Response to a Request for Public Comment to CASAC-AAMMS Regarding Proposed Guidance for Near-Road Monitoring of NO2 and Other Pollutants (75 FR, Vol. 171, pp. 54146-54147, 9/3/10)

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Comments on 1/21/2010 Draft Charge Questions for CASAC-AAMMS Advisory on Near Road Monitoring

General Comment:

It is axiomatic that ambient air quality data will be used for purposes never envisioned by monitoring network designers. Without a clear vision of who will use a given data set and how, such unanticipated data usage will be compromised. EPA should clearly state the purposes the NO_2, CO, and PM data from the near-road network is intended to fulfill.

Specific Comment:

Typo: Page 3, item 3b, line 2 - '…question 4a' should read '…question 3a'

Page 1, Introduction – "EPA…is preparing to conduct a near-road monitoring pilot study and write a near-road monitoring guidance with a multi-pollutant perspective…."

Comment: EPA should further define the term "multi-pollutant perspective" to indicate the extent to which data from near-road sites will be used to determine NAAQS compliance, population exposure, and population risk to allow consideration of such uses by persons responsible for final site selection.

Page 2, Item 1 – "Provide suggestions on any missing subjects that should be included in the guidance document…."

Comment: The concept of "meteorologically-related" seasonal parameters is important and should be noted in the guidance document. These parameters should include road-side snow banks which alter or impede air flow (and may release atmospheric contaminants concentrated within the snow pack), use of snow melting agents that will increase trace element and organic content of resultant tire mist aerosol, and traction-improving agents (sand) that will increase roadside particulate matter levels.

Page 2, Item 2 – "What pollutants and sub-species does the subcommittee believe should be included for consideration and discussion in the near-road monitoring guidance?"

Comment: It's not clear the extent to which experience and preliminary findings from the ongoing Sierra Club-EPA-FHWA near road MSAT study have been considered in developing the CASAC-AAMMS charge documents but any such available information should be assessed (http://www.fhwa.dot.gov/environment/airtoxicmsat/index.htm) by the AAMMS. Given the Agency proposal to further expand fuel ethanol content, acetaldehyde should be included in the proposed MSAT list**.** Given the reported NO_2 FRM interference bias from potential N, S, and Cl containing inorganic and organic compound roadway emissions (ASTM, 2009), the pilot study should include collocated alternative NO_2 monitoring technology to quantify the degree of measurement bias.

Page 3, Item 3 a – "Given the variability in emission rates from on-road vehicles based on vehicle technology, fuel, speed, environmental conditions, etc., does the subcommittee believe this approach is an appropriate way to "consider" fleet mix in near-road site selection or is a more refined inventory and modeling analysis required?"

Comment: The discussion of factors to be considered during site selection should be expanded to include high emitting vehicle mix. "Clunker" frequency may be the predominant parameter determining peak hourly near road concentrations (Bishop, et al. 2010). Guidance for identifying and accounting for such sources discussed below should be developed and considered in site selection.

Page 3, Item 3 b – "Further, should the suggested approach above in question 4a (sic) to consider fleet mix via the use of average, fleet-wide emission factors, or the use of inventory and modeling analysis, take into account mobile source controls that are "on the books" but have not yet been fully realized due to fleet turnover? If so, how far out into the future should states consider their effects?"

Comment: If proposed controls are expected to greatly alter emission patterns (i.e., more than ±10%) on some roads or classes of roads then those controls should be considered. Given the EPA requirement for monitoring network assessment every 5 years, a 5 year period should be adequate.

Page 4, Item 3 e – "Does the subcommittee agree that terrain and vegetation should be a consideration in the siting process? What priority should this parameter have in the overall process?"

Comment: As noted in the comment above (Item 1, page 2), terrain in the vicinity of near-road monitoring sites can be altered by heavy snow fall and road plowing operations. Heavy snowfall or high road-side snow banks can alter both near-ground wind flow patterns as well as the reactivity of horizontal surfaces between the roadway and the monitoring site. Many northern areas record their highest 1-hour NOx concentrations during winter morning inversions which place additional importance on the terrain- and reactivity-altering effects of snowfall.

Road slope should be considered in site selection criteria as it affects vehicle load, emissions, and roadway design (e.g., climbing lanes, runaway truck detours); roadway elevation may also affect older vehicles with engines tuned to lower altitudes.

