DRAFT for Public Comment

Detailed Scoping Report: Potential Public Health Impacts of Natural Gas Development and Production in the Marcellus Shale in Western Maryland

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Glossary of Terms

There are various types of monitoring that will be discussed in the report. Monitoring is used to establish baselines and to identify trends. The definitions below outline the differences between types of monitoring.

- **Ambient air monitoring** is the periodic or continuous measurement of outdoor air pollutants, often sampled at a fixed location.
- **Biological monitoring (Biomonitoring)** is the measurement of toxic chemical compounds and/or their metabolites in the body using blood, urine, saliva, adipose tissue, breast milk, exhaled breath, hair, or nails.
- **Dose** refers to the amount of a toxin present in the body.
- **Environmental monitoring** is the sampling of environmental media (air, water, soil) to assess the overall quality of the environment**.**
- **Exposure** occurs when a person comes in contact (through inhalation, ingestion, and/or dermal exposure) with a pollutant or mixture of pollutants that are present in the environment.
- **Exposure monitoring** is the use of personal monitors to determine an individual's exposure to a contaminant. Examples of exposure monitoring include a personal air sampling pump, carried on a belt or small backpack, connected to a filter or sorbent tube with an inlet in the wearers breathing zone, a passive air sampling badge, or a patch worn on the skin. The filter, badge, or patch is later analyzed for the chemical to be monitored. Sometimes surrogates or indicators are used to estimate personal exposure.
- **Hazard** refers to a chemical or physical agent that is likely to cause adverse health effects.

1. Executive Summary

On October 18, 2013, the Maryland Department of Health and Mental Hygiene (DHMH) signed a memorandum of understanding (MOU) with the Maryland Institute of Applied Environmental Health (MIAEH), School of Public Health, University of Maryland, College Park to conduct a health assessment (assessment) on the potential public health impacts associated with drilling in the Marcellus Shale in Maryland. The first phase is to identify the scope of the assessment. This detailed scoping report presents the results of that first phase including a summary of stakeholder concerns, the scope for the assessment, and the project timeline.

The scoping phase centered around two public stakeholder engagement meetings and a review of public comments received from the Maryland Department of the Environment (MDE) on drilling in the Marcellus Shale in Western Maryland. Ten themes emerged during the stakeholder engagement meetings: air quality, water quality, baseline health assessment, healthcare infrastructure, occupational issues, secondary impacts, climate change/weather, benefits, populations of concern, and zoning. Economic impact emerged as an additional theme during our review of the public comments.

Based on stakeholder input and the charge from DHMH, the scope the Baseline Assessment and Impact Assessment deliverables were refined. The Baseline Assessment will include demographics and factors critical to understanding population vulnerability including: unemployment, ownership of mineral rights, proximity to pre-existing vertical gas wells, and drinking water source. It will also include assessment of the healthcare infrastructure and major causes of morbidity and mortality in Garrett and western Allegany Counties.

The Impact Assessment will include water and air quality, noise, public safety, social determinants of health, mixed and cumulative exposures, vulnerable populations, and data on baseline environmental exposures, population health, and data gaps. Economic, climate change related, and occupational impacts, three areas of concern identified by stakeholders, will not be included in the public health assessment. However, secondary impacts associated with the economic benefits (i.e., the impact that jobs may have on health) will be examined and occupational exposures will be used as a means to understand the potential for broader public health impacts and community exposures. The Impact Assessment will provide estimates of the health consequences of allowing horizontal drilling and high volume hydraulic fracturing, under a range of realistic economic and regulatory scenarios, for the Maryland Department of the Environment (MDE), the Department of Natural Resources (DNR), and the Marcellus Shale Advisory Commission to use in making policy recommendations. The Final Report will draw on the baseline and impact assessments, and will focus on two types of recommendations: 1) Exposure and health monitoring and assessment programs to be carried on during and after extraction operations and 2) Public health responses and mitigation strategies to minimize negative health impacts and maximize health benefits of natural gas extraction using horizontal drilling and high volume hydraulic fracturing (HVHF). The final report and its recommendations will not recommend for or against expanded natural gas extraction using HVHF – it will merely estimate, to the extent possible, the health impacts of policy options by comparison with not allowing expanded natural gas extraction.

2. Introduction

On June 6, 2011, Governor Martin O'Malley issued Executive Order 01.01.2011.11, establishing the Marcellus Shale Safe Drilling Initiative (Initiative). The Initiative's purpose is to assist state policymakers and regulators in determining whether and how gas production from the Marcellus Shale and other shale formations in Maryland can be accomplished without unacceptable risks to public health, safety, the environment, and natural resources. On October 18, 2013, the Maryland Department of Health and Mental Hygiene (DHMH) signed a MOU with the Maryland Institute of Applied Environmental Health (MIAEH) at the University of Maryland, College Park to evaluate the potential public health impacts associated with drilling in the Marcellus Shale in Maryland. The study, as outlined in the MOU, will include:

- **Detailed Scoping**, including timetable for remaining deliverables, methods, and public input to determine study objectives.
- **Baseline Assessment** of current regional population health, including demographics, causes of morbidity and mortality, local health priorities, vulnerable populations, local healthcare and social service infrastructure.
- **Impact Assessment** of the potential exposures, including hazards and known health impacts both directly and indirectly associated with hydraulic fracturing, assessment of current exposures and data gaps prior to onset of hydraulic fracturing.
- **Final Report,** which will include the study findings, monitoring and assessment recommendations, and public health response and mitigation strategies.

The purpose of this scoping report is to describe the overall scoping process, the comments received by stakeholders, the specific topics to be considered in the subsequent phases, data sources and methods for the assessments, and provide a timetable for the health impact assessment. The public input was received through two public stakeholder engagement meetings and a review of public comments on drilling in the Marcellus Shale in Western Maryland given to MDE and the Commission. The stakeholder input and public comments were used along with a review of the issues identified in the MOU with DHMH to develop a list of specific topics to be investigated as part of this Public Health Impact Assessment. This detailed scoping report is organized into the following sections: 1) Executive Summary, 2) This Introduction, 3) Summary of Stakeholder-Public Input Process, 4) Summary of Stakeholder-Public Concerns, 5) Detailed Scope of Work.

3. Summary of Stakeholder-Public Input Process

3.1. Public Meetings

Two public stakeholder engagement meetings were held in Western Maryland to discuss community concerns with natural gas exploration and development. The first meeting was held on Tuesday, September 24, 2013 from 7:00 pm to 10:00 pm at Frostburg State University in Frostburg, MD. This meeting was attended by 29 local residents and activists. In addition to comments received during the meeting, participants were encouraged to submit note cards with questions or concerns. A total of 13 notecards were collected. The open dialogue of the meeting allowed attendees to express concerns related to the project. Ten key themes emerged: air quality, water quality, baseline health assessment, healthcare infrastructure, occupational issues,

secondary impacts, climate change/weather, benefits, populations of concern, and zoning. See Appendix 2 for the themes and an overview of stakeholder concerns from the September 24th meeting.

The second meeting was held on Saturday, October 5, 2013 from 1:00 pm to 4:00 pm at Garrett College in McHenry, MD. The format of this meeting was similar to the first meeting. The conversation was guided by the ten key themes that emerged from the September 24th meeting. This meeting was attended by 27 area residents. We received 8 notecards and 5 written testimonies.

