

# BetaGuard PM

## Measuring Particulate Continuously

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McIlvaine Hot Topic

December 1, 2011

MSI/Mechanical Systems, Inc.

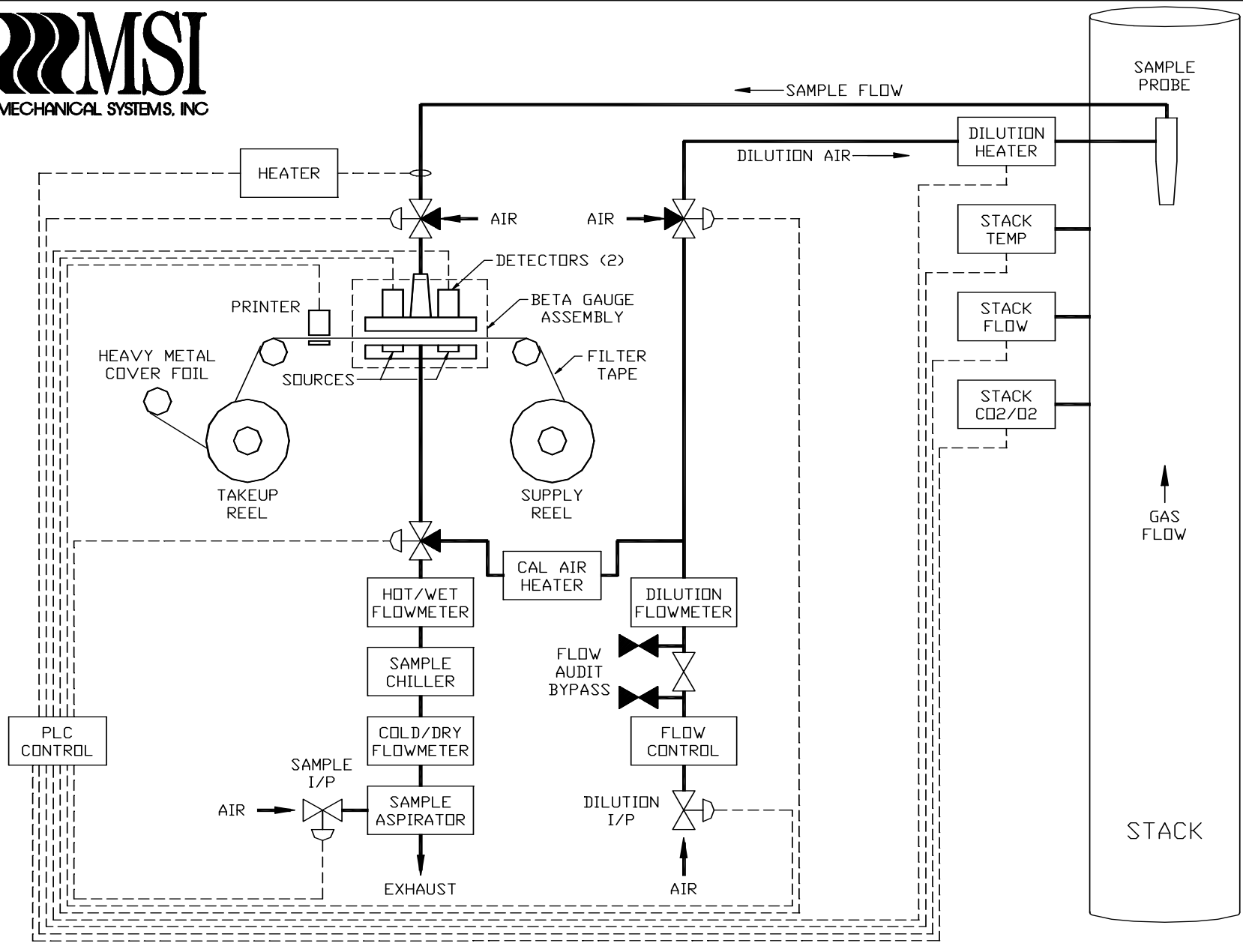
# MSI / Mechanical Systems, Inc.

