



PERFORMANCE AUDITS - *CURRENT PRACTICE AND FUTURE ACTIVITIES*

PRESENTED BY LAMAR MITCHELL
CARB Quality Assurance Section
2019 PQAQ Training, Davis, CA

OVERVIEW

- Background
- Types of performance evaluations
- Update trace gas assessments
- New equipment
- Future audit technologies

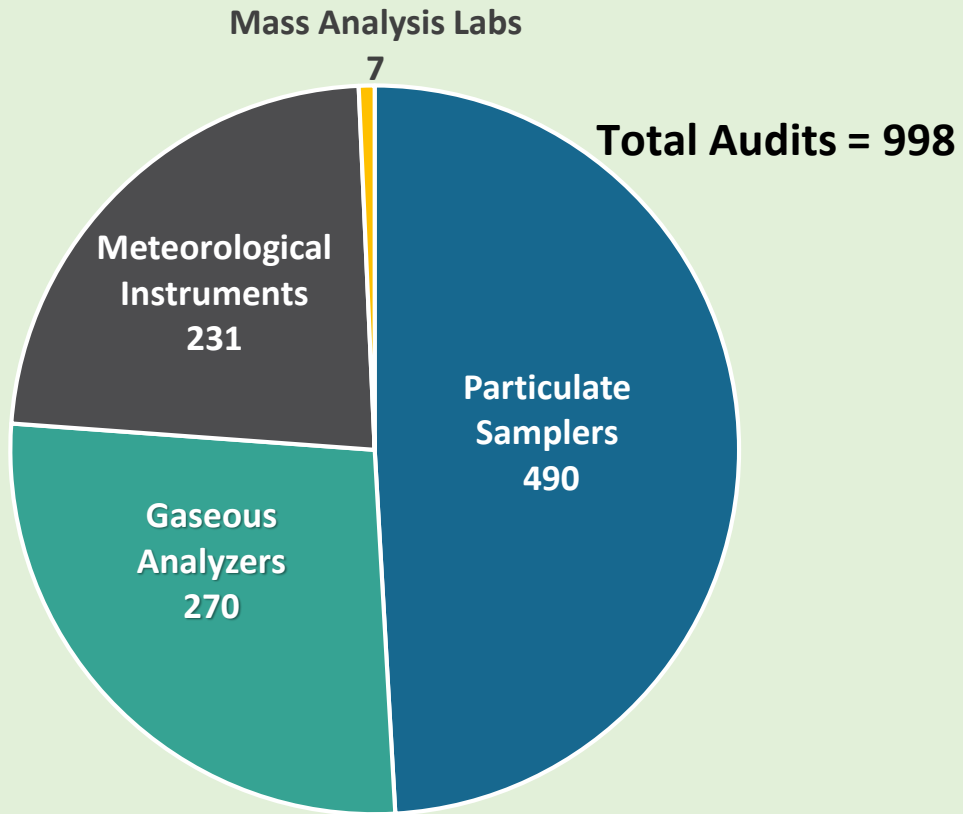
OVERVIEW

- Background
 - Independent verification
 - Federally mandated for ambient air data to be compared to national standards
 - Conduct audits using NIST traceable standards
 - Adhere to federally established acceptance criteria

OVERVIEW

- Background
- Types of Performance Evaluations

2018 AUDITS



2018 PERFORMANCE AUDITS

Include:

