

Improved O₃ Scrubbers for Network Photometer Upgrades

Ozone Transport Commission

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Recent Developments in Ozone Photometer Scrubbers

- Current network O₃ photometers are subject to positive interference bias (Hg, H₂O, Aryl VOCs) raising O₃ design values **Spicer et al. JAWMA 60: 1353–1364 (2010); Johnson et al. JAWMA 64: 360-71 (2014).**
- Nitric oxide-gas phase titration (NO-GPT) or heated graphite O₃ scrubbers improve both photometer accuracy (See Tech Note #40 - <http://www.twobtech.com/products.htm>) and O₃ NAAQS attainment **Ollison et al. JAWMA 63: 855–863 (2013).**
- FEM NO-GPT photometer or NO-chemiluminescence monitor swaps with existing FEM photometers would resolve such biases promptly. **79 FR 34734-5 (6/18/14); 76 FR 62402-3 (10/7/11).**

EPA Proposes No O₃ Monitor Upgrades in Revised NAAQS

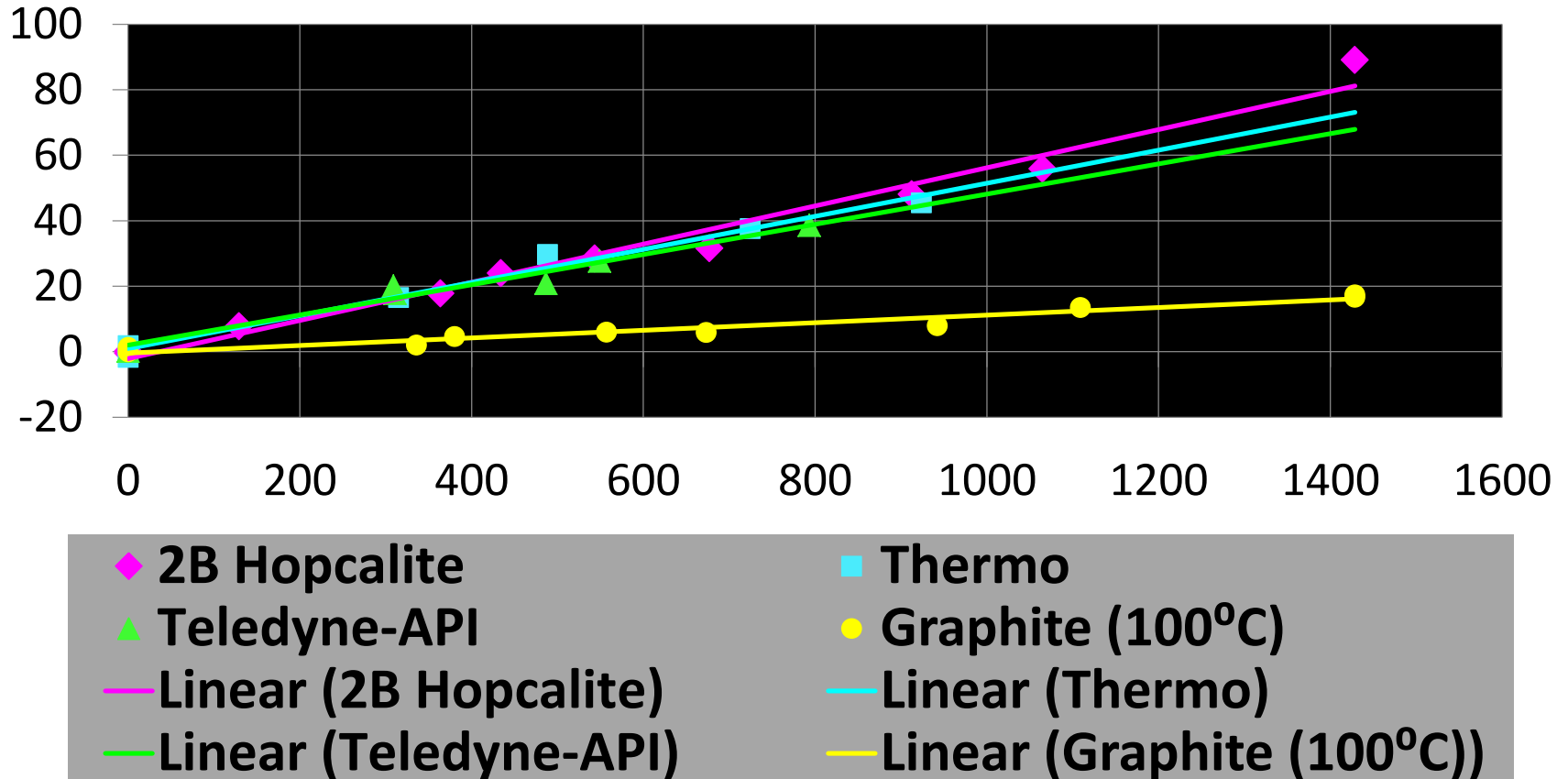
- “Commercial availability of **conventional UV-absorption O₃ analyzers** is excellent...However, the technique is **susceptible to potential measurement interference from mercury, some volatile aromatic hydrocarbons, water, and other compounds** that sometimes occur in ambient air (Spicer et al., 2010)... Although the interferences are substantially reduced by the use of scrubbers, **the potential for interferences prevents the technique from consideration as an FRM.**”
- “There will be **no requirement** for states to switch to NO-CL analyzers; therefore, **UV absorption FEM analyzers can still be used for routine O₃ monitoring.**”

