Top Ten Pitfalls of Appendix D Monitoring

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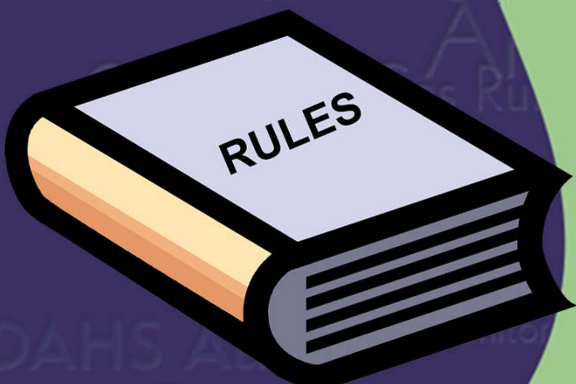
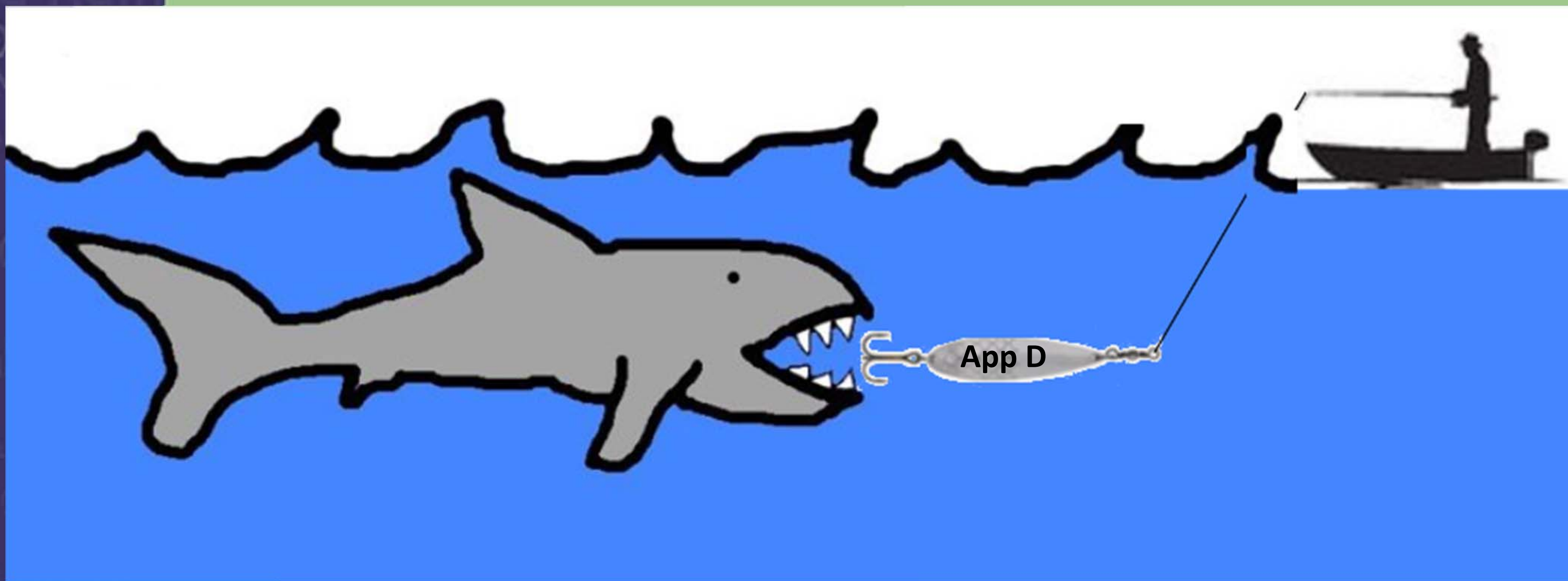
40 CFR 75 Appendix D

