United States Government Accountability Office

Testimony

Before the Committee on Environment and Public Works, U.S. Senate

For Release on Delivery
Expected at 10:00 a.m. ET
Wednesday, July 13, 2022

AIR QUALITY INFORMATION

Need Remains for Plan to Modernize Air Monitoring

Statement of J. Alfredo Gómez, Director,
Natural Resources and Environment

GAO-22-106136

July 13, 2022

AIR QUALITY INFORMATION

Need Remains for Plan to Modernize Air Monitoring

GAO Highlights

Highlights of GAO-22-106136, a testimony before the Committee on Environment and Public Works, U.S. Senate

Why GAO Did This Study

Information from the national ambient air quality monitoring system shows that the United States has made progress in reducing air pollution. It also shows that risks to public health and the environment continue in certain locations. EPA and state and local agencies cooperatively manage the system.

Since the system was established in the 1970s, air quality concerns have evolved. For example, concerns have increased about the health effects of air toxics, such as ethylene oxide. Congress is considering legislation related to some of these emerging air quality monitoring concerns.

This testimony discusses (1) needs for additional air quality information and (2) challenges in meeting those needs. This statement is based on a November 2020 report (GAO-21-38). For that report, GAO reviewed literature, laws, regulations, and agency documents. In addition, GAO interviewed EPA officials, selected state and local officials, representatives from air quality associations, and stakeholders such as academic researchers. GAO has also tracked EPA's actions to implement the recommendations made in the report.

What GAO Recommends

In its November 2020 report, GAO made two recommendations, including that EPA develop an air quality monitoring modernization plan that aligns with leading practices for strategic planning and risk management. EPA generally agreed with the recommendations. EPA has begun working with state, tribal, and local air agencies to implement them.

View GAO-22-106136. For more information, contact J. Alfredo Gómez at (202) 512-3841 or gomezj@gao.gov.

What GAO Found

The national ambient air quality monitoring system provides standardized information essential for implementing the Clean Air Act and protecting public health. But, in November 2020, GAO found that the system was unable to meet users' current needs for information to better manage health risks from air pollution. Air quality managers, researchers, and the public use the information from this system to characterize levels of pollution and study the human health and ecological effects of air pollution. They also use it to develop strategies to reduce adverse health effects, and demonstrate progress in addressing air quality issues over time. The system comprises sites across the United States that are equipped with monitors to measure air pollution levels.

Examples of Monitoring Sites in the National Ambient Air Quality Monitoring System

(Left to right) National Core network (NCore) monitoring site; canisters used to collect samples for measuring air toxics; near-road monitoring site.

Source: GAO. | GAO-22-106136

Additional air quality monitoring information would enable users of the system to better understand and address the health risks from air pollution, according to a review of literature and interviews with government officials, associations, and stakeholders that GAO conducted for its November 2020 report. GAO identified information needs related to (1) local-scale, real-time air quality; (2) air toxics; (3) persistent and complex pollution; and (4) use of low-cost sensors. For example, many stakeholders told GAO that they need more data to understand health risks in potential hotspots (local areas of high pollution), and other key locations.

The Environmental Protection Agency (EPA) and state and local agencies face persistent challenges in meeting additional information needs in four key areas. These are: (1) establishing priorities for air toxics monitoring; (2) developing and improving air quality monitoring methods; (3) integrating emerging technologies, such as low-cost sensors; and (4) managing and integrating additional monitoring data.

EPA has strategies aimed at better meeting needs for additional information on air quality, but GAO found that these strategies were outdated and incomplete. Developing a modernization plan that aligns with leading practices for strategic planning and risk management, would better position EPA to ensure that the ambient air quality monitoring system meets the additional information needs. It would also help position EPA to protect public health as future air quality issues emerge.

Chairman Carper, Ranking Member Capito, and Members of the Committee:

Thank you for the opportunity to discuss our work on air quality information needs that can help manage the risks that air pollution poses to public health. While the United States has made significant progress in reducing air pollution levels since the 1970s, air pollution continues to harm public health and the environment in certain locations, according to data from the national ambient air quality monitoring system.[1] This system consists of sites that measure air pollution levels at fixed locations across the country. The sites are equipped with monitors that use specific methods approved by the Environmental Protection Agency (EPA). Air quality managers, researchers, and the public use the information from this system to characterize levels of pollution, study the human health and ecological effects of air pollution, develop strategies to reduce adverse health effects, and demonstrate progress in addressing air quality issues over time.

