

Air emissions data show safety of US Northeast shale work

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Air emissions data from actual monitoring and testing contradict articles based on different methods claiming to have found health hazards related to oil and gas work. Data collected by objective parties in the northeastern US over the past 6 years indicate that air quality around oil and gas operations is, in fact, safe. This observation contrasts starkly with arguments made in a variety of published

Abbreviation key

ATSDR—Agency for Toxic Substances and Disease Registry (US Department of Health and Human Services)
 ACHD—Allegheny County Health Department
 DOE—US Department of Energy
 EPA—US Environmental Protection Agency
 NAAQS—National ambient air quality standard
 NETL—National Energy Technology Laboratory
 NO₂—Nitrogen dioxide
 OEPA—Ohio Environmental Protection Agency
 PADEP—Pennsylvania Department of Environmental Protection
 PAH—Polycyclic aromatic hydrocarbon
 PM_{2.5}—Fine particulates (less than 2.5 µm)
 VOC—Volatile organic compound
 WVDEP—West Virginia Department of Environmental Protection

TESTS SHOWING POLLUTION BELOW HEALTH-CONCERN THRESHOLDS

Table 1

PM_{2.5}

- PADEP continuous monitoring in areas of dense gas development activities in Bradford, Greene, and Tioga counties, Pa.
- EPA sampling and associated ATSDR study near a Washington County, Pa., compressor station.
- Sampling commissioned by WVDEP near well pad construction, vertical and horizontal drilling, hydraulic fracturing, and flowback and completion activities in West Virginia.
- DOE mobile air monitoring at a Greene County, Pa., well pad before and during hydraulic fracturing.
- DOE mobile air monitoring at Allegheny National Forest 1-2 km from oil and gas activities.
- OEPA mobile air monitoring near a well pad during hydraulic fracturing operations in Muskingum County, Ohio.
- OEPA continuous air monitoring from monitors in Jefferson County, Ohio, downwind from dense gas development areas.

NO_x

- PADEP short-term ambient air sampling at gas development sites in northcentral, northeast, and southwestern Pennsylvania, which included six compressor stations, six wellsites (two with completed wells, one with active hydraulic fracturing, one during flowback, one being flared, and one active wastewater impoundment), and one condensate tank farm.
- ACHD monitoring at the Deer Lakes gas development site during a baseline period and during well-pad construction, drilling, hydraulic fracturing, and production.
- PADEP continuous monitoring in areas of dense gas development activities in Washington, Bradford, and Tioga counties, Pa.
- Sampling commissioned by WVDEP near well-pad construction, vertical and horizontal drilling, hydraulic fracturing, and flowback and completion activities in West Virginia.
- DOE mobile air monitoring at a Greene County, Pa., well pad before and during hydraulic fracturing.
- DOE mobile air monitoring at Allegheny National Forest 1-2 km from oil and gas activities.

VOCs

- PADEP monitoring in Houston (Washington County), Mehoopany (Wyoming County), and Springville (Susquehanna County), Pa., all areas of dense gas development.
- ACHD monitoring at Deer Lakes and Imperial Pointe gas development sites during a baseline period and during well-pad construction, drilling, hydraulic fracturing, and production.
- PADEP short-term ambient air sampling at gas development sites in northcentral, northeast, and southwest Pennsylvania, which included six compressor stations, six well sites (two with completed wells, one with active hydraulic fracturing, one during flowback, one being flared, and one active wastewater impoundment), and one condensate tank farm.
- EPA sampling and associated ATSDR study near a Washington County, Pa., compressor station.
- Sampling commissioned by WVDEP near well-pad construction, vertical and horizontal drilling, hydraulic fracturing and flowback and completion activities in West Virginia.
- Sampling commissioned by EPA of school property in West Virginia before activity on a nearby well pad and during hydraulic fracturing.
- DOE mobile air monitoring at a Greene County, Pa., well pad before and during hydraulic fracturing.
- DOE mobile air monitoring at Allegheny National Forest 1-2 km from oil and gas activities.
- Sampling at a school 2,800 ft from a well pad and at a residence 2,500 ft downwind of a well pad during a baseline period and during hydraulic fracturing, flaring, and an inactive period following flaring.
- Sampling 1,800-2,900 ft downwind of production well pads, a well pad with a drilling rig, a well completion operation, and several compressor stations in northeast and southwestern Pennsylvania.
- Sampling in an urban Pittsburgh corridor and in a gas development area of southwestern Pennsylvania.
- OEPA canister sampling near an operating hydraulic fracturing well pad in Muskingum County, Ohio.
- OEPA average canister sampling data in Jefferson County, Ohio, downwind from dense gas development areas.

