1998

Annual *Data Quality* Report

Air Resources Board
Monitoring and Laboratory Division

The Report was Compiled
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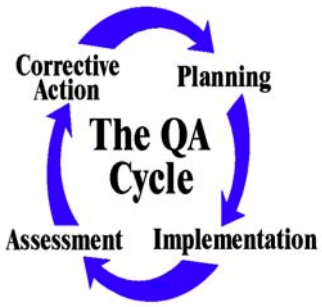
I. INTRODUCTION

The purpose of this report is to summarize the results of the quality assurance program for the Air Resources Board's (ARB) Monitoring and Laboratory Division (MLD) for 1998. This is the first volume of this document and presents accuracy data only. The tables used to depict the data offer a summarization of the network accuracy. The 95% upper and lower probability limits indicate with confidence that an analyzer's performance will fall within this range. Future documents will include reports on additional quality assessment and quality control parameters.

The ARB's 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 MLD is a key element to the success of this mission. The MLD, under State law, conducts ambient air monitoring in support of ARB divisions, local air pollution control and air quality management districts, and the United States Environmental Protection Agency (U.S. EPA). Monitoring programs include gaseous pollutants, particulate matter, toxic air contaminants, non-methane hydrocarbons, pesticides, consumer products, meteorological parameters, and visibility. Data from these monitoring sources provide the means to determine the nature of the pollution problem and assess how well control programs are working.

It is the goal of MLD to support and conduct appropriate 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 involving planning, implementation, assessment, and corrective action to ensure that a process, item, or service is of the type and quality needed and expected by the client. The objective of quality assurance is to provide accurate and precise data, minimize the loss of air quality data due to malfunctions, and to assess the quality 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 a set of internal tasks performed at the instrument level that ensures accurate and precise measured ambient air quality data. Q*uality 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. These external tasks are performed by staff independent of data generators. 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 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 non-methane hydrocarbon program with plans to extend it to the toxic air contaminants program.

***Table 1*. Audits Performed for Each Air Monitoring Program in 1998**

Air Monitoring Program	Field Performance Audit	Laboratory Performance Audit	System Audit **	Whole Air Audit
Gaseous Pollutants	X	X		
Particulate Matter	X	X		
Toxic Air Contaminants	X	X		FUTURE
Non-Methane Hydrocarbons	X	X		X
Pesticides	X			
Consumer Products		X		
Meteorology	X			

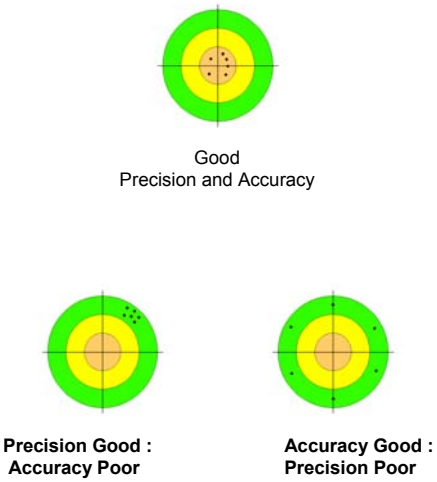
**System audits are performed by request and on an as-need basis.

II. QUALITY CONTROL AND QUALITY ASSESSMENT

The Quality Assurance Section (QAS) supports all ambient monitoring programs in the division; including gaseous criteria pollutants, particulate pollutants, toxic air contaminants, non-methane hydrocarbons, pesticides, consumer products, and meteorology, which are run by both the ARB and local and private air monitoring agencies. There are approximately 326 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 Programs: http://www.arb.ca.gov/aaqm/aaqm.htm. Information pertaining to each air monitoring site is available at http://www.arb.ca.gov/aaqm/mldaqsb/amn.html. The Air Monitoring Network website provides links to, and information about, site location, global positioning system (GPS) coordinates, and parameters monitored at each site.

The air quality monitoring programs collect real-time measurements of ambient level pollutants. The data generated are used to define the nature, extent, and trend of air quality in the State; to create State and federal laws; and to establish air quality standards. The precision and accuracy necessary depends on how

the data will be used. 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 to confirming the data set meet the established limits. They are initiated based upon a failed audit and resolved after a review of calibrations, precision checks and audit results which show an analyzer/sampler operating outside ARB's control limits of +/- 15 percent (+/-10 percent for PM10), or for siting or temperature conditions not meeting specifications.



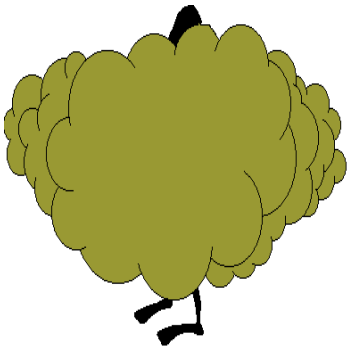
Data with no formal data quality objectives (i.e., toxics) are called *descriptive data sets*. The data quality measurements are made as accurately as possible in consideration of how the data are being used. The results are simply described in standard terminology, but no effort is made to confine the data set to values that are within a predetermined quality limit. The illustration above shows the relationship between precision and accuracy.

The ARB's Quality Assurance Program is outlined in a 6-volume series entitled the *Quality Assurance Manual*. The volumes, listed below, serve as guidance for the operation of the quality assurance programs used by the ARB, local districts, and private industry.

Volume I	Quality Assurance Plan
Volume II	Standard Operating Procedures for Air Quality Monitoring
Volume III	Laboratory Methods and Operations
Volume IV	Air Quality Data Processing (Not Available)
Volume V	Audit Procedures Manual
Volume VI	Standard Operating Procedures for Stationary Source Emission Monitoring and Testing

Volumes I, III, and V, and parts of Volume VI are 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.

