERT's main functionality: portable meteorological data collection platforms and portable ground level ambient air monitoring. These functions allow the ERT to contribute valuable real-time data to aid with immediate operational decisions, and collect large data sets for future analysis.

ERT also now has the capability to operate five portable meteorological towers, each with a complete set of instruments. The portable towers will be deployed on all sides of large-scale emission to help predict plume migration and model fire behavior. Collected data will be transmitted via satellite to NOAA and the National Weather Service, where it

is then disseminated across the RAWS weather network and incorporated into weather models used to predict plume migration and population exposure.

In addition to the meteorological towers, ERT operates two MIRAN Sapphire portable chemical monitors. These units allow ERT to take ground-level concentration readings for several airborne toxic compounds as well as identify unknown hazards. Once identified, further monitoring by other groups can then be requested for longer duration sampling by more sensitive instrumentation.

Furthermore, the Air Resources Board/Monitoring and Laboratory Division is currently in the process of acquiring one vehicle that can be used to perform multiple field related air monitoring procedures. The vehicle will primarily be used by the Quality Assurance Section to conduct performance audits of air monitoring stations throughout the state, but its function can easily be converted for use as a mobile air analysis laboratory to measure pollutants and particulates, or as a mobile command post during emergency response events. The customized multi-use vehicle is also equipped with a computer network integrated with a satellite communication system which enables internet access for data transmission.

QAS manager serves as the ERT team field surveillance lead, and reports to the ARB ERT coordinator. ERT staff are deployed when a request is made through Cal EPA from the State Operations Center. For further information, please visit ARBs ERT web page at <http://www.arb.ca.gov/qaweb/ert.htm>.

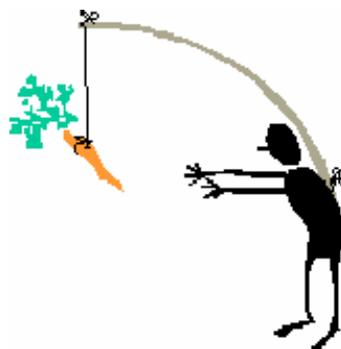
VIII. PROGRAM CONTACTS

Program	Contact	Phone	Email
Gaseous Pollutants	Don Fitzell	(916) 322-3892	dfitzell @arb.ca.gov
Particulate Matter	Jerry Freeman	(916) 323-1439	jfreeman@arb.ca.gov
Toxic Air Contaminants	Long Liu	(916) 327-4756	lliu@arb.ca.gov
Non-Methane Hydrocarbons	Long Liu	(916) 327-4756	lliu@arb.ca.gov
Pesticides	Don Fitzell	(916) 322-3892	dfitzell@arb.ca.gov
Dioxin/Asbestos	Rebecca Neumann	(916) 324-1145	rneumann@arb.ca.gov
Consumer Products	Wendy Howard	(916) 322-2382	whoward@arb.ca.gov
Meteorology	Alvin Danque	(916) 322-7053	adanque@arb.ca.gov

IX. UPCOMING ADDITIONS

This report will continue to evolve to include additional QA/QC measurements, new analyses of that information, and summary conclusions about data meeting our clients' needs for stated objectives. An element we expect to include in the next annual issue of this report is the:

- Annual Precision and Accuracy Report



APPENDIX A

AIR MONITORING NETWORK SURVEY

Quality Assurance Section
Monitoring and Laboratory Division





Gaseous Criteria Pollutant Monitoring as of December 31, 2004

Parameter Measured	Ozone	Nitrogen Dioxide	Carbon Monoxide	Sulfur Dioxide	Hydrogen Sulfide*
Sampling Schedule	Continuous hourly average				
Number of ARB Sites	36	22	22	3	0
Number of District Sites	145	90	73	38	15
Number of Sites in Mexico	8	8	8	3	0
Method Used By ARB	Ultraviolet photometry	Gas phase chemiluminescence	Non-dispersive infrared photometry	Ultraviolet fluorescence detector	Thermal oxidizer with ultraviolet fluorescence detector
EPA Reference Method	Ultraviolet photometry	Gas phase chemiluminescence	Non-dispersive infrared photometry	Spectrophotometry (pararosaniline method)	Not applicable
Data Availability	Planning and Technical Support Division, Air Quality Data Branch, (916) 322-6076; U.S. EPA Air Quality System (AQS)				

*Hydrogen sulfide is only a State criteria pollutant. A Federal standard has not been set.



