Written Testimony of

Bart Eklund
Senior Technical Expert
Haley & Aldrich
Austin, Texas

Before the
United States Senate
Committee on Environment and Public Works

Legislative hearing to examine S. 1345, the Comprehensive National Mercury Monitoring Act; S. 2476, the Environmental Justice Air Quality Monitoring Act; and S. ___, the Public Health Air Quality Act._

July 13, 2022

Chair Carper, ranking member Capito, distinguished members of the United States Senate Committee on Environment and Public Works, thank you for the invitation to speak with you today about air monitoring.

My name is Bart M. Eklund. I am a Senior Technical Expert with Haley & Aldrich, a Massachusetts-based company of environmental and geotechnical engineering consultants. I am a chemist by training and have over 40 years of experience with air quality monitoring. I have over 100 publications: papers in research journals, US government publications, and technical papers in conference proceedings.

I am an expert on air quality issues, in particular those associated with the measurement of air toxics. I have conducted air quality studies on six continents. I started my career working for the Federal Government (specifically the USGS) but have spent most of my time at private, consulting firms. I have been a contractor to the USEPA (e.g., developing guidance for air monitoring at Superfund sites, measuring greenhouse gas emissions from wastewater treatment systems) and the USDOE (e.g., measuring emissions of radioactive gases from landfills, modeling air emissions associated with the disassembly of nuclear weapons). Along with co-workers, I developed sampling and analytical methods and performed numerous air quality studies to characterize worker and community exposures. My experience includes work with various continuous and hi-vol methods and addressing criteria pollutants, particulate matter (TSP, PM_{10}, and $PM_{2.5}$), VOCs, SVOCs, PCBs, dioxins, H_2S, methane, metals and other elements, tritium, radon, pesticides, aldehydes, organic acids, amines, silica, and asbestos. In recent years, I have worked on numerous indoor air studies.

My testimony today is to provide context for the bills under consideration based on my technical expertise and experience with the technical and logistical challenges of air quality monitoring. Very brief overviews of air quality monitoring for regulatory compliance and for air toxics are given below, followed by a discussion of the key elements in developing air monitoring programs, recent trends in air monitoring, and a few observations related to the bills.

Overview of Air Monitoring Programs for Regulatory Compliance –

Under the Clean Air Act (CAA), new or modified facilities may need various types of air permits. The permitting process includes estimating the potential air emissions from the facility and evaluating the effect of these emissions on the local area.

Once operations begin, permitted facilities routinely perform air monitoring to measure the emissions from stacks and other stationary sources. This air monitoring may involve Continuous Emission Monitors (CEMs) to provide automated, continual data or periodic (e.g., annual) stack testing involving manual testing for a few hours at a time. The test results are used to evaluate compliance with permitted levels of air emissions.

The CAA established National Ambient Air Quality Standards (NAAQS) for six so-called criteria pollutants. These include several acid gases, carbon monoxide, particulate matter (dust), and lead. The permitting and on-going air measurements at a given facility address the criteria pollutants, but may also require air monitoring for other, additional chemicals.

Community air monitoring is performed across the US by state, local, and tribal agencies to evaluate compliance with the NAAQS. Meteorological (weather) data are collected at the same time to assist in evaluating the air pollutant monitoring data. These monitoring stations are relatively large, typically requiring a trailer (e.g., 14 ft.) to house racks of equipment, security fencing, and electric power service. Each monitoring location may have >$100,000 of equipment. The attached appendix has a few photographs showing typical monitoring stations.

The air monitoring performed under the CAA, whether inside the fenceline of a facility, or out in the communities, must use standard methods that have been approved by the USEPA. This ensures that data are of known accuracy and known quality. Other, non-approved air monitoring methods may be employed from time to time for informational purposes, but the data generally cannot be used for compliance or enforcement purposes.

The permitting program, with the element of confirmatory air monitoring, set up under the CAA has been a tremendous success. Air quality in the US has substantially improved over the course of my career. The USEPA states that air pollutions levels since 1990 have declined by 79% for carbon monoxide, 85% for lead, 54 to 61% for nitrogen dioxide, 21% for ozone and 91% for sulfur dioxide.[1]

This improvement in air quality across the US has occurred despite significant increases in population, vehicle miles, electricity generation, etc. that otherwise would be expected to worsen

[1] Our Nation's Air 2022 (epa.gov)

air quality. The public perception, however, often is that air quality issues have gotten worse over time.

Overview of Air Monitoring Programs for Air Toxics –

Since the CAA and its amendments were passed, interest has grown in hazardous air pollutants ("air toxics"). Since the 1980's, facilities have been required to provide annual estimates of their toxic releases to the atmosphere. These emission inventories are tracked in the Toxics Release Inventory (TRI) program.

Air monitoring for hazardous air pollutants ("air toxics") is routinely performed in the US. For example, the USEPA operates various national monitoring programs to address air toxics, including the:

- Urban Air Toxics Monitoring Program (UATMP);
- National Air Toxics Trends Stations (NATTS) network; and
- Community-Scale Air Toxics Ambient Monitoring (CSATAM) program.

