Ohio Environmental Council
[UNLEASHING THE POWER OF GREEN]
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Via Electronic Mail

TO: James Zehringer, Director, Ohio Department of Natural Resources
Michael Biddison, Ohio Department of Natural Resources
Chief Rick Simmers and Tom Tugend, Division of Oil and Gas Resources Management
FROM: Trent Dougherty, OEC Staff Attorney and Director of Legal Affairs
Jack Shaner, OEC Deputy Director and Sr. Director of Legislative + Public Affairs
DATE: November 28, 2011
SUBJECT: Comments on Draft Well Construction Rules to Implement O.R.C. Sec. 1509.17

Director Zehringer and Division Officials:

Thank you for this opportunity to comment on the Division's draft Oil and Gas Well Construction Rules dated October 28, 2011, amending Ohio Adm. Code Sections 1501:9-1-01 and 1501:9-1-08.

These comments were prepared for the Ohio Environmental Council by following technical experts:

- Julie Weatherington Rice, PhD, Sr. Scientist, Bennett and Williams
- Linda Aller, Principal Geologist, Bennett and Williams
- Nancy Meharry Gogle, Geologist, Bennett and Williams
- Al Kemerer, Mechanical Engineering, retired (Carroll County)
- Ann Christy, PhD, PE, Environmental Engineer, Associate Professor, Department of Food, Agriculture + Biological Engineering, The Ohio State University
- Stu Smith, Geologist and Hydrogeologist,
- Eun Kyoung Kim, PhD, PE, Principal, Ground Water Science and Visiting Scholar, Department of Food, Agriculture + Biological Engineering, The Ohio State University

We will appreciate the opportunity for further dialogue and, hopefully, the opportunity to review a revised set of draft rules. Thank you.

COMMENTS

Our concerns take two forms. The first set of concerns are conceptual, the second set are specific to the language of the draft rules. The draft rules, as currently written, are for one static period of time, the point in time that the well is constructed. The major problem with this approach is that it assumes that the conditions that occur at the point of construction will remain static over time. In fact, that is exactly what will NOT happen. This newly drilled well will have to exist in a dynamic situation where conditions are always changing, for the life of the well as an oil or gas generating well and as potentially a future Class II injection well. While these draft rules discuss construction and testing at the time of installation, they DO NOT call for ongoing testing and maintenance which will be critical if the wells are to function safely over time. It is possible that the issues of ongoing testing and maintenance will be covered in another set of draft rules, but it is also possible that they will not be addressed at all and so, therefore, they should be commented on – and corrected by the Department – here and now.

Conceptual Dynamic Limitations

These oil & gas wells will be constructed in areas of Ohio where there are other ongoing underground mineral extraction activities such as coal and underclay/fire clay mining. In addition, they will be drilled in locations where ground water wells also exist, both public and private. They will be drilled in areas where there are tens of thousands, perhaps hundreds of thousands of un-located and abandoned historic oil & gas wells and perhaps as many old groundwater wells. In addition, many of the records for old underground coal mines have been lost. We continue to stumble upon undocumented abandoned underground mines as we evaluate groundwater resources for public water supplies and review old landfill sites in eastern Ohio. In addition, since the Utica Shale play extends to the western boundaries of Delaware and Franklin Counties, it overlaps the Karst band that runs to the west of the Ohio Shale outcrop in a north to south trend across Ohio: (http://www.dnr.state.oh.us/OhioGeologicalSurvey/tabid/4430/Default.aspx; http://www.dnr.state.oh.us/Portals/10/pdf/karstmap.pdf; http://www.dnr.state.oh.us/geosurvey/pub/dms/dms_eg01/tabid/7235/Default.aspx; http://www.dnr.state.oh.us/Portals/10/pdf/newsletter/1999No.2.pdf) .

Where there is potential for drilling into the Utica Shale and/or other oil & gas deposits to intersect karstic areas, it is absolutely critical that the karst zones be identified and considered as drilling progresses. To ignore the karst area may well result in the failure of the cementing of the casing strings.

