Comments for the Draft Industry Guidance, Gas Well Drilling/Completion Large Water Volume Fracture Treatments

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We have a number of concerns about the Guidance document that we've arranged under four categories: water issues, waste management issues, health and safety issues, and sedimentation control.

Water Issues

We feel that the Guidance document isn't proactive enough in dealing with the issues the state is already facing in terms of degradation of water quality.

We would like to see a program instituted so that when water testing of homeowner domestic water supply (whether underground aquifer or surface water) is required for a new gas well, the test results be placed in a publicly available database (by location -- longitude and latitude -- and identification number so that no personal information is disclosed). Testing would include the items already required and additionally require tests for methane and BTEX.

The presence of methane or BTEX and elevated chlorides is a positive indicator of drilling contamination.[1]

We believe that a similar program should be set up where dewatering is taking place or where disposal of treated waste is allowed to be made to surface water. Dewatering or disposal would require similar water testing (dewatering would require testing along measured segments of a stream or

[1] Garfield county, Colorado, has had different researchers carry out a number of water quality studies. They have found an increasing degradation of water quality in areas of the county most affected by gas well drilling. Positive indicators of gas well contamination of water were the presence of chlorides and BTEX (or methane) in surface or groundwater, and findings show that these levels are rising yearly throughout the district examined. Geoffrey Thyne, 2008, *Review of Phase II Hydrogeologic Study Prepared for Garfield County*, SBS LLC, http://garfield-county.com/Modules/ShowDocument.aspx?documentid=6595 and Geoffrey Thyne, [2008], *Summary of PI and PII Hydrogeologic Characterization Studies –Mamm Creek Area, Garfield County, Colorado*, Science Based Solutions (Powerpoint presentation), http://garfield-county.com/Modules/ShowDocument.aspx?documentid=6596.

river, not each time but each year). The required tests would be for chlorides and BTEX.

With a database available for researchers, allowing complementary testing by researchers or later drillers in area, we believe the ability to analyze the ongoing history of water quality changes will be possible. Without such an analysis to aid industry guidance, the DEP's actions (such as the current Guidance document) are shots in the dark.

Waste Management

The state's drilling waste management program was set up back in the 1980s for an average disposal of 2,000 barrels.[2] We believe there are already serious problems with the waste management program that need to be addressed and that a new permit should be created. The problem of the state's lack of proper disposal planning was already evident in the STRONGER review in 2003.[3]

In the interim, we believe there are two workable options. Option 1 is that landspraying should not be allowed for over 2,000 barrels of liquid waste.[4] Option 2 uses a modified landspraying regimen for over 2,000 barrels with the following changes to the current General Water Pollution Control Permit:

Category 1 pits only (under 5,000 mg/l chlorides), hydroxide treatment with lime exclusively (not caustic soda) with 20 day settling period, absolutely no fracturing fluids or flowback, with a chloride load per acre maximum of 400 lbs.[5] We believe that landowner permission should be obtained for a disposal of 2,000 barrels or more of pit waste and that DEP spot monitoring of pit waste liquids (especially pH, iron and chlorides before and

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[2] Industry at that time found the 2,000 barrel basis laughable, saying that drilling waste management involved 1,000 barrels.

[3] State Review of Oil and Natural Gas Environmental Regulations, Inc., 2003, *West Virginia Follow-Up and Supplemental Review*, n.p.: State Review of Oil and Natural Gas Environmental Regulations, Inc., http://www.strongerinc.org/documents/WVFinal.pdf

[4] The Guidance document begins by stating that "land application will not be a viable disposal option" but goes on to say two paragraphs later, "it may not be practical." We applaud "will not," are disturbed by the backstep that follows. The reason for the backstep is pretty obvious since alternative management solutions are lacking.

[5] Oklahoma, in the 1980's, had a chlorides limit of 400 lbs per acre. We're unsure what that state's current limit is. Wisconsin has a chlorides load limit of 250 lbs per acre when landspreading food waste. Saskatchewan has a chlorides load limit when landspraying drill waste of 400 kg/ha (356 lbs an acre), Saskatchewan Energy and Mines, 1999, *Saskatchewan Drilling Waste Management Guidelines*, n.p.: Saskatchewan Energy and Mines, Petroleum Development Branch, GL99-01, http://eps.mcgill.ca/~courses/c550/Environmental-impact-of-drilling/Sask_Drilling_Waste_Guidlines.pdf.

during landspraying) is necessary as is a visual inspection of the landsprayed area afterwards to verify that there were no problems.[6]

Without a chloride load limitation it is possible that even with a chloride level below 5,000 mg/l that 5,000 barrels of liquids landsprayed over 2 acres would deposit over 2 tons of chlorides per acre.[7] We don't believe that it is the state's intent to effectively sterilize the soil in the applied area.

