# Worldwide Pollution Control Association

WPCA/TVA

Coal & Gas Seminar

August 24, 2016


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# Flue Gas Testing and Probes

WPCA Seminar
August 24, 2016

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# Agenda

- Introduction
- Test Methods
- Velocity, Pressure, Temperature
- Particulate Sampling
- Gas Sampling
- Specialty Applications

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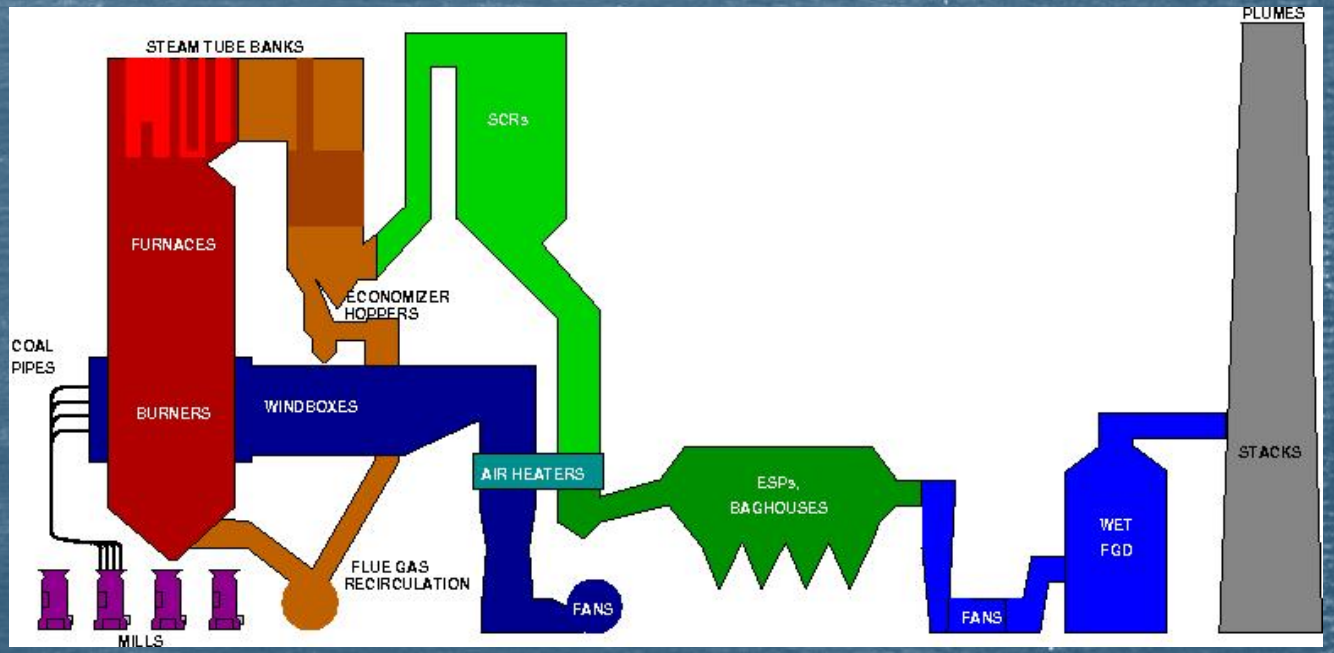
# Introduction

- Many aspects of plants require flow testing
  - Air, gas, liquid, steam, particulate
  - Fans, ducts, air heaters
  - Mills, coal pipes, burners, boiler
  - ESPs, PJFFs, SCRs, FGD, stack
  - Fan to stack and beyond …
- Many reasons to test
  - Performance optimization
  - O&M Cost reduction
  - Diagnostic, solving problems
  - Emissions compliance

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# Flow Testing Focus

- Performance
  - Flow uniformity, mixing
  - Combustion optimization
  - Ash capture / deposition / pluggage
- O&M Costs
  - Pressure drop
  - Chemical / sorbent costs
- Maintenance
  - Erosion / corrosion
  - Pluggage
  - Vibration
- Compliance
  - Stack testing
  - CEMS calibration

