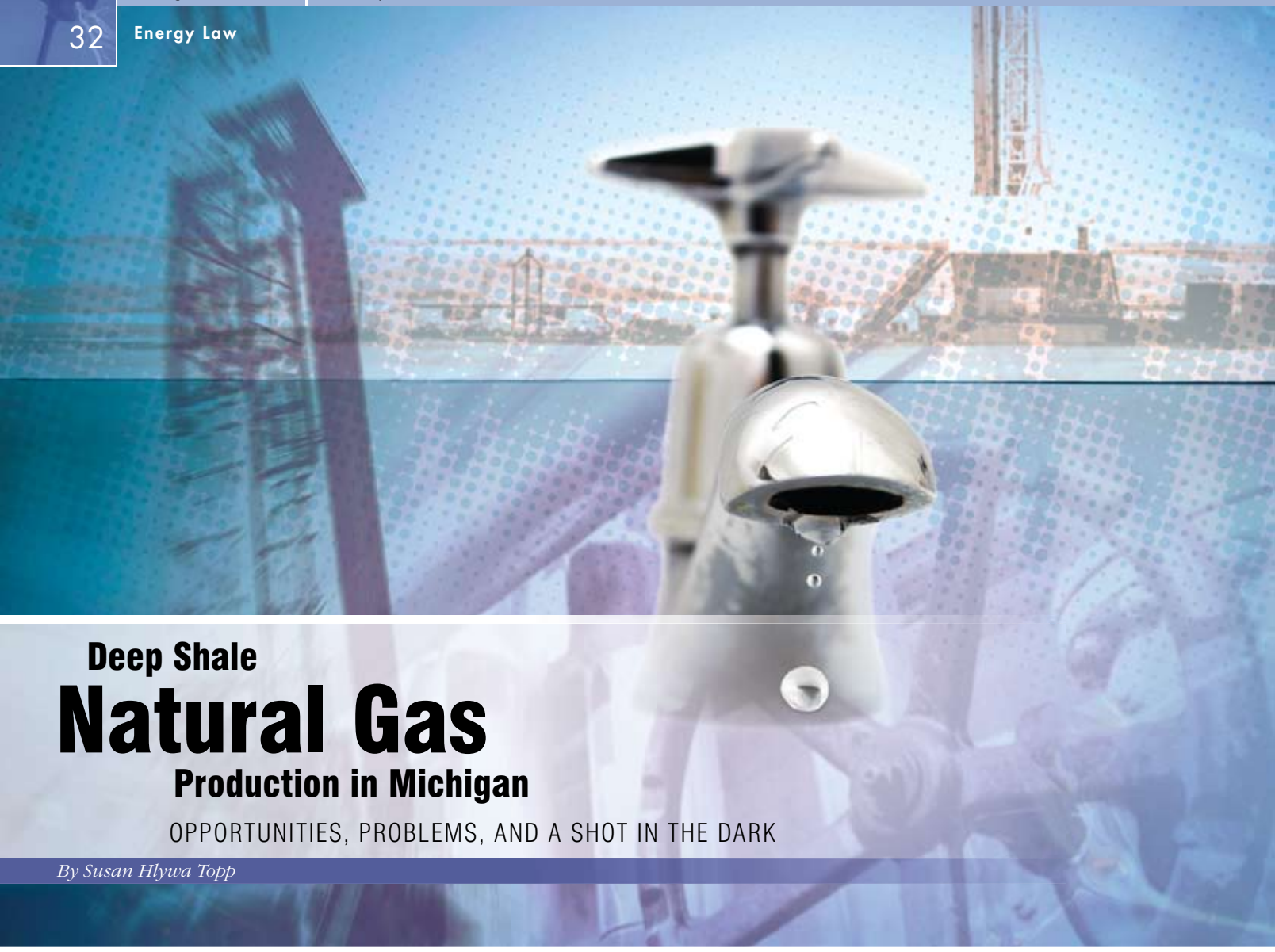


Deep Shale Natural Gas Production in Michigan

OPPORTUNITIES, PROBLEMS, AND A SHOT IN THE DARK

By Susan Hlywa Topp

Michigan has recently been pulled into the national debate over the use of hydraulic fracturing[1] in the production of natural gas. Hydraulic fracturing is used to produce natural gas from tight, non-porous shale formations with low permeability that exist deep below the land surface.[2] The ongoing debate pits those objecting to the potential adverse environmental impacts associated with the expanding use of this process against the proponents of energy independence and increased natural gas production.

