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I. Air Emissions

In Part One of our comments we discussed the problem of having industry consultants preparing the SGEIS. For the analysis of air impacts we have industry consultants doing the analysis based on data supplied only by industry. There is no evidence in the pages devoted to this topic that independent testing done by other state regulatory agencies or other independent entities was sought for the analysis of air impacts in the SGEIS. At the same time the unsupported claim from industry was used for the air analyses-- that only dry gas is relevant for the Marcellus shale. Some detailed evidence should have been provided that supported the dry gas assumption used. However, a recent US Geologic Survey estimate of Marcellus reserves predicts as much as 3.4 billion barrels of natural gas liquids.¹ The recovery of these fluids will involve significant air emissions and should have been part of the air analysis.

The SGEIS should have covered the cumulative worst case air emissions from thousands of drilling sites expected to be permitted in the Marcellus shale areas of the state. The SGEIS instead focused on a single well pad, limited to one well drilled at a time and only one closure at a time. Notably the modeling showed excess emissions of NO₂ and PM at a considerable distance, which had to be mitigated by additional controls and increases in stack heights. The SGEIS looked at no more than 2 drill sites and the maximum impacts. While there are acute short term standards for some pollutants like SO₂ and NO₂, other pollutants- PM, VOCs and NO_x are usually treated as pollutants that effect a region. However this SGEIS did no analysis of regional impacts for these pollutants when as many as 1500 wells could be permitted a year. We believe that the absence of adequate treatment for VOCs and toxics in the SGEIS relates to the lack of comprehensive air data at drilling sites, something that EPA and the Secretary of Energy's Advisory Board (SEAB) have now recognized and are seeking to correct. However, the SGEIS fails to acknowledge the inadequacies of the air analysis and makes no attempt to estimate VOC emissions, which include toxics, and that impact ozone formation. A recent article by Theo Colburn and others references several sources related to the expected tons of VOCs, hydrocarbons and methane that escape and mix with nitrogen oxides to form ground level ozone. "Gas field ozone has created a previously unrecognized air pollution problem in rural areas, similar to that found in large urban areas, and can spread up to 200 miles beyond the immediate region where gas is being produced."²

For toxics only a few pollutants are looked at. Benzene, a known human carcinogen is limited to 1tpy of emissions for one piece of equipment only, with no apparent limit on VOCs. If VOCs are excessive, benzene health- based levels could be exceeded for nearby residents. The SGEIS identifies formaldehyde as one of the toxic pollutants. This human carcinogen is both a direct and secondary pollutant, with most contributed by secondary formation from VOCs emitted into the air. Formaldehyde and acetaldehyde are both created from VOC emissions. Thus it is critically important to know the precise amount of VOCs emitted in order to estimate the amount of formaldehyde and acetaldehyde. We don't know how the estimates in the SGEIS were derived. The National Air Toxics Assessment has also found these 2 pollutants to be over the threshold for respiratory health effects in 100% of the nation. Urban areas often have levels of these pollutants 4-20 times the health- based respiratory hazard quotient, so urban areas in NY State are impacted. These pollutants are thus of serious concern for non-cancer health effects as well as cancer. Hydraulic fracturing will expand the areas of the state experiencing elevated formaldehyde and acetaldehyde concentrations and related health impacts on asthma and other respiratory diseases. Neither the respiratory impact, nor the cancer impacts were studied in the SGEIS. The air analysis chose a handful of toxic pollutants to examine, rather than the over 700 proposed toxic additives the gas industry claims it will use. Any toxic additives used could have air emissions impacts, either as the original chemical or as degradation products.

Additionally, over 100 public schools are located on the Marcellus Shale, yet the dSGEIS does not discuss the impact fracking air pollutants may have on the children who attend these schools, a particularly vulnerable population. A report released in July 2011 documented significant levels of air toxins around a gas drilling site less than 200 feet from an elementary school in Colorado.³ Four of these chemicals were known carcinogens. Significantly elevated levels of hydrogen sulfide were also found in this study. This highlights the inherent need for comprehensive air monitoring, permit requirements, and baseline air sampling.

If the air analysis is so incomplete as to eliminate considerations of large numbers of toxic additives, how can the SGEIS be complete? And how can it form a basis for air permitting?

In addition, the SGEIS claimed it could not deal with ozone because of unknowns associated with gas development. This is despite EPA's explicit request that regional ozone impacts be examined. The air analyses focused almost no attention on VOCs and methane, which contribute to ozone formation. Ozone is one of the most stringent air pollution limitations we have with federally enforceable requirements as part of a state implementation plan. The eventual area designations under stricter ozone standards will increase the number of nonattainment areas in the state. Nonattainment areas have more stringent requirements for VOCs and NOx emissions, which fall on all area businesses needing air permits. To the extent that the gas industry emissions go without adequate control, other businesses will bear the compliance burden. Both VOCs and methane contribute to ozone formation. The high ozone levels associated with hydraulic fracturing elsewhere in the country are so extraordinary as to require emergency attention. "In Wyoming's Upper Green River Basin, for thirteen days last winter alone residents suffered "unhealthy" ozone concentrations under EPA's current standards, including days when the ozone pollution levels exceeded the worst days of smog pollution in Los Angeles."⁴

Los Angeles has the worst ozone pollution in the country; however ozone is almost always associated with the summer season. Ozone is formed from NO_x + VOCs in the presence of sunlight. The findings in Wyoming are clearly extraordinary and need an immediate detailed scientific investigation. If these exceedances are occurring in rural Wyoming, the impacts on air quality in New York could be devastating. Yet the SGEIS fails to adequately consider VOCs and the extensive findings in other states. Unlike the consideration given to NO_x emissions largely from combustion, VOCs have been poorly considered. We are aware that the threshold for a major VOC source is 50 tons. Yet the SGEIS has merely accepted industry claims about its emissions. If industry is claiming that their VOC emissions will be less than 5 tons, then there must be federally enforceable permit limits to that effect and monitoring, recordkeeping and reporting that confirms these emissions. In addition, the leak detection and repair program should not be housed in the greenhouse gas mitigation plan, but as part of compliance monitoring for criteria pollutants. We think the state has much more authority to regulate VOCs under the Ozone SIP(State Implementation Plan) and RACT (Reasonable Available Control Technology) requirements for VOCs. We strongly recommend federal enforceability of the requirements for leak detection and repair. Compliance inspections should include review of ongoing recordkeeping for this program and the timeliness of repairs, rather than relying on annual reports.

Methane leaks also pose explosion and fire risks, so a leak detection and repair program is essential to proper management of a drilling site, protecting workers lives. We will address Greenhouse gases and climate change separately in our comments.

Recommendations

Heightened attention has been recently directed at the inadequate understanding of air emissions from hydraulic fracturing operations. This is a major problem and states and federal regulators have been playing catch up in response to citizen complaints of air pollution and health impacts—trying to collect data on a scatter shot basis while having an inadequate regulatory framework to apply to these sources that may not individually exceed major source thresholds.

