



## **NOISE, LIGHT, DUST, AND VOLATILE ORGANIC COMPOUNDS GENERATED BY THE DRILLING OF HORIZONTAL WELLS RELATED TO THE WELL LOCATION RESTRICTION REGARDING OCCUPIED DWELLING STRUCTURES**

By the West Virginia Department of Environmental Protection  
Office of Oil and Gas  
Pursuant to W.Va. Code §22-6A-12(e)  
**May 28, 2013**

### **INTRODUCTION**

As directed by the Natural Gas Horizontal Well Control Act (the Act) enacted by the West Virginia Legislature on December 14, 2011, the following fulfills the requirement of W. Va. Code §22-6A-12(e) that the West Virginia Department of Environmental Protection's (DEP) Office of Oil and Gas (OOG) report on noise, light, dust, and volatile organic compounds generated by the drilling of horizontal wells as they relate to the well location restrictions of the Act [W. Va. Code §22-6A-12(a)] regarding occupied dwelling structures. The sampling, data analysis, and literature review comprising the study supporting this report were performed by faculty and students of West Virginia University's (WVU) School of Public Health and under the administration of WVU's West Virginia Water Research Institute (WRI).

### **BACKGROUND**

The Act established that the center of a well pad may not be located within six hundred twenty-five (625) feet of an occupied dwelling structure, unless waived in writing by the surface owner, or upon issuance of a protective variance by the secretary. *See* W. Va. Code §22-6A-12(a). The legislative mandate directed OOG to determine whether the well location restriction was adequate or otherwise required alteration based on the noise, light, dust, and volatile organic compounds related to drilling horizontal wells.

The study covered five stages of well pad development: Site clearing and preparation; vertical drilling; horizontal drilling; hydraulic fracturing; and flowback and completion. These activities are all temporary, ending when a well is producing natural gas. Ambient air measurements of at least six days duration were obtained at seven well pads in West Virginia and collected during the development stages. The seven well pads were located in Brooke, Marion, and Wetzel Counties and included three different companies. Field monitoring took place from July 2012 to October 2012, and approximately 46 days of measurements of noise, light, dust, and volatile organic compounds, as well as other air pollutants, were obtained. In addition, the

Department of Energy's (DOE) National Energy Technology Laboratory operated a mobile air monitoring trailer, equipped with a suite of continuous monitors, at six of the seven sites.

During the ambient air monitoring conducted around each well pad, an on-pad sample of water or waste streams was also obtained. WVU's School of Public Health conducted the air sampling, while WRI conducted the water and waste stream sampling. The water sampling results were submitted to the Legislature as part of the agency's response to the impoundment and pit safety study required pursuant to W. Va. Code §22-6A-23.

West Virginia has a number of unique terrain features, which presented challenges in siting air monitoring equipment, as well as an opportunity to gather data across a variety of conditions. The range of terrain features encountered in the field at each well pad led to a robust data set. Siting scenarios included those with residences located approximately 250 feet to 1,250 feet from the well pad center; remote pads in a wildlife management area; pads abutted into hillsides; pads sited atop ridgelines; and a site located in a hollow with channeled air flow. Even with the quality control measures that were in place, not all of the air monitoring equipment operated at every site for the complete duration of the monitoring, due to weather-related events, equipment malfunction and maintenance, and miscommunication with well pad operators.

WVU operated a solar-powered wireless air monitoring system (WAMS), which enabled the continuous collection and recording of noise, light, dust, and hydrocarbon data except during sample equipment downtime. In addition, WVU collected 72-hour volatile organic compounds samples for laboratory analysis. WVU co-located at least one WAMS and volatile organic compounds sampling device with the DOE trailer in order to cross-check results. The environmentally-controlled DOE trailer used sampling methods more in line with national regulatory sampling requirements, while the WAMS used portable instrumentation that tended to show broad potential issues. Multiple WAMS were deployed around each well pad to the extent allowed by the terrain, allowing for more complete ambient air monitoring around each pad. The DOE trailer siting was limited by the availability of electrical power.