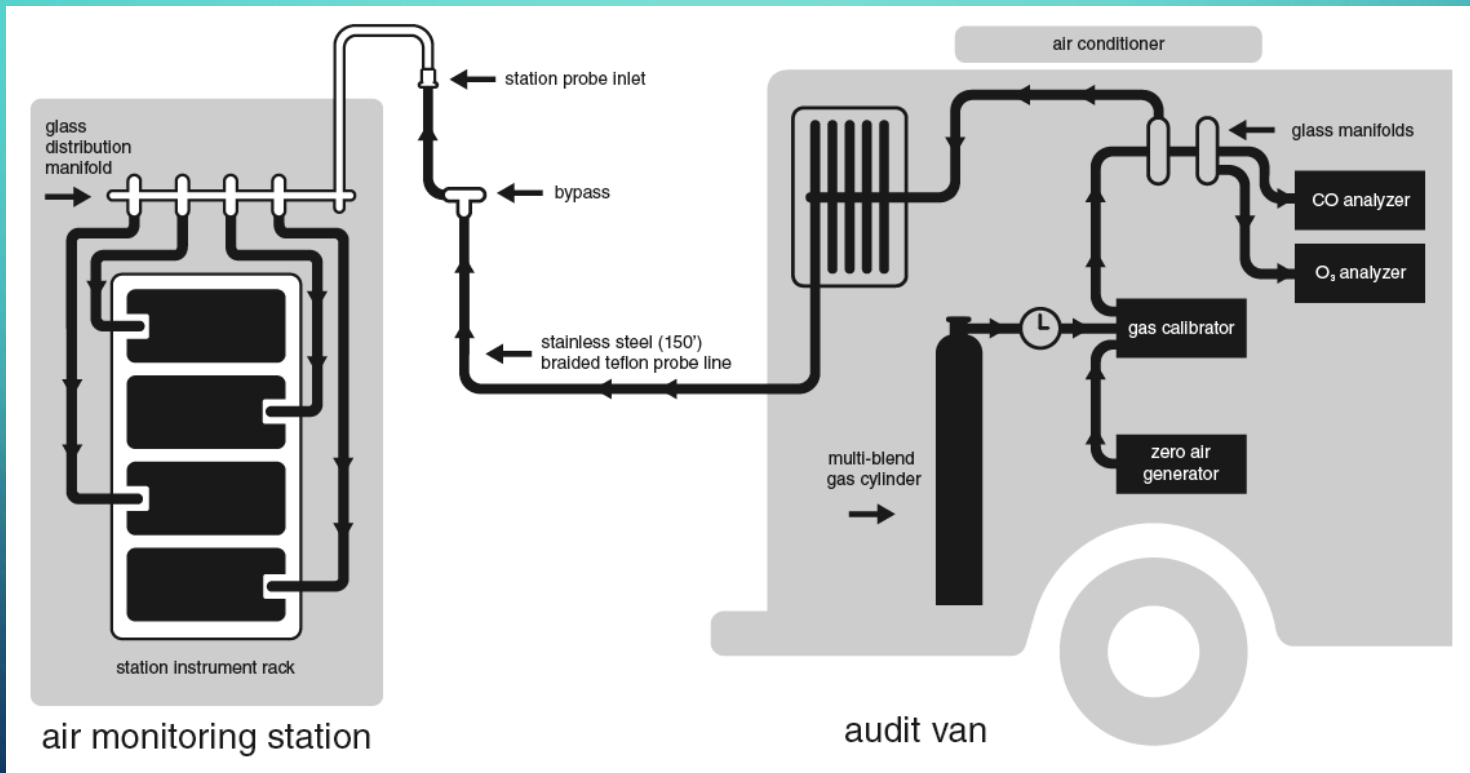
- Mass Analysis Laboratory
- Air Monitoring Stations
 - ≈ 267 active monitoring stations in the state.
 - 998 audits in 2018



OVERVIEW

- Background
- Types of Performance Evaluations
 - Gases and particulates

Through-the-Probe Audits developed by CARB in 1981 and then adopted nationally

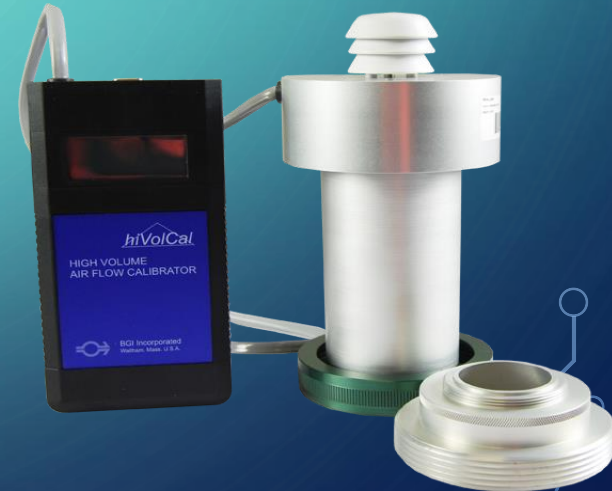


PARTICULAR SAMPLER OR FLOW RATE AUDITS



For particulate sampler audits we will use:

- BGI DeltaCal for BAMS and FRM2.5
- BGI TetraCal for SASS, Super SASS, Xontech, & TEOMs
- HiVol Direct read calibrator for HiVol samplers