The SEAB subcommittee recommendations form an important structure for moving forward to address air emissions. This effort is not un-biased – it clearly reflects the agenda of the Department of Energy (DOE) to promote the nation’s use of our own energy reserves. Yet it also recognizes the danger in failing to provide adequate protection for the public and the environment, as this new technology is advanced. “The Subcommittee believes that if action is not taken to reduce the environmental impact accompanying the very considerable expansion of shale gas production expected across the country – perhaps as many as 100,000 wells over the next several decades – there is a real risk of serious environmental consequences causing a loss of public confidence that could delay or stop this activity.”⁵ We believe DEC should carefully review and incorporate all of the Subcommittee recommendations in its regulatory program for this industry. First, these recommendations are likely to affect what federal agencies and other states do. Secondly, it is likely that industry will be working toward adopting some of these recommendations. So the Subcommittee recommendations are a good place for DEC to start.

Below we have used most of the SEAB subcommittee recommendations and expanded upon them:

- Comprehensive air monitoring to gather real data representative of actual air emissions. There should be less reliance on modeling with various assumptions, including some that are not conservative (health protective).
- Comprehensive monitoring should go beyond on-site equipment to include fugitive air emissions from natural and geologic pathways as well as those that are manmade, such as underground infrastructure pipes and conduits.
- Full Public Disclosure of drilling additives, site activities, permit requirements, and enforcement actions.
- Strong regulations that incorporate proven control technologies and methods as well as an equally strong oversight and compliance structure
- Air emissions must be addressed by establishing federally enforceable permit requirements, not voluntary suggestions. A gas company's multiple drilling sites will exceed major source thresholds and should be aggregated for coverage under a comprehensive Title V permit.
- Greater attention to VOCs, toxics and methane
- Best Practices reflecting Continuous Improvement
Reduced Emissions Completions should be the norm.
- Alternative fuel engines- electric and natural gas
Tier 4 diesel engines will be available in 2011 and should be required for use in NY if electric and gas engines are not feasible. The availability of Tier 4 engines also speaks to the advisability of a long phase in period for the hydraulic fracturing program, as more of these engines will be available. It is not acceptable for DEC to allow Tier 1 and 2 engines at all and they should be excluded from consideration.

Air Monitoring

We have discussed extensively in Part One of our comments, the fact that adequate DEC staff resources have not been even identified, much less adequately delineated for this massive drilling program. Yet we have a proposed air monitoring plan by DEC. We find this program far too skimpy, and therefore not adequate for the job. The program being advanced is more a reflection of the reality of limited DEC resources, than the kind of comprehensive program that is needed. We recommend:

- Baseline comprehensive air sampling prior to the permitting of each individual drill site including a full spectrum of criteria and toxic pollutants, hydrogen sulfide and methane. The presence of naturally occurring methane must be identified prior to drilling activity.
- Identification of schools, day care, nurseries and hospitals within a half mile of drilling and baseline air monitoring.
- Follow-up air monitoring must be planned on a regular schedule every 6 months for the protection of residences and the facilities identified above to document the effective control of emissions at drilling sites.

We support DEC having the resources it needs to run the program, however if the resources are not provided provision must be made for certified consultants, independent of the industry doing the monitoring.

II. Climate Change

The oil and gas industry is the top producer of methane emissions in the nation. Since methane has significant global warming potential, many times greater than carbon dioxide this is a very serious matter. Methane is particularly significant over the next 20 years as we attempt to reverse potentially catastrophic effects of climate change. NASA has estimated the 20 year global warming potential at 105 times CO₂ rather than the 72 times mentioned in the SGEIS. The NASA estimate reflects the methane influence on the creation of ozone. An Executive Order under Governor Paterson launched NY State on the development of a Climate Action Plan which led to analyses of some of the significant impacts that are likely to affect New York. Many of the potential impacts have not been fully analyzed; however the findings thus far are alarming. Yet despite Governor Cuomo's reauthorization of the Executive Order, work on the Climate Action Plan appears to have been halted. This work represents thousands of hours of work for state workers over the course of several years in addition to outside parties who contributed to the effort. We can only guess at the rationale, since the key Agencies involved can only say that they need direction from the Governor. Failure to act on both the measures to reduce greenhouse gas (GHG) emissions and thus mitigate the severity of the expected impacts of climate change, as well as the failure to undertake some of the most important adaptation measures, is certain to result in profound adverse consequences for New Yorkers.

If the Climate Action Plan is the first casualty of the plan to conduct hydrofracking in the state, the impacts of that decision should have been fully discussed in the SGEIS. If it is not a casualty, we should see immediate efforts to revive the Climate Action Plan efforts.

Despite the rhetoric in the SGEIS concerning greenhouse gas emissions, the reality is that the most important measures to control methane emissions for this industry have been made optional or voluntary, with a long list of green options from which to choose.

The SGEIS relied on industry estimates to calculate the total expected emissions from a single well pad. A generic EIS should be aggregating emissions from the total number of well pads expected to be producing in the state at the same time, in order to provide a clear picture of the air quality impacts. The DEC also apparently accepted the industry claim that fugitive emissions are negligible, despite numerous reports and video-recordings using special devices that demonstrate billowing clouds of methane releases.

Despite clear underestimates in the SGEIS we have an estimate at the end of Chapter VI of 20,300 tons of CO₂ equivalent emissions annually (accounting for methane and CO₂) per well pad with four wells. For 1000 well pads annual emissions become 20,300,000 tons of CO₂ equivalents, but the SGEIS does not tell us this, nor does it provide the previous estimate of the greenhouse gas emissions for gas drilling contained in the current state GHG (greenhouse gas) inventory—zero tons. We believe this ballooning of the entire state GHG inventory as a result of gas drilling is partly responsible for the abandonment of the Climate Action Plan. The Governor

and the DEC would have difficulty demonstrating the needed 80% reduction in greenhouse gas emissions by 2050 when hydraulic fracturing will cause our emissions to increase in the opposite direction by a large percentage.

Gas drilling emissions alone account for at least one-fifth of human-caused methane in the world's atmosphere according to the World Bank. This could rise significantly higher as hydraulic fracturing expands. In January 2011, Pro Publica revealed the findings of EPA research concerning methane leakage associated with natural gas production. EPA doubled previous estimates associated with leakage from pipes and equipment and found that emissions from hydraulic fracturing were 9000 times higher than previous estimates.⁶

In addition:

“The EPA tracks fugitive and vented methane emissions through a program called Natural Gas STAR and then works to get drilling companies to save money by stanching their leaks and selling the gas they capture for profit. It was a discrepancy in the Gas STAR data that prompted the EPA to sharply revise the government's greenhouse gas statistics late last year.

According to Gas STAR's most recent figures, at least 1.6 percent of all the natural gas produced in the United States each year, about 475 billion cubic feet, is assumed to be leaked or vented during production. But those numbers were reported before the EPA adjusted its greenhouse gas estimates, and they are expected to rise when the new estimates are plugged into the calculation.

If companies could capture even the gas leaked in Gas STAR's current estimates, it would be worth \$2.1 billion a year at today's prices and would cut the nation's emissions by more than 2 percent right off the bat. Several studies show that maintaining and installing equipment to capture the emissions pays for itself within 24 months.”⁷

Thus in addition to the newer findings that hydraulic fracturing methane emission estimates need to be 9000 times higher, it is clear that an existing federal program has regularly acknowledged the significance of fugitive emissions and has found enormous emissions with large global warming potential. ProPublica published this story in January citing the EPA findings, nine months before the revised draft SGEIS was released. DEC did not have to rely on industry estimates. Thus it is unacceptable for the SGEIS to downplay fugitives, at the same time it is discussing the Natural Gas Star program and encouraging industry to participate. Stringent control of all vented and fugitive emissions represents no regulatory burden, since recovering these emissions results in saleable natural gas and a large economic benefit. The short payback period of 2 years demonstrates the economic feasibility. We recommend stringent control rather than voluntary or optional efforts.