The most recent report from the USEPA includes results from 53 monitoring sites in approximately 30 urban and rural areas.[2] Other areas of the US were addressed in prior years.

The USEPA also has a Mercury Deposition Network (MDN)[3] which is part of the Clean Air Status and Trends Network (CASNET). Samples are collected weekly at about 80 sites (i.e., about 4,000 samples per year) and analyzed for total mercury. A subset of precipitation samples is analyzed for methyl mercury.

The above programs are only part of the USEPA's monitoring efforts, an overview of which can be found in the recent GAO report.[4]

In addition to the USEPA's efforts, individual facilities or industry consortiums may monitor for air toxics at their fence line or in the neighboring communities. Such monitoring may be voluntary or be called for in their permits. For example, large industry-funded air monitoring networks are present in Texas and Louisiana in areas where chemical and refining facilities are clustered (e.g., Texas City, Beaumont, Lake Charles) or oil & gas production is underway (e.g., Barnett Shale). One of these industry-led networks –The Houston Regional Monitoring network – has been in operation for over 40 years. The fenceline monitoring results over time can be compared with estimated impacts based on permit applications or emission inventories.

A Federal regulatory-driven monitoring effort since 2015 has been the requirement under CAA Section 112(d) for refineries to conduct continuous monitoring for benzene along their fenceline. Samples are collected over two-week time periods using EPA Method 325 and additional

[2] Air Toxics Monitoring National Program Reports | US EPA

[3] 2020as.pdf (wisc.edu)

[4] GAO. Air Pollution – Opportunities to Better Sustain and Modernize the National Air Quality Monitoring System. GAO-21-38. November 2020.

monitoring or corrective actions are required if the fenceline results exceed the criterion for the annual average benzene concentration.

An example of a State-led monitoring requirement for air toxics is California Assembly Bill No. 1647, which requires the owner or operator of a petroleum refinery to install and operate a continuous monitoring system along the facility fenceline. These are often referred to as "Rule 1180" monitoring systems. An extensive list of air pollutants is addressed.

Note that there is less standardization of monitoring methods for air toxics compared with compliance monitoring under the CAA. The USEPA has put forth some methods, such as Method TO-15 for volatile organic compounds (VOCs). But even for Method TO-15, there can be significant differences from lab to lab in terms of which analytes are reported, how sampling devices are cleaned, etc. For air toxics such as ethylene oxide, there may be no consensus approach at this time.

Design of Air Monitoring Programs –

The key elements of design of air monitoring programs are described below. Policy makers specify:

1) Objectives of a program, and
2) Chemicals that are of interest.

The objectives might be to directly measure potential inhalation exposures in the community or might be to make measurements along a facility fenceline as a check of how accurate the annual emission inventory is or how much the air emissions change over time. The next steps are to identify

3) Time frames that are of interest, and
4) What concentrations are acceptable.

In general, community air monitoring is concerned with short-term exposure for highly reactive chemicals (e.g., acid gases, ozone, ammonia) and long-term exposure for air toxics such as lead or benzene. Chemicals may have both short-term and long-term effects, but the levels of concern are far different for the different time frames. The levels of concern for long-term (chronic) exposure may be thousands of times lower than the levels of concern for short-term (acute) exposure.

There are national air quality standards (NAAQS) for six air pollutants and standards (OSHA Permissible Exposure Limits [PELs]) for worker exposure. For the concentration of air toxics (other than lead) in the community, however, there generally are no standards. There may be screening levels or guidance levels, but these do not have the same weight as standards. Furthermore, the acceptable level may vary from State to State based on the local environmental laws (e.g., one state may allow one-in-a-million cancer risk and another state may allow one-in-100,000 cancer risk). In some cases, there also can be differences based on duration of exposure

(24 hour/day vs. 40 hour/week) or land use (rural vs. urban areas). Other design considerations include:

5) Sampling period & frequency

Monitoring may be continuous (e.g., for chemicals with short-term effects) or periodic. The time resolution also may be an issue as well as the sampling duration. For most air toxics, the traditional approach has been to collect 24-hour, time-integrated samples about once per week.

6) Number and location of monitors or sampling devices

Monitors are available that provide data for a given location or along an extended path. The traditional approach has been to collect samples at a given location that is a reasonable worst-case or is representative of a larger area.

7) Monitoring methods

The analytical sensitivity of the method needs to sufficient to address whether the air quality exceeds or does not exceed the acceptable concentrations.

For most criteria pollutants, continuous monitors are available to provide immediate feedback for comparison to the NAAQS. For most air toxics, however, this is not the case. The traditional approach has been to collect samples in the field and ship them to an analytical laboratory for processing and analysis. Using traditional approaches, the key cost elements are the labor to collect the samples and the cost of the off-site analysis. Both are proportional to the number of samples.