DATA SOURCES, REPORTS, AND STUDIES

AIR MONITORING BY REGULATORY AGENCIES

- PADEP Continuous PM_{2.5}, NO₂, and Ozone Monitoring Data.
- PADEP VOC Monitoring Data.
- ACHD Deer Lakes and Imperial Pointe Monitoring Data.
- PADEP Short-term Ambient Air Sampling Studies: “Northcentral Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report,” May 6, 2011; Northeastern Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report, Jan. 12, 2011; Southwestern Pennsylvania Marcellus Shale Short-Term Ambient Air Sampling Report, Nov. 1, 2010.
- EPA/ATSDR Studies of Air Quality Nearby to the Brighig Compressor Station in Washington County; EPA Region III Natural Gas Ambient Air Monitoring Initiative in Southwestern Pennsylvania, August 2015.
- OEPA Preliminary Hydraulic Fracturing Assessment in Muskingum County; OEPA: Hydraulic Fracturing Well Preliminary Air Monitoring Assessment Muskingum County, February 2014.
- OEPA Continuous Monitoring Data and VOC Canister Sampling Data; OEPA: Ohio Air Quality 2012, October 2013; OEPA: Ohio Air Quality 2013, October 2014; OEPA: Ohio Air Quality 2014, October 2015.

STUDIES COMMISSIONED BY AGENCIES, PERFORMED BY THIRD PARTIES

- West Virginia University Air, Noise, and Light Monitoring Study: McCawley, M., “Air, Noise, and Light Monitoring Results for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations” (ETD-10 Project), prepared for WVDEP, May 3, 2013. Pekney, N.; Reeder, M.; Veloski, G.; Diehl, J.R.; “Data Report for Monitoring Six West Virginia Marcellus Shale Development Sites Using NETL’s Mobile Air Monitoring Laboratory” (NETL-TRS-4-2016; EPA Technical Report Series; DOE NETL, Pittsburgh, Pa., 2016, p. 100.
- Techlaw Study of Skyview Elementary School: “Techlaw, Trip Report Air Sampling Event, Skyview Elementary School Site, Morgantown, Monongalia County, WV”; prepared for Raj Sharma, US EPA Region III, Jan. 17, 2012; Skyview Elementary Update, Feb. 15, 2012.
- DOE NETL Mobile Air Monitoring Studies in Greene County: Pekney, N.; Veloski, F.; Reeder, M.; Tamilia, J.; Diehl, J.R.; Hammack, R.W.; “Measurement of Air Quality Impacts During Hydraulic Fracturing on a Marcellus Shale Well Pad in Greene County, Pa.”; American Association of Petroleum Geologists, 2014.
- DOE NETL Mobile Air Monitoring at Allegheny National Forest; Pekney, N.J.; Veloski, G.; Reeder, M.; Tamilia, J.; Rupp, E.; Wetzel, A.; “Measurement of Atmospheric Pollutants Associated with Oil and Natural Gas Exploration and Production Activity in Pennsylvania’s Allegheny National Forest[VS1]”; J. Air Waste Manag. Assoc., Vol. 64, No. 9, 2014, pp. 1062-1072.

PUBLISHED STUDIES

- Maskrey, J.R.; Insley, A.L.; Hynds, E.S.; Panko, J.M.; “Air Monitoring of Volatile Organic Compounds at Relevant Receptors during Hydraulic Fracturing Operations in Washington County, Pennsylvania”; Environ. Monit. Assess., Vol. 188, No. 410, 2016.
- Goetz, J.F.; Floerchinger, C.; Fortner, E.C.; Wormhoudt, J.; Massoli, P.; Knighton, W.V.; Herndon, S.C.; Kolb, C.E.; Knipping, E.; Shaw, S.L.; DeCarlo, P.F.; “Atmospheric Emission Characterization of Marcellus Shale Natural Gas Development Sites”; Environ. Sci. Tech., Vol. 49, No. 11, 2015, pp. 7012-7020.
- Swarthout, R.F.; Russo, R.S.; Zhou, Y.; Miller, B.M.; Mitchell, B.; Horsman, E.; Lipsky, E.; McCabe, D.C.; Baum, E.; Sive, B.C.; “Impact of Marcellus Shale Natural Gas Development in Southwest Pennsylvania on Volatile Organic Compound and Regional Air Quality”; Environ. Sci. Technol., Vol. 49, No. 5, 2015, pp. 3175-3184.
- Paulik, L.B.; Donald, C.E.; Smith, B.W.; Tidwell, L.G.; Hobbie, K.A.; Kincl, L.; Haynes, E.N.; Anderson, K.A.; “Emissions of Polycyclic Aromatic Hydrocarbons from Natural Gas Extraction into Air”; Environ. Sci. Tech. Vol. 50, No. 14, 2016, pp. 7921-7929.

studies cited by opponents of domestic shale development.