The rules discuss a procedure for casing off current or old coal mine workings. This is discussed in section 1501:9-1-08 M(2) – Mine string. There are two serious problems with this section. 1) it does not take into consideration how the driller is supposed to know if/where the current/old workings are under the drilling pad and 2) it does not take into consideration the effects of land subsidence over time on the casing strings and the cementing, especially the outermost cementing. As this section is currently drafted, it can only address ONE (1) mine void under the drilling pad. It has not been uncommon to find two levels of old workings at one site and we know of at least one location where there are three. In addition, not all of the old workings are located above valley grade. The old Tripp mine (Middle Kittanning coal) is beneath the creek valley at the Village of Carrollton's well fields while the Lower Freeport coal was drift mined in the uplands surrounding the well fields. The actual groundwater wells for the Village are located between the two sets of abandoned workings. No mine map exists for the Tripp mine or for the Lower Freeport drift mines. In fact, no one even knew the Tripp mine existed until research by staff from Bennett & Williams Environmental Consultants Inc. found it again as we searched for an explanation of the prolific groundwater resources at the Village of Carrollton's well fields.

It is physically impossible to install packers above and below more than one void and cement both from above and below the packers more than one time. But packers have to be set or the cement used to seal the outermost casing in place will simply flood out into the current/abandoned workings and fail to seal off the outermost casing. Therefore, if there are more than one set of mine workings, this process will require more than one set of nested casings or it will require the outermost casing to span the whole known section of historic/current underground coal mining in the area. If a separate casing is set for each mined out zone, you have to know ahead of time how many there are. The numbers of nested casings that are physically possible to install are dependant on the diameter of the initial drive pipe. So if the initial drive pipe is gauged to allow for one set of mine string casings and there are actually two sets of mined out zones, then it will be impossible to install a second set without compromising the casing arrangements for the other zones of the well.

Several experts have suggested that the problems of identifying undocumented coal mine workings could be solved by drilling a pilot hole to determine how many voids are intersected. Locating a void or loose rubble at the expected level of the coal seam does establish the existence of the current/abandoned mined seam. Not finding a void, unfortunately, does not necessarily mean that there are no current/abandoned workings at that level. It is very possible that since historic coal mines left as much as 40% of the coal in place as pillars to hold up the rooms, the pilot hole could be drilled through a pillar that could not encompass the larger diameter mine sealing case or handle the pressure of the cement grout.

There are two ways this situation could be addressed. Either separate casings should be required for each historically/currently mined coal seam in the area or the mine casing should extend from the top of the uppermost seam to the bottom of the lowest possible seam. If any of the seams are flooded and or have methane gas deposits, leaving the annulus uncemented between coal seams could create an unexpected conduit for groundwater flow or methane gas migration between the seams. This consideration is especially important in areas where underground coal mines are currently active or planned.

The second problem with this mining string of casings is that as the old/current workings subside, the outermost casing cement will crack away from the rock allowing for coal bed methane to migrate up the outside of the outermost casing. James Northrup of Cooperstown, New York has provided extensive testimony on this avenue of groundwater contamination to the State of New York during their hearing process. While the coal bed methane can be fingerprinted as not having come from the fracked shale zone, the creation of the well provided the avenue for the coal bed methane to migrate into groundwater sources. Therefore, the resulting groundwater contamination is caused by the shale gas well, even if it is indirectly.

Specific Sections

1501:9-1-01 General Provisions

(A) Definitions:

It is unclear if these definitions are supposed to be added to the original definitions and/or to replace them.

1501:9-1-08 Well Construction

(A) General:

Other states are more specific. Why not Ohio?

(C) Drilling Fluids:

(3) The surface casing set to protect potable water under the "Underground Source of Drinking Water (USDW)" may well be deeper than underground coal mines or karst limestone voids.

(D) Casing Standards:

How is radioactive scale in used pipes supposed to be addressed before used pipes can be installed? Should the casing used to segregate the USDW zone be relegated to only new casing use? See UP EPA web site: http://www.epa.gov/rpdweboo/tenorm/oilandgas.html.

(H) Wellbore Diameters:

(1) The requirement of "the diameter of each section of the wellbore must be at least one inch greater than the outside diameter of casing collar to be installed" is less demanding than the New York regulation which require from 1 5/8 inch minimum clearance for a 4 ½ inch

pipe to 4 1/8 inch clearance for a 13 3/8 inch pipe. See New York Department of Environmental Conservation web page http://www.dec.ny.gov/energy/1757.html.

(F) Surface Water Infiltration:

(1) What constitutes "liquid-tight"? Are there specific design and materials requirements listed elsewhere and/or on the permits that demonstrate this compliance?

(I) Borehole Conditioning:

(1) Replace "may" with "shall". It makes the statement more forceful and the proposed standard more protective.