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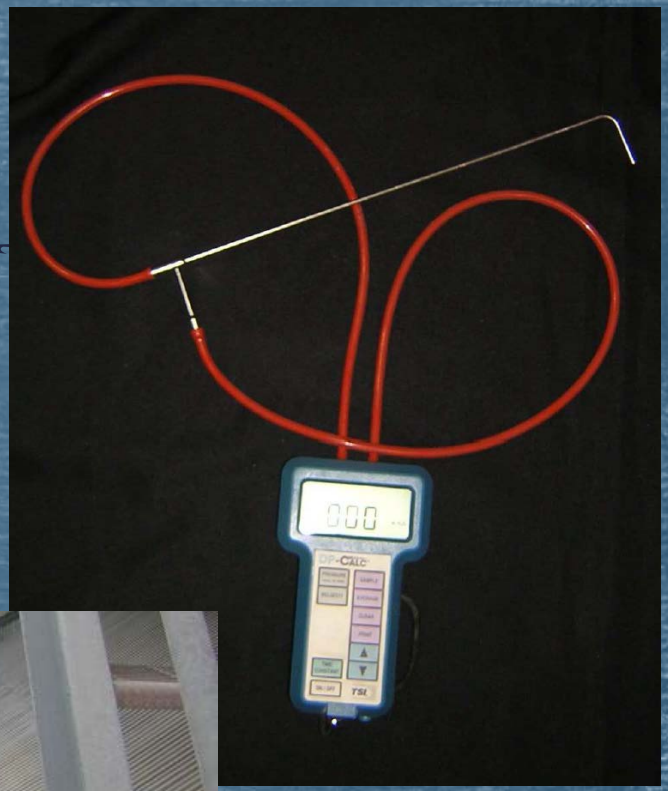
# Test Methods



- Flow basics
  - Pressure, Velocity, Temperature
  - Particulate Sampling
  - Gas Sampling / Chemical Species
- Industry test codes
  - ASTM
  - ASME
  - EPA
  - ISO

- Specialty tests
  - Variations of above
  - Performed for diagnostic/optimization, not compliance

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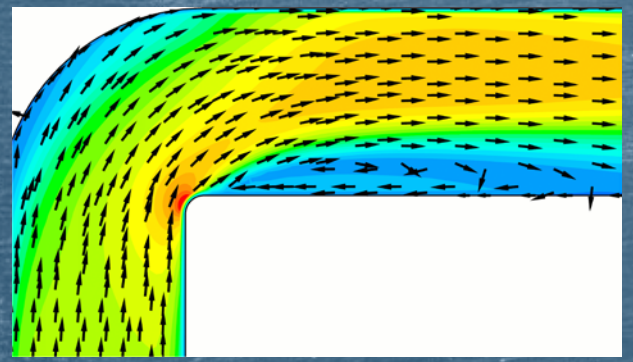
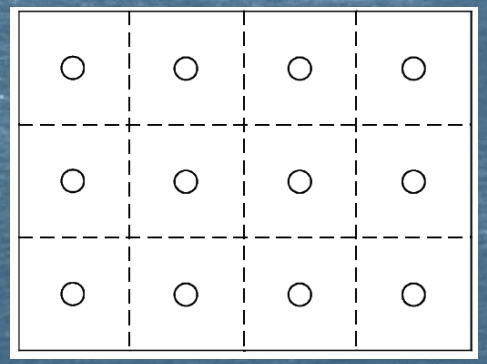
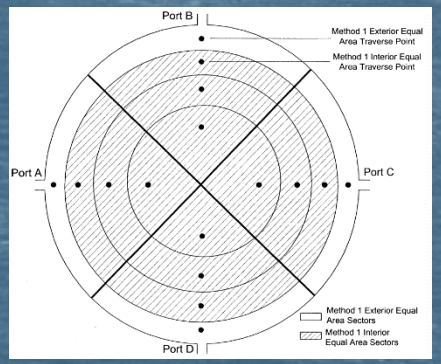
# Velocity, Pressure, Temperature