A. Gaseous Pollutants



Ambient concentrations of carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), and sulfur dioxide (SO2) are continuously monitored by an automated network of stations run by MLD and the districts. Exposure to these pollutants cause adverse health effects including, respiratory impairment, fatigue, permanent lung damage, and increased susceptibility to infection in the general population. Non-criteria pollutants such as methane and total hydrocarbons, are also monitored continuously as precursors for criteria pollutants to help ensure the ambient air quality standards are met. Gaseous criteria pollutant data are a controlled data set and are subject to meeting mandatory regulations. Non-criteria gaseous pollutant data are considered to be a descriptive data set and are not required to meet any data quality objectives. However, effort is made by the site operators to ensure that audit standards are met and that the data collected is as accurate as possible.

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

Tables A1 and A2 summarize the 1998 performance audit results for the criteria and non-criteria pollutants. The average percent difference represents 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 the individual measurements. Overall, the responses of the individual analyzers, indicate that as a whole the network is providing accurate data. Ninety-six percent of the instruments audited were found to be operating within the ARB's control limits. The most common causes for instruments to be operating outside the control limits were inaccurate calibrations and leaks in the sampling system.

Further information about the systems and procedures are available at: http://www.arb.ca.gov/aaqm/qmosqual/sysaudit/criteria/qa_gas.html. In the future the ten year accuracy report will be available on the Internet.

Table A1. **1998 Criteria Pollutants Performance Audit Results for ARB Reporting Organization and Portions of San Diego, South Coast, and Bay Area.**

Pollutant	Number of Analyzers Audited	Average % Difference	Probability Limits 95%UL	95%LL
CO	70	0.4	8.1	-7.2
NO2	93	-1.0	8.2	-10.1
O3	146	-1.7	5.4	-8.8
SO2	32	2.1	13.2	-8.9
H2S	6	-0.3	9.0	-9.6

Source: Quality Assurance Section, Accuracy Estimates

Table A2. **1998 Non-Criteria Pollutants Performance Audit Results for ARB Reporting Organization and Portions of San Diego, South Coast, and Bay Area.**

Pollutant	Number of Analyzers Audited	Average % Difference	Probability Limits 95%UL	95%LL
THC	18	1.3	9.9	-7.3
CH4	15	0.3	7.8	-7.1

Source: Quality Assurance Section, *Accuracy Estimates*

MLD also participates in the U.S. EPA's National Performance Audit Program (NPAP). The results of the NPAP audits, available upon request, are calculated and compiled by the U.S. EPA. The audits differ from our TTP audits in that the gas is introduced at the back of the instrument.

Precision: Precision checks are performed by Air Quality Surveillance Branch (AQSB) staff on a nightly basis to confirm linearity of the instrument. Precision checks compensate for normal expected variation in an analyzer response. 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. These results will be available in future reports.

B. Particulate Matter

Particulate Sampler

Particulate matter monitoring is conducted using both manual and continuous type samplers. Manual samplers are operated on a 6-day sampling schedule for PM10 and a similar or more frequent schedule for PM2.5. ARB's particulate program is divided into two groups: monitoring of particulate matter less than 10 microns in diameter (PM10 and PM2.5) and monitoring of total suspended particulates (TSP), including TSP mass, TSP sulfate, and lead (Pb). Respirable particulate matter (PM10) and fine particulate matter (PM2.5) increase the chance of respiratory disease, lung damage, cancer, and premature death. Particulate matter is a controlled data set that is subject to meet formal data quality objectives and federal and state regulations. Visit the Particulate Matter Monitoring home page at http://www.arb.ca.gov/aaqm/partic.htm for more information.

Accuracy (field): The accuracy of particulate samplers is determined using a certified variable orifice (PM10 and TSP), or a calibrated mass flow meter (dichot and continuous samplers) that is certified against a NIST-traceable flow device or calibrator. Since, accurate measurement of particulate matter is dependent upon flow rate, annual flow audits are conducted at each site. The 1998 performance audit results are listed below in Table B1. The average percent difference 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 the samplers audited. Overall, the flow audit results indicate that the network is providing accurate flow rate data. Ninety-four percent of the instruments audited were found to be operating within the ARB's control limits. Instruments operating outside the control limits typically had an improper set-point of the mass flow controller. Under normal operation, the set-point of the mass flow controller should compensate for a change in temperature and pressure.

***Table B1*. 1998 Particulate Sampler Performance Audit Results for ARB Reporting Organization and Portions of San Diego, South Coast, and Bay Area.**

Pollutant	Number of Samplers Audited	Average % Difference	Probability Limits 95%UL	95%LL
PM10	139	0.7	4.9	-6.4
Dichot	15	0.3	8.6	-7.9
TEOM	25	-1.4	5.3	-8.1
TSP	10	-0.7	3.2	-4.7
Pb	22	-1.3	8.0	-10.6

Source: Quality Assurance Section, *Accuracy Estimates*

Precision (field): Sampling precision is obtained by collocated sampling, the simultaneous operation of two identical samplers placed side-by-side. In 1998, collocated high-volume SSI samplers were operated at Bakersfield and Visalia, and collocated dichot samplers at Bakersfield and Fresno. Collocated samplers represent a subset of the whole network. The data generated is used as a comparison for the entire network to confirm equivalent and precise data is being obtained. The results will be presented in future reports.

Accuracy (lab): Laboratory audits include an on-site check and assessment of the PM10 filter weighing balance, relative humidity and temperature sensors, and their documentation. The performance audit conducted on July 27, 1998 of the Engineering and Laboratory Branch's particulate matter mass analysis program found that the balance, relative humidity and temperature sensors passed the U.S. EPA's audit criteria. District reports are available upon request.

Laboratory audits are also conducted using NIST traceable filter standards for nitrate (NO3-), sulfate ($SO4^{-2}$), chloride (Cl-), ammonium (NH4+), and potassium (K+). The Engineering and Laboratory Branch participated in the PM10 ions laboratory performance audit conducted in July 1998. The results for all compounds were within the targeted +/-20% limits established for the audit.

