Advanced Instrumentation in Air Monitoring to Achieve Low-Level Detection

August 4th, 2022

Blake Ericson

MONTROSE ENVIRONMENTAL

Overview

- Reality of Traditional Testing
- Advanced Instrumentation
- Data Overview
- Method Comparisons
- Summary and Questions

Reality of Emissions Testing

MONTROSE ENVIRONMENTAL

Sometimes being at the top isn't so bad...

Wet Chemistry Test Methods

CTM027, CARB 430, M26A, etc.

- A lot of equipment and personnel
- Test runs are typically several hours
- Off-site analysis
- Analyte specific
- Technique driven

Why Must we Improve Reliability of Test Results?

- Variability
- Misrepresented test results
  - What is the actual number below the ‘limit’
  - Is that a real number?
- If determined results are above the limit:
  - NOV, fines, etc.
  - Extra runs or longer running time
  - Retests
  - More waiting and expenses

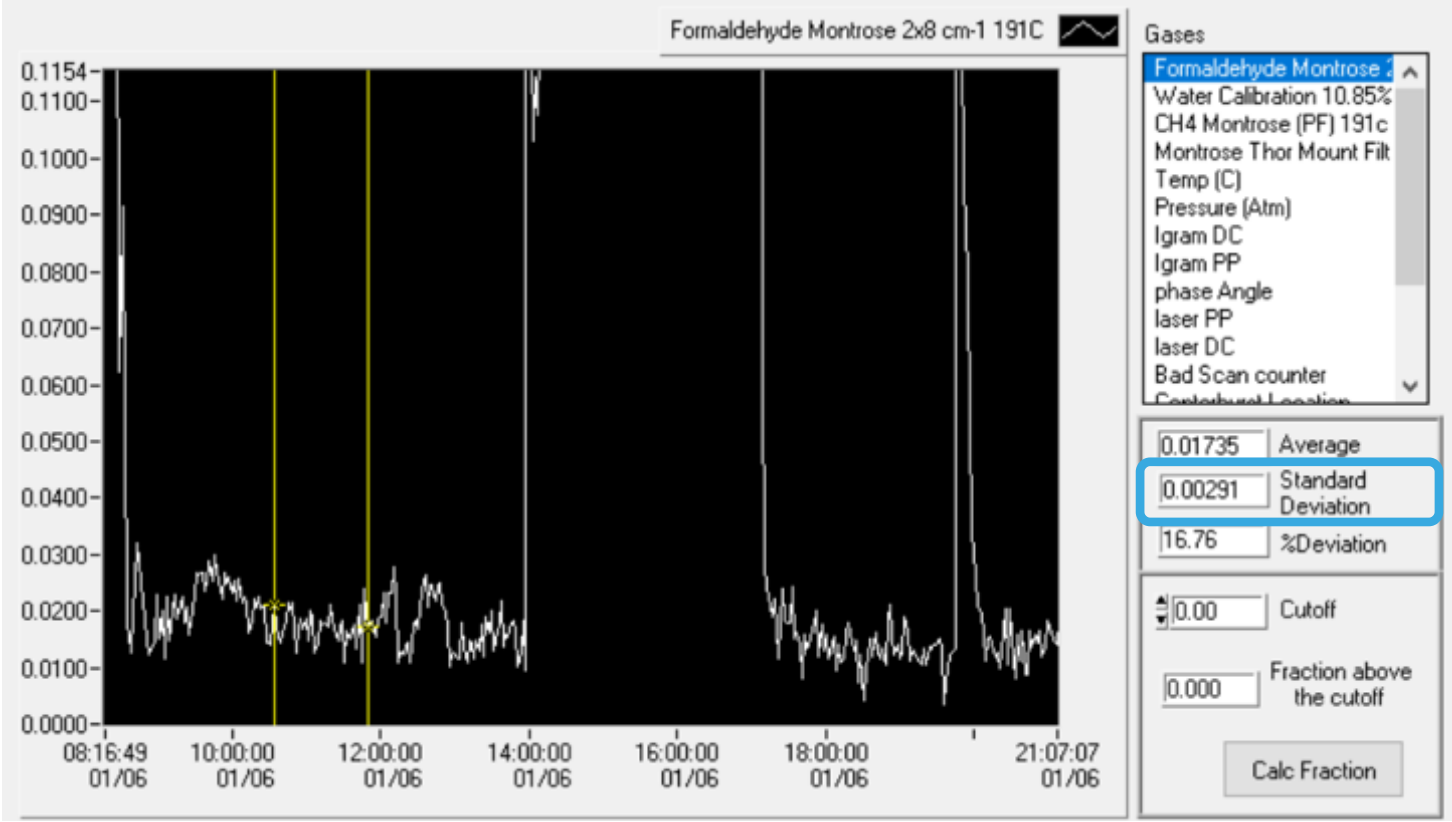
Quantification
Beyond Just Detection

- The landscape is changing
- Why do we care?
  - Costs, performance, health information, etc.
- New technology
  - Improves data quality
  - Lowers end cost
  - Simplifies testing
  - **On site or real-time results are a great advantage**

StarBoost™ Technology

- Optimized hardware and software
- US EPA Method 320 & ASTM D6348 compliant
- 10 – 50 x Higher SNR
- Much lower DLs
  - ~ 8 - 10 ppbv formaldehyde in 10% water
  - 10-20x better detection than standard FTIR
- Real-time continuous measurements
- Zero baseline drift