The Natural Gas Star program is the one that the DEC is encouraging industry to participate in on a voluntary basis. DEC is also proposing to require a greenhouse gas mitigation plan that may contain many of the elements of the Natural Gas Star program or may not. We understand that both the Governor and the DEC are proposing deregulation for the Natural gas industry, but this proposal is ridiculous, given the enormous economic as well as environmental benefits associated with reducing greenhouse gas emissions.

Climate Change is a very serious matter. Greenland is losing 150 million tons more ice every year than is being replaced by snowfall, thus this represents a net loss every year. (Extreme Ice, Nova, PBS Special, Dec. 2011) New York has a large amount of coastline that will be inundated in addition to other climate change impacts.

We recommend stringent regulatory control of methane emissions and continuous emissions monitoring of air methane levels near drilling sites. No readings should exceed 10% of the Lower Explosive Limit. Continuous emissions monitoring (CEM) would provide important worker safety benefits in addition to signaling elevations in site methane emissions. CEM would then enable workers to evaluate equipment for methane venting or leaks, and make repairs.

All recordkeeping related to routine monitoring for methane leakage and equipment repairs must be continuously maintained and available to DEC personnel for compliance inspections. As discussed under the air emissions section—leak detection & repair should be required for control of VOCs and methane since both are likely to occur together. There are federally enforceable requirements related to the regulation of VOCs.

At this time there is no federal regulation of greenhouse gas emissions, only requirements for reporting. Methane is covered under 112r, the Clean Air Act provisions related to emergency planning because of its explosive potential. However, under DEC air regulations Part 200, the definition of an air contaminant is broad:

(d) *Air contaminant or air pollutant.* A chemical, dust, compound, fume, gas, mist, odor, smoke, vapor, pollen or any combination thereof.

As a result methane constitutes an air contaminant that must be regulated, under state authority as air emissions.

III. Toxic Substances: The Use of Toxic Chemical Additives for Drilling and Hydrofracking and the Concentration & Dispersal of naturally occurring toxic substances from Shale layers

Two reports were produced this year pertaining to toxics associated with the gas industry. In some cases the findings overlap, but each has important insights. We provide both as attachments:

- *Chemicals Used in Hydraulic Fracturing*, US House of Reps, Committees on Energy & Commerce, Minority Staff Report, April 2011, and
- Colburn Kwiakowski, Schultz, & Bachran, "Natural Gas Operations from a Public Health Perspective," *International Journal of Human and Ecological Risk Assessment*, September-October 2011.
<http://www.endocrinedisruption.com/files/Oct2011HERA10-48forweb3-3-11.pdf>

While most of the attention has focused on chemicals used in fracking, Theo Colburn and colleagues had a unique opportunity to explore the issue of chemical additives used for drilling as a result of a blowout that occurred following drilling and before hydraulic fracturing had begun.

The House Committee Report found:

*"The absence of a minimum national baseline for disclosure of fluids injected during the hydraulic fracturing process and the exemption of most hydraulic fracturing injections from regulation under the Safe Drinking Water Act has left an informational void concerning the contents, chemical concentrations, and volumes of fluids that go into the ground during fracturing operations and return to the surface in the form of wastewater. As a result, regulators and the public are unable effectively to assess any impact the use of these fluids may have on the environment or public health."*⁸

*"Between 2005 and 2009, the 14 oil and gas service companies used more than 2,500 hydraulic fracturing products containing 750 chemicals and other components. Overall, these companies used 780 million gallons of hydraulic fracturing products – not including water added at the well site – between 2005 and 2009."*⁹

*"In many instances, the oil and gas service companies were unable to provide the Committee with a complete chemical makeup of the hydraulic fracturing fluids they used. Between 2005 and 2009, the companies used 94 million gallons of 279 products that contained at least one chemical or component that the manufacturers deemed proprietary or a trade secret. Committee staff requested that these companies disclose this proprietary information. Although some companies did provide information about these proprietary fluids, in most cases the companies stated that they did not have access to proprietary information about products they purchased "off the shelf" from chemical suppliers. In these cases, the companies are injecting fluids containing chemicals that they themselves cannot identify."*¹⁰

*"Hydraulic fracturing companies used 2-butoxyethanol (2-BE) as a foaming agent or surfactant in 126 products. According to EPA scientists, 2-BE is easily absorbed and rapidly distributed in humans following inhalation, ingestion, or dermal exposure. Studies have shown that exposure to 2-BE can cause hemolysis (destruction of red blood cells) and damage to the spleen, liver, and bone marrow.¹⁷ The hydraulic fracturing companies injected 21.9 million gallons of products containing 2-BE between 2005 and 2009."*¹¹

The Colburn article cites legislative efforts, which have "granted exclusions and exemptions for oil and gas exploration and production from a number of federal environmental statutes, including the Clean Water Act, the Clean Air Act, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, better known as the Superfund Act), the Resource Conservation and Recovery Act (RCRA), the Toxic Release Inventory under the Emergency Planning and Community Right-to-Know Act (EPCRA), and the National Environmental Policy Act (NEPA) (Oil and Gas Accountability Project 2007). The most recent of these efforts was an amendment included in the 2005 Energy Policy Act that prevented the use of the Safe Drinking Water Act to regulate certain activities, known as hydraulic fracturing, which are involved in 90% of natural gas drilling."¹²

"The cumulative effect of these exemptions and exclusions has been to create a federal void in environmental authority over natural gas operations, leaving the responsibility primarily up to

*the states. Although some states have oil and gas commissions to watch over natural gas production activity, the primary mission of these agencies has been to facilitate natural gas extraction and increase revenues for the states."*¹³

New York does not have to facilitate natural gas extraction and the DEC and DOH have the regulatory authority to prohibit the use of particular toxic chemical additives. Trade secret and confidential claims are particularly inappropriate when there is a high probability of health impacts requiring medical treatment for workers and nearby residents.

The problems of trade secrets, inadequate information in MSDS sheets and the absence of CAS number for many ingredient chemicals were discussed in the House Committee Report and the Colburn article. The results of the Colburn review are quite significant in relation to toxics information: Of 944 products identified--

- Only 14 % (131) provided information on 95%+ of the ingredients.
- 43% of the products provided information on less than 1% of the total product composition
- Out of 632 chemicals reported in products, the review team could only locate CAS numbers for 56%

These are very serious data limitations when trying to understand health effects. As a result the researchers were only able to use the data on 56% of the chemicals to assemble a profile of health effects in 12 categories.

"More than 75% of the chemicals on the list can affect the skin, eyes, and other sensory organs, the respiratory system, the gastrointestinal system, and the liver. More than half the chemicals show effects on the brain and nervous system. These first four categories represent effects that would likely be expressed upon immediate exposure, such as eye and skin irritation, nausea and/or vomiting, asthma, coughing, sore throat, flu-like symptoms, tingling, dizziness, headaches, weakness, fainting, numbness in extremities, and convulsions."

