Thank you for the opportunity to comment on this well-constructed scoping document. Unfortunately, I only learned of its existence several days ago, so I have not had the time to provide a more comprehensive review. In addition, I'll primarily limit my comments to the topics of human health and ecological risk. Recognizing that this document refers to an HIA, I'll try to avoid the discussion of quantitative risk assessment. Finally, time constraints did not allow me to include literature references, which I can provide at a later date, if necessary.

First, I'll comment on a few matters of general interest:

1) The authors focus almost exclusively on the fracking fluid additives, which constitute between 0.5 and 2% of the total mixture. There was little discussion of hazards associated with effluent leaks and other possible contamination of the post-drilling process.
2) There are several statements and bar graphs shown in which the authors report higher levels or incidence rates, without a complete analysis of the data. For example, on page 29, they discuss another UNGDP study, where they indicate that [the median air concentrations] of benzene were 2.6 ug/m^3 (range 0.9-69 µg/m^3) and 0.9 µg/m^3 (range 0.1-14 µg/m^3) at points <= 0.5 miles from the well pad and points >= 0.5 miles from the pad, respectively. Given the large variability in these findings, I believe that the statement that the benzene concentrations were "significantly higher" nearer the well is premature. A t-test or non-parametric test, as appropriate, should be conducted to validate the conclusion.
3) When illustrating cross-regional differences in the bar graphs, the authors would be well served to maintain the same color scheme throughout. The fact that they sometimes change the region represented by each color is confusing.
4) Comparisons of studies across geographic regions must be tempered by a knowledge of the baseline conditions in each region. For example, divalent cation and radioactive metal concentrations are typically (but not always) higher in the Rocky Mountain states.
5) Finally, you may want to emphasize that it's to the industry's advantage to comply with the document's recommendations now rather than later. As more complete fracking impact assessment data are made available, the industry may be faced with even greater costs related to increased toxicity testing or reverse engineering requirements.

Now I'll comment on specific findings and conclusions within the document:

1) The use of 25% and 75% extraction scenarios (p. 31) is an excellent method for assessing the range of probable impacts.
2) Given the elevated air emission HQ findings of residents near well sites (p. 36) and the increased incidence of smoking in the two counties of concern (p. 144), further discussion of the relationship between these two findings, especially with regard to co-carcinogenicity and effects of PM2.5 exposure in smokers, is warranted.
3) Similarly, the relationship between findings of neonatal and childhood impacts in near-well residents (pp. 36-39), and infant mortality (pp. 153-154) should also be considered. Although inadequate health care is a contributory factor to infant mortality, contaminant exposure to teratogens or contaminants that delay fetal development may exacerbate the issue. If known teratogens are found the fracking mix, previous research and/or risk assessments should be consulted, and exposure scenarios should be considered.