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U.S. EPA AUDIT RANGES

Audit Level	EPA Concentration Ranges, ppm			
	O ₃	CO	NO ₂	SO ₂
1	0.004 – 0.0059	0.020 – 0.059	0.0003 – 0.0029	0.0003 – 0.0029
2	0.006 – 0.019	0.060 – 0.199	0.0030 – 0.0049	0.0030 – 0.0049
3	0.020 – 0.039	0.200 – 0.899	0.0050 – 0.0079	0.0050 – 0.0079
4	0.040 – 0.069	0.900 – 2.999	0.0080 – 0.0199	0.0080 – 0.0199
5	0.070 – 0.089	3.000 – 7.999	0.0200 – 0.0499	0.0200 – 0.0499
6	0.090 – 0.119	8.000 – 15.999	0.0500 – 0.0999	0.0500 – 0.0999
7	0.120 – 0.139	16.000 – 30.999	0.1000 – 0.2999	0.1000 – 0.1499
8	0.140 – 0.169	31.000 – 39.999	0.3000 – 0.4999	0.1500 – 0.2599
9	0.170 – 0.189	40.000 – 49.999	0.5000 – 0.7999	0.2600 – 0.7999
10	0.190 – 0.259	50.000 – 60.000	0.8000 – 1.000	0.8000 – 1.000

- Audit levels 1 & 2 have an absolute value or percent difference criteria.
- All other audit levels have a percent difference criteria
- No Corrective action taken at audit levels 1 & 2

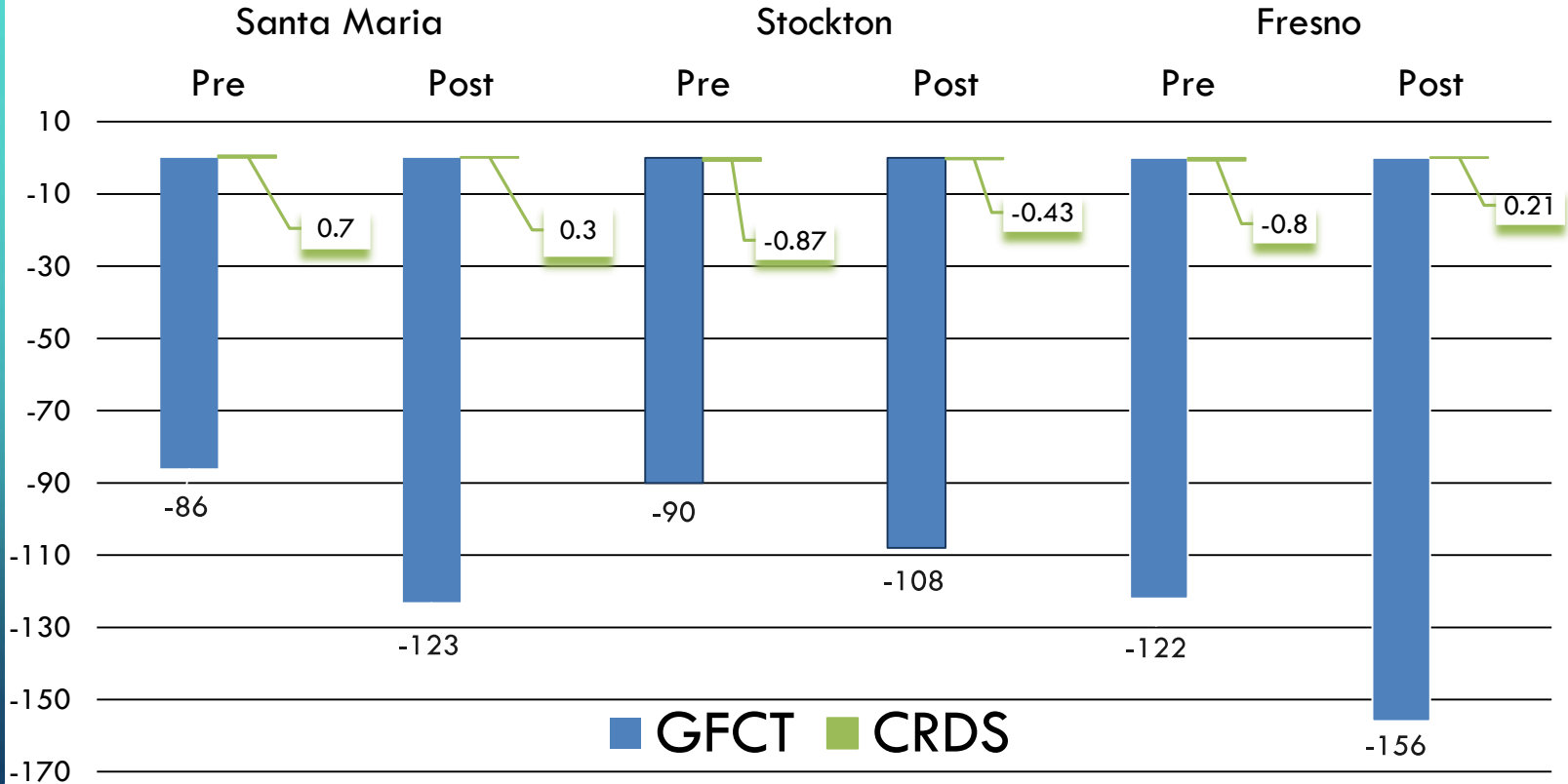
TRACE ANALYZER AUDIT ISSUES

- CO analyzer performance
 - Gas filter correlation technology (GFCT)
 - Known drift behavior
 - Intended for continuous sampling
 - Significant warm-up time
 - Not ideal for trace auditing
- Explore options for improved confidence and reliability of assessments.