StarBoost™ Technology

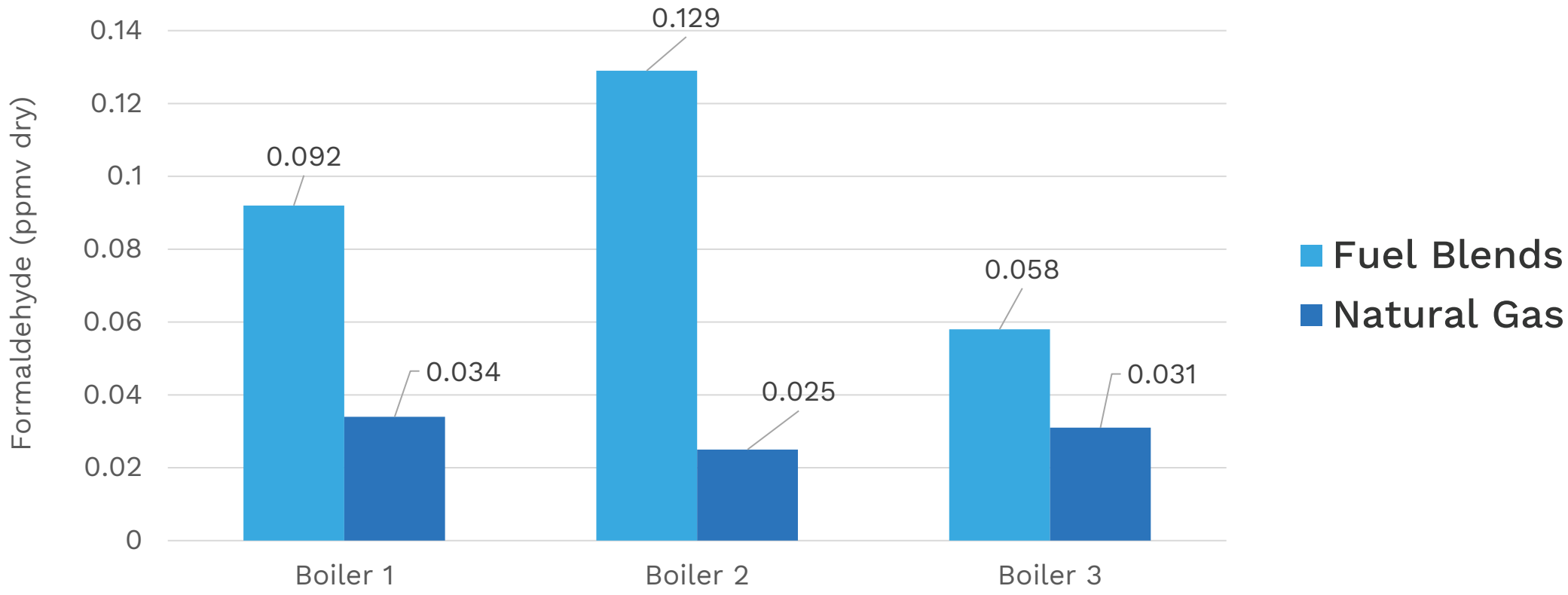


Natural Gas Fired Turbine Field Test

Formaldehyde MDL < 10 ppb

Fuel Comparison Study on Boiler Set

Blended Fuel vs Natural Gas – StarBoost™ FTIR Testing

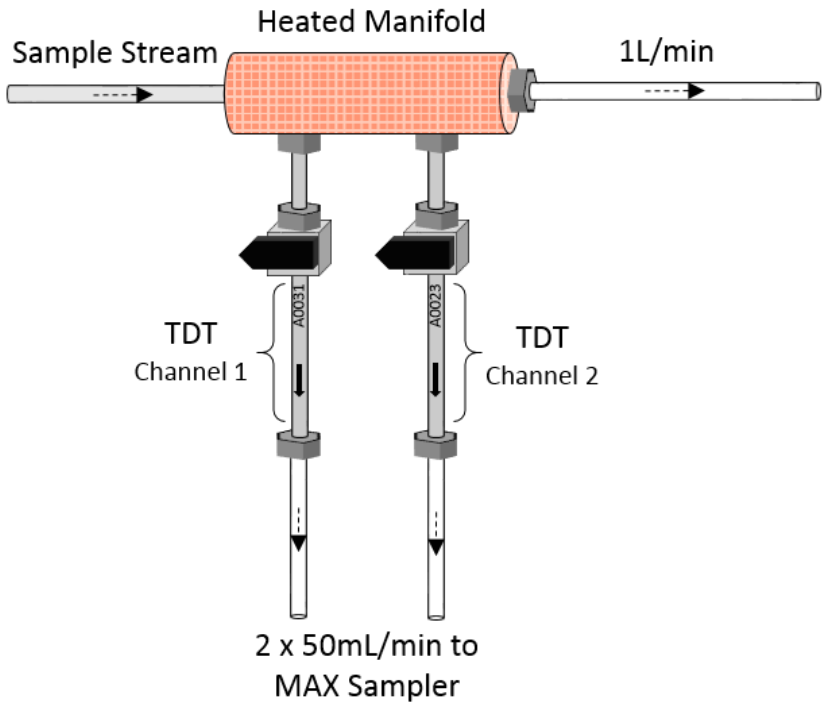


MAX™ Technology

GC-FTIR Analyzer

- **Samples are collected on a TDT**
  - Requires no solvent or extraction
  - GC separates components of sample
  - Analysis time of 20-50 min per TDT
  - Sensitivities of 10-30 ppb in 10% moisture
  - On site analysis with quick results
  - US EPA Method 18 Compliant