MLD also participates in both the field and laboratory NPAP programs for PM10 and dichot. The U.S. EPA compiles the NPAP audit results which are available upon request. The federal program covers only a portion of the PM10 network. We compare our performance audit results to the NPAP results to look for unusual features and determine overall trends.

Precision (lab): Laboratories perform various tasks to ensure that quality data are produced. Tasks include duplicate weighings on exposed and unexposed filters, duplicate analysis on every 10^{th} filter, and a calibration of the balance before each weighing session. Filters are also visually inspected for pinholes, loose material, poor workmanship, discoloration, non-uniformity, irregularities, and are equilibrated in a controlled environment for a minimum of 24 hours prior to pre- and post-sample weighing. The results of these checks will be presented in future reports.

C. Toxic Air Contaminants

Stainless Steel Toxics Canister

The ARB established a toxic monitoring network within major urban areas in 1985 to provide data to determine the average annual concentrations of toxic air contaminants as input to the identification process, and to assess the effectiveness of controls. A sample of ambient air is collected in a stainless steel canister every 12th day over a 24-hour period and analyzed by the Engineering and Laboratory Branch. Toxic air contaminants include volatile organic and oxygenated compounds. Particulate samples are also collected and analyzed for toxic metals, including hexavalent chromium; and arsenic, beryllium, cadmium, and lead. Toxic air contaminants can vaporize easily at ambient temperatures, can be photochemically reactive in the atmosphere, and in addition to their toxic qualities, contribute to the formation of ozone. This is a descriptive data set, and no mandatory corrections are made to the data if an audit is found to be outside established audit standards. The laboratory and monitoring staff are made aware of any exceedances and every effort is made to ensure that the data collected is as accurate as possible.

The audit programs contained two elements in 1998; the TTP audits and laboratory audits. Additional information about the audits is available on the Internet at http://www.arb.ca.gov/aaqm/toxics.htm. The QAS has prepared several papers that can be found on the Internet as well.

Accuracy (field): TTP performance audits were conducted for volatile organic compound constituents annually at each air toxic site to assess the accuracy of the total measurement system. These include errors inherent in contamination in transport, effects of sample pump and probe, and laboratory bias. The results for 1998 are shown in Table C1. The values represent the average percent difference for each compound from all audits conducted at ARB sites. The results indicate inconsistent recovery rates, as well as audit criteria exceedances, for several compounds. The laboratories and site operators were asked to investigate the variability. These audits have been suspended for calendar year 2000 due to budget cuts.

***Table C1*. 1998 Toxic Air Contaminants TTP Audit Results for California's Toxic's Network.**

Compound	TTP	
	Ave % Diff	Std Dev
Benzene	-11.8	18.6
1,3-Butadiene	NA	NA
Carbon Tetrachloride	4.9	19.6
Chloroform	-7.8	12.2
ortho-Dichlorobenzene	-15.9	57.6
Ethylbenzene	-32.5	27.7
Methyl Chloroform	-7.6	15.0
Methylene Chloride	-16.8	11.2
Perchloroethylene	-21.5	20.2
Styrene	-58.2	33.5
Toluene	-12.0	21.0
Trichloroethylene	-5.0	26.5
m/p-Xylene	-37.1	31.4
o-Xylene	-26.1	37.2

NA= Not analyzed/Not Audited

Toxic metals and carbonyls are collected using a low flow, multi-channel sampler (shown at right), capable of sampling onto filters or cartridges. Because the accuracy of measuring toxic metals and carbonyl compounds is dependent upon the sampling flow rates, flow audits are conducted annually at each site. Table C2 shows the combined differences from the certified value of all the individual audit points for each pollutant. The upper and lower probability limits represent the expected accuracy of 95 percent of the individual measurements. Overall, the results indicate that the samplers are stable and collecting accurate measurements of toxic metals and carbonyl compounds. Ninety-four percent of the instruments audited were found to be operating within the ARB's control limits.

Toxic metals and carbonyl sampler

***Table C2*. 1998 Toxic Air Sampler Performance Audit Results for ARB Reporting Organization and Portions of South Coast, San Diego and Bay Area.**

Pollutant	Number of Samplers Audited	Average % Difference	Probability Limits 95%UL	95%LL
Cr6+	28	0.6	5.0	-3.8
Total Metals	29	0.2	6.6	-6.2
Aldehydes	31	0.9	9.1	-7.2

Source: Quality Assurance Section, *Accuracy Estimates*

Accuracy (lab): Laboratory performance audits are conducted semi-annually to assess the accuracy of the laboratory's ability to measure ambient concentrations of volatile organic compounds (VOC). The 1998 audit results are shown in Tables C3 and C4. The values represent the average percent difference for each compound from the two audits. The laboratory performance audit results illustrated in Table C3, show a low recovery rate for methyl chloroform and perchloroethylene for the entire network. ARB's laboratory was asked to investigate the potential cause of the low responses. The toxic metals laboratory performance audit results indicate that the laboratory is accurately identifying these compounds.

***Table C3*. ARB's 1998 Toxic Air Contaminants Laboratory Performance Audit Results.**

Compound	Average % Difference
Benzene	-3.7
1,3-Butadiene	6.3
Carbon Tetrachloride	-2.2
Chloroform	-1.1
ortho-Dichlorobenzene	NA
Ethylbenzene	-5.7
Methyl Chloroform	-49.0
Methylene Chloride	-3.2
Perchloroethylene	-33.6
Styrene	-6.3
Toluene	6.1
Trichloroethylene	-16.4
m/p-Xylene	-12.5
o-Xylene	-11.7

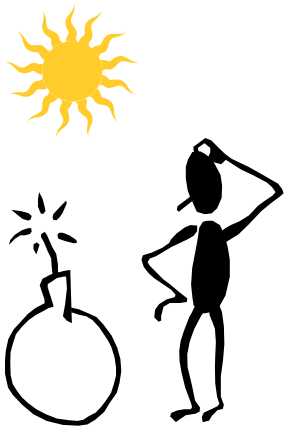
NA= Not analyzed/Not Audited; One audit was conducted in 1998.

