

**Charge Questions for the  
Clean Air Scientific Advisory Committee's (CASAC)  
Ambient Air Monitoring and Methods (AAMM) Subcommittee  
Advisory on Near Road Monitoring  
To Support Measurement of Multiple NAAQS Pollutants  
September 29<sup>th</sup> and 30<sup>th</sup>, 2010**

**Purpose of the Advisory**

EPA is seeking CASAC advice on the concepts and information that should be included in the forthcoming near-road monitoring guidance document, advice on how future near-road monitoring requirements, for pollutants such as Carbon Monoxide (CO) and Particulate Matter (PM), may be drafted in a way to mesh with the existing Nitrogen Dioxide (NO<sub>2</sub>) requirements and foster a multi-pollutant monitoring infrastructure, and the objectives, approach, and execution of the near-road monitoring pilot study.

**Introduction**

On February 9<sup>th</sup>, 2010 revisions to the primary National Ambient Air Quality Standards (NAAQS) for NO<sub>2</sub>, via final rule, were published. EPA tightened the NO<sub>2</sub> standard from an annual average of 0.053 ppm to a 1-hour level of 100 ppb, 98<sup>th</sup> percentile form, averaged over three years. In support of this revision, EPA also promulgated new minimum monitoring requirements, of which a majority of the required monitoring is to be conducted near major roads. EPA relied on a body of scientific literature to finalize the near-road minimum monitoring requirements, which is to have ambient monitoring conducted at the location of maximum NO<sub>2</sub> concentrations in an area, which at a minimum is directly attributable to mobile source emissions. Although this near-road monitoring is required to be implemented to meet the monitoring requirements of NO<sub>2</sub>, EPA believes that these near-road monitoring stations will create the infrastructure to accommodate other pollutant measurements. Therefore, EPA envisions these near-road monitoring stations as multi-pollutant monitoring stations.

Multi-pollutant monitoring has been a priority of the agency over the past decade, which is evident in the introduction of the multi-pollutant National Core (NCore) monitoring network that is set to come online January 1, 2011. As a result of the Agency's commitment to pursue multi-pollutant monitoring approaches and in follow-up to comments from state and local air monitoring agencies requesting assistance in implementing the newly required near-road NO<sub>2</sub> monitoring stations, EPA in collaboration with the National Association of Clean Air Agencies (NACAA) and individual states, is preparing to conduct a near-road monitoring pilot study and write

near-road monitoring guidance with a multi-pollutant perspective. This guidance document will be a key reference for state and local monitoring agencies as they implement the NO<sub>2</sub> near-road monitoring network that is required to be operational no later than January 1, 2013, and will also support additional deployments of near-road monitors that may be required by future rulemakings and/or Agency initiatives.

## **Charge Questions**

### ***Questions regarding the near-road monitoring guidance document***

EPA received public comment during the period of development and promulgation of the recently revised NO<sub>2</sub> NAAQS rule requesting assistance in the implementation of the required near-road NO<sub>2</sub> monitoring stations. As a result, EPA, in collaboration with NACAA and individual states, intends to prepare a near-road monitoring guidance document to support the implementation of required near-road monitoring stations. The guidance document is intended to provide an example blue-print for state and local agencies to follow, from start to finish, of the implementation of near-road monitoring stations. A draft outline of the guidance document is presented in an accompanying document. The guidance is expected to present material in a multi-pollutant frame of reference, while maintaining appropriate focus on meeting minimum monitoring requirements. Further, EPA and NACAA intend to develop this guidance document in parallel to a near-road pilot study. The near-road pilot study is presented below, and its draft objectives are presented in an accompanying document titled “Near-road Monitoring Pilot Study Objective and Approach.” Specifically, as the pilot study proceeds, the information gathered will be used to bolster the material in the guidance, and verify that the approaches, assumptions, and expectations are valid, through real-world experiences.

