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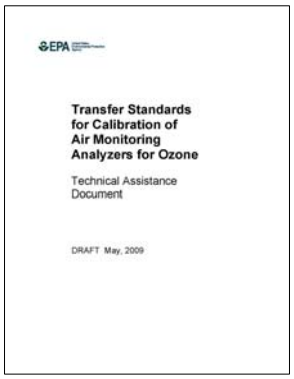
Office of Air Quality Planning and Standards

Review-Ozone Transfer Standard Guidance



EPA

Transfer Standards for Calibration of Air Monitoring Analyzers for Ozone

Technical Assistance Document

DRAFT May, 2009

Table 4-1 6-Day Initial Ozone Verification

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Background

- Original document developed in 1979
  - Not many standards available
  - People were building there own
  - SRPs were not around yet
- Why Now
  - Newer/better technology
  - Newer terminology
  - Some methods no longer used

Guidance Document at:
http://www.epa.gov/ttn/amtic/srpqa.html

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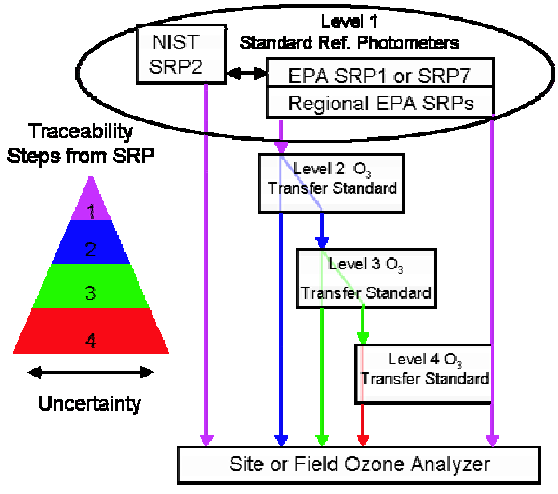
New Model for Ozone Standards



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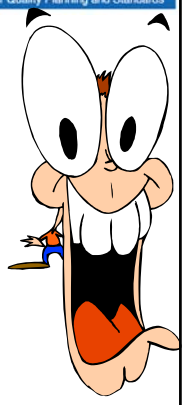
What Have We Done



- Language- included a glossary
  - Using Levels starting from family of SRPs
  - Replaced “certification” with “verification”
- Consolidated to 4 sections from 6
- Removed Old Methods
  - Boric Acid Potassium Iodide
  - GPT with Excess Nitrogen Oxide
  - GPT with Excess Ozone
- “Softened” Qualification
- Nothing changed with verification procedure

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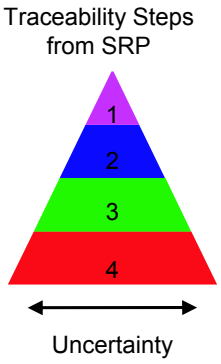
What are we going to do?

- Adding Uncertainty
  - Trying to determine a way to add an uncertainty estimate at each level
  - If the additive uncertainty reaches some unacceptable value then you fix and you can’t go below that transfer standard level.
  - Develop in a user friendly way (e.g. a Transfers Standard DASC tool on the Web?)



What do you think?

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Summary Table

Requirement	Frequency	Acceptance Criteria	Information /Action
Regional Standard Reference Photometer (SRP) (Level 1 Standard)			
Verification	1/year	Regression slope = 1.00 ± 0.01 and intercept <± 1 ppb	This is usually at a Regional Office and is compared against the traveling EPA SRP
Ozone Level 2 Transfer Standard			
Qualification	Upon receipt of transfer standard	±4% or ± 4 ppb (whichever greater)	Transfer Standard Doc EPA XXXX App B
Verification (6x6)	After qualification and upon receipt/adjustment/repair	RSD of six slopes 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc XXX Section 4.1
Verification/ reverification to SRP Min- 6 points 7 replicates	After qualification and upon receipt/adjustment/repair 1/year	Each individual point difference ≤ ± 3%	Level 2 standard usually transported to EPA Region's SRP for comparison
(if recertified via a transfer standard)*	1/year	Regression slopes = 1.00 ± 0.03 and two intercepts are 0 ± 3 ppb	
Ozone Transfer Standards Levels 3 and Greater			
Qualification	Upon receipt of transfer standard	± 4% or ±4 ppb (whichever greater)	Transfer Standard Doc EPA XXXX App B
Verification (6x6)	After qualification and upon receipt/adjustment/repair	RSD of six slopes 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc XXX Section 4.1
Reverification to Level 2 standard	Beginning and end of O3 season or 1/6 months whichever less	New slope = ± 0.05 of previous and RSD of six slopes 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc XXX Section 4.2

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Recommendations On Use Of Specific Types Of Transfer Standard Devices

- Level-2 standards and/or standards used in the verification of other transfer standards include both a generation device and a photometer.
- Level-3 standards be, at a minimum, a photometer. The level 3 standard can be a photometer and generator but should not be just a generator.
- Level-4 and greater can be a ozone generation device.

What Else?

- Strongly suggest bringing the monitoring organizations "bench standard" to the SRP not a surrogate
- No adjustments- Suggesting that verifications be accomplished without adjustments. Allows for "drift and fix" paradigm.

Questions

- Does the guidance seem reasonable?
- Specific Comments?
- What are your concerns?

Please provide any and all comments by June 19
papp.michael@epa.gov

Developing model for traceability calculations

1. Would like to include uncertainty of higher level photometer comparisons in verifications.
2. Existing least-squares model assumes that for a given photometer verification, the higher level photometer measures without error. Would like to relax this assumption.

Proposed Approach

The current approach is a linear regression where:

- $Y=\alpha+\beta X+e$
- Y=reading of lower level photometer
- X=reading of higher level photometer
- If normal errors, $e \sim N(0,\sigma^2)$

The proposed approach:

- Introduce regression parameters specific to each photometer (α_X ,β_X), (α_Y ,β_Y), where α_X, α_Y, β_X, β_Y, would be regression parameters for regression of X or Y on true (unknown) ozone concentration.
- Estimate parameters of (α_Y ,β_Y) in highest level comparison using assumption that highest level photometer measures without error (this can also be considered to be an assumption of the current approach).
- In lower level comparisons apply regression model allowing for error in both X and Y and use relationship $\alpha=\alpha_Y- \beta\alpha_X$, $\beta= \beta_Y/\beta_X$ to estimate slope and intercept of lower level photometer, given previous estimates for higher level photometer.

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- Suppose four-level traceability chain, with acceptance criteria for regression slope at each level being 1 +/- 0.05.
- For each verification, simulate 6 ozone readings over 0-1000 ppb at approximately SRP1/SRP7 precision
- All photometers tested have bias β=1.04

Photometer	True values			Estimated values current approach		Estimated values proposed approach	
	α	β	Cumulative bias	α	β	α	β
NIST	0	1	1.00	0	1	0	1
Level 1	0	1.04	1.04	-0.476	1.041	-0.476	1.041
Level 2	0	1.04	1.08	-0.044	1.002	-0.521	1.042
Level 3	0	1.04	1.12	-0.686	1.002	-1.208	1.044
Level 4	0	1.04	1.17	0.259	1.000	-0.948	1.043

- For current approach:
  - the first comparison suggests bias, but not others.
- For proposed approach:
  - All comparisons suggest bias, although none exceed bounds of acceptance criteria.
  - Cumulative bias exceeds acceptance criteria by second comparison.

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