(3) Subsurface voids: See our comments above.

(J) Cement Standards

(6) Should assume hydrogen sulfide gas will be present in all shale wells and therefore sulfate resistant cement should be the standard for shale gas and oil wells.

Isn't a cement log always required? If not, why not? Both the cement logs and the cement tickets should be required. It appears that the cement for the Carroll County wells is not being purchased locally so there is no local verification of the volumes of cement being used at the well sites. This is a simple requirement but a critical piece of information to verify the integrity of the cementing efforts.

(M) Casing Strings

(2) Mine string: See comments above.

(3) Conductor Casings:

b. What constitutes a "cement drop"? Is it any visible drop, a 5% drop, a 10% drop, a 50% drop? How does the driller know when to emplace cement from the surface?

(4) Surface Casing:

c. "Surface casing may not be perforated unless intermediate casing is set and cemented to surface, unless authorized by the inspector." If the surface casing is supposed to be protecting the USDW, why would you ever want to perforate it?

g. A minimum surface casing depth below the deepest local stream base is nowhere near deep enough to protect USDW. Well fields are often established below local stream base because the local streams and river recharge the well fields. The alternative of "at least 50 feet below the base of the lowest spring or deepest water well within a 500 foot radius" of the proposed well is also NOT sufficient to protect USDW. If these are the criteria that are being used to protect public and private wells, no wonder they are getting contaminated! At a minimum, the surface casing should be set to the 10,000 milligrams per liter total dissolved solids zone. If it is not clear where that elevation is, the driller should take water samples to determine the correct location.

(5) Alternative surface casing requirements: There should be NO alternatives that require less casing. If this happens, no one should be surprised when groundwater contamination occurs.

(O) Well Construction Records: The well construction records should include a cement bond log and also include the cement tags so there is independent verification that the cementing operation, as reported, actually occurred.

There are no requirements for blow-out protectors. Why not?

Conclusion

This concludes our preliminary review of these Draft Rules. Much more information is needed to determine just how adequate these rules are. There should be documentation that the rules are based on successful rules from states with far more experience than we have in Ohio. Department officials have stated to us several times that the industry is working to a higher set of standards than Ohio currently is requiring. If the industry thinks Ohio's standards are not adequate, why isn't the Department proposing stronger standards that are at least as strong as current industry standards being employed in Ohio? Wouldn't it be more reasonable to simply codify the higher industry standards and then work to upgrade those as well?

The OEC appreciates the importance of effective and protective well construction rules. We cannot stress how important the cementing job can be for a well. It is well recognized that the BP Gulf well blew out because the cementing job was flawed and there was no blow-out protector on the well. When oil & gas wells contaminate fresh ground water sources, often it is faulty well construction, including the cementing process, that provides pathways to the near surface fresh water zones. We strongly believe that the draft rules need significant modification to address these fundamental concerns.

Additional Comments Not Necessarily Related to Well Construction

The OEC recognizes that the draft rules regard well construction, only. Nonetheless, we respectfully ask the Department to address the following issues, as it prepares further rule makings to implement Ohio Senate Bill 165 (128 GA) and otherwise to update and upgrade the oil and gas regulations to address the following important topics. (NOTE: The following list of issues and concerns was not prepared in conjunction or consultation with the technical experts, listed at the beginning of this memo.)

Recycling of waste water (complete water cycle, including chemical mixing, well injection, flowback, and produced waters).

Acquisition of water (no significant harm to any surface water body source; seasonal limits; property rights protection of aquifers; quantity protection for public water supplies).

Groundwater monitoring (pre- and post-drilling water quantity and quality testing).

Surface water monitoring (pre- and post-drilling water quantity and quality testing).

Transparency and public access to amount and composition of fracking fluids, without trade secret confidentiality.

Property owner access notification.

Real-time public access to inspection and enforcement documents.

Placement of seismographs (in coordination with USGS) adequate to identify locations of events and to determine unknown fault lines.

No open wastewater pits; no pipeline stream crossings.

Blowout and other incident immediate reporting requirements.

Local notice and construction requirements for support roads, pipelines, well pads.

Bonding, financial assurance (including single wells, idle wells, road maintenance).

Payments into local road funds, statewide spill fund.

Ensure severance taxes apply to first year of production.

Local community advisory panels.

Individual permits and public notices (no general permits).

Punitive fines in addition to damages as part of enforcement actions (including cumulative per day penalties).

