Testimony of
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Hearing on Greenhouse Gas Measurement Technology
Before the
Committee on Science, Space, and Technology
Subcommittee on Research and Technology and Subcommittee on Environment
U.S. House of Representatives
June 23, 2022

Good morning, Chairwomen Stevens and Sherrill and Ranking members Feenstra and Bice. My name is Dr. Bryan Hubbell. I am the National Program Director for the Air, Climate, and Energy (ACE) Research Program in the U.S. Environmental Protection Agency's Office of Research and Development. I have 24 years of experience at EPA applying, conducting, and leading research on the health and environmental effects of air pollution and climate change. The ACE research program provides scientific and technical information critical to improve air quality, reduce the impacts of air pollutants and greenhouse gases on human health and ecosystems, reduce environmental and health inequities, and respond to impacts of climate change and transformations of the energy and transportation infrastructure. A key element of the ACE program is development and application of methods for measuring air pollutants and greenhouse gases. These include methods for measuring emissions from sources and concentrations of pollutants near sources and in ambient air.

I appreciate the opportunity to talk with you today about the important work EPA's Office of Research and Development is doing to advance greenhouse gas (GHG) measurement.

Overview

Accurately quantifying greenhouse gas emissions is an important part of EPA's work to address climate change and protect people's health. Over the past decades, EPA has developed a suite of tools for measuring, collecting, and estimating source-based GHG emissions that have been continually evaluated, improved, and refined. These tools and assets provide a solid scientific foundation to support ambitious climate change mitigation policies, even while we continue our work with our federal partners and external stakeholders on improving our GHG data.

Greenhouse gas data are used in a variety of ways to help inform decisions that help protect the health of our nation. Accurate and comprehensive, source-based greenhouse gas emissions data provide the foundation of EPA's emission reduction programs and allow EPA and others, including Congress, to evaluate the effectiveness of those programs. Source-based emissions data are used by states and localities to understand their emissions and develop mitigation strategies that are tailored to their particular needs. EPA's Office of Air and Radiation (OAR) uses a large number of source-based emissions measurements and modeling for the development and publication of the U.S. Greenhouse Gas Inventory (GHGI) of emissions by gas and sector, including data from the facility-level Greenhouse Gas Reporting Program. The GHG Inventory adheres to methodological standards agreed by the Intergovernmental Panel on Climate Change (IPCC) and is consistent with inventories submitted by other countries to the United Nations Framework Convention on Climate Change (UNFCCC).

EPA's Office of Research and Development (ORD) works closely with agency partners and others to design and conduct research to improve greenhouse gas measurement technology. While ORD does not make policy decisions, we work hard to ensure that EPA program offices, other federal agencies, states, tribes, and communities have the highest possible data quality so that they can make well-informed decisions with confidence.

ORD Research on GHG Emissions Measurement

ORD scientists continue to conduct research to improve measurement methods and data for greenhouse gas emissions from several sources and sinks. Our research is currently focused on ground-based measurements of methane and other non-CO2 gases. This work is critical to informing both national and international greenhouse gas inventories, and it supports regulatory and voluntary emissions reductions programs.

Our work in this area includes:

- Exploring ways to more accurately quantify methane emissions from oil and gas operations. This work uses optical gas imaging methods to identify sources combined with conventional sample collection to estimate emission quantities.
- Improving mobile, ground-based remote sensing technologies to measure methane concentrations at facility fencelines.
- Evaluating methane emissions from municipal solid waste landfills. This includes planned work to evaluate whether drone-based sensors can be used as an alternative to surface monitoring.

These efforts contribute to EPA's broader efforts to close the gap between source-based, bottom-up inventories and top-down emission estimates. These two approaches are complementary and have important roles to play in ensuring that the nation has the most accurate information

possible on GHG emissions. For instance, top-down measurements are indispensable as an independent check and can be used to estimate large anomalous methane leak events from individual facilities (e.g., well blow-outs). And bottom-up, source-specific data can support implementation of many emission mitigation actions. Properly combined, top-down and bottom-up approaches together can provide results which are superior to either approach alone.

In addition to this in-house research on methane emissions measurement, ORD is also developing a Request for Applications (RFA) through our Science to Achieve Results (STAR) program to study methane emissions from landfills. We are planning to award $1M in research grants under this RFA, which we anticipate releasing by the end of the year.