"Health categories that reflect chronic and long-term organ and system damage comprise the middle portion of Figure 2. These included the nervous system (52%), immune system (40%), kidney (40%), and the cardiovascular system and blood (46%). More than 25% of the chemicals can cause cancer and mutations. Notably, 37% of the chemicals can affect the endocrine system that encompasses multiple organ systems including those critical for normal reproduction and development. The category of 'other' is more common, and includes effects on weight, teeth, and bone and the ability of a chemical to cause death. More than 40% of the chemicals have been found to have ecological effects, indicating that they can harm aquatic and other wildlife."¹⁴

A large number of the chemicals used are also volatile. Inadequate air emissions analysis was used in the SGEIS to dismiss the significance of VOCs as well as toxic air pollutants. The accidental blow-out of the Crosby well in Wyoming released methane and other gases, petroleum condensates, and drilling fluids (muds) from fissures in the ground adjacent to the well. This provided a unique opportunity to analyze the chemicals used during drilling, as fracking had not yet begun on that well.

"During the 58 hours the eruption took place, 25,000 square feet of soil surface in the area were contaminated. The driller released copies of the MSDSs for the products used during the blow-out and later we found the names of several more products from remedial action work plans to clean up the site." Twenty two drilling chemicals were identified. Nearly 60% were associated with 'other' effects which included mortality. A relatively high percentage of chemicals that affect the immune system were used.¹⁵

The importance of full disclosure of toxic chemical ingredients and their use was highlighted in both the House report and the Colburn article. The House report noted that companies were merely using suppliers and purchasing off the shelf products with no idea what chemicals they would be injecting into the ground. We wish to note especially here the observation that several more products were not identified until remedial work plans were being developed. This is significant as medical personnel were treating persons who were injured and exposed to toxic chemicals. Knowledge of the chemicals involved is critical to appropriate medical treatment.

This study is particularly concerning because some chemicals could not be studied because their CAS numbers were not available-- true for 44% of chemicals. Therefore, the potential exists for the chemicals that were not analyzed to have serious health effects. Additionally, the chemicals found in open-pit containments "produced a health profile even more hazardous than the pattern produced by the drilling and fracking chemicals".

We support the Precautionary Principle which places the burden of proof on proponents of an activity rather than on potential victims. The Gas Industry should be required to prove safety of their processes and chemicals prior to being given authorization to proceed.

- DEC should require companies to prove the necessity for and safety of the chemicals they intend to use.
- A thorough review of the acute and chronic toxicity of all chemicals should be done. DEC should propose to ban the use of highly toxic chemicals in gas drilling and fracking.

Some of the chemicals listed as additives have been classified as known or possible carcinogens.

Some of these chemicals include:

1. **Acrylamide**, a probable human carcinogen (EPA). Linked to muscle weakness, numbness, sweating, unsteadiness, and clumsiness.
2. **Benzene**, a known human carcinogen (ATSDR). Breathing benzene can cause drowsiness, dizziness, and unconsciousness. Long-term benzene exposure can cause effects on bone marrow, anemia, and leukemia.
3. **Ethyl benzene**, a possible human carcinogen (ATSDR). Exposure to low concentrations of ethyl benzene in the air for several months to years causes kidney damage in animals. Irreversible damage to the inner ear and hearing has been observed in animals exposed to low concentration for several days to weeks.
4. **Formaldehyde**, a reasonably anticipated human carcinogen (ATSDR) which appears on Dr. Landrigan's 15 Toxic Threats that put children at risk list. Formaldehyde has been linked to nasal and eye irritation, neurological effects, increased risk of asthma and/or allergy in low doses.

5. **Naphthalene**, a reasonably anticipated human carcinogen (ATSDR). Exposure to naphthalene in large amounts dangerous and has been linked to nausea, vomiting, fatigue, and loss of appetite among other things.

IV. Long Term Protection of Water Resources: Aquifers and Water Bodies

Freshwater is an essential requirement for all life. Aquifers providing freshwater have formed over millions of years and geologic layers serve to secure this resource for future generations by isolating the aquifer from contamination. Geologic changes occur over geologic time. Gas drilling may occur for 2- 40 years, yet aquifers will need protection for well beyond that from the intrusions that were part and parcel of the drilling process, in order to assure clean drinking water for present and future generations.

Surface water bodies are not similarly isolated, and they are filled by groundwater, springs and other surface water features. Surface water bodies such as lakes and rivers serve important ecological functions and provide water for wildlife and often for humans.

The SGEIS fails to adequately discuss the necessity of long term protection of New York's water resources. In fact despite some limited economics analysis in the SGEIS, there was no effort to place a valuation on the water resources of the state or to estimate the costs of any remediation as well as the costs of providing alternative water sources. Naturally this is a difficult task involving value judgments about the worth of an aquifer, which many might say is priceless. Such an analysis is absolutely necessary to plan an adequate regulatory program that fulfills the Environmental Conservation Law's requirements to preserve and protect the state's resources. By assigning no value to water resources, adequate personnel and financial resources cannot be estimated and allocated to their protection.

The weight of scientific evidence and the experience of many other jurisdictions around the country point to enormous obstacles to ensuring the long term protection of aquifers. The obstacles include a large number of unknowns associated with site geology and hydrogeology as well as limitations related to the technology used. For example a problem that was responsible for the BP oil disaster in the Gulf – concrete placement- is also one that will plague all gas drilling in the state, during drilling and for thousands of years after well closure. Aquifers need protection for the long term and vertical conduits must be securely closed or contamination will be the outcome.

The earlier financial assurances in the regulations were clearly inadequate for this long term post-closure care, \$250,000 per well, with a \$2 million cap per company. However, now the DEC has removed the specifics on the amount of financial assurances required-- instead indicating that DEC will decide this in the future. The industry must assume full financial liability during operations and for a long time period into the future. If sites are closed with no funds in an escrow account for long term care the financial burden will be shifted onto the public and this is unacceptable.

Earthquakes and increased seismic activity can occur naturally from geologic movements but also as a result of hydraulic fracturing, which supplies lubricating fluids to earth faults. The

discussion here will address the need for Comprehensive Site Assessment prior to drilling, Monitoring and Precautions during Operations and Production, Post Well Closure Care, Seismic Events and Our Recommendations in each of these areas. Here we heavily reference the work of Paul Rubin, consultant with Hydroquest, who provided detailed Testimony to the Delaware River Basin Commission. We are providing the entire testimony as an attachment. We urge DEC to read it and incorporate his recommendations in regulatory requirements.

a. Comprehensive Site Assessments Prior to Drilling

Careful evaluation and site surveys are necessary prior to any drilling activities. The SGEIS provides a very broad brush simplified view of an enormous area of the state. Appropriately it states that no site-specific reviews have been done. This becomes important as the Department intends to proceed with permitting drilling without requiring additional site-specific reviews, except in isolated instances.

Beyond historical and archaeological features of significance, surface features such as waterbodies, wetlands, caves and caverns, pipelines & conduits, abandoned wells and land fractures and fissures should be identified. Other structures – old mines, water treatment facilities, solid waste landfills, and hazardous waste/ radioactive waste sites located within the vicinity of a drilling site also need special attention. Increased seismic activity could affect the integrity of liners, piping and other equipment associated with these structures resulting in additional environmental impacts.