Particulate Matter Monitoring as of December 31, 2004

Parameter Measured	PM10 (0 - 10 microns)		PM2.5	
	Mass*	Nitrate, sulfate, chloride, ammonium, potassium	Mass (fine)**	Speciated
Sampling Schedule	Every 6 days (24-hr. samples), TEOM & BAM (continuous 24-hr.), (Ag. burn sites every 3 days from Sep. to Nov.)		Every 3 days, BAM (continuous 24-hr.) (Bakersfield & Fresno-First sites every day)	1 in 6 days
ARB Collection Method	High volume selective size inlet sampler		Mass sequential, single channel & continuous	Speciation air sampling system (SASS)
Sampling Media	Quartz microfiber filter - 8 x 10 inch, BAM - filter tape, Teflon filter - 46.2 mm		Teflon filter - 46.2 mm, BAM - filter tape	Teflon, nylon & quartz filter - 46.2 mm
Number of Sites Operated by the ARB	36* (includes 12 sites in Mexico)	8 (includes 1 site in Mexico)	28**	7
Number of ARB Collocated Sites	2	1	5	1
Additional Sites Analyzed by other Agencies	14 BAAQMD* 24 SCAQMD* 6 SDAPCD* 90 other*	17 SCAQMD	103**	16***
ARB Analysis Method	Method 016 Electronic analytical balance	Method 007 & Method 023 ion chromatography	Method 055 Electronic analytical balance	Method 055 Electronic analytical balance Method 014 X-ray fluorescence Method 062 Filter preparation Method 064 Ion chromatography Method 065 Thermal/optical carbon
Laboratory Analyst	Scott Randall	Roxanna Walker	Mike Humenny	George Dunstan
Data Availability	Planning and Technical Support Division, Air Quality Data Branch, (916) 323-4887; U.S. EPA Air Quality System (AQS)			

*These figures also include sites where PM10 mass is monitored using low-vol. method or continuously (1-hr. averages) using TEOM or BAM.

**These figures also include sites where PM2.5 mass is monitored continuously (1-hr. averages) using BAM.

***Analysis performed by U.S. EPA or SCAQMD laboratory.



Organic Toxic Air Contaminant Monitoring as of December 31, 2004

Parameter Measured	Volatile Organic Compounds (VOCs)			Polynuclear Aromatic Hydrocarbons (PAHs)
	Aromatic & halogenated Compounds*	Methyl t-butyl ether (MBTE)	Ethanal (acetaldehyde) Methanal (formaldehyde) Butanone (methylethyl ketone)	Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Dibenz(a,h)anthracene Benzo(g,h,i)perylene Indeno(1,2,3-cd)pyrene
Sampling Schedule	Every 12 days (24-hr. samples)			
ARB Collection Method	XonTech 910A gaseous sampler		XonTech 920 toxic air contaminant sampler	High volume size selective inlet sampler
Sampling Media	Polished stainless steel canister		DNPH-coated silica cartridges	Quartz microfiber filter 8 x 10 inch
Number of Sites Analyzed by the ARB	19 (2 in Mexico)		21	20
Number of ARB Collocated Sites	4 (Bakersfield, San Francisco, San Jose, Rubidoux)		2 (Bakersfield, Stockton)	3 (Bakersfield, Rubidoux, Simi Valley)
Additional Sites Analyzed by other Agencies	18 BAAQMD		0	0
ARB Analysis Method	Method 058 Cryogenic trap preconcentration capillary GC/MS	Method 050 Cryogenic trap preconcentration capillary GC/PID	Method 022 High performance liquid chromatography/ultraviolet detector	Method 028 High performance liquid chromatography/fluorescence detector
Laboratory Analyst	Ferry Niyati, Pam Gupta, Ben Chang, Nati Lapurga, Vince Scola, John Medina, Barry Taylor		Paul Chima	Dave Hartmann
Data Availability	Planning and Technical Support Division, Air Quality Data Branch(916) 322-4887; U.S. EPA Air Quality System (AQS)			

