

O₃ Scrubber Upgrade & Inlet Height Effects on Network Photometers

**Ozone Transport Commission
OTC/MANE-VU Committee Meeting**

September 10, 2015

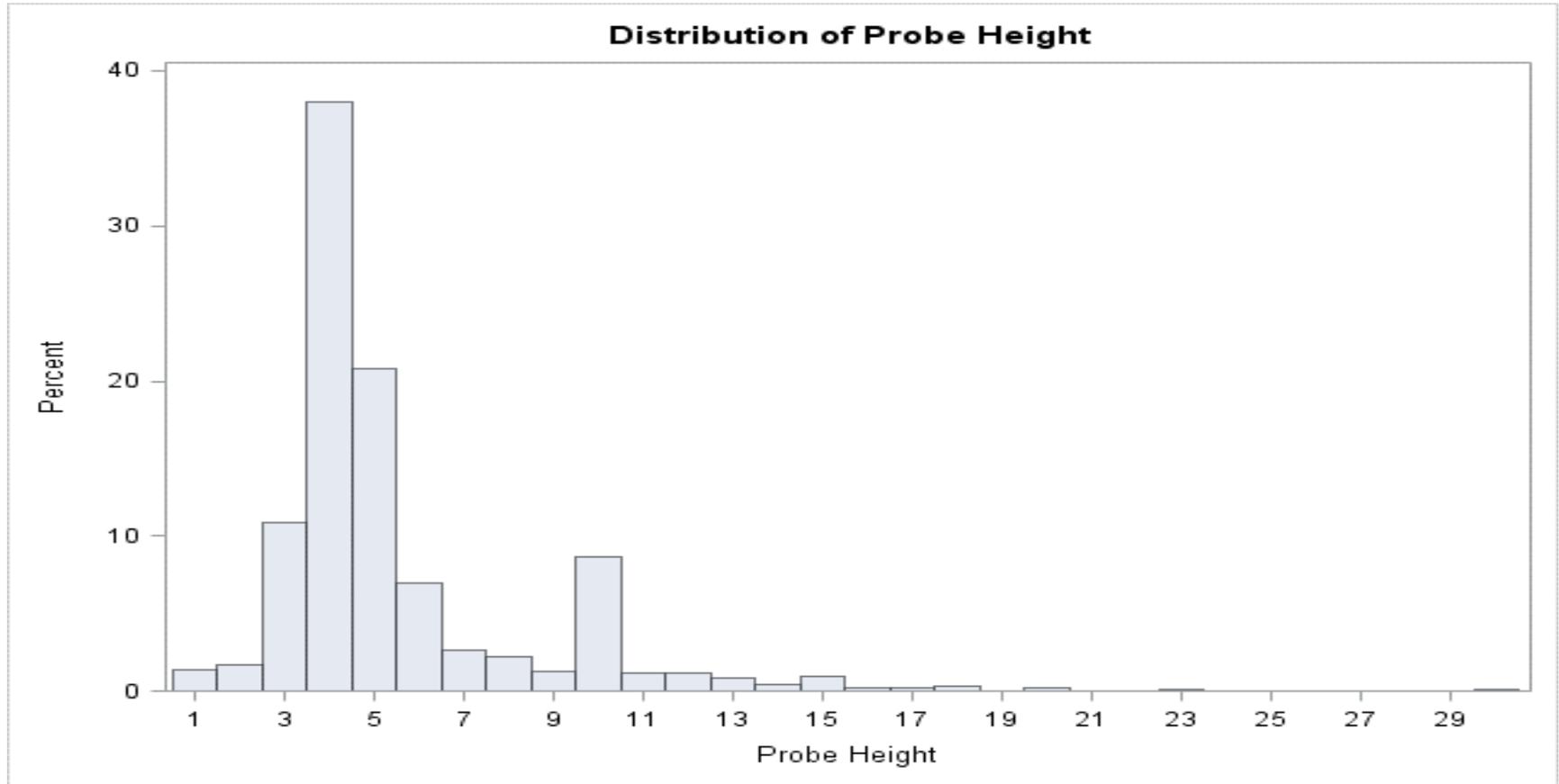
Washington, DC

Will Ollison

Upgraded O₃ Photometer & Inlet Height Measurements

- 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) O₃ scrubber upgrades (http://www.twobtech.com/model_GPT.htm) raise accuracy (Note #40 <http://www.twobtech.com/products.htm>) and NAAQS compliance **Ollison et al. JAWMA 63: 855–863 (2013).**
- U.S. O₃ monitor inlet heights average 5.4 meters (**Richard Wayland–personal communication**); but it's thought that 2 meter inlets better (1) approximate outdoor nose level exposure and (2) appear to better comply with ambient O₃ NAAQS.