To access the natural gas trapped in deeper shale formations using hydraulic fracturing, a well operator creates or increases existing fractures in the underground shale formation. The increased number and size of the fractures in the shale boosts the relative permeability or porosity of the rock and allows the trapped gas to flow into the well bore and up to the surface. The controversy over this production method stems from the technique used to reach the gas. The well operator first drills a deep vertical well bore into a productive zone in the shale and then extends a horizontal leg. In the Collingwood Shale formation in Michigan currently under production, the vertical bore is between 9,000 and 10,000 feet deep. A horizontal leg of the well can be an additional 5,000 to 6,000 feet in length. To complete the well, holes are shot through the well casing and the cement well sheath into the shale formation. A highly pressurized mixture of water and chemicals is injected into the well bore, creating cracks and fractures in the rock/shale formation. The fluids include a solid mixture such as sand that remains in the fractures to hold them open after the liquid is pumped out. Once the liquid is removed, the natural gas flows through the fractures and rises toward the surface through the bore hole to be captured by the producer.

The Opportunity

Shale gas production has expanded in the United States from 1 percent of natural gas production in 2000 to about 10 percent

FAST FACTS

The first well to use deep shale hydraulic fracturing was successful in the spring of 2010. This resulted in mineral lease sales of more than $178 million at the state mineral lease auction in May 2010, the most lucrative mineral sale in Michigan history.

Hydraulic fracturing of deep shale formations raises numerous environmental issues about groundwater withdrawal and water pollution from harmful chemical additives.

The expanding use of hydraulic fracturing has caused several states to place a moratorium on permitting deep shale wells and the Environmental Protection Agency to reopen a study investigating the regulatory exemption.

today, and a projected 34 to 56 percent in 2030.[3] Gas producers are currently using the hydraulic fracturing process to access gas in deeper shale formations in the Marcellus Shale formation in the Appalachian Basin as well as in the Barnett Shale formation in the Fort Worth, Texas, basin.[4] Before recent developments, producers used fracturing in Michigan to develop wells in the shallower Antrim Shale in northern Michigan. There are about 12,000 Antrim Shale "fracked" wells in Michigan. In the spring of 2010, Petoskey Exploration, LLC, a subsidiary of Encana Oil and Gas, successfully drilled the Pioneer 1-3 well in Missaukee County using hydraulic fracturing to access gas in the deeper Collingwood Shale formation. The apparent success of this first well to use hydraulic fracturing resulted in mineral lease sales of more than $178 million at the state mineral lease auction in May 2010, the most lucrative mineral sale in Michigan history.

This article will explore the environmental issues surrounding the hydraulic fracturing process.

Water Use and Permitting

A division of the Michigan Natural Resources and Environmental Protection Act (MCL 324.62501 through 324.62518, formerly Supervisor of Wells Act and Mineral Well Act) is the predominant statute regulating the production of gas and oil in Michigan.[5] Specific regulatory requirements are contained in the administrative rules.[6] The supervisor of wells and the Office of Geologic Survey of the Michigan Department of Natural Resources and Environment (MDNRE) provide regulatory oversight and permitting.

The MDNRE expects that approximately five million gallons of water will be used to fracture a Collingwood Shale well. This is approximately 100 times more than the amount of water used to fracture an Antrim Shale well.[7] Most of this water will not be available for return into the groundwater system because of the chemical contaminants added in the fracturing process. Despite the large volume of water withdrawal and use in the production process, the MDNRE has not adopted regulations specific to hydraulic fracturing.

The withdrawal of water for oil and gas exploration and production operations is also exempt from the requirements of Michigan's water withdrawal statute, the Great Lakes Preservation Act.[8] The MDNRE has indicated that it is developing equivalent procedures for evaluation of the potential effects of water use for large fracture jobs and that it will not approve a withdrawal of water for hydraulic fracturing if it is likely to cause an adverse impact to groundwater or surface water. To date, however, there has been little concrete assurance that the regulatory measures the MDNRE will take will protect Michigan's groundwater resources.