*Dichloromethane, trichloromethane, tetrachloromethane, 1,1,1-trichloroethene, tetrachloroethene, benzene, toluene, styrene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, o-xylene, m/p-xylene, ethylbenzene, and 1,3-butadiene.



Hydrocarbon Monitoring as of December 31, 2004

Parameter Measured	Non-methane hydrocarbon compound (NMHC)		Continuous non-methane hydrocarbons	Carbonyl compounds
	Total NMHC	Speciated NMHC (69 species, C2 through C12)		Acetone formaldehyde acetaldehyde
Sampling Schedule	Every 3 days, July through September plus episodes (3-hr. samples)		Continuous hourly average	3-hr. sample
ARB Collection Method	XonTech 910A gaseous sampler with XonTech 912 multi-sampler		Thermal environmental (TECO) 55C hydrocarbon analyzer	XonTech 925 or other carbonyl sampler
Sampling Media	Polished stainless steel canister		Not applicable	DNPH-coated silica gel cartridges
Number of Sites Analyzed by the ARB	0		2	0
Additional Sites Analyzed by other Agencies	6 SCAQMD (includes 2 continuous GC) 4 San Diego County APCD 6 San Joaquin Valley APCD 6 Ventura County APCD		16	4 SCAQMD 2 San Diego County APCD 2 San Joaquin County APCD 1 Ventura County APCD
ARB Analysis Method	Method 024 Cryofocusing direct GC/FID	Method 032 Cryofocusing GC/FID	Flame ionization detector	Method 022 High performance liquid chromatography/ultraviolet detector
Laboratory Analyst	Sean Roy	Sean Roy, Barry Taylor	Not Applicable	Paul Chima
Data Availability	Planning and Technical Support Division, Air Quality Data Branch, (916) 322-6076; U.S. EPA Air Quality System (AQS)			



Meteorological Monitoring as of December 31, 2004

Parameter Measured	Wind Speed	Wind Direction	Ambient Temperature	Relative Humidity	Atmospheric Pressure	Solar Radiation
Sampling Schedule	Continuous hourly average					
Number of ARB Sites	36	36	37	15	18	4
Number of District Sites	148*	145	122	62	34	42
Number of Mexico Sites	8	8	8	0	0	0
Method Used by ARB	Propeller or cup anemometer	Wind vane potentiometer	Aspirated thermocouple or thermistor	Thin film capacitor	Pressure transducer	Thermopile or pyranometer
Data Availability	Planning and Technical Support Division, Air Quality Data Branch(916) 322-4887; U.S. EPA Air Quality System (AQS)					

*Includes 3 vertical wind speed sensors.



