



the **ENERGY** lab

R&D FACTS

Oil & Natural Gas Development

Research on Local and Regional Air Quality Impacts of Oil and Natural Gas Development

Goal

The NETL research effort in improving the assessment of impacts to air quality from oil and gas exploration and production activities has the following goals: (1) using NETL's mobile air monitoring laboratory, conduct targeted on-site measurements of emissions from oil and gas production activities that may impact the environment and (2) use collected data in atmospheric chemistry and transport models to further understanding of local and regional air quality impacts.

Background

The development of shale gas and shale oil resources requires horizontal drilling and multi-stage hydraulic fracturing, two processes that have been known for many years but have only recently become common practice. In addition, fugitive atmospheric emissions can result from a variety of other operational elements (e.g., volatiles that escape from the wellhead during the drilling and production operations, large stationary power generators, increased truck traffic, water separation tanks, holding ponds, etc.); these emissions can negatively impact air quality. The environmental risks of shale gas and shale oil development may be very different from that of conventional oil and gas development and these risks are not completely known at present. Current estimates of the impact of oil and gas exploration and production activities on regional air quality based on air quality models must be updated to incorporate both results from on-site emissions monitoring and emission inventory data that accurately reflect industry operations. By providing a complete understanding of the impacts of oil and gas development on regional air quality, NETL can ensure that oil and gas development proceeds at a rate that protects the environment while ensuring an adequate domestic supply.

Accomplishments

Air Monitoring Station:

- A government-owned trailer has been modified to serve as an autonomous air emissions monitoring laboratory. The temperature controlled laboratory space houses 10 monitoring instruments, each capable of transmitting collected data back onsite to the NETL site via satellite. Instrumentation is as follows:

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PARTNERS

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- Picarro G2112-i CRDS analyzer to measure Methane , Carbon Dioxide, and Carbon Isotopes in Methane and Carbon Dioxide
- Thermo Fisher Tapered Element Oscillating Microbalance (TEOM) to measure PM₁₀ and PM_{2.5}
- Perkin Elmer Ozone Precursor Analyzer (a GC-FID with sample introduction via thermal desorption) to measure VOC's
- Teledyne-Air Pollution Instruments gaseous monitors for NO_x, O₃, and SO₂
- Picarro G1103 Ammonia Analyzer
- Sunset Laboratories Organic and Elemental Carbon Aerosol Field Analyzer to measure OC and EC
- A Pylon Trace Level Radon Gas Detector
- A Davis Instruments meteorological station to measure temperature, humidity, wind speed, wind direction, and other meteorological variables.

The mobile air monitoring laboratory collected pollutant concentrations during a year-long monitoring campaign in the Allegheny National Forest, a historically productive area for oil and gas wells that has seen the number of wells increase significantly in the past few years. Following the Allegheny National Forest air monitoring campaign, the station has been deployed in Washington and Greene counties in Pennsylvania and Marion, Brooke, and Wetzel counties in West Virginia to measure air quality impacts from development of the Marcellus Shale Formation.

University Collaborators:

- Researchers at West Virginia University have developed a wireless monitoring network that is capable of transmitting data from multiple monitors over long distances. Testing of range and collection of data continues.
- Researchers at Carnegie Mellon University have conducted smog chamber experiments to evaluate photochemical oxidation and secondary aerosol production from emissions typical of diesel exhaust.

Air Quality and Life Cycle Assessment Modeling:

- Data collected from the air monitoring station and findings from supporting studies described above will be used as input to atmospheric chemistry models such as the EPA-approved CMAQ or CAMx as well as life cycle assessment models that evaluate the greenhouse gas emissions from shale gas operations.