All abandoned wells must be carefully plugged with GPS (Global Positioning System) location noted for future maintenance and replacement. The SGEIS makes provision only for abandoned wells that are accessible to the applicant. However, no drilling should occur in an area where abandoned wells can provide a conduit for contamination to drinking water or to air. The presence of orphaned, improperly plugged or abandoned wells within close proximity (1 Mile) of planned new drilling operations pose a significant risk to water quality in overlying freshwater aquifers. Hydrofracking of new wells results in high hydrostatic pressures that can drive contaminants into freshwater aquifers.

Since the geology of the shale formation tells us that portions can reach the surface, the comprehensive site survey needs to identify such locations and do baseline testing for methane levels.

Detailed surficial fracture mapping should be done in advance of well permitting. The use of soil gas surveys and other fracture mapping techniques could be used to locate fractures that are open to the ground surface that are actively releasing methane from gas shales at depth. Analyses of this nature could be used to reduce the risk of aquifer contamination by avoiding placement of horizontal projections through gas-emitting fracture zones. Soil methane levels should also be tested.

Caves and caverns pose more complex problems as the full extent of their size and depth must be known. Communication with deeper rock formations is important to identify early. Baseline methane testing is important, as well as ongoing testing and warning signs.

Awareness of the locations of all pipelines and conduits is important as they provide a preferential pathway for methane migration, which can lead to offsite explosions in buildings. Precautionary measures and monitoring should be put in place to avoid catastrophes at local schools or other locations where large numbers of people could be impacted. Rubin's testimony cites the "explosion of a homeowners pump house and the contamination of 13 additional homes with combustible levels of methane gas in Chautauqua County, New York in 1983. In addition, a municipal well one mile away also found measurable levels of methane. Testing of the gases via radiocarbon dating methods confirmed that their origin was from the underlying Devonian shale. The data solidly pointed to the source of the problem as being newly installed deep gas wells, thus documenting methane migration through a fresh water aquifer some 27 years before today."¹⁶

It should also be noted that the solubility of methane in water increases in direct proportion to pressure, which explains the rapid depressurization and release of methane in homeowner wells.¹⁷

In addition to the Site Survey the comprehensive assessment should include:

- A seismic hazard analysis evaluating seismic risk to well casings, downhole cement integrity, and freshwater aquifers. They should also assess the risk to aquifers via sheared and failed boreholes.
- Watershed and aquifer boundaries relative to expected horizontal well projections
- Hydrogeologic assessment of both shallow and deep groundwater flow systems. (horizontal projections should not extend under watershed divides)
- Pre-alteration baseline groundwater flow and homeowner water chemistry maps over and outward from all horizontal projections.
- All homeowner wells within a distance of 2,000 feet beyond the outer boundary of wellhead horizontal projection arrays should be sampled prior to drilling and tested to establish baseline water quality according to accepted EPA methods. The regulations should specifically list all chemical parameters, test methods, and detection limits that apply.
- Baseline water testing for wells should include methane, all expected additives, company specific tracer chemicals (which should be required) and arsenic, mercury, radium
- Baseline water and sediment testing for chemical parameters at site and adjacent water bodies—rivers, streams, ponds, springs.
- Baseline biological monitoring of the presence and health of aquatic organisms.

In addition to site assessments, regional water quality monitoring including gauges to monitor water levels and flow should be installed with funding provided by appropriate fees from the gas industry

b. Monitoring and Precautions during Operations and Production

Long Term Isolation of aquifers is absolutely necessary, but the technology has not been sufficiently developed to provide for this isolation. Hydraulic fracturing involves deliberately creating both a large vertical pathway, a well bore, across multiple geologic zones, and also

hundreds of fractures that cannot be technically limited only to the shale layer. The natural state of multiple layers of rock & soil provide the important isolation that is critical for aquifer protection. Well-bores and casings use concrete and steel both of which are subject to degradation in less than one hundred years. Proponents of hydraulic fracturing make an optimistic assumption when they assume that the well bore and casings have been properly installed and isolate other rock formations and the aquifer from hydraulic fracturing. The reality is that the consistency and quality of concrete is variable and since this is all below ground it cannot even be inspected in the way bridge supports and other civil projects can. In addition, both natural gas and flowback liquids can impair the proper setting of concrete and both of these are present. Numerous reports of serious contamination have resulted in the typical industry response—hydrofracking was not responsible; it was poor concrete or poorly installed well casings. The industry is well aware of a variety of failure mechanisms related to concrete, including corrosion, shrinking, cracking, debonding, poor concrete blends, and micro-annulus formation. Since industry is aware of these problems, it should not be used as an excuse. Industry must be responsible for all aspects of the drilling and production process.

Contamination of aquifers can be extensive, permanent and irreparable. The failure to ensure the isolation of aquifers enables the commingling of saline and freshwaters, radioactivity and toxic hydrofracking additives. Even if no observable problems have occurred during the production phase of a well, problems can be discovered much later.

We recommend:

- Gas companies must be required to conduct and report on downhole microseismic or other technologic imaging results that may indicate the presence of faults or joints which could extend upward above gas-bearing shales.
- Cement mixtures and sealants should be required to conform with state-of-the-art self-healing mixtures similar to FUTUR cement that has the ability to react to and repair channels through which hydrocarbon-rich fluids and gases may otherwise migrate.
- Gas well installations should be required to use the best available materials and technology.
- Based on evidence that fractures extend beneath surface valleys and to distances of at least 2,000 feet, the regulations should prohibit gas well projections within a minimum of 2,000 feet from all surface water supply intakes, reservoirs, lakes, wetlands, major streams, and rivers and expressly prohibit drilling and hydraulic fracturing under water bodies (see Rubin testimony) Upward escaping methane and other contaminants that leak into these water bodies may irreparably harm them.¹⁸
- Regulations should require the assessment of hydraulic connectivity to nearby water wells. A step-drawdown pumping test on the production well should be performed upon drilling completion to near the base of the freshwater aquifer, before the borehole is cased and grouted. Preferably, this test should be conducted prior to well pad construction. The step-drawdown test should be conducted for a minimum of 24-hours, at increasing,

measured, discharges designed to significantly stress the aquifer but not dewater the well. Well discharge should be routed far from the pumping well to avoid recirculation of discharged groundwater. Because industry-wide zonal isolation materials have a design life of 100 years or less, any production well found to be hydraulically connected to homeowner wells should be promptly completed as a freshwater supply well suitable for future use by the property owner and their grandchildren. Failure to assess hydraulic connectivity along fracture pathways will almost certainly lead to another contaminant situation, like that in Dimock, PA, especially under pressurized hydrogeologic conditions.¹⁹