- EPA Method 1 – Test port location, quantity of traverse points








- EPA Method 2 – Velocity with S-type pitot probe

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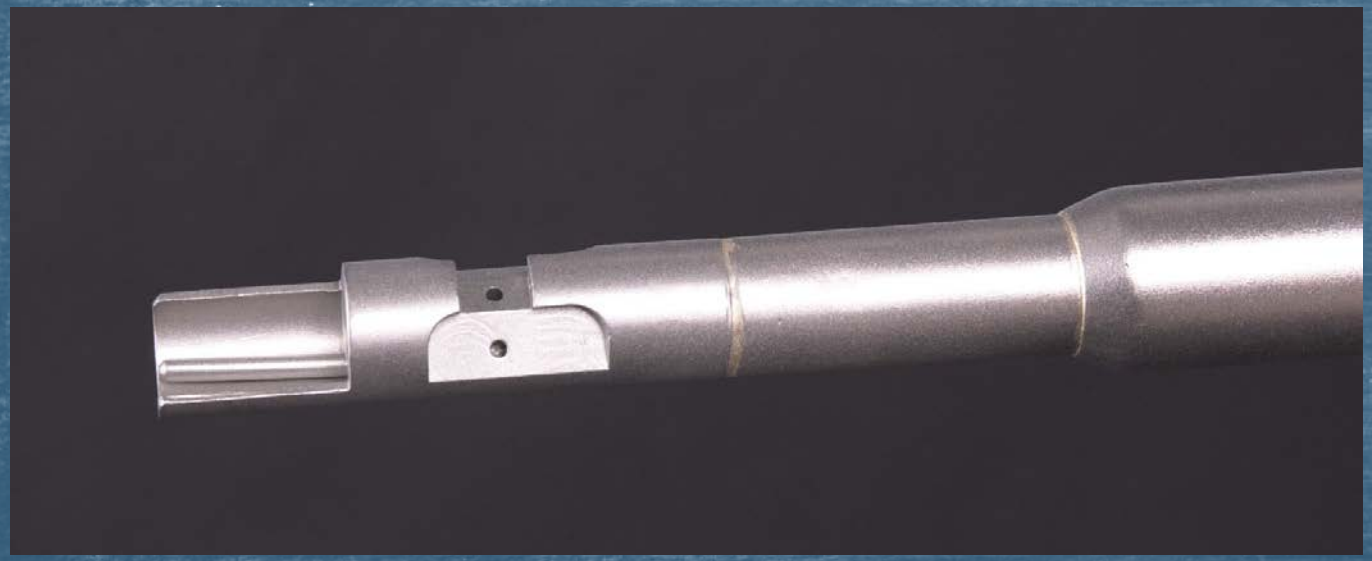
# Velocity, Pressure, Temperature

- EPA Method 2F – Velocity with 3D pitot
  - Increased accuracy over 1-D probe
  - Subject of current EPRI and NIST research




- Automated test systems
  - Reduce user influence and biases

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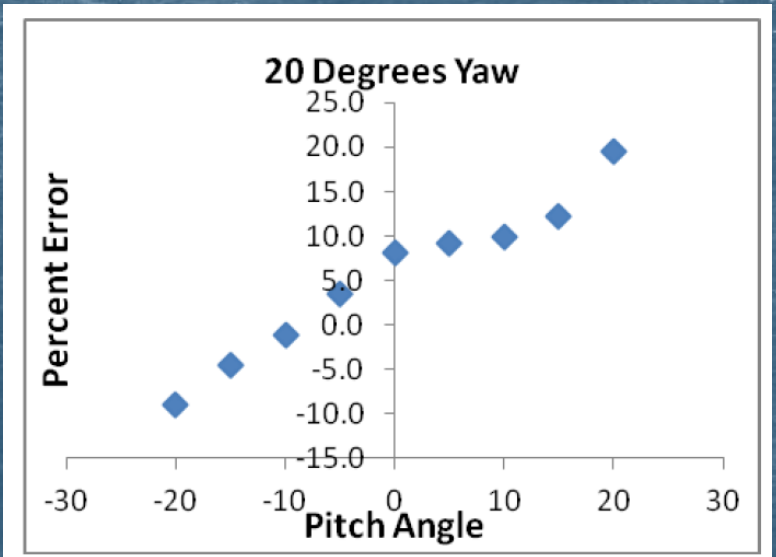
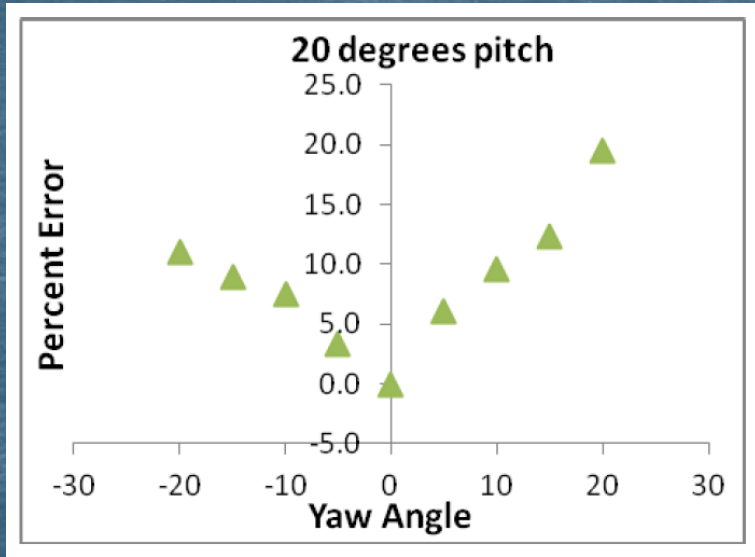
# Velocity, Pressure, Temperature