EPA and state and local agencies, which cooperatively manage the monitoring system, face challenges in sustaining this system. EPA and state and local agencies play different roles in the system's design, operation, oversight, and funding. For example, EPA establishes minimum requirements for the system. State and local agencies operate the monitors and report data to EPA. And, EPA and state and local agencies provide funding for the system.[2] We reported in November 2020 that EPA and state and local agencies faced challenges in sustaining the monitoring system in the face of decreasing funding and increasing demands on resources.[3] From 2004 to 2019, federal funding for state and local monitoring programs declined by nearly 20 percent after adjusting for inflation, and state and local funding for these programs also generally

[1]"Ambient air" means that portion of the atmosphere, external to buildings, to which the general public has access. 40 C.F.R. § 50.1(e).

[2]EPA provides federal funding for the monitoring system through grants to state and local agencies under the Clean Air Act for a range of state and local air quality management activities, including air quality monitoring. EPA regional offices administer and oversee the federal grants to state and local agencies. In fiscal year 2022, from EPA's appropriation for grants, Congress provided that approximately $230 million was to be for state and local air quality management grants, including those authorized under the Clean Air Act.

[3]GAO, *Air Pollution: Opportunities to Better Sustain and Modernize the National Air Quality Monitoring System,* GAO-21-38 (Washington, D.C.: Nov. 12, 2020).

declined.[4] Concurrently, EPA and state and local agencies face increasing demands on these limited resources, including aging monitoring infrastructure and rising operating costs.

Air quality concerns have changed since the national ambient air quality monitoring system was established by amendments to the Clean Air Act in the 1970s.[5] For example, concerns have emerged about issues such as the health effects of air toxics; local areas of high pollution, particularly in lower-income or minority communities; and growing effects of wildfire smoke on air quality and public health.[6] Additionally, technologies for measuring air quality, such as low-cost sensors, have improved since the system's inception, providing opportunities to enhance information on air quality.[7]

Congress is considering various legislative proposals related to air quality monitoring. For example, one bill would call for EPA to establish a pilot program for hyperlocal air quality monitoring projects in environmental justice communities that could provide information on localized levels of high pollution, while another would require EPA, in consultation with other agencies, to establish a national mercury monitoring program.[8] Another bill would expand monitoring and access to air quality information for communities affected by air pollution, such as environmental justice communities, and call for the deployment of low-cost sensors in certain communities.

My statement today focuses on (1) additional air quality monitoring information that could help meet the needs of air quality managers,

[4]Since we reported on these funding trends, congressional appropriations for fiscal years 2020 through 2022 for the EPA air quality management grants related to the monitoring system remained similar to fiscal year 2019 levels.

[5] 42 U.S.C. §7401 et seq. The Clean Air Act was also significantly amended in 1977 and 1990.

[6]Air toxics are a category of pollutants that are known to cause, or are suspected of causing, cancer, birth defects, reproduction problems, and other serious illnesses.

[7]See also GAO, *Science and Technology Spotlight: Air Quality Sensors*, GAO-21-189SP (Washington, D.C.: Dec. 7, 2020).

[8]The term "environmental justice communities" generally refers to areas where disproportionately high health and environmental risks are found among low-income and minority communities. The precise definition and scope of this term may vary among legislative proposals.

researchers, and the public; and (2) challenges that EPA and selected state and local agencies face in meeting these air quality information needs. My statement is based on our November 2020 report on the national ambient air quality monitoring system.[9]

For our November 2020 report, we identified and reviewed federal laws and regulations governing the national ambient air quality monitoring system; EPA reports, guidance, and information on the oversight and operation of the monitoring system; and 10 studies and articles, identified in a literature review, that discussed the performance of the monitoring system or emerging air pollution issues. We also conducted a series of interviews with knowledgeable federal, state, and local officials; representatives from air quality associations; and stakeholders.[10] Specifically, we interviewed (1) EPA officials from the Office of Air Quality Planning and Standards within the Office of Air and Radiation, the Office of Research and Development, and six selected regional offices; (2) officials from 14 state and local air quality monitoring agencies within the six selected EPA regions; (3) representatives from the two national and six regional associations of state and local air quality agencies; and (4) 10 stakeholders, such as academic researchers and individuals from the private sector.