A casual review of studies not based on actual data would lead many readers to assume that emissions haven’t been tested and that a health threat looms. In fact, much testing information exists, but most of it has been compiled by regulatory agencies with few incentives to publish the results and promote them to the media.

Actual air emissions data have been collected in 15 air-monitoring and testing studies by objective third parties. The parties, in some cases working jointly, include the Allegheny County Health Department, Pennsylvania Department of Environmental Protection, Ohio Environmental Protection Agency, US Environmental Protection Agency, US Department of Health and Human Services Agency for Toxic Substances and Disease Registry, Techlaw, West Virginia University for the West Virginia Department of Environmental Protection, and US Department of Energy National Energy Technology Laboratory (Table 1 and abbreviation key). In addition, measurements of air quality have been documented in studies by research groups led by J.R. Maskrey, J.F. Goetz, R.F. Swarthout, and L.B. Paulick (Table 2).

What tests show

These tests and studies measure concentrations of fine particulate matter, nitrogen dioxide, volatile organic compounds, polycyclic aromatic hydrocarbons, and ozone. None of the assessments reveals concentrations

constituting health concerns.

PAH data have been collected, without concentrations indicating health concerns, via sampling at 23 properties in Carroll County, Ohio, within 210-16,900 ft of an active gas-well pad.

Continuous ozone monitoring in counties of Pennsylvania with extensive gas development (Washington, Bradford, and Greene) reveals no increases—and, in most instances, decreases—in ground-level ozone as gas development has expanded and no exceedances of the ozone national ambient air quality standard. Continuous ozone monitoring data in Jefferson County, Ohio, near and downwind from areas of dense gas development, show no exceedances of the ozone NAAQS and no historical increases in ground-level concentrations.

Fundamental difference

Agency-led studies differ fundamentally from the many that claim adverse health effects: The agency-led studies include actual air emissions monitoring and testing. The others include one or more of the following approaches:

- Literature reviews. A number of authors have published articles consisting of reviews of other published articles from which they draw conclusions.

Among articles of this type is the review of chemicals, which lists chemicals that may in some way be used in unconventional natural gas development, followed by a list of the potential health effects of these chemicals with

no exposure analysis. The authors do not evaluate actual emissions or exposure data for any of these chemicals.

Another type of literature review summarizes articles discussing health effects. Many literature reviews discuss the potential for overall, rather than specific, health effects.

- Surveys of self-reported symptoms. Many articles claiming adverse health effects from gas development report on surveys of subjective health symptoms among community members living in the area of gas development. Survey participants often are self-selected, and the studies rely on these reports without medical verification. The reported health complaints are subjective and consist of very common symptoms (e.g., headaches, stress, nausea, rashes, sinus problems), all of which have many causes. None of these studies conducts an appropriate statistical analysis of health effects based on exposure.

- Studies based on exposure assumptions. Studies that have looked at the incidence of certain health conditions based on proximity to well pads (exposure surrogates) rather than on actual exposures have significant limitations. They are at best hypotheses-generating studies, which are not supported by the actual air data.

Overall safety

Additional monitoring and testing may be warranted for specific purposes, but data collected to date establish that air quality near shale operations in the northeastern US meets safety standards. The evidence from 6 years of data collection is overwhelming.

This conclusion should be welcome news to the region's residents, public officials, and the many Americans who benefit from affordable energy supplied by a region of rapid production growth. **OGJ**

The authors

Kathy Condo is a shareholder in the Litigation Services Group of law firm Babst Calland, handling toxic tort and products liability litigation in various federal and state courts, often with numerous technical and medical expert witnesses. She has become involved in counseling clients in threatened toxic tort litigation related to Marcellus Shale development and defending these cases when filed. A graduate of Pennsylvania State University, Condo holds a J.D. from Duquesne University School of Law. She is admitted to practice in Pennsylvania and West Virginia and is a member of the Allegheny County Bar Association.



Kathryn Klaber leads The Klaber Group, a consultancy providing strategic services to businesses and other institutions involved in shale development in the US and elsewhere. Her career includes 10 years in environmental consulting and 7 years with a chief executive-led economic development, policy, and advocacy organization. She is the founding chief executive officer of the Marcellus Shale Coalition. Klaber earned her undergraduate degree in environmental science from Bucknell University and her master's degree in business administration from Carnegie Mellon University, where she received the Enterprise Award for Entrepreneurship.