***Table C4*. ARB's 1998 Toxic Metals Laboratory Performance Audit Results.**

Compound	Average Percent Difference
Arsenic	0.9
Cadmium	-0.8
Lead	-1.4

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 in high ozone areas. Federal regulations require 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. PAMS sites also collect data on ozone, oxides of nitrogen, and various ground level and aloft meteorological parameters. This is a descriptive data set that is moving toward becoming a controlled data set. There are currently no mandatory data quality objectives or regulations the data are subject to; however, much effort is expended to ensure that accurate data are collected and the analyzers are operating within ARB's audit standards. The errors in this data set are simply described here and on the Internet

Accuracy: Performance audits are necessary to ensure the validity of the data. Three types of NMHC performance audits (laboratory, TTP sampler, and TTP continuous analyzer) are conducted to support both the canister-type collection system and continuous real-time analyzers. A cross-check is also run by the QA staff 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 program, was added after the 1997 South Coast Ozone Study and uses a system developed by QA staff. Staff are preparing an abstract on the whole air sampler for the PAMS Conference in the fall of 2000. Additional information about the PAMS QA program is available at the following Internet address, http://www.arb.ca.gov/aaqm/qmosqual/perfaudit/nmhc/qa_nmhc.html.

Laboratory performance audits are conducted annually to assess the accuracy of the laboratories ability to measure ambient levels of NMHC. *TTP performance* audits are also conducted annually at each NMHC monitoring site to assess the integrity of the entire sampling equipment and transport system, in addition to the accuracy of the analytical methods used by the laboratory. The 1998 *laboratory*

and *TTP Sampler* NMHC audit results are shown in Table D1. The average percent difference represents the combined differences from the certified value for the sites and laboratories audited. Based on the results, the PAMS network is performing well; however, more variability occurred in the responses for ethane, methylcyclopentane, and methylcyclohexane indicating a potential problem. Those laboratories exceeding the U.S. EPA's ±20% control limits were asked to investigate the variability. As would be expected, the TTP audits have greater bias than the laboratory audits.

Table D1. **1998 TTP Sampler and Laboratory NMHC Audit Results for California's PAMS Network.**

	TTP			Laboratory	
Compound	Avg % Diff	Std Dev	Compound	Avg %Diff	Std Dev
Ethane	-17.3	29.1	Ethane	-5.5	17.7
Ethene	10.0	14.7	Propane	-2.7	4.1
Propane	3.3	11.3	Propene	-1.6	3.1
Propene	13.9	9.3	Isobutane	-1.6	5.2
Butane	-4.7	5.3	Butane	-0.2	6.8
Butene	-4.3	9.7	Isobutylene	-8.8	7.8
2-Methylbutane	2.2	5.7	Isopentane	3.1	2.3
Pentane	1.6	8.0	Pentane	3.9	3.0
2,3-Dimethylbutane	4.2	11.7	1-Pentene	-1.1	6.2
2-Methylpentane	2.4	4.5	Hexane	1.7	4.8
Hexane	0.8	5.2	Benzene	0.0	5.8
Methylcyclopentane	12.4	18.1	Octane	2.2	4.7
Benzene	1.6	4.3	Toluene	-3.3	6.7
3-Methylhexane	14.9	10.7	O-Xylene	-4.9	9.0
2,2,4-Trimethylpentane	6.7	3.2	Decane	-4.6	8.1
Methylcyclohexane	19.8	20.4			
Toluene	0.7	4.1			
Octane	3.9	9.0			
Ethylbenzene	-3.1	6.3			
p-Xylene	-4.4	7.3			
o-Xylene	-4.7	8.5			
1,2,4-Trimethylbenzene	-6.2	13.6			
Decane	0.0	16.7			

The *Whole Air Sampler* performance checks complement the TTP and laboratory audits and involve all the laboratories that measure ambient concentrations of NMHC compounds. A specially designed sampler draws ambient air for three hours, filling up to ten canisters at a time to an approximate pressure of 14 psig each. 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 the QAS, who in turn, compare the results to the other participating laboratories. Overall, the laboratory responses compared well for each compound. If a laboratory's response for a compound was significantly different from the other laboratories, the laboratory was asked to investigate the cause. The results of the whole air comparison are available at http://www.arb.ca.gov/aaqm/qmosqual/perfaudit/nmhc/whole/wholetable.htm.

TTP continuous analyzer performance audits are audits of total NMHC analyzers (i.e. Bendix 8202a or Teco 55). Table D2 shows the audit results for 1998. The upper and lower probability limits represent the expected accuracy of 95 percent of the individual measurements. The performance audits indicate that the PAMS network of continuous analyzers is accurately measuring ambient concentrations of NMHC when the instruments are operating properly. Eighty percent of the instruments audited were found to be operating within the ARB's control limits. The instruments operating outside the control limits were typically due to a blocked restrictor that shifted the timing window or retention time. Problems with the TECO 55 have been reported by the Program Evaluation and Standards (PE&S) Section and AQSB and discussions are underway now on them.

***Table D2*. 1998 TTP Audits of Continuous Analyzer NMHC for PAMS Sites Under the CAPII.**

Pollutant	Number of Analyzers Audited	Average % Difference	Probability Limits 95%UL	95%LL
NMHC	16	0.9	11.5	-9.8

Source: Quality Assurance Section, Accuracy Estimates

Performance audits are also conducted of the flow rate on the PAMS carbonyl samplers. Accurate measurements of carbonyl compounds in ambient air are dependent upon flow rate. Table D3 represents the accuracy of the samplers audited in 1998. The upper and lower probability limits represent the expected accuracy of 95 percent of the individual measurements. The audit results indicate the PAMS carbonyl network is performing well, making it possible to accurately measure carbonyl compounds in ambient air. Eighty-seven percent of the instruments audited were found to be operating within the ARB's control limits. Instruments operating outside the control limits were primarily due to improper calibration of the mass flow controllers.

