



2019

Annual Data Quality Report

Executive Summary

California Air Resources Board's
Primary Quality Assurance Organization

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Executive Summary

The Code of Federal Regulations (CFR) defines the California Air Resources Board (CARB) as one of seven primary quality assurance organizations (PQAO) in California responsible for monitoring air pollutants and assessing data quality. The purpose of this report is to provide ambient air quality data producers and users with a centralized review of the data quality within CARB's PQAO with respect to criteria defined by measurement quality objectives (MQO).

The MQOs reviewed include data capture (amount of ambient data reported), precision (the degree of mutual agreement among individual measurements of the same property), bias/accuracy (the degree of agreement between an observed value and an accepted known or reference value), and the amount of precision and bias/accuracy data collected and reported. The criteria by which the assessments are made are mostly dictated in CFR¹ and are listed in Appendix A of this report. Appendix B provides details on the instruments/samplers that did not meet certain criteria. The U.S. Environmental Protection Agency (U.S. EPA) has designated CARB, the Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), San Diego County Air Pollution Control District (SDCAPCD), National Park Service (NPS), Morongo Band of Mission Indians, and Pechanga Band of Luiseño Indians as their own PQAOs. Where appropriate, comparisons of results to BAAQMD, SCAQMD, and SDCAPCD and the national average² are made. It is important to note that this assessment is solely based on data available in U.S. EPA's Air Quality System (AQS). PQAOs may have collected certain precision and/or bias/accuracy data that were not uploaded to AQS; in some cases, that particular data were not federally required to be uploaded.

The gaseous criteria pollutants assessed include: carbon monoxide (CO), ozone (O₃), nitrogen dioxide (NO₂), and sulfur dioxide (SO₂). The ambient data capture rate represents the percentage of ambient data collected and uploaded to AQS compared to the total amount of data possible. For gaseous pollutants, one-point quality control (1-pt QC) precision checks (mostly automated) are performed by the monitoring organizations to confirm the instrument's ability to respond to a known concentration of gas. Precision represents the degree of variability among the 1-pt QC checks. These checks are also used to assess bias/accuracy for each instrument via comparing the instrument response to a reference gas.

Precision for most particulate matter (PM₁₀ and PM_{2.5}) samplers is assessed via collocated sampling whereby two identical or equivalent samplers are operated side-by-side.³ Bias for PM samplers is assessed by using the routine flow rate verifications

¹ Title 40 CFR Appendix A to Part 58.

² National average includes state, county, district, National Park Service, and tribal sites, including those in California.

³ Collocated sampling is required for all PM samplers, except continuous PM₁₀

performed by site operators. Total PM_{2.5} bias for a PQAO is also assessed through the Performance Evaluation Program (PEP) run by the U.S. EPA.

Accuracy for both gaseous instruments and PM samplers is further verified by CARB's performance evaluation audit program using through-the-probe audit techniques on gaseous instruments and checking flow rates on particulate samplers. The ambient data capture rate and the accompanying precision and accuracy data for 2019 from both gaseous instruments and PM samplers are summarized below, followed with recommendations.

The statistics reported in this report are intended as assessment tools for the data producers and users to identify areas where program improvements can be made to achieve all MQOs set by U.S. EPA or the data producers themselves. Although CFR criteria for precision and accuracy are generally applied and evaluated at the PQAO level, assessments at the district or site level may differ and can be important as well. However, it is important to note that when certain CFR criteria are not met, it does not necessarily mean that the corresponding air quality data should not be used, but rather, the data should be used with the knowledge of the quality behind it. The 2019 ambient data in AQS for CARB's PQAO have been certified and are considered suitable for comparison to federal standards.

As all data in this report come from AQS, data producers are encouraged to review their monitoring networks to ensure that it accurately reflects the number of sites/samplers operating and that all required ambient, precision, and accuracy data collected are continually reported to AQS in a timely manner (within 90 days of the end of each quarter per CFR).

