

## March 5 Hydraulic Fracturing in Michigan

### Integrated Assessment Overview and Discussion

*Below are comments and questions received via email during or soon after the March 5 overview and discussion of the Hydraulic Fracturing in Michigan Integrated Assessment. Responses are provided for general questions. All other submissions have been organized by the technical report topics. Responses are not provided as the reports are still in draft form. However, a video recording of the March 5 event and a copy of the session presentation can be found at: <http://graham.umich.edu/ia/hydraulic-fracturing-march2013.php>. All comments and questions below will be shared with the technical report authors for consideration in their reports. Please direct any questions to [grahaminstitute-ia@umich.edu](mailto:grahaminstitute-ia@umich.edu). Additional project information can be found at: <http://graham.umich.edu/ia/hydraulic-fracturing.php>*

#### General

1. Is there a timeline for a phased distribution of information first based on literature/data available today and a later report on ongoing research  
*We hope to have the technical reports available in June for public comment. The final project report is expected in mid 2014. Additional public events may be scheduled over the next year.*
2. The first panelist emphasized the desirability of maximizing production of hydrocarbons. Is that the objective of all panelists? And is a BAN on fracking, and the many benefits of a healthy Michigan environment that is based on NOT fracking, going to be a part of every panelist's part of the study?  
*The purpose of the Phase 1 technical reports is to provide a solid foundation of information for decision makers and stakeholders, and upon which the policy analysis can be built. Phase 2 will build from the technical reports, focusing on an analysis of options regarding hydraulic fracturing in Michigan.*
3. As for the funding from the University of Michigan, I am curious how, by my understanding a total of \$600,000, will be distributed and utilized for the analysis?  
*Funds are primarily being used to support faculty and student work. Faculty are receiving approximately one month of support for each Phase 1 technical report. Students assisting with the preparation of the reports are paid by the hour – approximately 10-15 hours per week. Other expenses include hosting events such as the March 5 discussion and other project meetings.*
4. My comment... The oil & gas industry pays people well to further their agenda. The rest of us have to research on our own dime. What motivates the folks on the panel to spend the enormous amounts of time that will be needed to undertake a proper study? Do they have paid time allotted for it? Will they be motivated enough?  
*See above.*

5. Yesterday I watched the online web stream of your program on the study your group is currently doing on hydraulic fracturing in Michigan. You are to be congratulated on a well run and informative program. I was concerned about one statement you made in your introductory remarks. I do not think it should be taken as a given for your study that the DEQ is able to supervise high-volume hydraulic fracturing in Michigan with a related assumption that well construction where high volume fracturing has already been done in Michigan has been done correctly. You stated that the STRONGER organization had reviewed the DEQ organization in 2003 and found it had a well managed oil and gas environmental regulatory program. This 2003 report by STRONGER was conducted in 2002 using guidelines from 2000. These 2000 guidelines were developed prior to any high-volume hydraulic fracturing being done in Michigan and before high-volume hydraulic fracturing was being done to any great extent outside of the Barnett Shale area in Texas. The present technology of high-volume fracturing can be traced to George Mitchell's pioneering work in the 1990s developing the Barnett Shale. As an oil and gas professional, I can tell you that high-volume fracturing is not just an extension of fracturing that was done prior to the 1990s. A whole new level of well construction and monitoring is required for high-volume fracturing. The DEQ may have the staff to examine well construction proposals (casing programs, cementing details, etc.) and supervise well construction for high-volume fracturing, but I do not believe this should be a given for your group's 2013 work based only on a 2003 STRONGER review.  
*The slide which referenced the 2003 STRONGER review noted that the review was not specific to Hydraulic Fracturing.*
6. I would like the panel to address the use of "lit review" to describe this work on the IA - it is not a simple lit review; it is much more. Can you please elaborate so that this work is not glibly brushed off as somehow inadequate before it even gets moving?  
*All the panelists did mention that part of their work with the technical reports is to conduct literature reviews. That said, it is only one dimension of the work being done. Integrated Assessments (<http://graham.umich.edu/ia/methodology.php>) rely, for the most part, on existing data, studies, and reports. The goal is to pull that all together with additional analyses to develop better understandings for guiding future decision making.*

## **Technology**

1. I understand that the average vertical well uses about 50,000 gallons of water. If a vertical well uses 3-5 gallons of water, this is 100X more water. Does a horizontal well replace 100 vertical wells?
2. Johannes Schwank indicated they were looking at development technologies, but did not mention waste management and processing of flowback water. Will the Assessment cover this component? It appears the Brian Ellis will cover disposal but no mention of flowback treatment. I would recommend this as a Technology component.
3. Any data or discussion on how well the outside casing of an injection wells seals? My concern is that naturally occurring unhealthy compounds from one layer will get into the

aquifer that I draw drinking water. My well is approximately at 100ft in south central Michigan.