***Table D3*. 1998 Carbonyl Sampler Performance Audit Results for ARB Reporting Organization and Portions of San Diego, South Coast and Bay Area.**

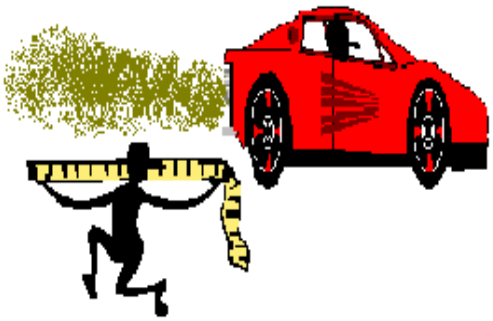
Pollutant	Number of Samplers Audited	Average % Difference	Probability Limits 95%UL	95%LL
Carbonyl	13	1.4	7.1	-4.4

Source: Quality Assurance Section, Accuracy Estimates

Precision: Precision for the PAMS NMHC program is obtained through collocated sampling. Collocated samplers represent a subset of the whole network. The data generated are used as a comparison for the entire network. Each of the four participating laboratories selects one site where a duplicate canister of ambient air is collected using two separate sampling system set-ups. The two canisters are sent to the representative laboratory for analysis and comparison.

The precision of PAMS carbonyls data is confirmed through the analysis of two cartridges that were sampled at the same time from a single sampler. The laboratory responsible for the site analyzes the cartridges and compares the results. The results from the precision checks will be presented in future reports.

MOTOR VEHICLE EXHAUST PROGRAM

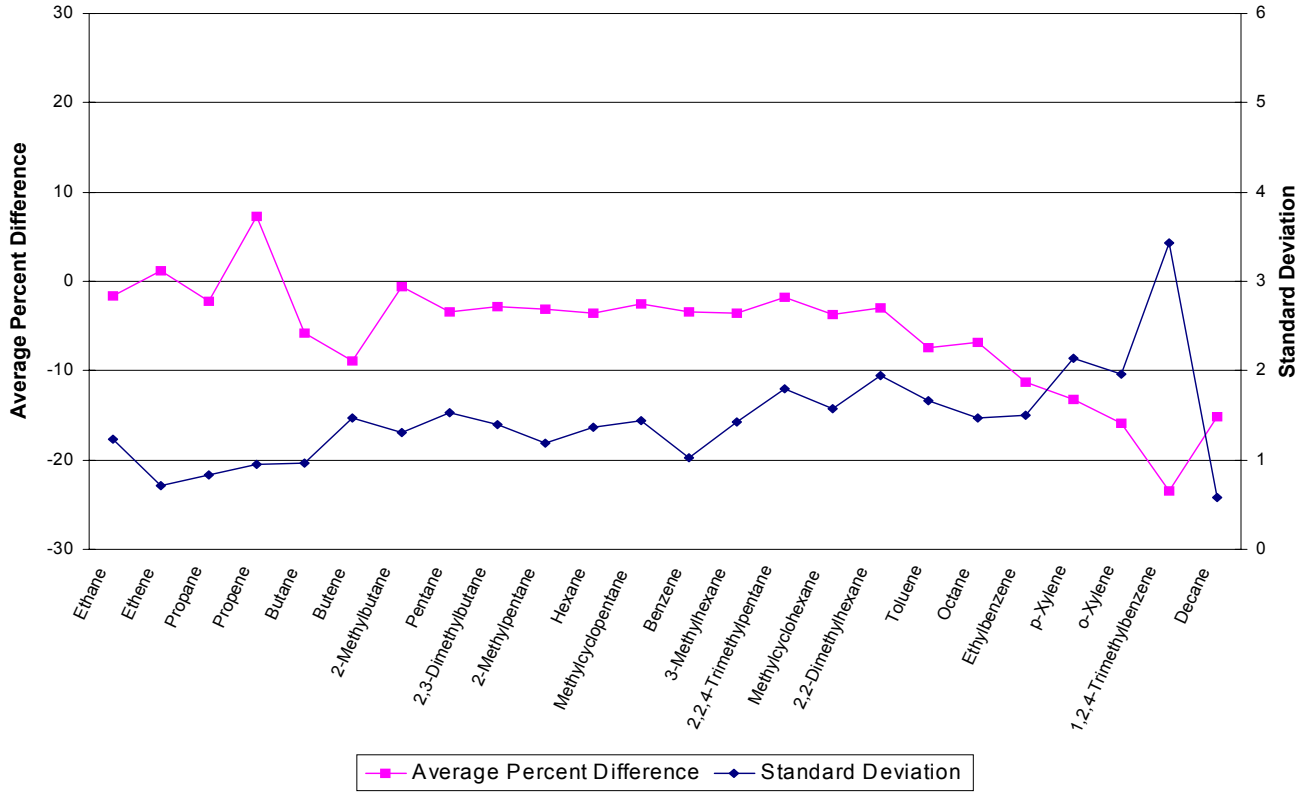


The motor vehicle exhaust program was originally started to determine the reactivity of fuel components in both gasoline and alternative fuels. The program allows hydrocarbon emissions to be compared against the regulatory standard for non-methane organic gases tail-pipe emissions, and to be evaluated for a number of ozone precursors. Special studies are currently being conducted to determine emissions generated from vehicles operated under manufacturers recommendations in the general public. This is a descriptive data set, and no mandatory corrections are made to the data. The laboratory tries to ensure that the data collected is as accurate as possible and meets audit standards.