The agency wishes to recognize and acknowledge the private citizens who allowed not only DEP personnel, but also the researchers from WVU and DOE, access to their property in order to site air monitoring equipment to record ambient air samples off-pad. Private residents also provided electricity to the DOE trailer at two pads, and the well operator provided electricity from a diesel-fueled generator at the remaining pads.

## **CONCLUSIONS**

While a comprehensive air monitoring assessment of noise, light, dust and volatile organic compounds emitted during well pad development in West Virginia was conducted as part of this study, it is important to note that not all operational, terrain, and meteorological conditions can be captured by short-term air monitoring alone, due to the wide variety of site specific conditions that may exist. Measureable noise, light, dust, and volatile organic compounds levels were recorded with some, but not all, of the monitoring devices. In some cases, ambient levels were below the detection capabilities of the equipment.

## **Noise, Light, and Radiation**

WVU obtained one-minute and one-hour noise measurements at the WAMS locations around well pads. The results of WVU's noise assessment indicated average levels were below the United States Environmental Protection Agency's (EPA) guideline of 70 decibels (dB). The EPA 70 dB threshold over a 24-hour period is a guideline over which hearing loss may occur if exposure at this level occurred for a lifetime.

EPA also has noise guidelines regarding annual average daily exposure levels over forty years of 55 dB to prevent outdoor activity from interfering with the ability to hear and causing annoyance, and 45 dB to prevent indoor activity interference and annoyance. In some instances, one-hour noise levels near well pads, based on approximately six days of averaged data, were above these guidelines, indicating the potential for interference if experienced for forty years. Sound barriers were not used at the sites monitored during this study. As recognized by EPA, sound levels inside stores, offices, and residences with normal conversation or television listening normally fall within the 40-65 dB range also. Due to the transient nature and/or frequency of sound, the agency recognizes that noises may be perceived as a nuisance, even though measurements indicate no harm.

Some of WVU's recommendations to minimize noise are useful practices that OOG shared in a workshop with the regulated community. OOG already works with individual operators and companies on a case-by-case basis to facilitate discussion and resolve citizen complaints. Inspectors will continue to work with operators to deploy sound mitigation measures, such as sound barriers, based on site specific circumstances.

WVU's assessment of the light data from the WAMS and DOE equipment indicate there was no impact on nighttime illumination from well pad activities. The noise and light results were consistent across various distances from the well pad. Ionizing radiation levels measured from filtered airborne dust were near zero. WVU states on page 24, "Radiation levels for alpha and beta sources were well below established background levels in air."

## **Dust and Volatile Organic Compounds**

EPA established National Ambient Air Quality Standards (NAAQS) for certain pollutants, including particulate matter and ozone (of which volatile organic compounds and oxides of nitrogen are precursors) in order to protect human health and welfare from the cumulative impact from all sources of air pollution in a given geographic area. Although there is no one-hour PM<sub>2.5</sub> (particulate matter less than 2.5 microns in diameter) NAAQS, WVU found that some one-hour PM<sub>2.5</sub> dust results were above the annual NAAQS, but that all results were below the 24-hour PM<sub>2.5</sub> NAAQS. This would not be uncommon since, by definition, long-term averages incorporate short-term values that are higher.

There were three methods used to sample volatile organic compounds at each drilling location. The portable WAMS sampler provided a total hydrocarbon value, and the other methods provided clearly defined compound data. At some pads, elevated benzene levels, above the benchmark Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Level used by WVU, were observed, although not consistently. ATSDR is a federal public

health agency for the United States Department of Health and Human Services. WVU recognizes on page 20, “Lifetime exposures cannot be estimated from a small number of short-term measurements.” It should be emphasized that this study characterized the nature of activities, emissions, and exposures that will not be present continuously over a long period of time.

Even in remote locations across the country, as well as in West Virginia, background ambient air is not free of pollutants, including dust and volatile organic compounds. That is, the mere presence and detection of air pollutants in ambient air is not precluded by federal and state rules. Based on WVU’s study data, vehicle traffic and engine exhaust are the likely sources of the intermittently high dust and benzene observations. While there are no indications of immediate danger to public health based on data obtained from this study, vehicle traffic associated with well pad development activities may pose a nuisance. The occupied dwelling structure setback of 625 feet from well pad center does not address the inconveniences associated with increased vehicle traffic such as congestion, vehicle idling emissions, and potential road dust and noise.