With regards to "priority," potential urban cold climate sites not in tunnels or under overpasses will be impacted by terrain-altering snowfall. If "at-grade sites with no obstructions" are to be required, there is no point in assigning a snowfall/snow bank priority to cold weather site design. Rather, it will become important for agencies operating such sites to track snowfall events that may impact near-road data and to assess the impact of such events during data analysis.

Page 4-5, Item 3 f – "Although there is no requirement to be downwind, in the preamble to final NO_2 NAAQS rule, EPA encouraged it when possible. EPA and NACAA intend to do the same in the guidance document. Does the subcommittee agree with this approach?"

Comment: Although most high-traffic roadways generally have comparable traffic volume in both directions over the course of a given day, the distribution between in-bound and out-bound traffic counts is highly dependent on the time-of-day. This and the different stagnation and boundary layer height patterns between morning and evening rush hours (when maximum concentrations are expected) may minimize the impact of the "upwind meander" cited by EPA as grounds for not specifying downwind monitoring sites. However, these factors also blur the distinction between upwind and downwind concentrations making a requirement for prevailing downwind sites questionable.

Pairs of portable nephelometers can be used to good survey advantage in a near-road site selection process. Nephelometers are a robust semi-quantitative technique for monitoring fine particles as a surrogate for NOx emissions in high traffic areas. Such battery-powered devices can be temporarily installed in shelters or hand-carried to inaccessible locations for sub-daily monitoring periods to generate useful upwind/downwind gradient data rapidly and inexpensively.

Page 5, Items a, b, c – "a. If a state were inclined to use saturation monitoring to aid in the selection of a near-road monitoring site, and considering that the NO_2 standard is a 1-hour daily maximum standard, what are the pros and cons to using passive devices to saturate an area to gather data?

b. Likewise, what are the pros and cons to using non-passive devices, such as near real-time or continuous devices including, but not limited to portable, non-FEM chemiluminescence methods for NO_2 or Gas Sensitive Semiconductors (GSSs) for NO_2 and other pollutants of interest?

c. Finally, what would be the pros and cons, to a state or local agency attempting to use a specially outfitted vehicle to collect mobile measurements to assist in the near-road site selection process for NO_2 specifically as well as other pollutants of interest?

Comment: Passive devices are small, require no power and are easily deployed and retrieved. However most passive devices have average exposure times well in excess of 1-hour and would require difficult data interpolation efforts. Also, the accuracy and bias of most passive devices is suspect absent wind speed and temperature control.

Non-passive, portable devices have much better time resolution and can deliver 1-hour average data for direct comparison to the NO_2 standard. However, many of those devices are expensive

relative to passive samplers and their performance is seldom well characterized although their short-term values may be normalized when paired with integrated samplers.

A mobile platform to measure NO_2 (and other gas-phase pollutants) can employ FRM/FEM monitors and deliver high quality, short-term data aiding understanding of mobile source emission levels and trends across various highway lanes and locations. However, transitory "grab samples" from a moving platform may better simulate integrated exposures over typical commuting routes rather than assist site selection unless run continuously over the day for all seasons.

EPA hints at "gas phase" measurements in this section but does not appear to preclude aerosol measurement devices in the site selection process. As noted in the comments above (Item 3 f), portable nephelometers can provide useful surrogate measures during the site selection process.

Page 6, Items 6 a & b – "EPA believes there are two issues not specifically considered in the near-road NO_2 monitoring language that might influence where near-road CO monitors may be most appropriately placed. The two issues are 1) the consideration of where light duty vehicles are operating under 'cold-start' conditions, which may often not be on the larger arterials or highways in an area, and 2) the impacts of light duty vehicle congestion and idling in areas such as urban street canyons and/or urban cores.

a. Does the subcommittee believe that the light duty cold start and congestion factors will significantly influence the location of peak CO concentrations in an area? What priority should these factors be given when compared with the factors (AADT, Fleet Mix, Roadway Design, Congestion Patterns, Terrain, and Meteorology) already being considered for peak NO_2?

b. Does the subcommittee have an opinion on whether, and possibly how, these two issues of vehicles operating under cold start conditions and light duty vehicle congestion and idling in urban street canyons and/or urban cores be considered in a future, nationally applicable, CO monitoring proposal? Are there other factors that may affect peak CO concentrations and not affect peak NO_2 concentrations that should also be considered for any future CO monitoring proposal?"