- All homeowner wells within 2,000 feet of the planned production well should be fitted with transducers and monitored. If a decrease in water level is measured in all homeowner wells being monitored, the test may be discontinued prior to 24 hours. The gas well should be closed.
- The entire borehole must be sealed with cement or alternate high-quality durable sealant material. The regulations should be amended to require continuous and complete plugging of the entire borehole from production zones to the ground surface.
- There must be provisions for prompt well or well field closure by DEC in response to serious events using Commissioner's Orders to cease operations. Such criteria should be established in regulations, for example: "sudden hydraulic or water quality response of homeowner wells to hydraulic fracturing operations that demonstrate a link between deep and shallow fracture systems; any contaminated homeowner wells within or near a well field; unchecked and spreading aquifer contamination that is not being actively investigated and remediated via systematic hydrogeologic investigation; sponsor-specific tracer detection in freshwater aquifers or surface water features; repeated buildup of sustained casing-head pressure (SCP) in gas wells; gaseous excursions to homeowner wells, homes, or outbuildings; gaseous excursions to land and surface waters; demonstrated water and/or air quality impact to caves and mines; destructive seismic activity within or near a well field; improperly maintained and/or leaking gas wells or spills, accidents, leaks, etc. related to gas wells, tanks, well infrastructure and related equipment; contaminated surface waters or surface water features (such as wetlands or vernal pools); presence of airborne contaminants that have or may adversely impact resident health or the environment (e.g., volatile organics); fish and other biota kills associated with gas field chemicals; too lengthy contaminant investigation and response time; resident health issues associated with gas field activities; sudden sickness and/or death of nearby homeowner animals, as well as other animal mortality (e.g., rabbits, deer, birds, frogs, fish); secret, non-disclosure, property buy-out, or settlement agreements between a project sponsor and private landowners that result in any lack of transparency regarding surface water, groundwater, and/or airborne contaminants and knowledge of their full environmental and health impacts)."²⁰
- Stringent regulation and stringent oversight and enforcement procedures including threat of closure must be used for gas drilling and production. There is a high potential for irreparable harm to natural resources and aquifers. Small fines are not adequate in this

situation. Gas companies must be held financially responsible for all environmental harm and adequate remediation. Gas-company specific chemical tracers must also be utilized.

- Complete remediation of contamination must be required to the extent technically feasible and if not possible companies responsible must pay for long term alternative water supply to the affected area. (Whole house filtration devices should not be considered effective remediation.) Property settlements with individual property owners might address their own concerns, but companies should not be permitted to buy themselves out of full liability for damage and corrective measures related to the entire resource. Allowing such settlements means that companies would effectively be buying an aquifer.
- Gas field hydrofracturing has already contaminated freshwater aquifers far removed from production wellheads. Rubin cites known instances in Dimock and Springfield Townships, PA, where there has not been a rigorous response and cleanup effort.²¹ He adds that “the hydrologic damage may already be so great that remediation is impossible.”²² While industry targets poorly cemented casings and failed sheaths, Rubin discusses another likely scenario – “opened and interconnected fault and joint pathways between formerly isolated horizons” due to hydrofracking.²³ This situation is far more serious according to Rubin than leakage solely up the annulus between the bedrock and the casing as there is no possible means of ever restoring the integrity of the freshwater aquifer by effectively plugging and abandoning vertical production wellbores.
- Only non-toxic hydrofracking additives should be permitted. A variety of mechanisms and the limits of current technology make it highly likely that adverse impacts from hydrofracking will occur in NY. This could include frank medical problems from ingesting contaminated water. Only non-toxic additives can provide the protection needed. Full public disclosure of all additives should still be provided with their physical and chemical characteristics.
- Disposal wells should be prohibited. Reuse or so-called beneficial use of brine should also be prohibited.

c. Well Closure and Long Term Maintenance

Groundwater Aquifer Protection requires protection over the long term, for centuries

Geologic changes occur over geologic time. Gas drilling may occur for 2- 40 years, yet aquifers will need protection for well beyond that from the intrusions that were part and parcel of the drilling process, in order to assure clean drinking water for present and future generations.

Contamination of aquifers can be extensive, permanent and irreparable. Casings and Plugging of abandoned wells depends on concrete materials, which have been shown to degrade significantly within 40 years. The failure to ensure the isolation of aquifers enables the commingling of saline

and freshwaters, radioactivity and toxic hydrofracking additives. Even if no observable problems have occurred during the production phase of a well, problems can be discovered much later.

It is imperative that a financial assurance mechanism be put in place to provide the resources for re-drilling, re-plugging of wells and providing maintenance for centuries into the future in order to ensure the continued protection of the aquifer. If state-of-the-art concrete mixtures are only viable for 100 years, then regulations permitting a large area drilling program must have a provision that guarantees re-boring and re-cementing of wells every 100 years over the course of one million plus years (i.e., 10,000 plus times). If degradation occurs in less than 100 years then the schedule for re-drilling and re-plugging must be more frequent.

Rubin cites a number of authors when listing a variety of mechanisms for concrete failures: “Cement shrinkage, debonding, and failure can result from a variety of causes including too high a water content, water expulsion, shrinkage after setting and during hardening, radial cracking, tensile failure, compressional failure, traction, cement dehydration, osmotic dewatering in the presence of high salt content formation brines, corrosive gases, high formation pressures and temperatures, changes in temperature and pressure, sustained casing pressure (SCP), poor cement blends, pressure testing, gas and water channeling, gas migration through setting cement, influx via mud channels, internal and external microannulus development, cement shattering, and cement plastic deformation.”²⁴

The current regulations addressing financial assurance are completely inadequate for the needs as we briefly addressed earlier. The Department was already forced to turn over abandoned oil wells to the EPA for closure because of the lack of funds to close them.

V. Seismic Events

Despite the fact that the SGEIS dismisses the significance of seismic events related to hydraulic fracturing, two major events in NY were discussed.

“The 3.2 magnitude event recorded on February 3, 2001, was coincident with, and is suspected to have been triggered by, test injections for brine disposal at the New Avoca Natural Gas Storage (NANGS) facility in Steuben County. The cause of the event likely was the result of an extended period of fluid injection near an existing fault for the purposes of siting a deep injection well. The injection for the NANGS project occurred numerous times with injection periods lasting 6 to 28 days and is substantially different than the short-duration, controlled injection used for hydraulic fracturing.

One additional incident suspected to be related to human activity occurred in late 1971 at Texas Brine Corporation's system of wells used for solution mining of brine near Dale, Wyoming County, New York (i.e., the Dale Brine Field). The well system consisted of a central, high pressure injection well (No. 11) and four peripheral brine recovery wells. Location was in the Clarendon-Linden fault zone. Fluids were injected in the high pressure injection well from Aug through early Nov. (3 months) and ceased due to an increase in seismic activity. A decrease in seismic activity occurred when the injections ceased.” SGEIS p. 4-32-4-33.

It is interesting to note that the SGEIS provided no information on the quantity of fluids injected or the depth of injection but both of these examples relate to disposal wells and hydraulic fracturing. Numerous other examples in other states have pointed to increased seismicity associated with hydraulic fracturing. In Arkansas a moratorium was imposed as a result of increased seismic events, and subsequently these events decreased.

It is appropriate to interject here the concept of LOAEL, Lowest Observable Adverse Effect Level, from toxicology. The LOAEL found in animals often has a safety factor applied to derive a safe concentration for humans.

We have clearly identified an adverse effect – increased seismicity – from injection wells. While the LOAEL might not have regulatory status in NY for seismicity, SEQRA does. Since an adverse effect was found it was the state’s responsibility—not to merely dismiss the effect and its magnitude but to fully examine the potential for significant impacts from this finding. SEQRA is not adequately satisfied on the issue of increased seismicity.

In October, 2011 the UK Blackpool Gazette reported on the British Geological Survey’s (BGS) conclusion that two recent seismic events felt nearby along the UK coast in Flyde were most likely to have been caused by fracking²⁵.