Health and Safety

The type of well that requires over 5,000 barrels of fluids creates a number of health and safety issues not found with the conventional wells of a few years ago.

We believe that a setback from structures humans use -- homes, businesses, churches and schools -- should be increased from 200 to at least 500 feet from the well. The reasons for this are several. The Federal Housing Administration has determined that a dwelling closer than 300 feet from the edge of the pad is in danger of "fire, explosion, spray and other pollution."[8] A blowout from such a well, even if no fire or explosion occurs, can have significant surface impact.

Emissions from the pit, the well while being drilled and the completed, producing well, can pose a significant danger. Emissions from the pit occur naturally as volatiles leave their liquid state. During treatment with aeration the volume of volatiles will increase sharply, as it will again during landspraying. During treatment of a pit and during landspraying company employees should be wearing approved safety apparatus to protect their health. Persons not involved with pit treatment and landspraying should

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[6] The waste management problems at the Berry Energy well in the Fernow Experimental Forest, although the amount of fluids landsprayed were slightly less than half of the 5,000 barrels that the Guidance document is concerned with, show the range of the current Permit's flaws. When vegetation death during landspraying was immediately evident there is no process in the Permit to allow suspension of the landspraying or changes in disposal. The operator gave inadequate activated carbon treatment to the waste before spraying which we believe an inspector's oversight would have caught. There were dramatically different testing results (by the operator and independent researchers) which call into question the way testing is done. We believe in this case that testing by the state would have prevented landspraying from occurring. We believe large quantities of chlorides sprayed onto a small area, without chloride load consideration, was a major contributing factor in vegetation and understory tree death.

[7] We have an Excel workbook that has a worksheet with formulas for chloride load, http://members.citynet.net/sootypaws/Woods/gaswell/pitfluids.xls.

[8] Department of Housing and Urban Development, 1999, *Changes to Handbook 4150.2, Valuation Analysis for Single Family One- to Four-Unit Dwellings*, Chapter 2: Site Analysis, 2.2.D and 2.2.D1.
http://portal.hud.gov/pls/portal/url/ITEM/4D0F9E3F276F4AFCE04400144F0EDA3C

remain a safe distance away (our best guess is a distance of at least 300 feet). We believe that inhabitants of a dwelling within 500 feet of a well can be in significant danger.[9]

Our understanding is that the types of wells covered by the Guidance document tend to have much higher volumes of produced natural gas, several million cubic feet per day. Our understanding is that wells producing over 3 Mmcfd now require a flaring unit to dispose of harmful volatile organic compounds.[10] Without a flaring unit, and possibly even with a flaring unit, a well like this can easily produce enough benzene to create a health hazard for those living as close as 300 feet.[11]

We also believe that condensate if produced will be at much higher quantities than at conventional wells. To protect water quality, the state's requirement of a secondary containment dike around tanks needs to be rigidly enforced. Our experience locally is that about 66% of those wells with

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[9] We base our belief on a variety of sources. Roxana Witter writes about benzene, "a statistically significant incidence of acute myeloid leukemia at doses and dose rates as low as 0.8ppm and 2ppm/years was demonstrated in the case control study portion of the Australian Health Watch Study," Roxana Witter, Roxana, et al, 2008, *Potential Exposure-Related Human Health Effects of Oil and Gas Development: A Literature Review (2003-2008)*, page 9, http://www.earthworksaction.org/pubs/hea_08091701A.pdf and for appendices, http://docs.nrdc.org/health/files/hea_08091702c.pdf. Biocides "pose a significant danger to workers and those living near the well and evaporation ponds," The Endocrine Disruption Exchange, 2008, *Analysis of Chemicals Used in Natural Gas Production: Colorado,* http://www.earthworksaction.org/pubs/colorado_analysis_1-15-08.pdf. Glutaraldehyde is a commonly used industry biocide that is volatile. Exposure to Glutaraldehyde can make a person chemically hypersensitive. See also footnote 11.

[10] From a discussion with a member of the staff at the Division of Air Quality. An alternative to a flaring unit that is economically beneficial to operators is a vapor recovery unit. Al Armendariz, 2009, *Emissions from Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements,* http://www.edf.org/documents/9235_Barnett_Shale_Report.pdf.