We selected our interviewees based on various criteria. First, we selected EPA regional offices in areas across the country with different characteristics that might be associated with a range of monitoring needs and considerations, such as different air quality concerns and population densities. Also, we selected state and local agencies to include jurisdictions with a range of characteristics potentially affecting the design and operation of their air quality monitoring networks, such as different air quality issues, population densities, and approaches to air toxics monitoring. Finally, we selected stakeholders based on their experience

[9]In addition to the objectives noted above, the November 2020 report also examined (1) the role that the national ambient air quality monitoring system plays in managing air quality and how EPA and state and local agencies manage the system and (2) the challenges that EPA and selected state and local agencies face in managing the national ambient air quality monitoring system and the extent to which EPA has addressed and could better address these challenges. See GAO-21-38.

[10]To identify the number of interviewees who expressed particular views, we use the following modifiers throughout the issued report and testimony statement: “Some” represents two to four interviewees, “several” represents five to eight interviewees, and “many” represents nine or more interviewees. We considered officials from a state or local agency or representatives from a national or regional association to be one interviewee, even though multiple officials or representatives may have participated in the interview.

in using air quality information and their knowledge about the extent to which the monitoring system produces needed air quality information. Our findings from these selected interviews cannot be generalized. More detailed information on our objectives, scope, and methodology is in the issued report. Since November 2020, we have tracked the actions that EPA has taken to implement the recommendations we made in the report.

We conducted the work on which this statement is based in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Air Pollutants Defined by the Clean Air Act

The Clean Air Act provides the framework for protecting air quality in the United States.[11] Under the Clean Air Act, EPA sets different types of limits—ambient air standards and emissions standards—for two categories of air pollutants. The first category comprises "criteria" pollutants for which EPA has established standards for the allowable levels of each pollutant in the ambient air. Such pollutants include carbon monoxide, lead, ozone, particulate matter, nitrogen dioxide, and sulfur dioxide.[12] EPA sets these allowable standards—called the National Ambient Air Quality Standards (NAAQS)—at levels intended to protect public health, including the health of susceptible and vulnerable populations such as people with asthma, children, and elderly people.[13] The criteria pollutants are commonly found throughout the United States and can harm public health, harm the environment, and cause property

[11]The purposes of the Clean Air Act are, among other things, to protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population. 42 U.S.C. § 7401(b)(1).

[12]EPA has established standards for two different sizes of particulate matter: particulate matter less than or equal to 10 micrometers in diameter, known as PM_{10}, and particulate matter less than or equal to 2.5 micrometers in diameter, known as fine particulate matter or $PM_{2.5}$.

[13]In addition, EPA sets "secondary standards" to protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air.

damage. They often come from sources such as power plants, factories, and motor vehicles.

The second category of pollutants currently includes 188 pollutants listed under the 1990 Clean Air Act Amendments and subsequent EPA regulations as "hazardous air pollutants."[14] For these pollutants, EPA has not established ambient air standards but regulates them by establishing emissions standards for individual categories of hazardous air pollutant sources. EPA also refers to hazardous air pollutants as "air toxics." Air toxics are pollutants known to cause, or suspected of causing, cancer, birth defects, reproduction problems, and other serious illnesses. Air toxics include pollutants such as benzene, found in gasoline, and mercury, which is emitted from sources such as power plants. The health risks of air toxics can vary considerably. Therefore, small quantities of more harmful pollutants can pose greater health risks than large quantities of less harmful pollutants. In addition, some air toxics can fall to the ground in rain or dust and contaminate land and waterways.

The National Ambient Air Quality Monitoring System

The national ambient air quality monitoring system provides standardized information essential for implementing the Clean Air Act and protecting public health. The system contains a suite of networks across the country that focus on different air quality issues but that have common methods for producing data at their monitoring sites, allowing the comparison of data across the country to provide a national perspective on various air quality issues.[15] This standardized information helps air quality managers, researchers, and the public understand and manage risks from air pollution, according to some literature we reviewed and stakeholders we interviewed.

Table 1 describes the networks within the national ambient air quality monitoring system:

(1) required networks of State and Local Air Monitoring Stations (SLAMS), which measure levels of the criteria pollutants and the precursor pollutants that mix to form criteria pollutants; (2) voluntary networks designed to measure air toxics, including a national network for

[14]For a list of these pollutants, see Environmental Protection Agency, *Initial List of Hazardous Air Pollutants with Modifications,* accessed July 1, 2022. https://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications.