TSP and Visibility Monitoring as of December 31, 2004

Parameter Measured	Total Suspended Particulates (TSP)		Coefficient of Haze	Relative Visibility
	Lead	Sulfate	Particulates	Light Scatter
Sampling Schedule	Every 6 days (24-hr. samples)	1 every 12 days 4 every 6 days 2 every 3 days (24-hr. samples)	2-hr. average	Continuous hourly average
ARB Collection Method	High volume total suspended particulate sampler		Optical test tape sampler	Nephelometer
Sampling Media	Glass fiber filter 8 x 10 inch		Filter tape	Not applicable
Number of Sites Analyzed by the ARB	2 (Includes 1 site in Mexico)	0	2	1
Number of ARB Collocated Sites	0	0	0	0
Additional Sites Analyzed by other Agencies	10 SCAQMD	15 SCAQMD	1	3
ARB Analysis Method	Method 105 Graphite furnace atomic absorption/ZEEMAN	Method 033 Ion chromatography	Light transmittance through a filter tape	Scattering coefficient of light by suspended particles
Laboratory Analyst	Peter Samra	Roxanna Walker	Not applicable	Not applicable
Data Availability	Planning and Technical Support Division, Air Quality Data Branch(916) 322-4887; U.S. EPA Air Quality System (AQS)			



Toxic Metals Monitoring as of December 31, 2004

Parameter Measured	Toxics Metals	
	Al, As, Ba, Br, Ca, Cl, Co, Cr, Cu, Fe, Hg, K, Mn, Mo, Ni, P, Pb, Rb, S, Sb, Se, Si, Sn, Ti, U, V, Y, Zn, Zr	Chromium VI
Sampling Schedule	Every 12 days (24-hr. samples)	
ARB Collection Method	XonTech 920 toxic air contaminant sampler	
Sampling Media	Teflon filter - 37 mm	Cellulose filter - 37 mm
Number of Sites Analyzed by the ARB	19	19
Number of ARB Collocated Sites	2 (Bakersfield, Stockton)	2 (Bakersfield, Stockton)
Additional Sites Analyzed by other Agencies	0	0
ARB Analysis Method	Method 034 X-ray fluorescence	Method 039 Ion chromatography
Laboratory Analyst	Mike Humenny	Samantha Scola
Data Availability	Planning and Technical Support Division, Air Quality Data Branch(916) 322-4887; U.S. EPA Air Quality System (AQS)	



Acid Deposition Monitoring as of December 31, 2004

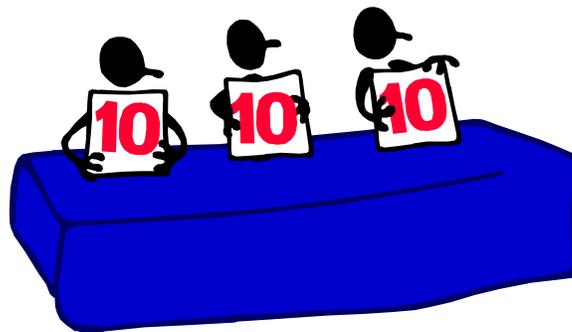
Parameter Measured	Wet Deposition			Dry Deposition 0 - 2.5 microns				
	Conductance & pH	Nitrate, sulfate	Ammonium potassium sodium	Mass	Nitric acid	Chloride nitrate sulfate	Ammonium	Calcium magnesium potassium sodium
Sampling Schedule	Continuous (Samples collected weekly)			Every 6 days (24-hr. samples)				
ARB Collection Method	Automatic precipitation sensor with Twin buckets			Size selective particulate sampler with multiple filters/cartridges				
Sampling Media	Plastic bucket			Teflon filter	Nylon filter	Teflon filter	Teflon filter	Teflon filter
Number of Sites Analyzed by the ARB	0			0				
Number of ARB Collocated Sites	0			0				
Additional Sites Analyzed by other Agencies	1 SDAPCD 5 other			6 other				
ARB Analysis Method	Method 036 Conductivity & pH meter	Method 037 Ion chromatography	Method 037 Ion chromatography	Method 041 Microbalance	Method 035 Automated colorimetry	Method 044 Ion chromatography	Method 046 Automated colorimetry	Method 048 Atomic absorption
Laboratory Analyst	George Dunstan			Nehzat Motallebi - Research Division				
Data Availability	Planning and Technical Support Division, Air Quality Data Branch(916) 322-4887; U.S. EPA Air Quality System (AQS)							