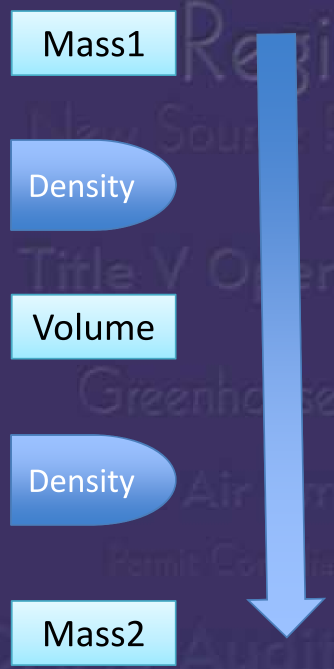
- §1.1 "…may be used in lieu of continuous SO_2 pollutant concentration and flow monitors for the purpose of determining hourly SO_2 mass emissions and heat input from: gas-fired units…or oil-fired units"
- Includes procedures for:
  - Design, installation and calibration of gas and oil fuel flow meters
  - Conducting fuel sampling and analysis to determine sulfur-in-fuel content, density and/or gross calorific value (GCV)



It's More than Meets the Eye



1. Mass-Volume Conversions



Pitfall: The fuel flow rate unit of measure is converted from mass to volume and back to mass (or volume to mass and back to volume) using different conversion methods that exist from within the meter to within the DAHS, including intermediate conversions from within the plant data system. The different conversion methods can impact the accuracy of the data reported in the quarterly EDRs.

Reviewing your system:

- What is the inherent measurement principle for the fuel meter type? Is the monitoring system principle (mass vs volume) correctly identified in the electronic monitoring plan?
- Are any density constants programmed into the fuel meter computer?
- What path does the fuel meter signal take to the DAHS? Are there any conversions made along the way?
- If density constants are used, how were they determined and how often are they (re)validated? Are the same constants used throughout the system?
- Is the data flow and conversions documented in an easy to read format?

2. Correcting to Standard Temperature

Pitfall: The flow computations correct gaseous flow rates to a temperature other than 68°F, a Part 75 requirement.

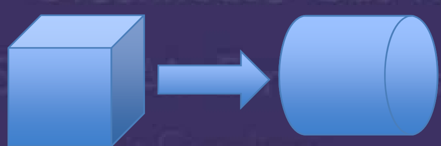
Reviewing your system:

- Confirm the flow metering system is configured to correct to 68°F (and 1 atm). Correcting to 60°F can cause a ~1.5% error in reported fuel flow (Part 75 meter accuracy is 2%).

Other flow computer considerations:

- Super-compressibility factor. The AGA3 gross method is simpler than the AGA3 detailed method but is only valid over a narrow range of fuel specifications.
- Calibration constants (e.g. "k" factors). Are the constants from the calibration report used within the plant's / flow computer's computations?

3. Invalid Flow Meter Calibrations



Pitfall: The fuel meter is not calibrated according to §2.1.5.1 or §2.1.5.2.

Reviewing your recordkeeping:

- Does the calibration recordkeeping reference an applicable standard from §2.1.5.1?
- If calibrated according to §2.1.5.2:
    - Does the recordkeeping document that the <u>reference meter</u> was calibrated according to §2.1.5.1 within the past 365 days?
    - Were any secondary elements, such as pressure and temperature transmitters, calibrated immediately prior to the comparison?
    - Were three, 20-minute runs per flow rate tested?
    - Do the tested flow rates correspond to the normal minimum, maximum and approximate midpoint range of unit operating load? The normal maximum may be notably less than the meter's upper range value (URV).
- Are the results expressed as a percent of the meter's URV?

4. Poor Transmitter Accuracy Test Records

Pitfall: Transmitter accuracy test recordkeeping does not satisfy §2.1.6.1 requirements.

Reviewing your recordkeeping:

- Ensure the recordkeeping documents the NIST traceability of the calibration equipment.
- Ensure the transmitter reading and reference values are presented in consistent units of measure (e.g. mA or °/”H_2O/psi).
- Final results should be calculated as a percent of the full-scale range of the transmitter. The full-scale range of each transmitter should be documented.
- Ensure all transmitters are calibrated and the reported values represent the max/sum of all three transmitters at each level.
- The calibration levels should include a zero-level and two other levels such that the normal unit operating range is represented. As an exception, the zero and upscale levels for the temperature transmitter may correspond to fixed reference points (e.g. freezing/boiling water).