Accuracy: The Southern Laboratory Branch analyzes exhaust samples collected in the dynobay by the Mobile Source Control Division. Laboratory performance audits are conducted annually of the Southern Laboratory Branch for components of motor vehicle exhaust. The percent differences of the audit values and laboratory results shown here were calculated using the average reported concentration for each GC. Figure D1 illustrates the results for 1998. Overall, the laboratory performed well and provides accurate data to support the

Motor Vehicle Exhaust program. The laboratory did experience low recovery rates for the heavier-end hydrocarbons, but this seems to be typical of all our laboratory operations.

***Figure D1*. ARB's 1998 Motor Vehicle Exhaust Laboratory NMHC Audit Results.**



E. Pesticides

Two types of monitoring, ambient and application, are conducted by MLD to determine the airborne concentration of pesticides. Some of the active ingredients found in pesticides are known to cause a wide range of adverse health effects in people, vegetation, and wildlife. Pesticides are descriptive data sets, so are not subject to meet data quality objectives.

Accuracy (field): Flow audits are performed on pesticide samplers after calibration and prior to sampling to assure data quality. Due to resource limitations, flow performance audits were not conducted in 1998.

Precision (lab): To determine analytical precision, collocated samplers are used and duplicate analysis performed on 10% of the samples. In addition, the laboratory analyzes known standards, runs system blanks to confirm the system is not contaminated, and conducts daily multi-point calibrations or mid-point

calibrations to asses the instrument linearity. These results will be available in future reports.

F. Consumer Products

Consumer products, a chemically formulated product used by the public in homes and businesses, emit approximately 260 tons per day of smog-forming VOCs. Monitoring VOC levels and finding ways to reduce VOC emissions from consumer products facilitates ARB's effort to reduce smog in the State. Consumer products are descriptive data sets. Although formal data quality objectives have not been established, effort is made by staff to ensure the accuracy and precision of the data.

Accuracy: The QAS does not conduct performance audits on the Consumer Product Program at this time due to resource availability. The Organics Laboratory, however, performs internal quality control checks to ensure the validity of the data produced. Below are tasks currently used by the laboratory to ensure precise data. For additional information about the Consumer Product Program, contact Wendy Howard at (916) 322-2382 or via e-mail at whoward@arb.ca.gov.

Precision (lab): To assess the analytical precision, duplicate analysis is performed on 10% of the samples. The results from the two analyses are compared, and for the sample to be valid, the percent difference must be less than 15%. Duplicate data that do not meet the criteria are deleted. Samples analyzed on the same date are also deleted and then re-analyzed. In addition, the laboratory analyzes known 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 asses the instrument linearity. Results from the precision checks are available upon request.

G. Meteorology

The ARB currently monitors such parameters as wind speed, wind direction, ambient temperature, relative humidity, barometric pressure, and total solar radiation. Near real-time data are generated to characterize meteorological processes such as transport and diffusion. From this information, forecasts about air quality, and burn day decisions can be made. The data are also used for control strategy modeling and urban airshed modeling. Modeling is essential to determine concentrations of a pollutant in an area and to change or designate an area as attainment or non-attainment. A meteorology subcommittee of the Air Monitoring Technical Advisory Committee (AMTAC) established the level of acceptability for meteorological data as those used by the U.S. for the Prevention

of Significant Deterioration (PSD) program. They are very strict and the QAS audits to those levels. This is a quasi descriptive data set as the Planning and Technical Support Division (PTSD) defines the specific levels; however, no mandatory corrections are made to the data. Even so, station operators are notified whether they passed the audit or not. Most operators make the effort to meet the audit standards.

Accuracy: The accuracy of meteorological sensors are checked by performing audits on an annual basis. Table G1 contains the 1998 audit results. The average difference 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 the individual measurements. Overall, the network is performing well and providing extremely accurate meteorological data useful for airshed modeling.

***Table G1*. 1998 Meteorological Sensor Performance Audits for ARB Reporting Organization and Portions of San Diego, South Coast and Bay Area.**

Sensor	Number of Sensors Audited	Average Difference	Probability Limits 95%UL	95%LL
Ambient Temp	70	0.0	0.9	-1.0
Horiz Wind Speed	83	0.0	1.9	-1.9
Relative Humidity	10	7.6	29.4	-14.1
Solar Radiation	2	6.4	10.5	2.3
Vert Wind Speed	6	0.0	0.1	-0.1
Wind Direction	80	0.0	3.3	-3.3

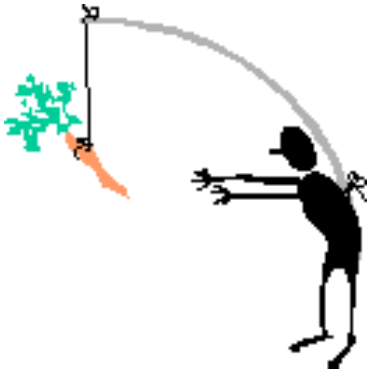
Source: Quality Assurance Section, *Accuracy Estimates*

III. QUALITY CONTROL REPORTS

Quality Control Reports are summaries of the quality control activities used by laboratories to determine the accuracy of air quality data. Such activities include: duplicate samples, control samples, spiked samples, calibrations, and audit results. All QC Reports are reviewed by the PE&S Section to verify that good laboratory practices were followed and to identify opportunities for data quality or process improvement. The PE&S Section makes suggestions, where appropriate, to help improve the overall quality and or effectiveness of the program. Quality Control Reports are submitted quarterly, biannually or annually, depending upon the program.

