THE IMPACTS OF HORIZONTAL HYDRAULIC FRACTURING IN NEW YORK SHALE FORMATIONS ON HUMAN HEALTH AND THE ENVIRONMENT

Comments Submitted to the United States Environmental Protection Agency
Re: Hydraulic Fracturing Study Design

September 28, 2010

INTRODUCTION

Otsego 2000 is an historic and environmental preservation organization located in the village of Cooperstown, New York, and the County of Otsego. We are a nonprofit charitable organization that has fought for almost 30 years to protect and enhance the rural, historic, agricultural, and environmental resources of our region. We are located on the shores of historic Otsego Lake, memorialized in the fabric of American folklore and literature as "Glimmerglass" through the writings of James Fenimore Cooper, whose father founded Cooperstown. We are home to the Glimmerglass Historic District, Hyde Hall National Landmark, Glimmerglass State Park, Glimmerglass Opera, the Baseball Hall of Fame, the New York State Historical Association, and numerous other important State and federal historic landmarks and places.

Otsego Lake is also the headwaters of the Susquehanna River, one of the world's oldest river systems and the second largest river system in the United States. The historic Susquehanna supplies nearly half of the fresh water in-flow to the Chesapeake Bay and, along its historic route, serves more than eight million people, bordering the major population centers of the East Coast.[1] The Susquehanna was designated an "American Heritage River" in 1997[2] by the U.S. government.

The Otsego County watersheds are part of the Susquehanna River Basin and are made up of numerous rivers, streams, and wetlands, which support extensive agricultural operations, provide drinking water to more than 500,000 residents and visitors, and support many endangered species and critical habitats. Otsego Lake is also the municipal source of water for the Village of Cooperstown.[3] Clearly, the protection of these waters is important to safeguard the municipal

[1] Susquehanna River Basin Commission, Overview and Fact Sheet. http://www.srbc.net/about/geninfo.htm
[2] http://en.wikipedia.org/wiki/American_Heritage_Rivers
[3] Comments on the Scope of the EPA Study of Hydraulic Fracturing, prepared by Paul Rubin, HydroQuest, September 11, 2010. http://63.134.196.109/documents/HydroQuestEPAComments9-11-10withfigures.pdf. See also the Comments of Otsego 2000 to the New York Department of Environmental Conservation on the dSGEIS, prepared by Zarin & Steinmetz, December 30, 2009. http://63.134.196.109/documents/DSGEISCommentLtr123009.pdf

drinking water supplies, the Susquehanna River Basin, and the foodshed in our region and far beyond.

Otsego 2000 submits these comments to convey our deep concern regarding the threat that the process of hydraulic fracturing poses to our water and health. We note that our own New York State Department of Environmental Conservation (DEC), charged with enforcement of state as well as federal environmental law, has, regretfully, failed in its function to study these matters scientifically before draft regulations were prepared and submitted for public comment.

In its defense, New York's DEC has been decimated by budget cuts. For example, the staff of the DEC Minerals and Resources Division, which has oversight of gas drilling, has been cut repeatedly and now numbers only 16 individuals responsible for the inspection and enforcement of regulations for tens of thousands of producing and abandoned wells in New York State.[4] In addition, the DEC is saddled with a statutorily imposed conflict of interest due to its role as both protector of the environment and the responsible agency for advancement of mineral extraction rights. This is similar to the flawed system in place at the Federal Minerals Management Services, which has been strongly criticized for its role in the recent BP Gulf oil spill.[5]

These weaknesses in the DEC, coupled with a severe budget crisis in New York State, have given the gas industry an opening. They stepped in as "consultants" to the DEC to help write one of the most troubling examples of an environmental impact statement ever prepared: The NYS DEC Draft Supplemental Generic Environmental Impact Statement Re High Water Volume Hydraulic Fracturing (dSGEIS). The defects in the dSGEIS are now well known and include a complete absence of scientific analysis in virtually every category of potential negative impacts, including cumulative impacts, fresh water consumption, chemical composition of fracturing fluids, air emissions, wastewater treatment and disposal, and radioactivity of produced water, among others. Significantly, in the dSGEIS the DEC admits that it has not completed its studies in any of these areas.[6] Yet the DEC submitted the flawed dSGEIS for public comment and announced plans to move quickly to issue drilling permits based on this document. We believe this decision by the DEC represents a failure of its regulatory mandate and a violation of Federal and New York State environmental law.[7]

The insufficiency of the dSGEIS and the regulatory failure that it represents has led to an unprecedented level of scrutiny and criticism. Virtually all regulatory and supervisory agencies operating in New York State which have considered the matter have asked the DEC to withdraw the dSGEIS. These include:

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[4] "Agency in Crisis: New York's Department of Environmental Conservation," March 18, 2010. http://eany.org/news/03182010.html; http://eany.org/issues/reports/DEC_ToxicSpill_FINAL.pdf

[5] "U.S. to Break Up Oil Rig Regulator," by Stephen Power, Neil King, and Siobhan Hughes, *Wall Street Journal*, May 12, 2010.. http://online.wsj.com/article/SB10001424052748704250104575237981485045538.html

[6] Otsego 2000 Executive Summary and Comments to the dSGEIS summarizing material omissions, November, 2009. http://63.134.196.109/documents/v1_NicoleCommentsFinal.pdf

[7] Wiseman, Hannah. "Untested Waters: The Rise of Hydraulic Fracturing and the Need to Revisit Regulation," 20 Fordham Envt. L. Rev. 115 (2009). http://www.earthworksaction.org/pubs-others/HydraulicFracking_Wiseman2009.pdf
See also: authorities cited in the Otsego 2000 Comments to the dSGEIS, prepared by Zarin & Steinmetz, cited above.