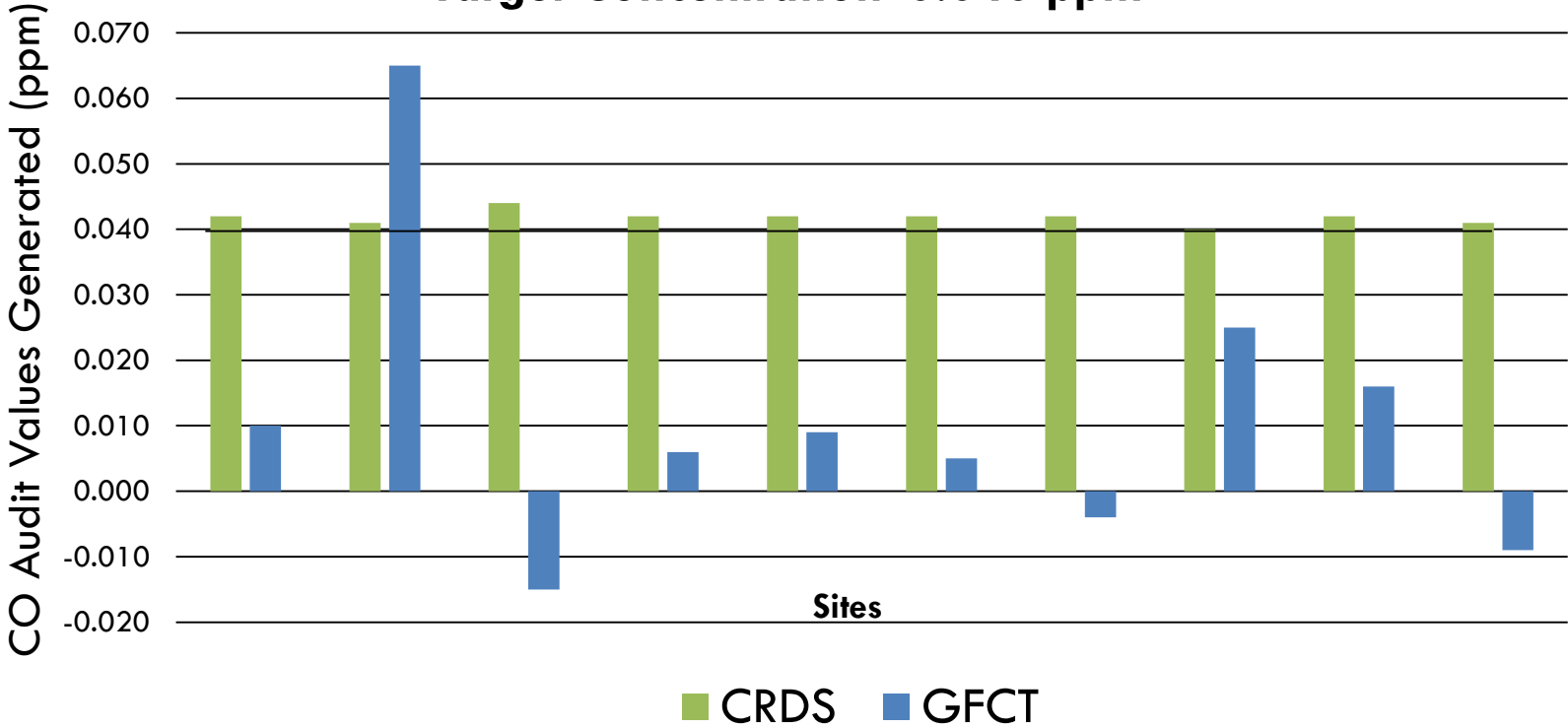
ALTERNATE CO ANALYTICAL METHOD

- Cavity Ring-Down Spectroscopy (CRDS) CO analyzer installed
 - Warm-up time greatly reduced
 - Consistently near target values (no drift)
 - Validates CO audit methodology for trace levels
 - Expensive
- Audited with CRDS and GFCT CO analyzers in parallel
- Likely to further enhance trace bias assessments