To complicate any public oversight of the process, the Collingwood Shale wells currently being drilled and fractured are under a cloak of bureaucratic confidentiality.[9] A well operator can shield its operation from public disclosure in one of two ways:

(1) If an operator obtains a permit to drill under one section of the statute, the MDNRE will keep the well information confidential to allow the operator to drill the well and test the formation without having to make the information available to the public.[10] If the well looks promising, the mineral well permit can be converted to a permit for the completion of the well in the targeted formation.[11] The MDNRE and Office of Administrative Hearings have taken the position that there is no right to a contested case hearing to challenge a permit issued under the Mineral Well Act, and only an "owner or operator" can appeal a decision on a mineral well permit under MCL 324.62504. The Ingham County Circuit Court upheld this position on appeal.[12]

(2) Alternatively, the operator can apply for a permit under another section of the statute to drill the vertical portion of the well to test the targeted Collingwood formation. The well operator can simply request that the MDNRE keep this information confidential. If the results of the vertical test well look promising, the operator can apply for a permit to drill the horizontal leg of the well. The issuance of a permit for the horizontal leg is a purely administrative action and occurs often within days of the request with no opportunity for an interested party to object to the new permit or to request a hearing. Even though the administrative rules provide that an interested party may petition the supervisor of wells to schedule a hearing to receive evidence pertaining to the "need or desirability of the action or an order by the supervisor," the MDNRE and the Office of Administrative Hearings have taken the position that the phrase "need or desirability of the action or an order by the supervisor" does not include the issuance of a permit.[13]

To increase permeability, the operator injects a mixture of water and chemicals into the formation….there is no current requirement that these chemicals be identified.

In both cases, there is no opportunity for an interested party to object to the issuance of the new permit or request a public hearing. Further, an interested party who files a Michigan Freedom of Information Act (FOIA) request for documentation pertaining to the application to drill, a permit to drill, or both will receive very little, if any, information from the MDNRE because of the confidentiality provision. FOIA exempts from disclosure any records that are "specifically described and exempted from disclosure by statute."[14] The MDNRE cites the confidentiality provisions of the statute to shield well information from disclosure.[15]

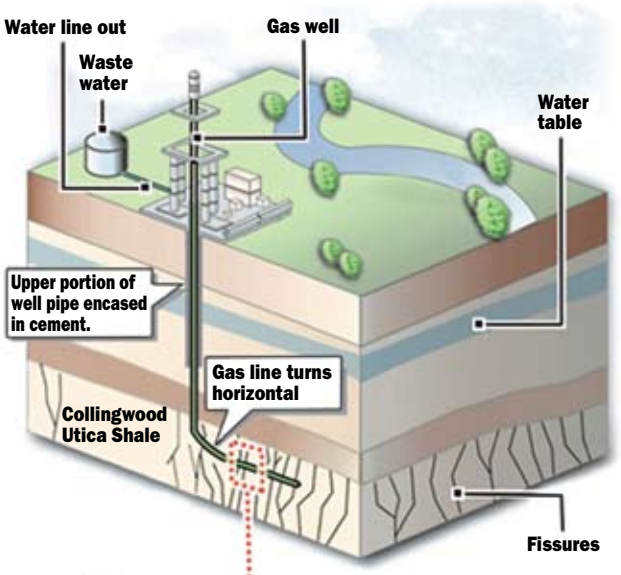
Chemical Additives in the Fracturing Process

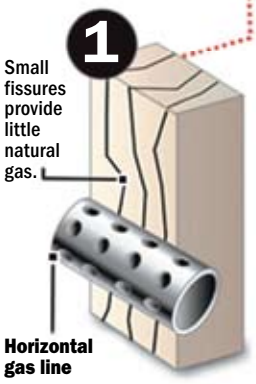
To increase permeability, the operator injects a mixture of water and chemicals into the formation. The chemical mixture that a well operator uses in the hydraulic fracturing process is proprietary, and there is no current requirement that these chemicals be identified.[16] The best available information indicates that additives include benzene, toluene, ethyl benzene, and xylene. These hazardous hydrocarbons, which are the primary components in gasoline, can potentially cause health problems over the long term with certain exposures. The proprietary nature of these additives has raised numerous concerns, including the consequent inability of regulators and medical professionals to specify test parameters to detect chemical migration or contamination in nearby groundwater.[17] The U.S. Environmental Protection Agency (EPA) has recently opened an inquiry into these fracturing compounds, which it is expected to complete in 2012.