[11] Agency for Toxic Substances and Disease Registry, 2008, *Health Consultation, Garfield County: Public Health Implications of Ambient Air Exposures to Volatile Organic Compounds as Measured in Rural, Urban, and Oil & Gas Development Areas*, Atlanta, GA: Department of Health and Human Services, Public Health Service, ATSDR, Division of Health Assessment and Consultation, pages 10 to 12 for benzene in the wellfield, http://www.garfield-county.com/Modules/ShowDocument.aspx?documentid=4455. Raj Goyal, 2008, *Colorado Air Toxic Inhalation: Overview of Screen-Level Health Risk Assessment for Garfield County*, Colorado Department of Public Health, Powerpoint presentation, slides 22, 26 and 27, http://www.garfield-county.com/Modules/ShowDocument.aspx?documentid=4758. Russ Walker, 2008, *Community Health Assessment for Garfield County: Risk Assessment*, Powerpoint presentation, especially slides 21-23, 42 and 43, http://www.garfield-county.com/Modules/ShowDocument.aspx?documentid=4756. Garfield county with three times the area has about 4,400 producing wells compared to Kanawha county's 3,200 wells.

tanks don't have secondary containment, even when those tanks fall also under the purview of 40 CFR 112.[12]

Sedimentation Control

We believe that a well requiring 5,000 barrels of fluid will have a substantially larger pad size than the normal 100 by 200 feet we are familiar with.[13] The DEP's construction stormwater manual needs to be available in an easy to access format (such as a zipped folder or folders for download) so that operators and surface owners can use it and appropriate sections (such as *3.35 -- Access Road/Low Volume Road/Driveway*) be also made available on the Office of Oil and Gas website. The Office of Oil and Gas's *Erosion and Sediment Control Field Manual* needs to be updated, with corrections of typographical errors, improvements of diagrams, and more reasonable culvert sizing. An important resource missing from the DEP's manual's References list is Gordon Keller's and James Sherar's *Low-Volume Roads Engineering Best Management Practices Field Guide* which we feel offers an excellent supplemental guide for road and site construction for oil and gas exploration in this state.[14]

What we've seen locally is a complete ignorance by some operators, incomplete understanding by others, of the requirements of the *Field Manual*.[15] We can hardly expect that this situation will improve when operators are drilling and completing wells requiring 5,000 barrels of fluids.

Training is the obvious solution and the state needs to be more proactive. A possible educational program might include local classes taught by the reclamation inspector using class visits to older and just-constructed sites as a chance for participants to critique and analyze what they see.

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[12] George Monk and Molly Schaffnit, 2009, *Gas Well Study, 2008*, http://members.citynet.net/sootypaws/Woods/gaswell/comments/otherwells/study.html

[13] Even though the clearing and surface disturbance may be quite large, newer local wells have a pad that is generally this size.

[14] Gordon Keller and Sherar, James, 2003, *Low-Volume Roads Engineering Best Management Practices Field Guide*. n.p.: U.S. Agency for International Development with U.S. Department of Agriculture, Forest Service, International Programs; Conservation Management Institute, Virginia Polytechnic Institute and State University. http://www.encapafrica.org/documents/low-volume_roads/low-res.zip; high resolution chapters available on http://www.encapafrica.org/lvr.htm

[15] George Monk and Molly Schaffnit, 2009, *Gas Well Study*, 2008. A critique of well site construction and reclamation can be found at http://members.citynet.net/sootypaws/Woods/gaswell/comments/reclaim.html. The 45 Days Later page gives an idea of just how bad things can get at a poorly constructed well site: http://members.citynet.net/sootypaws/Woods/gaswell/comments/reclaim_1492.html.

Without the state's active guidance, operators will continue to make the same mistakes they are already making, but in a much larger scale and with the potential for much larger negative impacts on the environment.

Conclusion

We believe that a Guidance document, without a serious intent to determine problems in water quality, to protect the health and safety of citizens and workers, and to minimize the environmental impacts of gas well drilling where extremely large volumes of fluids are involved, is a half-measure.