APPENDIX B

2004

DISTRICT USABLE DATA ANALYSIS

Quality Assurance Section
Monitoring and Laboratory Division



Precision Usable Data Rate % for 2004

Agency	Gaseous Analyzers								Particulate Samplers				
	CO	H ₂ S	NMOC (TECO 55)	NO ₂	O ₃	SO ₂	THC	TRS	BAM ₁₀	PM ₁₀ Partisol	PM ₁₀ (SSI)	PM _{2.5}	TEOM
Antelope Valley APCD	100			100	100								0
ARB	97		97	99	98	50					85	74	0
Bay Area AQMD	100	0	0	100	100	100					42	100	
Great Basin Unified APCD										54		10	0
Imperial County APCD	100			85	99								
Lake County AQMD		100			100								
Mendocino County APCD	100			100	100								
Mojave Desert AQMD	100	100		100	100	100						0	0
Monterey Bay Unified APCD	100			100	100	100							
National Park Service	100			100	100								
Northern Sierra AQMD					54				0			85	
Northern Sonoma County APCD					100								
Placer County APCD					71								
Sacramento Metro AQMD	92		78	78	91	92			77		87	80	83
San Diego County APCD	93		0	94	94	94					88	71	
San Joaquin Valley APCD	97		96	97	97						88		
San Luis Obispo County APCD	62			93	95	96						93	89
Santa Barbara County APCD	100	96		98	97	98	98	94			96		
Shasta County AQMD					100								
Siskiyou County APCD					100								
South Coast AQMD	98			93	96	92					83	84	
Tehama County APCD					100								
Ventura County APCD	77		85	100	100	100					87	95	
Yolo - Solano AQMD					64								
Overall Average:	94	74	59	96	93	92	98	94	39	54	82	71	43
Ratings:	Good	Poor	Poor	Excellent	Good	Good	Excellent	Good	Poor	Poor	Fair	Poor	Poor

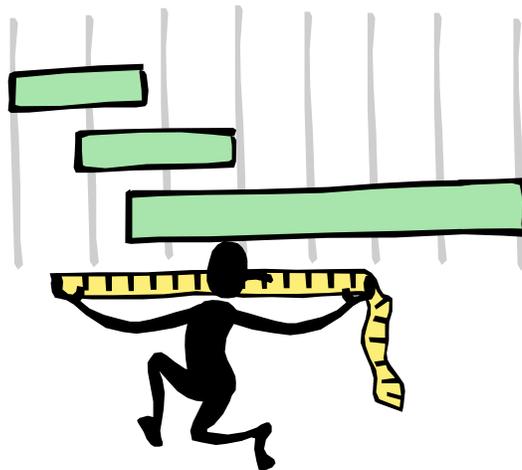
Overall Usable Data Rate (%)	76	Poor
Overall Gaseous Usable Data Rate (%)	88	Good
Overall Particulate Usable Data Rate (%)	58	Poor

Note: ARB's goal for usable data is 85%. Precision checks are not required for Kern, Modoc, North Coast, Butte, and Lassen counties for PM2.5 and PM10 (also applies to Coso and EMC companies).

APPENDIX C

SITING CRITERIA DISTANCES

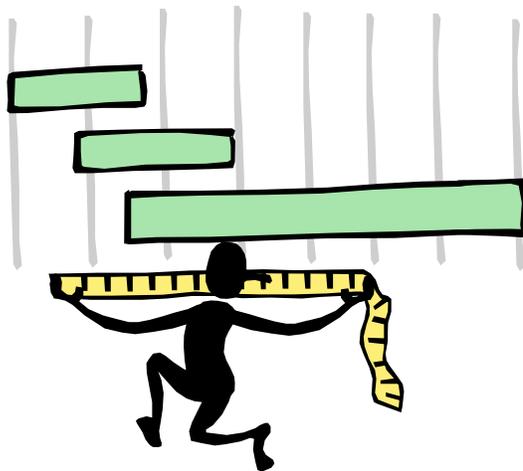
Quality Assurance Section
Monitoring and Laboratory Division