Comparison of Pre and Post Zeros – GFCT vs CRDS

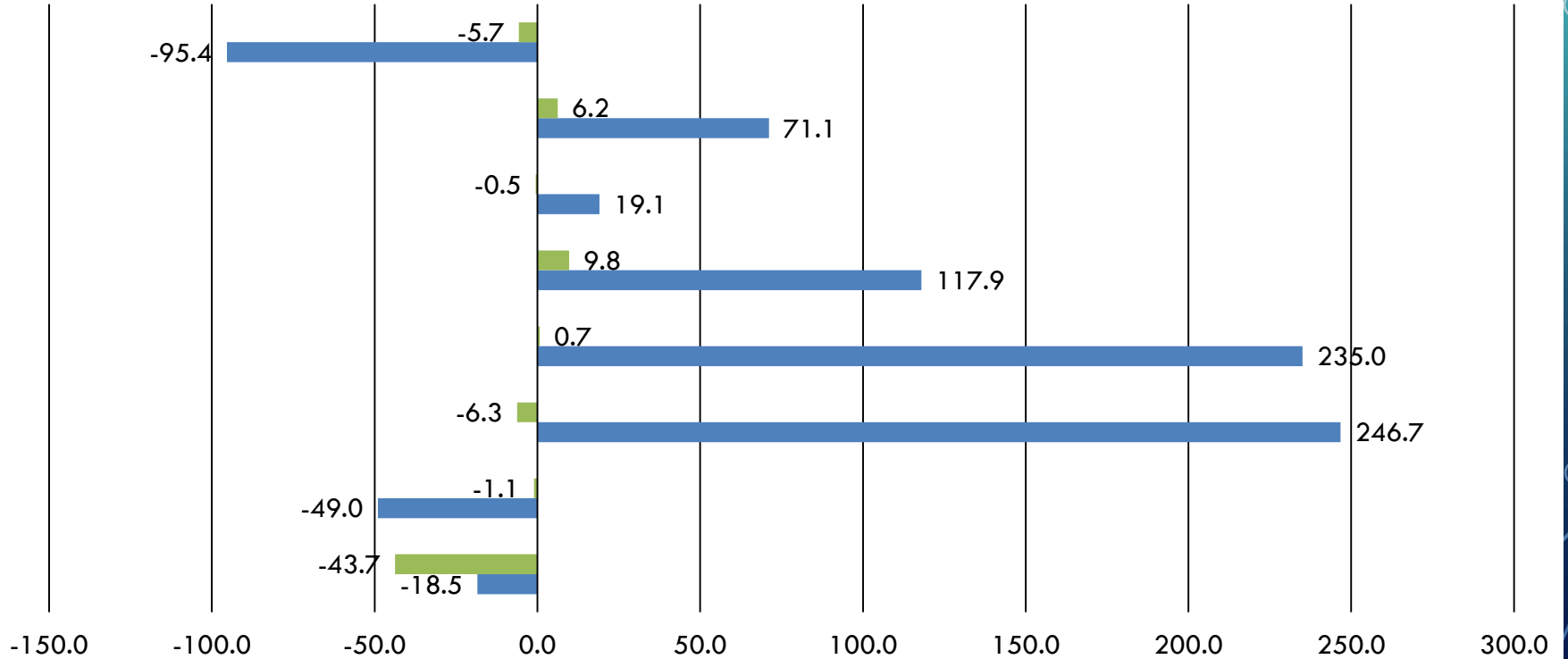


Comparison of CO Audit Level 1 Target Concentration 0.040 ppm



Audit Results -- Average Percent Difference Trace Level SO₂ - 2018

CRDS
GFCT



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AUDITS IN LATE 2019 OR EARLY 2020

- API T640 and T640X
 - Scattered light spectrometry
 - T640X Measures PM2.5 & PM10
- Thermo 5014i
 - Continuous BAM unit measures PM2.5
- API 602 Beta Plus
 - Continuous BAM unit measures PM10 & PM2.5 on filters.
- Direct-read NO₂ Analyzers

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PERFORMANCE AUDITS – *FUTURE ACTIVITIES*

PRESENTED BY AARON PLASENCIA
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OVERVIEW