1. United States Environmental Protection Agency[8]
2. NYS Public Employees Federation Steward Council Division 169[9]
3. Office of Watershed Inspector General for the NYC Watershed, Office of the New York Attorney General[10]
4. New York City Department of Environmental Protection[11]
5. State Senator Antoine Thompson, Chair, NY State Senate Environmental Conservation Committee[12]
6. NYS Conference of Environmental Health Directors[13]
7. Otsego County Soil and Water Conservation District (December 29, 2009)[14]
8. Otsego Lake Watershed Supervisory Committee[15] and others.

We are aware of no governmental or supervisory agency with responsibility for environmental regulation in New York State that has recommended that the DEC proceed on the current record, including the DEC's own employees' union representing 2,000 professional, scientific, and technical staff (number 2 in the list above).

Yet the DEC has steadfastly refused to withdraw the dSGEIS and has continued to insist that it is working toward a final GEIS to be issued once all the comments are reviewed. At the same time, months after the public comment period closed on the initial draft, the DEC unilaterally carved out the New York City Watershed and the Skaneateles (Syracuse) Watershed for heightened environmental protection. This the DEC did through a press release, without supporting scientific analysis or opportunity for public comment by the rest of New York State's communities.[16]

Thus, the DEC appears to have abandoned the "generic" process in all but name. We have grave concerns that this constitutes discrimination against less politically important communities in New York State and we fear that the DEC is now preparing to allow a two-tiered system, with environmental safeguards for some but not for all. We believe such actions are disturbing, potentially illegal, and must not be permitted to stand. For the reasons set forth below, we believe the Otsego County watersheds and others similarly situated throughout New York State are entitled to precisely the same protections afforded to New York City and to Syracuse.

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[8] http://www.epa.gov/region2/spmm/pdf/Marcellus_dSGEIS_Comment_Letter_plus_Enclosure.pdf
[9] http://www.riverkeeper.org/wp-content/uploads/2010/01/signed-final-12-28-09-PEF-Encon-Letter.pdf
[10] http://www.riverkeeper.org/wp-content/uploads/2010/03/Pages-from-WIG-DSGEIS-Comments_1-11.pdf
[11] New York City Comments on the dSGEIS, December 22, 2009, http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/nycdep_comments_final_12-22-09.pdf. "Final Impact Assessment Report: Impact Assessment of Natural Gas Production in the New York City Watershed," prepared by Hazen and Sawyer Environmental Engineers and Scientists, December 2009. http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/12_23_2009_final_assessment_report.pdf
[12] http://catskillcitizens.org/learnmore/ANTTHOMCOM.pdf
[13] http://www.nysacho.org/files/CEHD%20Gas%20Drilling%20Comments%20final%2012%2029%2009.pdf
[14] http://www.otsegosoilandwater.com/Otsego_Co_SWCD_dSGEIS_comments.pdf
[15] Comments on the NY DEC Draft of Supplemental Generic Environmental Impact Statement (dSGEIS) for Gas Drilling, October 2009. Otsego Lake Watershed Supervisory Committee. http://63.134.196.109/documents/10sep21_OLWSC_CommentsonDraftSGEIS_Oct09.pdf
[16] "DEC Announces Separate Review for Communities with Filtration Avoidance Determinations," April 23, 2010. http://www.dec.ny.gov/press/64699.html

As a result of these circumstances, it is imperative that the EPA step forward to enforce uniform, Federal environmental laws, and to conduct the type of thorough scientific analysis which the DEC should have done before issuance of the dSGEIS. In addition, by now it is clear that the impact of horizontal hydraulic fracturing such as that proposed in New York State, and more specifically the Susquehanna River Basin and the Delaware River Basin, will clearly have impacts beyond the borders of New York State or, for that matter, any one state. This is a second important reason why the EPA must now do a comprehensive study on an issue of such broad regional and national significance.

Finally, the EPA must do this study to correct its own record. Many have claimed that the EPA has already found the process of hydraulic fracturing safe, based on an earlier, limited study of methane coal-bed extraction processes issued by the EPA in 2005. (Wiseman, Hannah, "Untested Waters," cited above.) This faulty characterization of the EPA's position has served to confuse and mislead the public. We hope that with a new, thorough study the EPA can and will set the record straight about what risks are associated with hydraulic fracturing in New York's tight shale formations. Below, we focus on the most urgent matters that the EPA must include in its study.