Comment: The impact of light duty vehicle cold starts on CO concentrations is mitigated by the fact that not all cold starts occur simultaneously. However, vehicle congestion happens frequently and in generally known locations although scheduled road construction and prevalence of daily highway accidents are additional parameters that could be also considered in site selection. Therefore, because cold starts are spread throughout time and space but congestion is not, congestion should play a larger role in the creation of peak CO concentrations. However, high emission vehicles are effectively in 'cold start' all the time, a fact that illustrates how important it will be to develop means to account for their local fleet mix fraction during site selection. Including Fuel Efficiency Automobile Test (FEAT) monitors in the pilot study (http://www.feat.biochem.du.edu/reports.html) and possibly at near road sites (Zhan et al. 2009; http://www.feat.biochem.du.edu/assets/databases/Cal/Tricity_NH3_SO2_NO2_2008_Report_ARB.pdf) would both quantify high emitter impact and offer a control strategy basis superior to current I/M implementation (Austin, et al. 2009).

Page 7, Item 7 – "Does the committee believe that siting considerations for identifying the location of peak NO_2 concentrations will likely address all of the high priority siting considerations for PM (particularly $PM_{2.5}$) as well? If not, what other factors should be considered and what are the advantages in considering these factors for identifying the location of maximum PM concentration?

Comment: Mobile source peak PM concentrations are likely to occur at near-road NO_2 measurement sites absent special circumstances such as wet roadways and icing treatment where PM may be enhanced.

Page 7, Item 8 – "In addition to $PM_{2.5}$ mass, what other PM-related measurements are desirable at near-road monitoring stations (e.g., UFP number, black carbon, EC/OC, PM coarse, etc.)?

Comment: Considering cost, difficulty of operation, and space requirements of various PM-related monitors, the ultra-fine particle count number should be given the highest priority.

Page 7, Item 9 – "Does the subcommittee believe that reconsideration of microscale CO siting criteria is appropriate? Specifically, would an adjustment of CO siting criteria to match those of microscale $PM_{2.5}$ and microscale near-road NO_2 sites be logical and appropriate?

Comment: It may be appropriate to revise the inlet height requirement for microscale CO sites but increasing the allowable distance to roadways to 50 meters is seldom feasible in urban areas with street canyons and this modification should not be undertaken. Most street canyons contain multi-story building facades within 5-8 meters of the roadway edge and do not allow for installation of inlet probes further than that distance from the roadway.

Page 7, Item 10 – "Even if the adjustment of microscale CO siting criteria in sections 2, 6.2, and table E-4 in 40 CFR Part 58 Appendix E to match that of microscale $PM_{2.5}$ and microscale near-road NO_2 is appropriate and proposed, should there be consideration to maintain the requirement on how urban street canyon or urban core microscale CO sites should be sited?

Comment: Yes, it would be especially important to preserve the existing CO siting criteria if historical CO concentrations at an urban microscale site approach the NAAQS (e.g., within 75%). Historically, downtown (or urban street canyon) CO sites have been sited to address CO impact on pedestrians. Requirements for peak concentration, near-road sites do not address pedestrian exposure since major roadways typically do not possess sidewalks.

Pages 8-9, Item 12 – "EPA and NACAA will select the locations for permanent sites that are part of the near-road pilot study based on which state or locals volunteer to participate and can process grant funds in a timely manner to deploy equipment. From this pool of volunteers, selection should be made on certain attributes that provide the best potential to fulfill pilot study objectives. In the attached draft white paper, EPA and NACAA have proposed some potential criteria for consideration in selecting where the fixed, permanent stations should be located. These considerations include choosing a large and a relatively small urban area based on population, an area with varied or complex terrain, an urban area with an operational NO_X analyzer representative of neighborhood or larger spatial scales for comparison to the near-road NO_X analyzer, and an urban area with a cooperative (or non-cooperative) Department of Transportation. Does the Subcommittee agree with these considerations? Further, are there other

considerations that should be evaluated in selecting pilot cities to house permanent near-road monitoring stations as part of the pilot study?