In January both Scientific American and the NY times reported on the fact that disposal injection wells in Ohio were responsible for two earthquakes- 2.7 and 4.0 magnitude. There had been 9 tremors in total over 9 months. It is believed that disposal of fracking fluids providing lubrication of the rock faces at a fault line.²⁶

In Arkansas there was one earthquake of 4.7 magnitude among thousands of smaller ones linked to disposal wells. At the Rocky Mountain Arsenal in Colorado, wastewater from weapons productions was tied to quakes in the 1960s including several of magnitude greater than 5.0.²⁷

Scientists in the December 13th NY times article highlighted the data and information limitations.

“Scientific research needs to be done to understand the data on fluid injections and volumes,” said William Leith, senior science adviser for earthquake and geologic hazards at the United States Geological Survey, which has re-established a project to study induced seismicity in response to the string of suspicious quakes in shale-gas areas.”

“The reason I can’t make any real conclusive statements is just because of the limitations of the data,” the seismologist, Austin A. Holland, said.” (Oklahoma seismologist)

The mechanism for the quakes is thought to be related to the “migration of the fluid into rock formations below the shale. Seismologists say that these deeper, older rocks, collectively referred to as the “basement,” are littered with faults that, although under stress, have reached equilibrium over hundreds of millions of years.”

“There are plenty of faults,” said Leonardo Seeber, a seismologist with the Lamont-Doherty Earth Observatory. “Conservatively, one should assume that no matter where you drill, the basement is going to have faults that could rupture.”

This NY Times article provides an illustration of the importance of the precautionary principle. Scientists are inevitably limited by the availability of adequate data and information. Both Leith and Holland reference the problem of inadequate data upon which to draw conclusions. However, Seeber expresses the essence of the precautionary principle—he knows that older rocks “the basement” have lots of faults, so using his professional judgment he recommends assuming conservatively that “no matter where you drill, there are going to be faults that could rupture.”

The essence of the precautionary principle is acting in the face of limited information using professional judgment to protect the public from harm.

Excessive lubrication of faults and fractures with highly pressurized hydraulic fracturing fluids, bolstered by repeated hydrofracturing episodes, may result in fault activation and bedrock settlement. This, in turn, may result in catastrophic shearing of production well boreholes and casing strings even in the absence of natural seismic activity.

Whether a natural earthquake or one induced by hydrofracking, according to Rubin, even a magnitude 2 or 4 earthquake could lead to gas well failures due to shearing of well casings.²⁸

We recommend:

- A complete prohibition of disposal wells.
- Limiting hydraulic fracturing to non-fault zones.
- Microseismic surveys before and following fracturing and refracturing
- Careful documentation of injected fluids- total quantities and additive quantities
- A comprehensive seismic monitoring network in drilling areas

VI. Naturally Occurring Radioactive Materials (NORMS):

The Marcellus Shale is considered to be “highly radioactive”.²⁹ Recovering shale gas will include radioactive materials at much higher levels than people experience from surface rock formations. Uranium and thorium decay to form radium and radon. Eventually radon forms stable lead, a toxic metal. Radium emits alpha particles and gamma rays. It mimics calcium and goes to bone where it can lead to bone cancer or affects blood forming causing leukemia or aplastic anemia. Radon is also an alpha emitter. Alpha particles must be ingested or inhaled to cause harm to humans. Radon is the second leading cause of lung cancer after smoking, causing about 19,000 deaths annually.

Maximum Contaminant Levels for Drinking water are:

Uranium- 30 micrograms/liter

Radium 226 & 228- 5 pCi/l (picocuries per liter)

Radium 224- 15 pCi/l

Radon - 300 pCi/l
Gross alpha- 15 pCi/l

Radon is not of much concern in outdoor air, but it tends to build up within buildings with average concentrations in indoor air of 1.3 pCi/l of air and an action level of 4 pCi/l of air. At the action level it is recommended that homes undertake remediation which is relatively easy to do. Marvin Resnikoff, PhD indicates that Marcellus Shale is approximately 25 times background and points out that reuse of drilling fluids could increase concentrations of radioactive materials to as high as 16,000 pCi/l.³⁰ The reuse of drilling fluids also would increase the concentrations of other important naturally occurring toxins- arsenic, lead, and mercury. Such increased concentrations raise the risk and consequences for an aquifer that has not been adequately sealed in the drilling and fracturing process.

Dr. Resnikoff points out that DEC is using industry data derived from a non-certified lab and inappropriate methods. We have found industry bias and unscientific work elsewhere in the SGEIS, such as related to air emissions.

The dSGEIS states that “build-up of NORM in pipes and equipment has the potential to cause significant adverse impact” (p. 19) and goes on to express the need for additional data in order to “assess the need for mitigation and to require appropriate handling and treatment options” (p 5-142). Therefore the dSGEIS even admits that there is a gap of knowledge surrounding this issue of NORMs and fracking. There is also a need for additional data collection on how NORMs in the Marcellus Shale will impact the workers who work on equipment and are highly exposed in order to plan an adequate health and safety program.

We are also concerned about the handling of natural gas derived from shale formations and whether on-site treatment and cleaning of the gas will remove radioactivity prior to connecting to a sales line. High levels of radiation could impact homes that use natural gas.

We recommend:

- Baseline testing prior to drilling of aquifers and nearby wells for radium, mercury, lead, arsenic, and others usually found in Shale formations.
- Baseline testing of surface soil where the well pad will be for similar pollutants as above.
- Requirement for company to have radioactive material license.
- Specific permit conditions relevant to radioactive material handling and worker protection.
- Specific permit conditions must be established that detail the handling of pipes, feeder lines, condenser tanks and water/gas separators removed from service because of radioactive scale and sludge accumulation, to prevent a trail of radiation exposure and contamination and to prevent recycling of these materials and use in situations that will expose people to hi levels of radiation.
- The current plans for reuse of drilling fluids must be reevaluated as increasing contaminant concentrations may exacerbate the potential for serious harm to aquifers.

- Flowback water, brine and cuttings should all be tested for radium using ELAP certified labs and EPA approved methods and sent to a licensed treatment and disposal facility as necessary.
- Brine and other fluids that are contaminated with radioactive material and other toxins should not be allowed to be "beneficially reused" for road spreading or other so-called beneficial use.
- The DEC must develop a concrete, clear plan of action for disposal of fracking wastes that contain NORMs.
- Testing of natural gas for radiation prior to introducing it to a sales line and establish appropriate radiation limits.

VII. Drinking Water and Wastewater Infrastructure will be adversely impacted by Hydrofracking

Existing water and wastewater infrastructure is inadequate to serve existing needs. In 2008 two state agencies prepared reports which documented the extraordinary infrastructure needs for drinking water and sewage treatment over the next 20 years amounting to \$74.9 billion. (Dept. of Health, Drinking Water, Nov. 2008) Dept of Environmental Conservation, Sewage Treatment, March 2008) There are no longer federal grants to support water and wastewater infrastructure. Instead the state has established revolving loan funds. However, because local governments are so stretched financially they cannot provide the needed match to obtain these loans.

Drinking Water

Community Drinking Water systems must provide an adequate supply of water to meet the needs of the population served. While the SGEIS may have discussed the overall quantity of water available for a broad area, the SGEIS did not look at the potential for impacts on the supply of water for local community drinking water systems. Vast volumes of water are used in the hydrofracking process, which could reduce available water for community water systems. As we discussed in our Part One comments, there is unequal protection for drinking water. For NYC and Syracuse a setback buffer distance is provided from the boundaries of the watersheds. All other community water systems and homeowner wells have buffer protection that applies to the source of drinking water, not the watershed, thus the protection is one-tenth or less of that applied for NYC or Syracuse. These buffer distances relate primarily to drill site surface disturbances, which contribute suspended particulates that may increase the need for filtering. None of these buffers zones reduce the effect of the large scale use of toxic chemicals in hydraulic fracturing, the truck transportation, the accidents and spills, which will inevitably translate to some impacted water systems. Most community water systems rely on having relatively clean and pure water as intake water for the community. They then treat the water with simple filtration and chlorine to reduce microbial contaminants. These systems have little ability to deal with toxic contaminants.