IV. UPCOMING ADDITIONS

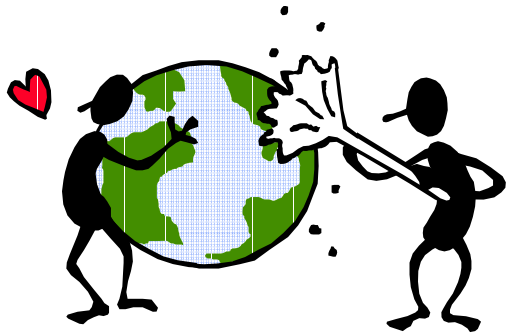
- Standards Laboratory-Background Information
- Standard Operating Procedures
- Precision Data-Tables and Graphs



APPENDIX A

AIR MONITORING NETWORK SURVEY

Quality Assurance Section
Monitoring and Laboratory Division



Gaseous Criteria Pollutant Monitoring as of October 13, 1999

Parameter Measured	Ozone	Nitrogen Dioxide	Carbon Monoxide	Sulfur Dioxide	Hydrogen Sulfide*
Sampling Schedule	Continuous Hourly Average	Continuous Hourly Average	Continuous Hourly Average	Continuous Hourly Average	Continuous Hourly Average
Number of ARB Sites	39	22	23	3	0
Number of District Sites	145	87	66	39	11
Number of Mexico Sites	9	9	8	8	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	Ethylene Chemiluminescence	Gas Phase Chemiluminescence	Non-Dispersive Infrared Photometry	Spectrophotometry (Pararosaniline Method)	Not Applicable
Data Availability	Technical Support Division, Air Quality Data Branch, (916) 323-4887; U.S. EPA Aerometric Information Retrieval System (AIRS)				

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

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Hydrocarbon Monitoring as of October 13, 1999

Parameter Measured	Non-Methane Hydrocarbon Compounds (NMHC)		Continuous Methane and Non-Methane Hydrocarbons		
	Total NMHC	Speciated NMHC (69 species, C2 through C12)	Methane	Non-Methane Hydrocarbons	Total Hydrocarbons
Sampling Schedule	Every 3 days, July through September plus episode sampling (Four 3-hr samples at 11 sites; two 3-hr samples at 2 sites)		Continuous Hourly Average		
ARB Collection Method	XonTech 910A with XonTech 912 Multisampler		Combustion Engineering 8202A or Thermal Environmental (TECO) 55C Hydrocarbon Analyzer		
Sampling Media	Polished Stainless Steel Canister		Not Applicable		
Number of Sites Analyzed by the ARB	14 (High Ozone Areas)		4	4	4
Number of ARB Collocated sites	1		0	0	1
Additional Sites Analyzed by other Agencies	6 SCAQMD (includes 2 continous GC) 4 San Diego County APCD 3 Ventura County APCD		11	17	11
Number of Parallel sites	0		0	0	0
ARB Analysis Method	Method 024 Cryofocusing Direct GC/FID	Method 032 Cryofocusing GC/FID	Flame Ionization Detector		
Laboratory Analyst	Judy Hodgkins	Sean Roy, Pamela Gupta, Stella Ling-Taylor	Not Applicable		
Data Availability	Technical Support Division, Air Quality Data Branch, (916) 323-4887; U.S. EPA Aerometric Information Retrieval System (AIRS)				

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Particulate Matter Monitoring as of October 13, 1999

Parameter Measured	PM10					PM2.5		Total Suspended Particulates (TSP)			Coefficient of Haze	Relative Visibility
	High Volume SSI (0 - 10 microns)			Size Fractional SSI (0 - 2.5 and 2.5 - 10 microns)								
	Mass*	Nitrate Sulfate Chloride Ammonium Potassium	Total Carbon	Mass (coarse and fine)	Al, As, Ba, Br, Ca, Cl, Co, Cr, Cu, Fe, Hg, K, Mn, Mo, Ni, P, Pb, Rb, S, Sb, Se, Si, Sn, Sr, Ti, U, V, Y, Zn, Zr	Mass (fine)	Speciated	Mass	Lead	Sulfate	Particulate	Light Scatter
Sampling Schedule	Every 6 Days (24 hr samples) (Ag Burn sites every 3 days from Sep to Nov)			Every 6 Days (24 hr samples)		Every 3 Days (Bakersfield and Fresno-First St sites everyday)		Every 6 Days (24 hr samples)	Every 6 Days (24 hr samples)	4 Every 12 Days 3 Every 6 Days (24 hr samples)	2-Hour Average	Continuous Hourly Average
Collection Method	High Volume Size Selective Inlet Sampler			Dichotomous Size Selective Inlet Sampler		mass sequential & single channel		High Volume Total Suspended Particulate Sampler			Optical Test Tape Sampler	Nephelometer
Sampling Media	Quartz Microfiber Filter 8 X 10 inch			37 mm Teflon Filter		46.2 mm Teflon Filter		Glass Fiber Filter 8 X 10 inch			Filter Tape	Not Applicable
Number of Sites Analyzed by the ARB	68* (Includes 13 sites in Mexico)	45 (Includes 13 sites in Mexico)	12 (Includes 4 sites in Mexico)	17	17	21	0	13 (Includes 11 sites in Mexico)	15 (Includes 11 sites in Mexico)	5	22	12
Number of Collocated Sites Analyzed by ARB	4	5	1 (Bakersfield)	2 (Bakersfield, Fresno)	2 (Bakersfield, Fresno)	5	0	0	1	1 (Bakersfield)	0	0
Additional Sites Analyzed by other Agencies	12 BAAQMD* 21 SCAQMD* 6 SDAPCD* 50 Other*	19 SCAQMD	6 BAAQMD	1 SCAQMD	0	61	0	1 SDAPCD 1 Ventura APCD 1 Other	0	0	9	1
Number of Parallel Sites	0	0	0	0		0	0		0	0	0	0
ARB Analysis Method	Method 016 Electronic Analytical Balance	Method 007 & Method 023 Ion Chromatography	Method 031 Thermal Con-version to CO2 Followed by IR Detection	Method 029 Electronic Microbalance	Method 034 X-Ray Fluorescence	Method 055 Electronic Analytical Balance		Method 016 Electronic Analytical Balance	Method 005 Graphite Furnace Atomic Absorption/ ZEEMAN	Method 033 Ion Chromatography	Light Transmittance Through a Filter Tape	Scattering Coefficient of Light by Suspended Particles
Laboratory Analyst	Karen Fletcher	Roxana Walker	Kypros Hostetter	George Dunstan	Bill Davis	Jose Orozco		Karen Fletcher	Mike Humenny	Roxana Walker	Not Applicable	Not Applicable
Data Availability	Technical Support Division, Air Quality Data Branch, (916) 323-4887; U.S. EPA Aerometric Information Retrieval System (AIRS)											