- 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

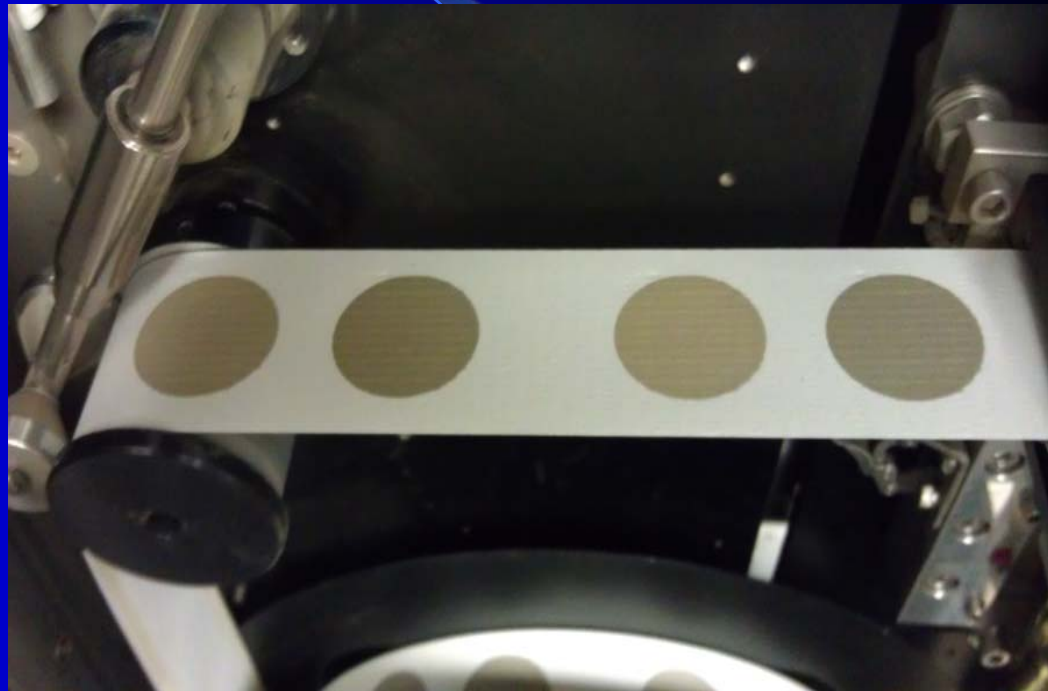
- Direct measure of mass concentration
- Replicates EPA Methods 5, 5B
- NIST traceable mass standards used to calibrate monitor's mass measurement
- Beta attenuation mass measurement is independent of particle characteristics
- Dilution sampling probe
- 100% Isokinetic sampling
- Automatic daily mass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



