

## **46th Annual A&WMA Critical Review**

### **Emissions from oil and gas operations in the United States and their air quality implications**

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The energy supply infrastructure in the United States has been changing dramatically over the past decade. Increased production of oil and natural gas, particularly from shale resources using horizontal drilling and hydraulic fracturing, made the United States the world's largest producer of oil in 2014. The U.S. Energy Information Administration has projected that increased domestic production of oil and gas will persist for decades and that the United States may become a net energy exporter over the next two decades. While the availability of abundant, lower cost, and domestically sourced oil and natural gas has had significant economic benefits, the environmental impacts associated with “fracking” for oil and gas have made it controversial.

The production and utilization of oil and gas from shale resources has multiple environmental impacts, including impacts on land, water, and air. The 46th Annual A&WMA Critical Review will focus on the air quality implications of the production and use of oil and gas from shale formations. Three types of air pollutants will be considered: greenhouse gases, air toxics, and photochemical air pollutants and their precursors. The Review will examine the changes in the magnitude and spatial distribution of emissions from oil and gas production activities, as well as changes in the magnitude and spatial distribution of emissions from sectors that are the largest users of the shale oil and gas. For users of shale oil and gas, the primary focus will be on large industrial sectors that are being transformed most dramatically, specifically electricity generation and chemical manufacturing.

As emissions from the oil and gas production and use have been changing, so have the tools available for measuring emissions. New, highly sensitive, high time resolution instruments have been developed and deployed in the past several years, providing new insights into the emissions from oil and gas production, processing and transmission, and use. Findings from these studies will be reviewed, and new insights will be described. One significant finding is that many source categories in oil and gas production, processing and transmission include “super-emitters”. This phenomenon, and the challenges it presents, are analogous to the well-known problem of estimating and controlling emissions from motor vehicles. It has been well known for decades that roughly 10% of the vehicle fleet contributes roughly 50% of on-road emissions; emissions from some parts of the oil and gas sector also have these types of high emitting sources, with significant implications for the design of emission control strategies. Another significant finding is the intermittency of many large sources in the oil and gas sector. Again, the phenomenon will be described along with implications for control strategies.

Finally, regional air quality implications of some of the changes in emission magnitudes and spatial distribution will be described. A particular focus will be on photochemical air pollutants, especially ozone.

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Dr. David Allen is the Gertz Regents Professor of Chemical Engineering and the Director of the Center for Energy and Environmental Resources at the University of Texas at Austin. He is the author of seven books and over 200 papers, primarily in the areas of urban air quality, the engineering of sustainable systems, and the development of materials for environmental and engineering education. Dr. Allen has been a lead investigator for multiple air quality measurement studies, which have had a substantial impact on the direction of air quality policies. He has developed environmental educational materials for engineering curricula and for the University's core curriculum, as well as engineering education materials for high school students. The quality of his work has been recognized with awards from the National Science Foundation, the AT&T Foundation, the American Institute of Chemical Engineers, the Association of Environmental Engineering and Science Professors, and the State of Texas. He has served on a variety of governmental advisory panels and from 2012 to 2015 chaired the U.S. Environmental Protection Agency's Science Advisory Board. He has won teaching awards at the University of Texas and the University of California, Los Angeles, and the Lewis Award in Chemical Engineering Education from the American Institute of Chemical Engineers.

Dr. Allen received his B.S. degree in Chemical Engineering, with distinction, from Cornell University in 1979. His M.S. and Ph.D. degrees in Chemical Engineering were awarded by the California Institute of Technology in 1981 and 1983, respectively. He has held visiting faculty appointments at the California Institute of Technology, the University of California, Santa Barbara, and the U.S. Department of Energy.

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**Emissions from oil and gas operations in the United States and their air quality implications**

**Presented by David T. Allen**

**Tuesday, June 21, 2016**

**New Orleans Convention Center**

**9:00 – 11:45 a.m.**

Following the review presentation, a panel of invited experts will critique the presentation and the author's conclusions, and will offer their views on the topic. Comments also will be solicited from the floor and from written submissions to the Critical Review Committee Chair. The Chair will then synthesize these points into a Discussion Paper that will be published in the November 2016 issue of *Journal of the Air & Waste Management Association (JA&WMA)*. The full-length review will be published in the June 2016 issue of *JA&WMA*.