The meetings were audio recorded and transcribed. Both meetings were open to the public and were advertised widely through press releases, radio and newspaper announcements, email blasts, and word of mouth.

3.2. Public Health Comments

MDE shared public comments related to health that were received during the comment period for the Marcellus Shale Safe Drilling Initiatives Best Practices Report. A total of 113 comments were received, and were reviewed and categorized according to the ten key themes. Economic impact emerged as an additional theme from these comments and natural disaster was added to climate change/weather. Many of the comments addressed multiple themes and were categorized accordingly.

Theme	Total Number of Comments
Water quality	99
Zoning	69
Baseline health assessment	67
Secondary impacts	65
Economic impact	63
Climate change, natural disasters, and weather	52
Air quality	43
Populations of concern	29
Occupational impacts	26
Healthcare infrastructure	25
Benefits	7

4. Summary of Stakeholder-Public Concerns

This section summarizes the concerns raised during the stakeholder engagement meetings, including notecard comments, personal statements, and meeting transcripts, as well as the public comments received from MDE. The issues are categorized by the themes that emerged during the scoping process and are ordered according to the total number of public comments received.

4.1. Water Quality

Water quality was a key concern that emerged throughout the public meetings and the public health comments. Issues can be organized into three distinct subcategories: water acquisition, chemicals used during high volume hydraulic fracturing (HVHF), and wastewater.

4.1.1. Water Acquisition

According to a report by Hansen, Mulvaney, and Betcher [1] on Marcellus Shale development in West Virginia and Pennsylvania, 4.3 to 5 million gallons of water are used to frack each well. Stakeholders voiced concerns regarding how this water would be acquired and the impact it would have on local water quality, availability, and cost. In addition, concerns were raised about how water will be stored and used by the industry.

Comments:

- "The water has to come from somewhere to be used in the fracking process. I learned this week that the City of Frostburg sold water to be used in wells in Pennsylvania back in 2009 and 2010. I mean if they're going to take water to be sold from the municipal supply from the City of Frostburg then it does impact me -- right away, up front, before anything else happens. And, so you have to deal with how much water is getting used right away at the acquisition level, what's the baseline that's needed for the population, etc."

4.1.2. Chemicals and Fracking Solution

Residents were concerned with the impact that hydraulic fracturing solution and chemicals would have on well water and municipal water supplies. Setbacks and buffer zones were discussed as one way to protect water supplies; suggested setbacks ranged from 600 feet – 4,000 feet. There is concern whether the buffer zones are adequate to protect individual landowners who may have their own private well.

To determine the impact that hydraulic fracturing may have on water, stakeholders discussed the importance of understanding baseline water conditions, especially for residents with well water. According to a local stakeholder, approximately 60% of residents and the majority of municipalities in Garrett County have wells. To ensure that landowners have a baseline of their well water quality, a stakeholder suggested that residents adopt a program similar to one in Ohio that trains landowners to conduct their own water testing and to certify the test results.

[1] Hansen E, Mulvaney D, Betcher M. (2013). Water Resource Reporting and Water Footprint from Marcellus Shale Development in West Virginia and Pennsylvania. Retrieved from http://www.downstreamstrategies.com/documents/reports_publication/marcellus_wv_pa.pdf.

An additional concern expressed by stakeholders at the public meetings was the potential for water contamination from traffic accidents involving trucks carrying hazardous materials.

4.1.3. Wastewater

There is concern with the routes that wastewater will travel and how people living along those routes will be protected from potential spills or accidents that could contaminate their water.

4.2. Zoning

Local zoning regulations was raised as an issue of concern by stakeholders because of the uncertainty regarding the adequacy of setbacks and buffer zones for well pads, especially for individual landowners. Stakeholders' suggestions for setbacks ranged from 600 to 4,000 feet.

Comments:

- "There is a clear discrepancy and gross unfairness in the setbacks for individuals versus municipalities, businesses, and institutions such as schools and daycares. The individual landowner deserves the same rights and considerations as any other entity."

4.3. Baseline Health Assessment

Residents felt strongly that it was important to understand the current health status of those living in Western Maryland. Stakeholders raised concerns with our ability to get an accurate depiction of the baseline health status due to a lack of secondary data. In order to fill this gap in the data, stakeholders suggested that we conduct a baseline survey to help understand the health status of local residents including cancer and non-cancer diseases, endocrine diseases, autoimmune disorders, diet, lifestyle, family history, chronic diseases, mental health, asthma and other respiratory diseases, and multiple sclerosis. There is concern that the current health status of impoverished and uninsured communities in Garrett County would not be captured by existing secondary data.

Comments:

- "We have a population of 30,000. We have a lot of elderly population; we have a lot of people with chronic conditions and multiple conditions, and CHF [congestive heart failure], COPD [chronic obstructive pulmonary disease], emphysema, asthma."

- "When we talk about poverty in Garrett County, we have a lot of folks that don't have health insurance, that don't even access health that are at-risk. Without them being able to be identified in some way, they can't get into your consideration."

- "When you start identifying your populations and you have this snapshot concept. Will you also be looking maybe 20 years or 30 years out? One of the things that's happening demographically throughout the county -- our population is aging; the millennial generation is migrating out of the county. So, for example, if there are health issues associated with the elderly and the snapshot now is 6% of the population, but it in 20 years, if gas drilling occurs, I will be in the population that may have those health needs of the elderly and that population may be greater in twenty years."

4.4. Secondary Impacts

The indirect, secondary impacts related to HVHF are of major concern to residents of Garrett and Allegany Counties. Residents' concerns included an overall disruption of what they considered to be a peaceful community, mental health and stress, noise, social impacts, and an increase in crime, diesel truck traffic, and destruction of roadways.

4.4.1. Peaceful Community and Mental Health

Many stakeholders are concerned that the "rural legacy" in Garrett County will be disrupted and potentially destroyed if HVHF occurs. Garrett County is a popular tourist destination for the region in both the winter and summer, and residents expressed concern that HVHF would negatively impact tourism. The peaceful rural landscape also attracts professionals such as healthcare providers; residents indicated that disruption to this peaceful community could affect their ability to recruit healthcare providers and other professionals to the area.

Mental health and stress was a key recurring theme throughout the public meetings. Stakeholders discussed the importance of understanding how the overall process of HVHF could impact psychosocial stress, mental health, depression, suicide, and anxiety. Many stakeholders expressed tremendous mental distress due to uncertainty about whether gas drilling and natural gas extraction would occur in their communities.

Comments:

- "Don't overlook the peace of living in Garrett County that would be disrupted and destroyed if fracking invaded our rural legacy--traffic and emissions, noise, air and water pollution."

- "Every time we see an ad in the paper for doctors to come to Garrett Memorial Hospital to work, three-fourths of the ad is touting our peaceful, relaxing, clean environment. If you talk to the doctors in the area, they say, 'I wanted to get out of the city, the urban areas, out of the violent areas, and come to a peaceful, rural environment.' That's a big draw and factor for our current medical community."

- "There's a significant amount of people that travel to our community from a broader regional area for peaceful relaxation. So it's a place where you can recharge. In my opinion, you have a great benefit of having a place where you can come and relax in a peaceful environment."

