Data's Journey to AQS and Beyond: The Data Management Process

The Beginning of Data Generation
(PM2.5 and ozone example)

Infographic Key

Data

Process

Staff involved with data collection and validation

Operators Chemists Data Managers Managers

Validation Process Menu

Qualifier codes can be applied or suggested at any level

Level 1

Goal
- Distinguish measurements from measurement errors or interferences

General Tasks
- Review the most important step in the process
- Check documentation - QC forms, station logs, control charts
- Look for missing data or downtime
- Review preliminary data
- Flag suspect data for further review
- Some validation is automated in DMS

Level 2

Goal
- Verify Level 1 review and ensure data quality control requirements are met

General Tasks
- Verify 1st level validation
- Review Level 1 qualifiers/QC form edits & notes
- Assess QC data closely
- Verify auto validation data (2-point QC checks)
- Review control charts/maps
- Review minimums and maximums against NAAQS & CAAQS
- Analyze 8-hr and daily averages
- Conduct data comparisons between local sites in the air basin

Level 3

Goal
- Approve agency data suitability for release to AQS

General Tasks
- Review data completeness and data capture rates
- Request for exceptional events
- Ensure proper validation steps 1 and 2
- Approve data for upload to AQS
- Review data for exceedance below to AQI (generally 7) days after quarter's end (some Districts do this monthly)

Monitoring

Monitoring station - field QC

When	PM2.5	Ozone
Daily	Verify proper operation	Verify proper operation and autocals performed
Bi-weekly	Flow/leak check, temperature and pressure	Maintenance checks
Monthly	Flow/leak check, temperature and pressure	Data completeness
Yearly/ Semi-yearly	Yearly zero background check	Pre-season season, semi-annual, as-is calibration
Yearly	Calibration	Multi-point calibration

Inside the monitoring station

Use standardized calibration procedures & proper standards

Keep logbooks for station and each instrument

SOPs must be on-site for every procedure

Performance Evaluation Audits

PE Audit types:
- Audits of criteria pollutant monitors
- Particulate samplers
- Meteorological sensors
- Laboratory

Some techniques:
- Statistics - Use a known concentration "Through the Probe"
- Pick compared instrument's flow rate to a NIST certified orifice, or a mass flow meter/standard

Data Aquisition Systems (DAS)

Validation Level 1

Continuous monitoring data - Ozone, NO2, continuous PM, CO etc.

Data sent via cellular modem, satellite or wireless to DMS

Data sent via cellular modem, satellite or wireless to DMS

Data sent to Laboratory Information Management System (LIMS)

The Great Filter Cycle

Clean filters
- Inspected, pre-conditioned
- Inspected again
- Weighed, mass value recorded on COC
- Electronically transfer data into LIMS
- Package & ship filters to sites with COC

Sampled - dirty filters
- MUST be post-weighed within 10 days of sampling, UNLESS shipped & received at -18°C (with temperature strips)
- Post-condition for 24 hrs
- Pull filter, note any field comments into LIMS
- Site operators must report any problems from field to lab

Standards Laboratory

Standards & services are provided for monitoring, audits and for the laboratory

Certification parameters include
- Low and high flow devices
- Temperature sensors
- and humidity sensors
- Barometric pressure
- Needle standards
- Gas mixes: NO, CO, & SO2

PM 2.5 Laboratory

Each Year the ARB PM lab weighs about 7,000 samples, which is equal to about 15,000 weighings when QC samples are included.

Plus several Districts have their own labs!

Laboratory conditions
- Temperature: 20-23°C
- Relative humidity: 30-40%
- Microbalances NIST-calibrated annually

Balance and weight standards
- Micro-balance NIST-certified & calibrated annually
- Primary weights NIST-certified annually
- Working weights certified quarterly

Types of blanks
- Used as controls during weighing sessions
- Lab blanks
- Field blanks
- Field blanks
- Trip blanks

Data Management Systems (DMS)

Exports real-time data to web pages, AQMIS, Airnow, etc.

Automatically performs: - Level 1 validation - Auto QC checks

Provides data review/validation resources for staff

Tracks data from incoming sources

DMS generally do the following:

Tracks regulatory data uploaded to AQS

Data uploaded to AQS

Laboratory data and QC imported into database

Schedules, assigns, and tracks samples

Stores and manages data. For example, LIMS performs calculations

LIMS generally do the following:

Prepares sample data for inspection, approval, and compilation for validation, reporting and/or further analysis

Initial sample log-in and associated data entry

Data uploaded to AQS

Data is validated within DMS/LIMS systems and externally as simply described in validation process menu, then exported to AQS.

