COURSE 474
CONTINUOUS EMISSION MONITORING
Extended Agenda

Day 1

Regulatory Requirements for CEM Systems (Part 60)

1. Intro to Emission Monitoring
    a. What is measured?
    b. Measuring techniques
    c. Manual Methods
    d. Continuous Methods
2. Clean Air Act of 1970 CEM Requirements
3. Existing source vs New Source CEM Requirements
4. Part 60 – New Source Performance Standards
    a. The Subparts
    b. Appendix A – Manual Methods
    c. Appendix B - CEM Performance Specifications
    d. Appendix F – CEM QA

Regulatory Requirements for CEM Systems (Part 75 and Part 63)

1. Allowances and Trading
    a. Why Trading?
    b. The Role of CEMS
2. Acid Rain Program
    a. Finding your way in Part 75
    b. New Concepts in Part 75
    c. Net Results for CEMS
3. NOx Budget
    a. Role of the States
4. CAIR
5. Technical Assistance Tools
6. 40 CFR 63 MACT Rules
    a. Affected Sources
    b. Monitoring Requirements
7. Subpart A – The General Provisions
    a. CEM Requirements
    b. Differences between Part 60 and Part 63
    c. Monitoring for Compliance
8. The MATS Rule – Subpart UUUUU (Utility MACT)
9. Subpart MACT for Petroleum Refineries

Sampling System Options – Source Level and Dilution Extractive Systems

1. Source Level Systems
    a. Cool-dry Extractive systems
        i. Probe
        ii. Sample Line
        iii. Chillers
        iv. Pumps
    b. Hot-Wet Systems
2. Dilution Extractive Systems
    a. In-stack – The “Kipp” Probe
    b. Out-of Stack systems
        i. STI Probe
        ii. M&C Probes
        iii. T, P, and MW effects on Dilution Systems

Basics for Electro-optical Analyzers

1. Energy and Light
2. Interaction of Light with Molecules
    a. Infrared
    b. UV
3. The Beer Lambert Law
4. Building an analyzer

Day 2

Extractive System Monitoring Instrumentation

1. Electro-Optical Techniques
    a. Photometric Methods
        i. Photometry
        ii. Gas Filter Correlation
        iii. Differential Absorption Fourier Transform Infrared Spectroscopy
    b. Luminescence Methods
        i. Fluorescence
        ii. Chemiluminescence
2. Electroanalytical Techniques
    a. Polarography
    b. Paramagnetism
    c. Gas Chromatography
3. Developments in Analyzers

In-situ Monitors for Gases

1. Path Monitors
    a. Optical Depth
    b. Calibration Issues
    c. Laser systems for HCl and NH_3
2. Point Monitors
    a. Calibration Issues
    b. Systems
3. Advantages and Disadvantages
4. Alternative Quarterly Test Criteria

Units of the Standard and Flow Monitoring (CERMS)

1. Units of the Standard
    a. Concentration Corrections
    b. Emission Rate Standards
    c. Thermal
    d. Mass Rate
2. F-Factors
    a. Dry F Factor
    b. Wet F Factor
    c. Tricks with F Factors
3. Flow Monitoring
    a. Flow Monitoring Techniques
    b. Differential Pressure
    c. Thermal Sensing Systems
    d. Acoustic Velocimetry
    e. Time-of-Flight Methods
4. Certifying a Flow Monitor
    a. Comparison against Method 2
    b. K Factors
5. Alternate Reference Methods
    a. Method 2 F
    b. Method 2 G
    c. Method 2 H

Monitoring for Mercury (CMMS)

1. Mercury in Flue Gases
    a. Cement Plants
    b. Coal-fired Power Plants
2. Manual Source Testing Methods
    a. Methods 101 A and 29
    b. Ontario Hydro Method
    c. Method 30A Instrumental Method
    d. Method 30B Carbon Trap Method
3. CMM Methods
    a. Conversion to Elemental Mercury
    b. Speciating vs non-speciating systems
    c. Cold Vapor Atomic Absorption Spectroscopy
    d. Vapor Atomic Fluorescence Spectroscopy
    e. Zeeman Modulated Atomic Absorption Spectroscopy
4. Periodic Sampling – Sorbent Tube Sampling

Certifying a CEM System

1. CEM Systems Design Requirements
2. CEM System Installation
3. CEM Certification
    a. 7-day Drift Test
    b. Response Time Test
    c. RATA
    d. Source Testers and ASTM D7036
    e. The Test Plan
    f. Conducting the Test
    g. Calculations
        i. Relative Accuracy
        ii. Bias
    h. Causes for Failure of the RATA