[15]Certain state and local air toxics monitoring programs use common methods for producing data. However, since these are not required networks, the use of common methods across all state and local air toxics monitoring is not assured.

establishing trends in air toxics and state and local networks designed to target specific concerns about air toxics; and (3) specialized networks focused on certain pollution issues, such as visibility and deposition of pollutants from the atmosphere into ecosystems.

Table 1: National Ambient Air Quality Monitoring System

Network	Purpose	Start year	Number of sites[a]
Required networks of State and Local Air Monitoring Stations (SLAMS)			
Criteria pollutant networks	Provide air pollution data to the general public in a timely manner; support compliance with the National Ambient Air Quality Standards (NAAQS) and emissions strategy development, and support air pollution research studies.	1980	4,300+
Photochemical Assessment Monitoring Stations (PAMS)	Measure ozone precursors to better characterize the nature and extent of ozone problems in areas not attaining NAAAQS.	1994	69
$PM_{2.5}$ Chemical Speciation Network (CSN)	Provide data on the chemical composition of particulate matter less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$) to assess trends, develop emissions control strategies, and support health studies, among other things.	2002	154
Near-Road NO_2 Network	Measure nitrogen dioxide (NO_2) and other pollutants near roads in larger urban areas where peak hourly levels are expected to occur.	2010	74
National Core (NCore) network	Support air quality model evaluations, long-term health assessments, compliance through comparison with NAAQS, and ecosystem assessments.	2011	78
Voluntary networks for assessing air toxics			
National Air Toxics Trends Stations (NATTS) network	Identify trends in air toxics levels to assess progress toward emission reduction goals, evaluate public exposure, and characterize risk.	2003	24
State and local air toxics monitoring	Support state and local air toxics programs and identify geographic areas at high risk.	1985	240+
Specialized networks			
Interagency Monitoring of Protected Visual Environments (IMPROVE)	Establish current visibility conditions in visibility-protected federal areas, identify emissions sources, document trends, and provide regional haze monitoring.	1985	110
Clean Air Status and Trends Network (CASTNET)	Assess environmental results of emissions reductions programs, such as a program to reduce acid rain, and pollutant impacts to sensitive ecosystems and vegetation.	1991	96
National Atmospheric Deposition Program (NADP)	Provide data on the amounts, trends, and geographic distributions of ammonia, mercury, and other pollutants found in precipitation that can affect the environment.	1978	473

Source: GAO analysis of Environmental Protection Agency information. | GAO-22-106136

[a]As of November 2020. These numbers include sites on tribal lands that report data to the Environmental Protection Agency; monitoring on such lands was not included in the scope of our

analysis in GAO, *Air Pollution: Opportunities to Better Sustain and Modernize the National Air Quality Monitoring System*, GAO-21-38 (Washington, D.C.: Nov. 12, 2020).

Air Quality Managers, Researchers, and the Public Need Additional Information to Better Understand and Address Health Risks from Air Pollution

In November 2020, we reported that air quality managers, researchers, and the public need additional information to better understand and address health risks from air pollution, according to some literature we reviewed and officials from EPA and selected state and local agencies, representatives of national and regional air quality associations, and stakeholders. These information needs related to (1) local-scale, real-time air quality; (2) air toxics; (3) persistent and complex pollution; and (4) use of low-cost sensors.

Local-Scale, Real-Time Air Quality

More local-scale, real-time information is needed to meet evolving public demands, according to many EPA, state, and local agency officials, representatives of regional associations, and stakeholders we interviewed for our November 2020 report. Some of these officials and stakeholders said that the increasing availability of other types of local-scale, real-time information—such as for traffic and weather—is creating a demand for such information on air quality. In addition, according to some public health researchers we interviewed, they need air quality information on a localized scale to get an accurate picture of the exposure that individuals face and the associated health effects. However, we reported that the monitoring system is unable to meet all such needs.

Specifically, we reported that the system is unable to meet needs for information on the following areas:

- **Air pollution hotspots, or local areas of high pollution.** Air pollution levels can change significantly from one location to another, and pollution hotspots may occur between existing monitoring sites. Some state and local officials said at the time that they have used mobile air quality monitoring units—such as monitoring equipment set up in movable vans or trailers (see fig.1)—to temporarily monitor air quality in certain areas.
- **Short-term, real-time air quality changes.** Some monitoring equipment in the system does not have the capability to provide real-time information. For example, particulate matter monitors that use manual, filter-based methods provide data once over a 24-hour period, as opposed to hourly for continuous monitors.