APPENDIX D

ARB's INSTRUMENT CONTROL LIMITS

Quality Assurance Section
Monitoring and Laboratory Division



Instrument/Sensor Control Limits

ARB's Control and Warning Limits

<u>Limits</u>		<u>Instrument</u>
<u>Control</u> ±15%	<u>Warning</u> ±10%	All Gaseous Criteria and Non-Criteria Analyzers
±15%	±10%	Total Suspended Particulate (TSP) Samplers
±10%	±7%	PM ₁₀ , Dichotomous (Dichot), Lead (Pb), Tapered Element Oscillating Microbalance (TEOM), Toxic Air Contaminant (XonTech 920) Samplers, Beta Attenuated Monitors (BAM), and Carbonyl (XonTech 925) Samplers
±4% (Flow) ±5% (Design)	None None	PM _{2.5}
±20%	None	Laboratory Audits (Toxics, PAMS, Motor Vehicle Exhaust, and Total Metals)

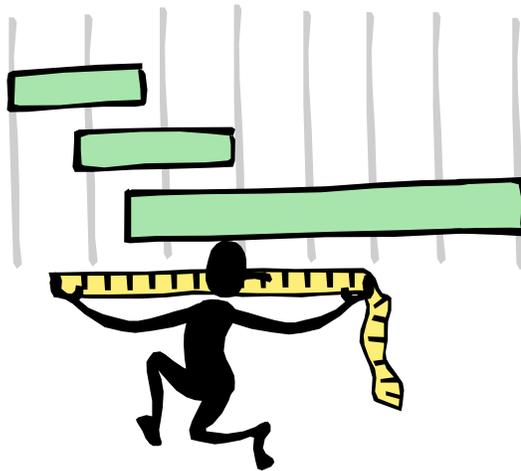
Acceptance Criteria For Meteorological (MET) Sensors

<u>Limits</u>	<u>Sensor</u>
±1.0° Celsius (±0.5°C PAMS only)	Ambient Temperature
±2.25mm of Mercury (Hg)	Barometric Pressure
±3%RH for 10-90%RH ±5%RH for <10 or >90%RH	Relative Humidity
±5% Watts/m ²	Solar Radiation
less than or equal to 5° combined accuracy and orientation error	Wind Direction
less than or equal to 0.5m/s	Wind Direction Starting Threshold
±0.25m/s between 0.5 and 5m/s and less than 5% difference above 5m/s	Horizontal Wind Speed
less than or equal to 0.5m/s	Horizontal Wind Speed Starting Threshold
±0.25m/s between 0.5 and 5m/s and less than 5% difference above 5m/s	Vertical Wind Speed
less than or equal to 0.5m/s	Vertical Wind Speed Starting Threshold

APPENDIX E

REFERENCES

Quality Assurance Section
Monitoring and Laboratory Division



References

1. Quality Assurance Handbook for Air Pollution Measurement Systems. Volume I. Principles, EPA-600/9-76-005, January 1984.
2. Quality Assurance Handbook for Air Pollution Measure Systems. Volume II. Ambient Air Specific Methods, EPA-600/4-77-027a, May 1977.
3. State and Local Air Monitoring Network Plan, California Air Resources Board, May 1993.
4. Code of Federal Regulations, Title 40, Protection of the Environment, Part 58, Ambient Air Quality Surveillance (July 1992).
5. Air Monitoring Quality Assurance Manual. Volume I. Quality Assurance Plan, Monitoring and Laboratory Division, California Air Resources Board, February 1995.
6. Strategic Plan, California Air Resources Board, 1997.
7. Technical Assistance Document for Analysis of Ozone Precursors (TAD), September 30, 1998.