4.4.2. Noise

Garrett County residents stated that they enjoy the peaceful community and low noise levels. One concerned stakeholder discussed the noise level in the community during the day due to "normal and reasonable impacts" from their neighbors. Others expressed concern that noise from a well pad in the area will continue twenty-four hours a day, seven days a week. A key issue for many stakeholders is whether there would be any monitoring or enforcement of such noise levels, and which agencies would be designated to be responsible for the monitoring and enforcement.

Comments:

- "I sleep with my windows open whenever I can. This morning I woke up to the sound of bugs; maybe the cars I could hear out on Route 495 was one vehicle every half an hour. We have a really precious place here to live and we endure normal and reasonable impacts on the peaceful enjoyment of our property. Our neighbors' lawnmowers, farming, and a lot of us enjoy firearms. There are some afternoons my neighbor will get out and he'll be shooting in his backyard on his private range. I'll discharge my firearm also and pretty soon the whole neighborhood is enjoying it. But that doesn't continue 24-7. My neighbor has a skeet shooting range and on the weekends there's people over there shooting skeet half the day, but it ends. It's not in the middle of the night. If you have a drill pad for let's say three months, and if you have ten well pads, we could be talking 30 months, 24-7, non-stop disturbance of the peaceful enjoyment of my property and that is totally unacceptable in my opinion."

4.4.3. Social Impacts and Crime

The social impacts and the increase in crime due to the influx of transient workers into communities are being reported from across the United States. Communities where HVHF is occurring are experiencing increases in sexually transmitted infections, domestic violence, alcoholism, crimes towards women, and assault.[2]

- "Regional jobs seem to be growing in this industry, but as a rule, the Marcellus drilling industry is based on a labor drilling force that comes from TX, OK, etc. where there has been not only a culture developed, but a long expertise. That phenomenon has been a liability to the communities I have visited -- people in PA that I have been talking to -- there are lessons to be learned if you look at this as a regional phenomenon."

- "[A] Cornell study looked at the socio-economic impacts of transient workers on the local economy and communities. [Sexually transmitted diseases] STDs were subject to a large increase, domestic violence was subject to increase, alcoholism, a lot of other crime, but most of the crimes were crimes on people coming from the transient versus the local population. We're seeing a lot of things coming out of North Dakota with the transient workers there."

4.4.4. Truck Traffic & Destruction of Roadways

It is estimated that 500 to over 1,000 truck trips are needed to "frack" one well.[3] Stakeholders raised concerns with the increased amount of traffic and the damage that large, diesel trucks will have on the roads. The increased traffic is related to several other concerns, including stress, mental health, air quality, and healthcare infrastructure.

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[2] Food and Water Watch. (2013). *The Social Costs of Fracking: A Pennsylvania Case Study* (pp. 1–13). Retrieved from http://documents.foodandwaterwatch.org/doc/Social_Costs_of_Fracking.pdf.

[3] New York State Department of Environmental Conservation (NYSDEC). (2011). *Revised Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program - Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs.* New York. Retrieved from http://www.dec.ny.gov/data/dmn/rdsgeisfull0911.pdf.

Comments:

- "There's a significant amount of traffic, but probably from a health standpoint, it's the exhaust. I know more and more about exhaust, but diesel exhaust is sort of an under-recognized public health concern."

- "Hundreds of trucks traveling back and forth, truckloads of toxic chemicals, gasses and chemicals released accidentally or at 'approved' levels during the fracking/drilling process – all leading to gastrointestinal problems, skin problems, breathing problems, cardiovascular events."

4.5. Economic Impact

Economic impacts emerged as a theme during our review of the public health comments, and the issue of decreasing real estate values due to HVHF, in particular, was a concern raised by stakeholders at the public engagement meetings.

Comments:

- "This may well be our next bubble. Furthermore, much of this oil and gas will be for export, so local communities incur the damage and taxpayers get the bill, while industry profits abroad. Meanwhile real estate values fall in the vicinity of drilling sites and banks are beginning to rethink providing mortgages in these regions."

4.6. Climate Change, Natural Disasters, and Weather

There was concern with the impact that climate change, natural disasters, and seasonal weather changes such as icy roads during the winter would have on residents' health and healthcare infrastructure (See section 4.8. for more information on Healthcare Infrastructure). Increased traffic accidents have been reported in areas where HVHF is occurring;[4] stakeholders are concerned with the synergistic effect that weather will have on traffic accidents. Stakeholders are also worried about the impact of climate change on population changes, re-emerging health conditions, and healthcare capacity.

Comments:

- "Will you be taking into consideration the effects of climate change in the coming decades on Western Maryland? It may affect some of the health effects."

4.7. Air Quality

Air quality emerged as a critical concern during the stakeholder engagement meetings and throughout our review of the public health comments. Issues include diesel truck traffic and exhaust, the impact that drilling, HVHF, and compressor stations will have on local air quality, and the impact that HVHF will have on low-lying communities, such as Swanton, Kitzmiller, and Deer Park.

[4] Food and Water Watch. (2013). *The Social Costs of Fracking: A Pennsylvania Case Study* (pp. 1–13). Retrieved from http://documents.foodandwaterwatch.org/doc/Social_Costs_of_Fracking.pdf.

Comments:

- “Perhaps there can be a middle ground saying we'll allow a 10% degradation in our water quality and our air quality, but not just come up with something that's similar to an industrial zone or Baltimore City.”

- “Since there are some gases that are released, drilling should not occur while inversions are going on.”

4.8. Populations of Concern

Stakeholders expressed concern with how HVHF would impact various subpopulations -- farmers, land-owners, non land-owners, business owners, and vulnerable populations (children, women of a childbearing age, elderly with co-morbidities, immunosuppressed individuals, and individuals with low socioeconomic status). In addition to these populations, stakeholders identified small pockets of vulnerable individuals in the towns of Luke, Westernport, Kitzmiller, Deer Park, and Swanton. These areas were identified as having small populations of low income individuals who have limited access to resources such as healthcare.

Comments:

- “The comprehensive drilling plans: when you're looking at those being moved into some of the isolated areas where they have some of the higher at-risk folks, you're going to have what's been termed as "sacrifice zones," because those are going to be more heavily developed. They may be in lower lying areas, where you're going to be able to trap more of these gases and those impacts are going to be much more concentrated because of that. You're going to be decreasing the land use, but then you may be increasing the impacts in those specific areas.”

- “I know last time we had talked about some of the pockets of the community that don't actually have access, they don't have insurance, they don't have access to doctors because of finances. You know, we looked at some of the smaller communities that are here, like Kitzmiller or Deer Park, Swanton. There are areas there that folks don't receive this, so there are folks that aren't identified in these types of studies who actually may be more impacted from these types of activities. So we had talked about that and I wanted to see if we could keep on the track of bringing that to the forefront.”

- “I just wanted to make sure that there will be a study of the babies and following them as they grow and looking at their IQ and things like attention deficient hyperactivity disorder (ADHD) instance and other behavioral issues and general progression academically as well as toddler age and following them fifteen to twenty years and then long term studies on the impacts following children up through the years.”

4.9. Occupational Issues

Stakeholders expressed several concerns regarding the occupational health and safety of HVHF workers. Questions were raised about the current occupational standards and whether they ensured adequate protection for workers.

Comments:

- "Typically the canaries are the people that actually work in the industry with fracking fluids every day or in that environment every single day. I think that as you're evaluating this, those are the people you need to look at."

- "Do the jobs have adequate health protections in terms of safety?"