- **Air quality in rural areas.** In rural areas, the distance between monitoring sites is often much greater than in urban areas, and some rural areas may not have any monitoring.

Figure 1: Example of a Mobile Air Quality Monitoring Unit

Exterior and interior of a mobile monitoring unit operated by the Delaware Department of Natural Resources and Environmental Control

Source: GAO. | GAO-22-106136

Air Toxics

In a 2004 report on air quality management in the United States, the National Academies of Sciences, Engineering, and Medicine (National Academies) noted that exposure to air toxics was an important concern that is not well quantified on account of limited information.[16] The report also noted that the many unknowns associated with a large number of unlisted pollutants, and stated that the development and use of many new toxic substances each year makes it challenging for the monitoring system to evolve quickly enough. More recently, in 2019, the California Air Resources Board identified over 800 new substances and proposed that they be reported to assess air toxics risk.[17]

In November 2020, we reported these specific needs included the following:

- **Air toxics information in key locations.** Additional air toxics information is needed in key locations near identified cancer clusters, environmental justice areas, industrial facilities, and other potential hotspots.[18] In addition, some air toxics, such as mercury, can affect

[16]National Academies of Sciences, Engineering, and Medicine, *Air Quality Management in the United States* (Washington, D.C.: The National Academies Press, 2004).

[17]The California Air Resources Board oversees all air pollution control efforts in California.

[18]For more information about federal efforts related to environmental justice, see GAO, *Environmental Justice: Federal Efforts Need Better Planning, Coordination, and Methods to Assess Progress,* GAO-19-543 (Washington, D.C.: Sept. 16, 2019).

aquatic and terrestrial ecosystems through deposition from the air to the water or land. More consistent monitoring is needed to track trends in and understand the sources and transport of such pollutants that can affect ecosystems, according to representatives from a regional air quality association we interviewed at the time.

- **More timely information on air toxics.** Frequent air quality measurements that are available quickly are more useful for risk reduction and for understanding pollution sources. To measure air toxics levels, samples of air are typically sent to laboratories for analysis, which takes time. In addition, monitoring for air toxics often uses canisters or other sampling devices that capture air over a defined amount of time, such as a 24-hour period (see fig. 2). This can make it difficult to understand which sources emitted the air toxics affecting that location throughout the day. All air toxics samples at National Air Toxics Trends Stations (NATTS) are collected over a 24-hour period once every 6 days.
- **Information on air toxics at low levels.** Some methods for analyzing air toxics samples cannot detect air toxics at levels low enough to allow identification of potential public health threats. For example, we reported that according to EPA officials, two of the 19 core air toxics have methods with a detection limit that is above or near the level that would be relevant for assessing health effects.[19] In such cases, officials cannot conclusively identify whether the air toxics present a public health risk. An inconclusive result is difficult to explain to the public, according to some state and local agency officials.

[19]Acrolein and ethylene oxide have detection limits that are above health-relevant levels. "Core air toxics" refers to the National Air Toxics Trends Stations' (NATTS) Tier I analytes, which are a group of 19 air toxics that have been identified as major risk drivers based on a relative ranking performed by EPA. We reported that EPA officials said the agency has taken some steps to improve monitoring methods for air toxics.

Figure 2: Example of Air Toxics Monitoring Equipment

Canisters used to collect samples for measuring air toxics operated by the Wisconsin Department of Natural Resources

Source: GAO. | GAO-22-106136

Persistent and Complex Pollution

In November 2020, we also reported that more specialized information is needed to better understand persistent and complex pollution issues to, in turn, help identify options for reducing the pollution and its health effects. Understanding persistent or complex pollution issues often requires information that the monitoring system does not comprehensively provide, including information about pollution precursors and their sources, the chemistry of the atmosphere, and the transport of the pollutants.

Specific information needs related to persistent and complex pollution included information on (1) particulate matter less than or equal to 2.5 micrometers in diameter (PM2.5) and ozone formation and transport; and (2) effects of wildfires on air quality and public health. Although programs exist that are specifically designed to gather specialized information about PM2.5 and ozone, we reported that additional information would help inform emissions control strategies.[20] Also, we noted that more information is needed to better understand the complex effects of wildfires

[20]Emissions can mix with other substances in the environment to form other pollutants, so understanding interactions can be important for designing an emissions control strategy for a given area. The Photochemical Assessment Monitoring Stations (PAMS) network provides information about the precursors and other factors that influence the formation of ozone, and the $PM_{2.5}$ Chemical Speciation Network (CSN) provides information on the chemical composition of particulate matter, which can help inform emissions control strategies.

on air quality and human health. We have ongoing work examining this issue.