Comment: An additional consideration should include snowfall issues noted above as well as other cold weather considerations. A candidate site from a snow-belt area should be included.

Page 9, Item 13 – " Please comment on the *minimum* equipment/pollutant measurement complement that should be deployed at each site and also the *ideal* equipment complement that each site should or could have, respectively. Specifically, what pollutants (e.g., NO_2, NO_X, NO, CO, PM (Ultrafine, 2.5, and 10), black carbon, air toxics (such as benzene, toluene, xylene, formaldehyde, acrolein, or 1, 3, butadiene) and ammonia) and other information should the pilot study measure or gather at the fixed, permanent monitoring stations, and by what methods?"

Comment: Minimum parameters in order of approximate priority;
1. NO/NO_2/NOx by FRM at 1-hour average,
2. NO_2 by photolytic converter FRM at 1-hour average,
3. CO by FRM at 1-hour average,
4. $PM_{2.5}$ by FEM at 1-hour average,
5. WD/WS,
6. MSAT (BTEX and 1, 3 butadiene by NO_2 denuded canister; HCHO, CH_3CHO, acrolein-with DRI correction for acrolein-x rearrangement by DNPH cartridge (Fujita et al. 2010) and acetaldehyde by DNPH cartridge,
7. UFP count, (e.g., by TSI Model 3031),
8. Precipitation/wet roadway status,
9. Temperature,
10. Traffic count (include both light and heavy vehicles if possible).

In addition to the minimum parameters noted above an ideal site should include;
4a. Black carbon by photoacoustic methodology,
5a. VOCs by photoionization (olefins and aromatics),
6a. High emitting vehicles by FEAT (http://www.feat.biochem.du.edu/reports.html).

Comments on the EPA White Paper entitled: "Near Road Pilot Study Objectives and Approach"

The following comments address questions/issues raised in that White Paper.

The first "objective" of the Pilot Study notes that: **"State and local agencies must consider fleet mix, roadway design, congestion patterns, terrain, and meteorology in the site selection process. Is there a relative priority amongst these factors?**

Comment: Given that roadway design, terrain and meteorology are generally parameters least susceptible to control strategy while fleet mix and congestion patterns are more susceptible, it seems logical to assign higher priority to the relatively fixed parameters. Of the susceptible variables daily variations in fleet mix may be large but the changes within an hour are probably less so and there is little way to predict the short term congestion patterns which may change

rapidly due to accidents, cargo spills, or precipitation. Therefore, priority for selecting near-road sites should be;

1. Roadway design,
2. Terrain,
3. Meteorology,
4. Fleet mix,
5. Congestion pattern.

Part "b" of the first objective also states: "**What other different types of data might be available to states (e.g., Annual Average Weekday Traffic, Level of Service, etc.), how current is such data, and what do they mean, or, how are they useful?"**

Comment: If additional data types are found to be useful, any trends (either seasonal or yearly) in those parameters should also be examined. Also, data on the number of high emitting vehicles found by I/M testing (perhaps listed by emission testing station location) could be useful, as may roadway proximity to low socioeconomic status communities.

Objective 4 of the Pilot Study includes the question: **"How can a state or local agency utilize modeling and/or saturation monitoring techniques to further characterize candidate near-road locations?"**

Comment: As noted in comments above regarding the "Charge Document", a modest form of saturation study for near-road monitoring sites should include fine PM and VOC surrogates for other pollutants. For example, portable nephelometers which can approximate $PM_{2.5}$ measurements can be deployed on a solo basis to determine the relative distribution of NOx, and other mobile source emissions along candidate roadways. Once a peak (or "hot spot") area has been identified, pairs of nephelometers (i.e., upwind and downwind) can be used to help further define areas of maximum concentration.

Objective 6 of the Pilot Study seeks to understand the support of other state/local agencies in developing near-road monitoring sites and asks: "**What other government agencies will state and local air agencies need to communicate or collaborate with to achieve success in the selection and installation of near-road monitoring stations?"**

Comment: Siting near-road monitoring stations will require the cooperation of state-level Transportation Departments, electric utilities, and possibly phone service providers. State-level "Departments of Information Technology" are involved in data acquisition if anything other than a standard, hard-wired phone line is used for data retrieval. Many states have adopted protocols for cell phone or radio frequency modems that are prescriptive and have often proven difficult to achieve.

References

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