Groundwater and Surface Water Contamination Experience

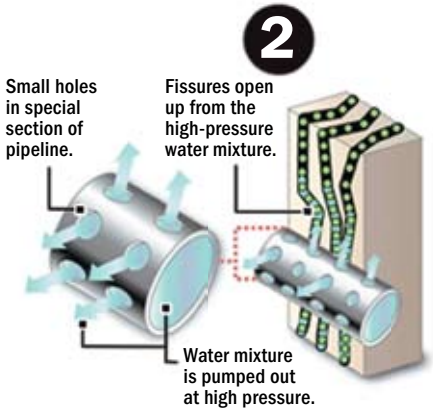
Liquid from the fracturing process has contaminated both groundwater and surface water in other states, most recently in Dimock, Pennsylvania.[18] In September 2009, a spill of more than 8,000 gallons of fracturing fluid occurred from a well site operated by Cabot Oil and Gas Corporation. The fracturing fluid flowed into a stream, causing a fish kill of 160 species of fish and other marine life in a 30-mile zone. Methane gas and metals migrating from the Cabot wells contaminated groundwater and several residential potable wells. The Pennsylvania Department of Environmental Protection later concluded that the release was caused by faulty well construction.

Also in 2009, the EPA discovered contaminants from the fracturing process in several drinking water wells in Pavillion, Wyoming.[19] The state of New York has placed a moratorium on new drilling permits for the development of the Marcellus Shale through May 15, 2011, because of concerns over potential groundwater contamination.





1. Drilling for maximum effect
The drilling turns horizontal at about 9,000 feet, hitting multiple fissures and increasing the volume of available natural gas.



2. Putting the Pressure On
A mixture of water, sand and chemicals is pumped into the pipeline, which has small holes through which the mixture is forced.

3. Increase Gas Flow
The small fissures are widened by the pressure. The water mixture is pumped back out of the well and natural gas follows back up the pipeline to the wellhead.

Courtesy of Tip of the Mitt Watershed Council

Federal Regulation and Exemption

Despite allegations of water contamination, hydraulic fracturing has so far been exempt from federal regulation.[20] The federal Safe Drinking Water Act (SDWA), enacted in 1974, and related federal Underground Injection Control (UIC) rules prohibit the underground injection or subsurface placement of fluids by well injection that endangers underground drinking water sources.[21] At first, the EPA did not apply the UIC regulations to fracturing fluids because the principal function of the fracturing process is resource recovery, not the placement of fluids.[22] States were free to regulate fracturing fluids under state law until 1997 when the EPA was temporarily forced to apply the SDWA to this process.[23]

The EPA studied the environmental impact caused by coalbed methane hydraulic fracturing and released its final report in July 2004. The EPA determined that fracturing of coalbed methane wells poses little or no threat to drinking water[24] based on the fact that 15 to 40 percent of the injected fluid is recovered and because of the mitigating effects of dilution, dispersion, adsorption, potential biodegradation of the fluid, and the underground barriers in the geologic strata.[25] In 2005, in response to recommendations from the National Energy Policy Development Group, Congress amended the SWDA to exempt from regulation hydraulic fracturing fluids and operations from oil and gas production activities unless such fluids contain diesel fuel, leaving the regulation to the individual states.[26]

On October 8, 2009, Congress approved $1.9 million for the EPA to re-open the 2004 hydraulic fracturing study. Congress directed the EPA to use a credible approach, the best available science, independent sources of information, and a transparent, peer-reviewed process.[27] The new study on hydraulic fracturing is expected to yield preliminary results by the end of 2012.

There are more questions than answers with respect to the environmental concerns on fracking. These questions must be answered, but by whom? Preservation of our groundwater is a paramount concern to all. Surely, public participation and stringent limitations on water use are warranted, as is full disclosure of all chemical additives to the fracking fluids. Until additional data and EPA studies are completed to shed light on these issues and appropriate regulations governing fracking are implemented, proceeding with hydraulic fracking of deep shale wells now is like taking a shot in the dark. ■

Susan Hlywa Topp is the owner of Topp Law, PLC, a boutique firm in Gaylord. She practices exclusively in the areas of environmental, oil and gas, natural resources, alternative energy, and real estate development law. Ms. Topp is vice chair of the SBM Environmental Law Section Energy Committee and co-author of the "Oil and Gas" chapter of the Environmental Law Deskbook 2d, *published online by the Environmental Law Section.*