4.10. Healthcare Infrastructure

A top concern among stakeholders during the public meetings was the ability of the healthcare system to handle acute issues related to HVHF, including its ability to handle the influx of transient workers and to ensure adequate protections for emergency responders.

4.10.1. Healthcare Capacity

Garrett County is a medically underserved area with many uninsured residents and a shortage of medical providers.[5] As a tourist area, there are population fluctuations during the summer and winter months that impact the capacity of the healthcare system. There is concern that the influx of workers due to HVHF will overburden the system and that the current infrastructure cannot adequately support additional acute health emergencies such as injuries and accidents.

Stakeholders are concerned about how personal health issues related to HVHF will be handled and what organization will be the point of contact for reporting and monitoring.

Comments:

- "Even with the hospital right now, when we have a trauma patient, we are not a trauma center. The people that live in this community also know that Garrett County Memorial Hospital is not a trauma center, so if we have someone with a cardiac issue and needs a heart catheterization, or something happens, or has an acute heart attack, they are going to be stabilized here and most likely sent to Mon General in Morgantown, West Virginia or West Virginia University Hospital."

- "There's obviously quite a bit of a transient population. So the people that actually live in the county is about 30,000 people. In the summertime, it can almost double; also, in the winter time with the ski areas and you know injuries associated with skiing can tax the infrastructure as well. So there's no consistency. You can't really say the current infrastructure covers everything because the population changing due to different activities that are going on."

- "When you talk about something like Superstorm Sandy, we went to one meeting and the hospital stated clearly that they had no preparedness for that type of event. That storm paralyzed this county to a degree that they've never seen. I mean it was a very unique and

[5] Maryland Medically Underserved Area/Population Designations (MUA/Ps) and Federally Qualified Health Centers (FQHCs) as of 3/4/2011. (2011, March 4). Maryland: Office of Health Policy & Planning, Family Health Administration, Maryland Department of Health and Mental Hygiene. Retrieved from http://dhmh.maryland.gov/maps/Services/MUAP_FQHC_3-4-11.pdf.

an unusual storm. When you're not prepared for it and something that catastrophic occurs, it impacts the facilities and the people coming to them."

- "If this were to happen in Garrett County, we would be bringing in people that would be working at these sites and would have occupational injuries, so I think the concern should really be could we address those? Could we address occupational injuries? There is going to be increased traffic accidents. We need to ask can our healthcare system, as it currently is, manage these increases in injuries?"

- "What are the safety records and accident records and what that might mean for the health system?"

- "What if there is an explosion? What if there is an injury? What if there are hazardous materials? How do we respond to that?"

4.10.2. Emergency Responders

Stakeholders described emergency responders as a vulnerable population and wanted their potential exposures and health needs to be considered. Stakeholders are concerned with the impact that HVHF emergencies will have on the health and welfare of first-responders, particularly during extreme weather events.

Comments:

- "I just want to bring up the risks to workers because I think one of the reasons why the natural gas industry has appeal is because of its job potential. I think the health study should look at whether the jobs have adequate health protections in terms of safety, and what the safety and accident records might have been and what that might mean for the health system here, for emergency responders, and the amount of accidents and the protections to the people doing the emergency responding during crises like major storms."

"Be sure that you get the impact from the health professionals themselves -- the hospital folks, the ER people, the first responders. Those professionals who are directly involved in healthcare accidents and whatever."4.11. Benefits

Stakeholders acknowledged several benefits associated with HVHF, including more jobs and the impact that it will have on poverty, unemployment, and underemployment, an increased tax base, providing health insurance to the currently uninsured, training and education, improved infrastructure, and reduction in greenhouse gas emissions. Concerns with benefits include identifying who will benefit and whether the benefits be equally distributed. The economic benefits of HVHF will be addressed in the economic impact study being conducted by the Regional Economic Studies Institute (RESI) at Towson University.

Comments:

- "Jobs impact the area. We have a need for more income from revenue that drilling will generate."

- "Training, education, and putting people back to work – I think this is the number one priority in this county."

- "As you've alluded to, there is evidence that increasing income may lead to better healthcare. I think a disadvantage of one of the things we are doing here today is that we don't understand the economics. So whether you're in favor or against drilling for gas for whatever reason without understanding the economics of that, there's no way we can understand any kind of benefits toward healthcare."

- "The farms in this area are basically farms that really need an infrastructure boost. They need a production boost. The farmers themselves are going to assess their own risk and say is this process going to contaminate my well. The farmers that I talk to feel that the benefits far outweigh the risks. They are going to build infrastructure from the money from their mineral rights into their farm."

- "If you look at healthcare and the segment of the population or a segment of the population that would definitely benefit economically it would be the farmer population and historically I think it's well known that that population is very underinsured. If there is a correlation between income level and insurability, then that population could benefit."

4.12. Study Process and Transparency

Transparency of the overall study process was a recurring theme that emerged during the public meetings. Stakeholders requested that we keep the study process as transparent as possible so that the community can be kept abreast of our progress.

Comments:

- "I just want to make a plea for the process to be as transparent as possible. We heard a comment about New York and how nobody really knows what happened with their study. This is such a wonderful opportunity and this is a great start. You've created a dialogue with people out here and you're going to continue it."

5. Scope of Public Health Assessment

The Memorandum of Understanding (MOU) between the University of Maryland College Park's Institute of Applied Environmental Health and the Maryland Department of Health and Mental Hygiene for the Marcellus Shale Public Health Report includes four deliverables: 1) Detailed Scoping; 2) Baseline Assessment; 3) Impact Assessment; and 4) Final Report. This report is the final product for the detailed scoping phase; it makes extensive use of public input and includes a timetable for the remaining deliverables and a description of the means by which they will be produced. The baseline assessment will focus on the current state of health of the population that is likely to be directly affected by drilling and extraction operations. It will include assessment of local healthcare and social infrastructure and social supports as secondary determinants of health. The impact assessment will examine potential impacts associated with HVHF using multiple scenarios for the extent of shale gas exploitation in Maryland developed by the RESI economic

impact assessment team. Recommendations for baseline monitoring of population exposures and health and a gap analysis of monitoring data will be developed. The final report will include findings and recommendations related to all public health aspects of HVHF during normal and upset conditions including recommendations for monitoring during and after extraction and potential public health response and mitigation strategies.

5.1. Stakeholder Informed Scope for Public Health Impact Assessment

The scope of work for the Baseline and Impact Assessments were derived from the stakeholder inputs and the charge from DHMH contained in the description of the deliverables listed in the MOU. This section describes the planned scope of the assessments as described in the MOU and how they were modified in light of public and stakeholder input.

5.1.1. **Baseline Assessment:** The MOU charged MIAEH to:

> *"produce a baseline assessment of the population that is likely to be directly affected by drilling and extraction operations. This will include an assessment of the population's health, based on demographics, major causes of morbidity and mortality, local health priorities, and considerations of vulnerable populations. The baseline assessment will also include some discussion of local healthcare infrastructure, as well as social infrastructure and social support, as secondary determinants of health.*"

The stakeholder input suggested that poor, uninsured populations might not be adequately included in the baseline assessment if only traditional data sources are consulted. A special survey targeting these populations was recommended. Unfortunately, designing, testing, validating, and implementing such a survey is beyond the time and budgetary constraints of this effort. However, we will use several other approaches to identify vulnerable populations as described in more detail below. Analysis of the input suggests that geographic distribution of several social factors are critical to understanding vulnerability. These factors include not only the usual demographic characteristics of the population, but also unemployment, ownership of mineral rights, proximity to pre-existing vertical gas wells, and drinking water source.

