State and Local Experiences Establishing Air Monitoring Sites Near U.S. Roadways: A Conversation

A group of state and local agency representatives discuss some of the challenges faced in setting up near-road air quality monitoring stations.

Susan Wierman: We’re here to discuss site-selection challenges, costs, future developments, and some lessons learned by state and local agencies implementing the new U.S. requirements for near-road monitoring. How is this important effort going?

I understand the Technical Assistance Document (TAD) issued by the U.S. Environmental Protection Agency (EPA) provided important guidance for site selection and development.

David Krask: Establishing a near-road site is not your typical installation of a new monitoring station, which is rarely easy in any event. Maryland derived great benefit from participating in the pilot study EPA conducted after they issued the draft TAD.

Five state and local agencies took part, and Jennifer Hains, Bruce Louks, and I were among the participants. We appreciated the opportunity to have a voice in helping to finalize the guidelines.

Site-Selection Challenges

Darrell Stern: The most difficult hurdle for Allegheny County, PA, was finding acceptable candidate sites that met all the requirements of the TAD and still provided easy and safe access for our staff. We were interested in using private property with

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off-highway access and parking, so that we could bypass highway right of way issues and the safety concerns associated with most near-roadway areas. These requirements limited our options considerably within the selected roadway segments, but we were ultimately rewarded for our perseverance, and our selected site is exactly what we were searching for.

Ken Stroud: In California, the Air Resources Board (ARB) helped the local San Joaquin Valley Air Pollution Control District identify candidate sites and assess potential costs. We followed the draft TAD and ranked a list of road segments in Fresno, giving greater emphasis to heavy duty vehicles than the standard procedure in the TAD because of ARB analysis showing the importance of these vehicles to air quality and health impacts.

Harlan Quan: Once road segments were ranked, staff from the ARB Monitoring and Laboratory Division and the District made site visits in early April 2012 to determine the viability of road segments to accommodate an air monitoring station to comply with EPAs requirements. The majority of road segments were found to be deficient in meeting the requirements of the TAD, mostly the requirements for a level grade, free of obstructions (sound walls, vegetation, etc.), located within 50 m of the roadway.

Stroud: The ARB team ranked the road segments and identified the top three to recommend to the local district.

Quan: Local knowledge of the area, property owners, local ordinances, or other factors may lead the District to a site not listed among the three road segments we recommended.

Stern: For our site, we actually picked the roadway segment with the third-highest average annual daily traffic (AADT) in Allegheny County, but we found it the most suitable with regards to population exposure, open topography, and safe access.

This segment is also a major congestion area due to the constriction of the Squirrel Hill Tunnels. Traffic slows to a crawl there for several hours each weekday morning. Additionally, our chosen site is located along an entry ramp to the highway so that we will capture acceleration emissions. All of these attributes added up to create what we believe to be our best possible choice.

Jennifer Hains: Maryland’s experience was similar. We made a list of our top 20 fleet-equivalent-AADT (FE-AADT) road segments and performed boots-on-the-ground reconnaissance as well as examining aerial photography to evaluate each site. Even though several of the sites were quickly eliminated from further consideration, this was a time-consuming process.

Among the remaining sites, it was difficult to find a location that met all of the siting requirements, could accommodate safe operator access, and included nearby availability of electrical power. Many of the road segments contained noise barriers or trees or other vegetation obstructions, or were situated right on housing developments. We consider ourselves extremely lucky in that we were able to find property owned by the Maryland State Highway Administration located 20 m from a traffic lane, with safe and easy access and readily available power, and that also ranked number one for the FE-AADT (see Figure 1).
Basic Costs and Future Developments

Quan: Based on past monitoring projects and queries to equipment manufacturers, we estimate the cost to establish one NO\textsubscript{2} monitor and meteorological sensors at a single site is approximately $85,000. This estimate is based on purchasing a site enclosure, site improvements and preparation, and monitoring equipment necessary to comply with EPA monitoring and data quality standards. In addition, we estimate an annual lease cost of $15,000, resulting in a total first-year cost of approximately $100,000.