I. THE EPA MUST STUDY THE FULL LIFECYCLE OF THE HORIZONTAL HYDRAULIC FRACTURING PROCESS.

The EPA must study <u>all</u> of the risks of horizontal hydraulic fracturing, not just those occurring during pressurized fracturing operations. The public has been seriously misled by the industry and state regulators which have repeatedly assured the public that there have been "no" instances of water contamination attributed to horizontal hydraulic fracturing.[17] These statements are false and based on a misleading, overly narrow definition of fracturing, which limits it to that portion of the process which is pressurized, thereby excluding all other risks, including below-ground migration of fracking fluids over time, casement failure, equipment failure, human error, negligence, wastewater disposal, air emissions and virtually every other potential pathway of contamination. In effect, the position taken by the industry and state regulators has been that if one cannot prove that contamination occurred *while the wells were under pressure*, then that instance of contamination cannot be attributed to the fracturing process.

Appendix 15 of the DEC's dSGEIS contains 15 statements from regulatory officials in states in which hydraulic fracturing has been employed. Each of these officials asserts, in very similar language, that there are no documented, confirmed, or verified instances of water contamination attributed to hydraulic fracturing. However, in reading these letters, it is clear that thousands of instances of contamination have occurred in locations where horizontal hydraulic fracturing is being used. These instances were simply not attributed to hydraulic fracturing because there was no way to prove they occurred *during* the pressurized fracturing process.

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[17] Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program, September 30, 2009. See Chapter 5: Natural Gas Development Activities and High Volume Hydraulic Fracturing, p.147. http://www.dec.ny.gov/docs/materials_minerals_pdf/ogdsgeischap5.pdf. See also Chapter 6: Potential Environmental Impacts, p. 37. http://www.dec.ny.gov/docs/materials_minerals_pdf/ogdsgeischap6.pdf; and Appendix 15: Hydraulic Fracturing – 15 Statements from Regulatory Officials. http://www.dec.ny.gov/docs/materials_minerals_pdf/ogsgeisapp2.pdf.

In one instance, the Ohio Department of Natural Resources admits it investigated a claim of natural gas incursion into fresh water aquifers in Bainbridge Township. The Ohio regulators state that the damage was caused by a "defective primary cement job on the production casing, which was further complicated by operator error."[18] However, they then assert that this contamination is not attributable to hydraulic fracturing because it was caused by operator error. In another instance, the Pennsylvania Department of Environmental Protection (DEP) admitted that they had investigated close to 80 cases of contamination, which they concluded were related not to hydraulic fracturing, but to "drilling through aquifers, improper design or setting of upper and middle well casing, or operator negligence."[19]

Another example is found in the letter submitted by the New Mexico Minerals and Natural Resources Department stating that it "currently lists approximately 421 groundwater contamination cases caused by pits and approximately an equal number caused by other contamination mechanisms" but none where the cause claimed was hydraulic fracturing.[20] In Texas, the Texas Railroad Commission stated that not a "single case [of water contamination] is associated with hydraulic fracturing." However, they admit to "354 active groundwater cases attributed to oil and gas activity [they do not discuss their closed cases] a few cases were due to blowouts that primarily occurred during drilling activity."[21] And Kentucky admits that they have received citizen complaints of alleged contaminations, but nothing that can be substantiated.[22]

The fact is that evidence is now mounting that both ground- and surface water contamination through the operations associated with horizontal hydraulic fracturing have clearly occurred throughout the United States.[23] The Pennsylvania Land Trust Association reports that it "identified a total of 1,614 violations accrued by 45 Pennsylvania Marcellus Shale drillers between 1/1/2008 and 8/20/2010, using records obtained by the PA Department of Environmental Protection. The report focused on 1,056 violations that were judged as having the most potential for direct impact on the environment.[24]

Based on these reports and others throughout the country, the EPA must now once and for all define the process of horizontal hydraulic fracturing to include the *full* lifecycle of associated activities and the risk potential throughout the lifecycle, including casement failure, operator error, and negligence, and the EPA must study the *full* array of impacts on water resources, including fresh water withdrawals, all sources of potential ground- and surface water contamination, and wastewater clean-up and disposal, including radioactive waste treatment. The continuing deception of the public by statements by government officials that this process is harmless and has never caused water contamination must be corrected.

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[18] Appendix 15: Hydraulic Fracturing – 15 Statements from Regulatory Officials, p. 14.
[19] Ibid, p. 16
[20] Ibid, p. 17
[21] Ibid, p. 19
[22] Ibid, p. 24
[23] Michaels, Craig; Simpson, James L.; and Wegner, William: *Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling*, published by RiverKeeper, September 16, 2010. http://www.riverkeeper.org/wp-content/uploads/2010/09/Fractured-Communities-FINAL-September-2010.pdf
[24] *Marcellus Shale Drillers Amass Violations,* Pennsylvania Land Trust Association, September 1, 2010. http://conserveland.org/violationsrpt

II. RISKS OF CONTAMINATION THROUGH UNDERGROUND MIGRATION AND CASING FAILURES MUST BE STUDIED.

The dSGEIS mapping of vertical fractures, faults, and fissures in Otsego County and elsewhere in New York is inadequate, and as such does not sufficiently address pre-existing contaminant pathways that extend from the Marcellus Shale to aquifers and surface waters. The presence of confirmed fractures and faults that extend from gas-rich geologic beds to the surface, some of which extend laterally for miles and are closely linked with others formed under similar structural conditions, constitute potential contaminant pathways to surface waterways and reservoirs, as well as to freshwater aquifers. Because the density, location, aperture width, and length of all fractures (often present but not visible beneath a soil mantle) are not known, it would not be prudent to risk placement of numerous gas wells within watersheds that contain lakes and reservoirs used for public water supplies, including the Otsego Lake and the Otsego County watersheds.[25]