After consideration of the charge from DHMH and stakeholder input, we developed the following list of factors that will be included in the <u>Baseline Assessment</u> and analyzed to identify vulnerable populations:

1. **Demographics**
    a. **Race/Ethnicity**
    b. **Age**
    c. **Poverty**
    d. **Education**
    e. **Employment**
2. **Ownership of Mineral Rights**
3. **Proximity to Existing Gas Wells**
4. **Well Water as Drinking Water Source**
5. **Access to Healthcare and Healthcare Infrastructure**
6. **Major causes of Morbidity and Mortality**
    a. **Asthma and Chronic Obstructive Lung Disease**
    b. **Cancer**

c. Cardiovascular Diseases

5.1.2. **Impact Assessment***:* The MOU charged MIAEH to:

"*produce an assessment of potential impacts, which will include the following elements:*

a. Description of hazards/known health impacts directly related to natural gas operations

i. Chemical hazards (drilling chemicals, other)

ii. Physical hazards (noise, injury hazards)

*b. Hazards/impacts associated with population changes/secondary impacts of natural gas extraction**

i. Traffic

ii. Injuries/illnesses associated with population/workforce changes

c. Potential Impacts Associated with Natural Gas Extraction

i. Potential exposure scenarios under normal operating conditions

ii. Potential exposure scenarios under upset conditions

iii. Assessment of multiple/cumulative exposures

iv. Assessment of impacts in specific vulnerable populations

d. Baseline monitoring and assessment

*i. Environmental***

ii. Population

iii. Gap analysis

**Population changes and other economic estimates will be adopted from the economic impact and other studies to be developed over the next year under the mandates of Executive Order 01.01.2011.11.*

***Environmental monitoring recommendations in this report will be informed by recommendations already described in other Marcellus Shale Safe Drilling Initiative reports. This report will emphasize environmental or population monitoring relevant to human health impacts that is not described elsewhere.*

Stakeholder input emphasized that among these hazards, special emphasis needs to be given to the effect of proximity to operations and local geography on the impacts of noise and air pollutants and to the effect of water source on impacts of chemical hazards. These concerns were expressed in the zoning comments as well as in discussion of specific hazards, especially noise and air pollution.

Water related impacts were a concern expressed by stakeholders. Many of the concerns about water quality fall into MOU Impact category a.i) the direct health impact of chemicals used in HVHF. This includes routes of exposure via contamination of well water, both municipal wells and private wells resulting from normal and upset conditions. Potential exposure to wastewater through spills or accidental releases that contaminate surface or groundwater sources of drinking water also fit within this part of the impact assessment and impacts associated with upset conditions. Vulnerability to this impact would depend on location and water source. Concern was also expressed about the adequacy of water supplies to support current needs and the demand created by the HVHF industry. This latter concern does not directly impact health and is a hydrology and civil engineering issue that will not be considered in this assessment.

Stakeholder input regarding secondary impacts such as HVHF effects on the status of western Maryland as a peaceful community and on mental health, bridge the MOU categories direct and secondary impacts. In the area of secondary impacts, stakeholders emphasized potential for crime, violence, domestic violence, alcoholism, and sexually transmitted diseases related to transient populations. Regarding traffic, the impact of air pollution from diesel exhaust as well as the noise and the potential for spills were important concerns. Climate change was also mentioned, but will not be taken up in this assessment for two reasons. First, whether HVHF will contribute to additional climate change more than other readily available alternatives is highly debated. Second, the health impact of climate change is a very large topic, beyond the limited resources of this project to project.

Occupational health issues, including both the potential for occupational disease from exposure and occupational injury due to safety concerns, were raised by stakeholders. The study's focus will be on the broad scope of public health, which will include workers and occupation health. We will consider information available regarding occupational exposures and their health effects as a means of identifying the potential for broader community exposures and public health impacts, and as important potential health impacts on workers. After discussion with DHMH, we have agreed that occupational exposures and potential occupational illnesses related to hydraulic fracturing will have a lower priority in the scope of this project than general population health impacts, due to the limits of time and resources available for this effort. We will, however, make it a high priority to examine the capacity of the local medical care infrastructure to handle occupational injuries, including traffic related injuries.

Economic impacts, such as lowered property values near drilling pads, are a major concern for the community. This issue will be addressed by Towson University Regional Economic Studies Institute (RESI) that is conducting the economic impact study for HVHF in Western Maryland. However, the health impact assessment will address a number of social determinants of health as impacted by economic effects of HVHF and thus address the health consequences of the economic impacts, as described by the economic impact assessment, including both potentially positive and negative outcomes.

The stakeholder input can be seen as emphasizing two main issues: 1) the critical role of exposure pathways in assessing the health impact of specific agents, and 2) the importance of social determinants of health and the impact that extensive HVHF development will have on these social determinants. Because the HVHF technique is relatively new, the composition of HVHF fluids are often proprietary, and the physical form of specific agents (e.g. use of nanosilica and other nanomanufactured forms of common chemical compounds) may not be accessible, it will be important for the impact assessment to consider that the lack of data concerning causal associations with long latency diseases from unknown agents will impart a high degree of uncertainty into the assessment. These considerations from our analysis of the charge from DHMH and public input, and an assessment that some factors such as high volume truck traffic are so integral to the HVHF process as to be arguably primary rather than secondary impacts, suggest that the impact assessment be organized around routes of exposure (e.g. air, water), types of hazards including social determinants, exposure scenarios, mixed and cumulative exposures, and vulnerable populations without regard to whether the exposures are considered primary or secondary. Thus, the assessment will focus on those exposures and

conditions that either would not occur in the absence of, or would be increased as a result of the HVHF industry.

After considering the charge from DHMH and stakeholder input, we developed the following organization of, and list of elements to be included in, the <u>Impact Assessment</u>:

1. **Air Quality**
    a. **Hazards associated with components of the fossil gas mixture**
    b. **Hazards associated with potential emissions from drilling and production operations and from truck traffic**
    c. **Potential exposures and deviations from current conditions**
        i. **Under normal operating conditions**
        ii. **Under upset conditions**
    d. **Geographic and population distribution of exposures**
2. **Water Quality**
    a. **Hazards associated with materials used in HVHF fluids**
    b. **Hazards associated with constituents of wastewater from HVHF operations**
    c. **Potential exposures and deviations from current conditions**
        i. **Under normal operating conditions**
        ii. **Under upset conditions**
    d. **Geographic and population distribution of exposures**
3. **Noise**
    a. **Hazards associated with noise**
    b. **Drilling and construction related potential exposures**
    c. **Production related potential exposures**
4. **Public Safety**
    a. **Motor vehicle collisions**
    b. **Access to emergency services (fire, medical transport, police)**
    c. **Other safety hazards including crime associated with transient worker population***
5. **Social Determinants of Health**
    a. **Benefits/risks of income changes***
    b. **Benefits/risks of property value changes***
    c. **Psychosocial stressors associated with transformation of rural environment and presence of transient worker population**
    d. **Psychosocial stressors associated with being a surface land owner without control associated with owning mineral rights**
    e. **Psychosocial stressors associated with landowners who are surrounded by leased land**
6. **Potential impact of associated with cumulative exposures**
7. **Potential impacts on specific vulnerable populations**
8. **Baseline monitoring and assessment prior to start of HVHF in Maryland**
    a. **Environmental exposures****
    b. **Population health**
    c. **Gap analysis**

* Population changes and other economic estimates will be adopted from the economic impact and other studies to be developed over the next year under the mandates of Executive Order 01.01.2011.11.
** Environmental monitoring recommendations in this report will be informed by recommendations already described in other Marcellus Shale Safe Drilling Initiative reports. This report will emphasize environmental or population monitoring relevant to human health impacts that is not described elsewhere.

