

BAM-1020 Training Session
- Considerations for Optimal Data Quality -

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Considerations for Optimal Data Quality

Met One maintains an active relationship with our BAM-1020 particulate monitor customers, especially domestic PM2.5 FEM users. This allows us to gain feedback and quickly identify and address any operational issues. Most issues and considerations can be grouped into the following areas:

- **Analog Output Scaling or Voltage Errors.**
- **Zero Filter Test Considerations.**
- **Shelter Conditions and Temperature Stability.**
- **Sample Humidity Control.**
- **Routine and Critical Maintenance.**
- **Site Selection and Collocation.**

Analog Output Scaling and Voltages

- Use of the BAM analog output requires additional setup steps and additional data validation scrutiny! Digital is recommended.
- 0.000 to 1.000 volts does NOT equal 0 to 1.000 mg, but instead usually -0.015 to 0.985 mg. Incorrect scaling of the logger usually looks like a 10 or 15 ug positive bias in the BAM data.
- The BAM output has a +/- .001 volt (1 ug) error tolerance. Any errors can be compensated for in the logger input voltage scaling.
- Setup requires forcing the BAM voltage at multiple levels and verifying all the way to the logger data file.
- Periodic BAM digital data downloads should still be compared to the logger data files on a routine basis.
- Early cycle mode clock synchronization is critical! A few seconds of full scale voltage included in the average will create a significant and possibly intermittent error.

Zero Filter Test Considerations

- The zero filter test must be performed at the field site, primarily to establish the BKGD zero correction, and secondarily to audit the site for sources of instability.
- An Excel spreadsheet is available for zero data analysis. Any background changes should be documented.
- The background correction can vary from site-to-site.
- The BKGD value really should be set to 0.0000 during the test if any adjustments are to be made. Leaving the previous value set during the test often leads to incorrect calculations.
- Noisy zero data should NOT be used to calculate the BKGD The noise must be addressed first.
- Any hourly noise should be statistically random with no diurnal swings or patterns. The noise averages out of the daily average.

Zero Filter Test Considerations

- Sources of hourly BAM noise can include static buildup on the inlet tube, poor grounding, flow leaks, large temperature swings in the shelter, faulty filter RH regulation.
- The first few hours of BAM data after power-up tend to be noisy and should be discarded.

Shelter Conditions and Temperature Stability

- The BAM shelter temperature must be maintained between 0 and 50 degrees C. Overheating should be avoided.
- The exact temperature is not important as long as it is fairly stable from hour to hour. Variations in the air density between the beta source and detector can appear as several micrograms of mass noise in the hourly data.
- Daily temperature variation patterns are not as important.
- Non-air conditioned mini shelter are the most problematic. The shelter temperature should be logged in the hourly BAM array whenever possible.
- Walk-in environmentally controlled shelters are optimal and recommended when possible.
- The BX-902B mini shelters have been recently redesigned for better performance.

Humidity Control

- The BAM filter tape is considered hydrophobic, but the particulate absorbs moisture. Excess moisture can cause positive BAM bias.
- The BAM regulates the filter RH to below 35% with the inlet heater and a filter RH sensor.
- The filter RH sensor is somewhat failure-prone, and usually fails at an absurd value such as -25% or 135%.
- The RH sensor MUST be equilibrated to ambient RH if calibration is attempted, or a large positive RH bias will result.
- Filter RH data is logged on BAM data channel 4. This should be reviewed regularly to ensure that the RH is being properly controlled.
- Insulating the BAM inlet tube above the heater can improve RH control, especially if an air conditioner is used.

Routine and Critical Maintenance

- Leaks at the filter tape cannot be identified by the BAM, and may result in positive or negative data bias, and can require invalidation of a large amount of data!
- Regular routine nozzle and vane cleanings prevent leaks.
- High RH locations are the most susceptible to nozzle debris buildup.
- Leak checks should include the PM2.5 cyclone.
- Filter spot evaluation is a useful tool for evaluating BAM operation. Leaks always result in improper-looking dust spots such as uneven distribution, fuzzy edges, halos, and pinholes.
- Artifacts on the tape can be caused by inlet motion in the wind, causing positive data spikes.
- The used filter tape should be kept until after data is validated.

Routine and Critical Maintenance

- BAM flow audits and calibrations should be performed with the same standards used for your FRM samplers.
- PM10 inlet and cyclone particle traps must be cleaned monthly! Thorough disassembly and cleaning should be done periodically.
- The vertical inlet tube should be cleaned at least yearly. Debris falling out of the inlet causes positive data spikes.

Site Selection And Collocations

- The instrument spacing must be between 1 and 4 meters. Two meters recommended when possible. The inlet heights must be within 1 meter. Improper collocation often causes invalid correlations.
- Proper FRM filter handling is absolutely critical when the data is compared to a BAM for a collocation study!
- Limited data sets in a very narrow concentration range may seem to indicate a slope or offset problem which goes away when some variation in the daily concentrations occurs and additional data points are added.

Other Considerations

- Existing BAMs should be upgraded to Rev 3.6.3. This has improved error subcategories, refined alarm definitions. All conditions resulting in hourly data repeats have been removed. Each data point is either a valid data point or a full-scale alarm value.
- The BX-965 Report Processor back panel option is highly recommended for all digital data logger applications. The data cannot be interrupted by BAM sample cycle functions. USB and Ethernet connectivity is provided. Custom Query data outputs are available.
- The BAM-1020 manual Rev H includes updated alarm descriptions, FRM comparison notes, and 3.6.3 firmware details.