

Objective

Utilize EPA Method 301 to Assess EPA Alternate Method 082 Suitability for Determining Plume Opacities on Large Diameter Stationary Sources

Introduction

- ASTM-D7520 Published in '09 :
 - Digital Camera based EPA Method 9
 - Camera and Software Replace Observer Eyes
 - The Primary Disagreement in ASTM Work Group:
 - ❖ Some Contend Stack Diameter Irrelevant, thus Smoke School Generators are a Suitable Surrogate for All Sources,

$$I = I_0 \cdot (-\tau)$$

Where:
 I_0 is the incident radiance
 I is the transmitted radiance
 τ is the path length

- ❖ Some Contend Large Diameter Stacks are Different and Require Separate Supporting Analysis and Data.
- ASTM Work Group and Committee Compromised by Application of an Arbitrary 7ft Limitation to ASTM-D7520-09

- EPA Recognized ASTM-D7520-09 via EPA Alternative Method 082:
 - EPA Was Silent on 7ft Limit
 - Certification Requirements Were Clarified and Enhanced
 - Industry Lawyers Responded Resulting In EPA Recognition of the 7ft Limit in Lieu of a Method 301 Study Supporting Its Removal

- Virtual Technology LLC Performed a Series of EPA Method 301 Studies:
 - Compare Alternative Test Method to The Current Compliance Test Method.
 - EPA Alternate Method 082 Compliant System (DOCS II) vs. Human EPA Method 9 Observers Reading Large Diameter Sources (> 7ft).

EPA ALTERNATE METHOD 082

301 Study For Large Diameter Stationary Sources
 Does Size Matter?

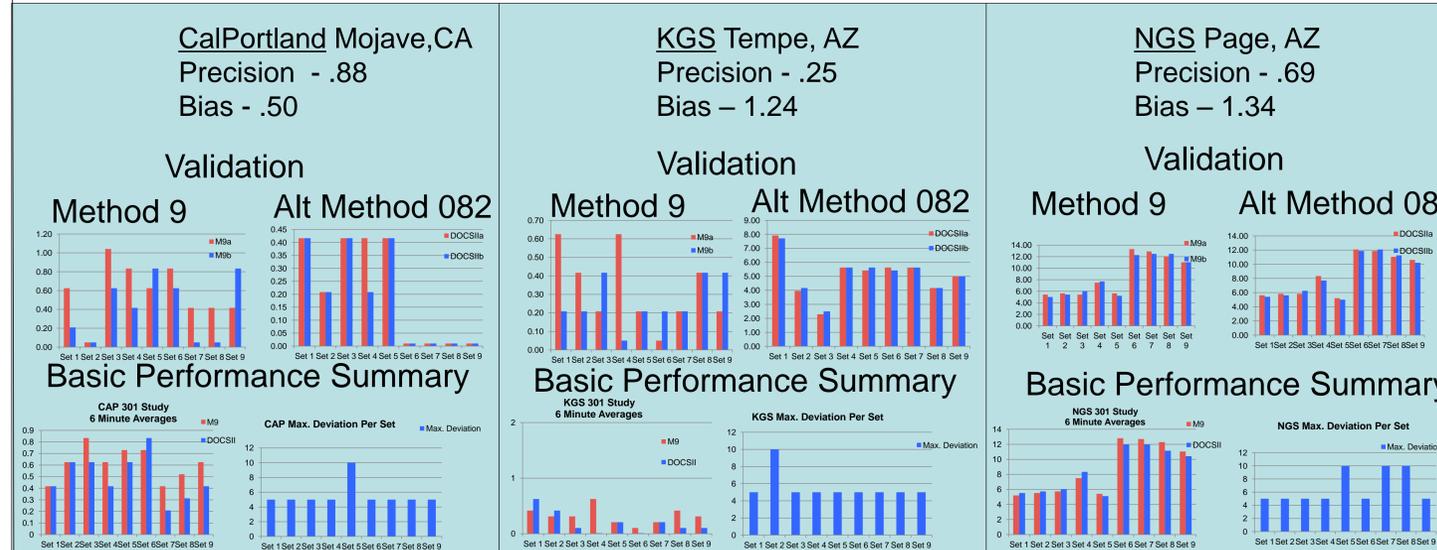
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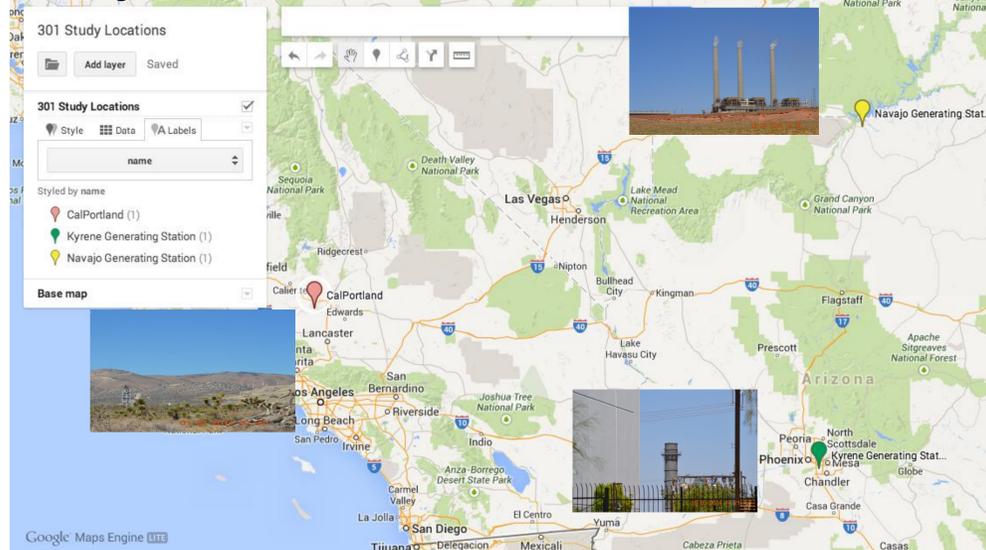
Results