Krask: In addition, the near-road monitoring requirements extend beyond NO\textsubscript{2} and include requirements for monitoring PM\textsubscript{2.5} and CO. Furthermore, EPA’s Clean Air Scientific Advisory Committee has recommended measuring a number of other species, including black carbon, ultrafine particles, and mobile source air toxics. This additional information will help us better protect public health, but it also increases costs.

Bruce Louks: Equipment and site set-up costs for our site were just about $250,000. This included the shelter, NO\textsubscript{2} and CO monitors, an aethalometer, an ultrafine particle counter, meteorology sensors, site preparation, training, and other equipment and supplies (see Figures 2 and 3).

Krask: Our costs so far are about $244,000. Maryland wanted to take a phased approach, recognizing we would learn a lot as the project developed, so we purchased basic equipment (including an NO\textsubscript{2} monitor, a CO monitor, and a data logger) in early 2011, aiming for an early start on getting the site up and running. After we received EPA grant money, we were able to purchase some additional recommended equipment including a semi-continuous PM\textsubscript{2.5}, an ultrafine particle counter, an aethalometer, a 3-D wind anemometer, and a traffic counter. Our site selection proved fortuitous in that we have an NCore site six miles south of the near-road site. The NCore site is in an area characterized as urban representative scale for CO, NO\textsubscript{2} and PM\textsubscript{2.5}. We are also using EPA near-road grant funds to add an ultrafine particle counter and aethalometer to the NCore site. This will enable us to compare observations from the near-road station to urban background observations.
Wierman: I understand that it cost Philadelphia about $80,000 just to run power to the site they selected, so I think costs can vary considerably.

Hains: We are currently working on selecting a location for the second site required for the Baltimore area. Other locations in our top 20 FE-AADT road segments all have remarkably similar characteristics to our first site location. The near-road TAD recommends choosing a second site that is differentiated from the first—for example, with a different fleet mix, congestion pattern, terrain, or geographic area within the CBSA. It could be located by a different route, interstate, or freeway designation. We might select a site with a lower traffic volume but more congestion than our first site.

**Lessons Learned**

Hains: If time and funding allow, it is worthwhile to conduct a passive monitoring study to evaluate your candidate sites. The pilot study documentation explains the analysis that can be done.

Louks: I agree. Once we began monitoring we confirmed several things we expected based on the passive monitoring study. First, the distance to the nearest traffic lane does matter. The monitoring regulations specify “within 50 m,” but I would encourage anyone to site within 20 m, if possible.

We also found that the relationship between NO$_2$/NO and AADT did prove to be fairly strong. This and the importance of distance from the traffic lane were both demonstrated by our passive sampling study.

Our experience also indicated it’s important to get the best available and most recent AADT data for the airshed. If possible, consider 5- to 10-year AADT projections.

Finally, we found that prevailing winds need to be characterized as best as possible, and the directional orientation of the monitoring probe to the roadway should be based on this analysis. We found a typical diurnal pattern in wind direction, and the morning commute is more impacting on our measurement, particularly in the summer when photochemistry and vertical ventilation is more intense.

Krask: One thing I would suggest is to consider getting a large shelter so you can easily accommodate additional instrumentation. Our installation date has been set back because, in an effort to get an early start on the NO$_2$ near-road monitoring requirements, we specified a smaller shelter than we ultimately needed.

And one final note: start early and expect delays. Take time up front to educate your management and the management of your transportation agency partners on the siting requirements and the unique practical and logistical difficulties these present.

Wierman: Thanks to all of you for taking part in this conversation and for working through a multitude of issues to implement this important program.

**References**

4. Quan, H. Report on Fresno Near Road NO$_2$ Siting; California Environmental Protection Agency, Air Resources Board, Monitoring and Laboratory Division, Air Quality Surveillance Branch and Northern Laboratory Branch, September 27, 2012.