David P. Kargbo, soil scientist with the EPA's Region III Office of Environmental Innovation, recently cautioned:

> "During drilling into the tight Marcellus Shale, there is a slight risk of hitting permeable gas reservoirs at all levels. This may cause shallow gas blowouts and underground blowouts between subsurface intervals. Other geo-hazards that may pose challenges to drillers in the Marcellus Shale include: (1) disruption and alteration of subsurface hydrological conditions including the disturbance and destruction of aquifers, (2) severe ground subsidence because of extraction, drilling, and unexpected subterranean conditions, and (3) triggering of small scale earthquakes."[26]

Added to this is the ever-present risk of well casing failure, which has already been blamed for methane and fracking fluids contaminations in other states. Kargbo recently cautioned about the still unresolved challenges of drilling in tight shale formations, including high fracking pressures and high below ground temperatures which will impact casing performance:

> "The control of well bore trajectory and placement of casing become increasingly difficult with depth... At the Marcellus Shale, temperatures of 35-51°C (120-150°F) can be encountered at depth and formation fluid pressures can reach 410 bar (6000 psi). This can accelerate the impact of saturated brines and acid gases on drilling at greater depths. In addition, the effect of higher temperature on cement setting behavior, poor mud displacement and lost circulation with depth makes cementing the deep exploration and production wells in the Marcellus

[25] Rubin, Paul A., HydroQuest, Comments to the EPA dated September 11, 2010, citing, Jacobi, *et al.* http://63.134.196.109/documents/HydroQuestEPAComments9-11-10withfigures.pdf
Northrup, James L. "Potential Leaks from High Pressure Hydrofracking of Shale," September 8, 2010. http://63.134.196.109/documents/NorthrupEPAFinal9-12-10.pdf

[26] Kargbo, David; Wilhelm, Ron G.; and Campbell, David J.: "Natural Gas Plays in the Marcellus Shale: Challenges and Potential Contaminants," Environmental Science and Technology, volume 44, pp. 5679 – 5684, June 2, 2010. http://pubs.acs.org/doi/abs/10.1021/es903811p

> Shale quite challenging. For example following a recent report by residents of Dimock, PA, of natural gas in their water supplies, inspectors from the Pennsylvania Department of Environment Protection (PADEP) discovered that the casings on some gas wells drilled by Cabot Oil & Gas were improperly cemented, potentially allowing contamination to occur...."[27]

Recent evidence of the risks of well casing failures has been growing and we are aware of no long-term studies of the anticipated life expectancy of well casings over long periods of time, perhaps hundreds of years. For example, Maurice B. Dusseault, with the University of Waterloo's Porous Media Research Centre, co-authored "Why Oil Wells Leak: Cement Behavior and Long-Term Consequences,"[28] reporting that oil and gas wells can develop leaks along the cement casing years after production has ceased and the well has been plugged and abandoned. Further, he and his colleagues found that these effects are influenced by the pressures and temperatures encountered in deep wells:

> "… in North America, there are virtually tens of thousands of abandoned, inactive, or active oil wells and gas wells, including gas storage wells, that currently leak gas to surface… some of the gas enters shallow aquifers… where the methane itself can generate unpleasant effects such as gas locking of household wells, or gas entering household systems to come out when taps are turned on." [29]

In another paper, Dusseault reports that drilling in seismically active areas or regions where the presence of underground faults and fissures is not well understood (such as in New York State) creates the risk of "shear," which can lead to well casing failures over time. He states, "Usually impairment arises through shear owing to displacement of the rock strata along bedding planes or along more steeply inclined fault planes. These displacements are shear failures. They are triggered by stress."[30] Dusseault confirms that casing failure can be "linked to reactivation of old faults, high-pressure injection, slurry-fracture injection, or massive solids production… reducing the incidence and rate of casing impairment through stress can be achieved through a number of tactics. Favored ones include **avoidance of the most troublesome regions** [emphasis added]."[31]

Moreover, repeated fracturing cycles in the same well or in adjacent wells exacerbates all of these risks. Paul A. Rubin, in his comments to the EPA on the hydraulic fracturing study scope, explains:

> "With each successive hydro-fracturing event, more toxic contaminants are introduced into subsurface formations, including those already aggravated and

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[27] Ibid.
[28] Dusseault, Maurice B.; Gray, Malcom N.; and Nawrocki, Pawel A.: "Why Oil Wells Leak: Cement Behavior and Long-Term Consequences," Society of Petroleum Engineers, Inc., OnePetro, paper number 64733-MS, presented at the International Oil and Gas Conference and Exhibition, Beijing, November 7-10, 2000. http://www.onepetro.org/mslib/servlet/onepetropreview?id=00064733&soc=SPE
[29] Ibid.
[30] Dusseault, Maurice B. *et al*., "Well Casing Shear: Causes, Cases, Cures," June 2001, *SPE Drilling & Completion.* http://www.terralog.com/article/spe72060.pdf
[31] Ibid.