As we discussed earlier in these comments, hydraulic fracturing poses the significant problem of aquifer and water body contamination, both of which could adversely impact community water systems. Three of the contaminants found in shale formations and in flowback water are subject to national primary drinking water standards: arsenic, mercury, and radium. DEC also proposes

to allow the use of hundreds of toxic chemicals as additives. In addition, it is critically important that sufficient testing is required to ensure that hydraulic connectivity is not present and associated with the supply water for a community water system.

The Department of Health report documents billions of dollars of need for community drinking water systems and increasing regulatory requirements over the last 30 years. Given the existing drinking water backlog in the state it is hard to envision a worse situation than adding thousands of hydrofracking wells. Sufficient oversight of the gas industry is absolutely essential to the protection of drinking water. Currently the DEC is proposing to have the entire program run by the Division of Mineral Resources. This is not a workable plan. The Division could play a role, but other divisions must provide oversight and enforcement in their areas of expertise. The Division of Water is essential for water protection and the Division of Air for air emissions. The Division of Hazardous materials also must be involved.

We recommend stringent regulation, oversight and enforcement of gas drilling in the state, so that local governments are not forced to cope with extraordinary burdens associated with providing clean water to their populations.

Sewage or Wastewater Treatment

The SGEIS operates under the erroneous assumption that drinking water and sewage treatment infrastructure will not be impacted adversely as a result of high volume hydraulic fracturing. We have noted earlier that the socioeconomic analysis failed to adequately identify and discuss the economic impacts to local governments. These economic costs from hydrofracking are likely to be the highest for drinking water and sewage treatment infrastructure. However, because it was not studied in the SGEIS, we have no idea what the total costs could be and who will pay? Based on the SGEIS and proposed regulations we think that the true costs will be shared by local governments, taxpayers and the environment with environmental degradation and health impacts adding additional costs that are never adequately quantified.

The 2008 DEC report that discussed the wastewater treatment needs for the state presented the billions of dollars in needs for the next 20 years in conjunction with no relief in sight for this considerable backlog. The report acknowledges that adequate water infrastructure funding is essential for protection of public health and the environment. Major cuts to federal programs and reductions in state funding have left local governments struggling with their wastewater needs. Many facilities are beyond their useful lives. One-fourth of sewage treatment plant equipment is beyond its 30 year lifespan. For example, there are more than 7000 miles of sewers in NY that are beyond their 60 year useful life. A 2004 DEC survey correlated aging equipment with declining water quality in receiving waters. At the same time there are increased requirements for sanitary overflows, combined sewer overflows, stormwater, and effluent limitations. The absence of funding is not at all correlated with reduced requirements. Fewer than 40% of NY municipalities have a capital improvement program for their wastewater system. DEC reported in 2008 that it had 203 enforcement orders for municipalities in relation to Clean Water Act violations. We discuss here some of the most important findings and the relationship to hydraulic fracturing.

First, it must be noted that sewage treatment processes are primarily focused on physical processes such as settling of solids and microbial processes which digest human wastes. Municipal sewage treatment plants discharge effluent to receiving waters. This effluent must comply with standards as well as, in some cases, standards that are established for receiving water bodies in order to improve water quality. In many cases despite full sewage treatment, nutrient pollution is still excessive, requiring upgraded treatment processes. Most of these standards have nothing to do with toxic pollutants and that is because sewage treatment plants are incapable of removing or treating most toxic pollutants. This is to some extent acknowledged in the 2008 DEC report when it discusses the inability of sewage treatment plants to treat pharmaceuticals and personal care products. Unfortunately other toxic pollutants were not discussed in that report. Municipalities that have high metals at their plants are required to establish industrial pre-treatment programs. These programs are designed to prevent industries from discharging the offending pollutants so they do not arrive at sewage treatment plants. Unfortunately, the DEC Wastewater report failed to discuss these Industrial pre-treatment programs and the work involved in implementing them. The SGEIS proposes that heavily contaminated wastewater from drilling operations be sent to municipal wastewater treatment plants. There is notably no discussion in the SGEIS that WWTs cannot remove most of the contaminants present in flowback water. Municipal sewage treatment plants that cannot finance essential upgrades to their wastewater infrastructure will not be able to operate an industrial pre-treatment program for thousands of drilling sites. These pre-treatment programs are ordinarily used for large industries, with the number of industries involved relatively few. Individual requirements are developed for the industries which require the treatment of their own sewage to remove problematic contaminants.

The fracking process uses millions of gallons of water and creates millions of gallons of hazardous liquid. Flowback water is composed of hundreds of deliberately introduced additive toxic chemicals, in addition to substances naturally present in shale layers, like arsenic, mercury and radioactive materials. Municipal sewage treatment plants may end up discharging a variety of toxic pollutants with their effluents to receiving waters. Sewage treatment plants are often upstream from drinking water intakes, and this raises the potential for significant public health impacts. A municipal wastewater treatment plant in Pennsylvania has highlighted the dangers of treating fracking flowback water in such facilities. A study of the Pennsylvania Brine Treatment Josephine Facility documented contamination which exceeded ATSDRs minimum risk levels for various toxins including benzene, strontium, barium, and bromide in effluent. Even though this treatment plant was approved for treating fracking waste, it was still discharging toxins that were not only at levels of concern but also not listed in their permit.³¹ This shows that even a facility that is approved to treat fracking flowback cannot safely do so.

As we mentioned above sewage treatment plants make use of microbial processes to treat wastewater.

Microbes can be killed or poisoned by a variety of pollutants including salts from brine, toxic additives and radioactive materials. The viability and health of the microbial system is essential for sewage treatment. However, the SGEIS does not even identify the multiple issues associated with directing flowback water to municipal sewage treatment plants; much less provide the kind

of detailed analysis required under SEQRA. Therefore we strongly object to directing flowback water to public sewage treatment plants.

Although the dSGEIS acknowledges potential problems with treating this flowback water, it does not require the industry to maintain their own flowback treatment plants. This leaves the possibility open for fracking flowback to be treated at publicly owned treatment facilities. These sewage treatment plants are NOT designed to handle the toxic chemicals or NORMs present in fracking fluid. Additionally, the financial burden of treating this waste at public facilities will be placed on the taxpayer, not the industry.

Additionally, New York's municipal wastewater infrastructure is already strained, with the financial burden of maintaining the system falling largely on local governments. Treatment of fracking waste will prove to be an additional burden on local government's already stretched abilities to maintain their aging, inadequately funded municipal waste management facilities. Efficient, effective drinking water facilities are necessary for a healthy economy, environment and population.³² The dSGEIS does not discuss the impact fracking waste treatment at municipal waste facilities would have on local governments, economic growth in communities, and potential public health impacts.

We recommend that the industry be required to operate private industrial sewage treatment plants, which can be designed to treat flowback water with the specific pollutants present.

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