Noise dB limits (peak, and 24 hour).

Specific standards for access roads, pipelines, pads, tanks, closure (O&M).

Wastewater trucking manifests.

Setbacks (residences, streams, nature preserves, parks).

Public disclosure of total "mature build-out".

In addition, we would like to re-submit our memo of November 2, 2011, relating a number of general recommendations and suggestions, copied below:

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TO: Michael Biddison, Acting Chief, ODNR Division of Mineral Resources Management
Tom Tugend, ODNR, Deputy Chief, ODNR Division of Mineral Resources Mgt.
Larry Wickstrom, Chief, ODNR Division of Geological Survey

FROM: Jack Shaner, OEC Deputy Director
Trent Dougherty, OEC Director of Legal Affairs

DATE: November 2, 2011

SUBJECT: General Recommendations and Suggestions for Oil and Gas Regulation + Oversight

Thank you for the opportunity to share perspectives and to suggest some general recommendations and suggestions for stronger regulation and oversight to better protect the people and communities, wildlife, natural resources, and public and private property from possible impact from oil and gas exploration and development. We expect to suggest more specific regulations and policies as ODNR develops administrative rules to implement Senate Bill 165 (128 GA).

We are especially interested to know what actions, including policies, administrative rules, or statutory laws, the ODNR is planning or considering to undertake—as is relevant—in response to the recommendations included in the 2010 STRONGER report and the USDOE Shale Gas Production Subcommittee 90-Day Report (released August 18, 2011), as well as the other recommendations and suggestions, listed below.

Again, we thank you for soliciting our thoughts. We look forward to continued constructive dialogue with the Department on this most important subject.

A. General OEC Concerns

The OEC is interested in strong oversight of all phases of oil and gas development. We are especially interested in the Department's plans for stronger oversight of the following areas:

1. Groundwater protection near drilling sites

The OEC strongly believes that water sampling prior to drilling should be expanded to include testing for water quantity. During discussions about Senate Bill 165 with the previous administration, it was our understanding that DMRM agreed to propose administrative rules to expand the existing requirement for water quality sampling to include water quantity sampling, at water wells located proximate to a proposed oil/gas well. This prospective rule was to be discussed in a stakeholder rulemaking subcommittee to review and revise water replacement regulations, pre-drilling, and post-drilling water well testing, and Best Management Practice (BMP) guidelines. We are most interested in confirming the Department's plans for this.

2. Groundwater protection near injection wells

We appreciate the fact that waste waters are injected deep below the earth's surface. However, we and the public would be better assured if the Department provided for:

A) more expedited groundwater mapping of the state, especially in areas planned for the siting of injection wells and in areas slated for intensive drilling; and
B) the installation of groundwater monitoring wells at injection well sites

3. Adequacy of Inspectors

Industry and agency reports suggest explosive growth in oil and gas development in Ohio. We are very interested to learn the Department's plans to keep pace with this growth, including expected numbers and workloads of field inspectors.

B. STRONGER Report

The 2010 STRONGER report praised the ODNR Division of Mineral Resources Management (DMRM) for its regulatory oversight of oil and gas development. The STRONGER report did, though, include three general recommendations:

1. "DMRM is in the beginning stages of revising OAC Chapter 1501:9 to reflect SB 165 changes. The review team acknowledges this rulemaking effort and encourages the expeditious completion of those portions necessary or appropriate to **implement the hydraulic fracturing provisions of SB 165**."

2. "DMRM should consider whether they will be getting all the **chemical information** they will need for investigations from the MSDS [Material Safety Data Sheets]. An MSDS does not always contain the specific chemical constituents of a product. Also, the state should ensure that information on chemical constituents of fracturing fluids is available to medical personnel in the event of a medical emergency."

3. "…in light of the anticipated development of the Marcellus and Utica Shales in Ohio, the state should continue to **evaluate the need and availability of surface and ground water for hydraulic fracturing** in the context of all competing uses and potential environmental impacts resulting from the volume of water used for hydraulic fracturing."

What are the Department's plans for responding to these recommendations?

C. USDOE Shale Gas Production Subcommittee 90-Day Report (August 18, 2011)

The United States Department of Energy's Shale Gas Production Subcommittee has recommended a number of recommendations to strengthen oversight of oil and gas development. See http://bit.ly/qRAxlz. The Subcommittee is expected to issue its 180-day final report on November 18, 2011.