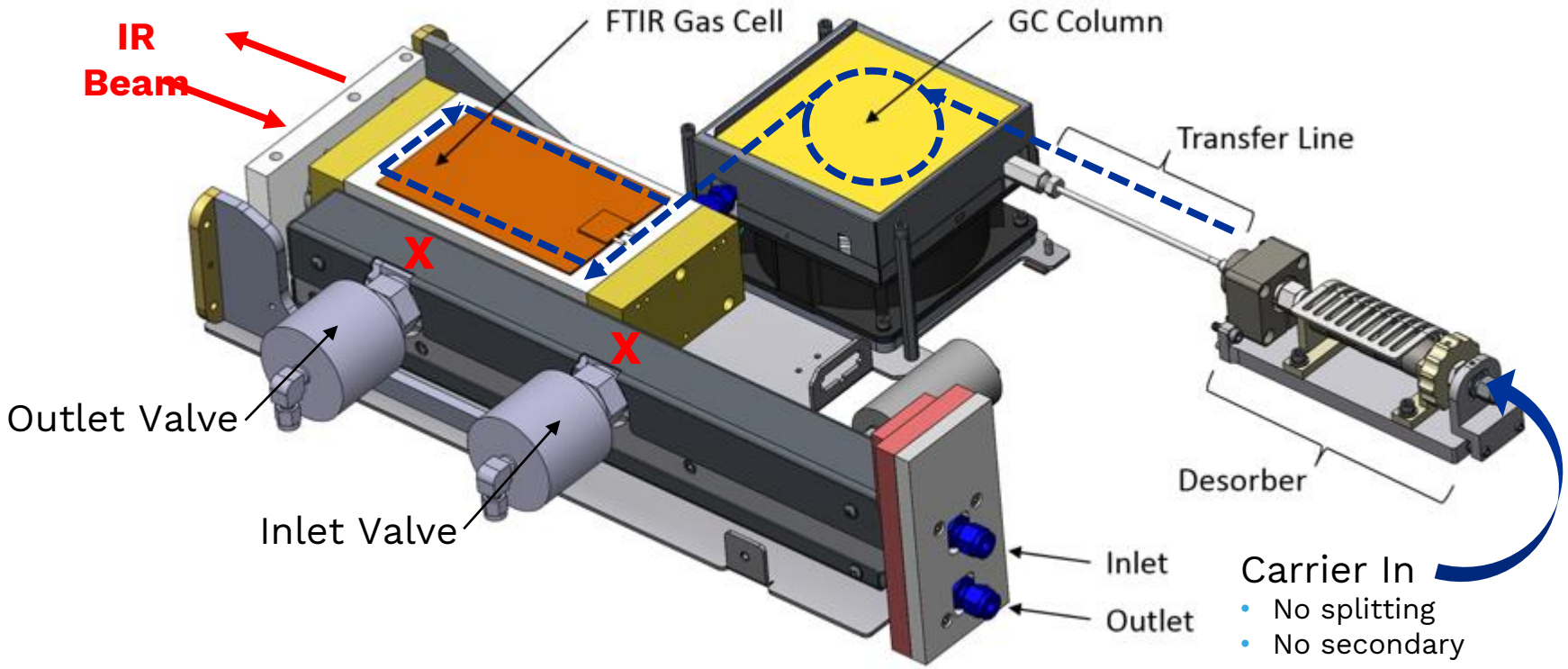
TDT Sampling



AS002 TDTs are a product of Prism Analytical Technologies

MAX TDT Sampler

MAX™ Technology



- GC separates components
- Components enter multi-pass gas cell
- Gas is probed by an IR beam