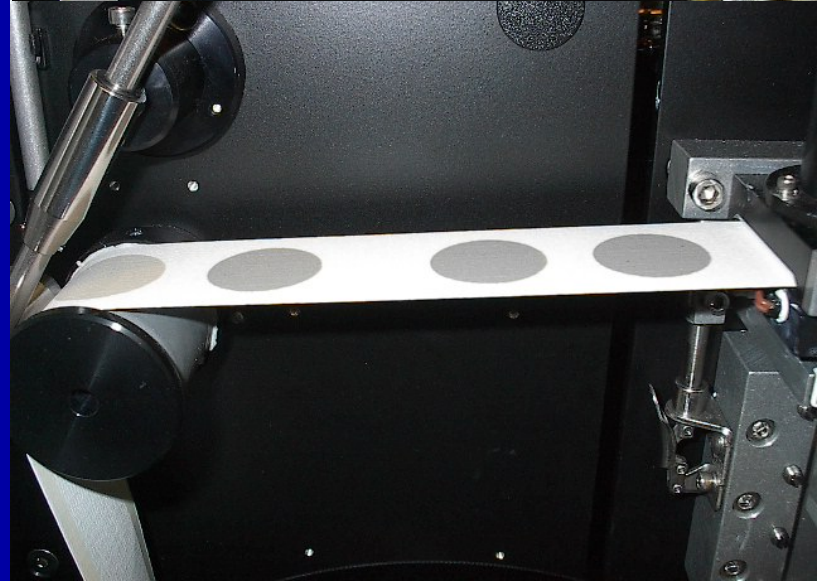
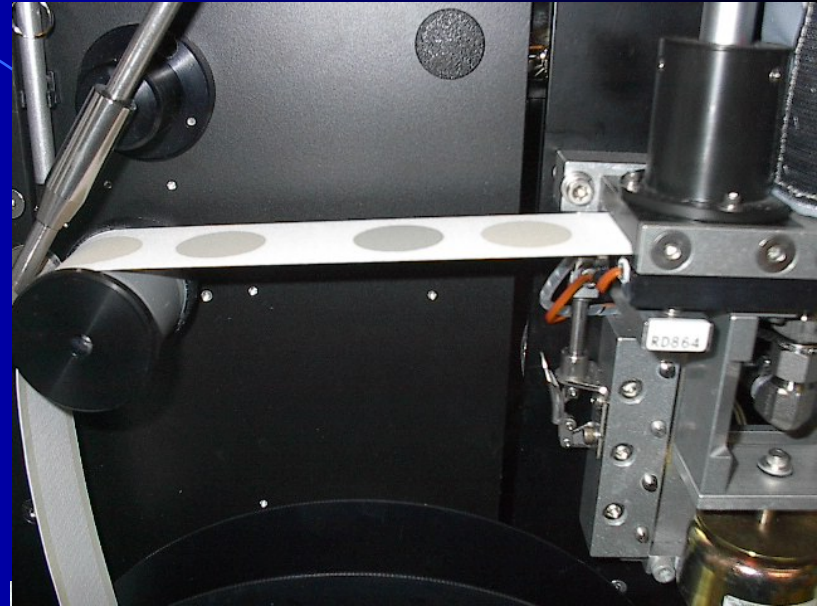
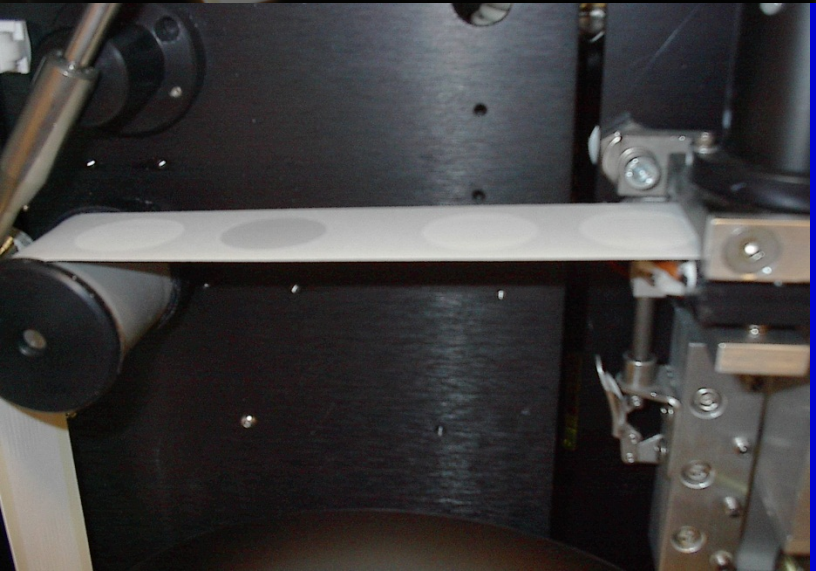
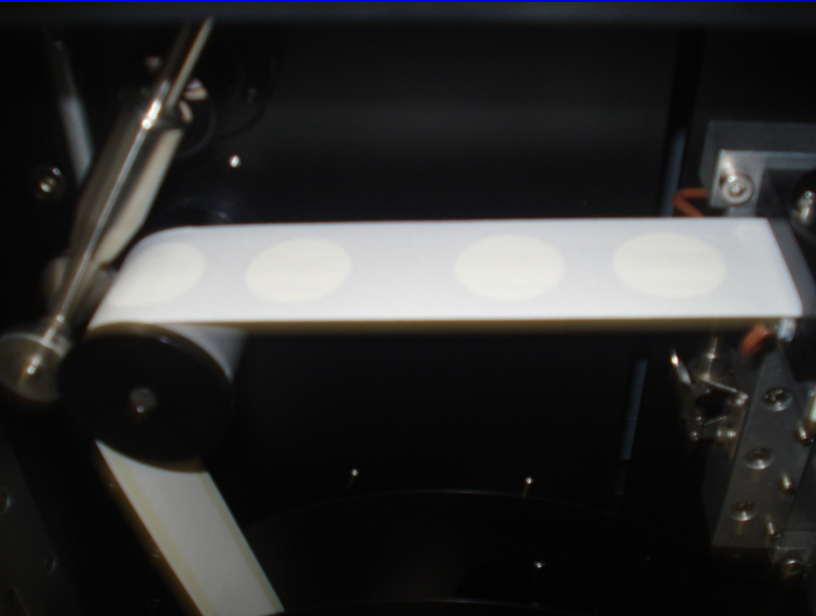