301 Study Precision Limit - 3.179

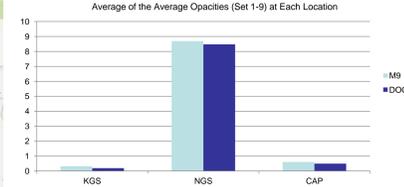
301 Study Bias Limit - 2.262



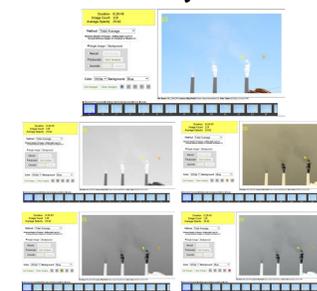
Legend



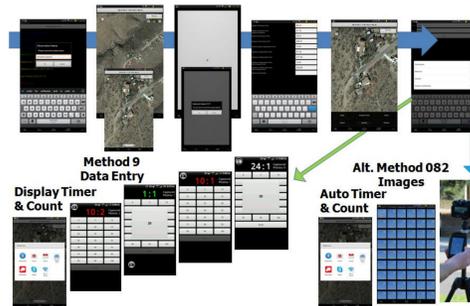
Comparison of Methods



Analysis



Location	Method 9 Avg	Alt Method 082 Avg
CalPortland	0.88	0.50
KGS	1.24	0.25
NGS	1.34	0.69



Experimental Design

- EPA Method 301 “Collect Multiple, Collocated, Simultaneous Samples...”:
 - 9 sets of 24 Reading Observations Gathered by 2 Pairs of Cameras and EPA Method 9 Observers, Collocated, with Observations Time-Synchronized
- 3 Sites With Stacks >7 Feet Operating Within Generally Accepted Regulatory Range (20%)
- Field Quality Measures:
 - Position and Orientation of Observers and Cameras Relative to the Sun
 - Geo-Location and Offsets of All Required Points
 - Metrology Data
 - Collocated and Time-Synchronized Observations
 - Digital Direct Connect to DOCS II Server
- Data Quality Measures:
 - DOCS II Analyst’s were Geographically Separated, and Performed Analysis without Visibility, to Method 9 Reading Results or the Other Analyst’s Results
 - Validated Results Exported into Spreadsheet by QA Person Who was Not Involved in Any Other Part of The Process
 - Analysis in Spreadsheets Validated by Third Party

Conclusions

EPA Alternate Method 082 Compliant System (DOCS II) Determined Avg. Opacities Do Not Vary from EPA Method 9 Observer Determined Avg. Opacities in a Statistically Significant Way When Observing Emissions From Stationary Sources > 7ft

Beer-Lambert-Bouguer Collectively Smile !