5.2. Baseline Health Assessment

The baseline health assessment will include a demographic characterization of the population of Western Maryland and a baseline health characterization of the community using information from a variety of sources (see Appendix 1a). This information will be used to describe the general population and identify potential high-risk populations. Population demographics will include information on race/ethnicity, age, poverty, education, and unemployment. Baseline health characterization will include major causes of morbidity and mortality, access to healthcare, and healthcare infrastructure characteristics. Using inpatient emergency department and hospital diagnoses, and chronic disease, birth, and death information from the Allegany and Garrett County Departments of Health for the years 2005-2013, we will examine major causes of morbidity and mortality for Western Maryland, with a particular focus on asthma and chronic obstructive lung disease, cancer, and cardiovascular diseases. We will use state and county-level data to determine levels of healthcare access and healthcare infrastructure characteristics for Western Maryland. We will supplement these sources of data with key informant interviews with healthcare professions and service providers in Western Maryland to understand baseline population health and healthcare infrastructure capacity. Health for Western Maryland residents will be compared to the health of Maryland residents.

We will use geographic information systems (GIS) (e.g., ArcGIS 10.1) to develop a series of vulnerability maps, using census tract level sociodemographic information (i.e., percent poverty, percent homeownership, percent female, percent below age 18, percent above age 65, percent unemployed, percent less than high school education) from the 2010 US Census and mineral rights ownership (if available), percent of homes on private, municipal well water, and municipal surface water, proximity to conventional gas wells, etc. in order to identify areas with vulnerable populations that may be disproportionately impacted by HVHF or populations who may be at risk due to susceptibility factors. We will create maps for both Garrett and Allegany Counties that illustrate the spatial distribution (average) of a certain sociodemographic group. In addition, we will zoom in to focus on communities living in the areas of Luke, Westernport, Kitzmiller, Deer Park, and Swanton that were identified by the stakeholders as communities of concern due to their exposure to economic and social stressors and proximity to local environmental hazards.

We will use descriptive statistics to describe health status of the general population for Garrett and Allegany Counties. We will examine and compare disease rates for asthma, chronic obstructive lung disease, cancer, and cardiovascular conditions for Garrett, Allegany, Western Maryland, state of Maryland, and the United States for 2005-2013 using data available from local health departments, the Maryland Department of Health and Mental Hygiene (MDHMH) and the Centers for Disease Control and Prevention (CDC). We will perform similar analyses for

inpatient emergency department and hospital diagnoses, birth-related outcomes, chronic disease-related mortality, and life expectancy. Results will be presented as bar charts.

To assess access to healthcare infrastructure, we will use GIS to map HRSA-defined medically underserved areas (MUAs). MUAs indicate areas at the census tract level that may have limited access to medical doctors and healthcare infrastructure. Choropleth maps will be created to illustrate the spatial relationship between MUAs and sociodemographic indicators including percent poverty, percent less than high school education, percent unemployed, percent children, and percent elderly. We will also attempt to map insurance status information if available at the census tract level. Unfortunately, because most health data is not available at the subcounty level (such as census tract level), we will not be able to explore spatial relationships between sociodemographic composition and health status within Garrett and Allegany Counties. However, we can explore county and regional variation in the State of Maryland.

In addition, we will conduct literature review of public health and social science research and conduct focus groups with residents to understand how HVHF has directly and indirectly affected the health of communities that have already been impacted in West Virginia and/or Pennsylvania.

Conducting a survey to understand the current health status of residents in Allegany and Garrett Counties was discussed during the September 24 Stakeholder Engagement Meeting. However, due to time and budgetary constraints, we will not be able to conduct a baseline health survey. The health assessment will be used as the baseline during the impact assessment.

5.3. Impact Assessment

An impact assessment will be conducted to describe the potential hazards and health impacts related to HVHF, including those associated with changes in air and water quality, noise, traffic, transient population growth, social determinants of health, and cumulative exposures to mixtures of these factors. The impact assessment will include a literature review and an evaluation of available data on air quality, water quality, and noise impacts from HVHF. See Appendix 1b for a list of the data sources that will be evaluated for baseline exposure data.

We will conduct a review of peer-reviewed literature, reports, and validated data to identify baseline air and water quality data from other states that can be used to draw inferences for Western Maryland. Additional review will be conducted to identify data sources from communities already impacted by HVHF. Literature review will also identify current understanding of the relationship between HVHF and acute health outcomes. The report will be limited in terms of addressing chronic health outcomes owing to the long latency period between exposures and chronic health outcomes. Literature reviewed and the Impact Assessment Report will be organized following the outline in bold at the end of section 5.1.2 above. See http://www.marcellushealth.org/resources.html for a listing of literature to be reviewed. This listing will be updated as new sources are identified.

Currently, there is very little information on the location of land uses that may contribute to air and water quality problems in the communities of concern. We will use GIS to assess the spatial distribution and concentration of various industries and facilities regulated by the USEPA and

MDE under the Clean Air Act (CAA), Clean Water Act (CWA), Toxic Substances Control Act (TSCA), Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and Emergency Planning and Community Right to Know Act (EPCRA) including Toxic Release Inventory (TRI) facilities and releases (air, water, soil); brownfields; underground storage tanks (USTs); landfills; chemical plants; refineries; and other permitted land uses in the region. In addition, we will explore spatial relationships between various permitted facilities and land uses and sociodemographic composition at the census tract level. We will construct choropleth maps which will include an overlay of individual or aggregate facility or land use types (i.e., total TRI releases or average number of conventional wells/census tract) to show cumulative burden for a specific population defined by sociodemographic status (e.g., percent poverty) or vulnerability (e.g., percent public well water). These maps will be created for both Garrett and Allegany Counties and the entire state of Maryland. Furthermore, we will employ several spatial assessment methods to ascertain the sociodemographic profile of populations burdened by individual and aggregate facilities in each county at the census tract level: (1) mean distance analysis, (2) spatial coincidence, and (3) proximity analysis. In spatial assessments, distance is used to assess how close a population is to an environmental hazard or land use facility and can be compared with distance of another population. The use of distance or proximity methods will be very important in understanding potential impact including exposure and health risks for various areas or populations of concern. Mean distance analysis is a simple but powerful technique that is used to assess spatial disparities in the distribution of hazards. For the mean distance analysis, we will use ArcGIS 10.1 to calculate the mean distance of each facility type (such as TRI facilities) from the centroid of each census block (smallest census division). In the spatial coincidence method, also known as the "unit-hazard coincidence" method, we will use ArcGIS to evaluate sociodemographic information for census tracts and blocks that contain a specific facility type. Populations within census divisions that contained a particular facility type will be considered exposed and those outside will be considered unexposed. We will use SAS and R to perform statistical analyses to assess burden disparities and potential zones of impact.