- Purpose of 3D testing versus 1D
  - Flow misalignment with probe can mean velocity measurement is biased
  - Has direct impact on measured flow rate
  - Flow rate has linear impact on emissions rate




Percent error at 20° yaw




Percent error at 20° pitch

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# Particulate Sampling

- EPA Method 5 and 17
  - Simultaneous velocity & sampling
  - Isokinetic sampling
- ESP/PJFF performance testing
- Stack PM testing, PM CEMs cal

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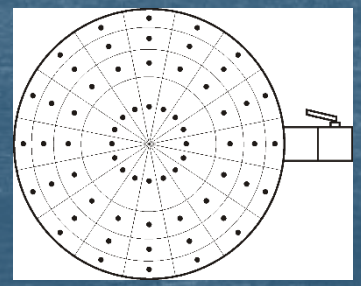
# Particulate Sampling

- Coal pipe testing / combustion optimization
  - Velocity with Dirty Air Pitot probe
  - Sampling with Isokinetic Extraction probe
- Manual or Automated methods
- ISO or ASME procedure



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# Gas Sampling

- Boiler tuning
- Inleakage detection
- SCR tuning
- Compliance / stack testing

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# Specialty Applications

- Water cooled probes for high temperature
  - Gas sampling – HVT probe
  - 3D pitot

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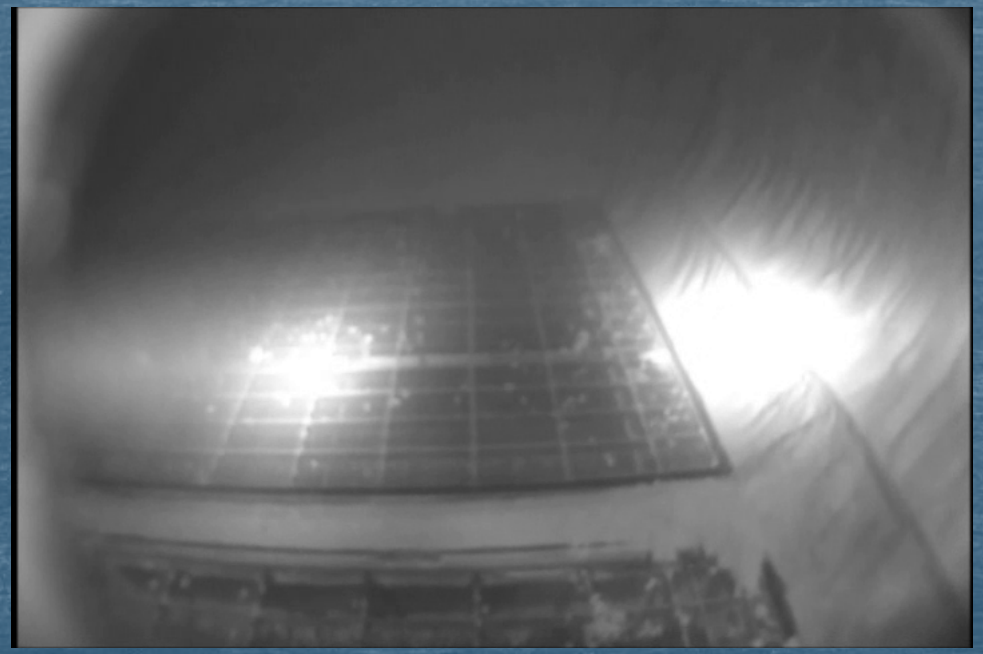
# Specialty Applications

- Online inspection cameras
  - Inspections
  - Diagnosing issues



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# Conclusions

- There are many test methods, probes, and options
- Choose wisely
- Go for extra accuracy and repeatability
- Minimize user error and bias
- Automate where possible
- If not an official compliance test, make up a better method

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# Questions

- Thank you


- Robert Mudry, P.E.
- rmudry@airflowsciences.com
- 734-525-0300 ext. 202


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