1. The accompanying draft guidance document outline provides an initial thought of the major topics required in the near-road monitoring guidance that will aid state monitoring agencies in the identification and implementation of NO<sub>2</sub> near road monitoring sites from a multi-pollutant perspective. Please comment on the overall content of the recommended topics in the draft outline. Please provide suggestions on any missing subjects that should be included in the guidance document and any unnecessary topics that are currently listed in the attached draft, if applicable.
2. EPA and NACAA envision the near-road guidance document to be written from a multi-pollutant perspective. What pollutants and sub-species does the subcommittee believe should be included for consideration and discussion in the near-road monitoring guidance? Some potential species for consideration include NO<sub>2</sub>, NO<sub>x</sub>, NO, CO, PM (Ultrafine, 2.5, and 10), black carbon, air toxics

(e.g., benzene, toluene, xylene, formaldehyde, acrolein, or 1, 3, butadiene), and ammonia. Please prioritize the recommended pollutants and provide the rationale for their ranking, including how this pollutant measurement will contribute to scientific and regulatory knowledge of near-road air quality and adverse human health effects.

The process by which state and local air agencies will identify candidate near-road sites will include the ‘consideration’ (per CFR, for near-road NO<sub>2</sub> stations) of the major factors that are known to influence pollutant concentration and dispersion. These factors are Annual Average Daily Traffic (AADT), fleet mix, roadway design, congestion patterns, terrain, and meteorology. The following charge questions are intended to solicit feedback that will address how best the near-road monitoring guidance document can provide a means for state and local agencies to effectively and adequately consider the factors listed above when selecting near-road monitoring sites in real-world situations.

### 3. Identifying Candidate Near-road Site Areas

- a. AADT & Fleet Mix – To consider fleet mix with regard to NO<sub>2</sub>, an idea is to encourage states that have fleet mix information to take an approach that uses average, fleet-wide grams per mile emissions estimates (one for light duty vehicles and one for heavy duty vehicles), combined with AADT information to further weight which road segments in an area may be more conducive to produce peak pollutant concentrations. EPA would use the latest emission factor information to aid such a calculation. 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?
- b. AADT & Fleet Mix – Further, should the suggested approach above in question 4a 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?
- c. Roadway Design – Studies suggest and support the concept that roadway design influences pollutant dispersion near the road. The EPA suggests establishing sites at-grade with the road, without any nearby obstructions to air flow; however, the Agency recognizes that this might not always be

feasible. Does the subcommittee agree with this recommendation for locating sites at-grade with no obstructions? What priority should be placed on this factor within the guidance, given the need for flexibility in identifying appropriate site locations?

- d. Congestion Patterns – The congestion of a roadway can be estimated by the metric “Level of Service” (LOS). LOS uses a letter grade from A to F to identify a roadway’s performance, with “A” the best conditions where traffic flows at or above the posted speed limit and all motorists have complete mobility between lanes to “F” the worst congestion where travel time cannot be predicted and generally traffic demand exceeds the facility’s capacity. Since motor vehicles generally emit more pollutants during congestion operations (although noting that NO<sub>x</sub> and select other pollutant emissions can also increase with increasing speed), how important a parameter should LOS be in the determination of appropriate near-road monitoring sites? Does the subcommittee have a view on how reliable LOS estimates are across the country?
- e. Terrain– State and local air agencies are required to consider terrain in the near-road monitoring site selection process, which in some cases may be inherently part of the roadway design. However, EPA recognizes that some states and local air agencies may have to make selections from amongst similar candidate sites that differ only by terrain, e.g. cut section versus open terrain, with or without vegetation, etc. 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?
- f. Meteorology – EPA took comment on, but did not finalize the requirement for near-road monitoring sites to be climatologically downwind of the target road segment. Reasons were because the additional limitations this would introduce in finding candidate sites would be in exchange for what may be a small increase in the opportunity to monitor peak NO<sub>2</sub> concentrations. Further, with sites being within 50 meters of target road segments, the phenomenon of upwind meandering (pollutant transport upwind due to vehicle induced turbulence) further reduces that absolute need to be climatologically downwind. Finally, EPA recognized that, logically, the potential for peak NO<sub>2</sub> concentration may very well occur when winds are calm or parallel (or nearly parallel) to the target road, allowing for pollutant build-up, as opposed to when winds are normal to the road. Although there is no requirement to be downwind, in the preamble to final NO<sub>2</sub> 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?