4. Will you be analyzing and comparing aspects including site preparation, water withdrawal, safety issues, chemical usage, and production of natural gas from Antrim shale wells vs high volume deep shale wells? I think if you do, you will be surprised to see the level of production achieved in Antrim wells with far less water withdrawal. I hope that you will examine and include in your report.
5. The study is supposed to assess hazards and risks. How can an adequate assessment be made in terms of the hazards and risks of chemicals used in this process when the chemical formulas are proprietary? Are the companies engaged in hydraulic fracturing making the full list of chemicals utilized available to those working on this study?
6. Do you intend to provide in your review an examination and comment on the following for high-volume hydrofractured (hvf) wells?
  - a. Approval process for well design (proposed casing program, proposed cementing program, etc.) by the Michigan Department of Environmental Quality (DEQ)
  - b. Staffing of the DEQ (academic training, professional certifications, field experience, etc.) with the ability to review well design and construction
  - c. Construction of at least two wells (cementing, casing, etc.) that have now been drilled in Michigan
7. Bill Rustem reported a long history of safe practice of hydrofracking in MI. To what extent are industry practices different or changing from earlier period - is it moving in direction of more or less safety viz. public health and protection of environment? Are modern practices "not your father's Oldsmobile?" (so to speak) --- Advocacy groups assert that the practice is quite different -- number of wells, scale of wells, intensity of traffic/transport, quantity of water diverted and tainted, toxicity of fluids put into the ground...
8. Shale plays suffer from the law of diminishing returns. Wells experience severe rates of depletion, belying industry claims that wells will be in operation for 30-40 years. For example, the average depletion rate of wells in the Bakken Formation (the largest tight oil play in the US) is 69% in the first year and 94% over the first five years. More than 80 percent of tight oil production is from two unique plays: the Bakken and the Eagle Ford. Together the Bakken and Eagle Ford plays may yield a little over 5 billion barrels – less than 10 months of U.S. consumption. As a result of these realities – high depletion rates, the need to drill ever more wells to maintain production, decreasingly productive wells as the best locations are drilled and depleted how can we in Michigan justify the heavy use of our most potent resource WATER?
9. Do you intend to do a review of best practices used by other states in data based regulations and transparency for high-volume hydrofracturing?
10. In my study to prepare to write and lecture on the short history of high-volume hydrofracturing (hvf) in Michigan I have been impressed by the early work of the Michigan

Department of Environmental Quality (MDQ) in their consideration of regulations and procedures needed for hvf in Michigan. However, since the time of the MDQ's study and orders on hvf, other states have adopted practices and regulations that represent best practices in data based regulations and transparency for hvf. Some examples of best practices now established by other states for hvf are:

- Pennsylvania has adopted regulations that strongly encourage companies that are planning hvf wells to conduct testing to establish a base line for water quality adjacent to the hvf well site before hvf is done. Michigan has no comparable regulations to encourage the testing of water to establish a base line of water quality prior to the time hvf is done.
- Colorado has adopted regulations on the disclosure of chemicals that assist greatly in making hvf operations transparent. The Colorado rule requires chemical information to be made available on a website that allows people to search and sort data by company, chemical ingredient, geographic area and other criteria.
- The states of Mississippi, Montana, Oklahoma, Texas, Pennsylvania, North Dakota, Louisiana, and Colorado have mandated that chemicals used in hvf be posted on FracFocus. FracFocus is a website designed expressly for the disclosure of chemicals used in hvf. In addition to providing information on chemicals, the FracFocus website provides a great deal of information to inform the public on hydrofracturing. Michigan presently posts individual Material Safety Data Sheets (MSDS) that list some of the chemicals being used for hvf on a difficult to search website. MSDS prepared for the disclosure of the chemicals used for single truckloads of chemicals do not inform the public on hvf.
- Texas has established explicit guidelines that a company must meet to substantiate the claim that a chemical a company is using in hvf is a trade secret and therefore should be exempt from being disclosed to the public.