Natural Gas Turbine Test Run Example

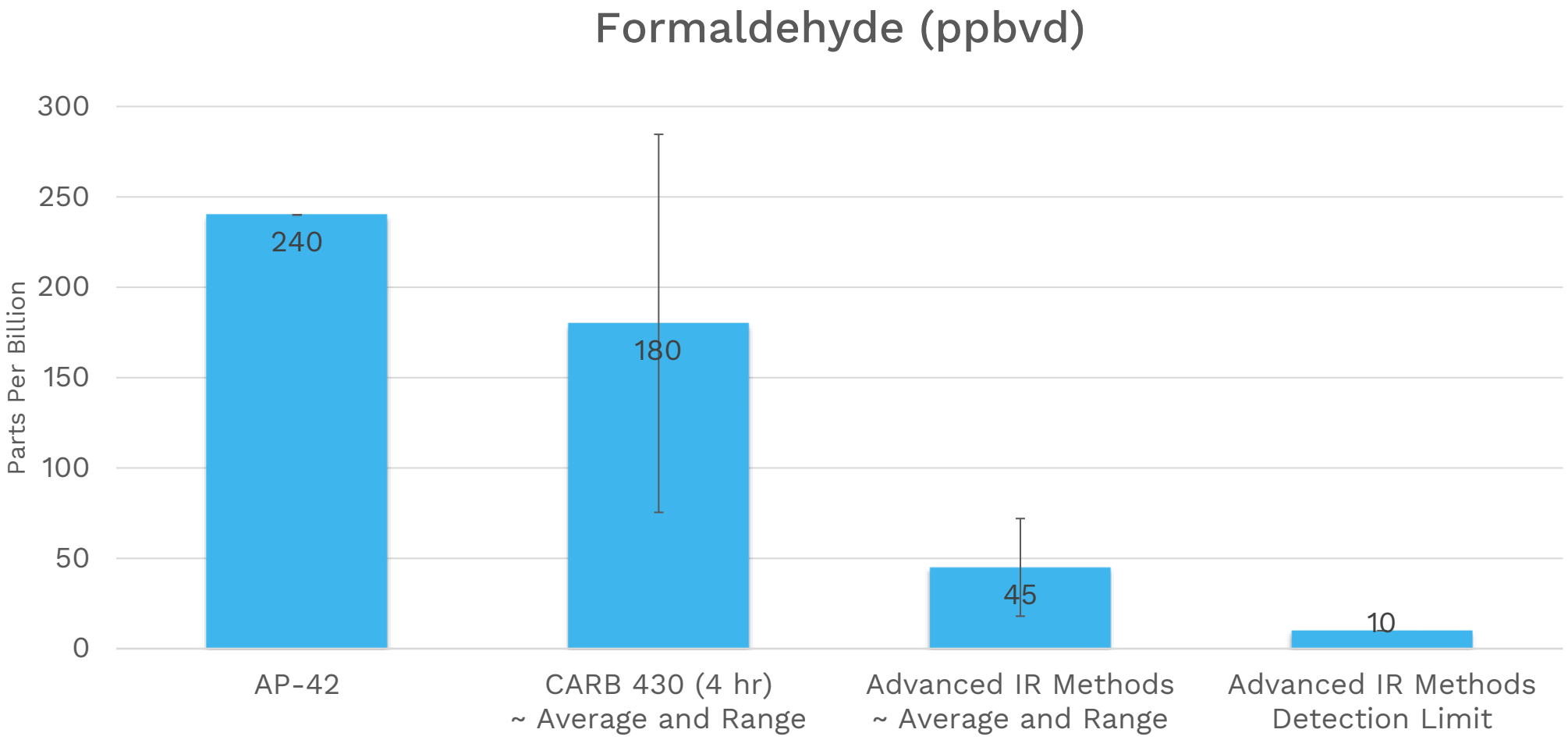
- 1 hour run time
- > 70% recovery to pass QAQC per method 320 and 18
- Great for low level detection

Run	Start Time	End Time	Date				
1	16:47	17:47	1/7/2019				
Analyte	Spike (ng)	Sample (ng)	Mass Difference (ng)	Spike Recovery (%)	Sample Concentration (ng/mL)	Stream Concentration (ppmvd)	Stream Concentration (Recovery Corrected) (ppmvd)
Formaldehyde	915.39	48.51	866.88	87.3%	0.041	0.033	0.038
Tube ID	Sample Rate* (mL/min)	Sample Time* (min)	Sample Volume** (mL)	Corrected Sample Volume (mL)			
A0526	20.0	60	1199.3	1183.05			
A0462	20.0	60	1199.3	1183.03			
Gas Cell Temperature (C)	Avg CO2 (%)	Avg CH4 (%)	Avg O2 (%)				
191.0	4.52	0.00	12.90				
* - Sampler Set Points							
** - True value from Sampler Data Log							