- Airpointer
- Remote Audits
- UAV Technology
- Wind Tunnel



AIRPOINTER



AIRPOINTER - CAPABILITIES



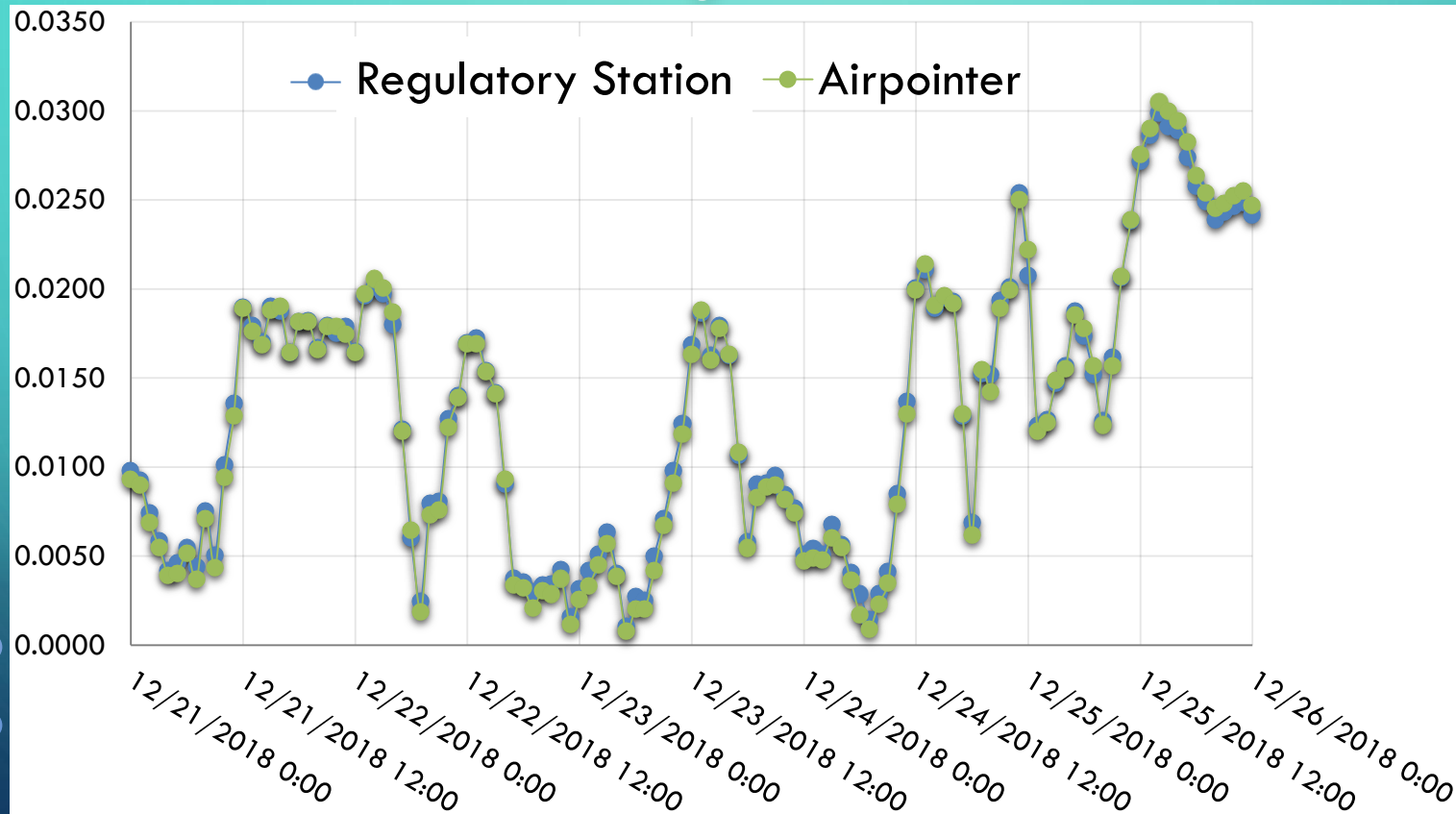
- FEM Designation
- Portability & Mounting
- API T640X
- O₃ & NO_x Analyzers
- Climate Control