Not all of the report's recommendations are relevant to the ODNR; some of the recommendations regard air pollution, and others regard federal issues. Most of the recommendations, though, are directly relevant to state regulators. For context and completeness, we have copied all of the recommendations, below.

From the report's introduction:

> "This 90-day report presents recommendations that if implemented will reduce the environmental impacts from shale gas production. The Subcommittee stresses the importance of a process of continuous improvement in the various aspects of shale gas production that relies on best practices and is tied to measurement and disclosure. While many companies are following such a process, much-broader and more extensive adoption is warranted. The approach benefits all parties in shale gas production: regulators will have more complete and accurate information; industry will achieve more efficient operations; and the public will see continuous, measurable improvement in shale gas activities."

Here are the Subcommittee findings and recommendations:

1. Improve public information about shale gas operations: Create a portal for access to a wide range of public information on shale gas development, to include current data available from state and federal regulatory agencies. The portal should be open to the public for use to study and analyze shale gas operations and results.

2. Improve communication among state and federal regulators: Provide continuing annual support to STRONGER (the State Review of Oil and Natural Gas Environmental Regulation) and to the

Ground Water Protection Council for expansion of the Risk Based Data Management System and similar projects that can be extended to all phases of shale gas development.

3. Improve air quality: Measures should be taken to reduce emissions of air pollutants, ozone precursors, and methane as quickly as practicable. The Subcommittee supports adoption of rigorous standards for new and existing sources of methane, air toxics, ozone precursors and other air pollutants from shale gas operations. The Subcommittee recommends:

(1) Enlisting a subset of producers in different basins to design and rapidly implement measurement systems to collect comprehensive methane and other air emissions data from shale gas operations and make these data publically available;

(2) Immediately launching a federal interagency planning effort to acquire data and analyze the overall greenhouse gas footprint of shale gas operations through out the lifecycle of natural gas use in comparison to other fuels; and

(3) Encouraging shale-gas production companies and regulators to expand immediately efforts to reduce air emissions using proven technologies and practices.

4. Protection of water quality: The Subcommittee urges adoption of a systems approach to water management based on consistent measurement and public disclosure of the flow and composition of water at every stage of the shale gas production process. The Subcommittee recommends the following actions by shale gas companies and regulators – to the extent that such actions have not already been undertaken by particular companies and regulatory agencies:

(1) Measure and publicly report the composition of water stocks and flow throughout the fracturing and clean-up process.

(2) Manifest all transfers of water among different locations.
(3) Adopt best practices in well development and construction, especially casing, cementing, and pressure management. Pressure testing of cemented casing and state-of-the-art cement bond logs should be used to confirm formation isolation. Microseismic surveys should be carried out to assure that hydraulic fracture growth is limited to the gas producing formations. Regulations and inspections are needed to confirm that operators have taken prompt action to repair defective cementing jobs. The regulation of shale gas development should include inspections at safety-critical stages of well construction and hydraulic fracturing.

(4) Additional field studies on possible methane leakage from shale gas wells to water reservoirs.

(5) Adopt requirements for background water quality measurements (e.g., existing methane levels in nearby water wells prior to drilling for gas) and report in advance of shale gas production activity.

(6) Agencies should review field experience and modernize rules and enforcement practices to ensure protection of drinking and surface waters.

5. Disclosure of fracturing fluid composition: The Subcommittee shares the prevailing view that the risk of fracturing fluid leakage into drinking water sources through fractures made in deep shale reservoirs is remote. Nevertheless the Subcommittee believes there is no economic or technical reason to prevent public disclosure of all chemicals in fracturing fluids, with an exception for

genuinely proprietary information. While companies and regulators are moving in this direction, progress needs to be accelerated in light of public concern.

6. Reduction in the use of diesel fuel: The Subcommittee believes there is no technical or economic reason to use diesel in shale gas production and recommends reducing the use of diesel engines for surface power in favor of natural gas engines or electricity where available.

7. Managing short-term and cumulative impacts on communities, land use, wildlife, and ecologies. Each relevant jurisdiction should pay greater attention to the combination of impacts from multiple drilling, production and delivery activities (e.g., impacts on air quality, traffic on roads, noise, visual pollution), and make efforts to plan for shale development impacts on a regional scale. Possible
mechanisms include:

(1) Use of multi-well drilling pads to minimize transport traffic and need for new road construction.

(2) Evaluation of water use at the scale of affected watersheds.