11. I wonder whether there is a position re whether there is any actual net reduction in CO<sub>2</sub>/GW when all the ancillary release of methane is taken into account?

Thanks.

### **Geology/Hydrodynamics**

1. In addition to the issue of earthquakes that have been associated with waste injection wells, will you also be reviewing the incidence of earthquakes that have been noted in hydraulic fracturing operations (in the Bowland Shale) in the United Kingdom?
2. The State does not have an integrated, sophisticated, online, publicly available system -- nor is it audited -- per Hal Fitch DEQ at the W Bloomfield town hall meeting. He noted, it was based on 'stream flow'. How can that be, when we know lakes Huron and Michigan are now the lowest in history?
3. The frack water, also known as slippery water or brine, is permanently injected into 'disposal wells'. On average 5 million gals of fresh water are required per well, however; In October 2012, FracFocus notes 42 million gallons went into FRACKING 2 wells in

Kalkaska. This contaminated water cannot be returned to the water table, ever. How can this be insured? Or is leaking just a matter of time? With these volumes of water being removed from the hydrologic cycle permanently, along with record drought and heat, how can we afford this water waste?

4. If fracking waste water is deeply injected into wells and is never returned to the 'water cycle', is there a danger of our losing too much fresh water for general use.
5. I'm worried about the long term effects of injection wells.
6. In Michigan we are in the 15th year of a drought that may continue into the future. Do any of the panelists know how much water is available, that is not consumed by humans directly or for agricultural/industrial uses? Generally 2-6 million gallons of water may be used to frack a well. A well may be fracked up to 18 times. For instance approximately 1500 horizontal wells fracked in 2011 in Pennsylvania used about 12-20 million gallons of water per day for Marcellus Shale drilling, which represents approximately .5-.8% of the 9.5 billion gallons of water the state uses daily.
7. As a geologist, I was both encouraged and discouraged by the comments on the geologic work that is going to be undertaken in your work on hydraulic fracturing in Michigan. I was encouraged and impressed by the scope of the work your group has undertaken to explain the geology of Michigan to the public. I was discouraged given my understanding of the time and resources it will take to accomplish the task your group has undertaken. I would suggest one possible work reduction item for your study. Several questions that were offered in the response to yesterday's presentation represented concerns about Class II disposal wells in Michigan. Class II disposal wells in Michigan are usually characterized as deep wells with two (not one) regulatory bodies looking after them. In my limited review of Michigan's Class II Wells, I have found them to be old and shallow with very little regulatory oversight.
8. I would make one other comment in response to a comment by one of your presenters yesterday that the volume of fluid generated by high-volume fracturing will be greatly diluted by other oil field brines that are being disposed of in Michigan. Should oil and gas companies find the critical mix of hydrofracturing techniques and hydrocarbon prices for a given formation in Michigan, thousands of wells will have hydrofracturing treatments. Because companies will want the cheapest hauling costs, the waste from these wells will be hauled to the nearest disposal well and not be distributed equally to all of Michigan Class II wells. Don't count on dilution to solve the problems of waste from high-volume fracturing.

## **Environment/Ecology**

1. OK - WHY is removing our water, and adding chemicals or contaminating it as brine, NOT considered pollution? Just because it is injected deeply does not mean that water wasn't polluted? Nice to protect surface water & run-off, etc., but it's ignoring the main thing: a

destruction of our future resource in favor of profiting off another. If there is a potential for better technology using less water... let's WAIT!