4) Although not directly a toxic effect, I think that the authors should emphasize that, in addition to the massive amounts of water used in these operations, that freshwater is a dwindling resource that few species can live without.
5) Fig. 10-11 is a good concise diagram of water contamination pathways. Does the reuse box refer to spills during the recycling process?
6) The authors' point (p 45) on monitoring radionuclides other than radon is well-taken. They may want to further indicate that carcinogenicity and chromosomal aberrations are the chief hazards of concern for radioactivity exposure. Cells that frequently undergo mitosis, which is much more common in children, are the most susceptible. Overall, systematic statements about acute and chronic effects are difficult because of differences in the radioisotope (or combination of radioisotopes) involved, the exposure level in rems, distance from the source, and the types of radiation produced. Nevertheless, the EPA has provided a useful guideline (http://www.epa.gov/radiation/understand/health_effects.html) of threshold exposures at exposure levels ranging from 5 to 2000 rems.
7) The Fernow Experimental Forest application is interesting because it found severe community-level effects after being exposed to fracking fluid levels that were within regulatory guidelines. With respect to further ecological analysis, I would suggest that two or three exposed target species be tagged to get a better understanding of movement, eating, drinking, and spawning behaviors . In particular, these species, such as deer and grouse, should be part of the human food chain. The results of this study can then be compared to measured concentrations of fluid components in land, water, and air, to provide a measure of potential impact to these species.
8) If a stream system may be compromised by the results of fracking operations, damage to the stream system itself, water column species, and organisms bound to sediment may be at risk. I would suggest a search of the literature to find relevant studies that address this issue.
9) The EPA has a long history of guidelines and references regarding the risk of cumulative exposures (Sect. 10.3.7). In addition, the IPCS (http://www.inchem.org/documents/harmproj/harmproj/harmproj7.pdf) have introduced a series of models that could be useful for assessing combined exposures to multiple chemicals. The authors may want to review these sources and make reference to them in Sect. 10.3.7.
10) Several fracking studies have found families of contaminants in which toxicity data is unavailable for all but a few. A classic example are the PAHs. The authors may want to recommend the use of Decision Trees or Quantitative Structure-Activity Relationship to estimate the hazard potential of these substances, and to suggest where additive or multiplicative effects are in place. Of course, this proposal assumes that the industry is willing to name the constituents of the fracking fluid, and allow technicians to monitor soil, air, and water samples post-drilling.
11) With reference to H_2S exposure (p 80), the authors may want to note that the gas is odorless but lethal at higher concentrations. This property has led to the deaths of several occupational workers.
12) The CGDP provides an excellent overview of industry and health group requirements to ensure a safer fracking experience.
13) The authors may want to include studies of air flow modeling for the most offensive airborne contaminants. (R19, p. 92).
14) The authors may want to change the text in R24 (p. 93) to 'Periodic soil **and sediment** monitoring should be conducted…'

15) In Sect. 12.7.2 (p. 96), it may be wise to employ community-based educators who can hold modular sessions on the fracking process and associated health impacts. This issue is partially addressed in R41.
16) In section 15.4.1 (p.136), I think that a stronger statement needs to be made regarding the monitoring of groundwater for fecal indicator species, and how elevated levels should be treated.
17) For Fig. 15-11, p. 138, the TRI results should be normalized by population in each region.
18) The authors appear to be misstating the facts in Sect. 15.4.3. According to the bar charts of Figs. 15-12 and 15-13, the state of Maryland is leading in both cancer risk and the RHI. Either the bar charts or the authors' conclusions need to be modified.
19) In Sect. 15-5 (p. 141), the term 'region' should have been defined earlier in the document.
20) Both Allegany and Garrett counties have high life expectancies, compared to Maryland. This finding may at least partially explain the elevated cardiovascular and cerebrovascular deaths (Figs. 15-22 and 15-23, p.151) in these two counties, compared to the state.
21) In Appendix A, the authors have a tendency to state that one locale has a higher incidence than another, when, in fact, the heights of the two bars are virtually identical. This tendency is particularly noticeable in Figs. 15-15 (p. 143), 15-19 (p 148), 15-25 (p 153), 15-26 (p 154), and 15-27 (p 154). I would suggest that the authors run chi-square tests on the results, to verify which comparisons are statistically significantly different.
22) With regard to deaths from individual causes I found it curious that Allegany had larger (sometimes much larger) mortality rates than Garrett (Figs. 15-18a, 15-18c, 15-18e, 15-18f, 15-19, 15-20, 15-21, 15-22, and 15-24). Yet the All-Cause mortality rate (Fig. 15-25, p 143) between the two counties is virtually the same. I would recommend further investigation as to why mortality rates for individual disorders differ between the two counties.