Use of Low-Cost Sensors

Low-cost sensors are increasingly available as a tool for government agencies and the public to directly measure air quality. EPA defines low-cost sensors as those costing less than $2,500. Because low-cost sensors can be deployed in many locations without significant initial investment, they can help meet some of the information needs related to monitoring that require pollution measurements in additional locations or more real-time data. For example, many state and local officials we interviewed for our November 2020 report said that low-cost sensors could be used for applications such as identifying ideal locations for regulatory monitors, locating pollution hotspots, supporting community-based monitoring initiatives, expanding air toxics monitoring, addressing citizen concerns and questions, and tracking wildfire smoke.

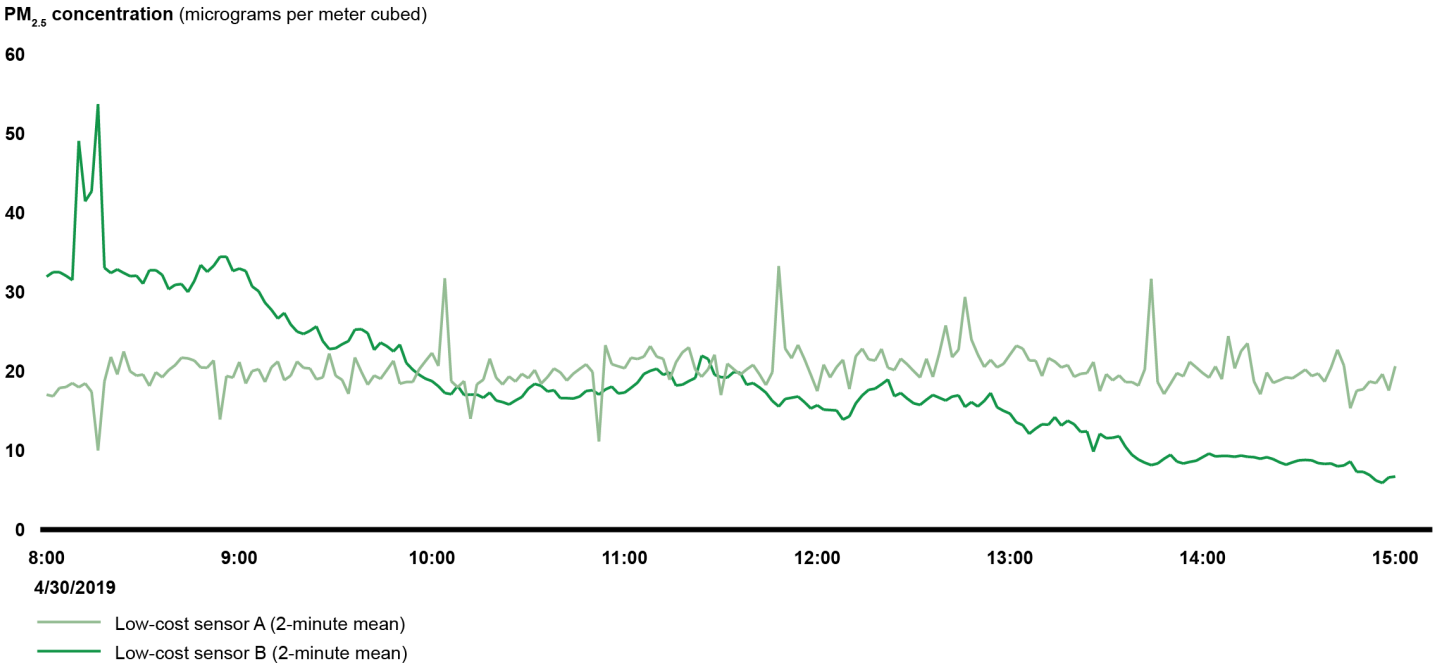
We reported that although many officials cited potential uses of low-cost sensors, some expressed concerns about potential limitations, such as the quality and use of the information. For example, while officials from some state and local agencies said that their agencies used low-cost sensors to supplement their monitoring for limited purposes, some had concerns about the quality of the information that these sensors produce.[21]

In addition, we reported that the public, government agencies, and researchers need additional information on how to use low-cost sensors and the data they produce, according to many EPA and state and local officials we interviewed. Specifically, this information included (1) accepted and cost-effective applications of sensors, (2) proper sensor calibration, and (3) proper siting of sensors. Many EPA and state and local officials we spoke with said that they were aware of external stakeholders—such as community groups, members of the public, private companies, and research groups—using low-cost sensors. We also reported that many EPA and state and local officials and regional representatives were concerned about the need to ensure that these external stakeholders appropriately interpret and apply the information from these sensors.

