Progress & Challenges in Air Quality Over the Past 20 Years

by Susan S.G. Wierman

In 1995, Susan S.G. Wierman was the deputy director of the Maryland Air and Radiation Management Administration, and since 1997, she has been the executive director of the Mid-Atlantic Regional Air Management Association. She is a long-time member of EM’s Editorial Advisory Committee. E-mail: swierman@marama.org.

To kick off EM’s 20th year as a stand-alone publication, this issue highlights accomplishments in improving air quality over the past 20 years and looks forward toward future challenges. The scope of this month’s articles is necessarily limited: space prohibits a comprehensive view. Topics covered in four featured articles include key court decisions interpreting the U.S. Clean Air Act, a Midwestern view of advances in air quality modeling, examples of collaborative policy development, and a scientific perspective on the future of multipollutant approaches to air quality management. Additional topics are touched on in this introduction, and others will be covered in subsequent issues of EM. Interested readers may find a more comprehensive timeline of actions by the U.S. Environmental Protection Agency (EPA) at http://www2.epa.gov/aboutepa/epa-history.

Accomplishments

Air quality has improved greatly in the last 20 years. EPA recently released the second integrated urban air toxics report to Congress, highlighting substantial reductions in benzene, mercury, lead, and other air toxics achieved since 1999. EPA’s Web site on Air Quality Trends contains a wealth of information about national and regional trends in air pollutant concentrations and emissions. As EPA marked its 25th anniversary in 1995—the year EM was born—the substantial U.S. Clean Air Act Amendments of 1977 and 1990 were well established law. However, as the article by Andrea Bear Field describes (page 10), in the last 20 years many litigants have turned to the courts for clarification. Her interesting article reviews cases related to climate change, interstate air pollution, and new source review.
Both our personal and professional lives have changed in many ways over the last 20 years because of the expanded use of the Internet and increased computing power. EPA’s Web page had only been in existence for one year back in 1995. Air quality modeling has advanced considerably since then, and in his article (page 14) Rob Kaleel describes how this has affected air quality management in the Midwest. Enabled by tremendous increases in computing power and reflecting better understanding of atmospheric chemistry and pollution transport, improved modeling techniques have enhanced the technical foundation for policy development.

By 1995, it was clear that by limiting emissions of sulfur dioxide (SO₂) and oxides of nitrogen (NOₓ), the acid rain cap-and-trade program was providing cost-effective emissions reductions,³ and many believed a cap-and-trade approach could address other air quality problems affecting broad regions. States in the Northeast agreed to implement a NOₓ budget rule to further reduce emissions in two phases (1999 and 2003).⁴ In 2003, EPA began to administer the larger NOₓ Budget Trading Program, requiring 22 states and the District of Columbia to submit State Implementation Plans (SIPs) that reduced emissions of NOₓ in order to reduce the regional transport of ground-level ozone (O₃). EPA added the Clean Air Interstate Rule (CAIR) in 2005, reducing SO₂ emissions more than the acid rain program had done, and superseding but not significantly extending, the NOₓ Budget Trading Program. Ten years later, 2015 will mark the start of the Cross State Air Pollution Rule, replacing CAIR.

Together with stricter standards for motor vehicles and fuels, as well as other initiatives, these programs have achieved significant emissions reductions, and air quality has improved. Satellite data, which are playing an increasing role

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EM has been an asset to me and my clients over the years. The articles have given me current information regarding regulatory and technology changes and both had a significant positive impact on the services that I was able to provide my customers. Whether it was the permitting of a new power plant or the siting of a landfill, EM provided information that was of value. The magazine has also kept me informed regarding activities within the Association and its membership, which helped me stay close to my network of colleagues.