Charles Shore
M.S., Toxicology
Gaithersburg

When you consider introducing HVHF to this rural community, you must access the negative consequences that will occur. Western Maryland is an isolated local without the advantage of adequate healthcare system that are predominate in the Washington metro area. Even, without acknowledging the actual dangers that may occur if fracking is introduced to the region, we know that there will be an extreme increase of traffic. Numerous trucks carrying toxic chemicals, will be traveling down rural roads. You can count on accidental chemical spills, and the stirring up of dust and gravel. Consequently, expect a monumental increase in respiratory decease and many other related health problems.

Another issue is the effect on the local economy. The tourist industry is the major source of income for Western Maryland residents. This area is famous for its pristine wilderness, enjoyed by many vacationers, and revered by environmental activists.

Is the need for HVHF that great that we can risk the disruption of the livelihood of the citizens of this region, and the destruction of a beautiful wilderness area?

From: hlast1@verizon.net
Sent: Tuesday, September 09, 2014 9:06:25 PM
To: governor.mail@maryland.gov
Subject: Contact Gov Form [Environment Issues] Chemical Disclosure when Fracking for Natural Gas

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NAME
Howard Last

ADDRESS
6473 Skyward Court
Columbia, Maryland
21045
Phone Number: 410-381-8478
Original Message:

Dear Governor Oâ?TMalley;
We are writing to ask you to support a common sense proposal on chemical disclosure in the event that Maryland authorizes the extraction of natural gas through a process of known as hydraulic fracturing. Our proposal is designed to protect the health of Maryland families and to bring transparency to the oil and gas industry.
Our proposal has six important elements:
1. Chemical formulas and other agents injected into our environment must not be subject to disclosure restrictions under trade secret regulations.
2. Drilling operators must report the chemical ingredients and concentrations they use to a publicly accessible on-line database managed by the Department of Health and Mental Hygiene (DHMH).
3. Drilling companies must provide comprehensive data to DHMH, including toxicological profiles and epidemiological evaluations of chemicals and agents used in the production of natural gas, in addition to information on chemical changes that may occur as a result of the hydraulic fracturing of the well, including information on chemical reactions to other chemicals or substances.
4. Maryland would establish a process to ensure that health professionals could expeditiously obtain and share information needed to treat patients and to report public health concerns.
5. Maryland would prohibit non-disclosure agreements between drillers and local residents that restrict the ability of residents to discuss environmental or health issues associated with natural gas production.
6. Hydraulic fracturing companies would pay for the costs of these programs through permitting fees.
We applaud the Maryland Department of the Environment (MDE), Department of Natural Resources (DNR) and Department of Health and Mental Hygiene (DHMH) for working closely with the various interest groups in the development of best management practices (BMPs) for hydraulic fracturing in Maryland. However, the draft BMPs continue to create unnecessary barriers to understanding the potential health risks caused by the injection of hydraulic fracturing chemicals into the environment.
The risks posed by these chemicals are not hypothetical. A hydraulically fractured gas well typically requires between 60,000 and 100,000 gallons of chemical additives to be injected into the ground. Some of these chemicals are known or suspected carcinogens, endocrine disrupters, neurotoxins, or otherwise toxic to humans. In many instances, there is little or no information on the health effects of the chemicals being used. Evidence indicates that hydraulically fractured wells are leaking at unacceptably high rates, and these leakage rates will increase over time.
We appreciate your attention to this issue and hope that you will support this common sense proposal.

Sincerely,

Howard Last

October 3, 2014

The report of potential hazards and already experienced hazards described in earlier studies and cited, be they in air pollution, water contamination and hazards to human health, frighten me a great deal. I intend to take a biking excursion in Western Maryland this fall and being in nature, cycling, hiking and camping is one of the most important aspects of my life. I would want to know that we are protecting our Maryland natural treasures, so that all people can enjoy them for many, many generations to come. Of course the livelihoods and health of the current residents of our westernmost counties should not be sacrificed, and the possibility of having jobs and having a healthy life are not at all mutually exclusive. If we work to have green energy sources used and produced in those counties and other counties, service jobs and new jobs in emerging green energy companies and state agencies can be created. We don't have to make the residents there feel that they must choose between jobs and health. That is also true for the people of the state of Maryland in general.