(3) Formal notification by regulated entities of anticipated environmental and community impacts.

(4) Preservation of unique and/or sensitive areas as off-limits to drilling and support infrastructure as determined through an appropriate science-based process.

(5) Undertaking science-based characterization of important landscapes, habitats and corridors to inform planning, prevention, mitigation and reclamation of surface impacts.

(6) Establishment of effective field monitoring and enforcement to inform ongoing assessment of cumulative community and land use impacts.

The process for addressing these issues must afford opportunities for affected communities to participate and respect for the rights of surface and mineral rights owners.

8. Organizing for best practice: The Subcommittee believes the creation of a shale gas industry production organization dedicated to continuous improvement of best practice, defined as improvements in techniques and methods that rely on measurement and field experience, is needed to improve operational and environmental outcomes. The Subcommittee favors a national approach including regional mechanisms that recognize differences in geology, land use, water resources, and regulation. The Subcommittee is aware that several different models for such efforts are under discussion and the Subcommittee will monitor progress during its next ninety days. The Subcommittee has identified several activities that deserve priority attention for developing best practices:

Air: (a) Reduction of pollutants and methane emissions from all shale gas production/delivery activity. (b) Establishment of an emission measurement and reporting system at various points in the production
chain.

Water: (a) Well completion – casing and cementing including use of cement bond and other completion logging tools. (b) Minimizing water use and limiting vertical fracture growth.

9. Research and Development needs. The public should expect significant technical advances associated with shale gas production that will significantly improve the efficiency of shale gas production and that will reduce environmental impact. The move from single well to multiple-well pad drilling is one clear example. Given the economic incentive for technical advances, much of the R&D will be performed by the oil and gas industry. Nevertheless the federal government has a role especially in basic R&D, environment protection, and safety. The current level of federal support for unconventional gas R&D is small, and the Subcommittee recommends that the Administration and the Congress set an appropriate mission for R&D and level funding.

The Subcommittee believes that these recommendations, combined with a continuing focus on and clear commitment to measurable progress in implementation of best practices based on technical innovation and field experience, represent important steps toward meeting public concerns and ensuring that the nation's resources are responsibly being responsibly developed.

D. Best Practices

1. Phase out of open pits

The OEC urges the phase out of open pits for retention of waste materials. If pits are used to store oil and gas wastes, they should have, at minimum, two layers of liners, with a leak detection system between the layers. Furthermore, pits should have fences tall and strong enough to keep out wildlife, and nets or other devices installed to prevent birds from coming in contact with the wastes.

There are more environmentally friendly alternatives to using lined or unlined pits. Closed containment systems such as steel tanks, ideally with secondary containment and leak detectors, can be used to store many oil and gas wastes during operations. The wastes can then be transported off site for permanent disposal. All above ground tanks that contain fluids other than fresh water must be contained in an impermeable bermed enclosure to contain a volume of one-third more than the total volume of the largest tank or of all interconnected tanks. All below grade tanks should have secondary containment and leak detection.

2. Closed-loop or "Pitless" Drilling Systems

During drilling operations, "closed-loop" drilling fluid systems (sometimes referred to as "closed mud" or "pitless" systems) can greatly reduce or eliminate the discharge of toxic drilling wastes on site. These systems negate the need for drilling reserve pits. Not only is it possible to have pitless drilling operations, it can also be an economic advantage to companies to used closed-loop drilling systems. Many companies are using closed loop drilling systems in Texas, Louisiana, Oklahoma, Alaska and other states. Examples of companies who are using closed-loop technologies include: Shell, El Paso, Chevron-Texaco, Exxon, and many others.

3. Well pad size: Does ODNR limit the size of well pads to be no larger than necessary?

4. Well pad interim reclamation: After the drilling phase is complete, does ODNR require the reclamation of that portion of the drilling pad not needed for oil or gas production?

5. Visual impacts: Beyond fencing and plantings, does ODNR ever consider requiring landscaping to help decrease the visual impacts of wells. Soil can be formed into ridges or gentle berms around

the well pad, and trees and other vegetation can be planted on the ridges to screen wells so that nearby residents don't see them.

6. **Noise impacts**: Would ODNR consider requiring mitigation of sound, including through sound barriers, mufflers, enclosing well-site or field compressors in a sound-insulated building, changing the blades on fans, housing compressors in acoustically insulated buildings?

NOTE: Again, this is an initial list of recommendations. We expect to submit additional ones.