— Jim Powell, QEP, A&WMA Executive Director

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in air quality management, vividly illustrate the reduction in NO\textsubscript{x} pollution in the eastern United States through 2011 (see Figure 1). NO\textsubscript{x} reductions have reduced ground-level O\textsubscript{3} pollution. EPA trends analysis indicates that nationally, O\textsubscript{3} concentrations declined 23% from 1990 to 2013, and annual fine particulate matter (PM\textsubscript{2.5}) concentrations were 34% lower in 2013, compared to 2000.\textsuperscript{2} SO\textsubscript{2} emissions from fossil fuel combustion, along with particulate organic matter from wildfires and wood burning, are major contributors to PM\textsubscript{2.5} and regional haze in rural areas.\textsuperscript{5} Reducing PM\textsubscript{2.5} concentrations has improved visibility and provided significant health benefits.

As multi-state air quality problems received increasing attention, various methods were used to promote collaboration and cooperation among regulators, scientists, and regulated industries. In the third feature article (page 20), Theresa Pella explains that the NO\textsubscript{x} Budget Trading Program built upon the broad-based collaborative work of the Ozone Transport Assessment Group, which focused on the eastern United States. Later, EPA's 1999 nationwide Regional Haze Rule initiated multi-state regional air quality planning and regulatory development work that involved not only states and EPA, but also federal land management agencies, tribal governments, and other

Figure 1. NASA images highlight reduction in NO\textsubscript{x} concentrations in the eastern United States.

Notes: Nitrogen dioxide (NO\textsubscript{x}) pollution has decreased across the United States, as illustrated by annual averages for the years 2005 and 2011. Measurements of NO\textsubscript{x} from the OMI instrument on the Aura satellite depict the concentration of the gas throughout a column of air in the troposphere. The images are color-coded: Blue and green denote lower concentrations and orange and red denote higher concentrations, ranging from 1x10\textsuperscript{15} to 5x10\textsuperscript{15} molecules per square centimeter, respectively.

stakeholders. Pella focuses on efforts to increase transparency and outreach in developing U.S. air quality policy. Her experience in working on O₃ transport and regional haze issues leads her to see the positive results of inclusive processes.

Future Challenges

Understanding and resolving future air pollution problems will often require multi-state, international, or multipollutant approaches, as well as the ongoing program evaluation. Dr. Chris Frey’s thought-provoking article (page 24) explores why it has been so difficult to take a multipollutant approach to reduce overall net risk. Particulate matter, regional haze, air toxics, ozone—each of these issues requires understanding multiple sources and the interactions of multiple pollutants, and all of these issues have sources and effects in common. Dr. Frey explains that the greatest challenge to a comprehensive look at the entire process—from emissions to health effects—may be the lack of robust multipollutant exposure-response models.

Emergency response and enhanced monitoring technology also pose challenges. One can’t look back on the past 20 years without remembering September 11, 2001, hurricane Katrina, superstorm Sandy, and the multiple wildfires that destroyed tens of millions of acres of western forests and communities. Short-term exposure to extreme air pollution can lead to long-term health effects, adding to the toll of immediate deaths from such catastrophic events. The book Dust, by Dr. Paul Lioy of the Rutgers University Robert Wood Johnson Medical School, is a thought-provoking article (page 24) explores the positive results of inclusive processes.

It is important to measure the right pollutants and understand the consequences. Dr. Lioy calls for “…a serious review of the types and number of monitoring and sampling tools that are available for disasters, and how to select those that can and cannot provide valuable information in a specific situation to prevent further exposures….”

The future development of real-time personal air quality monitors holds promise for needed special purpose monitoring—if these instruments allow measurement of contaminants not normally measured and allow quantification of unusually high levels of traditional pollutants. Both new technology and guidelines for data analysis and response are needed.

It goes without saying that climate change and reducing emissions of greenhouse gasses pose many health and environmental challenges. Furthermore, despite great progress in air quality improvement, EPA calculates that in 2013 approximately 75 million people in the United States still lived in counties with pollution levels above national health-based air quality standards.²

Important work remains to protect public health and the environment. em

References