Data is validated in AQS in various ways, as well

Near Real-Time Data Systems

Hourly data sent via internet

Air Now, AQMIS & other agency near real-time data systems

These systems are used by the public, schools and emergency response to make decisions about daily activities.

Validation Level 1

Validation Level 2

Validation Level 3

Validated Data

Databases

Database name	Pollutants included	Type of data
Air Now & Other agency real-time	Federal	Near real-time/ subject to change
AQMIS	State & Federal	Near real-time/ subject to change
IADAM	State & Federal	Data for Record
AQS	Federal	Data for Record Includes precision and accuracy

Operators and Data managers can use AQMIS to check "this-right-now"

Data from AQS is transferred into IADAM by ARB staff

AQS System

EPA's Air Quality System (AQS) stores data from about 60,000 monitors. The system contains ambient air pollution data collected by EPA, State, Local and Tribal air pollution control agencies. AQS also contains meteorological data, siting data and QA/QC information.

Monitoring Organizations and other users rely upon the system data to assess air quality, assist in Attainment/ Non-Attainment designations, evaluate State Implementation Plans (SIPs) for Non-Attainment Areas, perform modeling for permit review analysis and other air quality management functions.

Data for record is back-filled from AQS and IADAM into real-time systems so that Air Now and AQMIS also contain validated data from the past!

WOW!

AQS Submittal Process Expanded

Change	Cause	Certification Letter
Original values in data system	Hourly Lotus-Lite data submitted with original values in raw data system	Certification Letter: Districts send a letter to the ARB certifying that the data is complete, properly qualified, and QA/QC ready for storing
Original data with qualifiers	Lotus-Lite data submitted with qualifiers added to raw data system	Reports: Monthly, quarterly, annual reports are sent to EPA for storing in AQS
Original data with new values	Lotus-Lite data submitted with new values added to raw data system	The certification letter and reports are sent to EPA only if the data is complete, properly qualified, and QA/QC ready for storing
Original data with new qualifiers	Lotus-Lite data submitted with new qualifiers added to raw data system	AMP 450/AMP 600: Send QAR Report, Annual Data Report, Annual Precision Report, Annual Bias Report, Annual Summary Report, monitoring organization's QA/QC procedures

AQS is used to generate reports, summaries, QA and QC data, etc.

Districts send a certification letter to either U.S. EPA Region 9 directly, or if ARB certifies their data, Districts send the letter to ARB. ARB then sends a certification letter for those Districts' and ARB's data to EPA.

Certification letter

AMP600

Example: For gases and continuous PM2.5 in ARB's PQAO, the AMP350 is sent by AQPSD to the Districts once data are uploaded. Briefly, Districts review this report to ensure parameters are correct, it matches their DMS data, max values make sense and a monthly maximum is recorded.

AQS is used to calculate Design Values

1-hour ozone raw data.

1. Eight hour averages are calculated from 1-hour raw data.

2. The 4th maximum daily value is listed on the AMP 450 report

3. The value in #2 above is used to calculate the Design Value for an individual site – which is produced in the Design Value Report

End Users Of Our Data

Data Use Examples

Area Designation maps

Design Value
The Design Value is the pollutant concentration used as the basis for determining attainment of an air quality standard. The federal design value may or may not be the same as the State designation value.

End Users

Determine trends and attainment, confirm models, develop regulations …

The data drive changes which clearly have results!

Rule Development & SIPs

Emission Reduction

Better Air Quality!

Data Quality Report

Provides data producers and users an assessment of data quality
- Gases (CO, O3, NO2, SO2)
- Particulates (PM10, PM2.5)
- Precision and accuracy of criteria pollutants
- Compare against measurement quality objectives (federal criteria)
- Identify where improvements are needed

2013 Summary of Precision and Accuracy

Pollutant	Precision	Accuracy
Gases	✓	✓
Particulates	○ Less than required collocated sites ○ Annual precision criteria not met for PM2.5	✓

Corrective Action Notification (CAN)

Data and Air Quality Data Action (AQDA)

Technical Systems Audit (TSA)

TSA Questionnaire

Data Quality Objectives (DQOs)

DQOs

Created by ARB's Monitoring and Laboratory Division in collaboration with the Air Quality Planning and Science Division, U.S. EPA Region 9 and California's Air Monitoring Organizations.
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