Preliminary investigation suggests a paucity of location specific pre- and post HVHF air/water quality data on chemicals that are known to be associated with HVHF. Therefore impact assessment will also explore the possibility of using US EPA National Air Toxics Assessment (NATA) data to ascertain long-term trends in air quality and estimated health risks. We will use 1996, 1999, 2002, and 2005 NATA data as needed for these analyses. Potential neighborhood-level exposure scenarios will be evaluated for residents living within specified radius of well pads and compared to those living further away using GIS methods described above. These exposure scenarios will include vulnerable population including children as well as individuals that are at the tail end of the exposure distribution (95th percentile, 99th percentile). This analysis will integrate the three drilling scenarios developed by RESI and the baseline air and water monitoring data collected by the Maryland Department of Natural Resources (DNR). The impact assessment will also take into consideration the cumulative exposure resulting from different routes and pathways of exposure as well as exposures to multiple chemicals with similar health outcomes. To ensure transparency of this process, the impact assessment will clearly state all the assumptions, default parameters used, as well as the sources of data. In addition to the air quality data, attempts will be made to obtain noise data from the impacted communities. The noise data will be evaluated as a function of distance from the well pads. These estimates will be compared to local/state level guidelines.

The assessment will also consider potential benefits associated with HVHF. To further understand this, we will conduct focus groups with residents in West Virginia and/or Pennsylvania who have already been impacted by HVHF. This will provide us with valuable information that may not be found in the literature. Exposures may vary depending on the stringency of regulations and the rigor of enforcement. We will use experience in neighboring states as a guide to identify a range of realistic regulatory scenarios and resulting exposures.

The impact assessment will provide a basis for estimating the overall public health benefits and risks, for Marylanders living in Garrett and Allegany Counties, of allowing expanded natural gas extraction using HVHF. The impact assessment will not recommend for or against expanded extraction, but will provide an estimate of the local public health consequences under a range of scenarios to inform the Commission, MDE, DNR in their work, under the Executive Order. It will use estimates of current exposure as a baseline for comparison with expected conditions should HVHF go forward. It will not address health risks or benefits to transient worker populations and it will not address long-term climate related health impacts.

5.4. Final Report

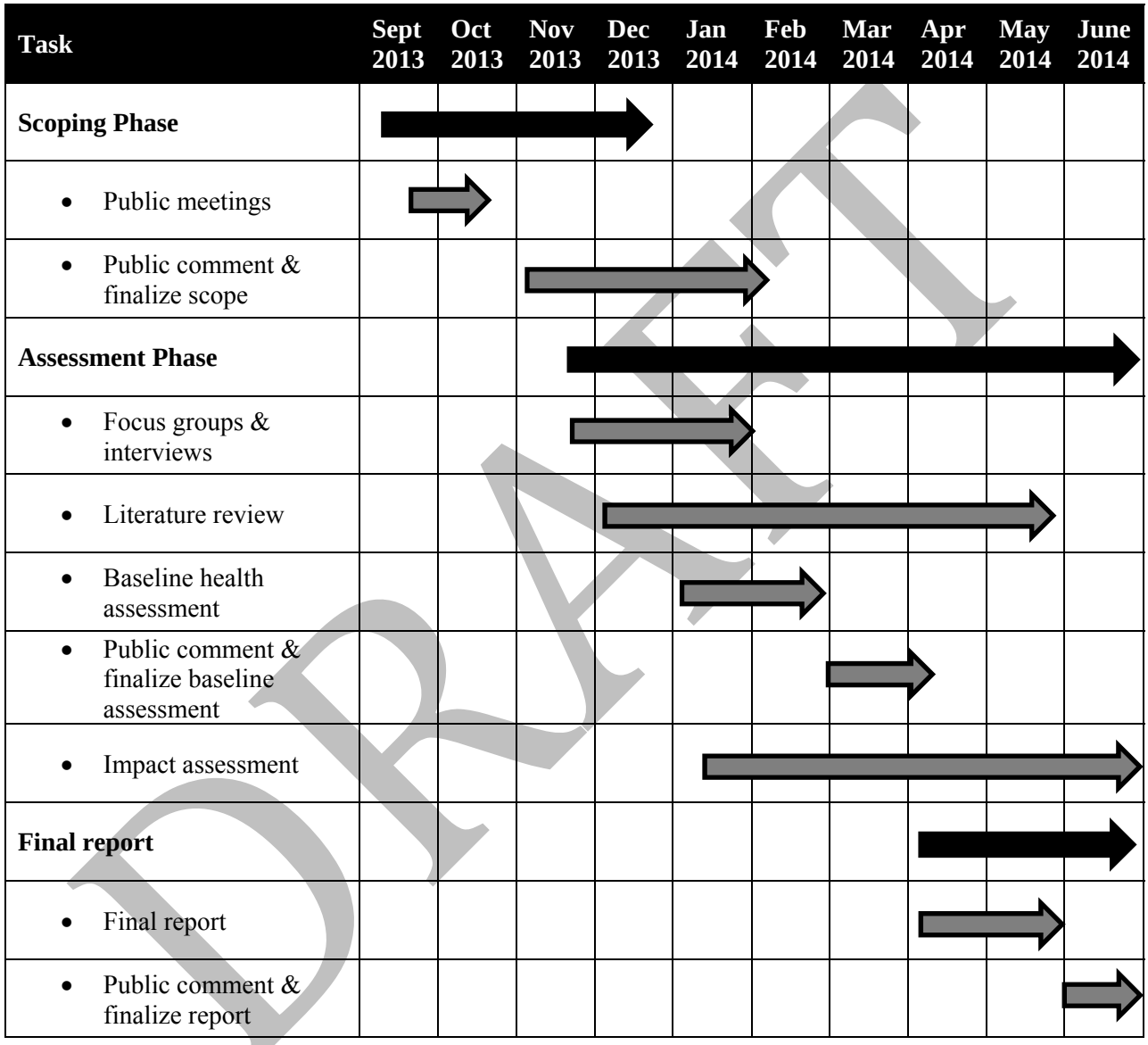
The final report will draw on the baseline and impact assessments to make recommendations related to all public health aspects of extraction operations during normal and upset conditions. The final report will focus on two types of recommendations: 1) Exposure and health monitoring and assessment programs to be carried on during and after extraction operations and 2) Public health responses and mitigation strategies to minimize negative health impacts and maximize health benefits of natural gas extraction using HVHF. The final report and its recommendations will not recommend for or against expanded extraction using HVHF – it will merely estimate, to the extent possible, the health impacts of policy options by comparison with not allowing expanded natural gas extraction.

5.5. Transparency and Communication

We will use our website – www.marcellushealth.org – to communicate with the public throughout our public health impact assessment. The website includes an overview of the study, members of the study team, project updates, resources that we will be using for our literature review (peer-reviewed literature, reports, and websites), as well as a section for the public to share their comments, feedback, and provide additional resources to the study team. We will also provide updates through our Facebook and Twitter pages.

6. Project Timeline

The project timeline provides a snapshot of the time frame and amount of time we anticipate dedicating to each of the three phases of the study: scoping report, baseline assessment, impact assessment, and final report.