> potentially opened in the first fracturing cycle. In addition, as gas companies expand their operations, they may turn to the new, more effective, multilateral drilling technology to selectively tap multiple target zones in adjacent areas. This will necessarily result in multiple wellheads and multiple fracturing operations in close proximity. Through these processes, it is highly likely that new, previously unconnected, fractures will be integrated into the area influenced by each production well."[32]

As a result, repeated horizontal hydraulic fracturing in the seismically active, geologic conditions present in Otsego County and elsewhere in the Appalachian basin would almost certainly result in significant risk of casing failure and contaminant excursions, including both methane and fracking fluid migration. It is obvious that these important matters must be investigated and studied before hydraulic fracturing can be permitted to commence.

III. THE TREATMENT OF RADIOACTIVE MATERIALS EXTRACTED WITH NATURAL GAS MUST BE STUDIED AND UNDERSTOOD.

One of the clearest examples of regulatory failure by the DEC is its failure to address the environmental impact of dangerous levels of radium, a radioactive element, found in the flow-back and produced waters extracted along with methane in the Marcellus and Utica shales. The New York State Department of Health (NYSDOH) reported that its preliminary analysis of Marcellus shale brine samples showed significantly elevated concentrations of radioactive materials in the waste stream. The NYSDOH expressly cautioned the DEC that "handling and disposal of this wastewater could be a public health concern" and that "disposal of waste produced may be problematic due to the potentially high concentrations of radioactive materials in the waste stream." [33]

David Kargbo, cited above, also confirmed high levels of radioactivity, stating: "…New York's Department of Environmental Conservation (NYSDEC) reported that thirteen samples of wastewater from Marcellus Shale gas extraction contained levels of radium-226 (226Ra) as high as 267 times the safe disposal limit and thousands of times the limit safe for people to drink."[34]

Yet despite this evidence, the NYSDEC issued the dSGEIS for public comment while admitting in the document itself that the DEC did not have sufficient data to analyze the radioactive content

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[32] Rubin, Paul A., HydroQuest, Comments to the EPA dated September 11, 2010, citing, Jacobi, *et al.* http://63.134.196.109/documents/HydroQuestEPAComments9-11-10withfigures.pdf

[33] NYSDOH Bureau of Environmental Radiation Protection Comments on the proposed Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program, July 21, 2009. http://s3.amazonaws.com/propublica/assets/natural_gas/nysdoh_marcellus_concerns_090721.pdf

[34] Kargbo, David; Wilhelm, Ron G.; and Campbell, David J.: "Natural Gas Plays in the Marcellus Shale: Challenges and Potential Contaminants," Environmental Science and Technology, volume 44, pp. 5679 – 5684, June 2, 2010. http://pubs.acs.org/doi/abs/10.1021/es903811p. See also Wilber, Tom; "Tests Show High Concentration of Radioactive Waste in the Marcellus," *Binghamton Press & Sun Bulletin*, December 6, 2009. http://www.pressconnects.com/article/20091206/NEWS01/912060349/Tests-show-high-concentration-of-radioactive-waste-in-Marcellus; and Lustgarten, Abraham, "Is the Marcellus Shale Too Hot to Handle?" ProPublica, November 9, 2009. http://www.propublica.org/article/is-the-marcellus-shale-too-hot-to-handle-1109

of flow-back and produced water.[35] The EPA must now, as part of its study of the impacts of hydraulic fracturing on the environment, correct this omission and determine how to test for, protect against exposure from, and treat and dispose of radioactive wastes found in the tailings, flow-back and produced waters resulting from hydraulic fracturing in the Marcellus and Utica shales.

There is an additional concern regarding exposure to radon, produced as a part of the decay process of radium.[36] After cigarette smoking, radon is the second leading cause of lung cancer in the world and has long been a focus of human health concern. It is well established that radon gas migration to homes and other structures through naturally occurring cracks and fissures in shale rock can be dangerous to human health.[37] Based on existing studies of methane soil gas anomalies over open fractures, there is evidence that naturally occurring fractures and faults provide upward gaseous migration pathways, even in the absence of deep hydraulic fracturing.[38] If fracture and fault networks are integrated and enlarged via hydraulic fracturing, it is clearly probable that radon gas excursions and contamination will also increase.[39]

There may also be a risk of increased exposure to radon in homes where natural gas or propane produced from the Marcellus shale is used for heating and cooking. Radon is released when methane and/or propane are burned in heaters, stoves, fireplaces, water heaters, and other appliances. There have been studies of the accumulation of radon in the home.[40] What remains unknown is whether methane and propane extracted from the Marcellus shale, which may contain higher levels of radium than gas extracted from conventional sources, will also contain higher levels of radon when it is delivered to homes, and what effect this might have on human health.