DRAFT
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WVDEP
Industry Guidance
Gas Well Drilling/Completion
Large Water Volume Fracture Treatments

Purpose

Devonian aged shales, such as the Marcellus, are rock formations that underlie much of West Virginia, Pennsylvania, and portions of New York at varying depths. They are believed to hold trillions of cubic feet of natural gas. Exploration of some of these shales have not previously been considered economical, but recent advances in drilling technology and rising natural gas prices have attracted new interest in these under-developed resources. The combination of these factors suggests that areas in West Virginia that have not traditionally experienced much gas well drilling might soon experience exploration. Horizontal drilling, coupled with large volume hydraulic fracture treatments, is becoming a common exploration technique. These fracture treatments often use much more water than the traditional process. Large amounts of water mixed with sand and other additives are pumped into the shale formation under high pressure to fracture the rock around the well to create a permeability conduit to the well bore. Water used in the hydraulic fracturing process, often referred to as "frac fluid," must be processed in one of three ways. It can be injected in permitted disposal wells, treated to remove generated pollutants then disposed of properly, or reused.

The West Virginia Department of Environmental Protection (DEP) has developed this guidance document to assist well operators in planning for the drilling and operation of these wells and the associated need to dispose/reuse large water volume fracture treatment wastes. It is intended to facilitate compliance with applicable statutory and regulatory requirements and to generally minimize negative environmental impacts associated with these activities by promoting the use of necessary best management practices. In addition to this guidance, the Office of Oil and Gas (OOG) is requiring companies to submit additional information through an addendum to permit applications for this type of activity. The additional information will provide a more thorough understanding of the proposed activity and better ensure protection of the environment. The addendum will become part of the permit and will be subject to inspection and enforcement requirements. The guidance focuses on three main areas including water use and withdrawal, site construction, and fluid disposal.

Water Use/Withdrawal

In 2003, the West Virginia Legislature passed the Water Resources Protection Act (Chapter 22, Article 26). That legislation requires users of water resources whose withdrawals exceed

750,000 gallons in any given month for one facility, to register with the Division of Water and Waste Management (DWWM). It is likely that some of the oil and gas industry operations discussed above will exceed this threshold and consequently be required to submit information to the DWWM. Operators should coordinate with the DWWM when submitting the required information so that it may be done in a timely manner.

At this point, the Act requires submission of the withdrawal information after it has occurred. However, to protect both ground and surface waters, operators will be asked to provide information regarding the source(s) of withdrawals, volumes anticipated to be obtained from those sources and the time of year the withdrawals are anticipated prior to start-up. In no case shall the operator withdraw water from ground or surface waters at volumes beyond which the waters can sustain. While determining sustainable stream flow and acceptable ground water recharge rates may be difficult, for streams, a general rule of thumb should be to limit withdrawals during low flow conditions to no more than 10 percent of a stream's flow. In most cases, streams experience their lowest flows during the months of July through November, so operators as a rule should seek larger stream sources for water supply and avoid headwater streams during the drier months of the year. Operators should contact DEP for low flow information for the state's waters.

Regardless of the volume of water withdrawn from the State's water resources, well operators must ensure that all uses of the waters are protected. Consequently, operators must consider water availability as part of their exploration and development strategy. For instance, if streams are expected to provide the source of the water, location and seasonal variations in precipitation may significantly impact water availability. It may be necessary to store water during higher stream flow periods. Construction of centralized ponds for water storage may be appropriate but must be done in an environmentally protective manner, and with land owner approval. Guidance on proper construction techniques for ponds can be obtained from the Dam Safety Office or the local Natural Resource Conservation Service field office. Dam Safety Rule 47CSR34 may apply, depending on the size of the structure and volume of water contained. Questions about the applicability of dam safety rules can be directed to the DWWM. Additionally, if stream flows and/or storage is not adequate, public water supplies should be identified and considered.

Operators should also consider the manner (hauled or pumped) in which the water will be delivered to the well site. Hauling large volumes of water will result in significantly increased truck traffic that may create safety concerns, road damage, dust problems and other environmental issues. Stream access when pumping from streams must also be carefully considered. Boat launch ramps and other public access points could be damaged by excessive use and should be avoided.

Site Construction

The activities for which this guidance has been prepared, particularly those incorporating horizontal drilling, are likely to result in considerably larger well sites than historically have been constructed. While these horizontal drilling sites may replace several vertical well sites, and result in less total surface disturbance at any given site, additional acreage is impacted. Whether

horizontal or vertical, larger sites create greater challenges for sediment and water control. Operators shall be required to utilize best management practices, which are designed to address larger sites and access roads. In addition to the requirements contained in the Erosion and Sediment Control Manual of the OOG, operators should consult the DEP's Construction Stormwater Manual. The manual can be found on the WVDEP's website at http://www2.wvdep.org/dwwm/stormwater/BMP/index.html.

