Revising Volume IV of QA Handbook for Ambient Air Monitoring - Meteorology

Part 2
Applications in Ambient Air Monitoring

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Purpose of “Applications”

- Continuing from Part 1 of these paired presentations…
- QA for Ambient Air Quality: not airport weather, road conditions, recreational areas, engineering design…
- See where and how this QA guidance fits into your program:
  - Program design
  - Equipment recommendations
  - Sensor locations
  - Helpful QA tips
- Further reading sources
- Watch for release of the revised handbook

Regulatory Basis for Volume IV

- Supports regulations and guidance for air quality measurements for regulatory purposes that include meteorology:
  - Licensing (40 CFR 51, Appendix W, Guideline on Air Quality Models; 40 CFR 52.21, Prevention of Significant Deterioration of Air Quality and 40 CFR 58, Appendix B, QA for PSD)
  - Network Design Criteria in 40 CFR 58, Appendices D and E
    - Siting for spatial scales and purposes
    - SLAMS, NCore, PAMS and Enhanced Ozone (photochemical)
    - Methods and QA point to Volume IV
  - EPA's QA Handbook for Air Pollution Measurement Systems, Volume II – Ambient Air Quality Monitoring Program
    EPA-454/B-17-001

Program Design

- Use existing data? Check the details, including QA
- If purpose is for an elevated source, you may need a tall tower, multiple short towers, or remote sensing
- Wind and temperature (not as simple as it sounds)
- Transport – produce wind vectors for trajectory
- Dispersion – scalar wind speed with unit-vector direction, atmospheric stability, depends on model input
- Photochemistry – add PAMS and/or model measurements; consider cloud cover without suitable airport observations
- Specific sources – for dust, add precipitation and wind gusts

Equipment recommendations - 1

- Acquire sensors and calibrate to sensor specification requirements in Handbook
- Install and operate so system performance be field verified to program requirements

- Ambient air temperature by thermistor resistance sensor in naturally ventilated shield
- Delta-temperature by paired, accurate sensors in mechanically-aspirated shields
- Horizontal wind speed and direction by mechanical or sonic anemometer oriented to true north; for gusts, record maximum 3-second running average of scalar speed (not instantaneous, particularly for sonics)

Equipment recommendations - 2

- Relative humidity: electronic capacitance sensor (do not use included temperature for the ambient measurement)
- Solar and ultra-violet wavelength radiation: Class-B pyranometers with built-in signal processing.
- Precipitation rate and total: recording gauge with tipping-buckets, include heated funnel for snow; typical increment 0.01-inch or metric unit, larger increment for high rainfall rates. Consider including a simple manual total gauge to assist with data validation.
- Barometric pressure: electronic aneroid sensor with outdoor inlet exposure; select pressure range by station elevation.
- Mixing layer depth: lidar ceilometer with suitable algorithm.

Sensor location

- Check program-specific requirements
- Wind sensor: 10-meters above ground level (mAGL) reduce interference from obstacles, higher of necessary
- Air temperature and humidity: 10-mAGL is satisfactory; option of 2 to 3-mAGL if located away from pavement or structures
- Solar sensors: clear paths to sun angles
- Ceilometer: clear path to vertical (check unit installation guide)
- Precipitation gauge: surface if area accommodates obstruction clearance, otherwise shelter roof with adequate operator access

A Few QA Tips

- Develop your program procedures utilizing guidance like Volume IV – but be specific to your process and equipment
- Utilize the instrument manual and manufacturer's expertise
- For wind sensors, ensure that technicians can readily check alignment from the ground.
- Remote access by smart data loggers is fine but include "frequent" onsite visits by trained technicians.
- Site technicians make simple site log entries on weather conditions to assist with data validation
- Very basic: follow your requirements, produce usable documentation

Further reading

- Some methods to test instrument performance compared to specifications (Test Method) and instructions on using instruments (Standard Practice) are based on ASTM Standards maintained by Subcommittee D22.11 of ASTM in Committee D22 Air Quality.
  Good example: D5741 “Standard Practice for Characterizing Surface Wind Using a Wind Vane and Rotating Anemometer”.
  See “meteorology” in: https://www.astm.org/
- American Meteorological Society and Air and Waste Management Association conferences have had presentations on the role of Standards and examples of meteorological field studies for air quality purposes.
- For background to QA for meteorology: “Quality Assurance in Meteorological Measurements for Environmental Applications Past, Present and Future” paper 2.4 at the 18th History Symposium with Dr. Ken Underwood at the AMS Annual Meeting in 2020.
  see Paul Fransioli for a copy: acslinlv@gmail.com

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Ensuring data quality is not for the weak

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