# Particulate Collected on Filter Tape

- 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:

$$\text{lb/mmBtu} = \text{mg/wscm} * \text{Fc} * 6.24 \times 10^{-8} * (100 / \% \text{CO}_{2w})$$

$$0.0099 = 9.5 * 1800 * 6.24 \times 10^{-8} * 100 / 10.8$$

- No correction needed for temperature, moisture, or pressure

# User Interface Control Panels



Local

Remote





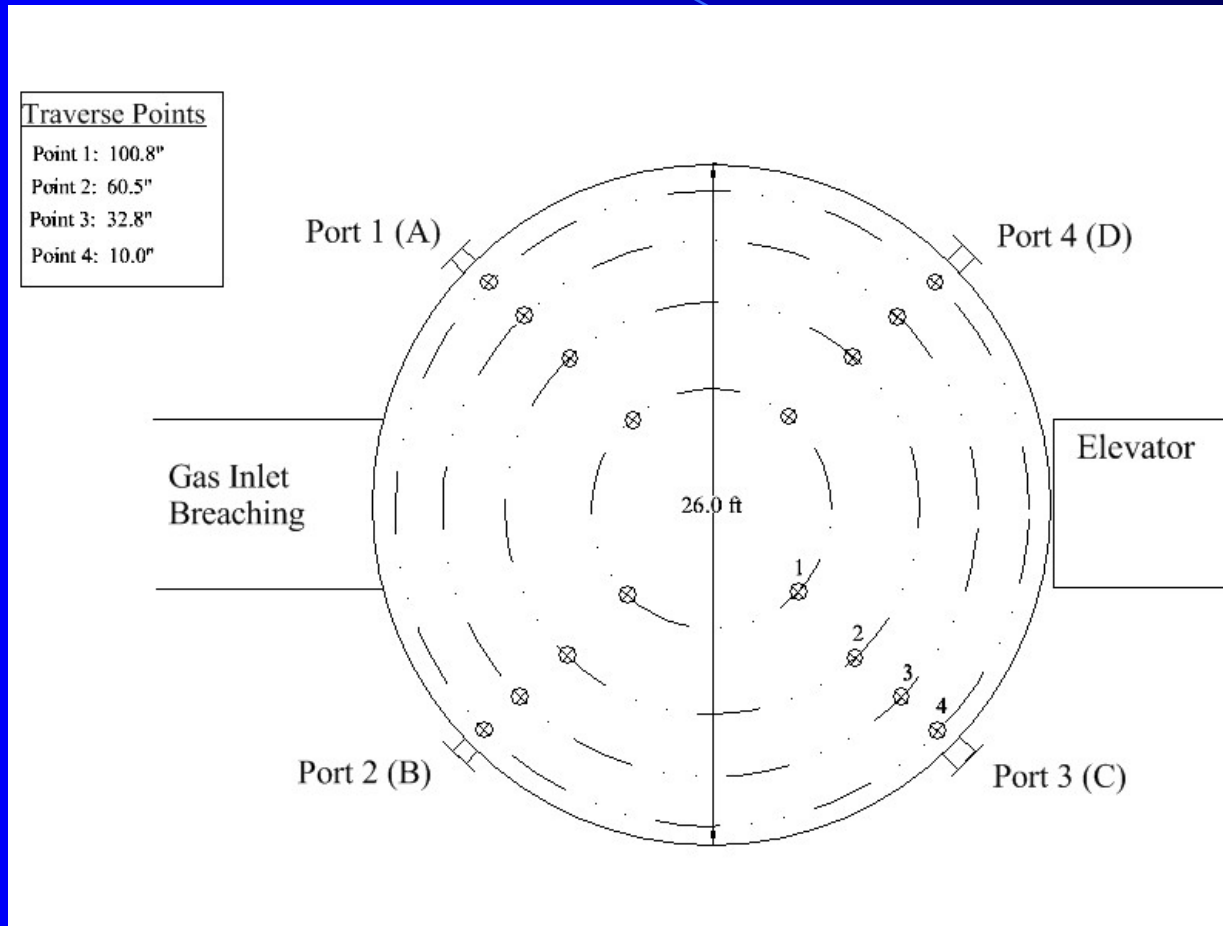
# How To Insure Accurate, Repeatable Data From Your PM CEMS