* These figures include 10 ARB and 19 district sites where PM10 mass is monitored continuously (1-hr averages) using Tapered Element Oscillating Microbalance (TEOM) monitors or Beta Attenuation Monitors (BAM). Of these, 6 ARB sites have TEOM or BAM only.

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Toxic Air Contaminants Monitoring as of October 13, 1999

Parameter Measured	Volatile Organic Compounds (VOCs)			Carbonyl Compounds	Polynuclear Aromatic Hydrocarbons (PAHs)	Toxic Metals			
						TSP Low-Vol		TSP High-Vol	
	Aromatic and Halogenated Compounds*	1,3-Butadiene and Benzene	Oxygenates (MTBE, ETBE and TAME)	Ethanal (acetaldehyde) Methanal (formaldehyde) Butanone (methyl ethyl 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	Al, As, Ba, Br, Ca, Cl, Co, Cr, Cu, Fe, Hg, K, Mn, Mo, Ni, P, Pb, Rb, S, Sb, Se, Si, Sn, Sr, Ti, U, V, Y, Zn, Zr	Chromium VI	Cadmium (Cd)	Arsenic (As)
Sampling Schedule	Every 12 Days (24 hr samples)			Every 12 Days (24 hr samples)	Every 12 days (24 hr samples)	Every 12 Days (24 hr samples)		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	XonTech 920 Toxic Air Contaminant Sampler		High Volume Total Particulate Sampler	
Sampling Media	Polished Stainless Steel Canister			DNPH-Coated Silica Gel Cartridges	Quartz Microfiber Filter 8 x 10 inch	Teflon Filter 37 mm	Cellulose Filter 37 mm	Glass Fiber Filter 8 X 10 inch	
Number of Sites Analyzed by the ARB	21 (2 in Mexico)			25 (major metropolitan areas)	21	23		11	17
Number of ARB Collocated sites	3 (Bakersfield, Concord, Rubidoux)			2	3	2 (Bakersfield, Stockton)		0	1 (Bakersfield)
Additional Sites Analyzed by Other Agencies	14 BAAQMD			0	0	1 SDAPCD		0	0
Number of Parallel sites	0			0	0	0		0	0
ARB Analysis Method	Method 052 Cryogenic Trap Preconcentration Capillary GC/PID-ECD	Method 051 Cryogenic Trap Preconcentration Capillary GC/PID	Method 050 Cryogenic Trap Preconcentration Capillary GC/FID	Method 022 High-Performance Liquid Chromatography/ Ultraviolet Detector	Method 028 High-Performance Liquid Chromatography/ Fluorescence Detector	Method 034 X-Ray Fluorescence	Method 039 Ion Chromatography	Method 005 Graphite Furnace Atomic Absorption/ ZEEMAN	
Laboratory Analyst	Michele Dunlop, Bruce Joab	Ferry Niyati	Ben Chang, Steve Madden	Paul Chima, Dave Hartman	Dave Hartmann	Bill Davis	Samantha Scola	Mike Humenny	
Data Availability	Technical Support Division, Air Quality Data Branch, (916) 323-4887; U.S. EPA Aerometric Information Retrieval System (AIRS)								

Dichloromethane, trichloromethane, tetrachloromethane (carbon tetrachloride), 1,2-dibromoethane, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene (perchloroethylene), toluene, styrene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, o-xylene, m-xylene, p-xylene, ethylbenzene, and chlorobenzene.

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Acid Deposition Monitoring as of October 13, 1999

Parameter Measured	Wet Deposition			Dry Deposition 0-2.5 micron				
	Conductance and pH*	Chloride Nitrate Sulfate	Ammonium Calcium Magnesium 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	6			1				
Number of ARB Collocated sites	0			0				
Additional Sites Analyzed by other Agencies	1 SDCAPCD	0		0				
Number of Parallel Sites	0			0				
ARB Analysis Method	Method 036 Conductivity and pH Meter	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	Lyman Dinkins			Nehzat Motallebi - Research Division				
Data Availability	TSD, Air Quality Data Branch, (916) 323-4887; U.S. EPA Aerometric Information Retrieval System (AIRS)			Technical Support Division, Air Quality Data Branch, (916) 323-4887				

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Ambient Meteorological Monitoring at Air Monitoring Stations as of October 13, 1999

Parameter Measured	Wind Speed	Wind Direction	Ambient Temperature	Relative Humidity	Atmospheric Pressure	Solar Radiation
Sampling Schedule	Continuous Hourly Average	Continuous Hourly Average	Continuous Hourly Average	Continuous Hourly Average	Continuous Hourly Average	Continuous Hourly Average
Number of ARB Sites	41	41	36	17	3	5
Number of District Sites	128	128	105	49	22	31
Number of Mexico Sites	9	9	9	0	0	0
Method Used by ARB	Propeller or Cup Anemometer	Wind Vane Potentiometer	Aspirated Thermistor or Thermocouple	Thin Film Capacitor	Not Applicable	Thermopile or Pyranometer
Data Availability	Technical Support Division, Air Quality Data Branch, (916) 322-6076; U.S. EPA Aerometric Information Retrieval System (AIRS)					

MLD/QAS/13 Oct 99

References

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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.