4. Modeling is another tool that may be useful in the identification of candidate near-road sites. In particular, the use of mobile source emissions modeling with MOVES and local-scale dispersion modeling with AERMOD, can be presented as part of the guidance document. Please comment on the available modeling tools, and their pros and cons, that the subcommittee believes may be appropriate to discuss and/or recommend for use in the near-road monitoring guidance document.
5. In regard to the process of identifying candidate near-road monitoring sites, beyond the evaluation of factors noted above in question 3, and the potential use of modeling, the use of saturation monitoring and on-road monitoring are also possible tools that state and local air agencies may choose to utilize in the near-road site selection process.
  - 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<sub>2</sub> 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<sub>2</sub> or Gas Sensitive Semiconductors (GSSs) for NO<sub>2</sub> 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<sub>2</sub> specifically as well as other pollutants of interest?

#### ***Questions regarding the CO monitoring network and near-road monitoring***

Currently, there are no minimum monitoring requirements for CO, except for the requirement of operating a trace-level CO instrument at NCORE monitoring stations. In the recent CASAC reviews of the CO ISA and REA, the CASAC CO subcommittee noted that the CO monitoring network was not where it needed to be to provide the most useful information. Due to the fact that CO emissions are dominated by the mobile source sector, it is not unreasonable to consider that a possible reintroduction of minimum monitoring requirements for CO, as part of the upcoming NAAQS revision, may have some focus on monitoring CO near roads. The following charge questions

are intended to solicit feedback that may aid in the development of what may become proposed monitoring requirements in association with a potentially revised CO NAAQS.

6. EPA recognizes that CO concentrations are primarily influenced by gasoline vehicles as opposed to NO<sub>2</sub> and PM<sub>2.5</sub> concentrations, which are currently more heavily influenced by heavy-duty (diesel) vehicle emissions. If EPA were to propose a new set of minimum monitoring requirements for CO near roads, the near-road monitoring stations created under the implementation of the NO<sub>2</sub> monitoring requirements may be an advantageous infrastructure for state and local air agencies to leverage. However, EPA believes there are two issues not specifically considered in the near-road NO<sub>2</sub> 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<sub>2</sub>?
  - 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<sub>2</sub> concentrations that should also be considered for any future CO monitoring proposal?

***Questions regarding the PM monitoring network and near-road monitoring***

Specifically considering mobile source impacts on PM, EPA believes that the factors influencing where peaks of PM<sub>2.5</sub> mass and ultra-fine PM mass and number may occur in the near-road environment are largely the same as those influencing NO<sub>2</sub> concentrations. Particularly, these PM component concentrations are believed to be more influenced by heavy-duty (diesel) vehicle emissions, as is the case with NO<sub>2</sub>, and unlike CO concentrations which are more influenced by light-duty vehicles. The following charge questions are intended to solicit feedback that may aid in the

development process of future proposed monitoring requirements in association with a potentially revised PM NAAQS.

7. Does the committee believe that siting considerations for identifying the location of peak NO<sub>2</sub> concentrations will likely address all of the high priority siting considerations for PM (particularly PM<sub>2.5</sub>) 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?
8. In addition to PM<sub>2.5</sub> mass, what other PM-related measurements are desirable at near-road monitoring stations (e.g., UFP number, black carbon, EC/OC, PM coarse, etc.)?

***Questions regarding the monitor siting criteria for microscale CO, microscale PM<sub>2.5</sub>, and the new near-road NO<sub>2</sub> siting criteria***

Per 40 CFR Part 58 Appendix E, near-road NO<sub>2</sub> monitors are required to be placed within 50 meters of the target roadway they are intended to represent. Further, the inlet manifold for NO<sub>2</sub> analyzers are required to be between 2 and 7 meters above ground level. These siting criteria match those for microscale PM<sub>2.5</sub> monitor inlets. Meanwhile, microscale CO monitors are required to be within 10 meters of the target road they are intended to represent, and must have the inlet manifold be between 2.5 and 3.5 meters above ground level. EPA recognizes that in the past, specifically the 1970s when the CO siting criteria was first written, it was envisioned that microscale CO sites would be often placed in urban cores and in urban canyons, where CO concentrations were expected to be high. The siting criteria were written with deliberate intent to ensure monitor probes were close to the target road or intersection and that sidewalk pedestrian exposure was represented.