Conducting the RATA – Group Problem

1. The Class will be divided into groups of 3
2. Half of the groups are Source Tester Companies/ The other half CEM Owners
3. Each group is given an analyzer
4. Each Source Testing Company will conduct a RATA on the emission source of the CEM Owners who will be operating their CEM system
5. Each group will calculate the relative accuracy (RA) for the test

Day 3

Opacity monitoring (COMS)

1. Light Scattering Phenomena
    a. Rayleigh Scattering
    b. Mie Scattering
    c. Geometric Optics
2. Optical Density Calculations
    a. Pathlength Correction Factor
    b. Combiner Equation
    c. Bouger Law Correlations
3. ASTM D6216 Design Specifications
    a. Manufacturer's Specifications
    b. The MCOC
4. Opacity Monitor Operational Design
    a. Single Pass
    b. Double Pass
5. 40 CFR 60 Appendix B Performance Specification 1

    a. Performance Specification
    b. Certification
6. 40 CFR 60 Appendix F Procedure 3
    a. Daily Checks
    b. Quarterly Audits – Audit Filters
    c. Annual Zero Alignment

Monitoring for Particulate Matter

1. Correlation Methods
    a. PS11 and ISO 10155
    b. PM CPMS – Definition and Applicability
2. PM Monitoring Techniques
    a. Beta Radiation Attenuation
    b. Light Scattering (Forward, Back, and Side)
    c. Electrodynamic Techniques
3. PM Monitoring in Wet Stacks
4. Bag Leak Detectors and ASTM D7392
5. PM 10/2.5 Manual Methods

Data Acquisition Systems and Reporting

1. The Total System
    a. Controllers
    b. Role of the Computer
    c. Networks
2. Functions of the DAS/DAHS
3. Minimum Screen Requirements
    a. Default Screens
    b. Alarm Screens
    c. Data/QC Screens
    d. Data Base
4. Averaging Requirements
    a. Block Averages
    b. Rolling Averages for the Utilities and Refineries
5. Electronic Reporting
    a. Part 60
    b. Part 75

Predictive Emission Monitoring Systems and PS16

1. Reasons for using PEMs
    a. Rationale as an Alternative to CEMS
    b. Federal Part 75 Criteria
    c. State Issues
2. Parameters and Sensors
    a. O&M Indicators
    b. Parameter Surrogates
3. Predictive Systems
    a. Phenomenological Models
    b. Empirical Models
    c. Least Squares Methods
    d. Neural Net Methods
4. 40 CFR 60 Performance Specification16
    a. Design Criteria
    b. Certification
    c. QA/QC
5. 40CFR60 Performance Specification 17

CEM Quality Assurance Principles and Requirements

1. Quality Assurance Objectives
    a. Precision
    b. Accuracy
    c. The True Value
2. A Total CEM System Quality Assurance Program
    a. Purchasing a System
    b. Certifying a System
    c. Continuing Operation
    d. The QA Plan
    e. Writing the Plan
    f. Implementing the Plan
    g. The Agency and its responsibilities with respect to the CEM QA Plan
    h. Approaches to Maintenance
    i. The CEM Logbook
    j. Declaring Obsolescence
3. Availability
    k. Par t 60 – Role in Excess Emission Reports
    l. Part 75 – Availability and Missing Data Substitution

Performance Audits – A Review Session

1. The Daily Calibration Verification
    a. Criteria and Significance
    b. Quality Control Charts
2. The Cylinder Gas Audit (CGA)/Linearity Error
    a. Part 60 - 40 CFR 60 Appendix F
    b. Part 75 - 40 CFR 75 Appendix B
3. The Annual/Semi-annual RATA
    a. Part 60 - 40 CFR 60 Appendix F
    b. Part 75 - 40 CFR 75 Appendix B
4. The Flow-to-Load Ratio Test
5. The Opacity Monitor Audit
6. Optional Techniques
7. Availability
    a. Part 60 and Excess Emission Reports
    b. Part 75 and Missing Data Substitution
    c. CEM Performance today

Systems Audits - Inspecting CEM Systems

1. Types of Systems Audits
    a. Internal
    b. External
2. The Audit/Inspection
    a. Use of Checklists
    b. Entrance Briefing
    c. The Site Tour
    d. Interviews/Discussions
    e. Records Review
    f. Exit Briefing
3. The Audit Report