As the pits associated with these operations will be containing significant larger volumes of fluids than conventional operations, they must be designed and installed in such a manner as to provide structural integrity for the life of the pit. Proper design and installation is imperative to the objective of preventing a failure or improper discharge that could result in significant adverse impacts. Increased efforts will be necessary when these features are not completely located in cut portions of the site. Additionally, as outlined in an industry directive from the DEP Cabinet Secretary, the operator will be required to conduct regular inspections of all pits and ponds with a capacity greater than 5000 bbl.

For an increased level of safety, pits must incorporate lifelines and perimeter fencing. Additionally, as these sites are likely to have additional equipment during the drilling and completion of the well, operators must plan for adequate spacing of equipment and access to all areas of the site to assist in creating a safe working area.

Specific to the permit application, the construction and reclamation plan must provide an estimate of the amount of acreage to be disturbed, the location of all pits at the drill site (with approximate dimensions of the drill site and pits), and the land application area if applicable.

Accurate drawings of the site and access roads, including locations of all best management practices, will be required. It is imperative that the plan be clear, concise and complete so that all parties understand the proposed activity. Due to the quality and quantity of the pit fluids, land application will not be a viable disposal option in many instances.

Water Disposal

Perhaps the greatest challenge regarding these operations is the disposal of the drilling or frac fluids. The operator must thoroughly plan for this situation. Once wells are drilled and completed, thousands of barrels of this fluid may need proper treatment and disposal. Currently there are limited options, all of which may involve some time constraints for authorization or implementation.

While land application may generally be an option on smaller, shallower wells, it may not be practical in dealing with the volume of water expected at these sites. Presently, underground injection control (UIC) may be the best option. This practice is generally recognized as being environmentally sound and has proven effective for the past 25 years. However, to handle the expected amount of water, many additional UIC wells will need to be permitted, drilled or converted. The Office of Oil and Gas issues Class II UIC permits for brine and fluid disposal. Currently, WV has only two permitted commercial UIC wells available.

Operators should seriously consider options for the recycling of fracture treatment flow-back fluid. Technologic advances are making it more economical to treat these fluids with better results in water quality. The treatment of these fluids may greatly enhance the quantity of acceptable, reusable fluids and provide more options for ultimate disposal.

Some operators may consider transporting frac fluids to local, publicly owned treatment works (POTWs). The OOG and the DWWM must be notified, via the application addendum, if this is an option being considered for disposal. The DWWM will be in contact with the POTW to ensure that the treatment facility can handle the flow and the quality of the waste. If the facility does not already have a permit for pretreatment, an NPDES permit modification and treatment requirements will need to be considered before approval of the discharge to the facility is allowed. Federal regulations prohibit on-site treatment and disposal of the frac fluid to a nearby receiving stream.

Transport and disposal at a centralized treatment facility can be an option. Currently there are no centralized treatment facilities available. However, the DWWM has received several inquiries regarding such disposal and is currently considering them.

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State of West Virginia
Department of Environmental Protection
Office of Oil and Gas

Well Work Permit Application Addendum
(to be completed when fluid volumes used or disposed may be greater than 5000 barrels)

1) Well Operator _____

2) Operator ID # _____

3) Operator's Well Number _____

4) County _____

5) Approximate Amount of Water to be Used (bbls.) _____

6) Fracture/Drilling Water Source (estimate % of each source to be used)
_____ Surface Water _____Groundwater _____Purchased Water
_____Reused Water

7) Location of Surface Water Source (if applicable)
a) County _____
Water Source Name _____
Latitude (d/m/s) _____ Longitude (d/m/s) _____
b) Anticipated month(s) of water withdrawals _____

8) Location of Groundwater Source (if applicable)
a) County _____
Water Source Name/ID _____
Latitude (d/m/s) _____ Longitude (d/m/s) _____
b) Anticipated month(s) of water withdrawals _____

9) Location of Purchased Water Source (if applicable)
Public/Private Water System Name _____

10) Location of Reused Water (if applicable)
County _____
Well/Facility ID _____

11) Will Centralized Pits/Ponds Be Utilized _____yes _____no

Location (if applicable)

Latitude (d/m/s)_____ Longitude (d/m/s)_____

Dimensions in Feet (if applicable)

Length_____ Width_____ Depth_____

12) Water Disposal Method (estimate % each facility is to receive)

_____Land Application _____UIC—provide UIC permit number_____

_____POTW—provide facility name_____

_____NPDES—provide permit number_____

_____Other_____