Distribution of O₃ Compliance Monitor Inlet Heights (m)

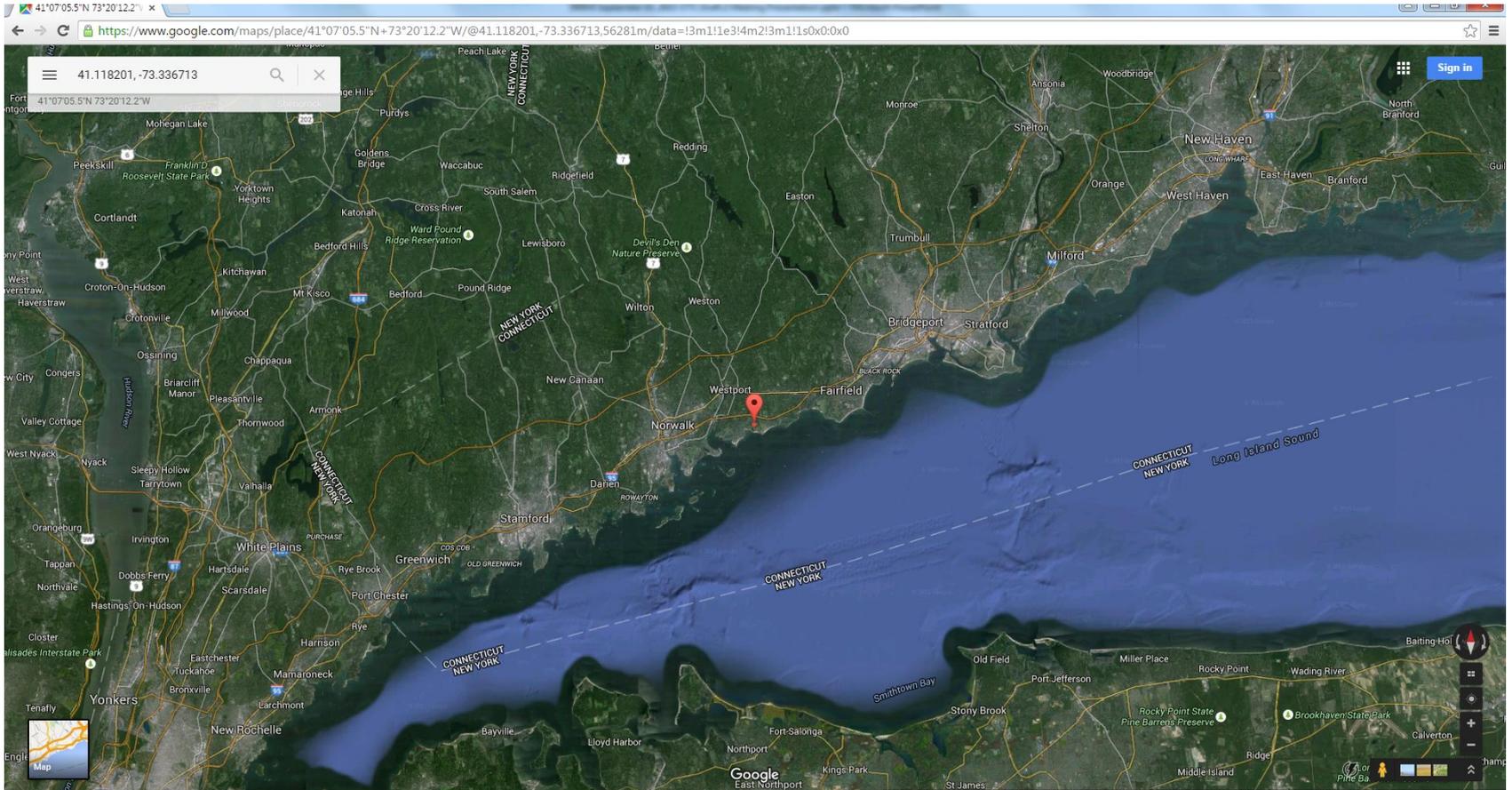


Richard Wayland – Personal Communication

Westport, CT Upgraded O₃ Monitor and Inlet Height Study

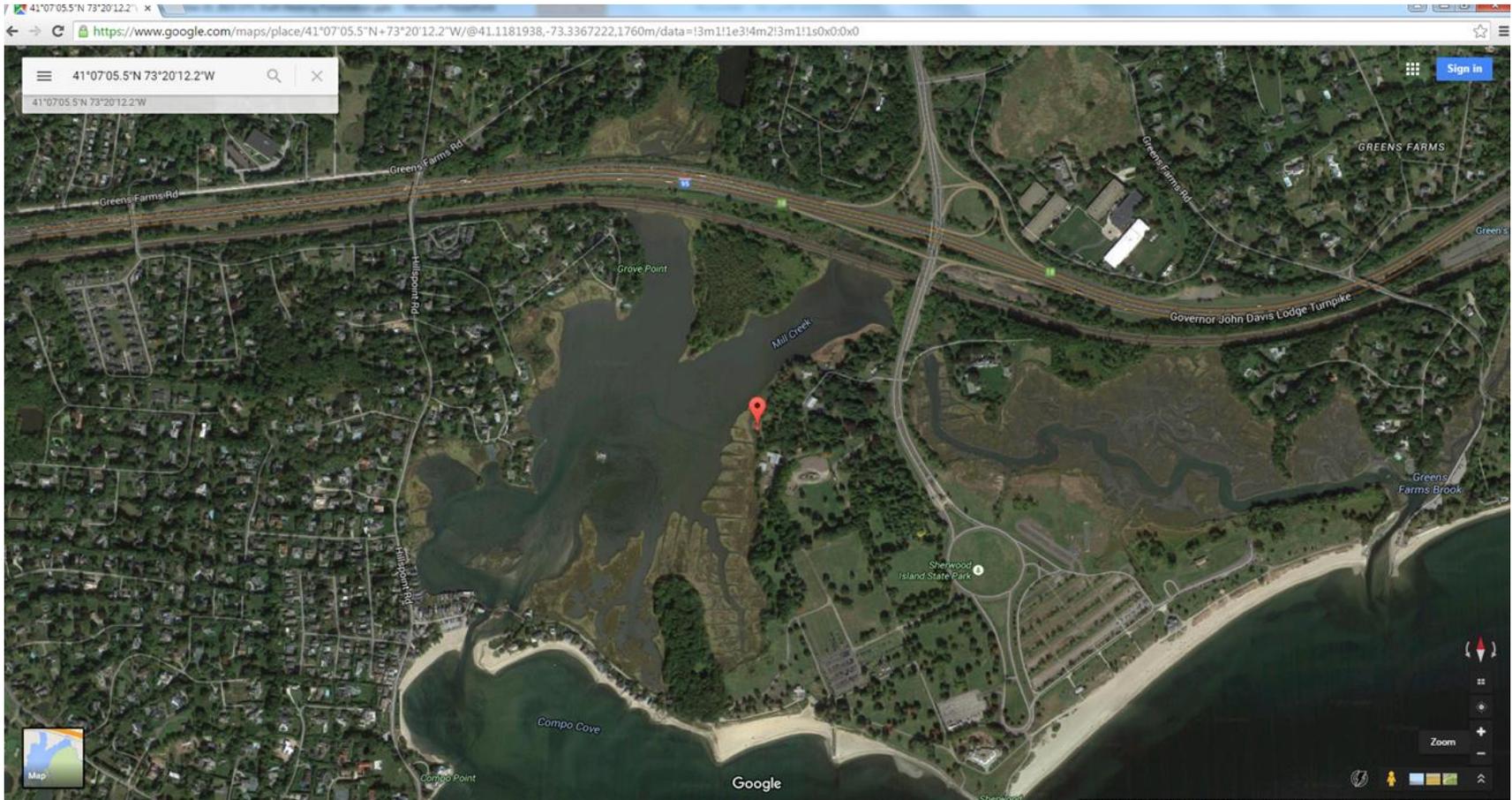
1. A collocated NO-scrubbed upgraded Teledyne-API T400 photometer, with alternate 5-min sampling (4-min before 6/29/15) at 2m and 6.2m inlets, is compared to the conventional Westport site TAPI T400.
2. Measured O₃ levels adjusted daily for relative monitor drift.
3. Preliminary findings:
 - Upgraded NO-scrubbed photometer O₃ peaks decrease with inlet height during stable meteorological conditions
 - Collocated upgraded NO-scrubbed photometer O₃ peaks generally decrease with respect to conventional photometer values.

