BetaGuard PM
Measuring Particulate Continuously

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McIlvaine Hot Topic
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MSI/Mechanical Systems, Inc.
BetaGuard PM CEM
- Development began in 1995
- Field trials in 1998 and 1999
- Commercial product in January 2001
- First commercial installation in 2002
- Accumulated over 1.2 million operating hours
- Meets all US EPA PS-11 specifications
- Uses beta gauge for mass measurement & thermal flow meters for volume measurement to directly measure PM concentration
MSI BetaGuard PM

- Direct measure of mass concentration
- Replicates EPA Methods 5, 5B
- NIST traceable mass standards used to calibrate monitor’s mass measurement
- Beta attenuation mass measurement is independent of particle characteristics
- Dilution sampling probe
- 100% Isokinetic sampling
- Automatic daily mass and flow drift checks
- Designed for long-term unattended operation with high availability
- PS-11 correlations with real zeroes
- Minimal moving parts
Particulate Collected on Filter Tape

- Particulate collected on glass fiber filter tape
- Measurement independent of fuel type/characteristics
- Measurement independent of air pollution control equipment operation
- Provides conformation of changes in emissions and operations
Variation In Particle Characteristics
Output Mass Concentration

- Calculate lb/mmBtu using the following formula:
  \[
  \text{lb/mmBtu} = \frac{\text{mg/wscm} \times Fc \times 6.24 \times 10^{-8} \times (100/\%\text{CO}_2\text{w})}{0.0099 = 9.5 \times 1800 \times 6.24 \times 10^{-8} \times 100/10.8}
  \]

- No correction needed for temperature, moisture, or pressure
User Interface Control Panels

Local

Remote
How To Insure Accurate, Repeatable Data From Your PM CEMS

- Select appropriate PM monitor for your application
- Install probe at a representative sampling location
- Properly conduct the PS-11 correlation test
- Require more accurate stack testing for correlation test
- Get instrument techs trained &/or maintenance plan
- Perform manufacturer’s preventive maintenance
- Maintain spare parts on-site
- Rigorously follow QA/QC Plan
- Require tighter PS-11 certification criteria
Appropriate PM Monitor

- Beta Gauge or Light Scatter?
- Know your process – what is your particulate makeup?
- References – talk with others in your industry
- You get what you pay for!
Representative Sampling Location

- Where is the representative sampling location?
- Conduct a particulate characterization test
Properly Conduct PS-11 Correlation Test

- Currently PS-11 requires 3 PM levels
  - High: 100% to 50% of PM CEMS max reading
  - Mid: 75% to 25% of PM CEMS max reading
  - Low: 50% to 0% of PM CEMS max reading
- Operate your PM CEMS for 60 days before
- For high-level, modify process using “normal” events that could happen
- For high-level, inject native dust into gas stream – effective for BH
- For low-level, sample ambient air or reduce load
- EPRI working on new procedures
More Accurate Stack Testing

- Method 5 test method improvements are needed
  - Isokinetics
  - Temperature
  - Mass measurement
- Testers must pay closer attention to details
- Recommend on-site sample analysis
Bad Stack Test Data

Method 5B vs. BetaGuard PM
Training &/or Maintenance Plan

- Give plant instrument techs as much training as possible
  - Send them to WFAT
  - Have them watch startup and ask questions
  - Attend on-site training; theory, operation, maintenance, troubleshooting, audits, hands-on
- Have technicians dedicated to CEMS at plant
- Purchase 1-yr maintenance plan from vendor
Perform Preventive Maintenance

- Do your vendor’s recommended preventive maintenance
- Schedule time for instrument techs to perform routine maintenance
- Every stack has different conditions, make site specific adjustments to recommended preventive maintenance
Keep Spare Parts On-site

- Without spare parts on-site, your data availability will suffer.
- If the PM monitor you purchase has a sufficient operating history, your vendor knows which parts are suspect to failure.
Follow Your QA/QC Plan

- Perform frequent checks – weekly
- Perform required quarterly audits
  - Track PM monitor’s performance
  - Make adjustments before failure
- Train new instrument technicians
- Plan annual RRA or RCA with plant
Require Tighter PS-11 Criteria

PS-11 correlation criteria

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<tr>
<td>CC</td>
<td>&gt;0.85</td>
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<tr>
<td>RRA/RCA</td>
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BetaGuard PM Correlation, 2009 RRA, 2010 RRA, & 2011 RCA

Emission Limit = 90.6

$y = 1.49 \times - 0.346$

CC = 0.988
CI = 0.79%
TI = 2.7%