I also am very concerned for the people who often end up taking jobs in toxic environments. The study did not address the health risks of the likelihood of increased methane in the environment as one respondent noted. The very necessity of so much monitoring and attempts to safeguard underground water sources by separations in boundaries makes it painful to contemplate. Doesn't all this indicate that cleaner available sources of energy should be used and extractive activities be avoided? If the health of the residents will need so many armies of health workers to arrive to offset the hazards, doesn't that signal that fracking should not be approved?

Comments on "Potential Public Health Impacts of Natural Gas Development and Production in the Marcellus Shale in Western Maryland"

Rebecca Rehr, MPH

My employer, The Maryland Environmental Health Network, is submitting comments to which I was a major contributor. I would like to take this opportunity to submit comment as an individual. As part of the public health fellowship I just completed at the U.S. Environmental Protection Agency in the Office of Children's Health Protection, I learned a lot about the social determinants of health and I am choosing to focus my comments on the relevant subjects in the public health study.

The study authors from the Maryland Institute of Environmental Health (MIAEH) should be lauded for their efforts in completing this study on such a tight timeline with limited resources. As a graduate of MIAEH, I am proud of their work and their contribution to making Maryland the first state to complete a health study before allowing fracking. In seven of the eight major research areas, the team found a high or moderately high likelihood of negative health impacts associated with Unconventional Natural Gas Development and Production (UNGDP). This evidenceseems to be sufficient to answer, "No" to the question, "Can UNGDP be done safely?"

There are several topics in the study that merit further analysis and call for more resources to collect adequate and accurate data to address potential adverse health effects associated with UNGDP. I think concerns about air quality, water quality, and chemical disclosures are incredibly important, but will be well covered in others' comments. One issue that may be underrepresented in public comments is social disruption and resulting health outcomes, particularly an anticipated increase in sexually transmitted infections (STIs). Study authors draw upon several reports citing increased incidence of STIs in areas across the country where UNGDP is currently underway [emphasis added]:

> In heavily fracked, rural counties in Pennsylvania, the average annual number of gonorrhea and chlamydia cases increased by 32.4% while the average annual number of the same cases in non-fracking counties only increased 20.1 percent from the previous year. Comparing the two, **the most heavily impacted rural Pennsylvania counties had a 61% greater increase in STI rates than counties without UNGDP**. This phenomenon is not unique to the Marcellus Shale area. In UNGD regions in North Dakota, doctors are treating more chlamydia cases. Furthermore, this region reported increased sexual and domestic assault rates and local women feeling increasingly unsafe. Overall, in communities with UNGD operations, a trend has emerged with increases in arrests for both crime and substance abuse and STIs corresponding to periods of increased natural gas development.

While the study team brings attention to these alarming statistics, they do not address solutions or preventive measures in their recommendations. Oil and gas development in the Bakken region of North Dakota created a population boom (mostly males) for which there was insufficient social and physical infrastructure. Well-documented consequences have included increases in violent crime, drug addiction, increases in STIs, and rape involving male and female victims. Where there is a boom, there is a bust. Not only are we seeing what is happening during boom times in North Dakota, but we can see effects of the resulting bust in the hills of West Virginia. These areas, once bustling coal towns, are now some of the most impoverished communities in the nation. UNGDP disrupts not only ecosystems and public health of communities surrounding the wellpad, but also the social cohesion in the surrounding community. Fracking should not begin in Maryland until measures are put in place to prevent the same things from happening in Maryland.

Thank you again to the MIAEH team for their work and to DHMH for the opportunity to comment. Study authors discuss several important public health issues associated with UNGDP, including air quality, water quality, and chemical disclosures. My comments focused on the need to address anticipated adverse effects on the social determinants of health, including increases in STIs and violence.