Westport, CT Monitoring Site



Google Maps 41.118201, -73.336713

Westport, CT Monitoring Site



Google Maps 41.118201, -73.336713

Westport, CT Monitoring Site



Alan Leston – Personal Communication

2 Meter Westport Inlet



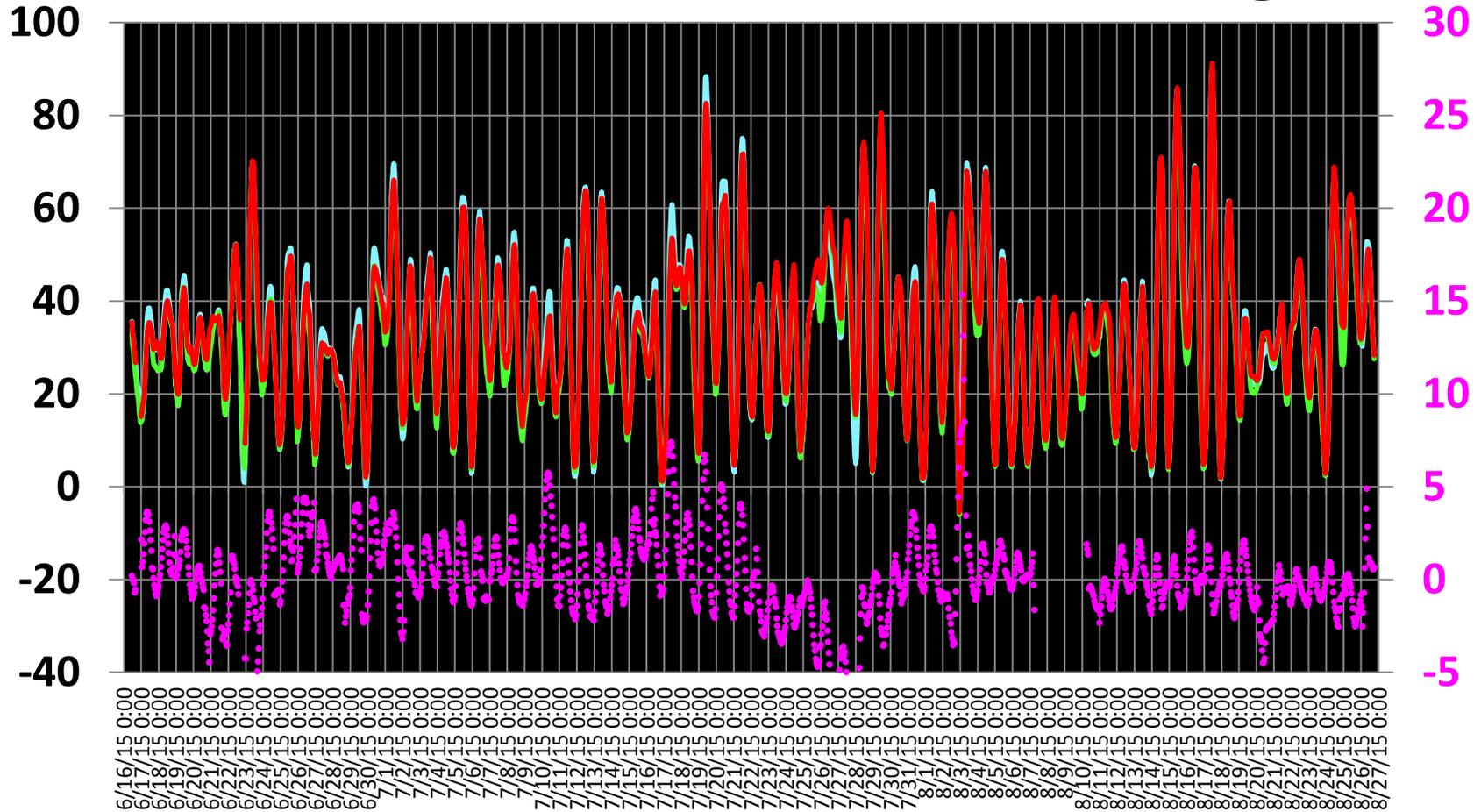
Alan Leston – Personal Communication

6.2 Meter Westport Inlet



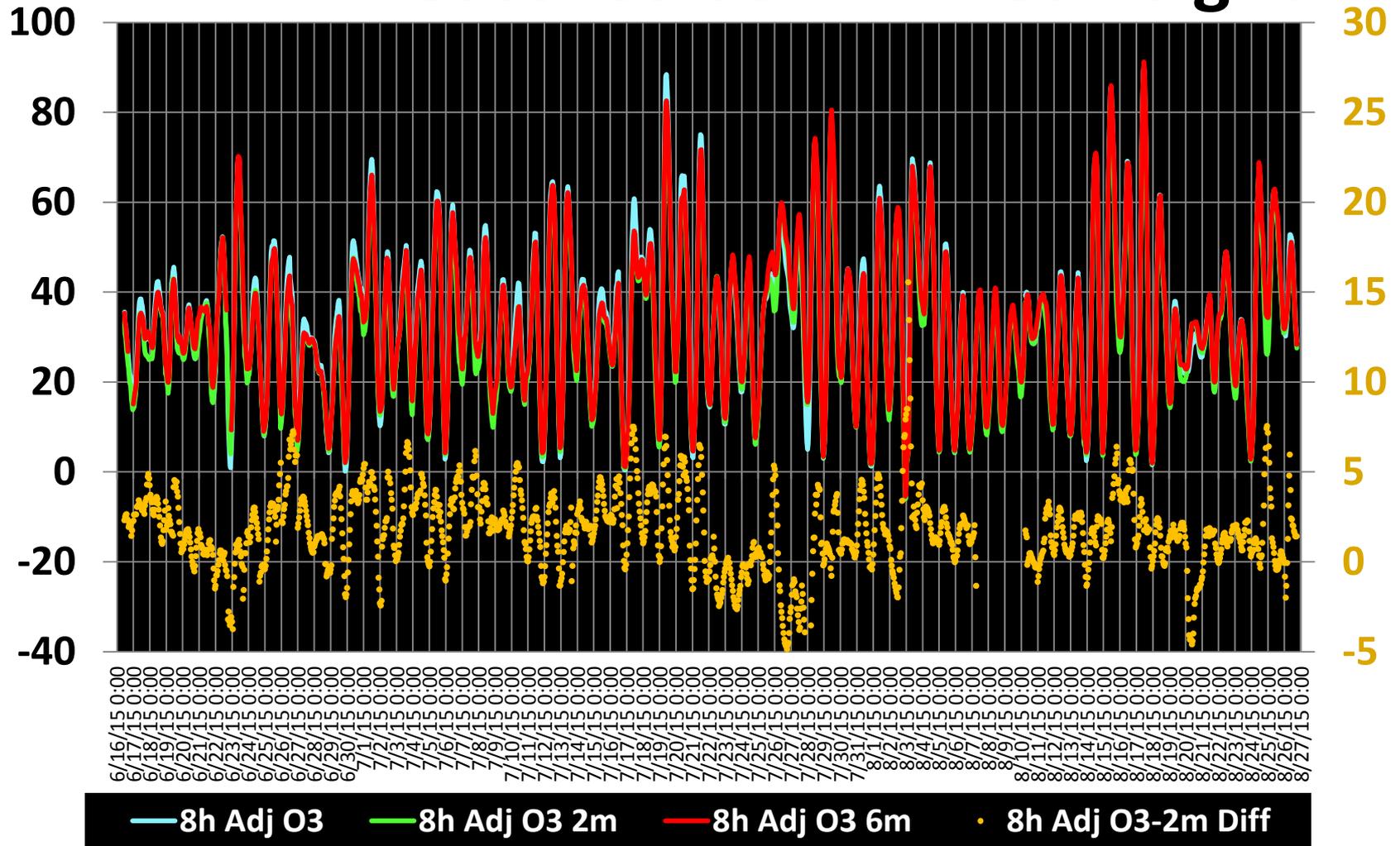
Alan Leston – Personal Communication

Rolling 8-Hour O3 Values (ppb) Collocated 6.2m Inlet Height



— 8h Adj O3 — 8h Adj O3 2m — 8h Adj O3 6m • 8h Adj O3-6m Diff

Rolling 8-Hour O3 Values (ppb) Measured at 2m Inlet Height



EPA Inlet Height Considerations

The 2006 Ozone CD notes, based on the information derived from non-urban studies, that the degree of atmospheric stability is important as “**there was a decrease of about 20% in going from a height of 4m down to 0.5m above the surface during stable conditions, but O₃ decreased by only about 7% [i.e., by about 5 ppb at 70 ppb O₃] during unstable conditions.**” While there is some information indicating decreasing ozone concentration with decreasing monitor probe height, there are too few studies available at this time with the appropriate data to develop a reasonable quantitative relationship for adjusting ozone data (or design values) in urban areas.

Richard Wayland–Personal Communication

Recommendations

- EPA regulatory staff recognize increasing vertical O₃ gradients above 2m and the need to adjust monitored values to better reflect actual human outdoor exposures at this level.
- The Westport data show a persistent, although meteorologically variable, positive O₃ gradient upwards from the 2m AGL values thought to be more representative of outdoor human exposures than current monitor inlet heights in the 4m to 6m range.
- SLTs should consider moving O₃ monitoring inlets to the 2m level now as a timely, practical remedy of this positive O₃ gradient bias, given EPA's acknowledged lack of adequate gradient data to downward adjust high inlet urban O₃ design values appropriately.