Gaseous Instruments

Key findings and recommendations pertaining to gaseous instruments are highlighted below.

- Ninety-six percent of the gaseous instruments operating under CARB's PQAO achieved the ambient data capture rate of at least 75 percent in 2019, with 95 percent also achieving CARB's goal of at least 85 percent data capture.
- Ninety-six percent of the gaseous instruments operating under CARB's PQAO reported at least 75 percent of the required QC checks submitted to AQS. Most met the revised critical criteria (on percent and absolute difference) for individual QC checks, set by U.S. EPA,^{4,5} starting in March 2018.

⁴https://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/APP_D%20validation%20template%20version%2003_2017_for%20AMTIC%20Rev_1.pdf

⁵<https://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/Changes%20to%20Validation%20Templates%202013%20to%202017.pdf>

- CFR precision and bias/accuracy criteria (from 1-pt QC checks) were met at the PQAO level on an annual basis.
- Performance audit data indicate that, except for a few instruments, CARB's PQAO met the audit criteria. This finding is consistent with the bias information obtained from the 1-pt QC checks.

Recommendation – Gaseous Program

- Although MQOs associated with the gaseous instruments were met at the PQAO level, there were a few instances of analyzers not meeting the MQO (e.g., ambient data capture rate, submittal of required QC checks, etc.). Monitoring agencies should investigate why these objectives were not met for each analyzer in their respective jurisdictions and develop corrective actions, if appropriate, to meet them in subsequent years.

PM Samplers

Key findings and recommendations pertaining to PM samplers are highlighted below.

- Ninety-nine percent of the particulate samplers operating under CARB's PQAO achieved the ambient data capture rate of at least 75 percent in 2019, with 94 percent also achieving CARB's goal of at least 85 percent data capture.
- As indicated in CARB's *Annual Network Plan Covering Operations in 25 California Air Districts, July 2020*,⁶ CARB's PQAO continued meeting the minimum 15 percent collocation requirement.
- For the 5 PM₁₀ and 15 PM_{2.5} pairs of collocated samplers that were present within CARB's PQAO, all reported at least 75 percent of the required precision data in 2019 – an improvement compared to 2018.
- For PM₁₀, with the exception of one geographic area, the precision criteria was met in CARB's PQAO (as well as in other California PQAOs).
- For PM_{2.5}, CARB met the precision criteria at the PQAO level for two of six methods of collection (both methods involving sequential samplers with very sharp cut cyclone), with overall precision results slightly improving compared to previous years.
- Almost all PM₁₀ and PM_{2.5} samplers reported flow rate verification data to AQS, and the results indicate that the PM network exhibited low bias.
- The audit accuracy data indicates that CARB's PQAO met CARB criteria for flow rate audits. This finding is consistent with the bias information from the routine flow rate verification data.

⁶<http://www.arb.ca.gov/aqd/amnr/2020anp.pdf>

- Total PM_{2.5} bias for CARB's PQAO, via the Performance Evaluation Program conducted by U.S. EPA based on mass samples, shows results higher than bias results determined via flow rate verification and audits.

Recommendations – PM Program

- In terms of precision, coefficient of variation (CV) values among collocated PM_{2.5} samplers remain high in 2019 within CARB's PQAO and generally on a national basis. CARB has continued exploring the potential causes behind low PM_{2.5} precision among some of the collocated PM_{2.5} samplers within CARB's PQAO. The empirical analysis includes the evaluation of multiple years of data and a breakdown of results based on monitors that use federal reference vs federal equivalent methods. While no definitive source of imprecision has been identified, staff have begun a discussion with monitoring agencies to closely examine operational practices in order to help the PQAO achieve the precision criteria for PM.
- There were instances of samplers not meeting the MQOs (e.g., ambient data capture rate, submittal of required collocated measurements, etc). Monitoring agencies should investigate why these objectives were not met for each sampler in their respective jurisdictions and develop corrective actions, if appropriate, to meet them in subsequent years.