Finally, farmers who have negotiated terms in their gas leases that allow for direct, consumptive use of gas mined on their property are similarly potentially threatened and may be exposed to liability to their tenants and farm workers for damage to their health due to radon contamination. Farm machinery and equipment, barn heaters, and agricultural vehicles often run on raw, compressed natural gas or propane. Studies must be conducted on the possible radium and radon levels of raw gas extracted from the Marcellus and Utica shale, its potential accumulation via

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[35] Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program, September 30, 2009. Chapter 7: Mitigation Measures, p. 103. http://www.dec.ny.gov/docs/materials_minerals_pdf/ogdsgeischap7.pdf

[36] Gray, P.R., "NORM Contamination in the Petroleum Industry," *Journal of Petroleum Technology*, vol. 45, No. 1, pp. 12 – 16. (January 1993) http://www.onepetro.org/mslib/servlet/onepetropreview?id=00022880&soc=SPE

[37] "Exposure to Radon Causes Lung Cancer in Non-Smokers," EPA http://www.epa.gov/radon/healthrisks.html; "A Citizen's Guide to Radon," EPA. http://www.epa.gov/radon/pubs/citguide.html; and "Handbook on Indoor Radiation – A Public Health Perspective," World Health Organization (WHO) http://whqlibdoc.who.int/publications/2009/9789241547673_eng.pdf

[38] Rubin, Paul A., HydroQuest, Comments to the EPA dated September 11, 2010, citing, Jacobi, *et al.* http://63.134.196.109/documents/HydroQuestEPAComments9-11-10withfigures.pdf; see also Lustgarten, Abraham. "Why Gas Leaks Matter in the Hydraulic Fracturing Debate," August 2, 2010. http://www.propublica.org/article/why-gas-leaks-matter-in-the-hydraulic-fracturing-debate

[39] Northrup, James L. "Radioactive Waste in Horizontal Hydrofracking," September 20, 2010. http://63.134.196.109/documents/10sep21_RadioactiveWastefromHorizontalHydrofracking.pdf

[40] Field, William J. et al.; "Residential Radon Gas Exposure and Lung Cancer," American Journal of Epidemiology vol. 151, Issue 11, pp. 1091-1102, October 26, 1999. http://aje.oxfordjournals.org/content/151/11/1091.short

farm equipment, and its potential effects on the health of farm workers and animals. These are serious matters that call into question the assertion that natural gas is the healthy, clean burning alternative fuel we have been led to believe it is.

IV. NY DEC ADMITS IT LACKS TREATMENT FACILITIES FOR HAZARDOUS WASTES ASSOCIATED WITH HYDRAULIC FRACTURING.

Paradoxically, the DEC proposes classifying the fracking chemicals as they are being hauled up to the well pads as "hazardous wastes," while the same chemicals regurgitated after a fracking cycle in flow-back water would be classified merely as "industrial waste."[41] Beyond what these wastes are called, where and how these dangerous wastes will be treated and disposed of is critical to protecting surface and groundwater. There are three potential means of disposing of these wastes. At present, none has been sufficiently studied.

As we now understand the process proposed by the DEC, high water volume hydraulic fracturing will create billions of gallons of contaminated fluids each year in New York State alone.[42] What has been obscured is that New York State does not have facilities to process or treat this quantity of waste, and neither do its neighboring states. The possibility of tanker trucks hauling billions of gallons of contaminated water from drilling sites to non-existent wastewater treatment plants must be addressed and resolved as part of the EPA study. Whether it is municipal garbage floating on barges, or radioactive waste from nuclear power plants, or tanker trucks full of toxic wastewater being hauled from state to state or disposed of in interstate waterways, the days of ignoring the by-products of industrial operations are over. The EPA must include the study of flow-back and produced water *treatment and disposal* as part of its study of the potential fracturing impacts on water sources.

1. Injection of Wastes in Underground Wells Creates Unknown Long-Term Risks.

> The first option to dispose of wastewater is to inject it permanently underground into abandoned gas wells. There are a number of problems with this as a solution to the waste disposal issue. First and foremost, New York State lacks such injection or disposal wells. There are only four such sites permitted in New York State, as compared, for example, with 12,000 such sites in Texas.[43]
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> Moreover, if this option is chosen, there must be long-term studies of the impact of permanently removing billions of gallons of fresh water from the water tables. In addition, the EPA must study the risks of potential migration of the abandoned contaminated fluids over possibly hundreds of years as a result of seismic activity,

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[41] Draft Supplemental Generic Environmental Impact Statement on the Oil, Gas, and Solution Mining Regulatory Program, September 30, 2009. See Chapter 5: Natural Gas Development Activities and High Volume Hydraulic Fracturing, compare p.67 and p. 121. http://www.dec.ny.gov/docs/materials_minerals_pdf/ogdsgeischap5.pdf

[42] "Final Impact Assessment Report: Impact Assessment of Natural Gas Production in the New York City Watershed," prepared by Hazen and Sawyer Environmental Engineers and Scientists, December 2009. http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/12_23_2009_final_assessment_report.pdf

[43] Northrup, James L. "Radioactive Waste in Horizontal Hydrofracking," September 20, 2010. http://63.134.196.109/documents/10sep21_RadioactiveWastefromHorizontalHydrofracking.pdf

future fracturing activities, and eventual casement failure in the injection wells. (See e.g. M. Dusseault *et al*. "Casing Shear: Causes, Cases, Cures," cited above.)

2. Disposal of Wastes by Spreading for Dust Control and De-Icing is Equally Troubling.

A second wastewater disposal method that must be studied and is already in use in some places is the spreading of hydro-fracking wastes on roads to reduce dust levels and for de-icing purposes. This practice is highly questionable and may lead to rapid contamination of surface drinking water sources by brine, radioactivity, and fracking chemicals. NYSDOH has expressly cautioned against such use of brine and produced water, which contain high levels of naturally occurring radioactive materials (NORM), stating: "Production brine from other formations has been used as spray-down water for dust suppression on unpaved roads or vehicle race tracks. It has also been used to de-ice roadways. The high levels of NORM in production brine from the Marcellus may prohibit this or other potential beneficial uses unless the radium can be substantially removed."[44] The EPA must now fully consider the impacts of such disposal practices on surface waters and public health.

