ENVIRONMENTAL

Enhanced Measurements of Low-Concentration Emissions From Combustion Units

General Overview

Stack testing - do we need it?

Past, present, and future applications

Adaptation

New innovative technologies

- ► StarBoost[™]
- ► MAX[™]
- PTR
- Method comparisons
- About us
- Final thoughts



Reality of Emissions Testing

40 CFR 63, Subpart DDDDD Do Boilers Need Source Testing?

Yes!

- NESHAP (YYYY for NGTs)
- Emission limitations for HAPs emitted from industrial, commercial, and institutional boilers and process heaters
- You must demonstrate compliance with all applicable emission limits using performance stack testing, fuel analysis, or continuous monitoring systems
 - CEMS or PM CPMS

Wet Chemistry Test Methods

EPA M26A, CARB 430, etc.

- Generally requires a lot of equipment and personnel
- Test runs are typically 4+ hours to meet required DL
- Samples are commonly shipped off-site for laboratory analysis
- Analyte specific
- Human and equipment error technique driven

Why Must we Improve Reliability of Test Results?

Variability

- Test results might not properly represent actual emissions
 - What is the actual number below the 'limit'
 - Is that a real number?
- If determined results are above the limit, then re-test...
 - NOV, fines, etc.
 - Extra runs or longer running time
 - More waiting on test results

Quantification Beyond Just Detection

- The landscape is changing
- Why do we care?
 - Costs, performance, health information, etc.
- Data needs to be precise and accurate
- Technology advances improve data quality, lowers end cost, simplifies testing and are more reliable
- On site or real time results are a great advantage...

StarBoost[™] FTIR Technology

- Optimized hardware and software
- US EPA Method 320 & ASTM D6348 compliant
- > 10 50 x Higher SNR
- Low DLs
 - ~ 8-10 ppbv formaldehyde in 10% water
 - Combustion, Ammonia, HCl, others
 - > 10-20x better detection than standard FTIR
- Real-time continuous measurements
- Zero baseline drift



StarBoost[™] FTIR Technology

Natural Gas Fired Turbine Field Test - 15 sec data



StarBoost[™] FTIR Technology Natural gas fired turbine field test Formaldehyde MDL < 10 ppb (5 µm TE-MCT) Formaldehyde Montrose 2x8 cm-1 191C Gases Formaldehyde Montrose 0.1154 -Water Calibration 10.85% 0.1100-CH4 Montrose (PF) 191c Montrose Thor Mount Filt 0.1000-Temp (C) Pressure (Atm) 0.0900 -Igram DC Igram PP 0.0800 phase Angle laser PP 0.0700laser DC Bad Scan counter 0.0600 -0.0500-0.01735 Average Standard 0.00291 0.0400-Deviation 16.76 %Deviation 0.0300 -\$0.00 0.0200-Cutoff 0.0100 -Fraction above 0.000 the cutoff 0.0000-10:00:00 12:00:00 14:00:00 16:00:00 18:00:00 21:07:07 09:16:49 Calc Fraction 01/06 01/06 01/06 01/06 01/06 01/06 01/06

MAX[™] GC-FTIR Technology

- GC separates components of sample
 - Large number of compounds
- Analysis time of 10-50 min per TDT
- Sensitivities of 10-30 ppb in 10% moisture
- On site analysis with quick results
 - Including QAQC & Analyte Spiking
- US EPA Method 18 Compliant







New Montrose Test Van

- PTR-TOF-MS detection to ppt or ppq 'proton transfer reaction - time of flight - mass spectrometer'
- Fast GC to further enhance Detection by the "PTR"
 - Separates compounds and eliminates interferences
 - M18 Compliant
- On-board generator for continuous power supply
- Met station and software for processing
 - Can be driven around plant perimeter
 - May be used in fixed position
 - Remotely operated

Fuel Comparison Study on Boiler Set

Blended Fuel vs Natural Gas - StarBoost[™] FTIR Testing



Method Comparisons

Performance testing results



NGT Method Comparison Study

Method Comparisons

- Comparison of MAX[™] GC-FTIR to StarBoost[™]
- Three test conditions
 - Low-load, high-load, and high-load w/ liquid fuel





42 ppbvd Method 320 StarBoost[™] FTIR Turbine X – Test 2 Simultaneous Test Results

> 19 ppbvd Method 18 MAX[™] GC-FTIR

19 ppbvd Method 320 StarBoost[™] FTIR Turbine X – Test 3 Simultaneous Test Results

> 79 ppbvd Method 18 MAXTM GC-FTIR

78 ppbvd Method 320 StarBoostTM FTIR

Montrose Source Testing Capabilities

- 27 offices with 350+ personnel
 - Does not include laboratories and other services
 - Now international!
- Ability to mobilize quickly and effectively
 - Process Monitoring
 - Permitting
 - Fence-line Monitoring
 - Laboratory Analysis
 - LDAR
 - Industrial Hygiene
- Research, engineering, and compliance testing
 - Proud to develop field instrumentation
 - 50+ projects (to date) with MAX[™] and StarBoost[™]



Conclusions

Standard methods provide no "comfort"

- Results take too long
- Results can be variable (even when emissions are not)
- Cost for re-test operation can be very high

Enhanced methods can be a solution

- Detection limits are low
- ▶ MAXTM for same-day results, test multiple locations
- StarBoost[™] for real-time results, combustion tuning, etc.
- These are powerful new tools

Questions? Thank you for your attention



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