While methane emissions from landfills and oil and gas facilities is a focus, our researchers are also looking at other greenhouse gas emissions sources. For example, our research has significantly improved the understanding of greenhouse gas emissions from temperate freshwater reservoirs, particularly where human influences are causing increased emissions. Freshwater reservoirs, lakes, rivers, and other water bodies can be sources of methane, CO2, and nitrous oxide. Accurate measurements of these emissions are crucial to understanding how much we need to reduce emissions from man-made sources to achieve our national climate mitigation goals. This information can also be used to inform operation of managed aquatic systems, such as reservoirs, to meet multiple needs such as controlling water flows and reducing emissions. Prior measurement methods lacked adequate and representative data, but new techniques developed by ORD researchers have already improved national and international greenhouse gas methodologies and inventories.

And finally, we plan to evaluate how aquatic systems, such as watersheds and wetlands, can remove and store CO2 from the atmosphere. This will include developing a model to evaluate

seasonal and annual carbon sequestration by wetlands in soils and plant biomass and net CO2 and methane emissions in watersheds and wetlands. We also plan to research the role of "blue carbon," which is the carbon stored in coastal and marine ecosystems, and how protecting coastal estuaries can benefit local communities as well as reducing atmospheric CO2.

Interagency Collaboration

Monitoring and measuring all sources and sinks of GHGs requires the combined expertise of multiple federal agencies. EPA partners and coordinates with NOAA, NIST, NASA, DOE, and USDA at multiple levels to ensure we are using the best available data and measurement technologies and practices. This includes engagement through the U.S. Global Change Research Program, the White House Greenhouse Gas Monitoring & Measurement Interagency Working Group, and on other research efforts.

For example, ORD is working with NIST, NOAA, the California Air Resources Board, and other partners to combine airborne, satellite, and ground-based measurements for landfill GHG emissions assessment. This will include identifying high emitters and validating emerging satellite and airborne approaches for different landfill configurations and designs.

ORD is similarly engaging with NASA, NOAA, and DOE to investigate collaborative research approaches for oil and gas production. ORD researchers are also working with USGS on efforts to better characterize methane emissions from reservoirs and other freshwater bodies, leveraging USGS data on waterbody location and extent.

Next Steps

While EPA and other federal agencies have made great strides in greenhouse gas measurement, there are specific gaps in knowledge regarding some sources of non-CO2 emissions. ORD's research, in collaboration with federal partners, will help address these gaps

and to reduce uncertainties. This work includes resolving uncertainties in emission detection and quantification capabilities of various airborne and satellite systems now being used, and it also includes establishing refined measurement and monitoring approaches that capture information about source locations and operational status and activity, which is crucial to inform mitigation efforts and reduce emissions.

Another key research goal for ORD is to identify high emissions locations and events that can account for disproportionate amounts of greenhouse gas emissions. These efforts provide information beyond quantification of emissions to identify approaches to prevent or reduce those emissions. For example, results of one ORD study of methane emissions from oil and gas production pads showed that high emissions could be reduced by changes in operating or maintenance practices.

Additionally, as interest continues to grow in developing nature-based solutions to capturing and storing carbon, ORD will continue to coordinate with federal partners in studying how to measure the carbon stored by natural systems and the benefits they provide to their local communities. This work will include understanding variability in storage across different types of ecosystems, the stability of storage in a changing climate, and how to consistently evaluate greenhouse gas removal and storage.

Conclusion

Greenhouse gas measurement is clearly an active area of research at EPA and other federal agencies. I am proud of the work our researchers have made in improving measurement technology on the ground, in advancing remote sensing measurements, and in understanding how our natural environment can remove carbon from our atmosphere. Even though ORD does not directly make decisions regarding the mitigation of greenhouse gas, we are proud of our work to

help ensure that our EPA program partners, other federal agencies, states, tribes, and communities have the data and information they need to make decisions to protect health and the environment. We look forward to continuing this research and to addressing key research needs in the future.

Thank you again for the opportunity to appear before you today. I am happy to take any questions you may have.

Dr. Bryan Hubbell Bio:

Dr. Bryan Hubbell is the National Program Director for the Air, Climate and Energy Research Program in the US EPA Office of Research and Development, which provides information critical to improve air quality; reduce the impacts of air pollutants on to human health and ecosystems; reduce environmental and health inequities; and respond to impacts of climate change and transformations of the energy and transportation infrastructure. Dr. Hubbell has worked for the EPA for 24 years as an expert on the health and environmental impacts of air pollution. He led the EPA project team that developed the environmental Benefits Mapping and Analysis Program (BenMAP) which is used around the world to estimate the benefits of clean air. Bryan earned a Ph.D. in economics from NC State University. He is an author on over 50 peer-reviewed publications on a wide variety of topics and disciplines and has presented extensively in the U.S. and internationally on health and environmental impacts of air pollution and economic benefits and costs of air quality regulations.