[21]The sensors have been used for such applications as special studies related to wildfires, identifying sources, and engaging the community on pollution issues.

To demonstrate and understand the use of sensors to gather air quality information, for our November 2020 report, we purchased five low-cost sensors from four different manufacturers to measure fine particulate matter. One sensor operated from April 2019 to March 2020, and the others operated from April to June 2019. Our sensor demonstration illustrated (1) the difficulty of measuring specific pollution levels without properly calibrating the sensors and (2) the need to understand how the siting of the sensor can affect the data that it produces to help avoid misinterpretation. Our sensor demonstration also illustrated that even when two different sensors are located side by side, they may produce different pollution measurements (see fig. 3).[22]

Figure 3: Differences in PM2.5 Sensor Measurements from Two Sensors in the Same Location



Source: GAO analysis of GAO low-cost sensor data. | GAO-22-106136

Note: PM2.5 is particulate matter less than or equal to 2.5 micrometers in diameter. The data presented in the figure illustrate sensor differences over a short period of time, and this period is too limited to draw broad conclusions.

[22]When measured by EPA-approved monitors, the 24-hour health-based standard for $PM_{2.5}$ exposure is 35 micrograms per meter cubed, and the annual health-based standard for $PM_{2.5}$ exposure is 12 micrograms per meter cubed.

EPA and State and Local Agencies Faced Persistent Challenges in Meeting Needs for Air Quality Information Even with Targeted Efforts to Address Such Needs

In November 2020, we found that EPA and state and local agencies faced challenges in meeting needs for additional air quality information, and these challenges persisted in four key areas:

- **Establishing priorities for air toxics monitoring.** Partially due to the large number of existing air toxics, monitoring for these substances needs to be prioritized, according to the National Academies and some EPA, state, and local officials, and regional representatives we interviewed at the time. We reported that some state and local agency officials also said that monitoring for air toxics needed to be prioritized because their agencies' budgets were mainly used to support required monitoring for criteria pollutants. Officials at some state and local monitoring agencies said that they looked to EPA for help with prioritizing what to monitor in their areas. Specific prioritization challenges that EPA and state and local agencies identified included (1) identifying air toxics that present the highest public health risks and might, therefore, be priorities for monitoring; and (2) anticipating emerging air toxics issues in order to prioritize monitoring for those air toxics.
- **Developing and improving air quality monitoring methods.** We reported that the limited availability of adequate analysis methods to meet information needs, primarily for air toxics, was a challenge, according to many EPA and state and local agency officials and regional representatives we spoke with at the time. Some existing analysis methods for pollutants were not sufficiently cost effective, timely, or sensitive, according to these officials and representatives. For example, state officials said that laboratory methods for analyzing formaldehyde—a relatively common air toxic—were prohibitively expensive. In addition, we reported that some state agency officials and regional representatives said continuous monitoring equipment was not available for some air toxics and was not cost effective. Finally, as previously mentioned, some monitoring methods did not detect pollution at low enough levels needed to understand health effects.

  EPA has programs to improve or develop new monitoring technologies, but these efforts had been targeted to specific monitoring purposes and did not fully addressed the challenges described above. Furthermore, the EPA Office of Research and Development's internal budget for air quality monitoring research, including development of methods, has remained flat for the past decade. According to EPA officials at the time, methods development priorities must compete with other Office of Research and Development research priorities for resources. As a result, the office

was only able to take action on some monitoring technology research and development needs, and only one air toxics monitoring method had been updated in the past 20 years.