3. **Treatment of Wastes at Municipal or Private Treatment Facilities is not yet Financially or Technologically Feasible.**

Finally, the disposal of these wastes through municipal or privately-owned water treatment facilities must be studied. Existing water treatment facilities in New York State do not have the capacity to filter or remove dissolved fracturing chemicals from the wastewater stream. Treatment facilities in Pennsylvania are also overloaded, leading to the real possibility of wastewater-filled trucks with nowhere to go and the increasing temptation to dump into any available stream.

Municipal and privately-owned water treatment plants are currently set up solely to handle household wastes, not dissolved chemicals. Again, David Kargbo *et al.* state:

> "One common disposal method required by some states is processing the wastewater in wastewater treatment plants (WWTP). A significant challenge to this method is the observation that contaminants and total dissolved solids (TDS) in the water may complicate wastewater treatment…. Although the hydrofracture fluid systems are 90-95% water, the TDS in the wastewaters can rise to over 200,000 mg/L, precluding many standard water treatment technologies from processing and cleaning hydro-fracture wastewater." [45]

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[44] NYSDOH Bureau of Environmental Radiation Protection Comments on the proposed Draft SGEIS on the Oil, Gas and Solution Mining Regulatory Program, July 21, 2009. http://s3.amazonaws.com/propublica/assets/natural_gas/nysdoh_marcellus_concerns_090721.pdf

[45] Kargbo, David; Wilhelm, Ron G.; and Campbell, David J.: "Natural Gas Plays in the Marcellus Shale: Challenges and Potential Contaminants," Environmental Science and Technology, volume 44, pp. 5679 – 5684, June 2, 2010. http://pubs.acs.org/doi/abs/10.1021/es903811p.

See also, Otsego Lake Watershed Supervisory Committee Comments submitted to the DEC, December 31, 2009, citing the Hazen and Sawyer Final Impact Assessment, quoted below.[46]

Thus, the fracturing wastewater in New York as well as in other states will simply be diluted and passed through into receiving waters, essentially untreated. This will have serious negative impacts far beyond any one region or state, as the Susquehanna River Basin, the Delaware River Basin, and many other watersheds and waterways may be threatened by long-term cumulative impacts of contamination. All of these risks will be further exacerbated by long-term cumulative impacts of consumptive fresh water withdrawals. As David Kargbo *et al*. summarized:

> "Concerns about the ecological impacts to aquatic resources resulting from huge water withdrawals have been raised throughout the Marcellus Shale region. This is particularly an issue under drought conditions, low seasonal flow, locations with already stressed water supplies, or locations with waters that have sensitive aquatic communities that depend on clean, cool waters. For example, about 36% (12,639 km2 ((4937 mi2)) of the Delaware River Basin (DRB), which is home to 5 million people, are headwaters and underlain by the Marcellus Shale. Water withdrawal for hydraulic fracturing is a major water resources concern in the DRB."[47]

V. EQUAL PROTECTION FOR SIMILARLY SITUATED WATERSHEDS IS A LEGAL AND MORAL IMPERATIVE.

Virtually all studies of the geology of the Marcellus shale formation conclude that the geological characteristics, permeability, and faulting are very consistent throughout the formation; Paul Rubin, in his comments to the EPA, affirms that the geology of these watersheds is "virtually indistinguishable."[48] (See also, Hazen and Sawyer, Final Impact Assessment Report, cited above.) The dSGEIS recognized this scientific fact and proposed "generic" permitting procedures, insisting that operations in New York State must be centrally controlled and permitted under "generic" rules. To the extent the proposed rules were not generic, the inconsistencies were limited to small, suggested differences in set back requirements.

However, after the public comment period closed on the dSGEIS, the DEC unilaterally moved to exempt the New York City and Syracuse watersheds from generic treatment under the dSGEIS. The DEC announced it would require site-specific review for permit applications in these privileged watersheds.[49] The stated rationale for this decision was that New York City and

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[46] Comments on the NYDEC Draft of Supplemental Generic Environmental Impact Statement (dSGEIS) for Gas Drilling, October 2009, Otsego Lake Watershed Supervisory Committee.
http://63.134.196.109/documents/10sep21_OLWSC_CommentsonDraftSGEIS_Oct09.pdf

[47] Kargbo, David; Wilhelm, Ron G.; and Campbell, David J.: "Natural Gas Plays in the Marcellus Shale: Challenges and Potential Contaminants," Environmental Science and Technology, volume 44, pp. 5679 – 5684, June 2, 2010.
http://pubs.acs.org/doi/abs/10.1021/es903811p.