WVU recommended on page 21 that “Better use [of] roadway wetting agents would reduce many of the peak dust exposures seen from roadside samples that were taken over the course of the survey.” Such common sense measures as use of DEP-approved dust suppressants and lower vehicle travel speeds have already been used at various sites to mitigate dust and will continue to be used on an as-needed basis. WVU also recommended on page 21, “Greater spacing of diesel-container trucks, while waiting in line for HF [hydraulic fracturing], could reduce the local concentration of diesel exhaust and may reduce noise as well.” As a more practical alternative to spacing requirements, the Diesel-Powered Motor Vehicle Idling Act (W. Va. Code §17C-13A) applies on both private and public property, including staging areas. This statute limits regulated entities to no more than 15 minutes of idling per one-hour period; however, a number of exceptions, including for public safety and manufacturing processes, are contained in the statute. The Diesel-Powered Motor Vehicle Idling Act is enforceable by a law enforcement officer such as local police, county sheriffs, and state police, but does not include DEP inspectors.

For ambient air pollution levels to meet the NAAQS, a broad spectrum of sources of air pollution is regulated by state and federal standards and rules, including the oil and gas sector. The existing federal and state regulatory structure implemented by the DAQ includes rules and policy, as well as permitting and enforcement authority, to prevent and minimize air pollution from a wide range of stationary sources, including oil and gas production and transmission activities. While DEP continues to review its regulatory approach and the authorities of its oil and gas and air quality programs for further improvement, implementation of current standards and practices remain in effect.

There are a number of ambient air studies underway by federal and state agencies that, when completed, will provide additional data on emissions from the oil and gas sector. Further, a new federal regulation affecting air emissions from wellhead operations went into effect in October 2012. While focusing on production activities, the rule requires that well completion operations at hydraulically-fractured wells drilled on or after January 1, 2015 safely maximize

resource recovery and minimize releases to the atmosphere during flowback and subsequent recovery.

The results of this WVU study will be used to inform the air quality report due to this body by July 1, 2013. *See* W. Va. Code §22-6A-22.

### **Location Restriction Recommendation**

While there were no indications of a public health emergency or threat based on the data obtained from this study, WVU recognized, “There is no good reason to believe that using the center of the P[p]ad as the reference point from which the setback is taken will assure that activity associated with some possible sources of the studied contaminants will not occur closer than 625 feet from the actual source.” (p. 19) Also noted by WVU, “There does not appear to be a simple solution to specifying a setback distance. There is no single geometry to which all drill site activities conform. The activities follow the terrain of the site and the needs of the process.” (p. 188).

WVU conducted a literature review of the manner in which various states address setback provisions regarding unconventional drilling activities. Of the state programs reviewed, well location restrictions ranged from 100 feet to 1,532 feet, and used a variety of reference points for the beginning of the setback (for example, outer edge of pad; distance from designated activity area; distance from buildings, public roads, major aboveground utility lines and railroads; distance from high occupancy building unit zone).

While the statutorily-specified location restriction is defined to be from the center of the well pad, there are a wide variety of pad sizes and configurations that may allow an occupied dwelling to be close to a well pad.<sup>1</sup> Because of the potential for different well pad geometries, DEP recommends that the Legislature reconsider the reference point (i.e., from the center of the well pad) for the location restriction to occupied dwellings to reduce potential exposures. One option to consider would be to establish a location restriction from the Limit of Disturbance (LOD) of the well pad to provide for a more consistent and protective safeguard for residents in affected areas. The outermost sediment control barrier establishes the LOD around the well pad.

### **SUPPORTING INFORMATION**

*Air, Noise, and Light Monitoring Results for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations*, Michael McCawley, PhD, School of Public Health, West Virginia University, May 3, 2013, submitted May 10, 2013.

*Air, Noise, and Light Monitoring Plan for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations (ETD-10 Project)*, Michael McCawley, PhD, School of Public Health, West Virginia University, July 1, 2012.

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<sup>1</sup> Under W. Va. Code §22-6-21, no well shall be drilled nearer than two hundred feet from a dwelling without first obtaining the written consent of the owner of such dwelling.