PERFORMANCE AUDITS - CURRENT PRACTICE AND FUTURE ACTIVITIES

PRESENTED BY LAMAR MITCHELL
CARB Quality Assurance Section
2019 PQAO 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

Total Audits = 998

- Particulate Samplers: 490
- Gaseous Analyzers: 270
- Meteorological Instruments: 231
- Mass Analysis Labs: 7

Total Audits = 998
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
OVERVIEW

• Background
• Types of performance evaluations
• Update trace gas assessments
• 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.
ATTEMPT TO IMPROVE AUDIT ANALYZER PERFORMANCE
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 CO Audit Level 1
Target Concentration 0.040 ppm
Audit Results -- Average Percent Difference
Trace Level SO$_2$ - 2018

-95.4 -5.7 6.2 19.1 9.8 0.7 -6.3 235.0
-49.0 -1.1 246.7
-43.7 -18.5
OVERVIEW

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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 NO$_2$ Analyzers
OVERVIEW

• Background
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PERFORMANCE AUDITS
— FUTURE ACTIVITIES

PRESENTED BY AARON PLASENCIA
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2019 PQAO Training, Davis, CA
OVERVIEW

• Airpointer
• Remote Audits
• UAV Technology
• Wind Tunnel
AIRPOINTER - CAPABILITIES

• FEM Designation
• Portability & Mounting
• API T640X
• $O_3$ & $NO_x$ Analyzers
• Climate Control
TRIALS AND TRIBULATIONS

• Establishing Communication
• Stainless Steel Inlet
• Acceptance Testing
  • Through-the-Probe Audit
• Power Requirements
COMPARING O$_3$
COMPARING NO\textsubscript{X}

\begin{center}
\begin{tikzpicture}
\begin{axis}[
    title={Airpointer vs. Regulatory Station},
    ytick={0,0.005,0.01,0.015,0.02,0.025,0.03,0.035},
    xtick={12/21/2018 0:00, 12/22/2018 0:00, 12/22/2018 12:00, 12/23/2018 0:00, 12/23/2018 12:00, 12/24/2018 0:00, 12/24/2018 12:00, 12/25/2018 0:00, 12/25/2018 12:00, 12/26/2018 0:00},
    ymajorgrids=true,
    xmajorgrids=true,
    grid style=dashed,
    enlarge x limits=false,
    enlarge y limits=false,
    legend style={at={(0.5,-0.15)},anchor=north},
]
\addplot [mark=*, color=green!50!black, line width=1.2pt]
coordinates {
    (12/21/2018 0:00, 0.025) (12/22/2018 0:00, 0.02) (12/22/2018 12:00, 0.015) (12/23/2018 0:00, 0.022) (12/23/2018 12:00, 0.02) (12/24/2018 0:00, 0.018) (12/24/2018 12:00, 0.015) (12/25/2018 0:00, 0.013) (12/25/2018 12:00, 0.01) (12/26/2018 0:00, 0.008)
};
\addplot [mark=*, color=blue!50!black, line width=1.2pt]
coordinates {
    (12/21/2018 0:00, 0.032) (12/22/2018 0:00, 0.03) (12/22/2018 12:00, 0.028) (12/23/2018 0:00, 0.03) (12/23/2018 12:00, 0.028) (12/24/2018 0:00, 0.026) (12/24/2018 12:00, 0.024) (12/25/2018 0:00, 0.022) (12/25/2018 12:00, 0.02) (12/26/2018 0:00, 0.018)
};
\legend{Airpointer, Regulatory Station}
\end{axis}
\end{tikzpicture}
\end{center}
Comparing PM

Airpointer vs EBAM

- PM10 640x
- PM2.5 640x
- PM10 ebam
- PM2.5 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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