[48] Rubin, Paul A., HydroQuest, Comments to the EPA dated September 11, 2010.
http://63.134.196.109/documents/HydroQuestEPAComments9-11-10withfigures.pdf

[49] "DEC Announces Separate Review for Communities with Filtration Avoidance Determinations," April 23, 2010.
http://www.dec.ny.gov/press/64699.html

Syracuse maintain "unfiltered" drinking water systems. What the DEC failed to note in making this distinction is that the risk to human and animal health due to methane migration and the presence of fracking fluids in drinking water is the same whether the water is filtered or unfiltered, since filtration and existing water treatment facilities throughout the state do not remove the dissolved chemical contaminants which are a by-product of fracturing. (See discussion at Part III, above). Win McIntyre, Coordinator, Otsego Lake Watershed Supervisory Committee explained:

> "[C]ontaminants in gas drilling wastewater are in solution, and, if in the water supply, cannot be removed by conventional filtration processes used by municipal water treatment facilities. Thus, it's irrelevant whether the water supply is filtered or unfiltered, the impact on public health of low levels of toxic chemicals will be the same…. The point is that the typical filtration process for surface drinking waters removes only insoluble particulate matter, and not contaminants in solution."[50]

The point was reinforced in the DEP/Hazen and Sawyer report, which states, "In the event that filtration is ultimately required, NYC expects that the current $10 billion filtration plant design would not be adequate to remove the chemicals that could be introduced into the watershed. Advanced oxidation, granulated activated carbon adsorption, and/or membrane filtration processes could be required."[51] These advanced treatment processes do not exist either in New York City or at the Otsego Lake/Village of Cooperstown filtration plant, or at other municipal water treatment facilities in the State.

Therefore, since filtration of surface drinking water will not remove the dissolved contaminants from gas drilling flow-back wastewater, the impact of contamination will be the same regardless of whether the water is filtered or unfiltered. Thus, the same level of protection from gas drilling should be provided for *all* surface public drinking water supplies. More specifically, whatever protection is deemed appropriate for the NYC watershed should also be applied to all other surface public drinking water supplies in the shale-gas region of New York State.[52] The law requires equal treatment of similarly situated groups in the absence of a rational basis for discrimination (See citations in Otsego 2000 Comments to the dSGEIS, Zarin & Steinmetz, December 31, 2009, cited above).

Thus, the distinction the DEC attempts to draw between "filtered" or "unfiltered" water supplies is scientifically and legally unsupportable as well as morally repugnant. The same level of protection from gas drilling wastes should be accorded to all public drinking water supplies. The EPA must study the scientific basis for the DEC's decision to accord special protection to certain watersheds to determine if they are scientifically supported. We strongly maintain that there is no

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[50] McIntyre, Win: "Gas Drilling in Drinking Water Watersheds," April 2010.
http://63.134.196.109/documents/10sep21_McIntyre-DrinkingWaterinWatersheds.pdf

[51] "Final Impact Assessment Report: Impact Assessment of Natural Gas Production in the New York City Watershed," prepared by Hazen and Sawyer Environmental Engineers and Scientists, December 2009.
http://www.nyc.gov/html/dep/pdf/natural_gas_drilling/12_23_2009_final_assessment_report.pdf

[52] Comments on the NY DEC Draft of Supplemental Generic Environmental Impact Statement (dSGEIS) for Gas Drilling, October 2009, Otsego Lake Watershed Supervisory Committee.
http://63.134.196.109/documents/10sep21_OLWSC_CommentsonDraftSGEIS_Oct09.pdf

legitimate way to protect the health and water of one large group of New Yorkers while denying the same protections to all.

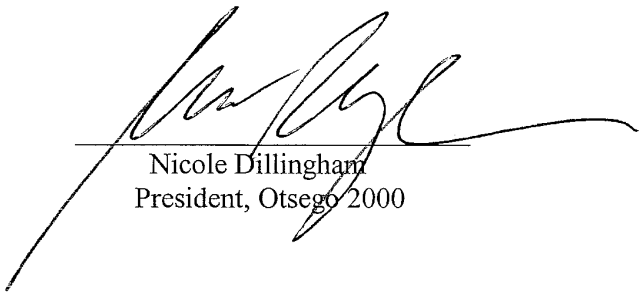
CONCLUSION

The threat of contamination of huge portions of our water supplies is a risk which is both great and obvious, yet our state government has been slow to react and our industry leaders, driven by short-term profits, have been urging a rush to drill before the studies of environmental impacts are complete. A failure on the scale being proposed could compromise huge portions of our nation's water supplies and be effectively irremediable. If the U.S. EPA will not take the time to study these matters thoroughly, who will do so? And who will bear the risks of missing the obvious? This time, we must determine whether the risks of failure are "too big" before we undertake them.

All of the scientific evidence discussed above and in the comments submitted by virtually all regulatory and supervisory agencies in New York State, as well as the thousands of comments submitted by home owners, farmers and ordinary citizens of New York, Pennsylvania, and elsewhere who want to preserve the water resources of the region, point to the conclusion that the process of horizontal hydraulic fracturing in tight shale formations is not safe. This is not a close question. We call on the EPA to expand the scope of its study of hydraulic fracturing to allow a thorough investigation of the potential impacts of hydraulic fracturing on water quality throughout the lifecycle of a well, and to prepare a definitive analysis and report of its findings which will withstand scientific scrutiny and protect the environment the EPA was established to defend.

We greatly appreciate the opportunity to transmit these comments.

Respectfully submitted,



Nicole Dillingham
President, Otsego 2000