2. As probably many people are, I'm worried about the impact of this type of drilling especially in an area where the water table is so important to our ecology.
3. Since the staffing of the DEQ is so minimal, will the study include the feasibility of proper monitoring of the drilling and disposal wells. And will the study include how the "water assessment tool" is being used and is who is keeping track of the water used and where and the effects on local water?
4. Will the accuracy and overall quality of the Water Withdrawal Assessment Tool be assessed in this effort? Perhaps in cooperation with Water Resources Advisory Council?
5. In your work do you intend to evaluate the radioactivity in formation waters produced from high-volume fractured (hvf) wells in Michigan and the suitability of Michigan's Class II Disposal Wells to receive fluids from hvf wells? The Michigan Department of Environmental Quality in November of 2012 received an analysis of the radioactivity of the formation water from the Utica / Collingwood in the hvf St. Excelsior 1-13 HD Well. This analysis showed a total of 4,615 pCi/L radioactivity from radium 226 and radium 228. The Environmental Protection Agency has established the permissible level of radioactivity in drinking water from radium 226 and radium 228 at 5 pCi/L. Oil field wastes are disposed in Class II Disposal Wells which while in operation in Michigan currently have no federal or state radiological regulations and are only required to pass a test of well integrity once every five years.
6. For yesterday's session I posed the question of radioactive formation water from high-volume fractured wells being disposed of in Class II wells (my specific question is given below). Although your group could certainly review this topic, an alternative exists. Historically Michigan has dealt with the problem of natural occurring radioactive material (NORM) in oil field wastes by the Supervisor of Wells conducting a technical evidentiary hearing. A hearing of this type was held in 1992 and determined that NORM levels detected from formations that were producing oil and gas in 1992 were not an immediate threat to public health and safety (Supervisor of Wells Order No. 3-6-92 and Order No. (M) 1-6-92 dated November 3, 1992). If your group would make an early determination that a technical evidentiary hearing is the responsible way to deal with the question of radioactivity associated with the new Utica / Collingwood production, the data collection for this investigation could proceed as part of the evidentiary hearing process and hopefully the radioactivity issue could be dealt with in a timely manner without your group having to devote your resources to working on the investigation. Referring the radioactivity investigation to another venue, would free up your group to investigate the more general topic of Class II wells.
7. NY Is banning this practice since there is a concern for their ground water contamination. Explain why we are doing it here in Michigan when they are banning it in New York? One mistake and our water quality is ruined FOREVER. My second question is why are we using

our fresh water resources here ruining millions of gallons of precious water when we are in a drought currently, and our lakes are at low levels as is?

8. It was mentioned several times by members of the committee that much is unknown about the short and long term effects of horizontal hydraulic fracturing. Why isn't there a moratorium on this process until the EPA's study and your study is completed. This is what New York has done, and seems to be the only safe way to proceed at this time.
9. As seen in the states of NY and VT..... Will all components of this committee be at least aware of the rationale used by these states in making this decision (to hold moratorium for 1 yr periods at a time)?
10. To what extent will the analyses (particularly health and environment) look at cumulative impacts both in terms of density of drilling and over time?

## **Human Health**

1. Will there be attention given to the LONG TERM health impact on Michigan residents over the next 25 to 50 years or longer? Specifically, I am thinking in terms of spills, illegal dumping, and failure of the cement / steel pipe of long abandoned wells which may allow produced water from the area being hydraulically fractured to potentially contaminate the fresh water resources on which Michigan residents depend.
2. Is anyone looking at the increased transportation (of water, trucked oil or gas, construction supplies, etc.) effects on air pollution, roads, and increased traffic?
3. What is the comparative advantage in carbon footprint of natural gas using fracking over coal; over tar sands oil? diesel?
4. In 2005, the Bush/ Cheney Energy Bill exempted natural gas drilling from the Safe Drinking Water Act. It exempts companies from disclosing the chemicals used during hydraulic fracturing. Essentially, the provision took the Environmental Protection Agency (EPA) off the job. It is now commonly referred to as the Halliburton Loophole.  
What is the Safe Drinking Water Act? In 1974, the Safe Drinking Water Act (SDWA) was passed by Congress to ensure clean drinking water free from both natural and man-made contaminants. First Michigan has an obligation and legacy protecting the water so can we regulate what we don't know? As a statement we have a right to know and understand the chemical nature of the fluids used in fracking. How do the panelists view exposure to humans and the environment and disposal of chemical fluids after the use?
5. For each frack (event), 80-300 tons of chemicals may be used. Presently, the natural gas industry does not have to disclose the chemicals used, but scientists have identified volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene and xylene. The gas comes up wet in produced water and has to be separated from the wastewater on the surface.

Only 30-50% of the water is typically recovered from a well. This wastewater can be highly toxic. What is done with the wastewater? Evaporators evaporate off VOCs and condensate tanks steam off VOCs, 24 hours a day, seven days a week. The wastewater is then trucked to water treatment facilities. Most treatment facilities cannot process the chemicals in the wastewater. What are the solutions and who shall pay for them?