FOOTNOTES

1. In oil and gas industry vernacular, hydraulic fracturing is often referred to as "fracking" or "fracing."
2. See U.S. Department of Energy, *Modern Shale Gas Development in the United States: A Primer* (April 2009) for in-depth discussion of the fracking process and history.
3. *An Energy Answer in the Shale Below? New Technology Opens Vast Stores of Natural Gas, and the Land Rush is On,* Washington Post (December 3, 2009); U.S. Department of Energy, Energy Information Administration, *Annual Energy Outlook 2009,* at 77, and *Annual Energy Outlook 2010* at 72, available at <http://www.eia.doe.gov/oiaf/aeo/pdf/trend_4.pdf>. All websites cited in this article were accessed September 30, 2010.
4. Other shale formations include the Fayetteville Shale in the Arkoma Basin between Arkansas and Oklahoma, the Haynesville Shale in the North Louisiana Salt Basin extending into Texas and Arkansas, the Woodford Shale in the Anadarko Basin in Oklahoma, and the New Albany Shale in the Illinois Basin.
5. MCL 324.61501 *et seq.*
6. Mich Admin Code, R 324.101 through 324.1301.
7. Michigan Department of Natural Resources and Environment, Office of Geological Survey, *Hydraulic Fracturing of Natural Gas Wells in Michigan* (August 13, 2010) at 2, available at <http://www.michigan.gov/documents/deq/Hydrofrac-2010-08-13_331787_7.pdf>.
8. MCL 324.32701 *et seq.*
9. Michigan Department of Natural Resources and Environment, File and Response to Freedom of Information Request for the Application and Permit for the State Koehler & Kendall 1-27 Horizontal Drill Collingwood Shale Well, Cheboygan County.
10. MCL 324.62509(5); Mich Admin Code, R 299.2367, R 324.416(3).
11. Mich Admin Code, R 299.2323.
12. *In the Matter of Star Township on the Permit Issued to Beeland Group, LLC,* SOAH, Opinion and Order August 1, 2008; *Star Township v Michigan Dept of Environmental Quality,* Case No. 08-1054-AA, Ingham County Circuit Court (April 27, 2009).
13. *Id.*
14. MCL 15.243(1)(d).
15. MCL 324.62509(5); Mich Admin Code, R 299.2367, R 324.416(3).
16. Memorandum Examining the Potential Impact of Hydraulic Fracturing, 111th Congress HR (February 18, 2010), available at <http://energycommerce.house.gov/Press_111/20100218/hydraulic_fracturing_memo.pdf>.
17. Oil and gas exploration and production facilities are exempt from the reporting requirements of toxic chemicals they release, store, or transfer under the Emergency Planning and Community Right to Know Act, 40 CFR § 372.23.
18. Bateman, *A Colossal Fracking Mess,* Vanity Fair (June 21, 2010).
19. U.S. Environmental Protection Agency, *Pavillion Groundwater Investigation, Pavillion, Wyoming: Phase I Sampling Results* (August 11, 2009), available at <http://www.epa.gov/region8/superfund/wy/pavillion/Pavillion_GWInvestigationPublicPresentation.pdf>.
20. See Orford, *Fractured: The Road to the New EPA "Fracking" Study,* Marten Law News (September 16, 2010) for an excellent summary of the history and evolution of EPA regulation of fracking fluid.
21. 42 USC 300h(b)(1); Underground Injection Control, 42 USC 300h *et seq.*
22. *Legal Environmental Assistance Foundation, Inc v U.S. E.P.A.,* 118 F3d 1467, 1471 (CA 11, 1997).
23. *Id.* at 1478.
24. U.S. Environmental Protection Agency, *Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs,* EPA 816-R-04-003, at 7-5 (2004), available at <http://www.gwpc.org/e-library/documents/general/Evaluation%20of%20Impacts%20to%20Underground%20Sources%20of%20Drinking%20Water%20by%20Hydraulic%20Fracturing%20of%20Coalbed%20Methane%20Reservoirs.pdf>.
25. *Id.*
26. 42 USC 300h(d)(1); commonly referred to as the "Halliburton Loophole."
27. HR 2996, Conference Report for the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010, 111th Congress (2009) (Report 111-316), available at <http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_reports&docid=f:hr316.111.pdf>.