TRIALS AND TRIBULATIONS

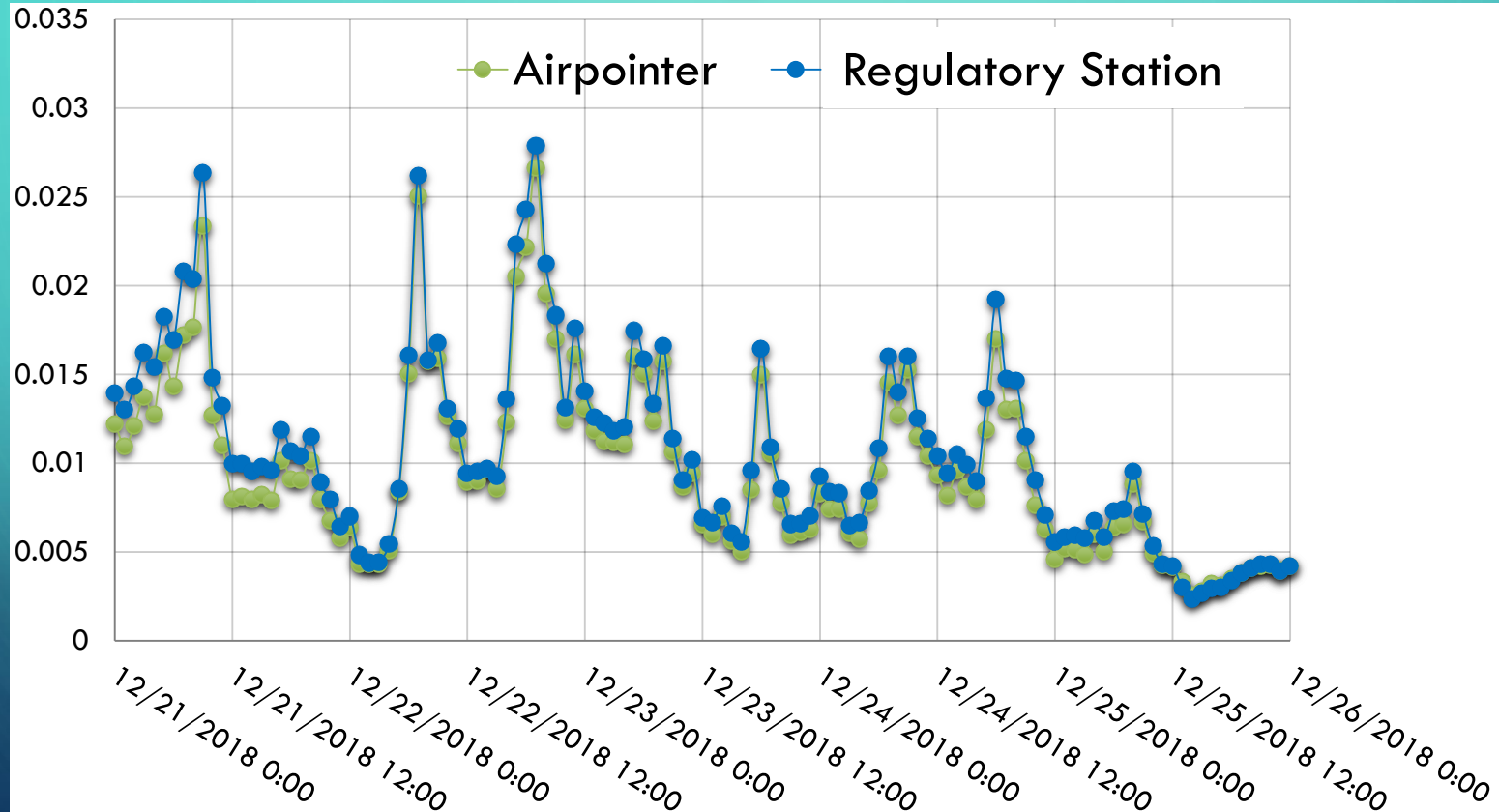
- Establishing Communication
- Stainless Steel Inlet
- Acceptance Testing
 - Through-the-Probe Audit
- Power Requirements