6. Your presentation of what you're researching and how you'll do it is fine. But we have found that actual information - for instance chemical make-up and such - has been very very limited and hard to come by from agencies that should have more hard data.

### **Policy/Law**

1. But we have found that actual information - for instance chemical make-up and such - has been very, very limited and hard to come by from agencies that should have more hard data.
2. We know that MI has much land that has "lacy" rock so is a possibility for fracking. Our concern is for the water sources - streams, rivers - and a huge Great Lake. If millions of gallons are needed for each drill that will use up lots of water very quickly. Michigan's Great Lake, and her streams, are a major source of income and recreation. How will that be protected?
3. Quick question on the legal review; will you be considering:
  - a. impacts on the public trust resources of the state?
  - b. disjointed nature of the permitting and site review between responsibilities that are scattered between DNR and DEQ for state leases?
4. Will the legal aspect of the IA cover the practices used by the oil and gas companies to obtain leases from individual landowners?
5. When there is a problem with groundwater as a result of these industrial processes - how will they be remediated, and using what funds (who pays, what insurance)? What sorts of danger are communities and the environment at risk for? Who will monitor for safety? Who will monitor in advance of and after any contamination event? How do we assess these risks and their costs? In what terms?
6. Will you include in your study the Legal Analysis by the National Wildlife Federation called Hydraulic Fracturing in the Great Lakes Basin: The State of Play in Michigan and Ohio.
7. Despite talk of no pollution, fracturing still uses large quantities of water, which is no longer safe in the ecosystem. Does it pull down the aquifer? Is it protected under the Great Lakes Compact?

## **Economics**

1. Will your study include detrimental impacts to the economy, such as loss of property values? I spoke with a man who can no longer use his cottage because of the noise near Atlanta, MI.
2. The exciting new advances in green energy would also create jobs, so will the economics study cover the effects on community change? For example, Williston ND cannot provide infrastructure and is over-run with drug problems.
3. Will the economic analysis look at the potential impact of current and future natural gas prices on expansion of drilling in Michigan? For example will you look at scenarios related to approval or disapproval of proposals to export liquid natural gas?
4. How do we evaluate the costs and impact regarding transportation and pollution and other impact from transport in the complete process/cycle of hydrofracking? That is - transport of all items to and from the wells and to market, and to points of disposal - costs of fuels, level of air pollution from this activity, level of impact to local infrastructure and quality of life, ratio of these costs to the amount of "energy" obtained from the process and to the economic value of this output? How does this compare with other energy development (for other types of energy)?
5. According to the Energy Information Agency (EIA) natural gas prices are low, production is high, and storage is at a record high. Is the study going to consider the financial return to the people of Michigan both from leasing and royalties that will necessarily bring in less revenue given the above conditions? For example, why is the State of Michigan leasing/allowing development of public lands at a time when the people of Michigan would be compensated so poorly? Generally, the private sector leaves oil/gas in the ground when prices are too low, shouldn't the State of Michigan as well?
6. Who is going to reimburse land holders if their ground water is ruined? Who is going to stand behind the purchase of their land that they now cannot sell because of this contamination? Who is Responsible?

## **Social/Public Perception**

1. This is a huge problem, given most citizens do not fully understand the issue. Education is needed, using actual numbers (gallons, feet, etc.); real photos (not drawings); naming chemicals involved including proprietary (not simply referred to as 'additives') , so Michigan residents make a truly informed choice.
2. Regarding public perception -- for many, this is derived from films such as Gasland, etc. Have there been instances where drinking water has been affected in Michigan -- well water, etc.?
3. So much misinformation and fear rules the public mind as was evident at the town hall meeting in W. Bloomfield last week.
  - a. What is the plan to obtain extensive participatory comments?

- b. What is the plan for educating the public about fracking, water and waste water, air, restoration, etc.?
- c. As a member of ASTM committee forming standard for the subject of fracking, I would like to know.

<b>Comments By County</b>	<b>Comments By Organization</b>
Washtenaw: 5 Wayne: 5 Grand Traverse: 2 Leelanau: 2 Oakland: 2 Allegan: 1 Highland: 1 Kent: 1 Livingston: 1	Ban Michigan Fracking Ecology Center Giffels Webster Izaak Walton League League of Women Voters (2) Northern Michigan Environmental Action Council Optimal Value Energy LLC Tip of the Mitt Watershed Council University of Michigan West Michigan Environmental Action Council