- 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

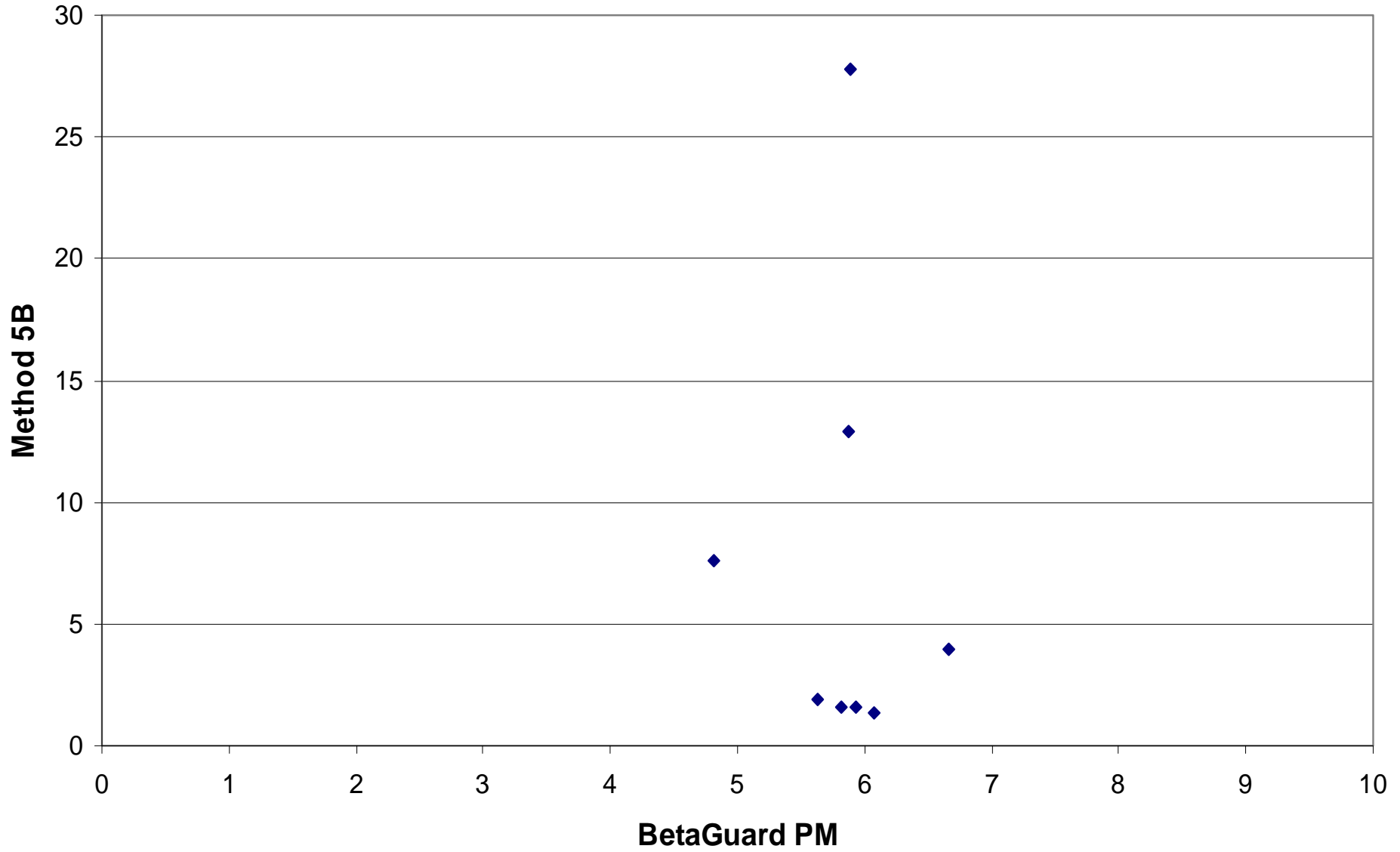
# Properly Conduct PS-11 Correlation Test

- 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



# 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

	PS-11	Yours
CC	>0.85	>0.90
CI	<10%	<7.5%
TI	<25%	<15%
RRA/RCA	±25%	±20%

# BetaGuard PM Correlation, 2009 RRA, 2010 RRA, & 2011 RCA

Emission Limit = 90.6  
mg/wscm