Other considerations include, 8) network operations (equipment needs an operator to do regular inspections and maintenance), 9) quality assurance (e.g., third-party audits), and 10) data management, and reporting. Note that continuous measurement methods can produce very large data sets to review, validate, and manage. When the concentrations of interest are very low, more data review is needed to ensure that the chemicals are correctly identified and quantified.

Recent Trends in Air Monitoring –

There have been two notable trends in air monitoring in recent years. First, there has been a trend towards collecting continuous data. Using benzene as an example, traditional monitoring would have collected a 24-hour sample every 6^{th} day at a given location. That yields about 60 data points per year. Many stakeholders were concerned that air emission events might be missed with such intermittent sampling and so continuous methods (such as field gas chromatographs [GCs]) have become more common. Data might be collected every 15 minutes, yielding over 30,000 data points per year (500-times more than previously).

In my experience, stakeholders quickly lose interest in reviewing and evaluating the data because the results tend to be "good news" in that few problems or exceedances are detected. The focus then shifts to getting data during certain short-term, difficult to predict events, such as fires, accidents, and emergency releases.

The second notable trend has been toward use of small, relatively inexpensive sensors to develop a widely distributed air monitoring network. This might entail fixed sensors (e.g., a sensor on every light pole) or community members using their smartphones or other devices to collect data. As expected, the use of citizen-scientists and low-cost sensors has both pros and cons. On the plus side, it can lead to greater community awareness and involvement. There is more potential to identify areas or times where air concentrations differ from the average. But, the sensors are not very accurate compared with USEPA standard methods. False positive results are certainly possible and such false alarms can cause unwarranted concern in the community.

My opinion is that networks of low-cost sensors will prove to have only a very limited role in evaluating and improving air quality.

Observations on the Proposed Bills –

I offer up the following opinions that may be relevant.

1. There is a great deal of existing air monitoring data that may be relevant to the objectives of these bills.

The USEPA air toxics programs previously cited addresses some of the chemicals of interest in today's hearing. For example, the most recent annual report gives data for:

- Chloroprene: 2,934 samples;
- Formaldehyde: 3,157 samples;
- Mercury: 602 dust samples (TSP); and 1,544 inhalable dust samples (PM_{10}).

The detection levels were relatively low and so the data should be useful for purposes of evaluating public health. The USEPA continues to collect this data each year, but stopped publishing annual reports after the 2015-2016 year.

As previously noted, there are thousands of measurements per year for mercury deposition from USEPA's Mercury Deposition Network and over 20 years of data.

The existing monitoring efforts and the resulting data sets are an underutilized resource. There is much information that could be gleaned from the existing data sets. Evaluating the existing data is more cost-effective than generating new data.

2. Existing air toxics monitoring already is skewed towards environmental justice areas.

Monitoring stations operated by individual facilities and industry consortiums that collect air toxics data are located at facility fencelines and in the surrounding communities –

these are the exact locations of interest from an environmental justice (EJ) perspective. This may also be true for the USEPA air toxics stations (e.g., UATMP), but I am not aware of any evaluation of monitor siting with respect to EJ.

The NAAQS stations operated by state and local governments, on the other hand, tend to be located in more suburban locales. This was done because ozone was a primary concern and ozone exposure tends to be a suburban issue rather than an issue for the city center or the industrial precincts of a city.

Again, the existing monitoring efforts and data sets are an underutilized resource. The existing data sets can provide some insights into questions such as how much concentrations may vary from location to location and the how much of the total exposure dose is attributable to outdoor air versus exposure to indoor air and during commuting.

3. Continuous air monitoring of various air toxics may not be feasible.

Stakeholders often prefer continuous analyzers that provide real-time data. But for many air toxics (e.g., formaldehyde, ethylene oxide), there may not be any methods that can achieve that goal. Therefore, alternatives may need to be considered (e.g., 24-hour samples analyzed in an off-site analytical laboratory).

In some cases, monitoring approaches have been devised and proof-of-concept testing has been performed. Vendors may make extravagant claims. But if no standard method has been developed and validated, there will be questions about data quality, the degree to which the monitoring can be automated, and the long-term reliability of the equipment for the intended purpose.

There are trade-offs that involve analytical sensitivity, time resolution of the data, how quickly the data are available, the size and cost of the monitoring equipment, and so on. In general, to achieve the very low detection limits needed to evaluate long-term exposure to air toxics, there is a need for large, costly, sophisticated monitoring approaches. An overview of some of the newer monitoring options can be found on the website of the California Air Resources Board (CARB).[5]

Thank you for the opportunity to discuss these issues. I look forward to any answering any questions you may have.

Bart Eklund

beklund@haleyaldrich.com
www.haleyaldrich.com

[5] Outline of Measurement Technologies | California Air Resources Board

Appendix – Examples of Air Monitoring Stations

Source: CAMS 15 Site Photographs (texas.gov)

Source: Ambient Air Monitoring Network Review Update (govdelivery.com)

Source: Air Monitoring Equipment Shelters | Shelter One