Standards to Data
Presenter: Jerry Freeman
Lake Tahoe Air Basin
The Unbroken Chain of Traceability

NIST Standard  Standards Lab  Field Sites
What is Traceability?

Final measurement will have traceability to NIST if:

- Unbroken chain of measurement back to NIST Standards is maintained.
- Each step has known & documented uncertainties.
- Quality system to ensure measurement accuracy.

NIST: National Institution of Standards and Technology
Standards Laboratory's Certification Services

- Ozone
- Low Flow
- High Flow
- Meteorological
- Gas Analysis
Ozone Certification
Standard Reference Photometer (SRP #4)
SRP #4’s Photometer = 89.7cm
Electronic Module
Pneumatic Module
EPA’s SRP Field Sites
Ozone Traceability

Figure 1.1. Ambient air ozone traceability scheme
Ozone Hierarchy

Level 1

NIST
SRP 2, 0

U.S. EPA OAQPS
SRP 7

U.S. EPA Regional Labs
SRP 1, 3, 4, 5, 6, 8, 9, 10, 13, 36

Level 2 – Primary Standards
State & Local Monitoring Labs

Level 3 – Transfer Standards
Ambient Air Monitoring Stations
SRP Test Bench
SRP Test Bench
# Certification Summary Sheet

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Date</th>
<th>Slope</th>
<th>Intercept</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/1/2013</td>
<td>1.004073</td>
<td>-0.000263</td>
</tr>
<tr>
<td>2</td>
<td>10/1/2013</td>
<td>1.003733</td>
<td>-0.001128</td>
</tr>
<tr>
<td>3</td>
<td>1/8/2014</td>
<td>1.003248</td>
<td>-0.000742</td>
</tr>
<tr>
<td>4</td>
<td>4/9/2014</td>
<td>1.001502</td>
<td>-0.000458</td>
</tr>
<tr>
<td>5</td>
<td>7/1/2014</td>
<td>1.002233</td>
<td>0.000386</td>
</tr>
<tr>
<td>6</td>
<td>10/7/2014</td>
<td>1.001384</td>
<td>-0.001017</td>
</tr>
</tbody>
</table>

**MEAN Slope:** 1.002695  
**MEAN Intercept:** -0.000537

- RSD Slope \( [(\text{Stdev} / \text{Mean}) \times 100] \): 0.11\% (\(< 1.5\) 
- FRSD Intercept \( [(\text{Stdev} / \text{Fullscale}) \times 100] \): 0.06\% (\(< 0.5\) 
- Change From Previous Calibration: 0.08\% (\(< 1.0\) 

**NEW CERTIFICATION RELATIONSHIP**

- Correlation Coef.: \(0.9999975\)

| Net Display = 1.002695 \(\times\) True Ozone = -0.000537
| True Ozone = 0.99731 \(\times\) Net Display + 0.000536

<table>
<thead>
<tr>
<th>Calibration</th>
<th>SLOPE</th>
<th>INTERCEPT</th>
<th>CORR. COE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS</td>
<td>PASS</td>
<td>PASS</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Verification</th>
<th>SLOPE</th>
<th>INTERCEPT</th>
<th>CORR. COE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASS</td>
<td>PASS</td>
<td>PASS</td>
<td></td>
</tr>
</tbody>
</table>
Low Flow Certification
Gas Calibrator Certification
Rotometers to Flow Meters
BGI Flow Calibrators
Molbloc-L
50 sccm – 100 slm
High Flow Certifications
High Flow Workstation
HiVol Fixed Orifice
Digital HiVolCal
Meteorological Certifications
Relative Humidity (RH) Calibrator

5 @ 20% & 90%
Temperature Calibrator

5 @ 0 & 50°C
Pressure Calibrator

CPC6000 Modular Precision Pressure Controller
Anemometer Certification
## Workload – Assays

### Monthly Average

<table>
<thead>
<tr>
<th>Ozone</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Flow</td>
<td>20</td>
</tr>
<tr>
<td>High Flow</td>
<td>6</td>
</tr>
<tr>
<td>Metrological</td>
<td>5</td>
</tr>
</tbody>
</table>
Certification Reports
CALIFORNIA AIR RESOURCES BOARD

FLOW CERTIFICATION REPORT

Log Number: 2014239

Calibration Date: 9/12/2014
Report Date: 9/16/2014

To: AIR MONITORING - SOUTH
From: ROBERT RUSSELL
DATA ANALYSIS & SPECIAL PROJECTS

IDENTIFICATION

Instrument: SABIO 2010D GAS CALIBRATOR
Property No.: 20121927
Serial No.: 118005113
Previous Log No.: 2014045
Bar Code No.: 20121927
Elevation: 25.09
Property of: AIR MONITORING - SOUTH

Site Name: MLD Standards Lab
Site Number: Location:
1927 13th Street
Sacramento, CA 95811