9. To allow for near-road monitoring infrastructure to be multi-pollutant, and in reflection of the recently promulgated near-road NO<sub>2</sub> siting criteria, reconsideration of the existing microscale CO siting criteria presented in sections 2, 6.2, and table E-4 in [40 CFR Part 58 Appendix E](#) may be warranted. 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<sub>2.5</sub> and microscale near-road NO<sub>2</sub> sites be logical and appropriate?
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<sub>2.5</sub> and microscale near-road NO<sub>2</sub> 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?

11. Does the subcommittee have an opinion on how “urban street canyons” or “urban core” might be defined, perhaps quantitatively, and with regard to use in potential rule language?

***Questions regarding the near-road monitoring pilot study***

The accompanying draft document titled “Near-road Monitoring Pilot Study Objective and Approach” provides background, draft objectives, and a draft approach for the near-road monitoring pilot study. The overarching goal of the pilot study is to allow EPA, state, and local air monitoring stakeholders to evaluate, improve, and document the near-road siting process. This pilot study is intended to allow participants to gather real-world experience which can be translated and communicated to all stakeholders who will be implementing the required near-road network by January 1, 2013. To do this, the pilot study is intended to gather experience and information to inform seven particular questions, listed in the accompanying draft white paper, which in turn are expected to ultimately inform the near-road guidance document.

The approach for executing the pilot study is presented as a two-pronged effort. The first prong could be considered as a quasi-saturation monitor based evaluation, specifically to look at how a city could evaluate the effects of fleet mix, roadway design, congestion patterns, terrain, and meteorology on pollutant concentrations within a particular CBSA. The second prong could focus on the selection and installation of permanent near-road monitoring stations in at least two urban areas, using information gained as part of the first prong. EPA notes that there is a limited budget for the pilot study, and thus a limit on the amount of saturation monitoring to be conducted, and the number of full-scale, permanent-type monitoring stations that can be deployed, the number and type of pollutant monitors and equipment at each permanent-type station. EPA and NACAA have proposed four to five urban areas to have saturation monitoring, and at least two urban areas to have permanent near-road monitoring stations (that would fulfill NO<sub>2</sub> near-road monitoring requirements) for the pilot study. The following charge questions are intended to inform the execution of the pilot study.

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<sub>x</sub> analyzer representative of neighborhood or larger spatial scales for comparison to the near-road NO<sub>x</sub> 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?

13. EPA and NACAA have proposed that at least two urban areas should have permanent near-road monitoring stations (that would fulfill NO<sub>2</sub> near-road monitoring requirements) implemented for the pilot study. 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<sub>2</sub>, NO<sub>x</sub>, 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? This list should be in priority order, as feasible, and can include any NAAQS or non-NAAQS pollutant by any method (FRM/FEM and/or non-reference or equivalent methods), any particular type of other equipment for gathering supporting data such as meteorology or traffic counts.
14. EPA and NACAA have proposed four to five urban areas to have saturation monitoring, using either passive devices and/or continuous/semi-continuous saturation type multi-pollutant monitoring packages (i.e., several types of monitors in one mountable or deployable “package”). Please provide comment on:
  - a. The pollutants that should be measured with the saturation devices at each saturation site.
  - b. The number of saturation devices per pollutant, both passive and/or continuous/semi-continuous, that may be deployed in each pilot city.
  - c. Whether placing saturation monitoring devices near certain road segments should include, at a minimum: 1) the highest AADT segment in an area, 2) the road segment with the highest number of heavy-duty truck/bus counts, 3) at a road segment with more unique roadway design, congestion pattern, or terrain in the area, and 4) if feasible, at a lower AADT segment with a similar fleet mix, roadway design, congestion, terrain, and meteorology as the top AADT road segment in the area.