5. Meter Design and Installation

Pitfall: Fuel meters have not been designed and/or installed according to the applicable standard and/or the manufacturer's recommendations. Examples we've seen include inadequate up/downstream distances from disturbances, Coriolis meters installed upside down; orifice plates installed backwards, condensate drain hole at bottom of orifice plate, etc.

Reviewing your system:

- Review applicable standard and/or manufacturer's specifications to identify any deficiencies (e.g. flow straighteners)
- Fuel metering location and suitability of the location should be documented.
- Take pictures to document the Primary Element Inspections (PEIs)
- Don't take (optional) orifice plate measurements unless you compare to the acceptability criteria

6. Applying natural gas GCV hourly

Pitfall: Without petition approval, reporting hourly averages of natural gas Gross Caloric Value (GCV) from a gas chromatograph (GC) rather than monthly averages within the EDR. §2.3.4.1 states that if multiple GCV samples are taken and analyzed in a month, the values from all samples should be averaged to obtain a monthly value.

Reviewing your system:

- If a gas chromatograph is used to monitor the GCV in real time, the data should be reduced to monthly averages for EDR reporting purposes, or the facility should submit a petition to apply the data hour-by-hour.
- If a GC is utilized,
  - the hardcopy monitoring plan should detail the data reduction and missing data substitution procedures.
  - the electronic monitoring plan should include the GC as a monitoring system component.
  - the QA/QC Plan should document the applicable QA/QC procedures and passing criteria.

7. Using Flow Meters to Determine Operating Status

Pitfall: The DAHS is configured to use fuel flow rate thresholds to determined process on status. Malfunctioning fuel meters or fuel meters unable to detect low flow rates may cause under-reporting.

Reviewing your system:

- Consider using other process data (e.g. flame-on) to determine process on status or use a combination of signals.
- Consider configuring DAHS alarms to review questionable "off-line" data. For example, if O_2 is less than 20%, but the unit is offline, the data should be reviewed. Such alarms can help identify fuel flow meter malfunction events.
- If fuel meters are unable to accurately record low flow rates, consider utilizing the default minimum fuel flow option.

8. Incorrect ID in Electronic Monitoring Plan

Pitfall: The make, model and serial number of the transmitter or flow computer is referenced in the electronic monitoring plan instead of the primary element.

Reviewing your monitoring plan:

- The primary element should be marked with a unique serial number.
- The make, model and serial number of the primary element (e.g. orifice plate) should be referenced in the electronic and hardcopy monitoring plans.
- Calibration records for transmitters or flow computers should identify the primary element that they serve.

9. Mislabeling URV and UMX values

Pitfall: The Max Fuel Flow Rate reported in the electronic monitoring plan must be based on either the “Upper Range Value (URV)” of the fuel meter or the “Unit Maximum Rate (UMX)” equivalent to the reported maximum hourly heat input capacity. The value in the electronic monitoring plan may be mislabeled or may be inaccurate.

Reviewing your monitoring plan:

- How was the max fuel flow rate determined (this should be explained in the hardcopy monitoring plan), and is the source code reported in the electronic monitoring plan correct?
- Does the reported maximum fuel flow rate make sense? The URV of the fuel meter is often much higher than the capacity of the combustion unit which could lead to over-reporting during missing data periods.
- If using the UMX and the maximum heat input capacity is updated, then the maximum fuel flow rate should also be updated.

10. Unnoticed Shifts in Data

Pitfall: Something negatively impacts the metering system's ability to function properly, which leads to erroneous data that may go unnoticed. The change may occur suddenly (e.g. the meter is unknowingly damaged during a unit outage) or slowly over time (e.g. pressure lines may slowly become clogged).

Reviewing your data:

- Plot fuel flow (or heat input) to load and review and understand any outlying data points or shifts in data trends.
- Review before and after fuel flow meter or transmitter calibrations.
- Review before and after unit outages.
- Review before and after any DAHS configuration changes.
- Review across quarterly boundaries.

Questions?

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