CALIBRATION STANDARDS

<table>
<thead>
<tr>
<th>ID Number</th>
<th>MOLBOX FLOW STANDARD</th>
<th>MOLBOXn FLOW STANDARD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20021121</td>
<td>20021493</td>
</tr>
</tbody>
</table>

LINEAR RELATIONSHIP

<table>
<thead>
<tr>
<th>POS</th>
<th>MFM / MFC Position</th>
<th>instrument Range</th>
<th>Maximum Display</th>
<th>Best Fit Linear Regression</th>
<th>Change From Previous Calibration (%)</th>
<th>Previous Calibration Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>10 slpm</td>
<td>10</td>
<td>10</td>
<td>1.0106</td>
<td>-0.1189</td>
<td>9/11/2014</td>
</tr>
</tbody>
</table>

Certification Equation: 10 slpm Corrected Air Flow = 0.9862 * (Instrument Display) + 0.123

Verification Expires: 9/12/2015

This instrument meets Verification Criteria.
CALIFORNIA AIR RESOURCES BOARD

OZONE CERTIFICATION REPORT

To: AIR MONITORING - SOUTH

From: JERRY FREEMAN
OPERATIONS PLANNING & ASSESSMENT

Log Number: 2014239

Calibration Date: 9/2/2014
Report Date: 9/2/2014

Identification

Instrument: SABIO 2010D GAS CALIBRATOR
Property No.: 20121927
Serial No.: 11800513
Previous Log No.: 2014 045
Bar Code No.: 20121927
Elevation: 25.0'
Property of: AIR MONITORING - SOUTH

Site Name: MLD Standards Lab
Site Number: 34-299
Location: 1927 13th Street
Sacramento, CA 95811

Calibration Standard

NIST STANDARD REFERENCE PHOTOMETER

ID Number: 4

Calibration Results

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>OZONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instrument Range</td>
<td>500 ppb</td>
</tr>
<tr>
<td>Air Flow Rate, SLPM/SCCM</td>
<td>1095</td>
</tr>
<tr>
<td>Air Flow Setting</td>
<td>1094</td>
</tr>
<tr>
<td>Best Fit Linear Regression</td>
<td>Slope: 0.9944</td>
</tr>
<tr>
<td></td>
<td>Intercept: (O3 = ppm): 0.00187398</td>
</tr>
<tr>
<td>Deviation From True (%)</td>
<td>-0.56</td>
</tr>
<tr>
<td>Change From Previous Calibration (%)</td>
<td>0.10%</td>
</tr>
<tr>
<td>Previous Calibration Date</td>
<td>8/29/2014</td>
</tr>
<tr>
<td>Certification Expires:</td>
<td>3/3/2015</td>
</tr>
</tbody>
</table>

Certification Equation:

True Ozone Conc = 1.0038 * (Net Display) - 0.00144 ppm

Calibrated by: [signature]

Checked by: [signature]
Gas Analysis System
NEW Gas Analysis System
## EPA Protocol Gas Verification Program

<table>
<thead>
<tr>
<th></th>
<th>NO (CC89594)</th>
<th>CO (CA03690)</th>
<th>SO2 (CA01201)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARB</td>
<td>97.73</td>
<td>45.23</td>
<td>102.80</td>
</tr>
<tr>
<td>PGVP</td>
<td>99.04</td>
<td>44.87</td>
<td>101.06</td>
</tr>
<tr>
<td>% bias</td>
<td>1.34%</td>
<td>-0.81%</td>
<td>-1.69%</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>0.26%</td>
<td>0.33%</td>
<td>0.06%</td>
</tr>
</tbody>
</table>
Gas Certifications

G1 Direct Inject
- Ranges (PPM)
  - NO  20 - 200
  - CO  8 - 600
  - SO2 13 - 200

G2 Dilution
- Typical Conc.
  - NO  200 PPM
  - CO  6000 PPM
  - SO2 200 PPM
Super Blend Certification

CERTIFICATE OF ANALYSIS
CALIFORNIA AIR RESOURCES BOARD
MONITORING AND LABORATORY DIVISION

Cylinder Number: JJ8640
Analysis Date: 8/28/2014
Owner: AM - North
Procedure Type: G1

Certified Concentration(s):

NO: 63.7 ppm
CO: 3089.6 ppm
SO2: 50.16 ppm

Certification valid until 8/28/2016
or if the press. is less than 200 psi
Certified by: R. RUSSELL
Conclusion

What we can DO

• Ozone
• Low Flow
• High Flow
• Meteorological
• Gas Analysis

What we can’t DO
Conclusion

What we can DO

FOR FREE

What we can’t DO

* Include Return Shipping Label
Points of Contact

Robert Russell
916-322-0216
Robert.Russell@arb.ca.gov

Jerry Freeman
916-324-1845
Jerry.Freeman@arb.ca.gov