79 FR 35367 (12/17/2014).

Feasible Scrubber Upgrades to Existing Network Photometers

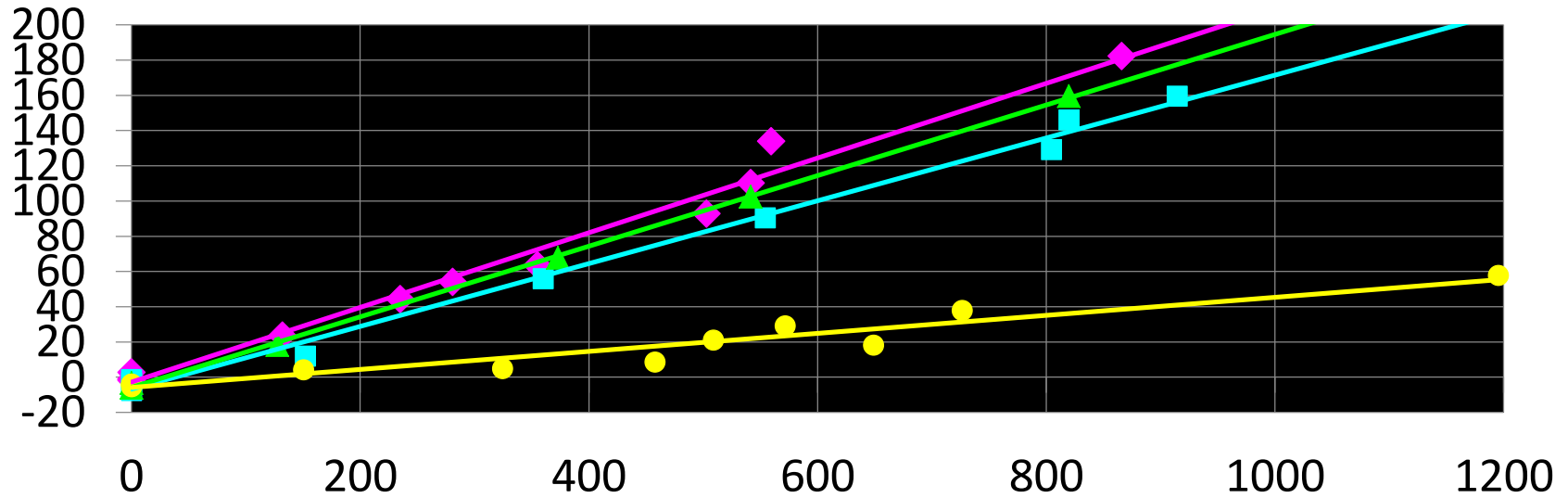
- NO-GPT O₃ scrubbers presently remain commercially available for low-cost network photometer upgrades http://www.twobtech.com/model_GPT.htm.
- NO-GPT upgraded photometer accuracy may be further improved by equally diluting both sample & reference streams with N₂O, which is used as the photolyzed source of NO in the scrubbed reference stream.
- Graphite scrubbers may also be commercially available this year, providing lower-cost but slightly less improved photometer upgrades. [J.W. Birks, et al., *Heated Graphite Scrubbers to Reduce Interferences in Ozone Monitors*, U.S. Provisional Patent Application, 28 July 2014.](#)

4-Fold Graphite Scrubber Cut in O₃ bias (ppb) vs. p-Xylene (ppb)



J.W. Birks et al. *Heated Graphite Scrubbers to Reduce Interferences in Ozone Monitors*, Private Communication, 2015

4-Fold Graphite Scrubber Cut in O3 bias (ppb) vs. Phenol (ppb)



J.W. Birks et al. *Heated Graphite Scrubbers to Reduce Interferences in Ozone Monitors*, Private Communication, 2015

40 CFR Part 58, Appendix C Modification Applications

- Low-cost scrubber upgrades need EPA approved 40 CFR Part 58 Appendix C modification applications from state, local, or tribal (SLT) agencies or associations (NESCAUM, MARAMA).
- EPA approved **vendor instrument applications** apply to all monitoring sites/regions. **SLT or association applications** apply only to specific areas and EPA may require justified acceptable performance tests by O3 level, season, and area.
- EPA may also require added interference testing depending on the technical and geographical scope of the requested modifications.
- Uncooperative vendors may choose to withhold warranty repair and vendor upgrade coverage of modified units.

Recommendations

- 40 CFR Part 58, Appendix C provides an O₃ monitor modification process for certifying FEM photometer O₃ scrubber upgrades; SLT agencies should ask EPA to facilitate such relatively low-cost photometer upgrades.
- SLTs or associations (e.g., NESCAUM, MARAMA) should conduct the comparison testing needed to develop upgraded network photometer scrubber modification applications.
- EPA should favorably review such applications and support cost-effective scrubber modifications to improve the accuracy of existing network O₃ photometers and to enhance O₃ NAAQS compliance.