COMPARING O₃

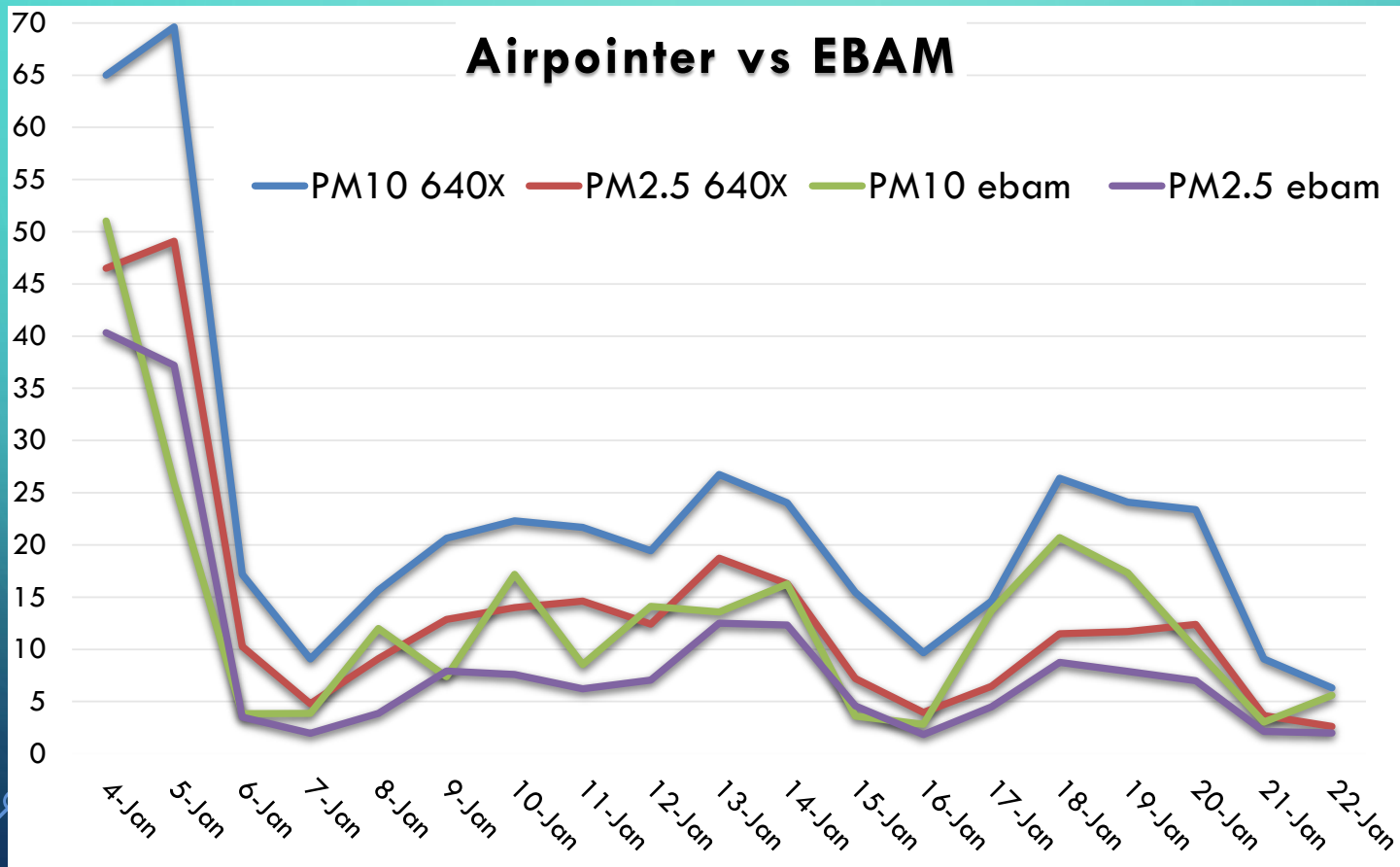


COMPARING NO_x



COMPARING PM

Airpointer vs EBAM



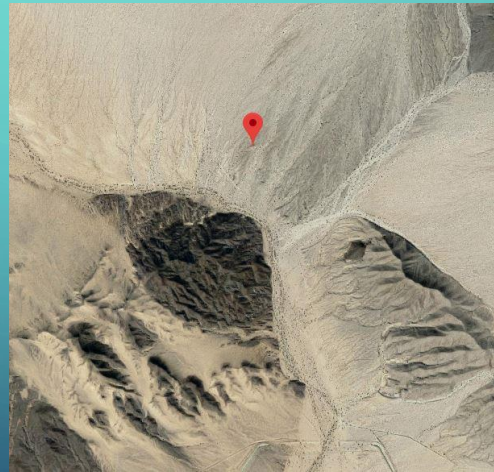
DEPLOYMENT



- Community Monitoring
- Areas of Interest
- Data Validation

LOOKING FORWARD: REMOTE AUDITS

- Dedicated/Rotating Audit System
- Remote Sites
- Automated Audits



Joshua Tree



Death Valley

LOOKING FORWARD: REMOTE AUDITS (continued)

- Infrastructure Cost
 - Calibrator, ZAG, Gas Cylinder



- Limitations
 - Gas Only
 - Siting/Residence Time/Flows



- Referee Instrument for Troubleshooting



UAV TECHNOLOGY



- Unmanned Aerial Vehicle
- Siting – Birds Eye View
- Layer Profiling / GIS Mapping
- FAA Requirements
- Restrictions

WIND TUNNEL



- Ultrasonic Meteorological Audits
- Transportability

TAKE-HOME MESSAGE

- Audit program evolves to reflect latest requirements
- Improvements on current practices to maintain integrity
- Possible future use of new technology

QUESTIONS?



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