PTR-TOF-MS for Ambient Monitoring

- PTR-TOF-MS – detection to ppt or ppq
  - ‘proton transfer reaction - time of flight – mass spectrometer’
- Fast GC
  - Separates compounds and eliminates interferences
  - M18 Compliant
- Met station and software for processing
  - Can be driven around plant perimeter
  - May be used in fixed position
  - Remotely operated

Method Comparisons



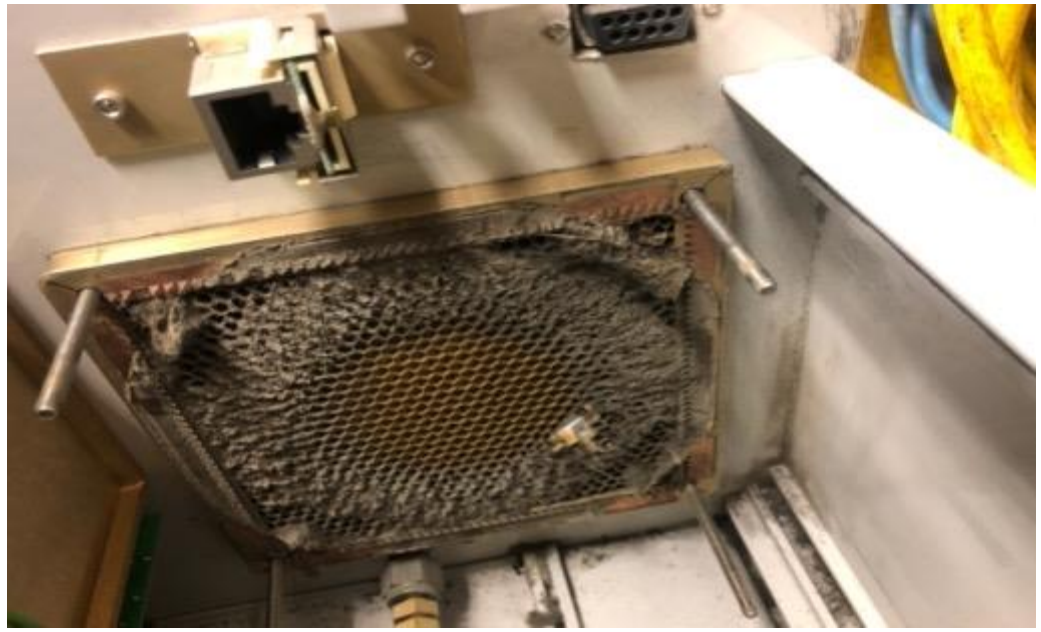
Method Comparisons

- Any vendor will tell you their product works perfectly
- Actual testing results from a natural gas turbine
- Comparison of MAX™ GC-FTIR to StarBoost™ technologies

Turbine X – Test 1 Simultaneous Test Results	Turbine X – Test 2 Simultaneous Test Results	Turbine X – Test 3 Simultaneous Test Results
38 ppbvd Method 18 MAX™ GC-FTIR	19 ppbvd Method 18 MAX™ GC-FTIR	79 ppbvd Method 18 MAX™ GC-FTIR
42 ppbvd Method 320 StarBoost™ FTIR	19 ppbvd Method 320 StarBoost™ FTIR	78 ppbvd Method 320 StarBoost™ FTIR

Field Testing Is Tough!

- Most studies are done on a bench-top
- You are only as good as your equipment
  - Poor equipment or malfunctions
  - Severe impact to analysis and data quality
  - Makes QAQC checks difficult
- As a customer/regulatory agent
  - Don’t fret the black-box
  - Ask technical questions
  - Expect a well-trained operator



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
- No waiting for answers
- These are powerful new tools

Thank you for your time!

Questions?

MONTROSE ENVIRONMENTAL

Contact Us!

Blake Ericson – bericson@Montrose-env.com
(586)-242-3599