Appendix 1a: Anticipated Data Sources for Baseline Assessment

Data Source	Indicator[6]	Data Year	Area	Source
Environmental				
Basic Data Report No. 11: Water-Well Records, Chemical-Quality Data, Ground-Water Use, Coal Test-Hole Data and Surface-Water Data	Location of selected drinking-water wells	1980	Garrett County	DNR Report
County Water and Sewer Plan	Sewer and water infrastructure	Most recent available	Allegany & Garrett Counties	MDE
Sociodemographic				
U.S. Census	Age, race/ethnicity, poverty, median household income, unemployment, education, homeownership	2010	Allegany, Garrett Counties, Maryland, U.S.	Census Bureau
Health Professional Shortage Areas	Full-time equivalent shortage/facility	2013	Allegany & Garrett Counties	HHS Health Resources and Services Administration (HRSA) http://hpsafind.hrsa.gov/
Tax Parcel	Tax parcel data	Multiple years	Allegany & Garrett Counties	MDP http://www.mdp.state.md.us/OurProducts/Property

[6] This is a sample of indicators that will be reviewed, the list is not all inclusive.

Data Source	Indicator[6]	Data Year	Area	Source
				MApProducts/PropertyMapProducts.shtml
Crime Statistics	Total, property, and violent crimes	Multiple years	Allegany & Garrett Counties	Governor's Office of Crime Control & Prevention http://www.goccp.maryland.gov/msac/crime-statistics-county.php?id=6
Health				
BRFSS Supplemental Data	Health status, healthy days, healthcare access, physical activity, diabetes, hypertension, cholesterol, asthma (adult, childhood, work-related), immunization, tobacco use, alcohol consumption, disability, arthritis, HIV/AIDS, emotional support, indoor air quality	2005	Allegany, Garrett, Washington Counties; Western Maryland	Center for Preventive Medicine, DHMH
BRFSS Tables	Health status, healthy days, healthcare access, physical activity, arthritis, diabetes, hypertension, cholesterol, asthma, immunization,	2005	Garrett County	Garrett County Health Department

Data Source	Indicator[6]	Data Year	Area	Source
	tobacco use, alcohol consumption, indoor air quality			
BRFSS, Report on Nutrition and Physical Activity Factors	Physical activity, fruit and vegetable consumption	2005	Garrett County	Garrett County Health Department
Status of Health	Priority indicators for Garrett, mortality, birth rates, infant mortality rates, injury-related ED visits/hospitalizations, life expectancy at birth	2005-2013	Garrett County	Garrett County Health Department
Allegany County Community Health Needs Assessment[7]	Tobacco and alcohol use, physical activity, social support, birth indicators, chronic disease risk factors, injuries, self-reported health status, death rates, ED visits, access to care	2011	Allegany County	Western MD system and Allegany County Health Department
Environmental Health Public Tracking (EPHT)	Acute Myocardial Infarction (AMI), asthma, birth defects, cancer, carbon monoxide emergency department visits,	Multiple years	Allegany and Garrett Counties	DHMH http://phpa.dhmh.maryland.gov/OEHFP/EH/tracking/SitePages/Home.aspx

[7] We will also review the data sources listed in section F of the Allegany County report.

Data Source	Indicator[6]	Data Year	Area	Source
	carbon monoxide inpatient hospitalizations, childhood blood lead, vital statistics			
EPHT County Profiles	Overall health, maternal and child health, communicable disease, mental health, substance abuse, health insurance, unmet medical need, injury and violence, chronic disease	2005-2009	Allegany and Garrett Counties	DHMH http://phpa.dhmh.maryland.gov/OEHFP/EH/tracking/SitePages/County-Profiles.aspx

Appendix 1b: Anticipated Data Sources for Impact Assessment

Data Source	Indicator[8]	Data Year	Area	Source
Air Quality				
Piney Run Air Monitoring Data	Methane, benzene, toluene, ethylbenzene, xylene (BTEX), NO, NO_2, NO_x, ozone, SO_2, CO, $PM_{2.5}$, SO_4, PM_{10}	2013	Garrett County	MDE
Water Quality				
DNR Surface Water Monitoring Data	Alkalinity, aluminum, barium, bromide, calcium, chloride, conductivity, iron, magnesium, manganese, nitrate, nitrite, orthophosphate, pH, potassium, selenium, sodium, strontium, sulfate, TDS, temperature, TSS, turbidity	2013	Allegany & Garrett Counties	DNR
DNR Groundwater Quality Constituents for Western MD Marcellus Monitoring	Calcium, magnesium, sodium, potassium, sulfate, chloride, alkalinity, fluoride, bromide, silica, color, pH, dissolved oxygen,	2013	Western Maryland	DNR

[8] This is a sample of indicators that will be reviewed, the list is not all inclusive.

Data Source	Indicator[8]	Data Year	Area	Source
	TDS, methane, trace elements, nutrients, and radionuclides			
Other Environmental Data				
Toxic Release Inventory (TRI)	Toxic release data	2012	Allegany & Garrett Counties	Environmental Protection Agency (EPA)
Brownfields and Superfund Sites	Brownfield and superfund locations	Multiple years	Allegany & Garrett Counties	EPA
Health				
National Air Toxics Assessment (NATA)	Cancer risk, neurological risk, respiratory risk	2005	Maryland	EPA

Appendix 2: Top Ten Themes for September 24, 2013 Stakeholder Engagement Meeting

1. **Air quality**
    a. How will drilling, fracking, and compressor stations affect local air quality?
    b. What are the fugitive emissions and what are the environmental impacts?

2. **Water quality**
    a. How will water acquisition, the use of bulk water, and the selling of local water affect water quality and availability?
    b. How will the fracking solution, chemicals, and wastewater affect drinking water (aquifers, surface water, and groundwater)?

3. **Baseline health assessment**
    a. It is important to understand the baseline health of Garrett and Allegany Counties. A survey will be conducted to help understand the health status including cancer and non-cancer diseases, endocrine diseases, autoimmune disorders, diet, lifestyle, family history, chronic diseases, mental health, asthma and other respiratory diseases, and multiple sclerosis. Additional health indicators will be added based on information from the literature review.

4. **Healthcare infrastructure**
    a. What is the current healthcare capacity?
    b. Is there capacity to handle acute issues related to fracking?
    c. Are there health protections for emergency responders (police officers, firemen, EMT, hospital personnel)?
    d. How will first responders be impacted during fracking emergencies due to extreme weather events?
    e. How will health issues related to fracking be handled? Will the local health departments be the point of contact?

5. **Populations of concern**
    a. How will fracking affect farmers, land-owners, non land-owners, business owners, and vulnerable populations (children, women of a childbearing age, elderly with co-morbidities, immunosuppressed individuals, and individuals with low socioeconomic status)?

6. **Occupational issues**
    a. What are the occupational exposures?
    b. Are current OSHA standards adequate?
    c. What are the current protections for workers?
    d. Will there be regular inspection and oversight on well pads for workers?

7. **Secondary impacts**
    a. How will the social fabric of the community be impacted by diesel truck traffic, increased traffic on the road, accidents, crime, and an influx of transient workers?

8. **Weather/climate change**
    a. How will seasonality and major weather events affect fracking?

9. **Benefits**
    a. How will fracking affect jobs, the tax base, poverty, unemployment, uninsured, training/education opportunities, infrastructure, and public schools?
    b. How will these benefits affect public health?

10. **Zoning**
    a. How will zoning laws affect fracking and buffer zones?