- **Integrating emerging technologies.** EPA and state and local agencies faced challenges in integrating emerging technologies into the monitoring system to help address needs related to real-time, local-scale information and the use of low-cost sensors. EPA had undertaken targeted actions to address these challenges, such as (1) working with state and local monitoring agencies to study low-cost sensors' performance in specific environmental conditions and (2) developing workshops and a tool—the Air Sensor Toolbox—to communicate the performance of these sensors.[23] However, we reported that challenges persisted, such as performance issues with low-cost sensor measurements. These issues had been documented and included issues with accuracy, interference from other pollutants, and variable performance in different temperature and humidity conditions. In addition, as new low-cost sensors continue to become commercially available, communicating the performance of these emerging sensors persisted as a challenge, according to EPA officials.
- **Managing and integrating additional monitoring data.** We reported that EPA and state and local agencies faced challenges in meeting current data management needs, and these challenges likely would persist, according to some EPA and state and local officials. The Air Quality System, EPA's data management system, barely meets current data management needs because the architecture of the system—which dates back to the 1990s—is antiquated and inflexible. Furthermore, increasing continuous monitoring for more pollutants will create substantially more data to manage, which could challenge the current system's capabilities, some EPA and state and local officials noted at the time. We have ongoing work assessing EPA's progress in modernizing data systems for air quality data, including the Air Quality System.

While EPA has strategies aimed at better meeting the needs for additional air quality information, we found in our November 2020 report

[23]The Air Sensor Toolbox provides information on the performance, operation, and use of low-cost sensors. See https://www.epa.gov/air-sensor-toolbox, accessed July 5, 2022.

that these strategies were outdated and incomplete.[24] Specifically, EPA's strategies did not reflect needs for additional information or changes in the agency's approaches and resources. Furthermore, these strategies did not fully address challenges with meeting information needs, such as establishing priorities for air toxics monitoring.[25]

We made two recommendations to help EPA, along with state and local agencies, manage and modernize the air quality monitoring system to ensure that it meets information needs and helps protect public health as future air quality issues emerge. These recommendations, which we have identified as priority recommendations, are that EPA, in consultation with state and local agencies, should[26]

1. develop, make public, and implement an asset management framework for consistently sustaining the national ambient air quality monitoring system. Such a framework could be designed for success by considering the key characteristics of effective asset management. These include identifying the resources needed to sustain the monitoring system, using quality data to manage infrastructure risks, and targeting resources toward assets that provide the greatest value; and
2. develop and make public an air quality monitoring modernization plan to better meet the additional information needs of air quality managers, researchers, and the public. Such a plan could address the ongoing challenges in modernizing the national ambient air quality monitoring system by considering leading practices for strategic planning and risk management. These include establishing priorities

[24]Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards, *Final Draft: National Monitoring Strategy: Air Toxics Component* (Research Triangle Park, N.C.: July 2004); Office of Air Quality Planning and Standards, *Ambient Air Monitoring Strategy for State, Local, and Tribal Air Agencies* (Research Triangle Park, N.C.: December 2008); and *Draft Roadmap for Next Generation Air* Monitoring (March 2013).

[25]According to EPA officials, the larger air pollution community is doing a great deal of work on sensors but very little work on air toxics, yet the officials noted that the risk is likely in air toxics.

[26]Priority open recommendations are the GAO recommendations that warrant priority attention from heads of key departments or agencies because their implementation could save large amounts of money; improve congressional or executive branch decision-making on major issues; eliminate mismanagement, fraud, and abuse; or ensure that programs comply with laws and that funds are legally spent, among other benefits. Since 2015, GAO has sent letters to selected agencies to highlight the importance of implementing such recommendations. See GAO, *Priority Open Recommendations: Environmental Protection Agency,* GAO-22-105600 (Washington, D.C.: July 1, 2022).

and roles, assessing risks to success, identifying the resources needed to achieve goals, and measuring and evaluating progress.

In its comments on our draft November 2020 report, EPA generally agreed with our recommendations and stated that, if fully implemented, they would add value and help sustain the national monitoring program. Since we issued our report, EPA has been working with its state, tribal, and local partners on plans for an asset management framework and an air quality monitoring modernization plan. By continuing to take steps to implement our recommendations to manage and modernize the air quality monitoring system, EPA will better ensure that it can meet additional information needs and help protect public health as future air quality issues emerge.

Chairman Carper, Ranking Member Capito, and Members of the Committee, this completes my prepared statement. I would be pleased to respond to any questions that you may have at this time.

GAO Contacts and Staff Acknowledgments

If you or your staff have any questions about this testimony, please contact J. Alfredo Gómez, Director, Natural Resources and Environment, at 202-512-3841or gomezj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are Anne Hobson (Assistant Director), Kate Shouse (Analyst-in-Charge), Marya Link, Patricia Moye, Tara Congdon, and Adrian Apodaca. Other staff who made key contributions to the report cited in the testimony are identified in the source product.