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The New York City Council  
Committee on Environmental Protection  
Councilmember James F. Gennaro, Chairman

## BRIEFING PAPER OF THE INFRASTRUCTURE DIVISION

Robert Newman, Legislative Director

### **Oversight: Natural Gas Drilling in the New York City Drinking Water Watershed**

#### **I. Introduction**

On Wednesday September 10, 2008 at 1 p.m., the Committee on Environmental Protection will hold an oversight hearing on the topic of "Natural Gas Drilling in the New York City Watershed". Invited to testify are officials from the Mayor's Office of Long-Term Planning and Sustainability, Emily Lloyd, Commissioner of the New York City Department of Environmental Protection, Suzanne Mattei, Regional Director of the New York State Department of Environmental Conservation, Commissioner Alexander B. Grannis, Commissioner of the New York State Department of Environmental Conservation, Brad Field, Director, Division of Mineral Resources, New York State Department of Environmental Conservation, Val Washington, Deputy Commissioner, Office of Remediation and Materials Management, New York State Department of Environmental Conservation, Alan Steinberg, Regional Administrator of the United States Environmental Protection Agency, Region 2, Walter Mugdan, Environmental Protection Agency Director, Division of Environmental Planning and Protection, Valerie Grey, Assistant Commissioner, New York State Department of Health, Cathleen Breen of NYPIRG, Robert Muldoon of the Sierra Club, Larry Levine of the Natural Resources Defense Council, Isabelle Silverman of Environmental Defense, Audrey McClendon, Chairman of the Board and Chief Executive Officer of Chesapeake Energy Corporation, Bob R. Simpson, Chairman of the Board and Chief Executive Officer of XTO Energy, Inc. and many elected officials and other entities.

#### **II. Background**

There is no life without potable water, and the New York City Watershed provides potable water for more than fourteen million people in New York City, upstate New York, Philadelphia and northern New Jersey. Developed and nurtured by New York City over more than one hundred years and supported by recent acquisitions of land and conservation easements, it is probably the most important regional natural resource. New York City's drinking water was recently declared the winner of the 2008 New York State Water Taste Test[1]. New York City's watershed is so clean that New York City is one of four major cities in the nation with a water supply that is not filtered. New York City has demonstrated the importance of this resource to its future by purchasing more than ten percent of the watershed, better than 110, 000 acres, largely by fee simple ownership or by conservation easement.[2] Nothing should be allowed to jeopardize an unfiltered and pure drinking water source for more than fourteen million people able to serve the drinking water needs of this and future generations. Even Mayor Bloomberg has been quoted as saying "[o]ur great concern would be when you're drilling so close to the water supply, the watershed for this city".[3]

Natural gas trapped deep in the bedrock below the New York City watershed is also an important regional resource but it can only serve the natural gas needs of New York and other places and improve the economy of New York and other places for a very brief period, particularly

in comparison to the time it took for the resource to develop. The seven or more years it may take to fully exploit the resource must be carefully weighed against the drinking water needs of millions of people far into the future. Exploiting this resource must be done with great care and attention to public health and environmental protections. Before we exploit this resource, New York City must be very certain that nothing will destroy its significant investment in the future of the City.

*a. What is Marcellus Shale?*

Shale is the name for sedimentary rock that was once layers of mud and clay.[4] Marcellus shale is named for the Marcellus shale outcrop found near the Town of Marcellus, New York in 1839.[5] The Marcellus shale formation is found from Ohio to New York, a distance of more than six hundred miles, at depths ranging from a mile to more than nine thousand feet below the surface. Trapped in the deep reaches of the bedrock are anywhere from 168 trillion cubic feet of gas to as much as 516 trillion feet of gas, allegedly enough to supply the needs of the entire United States for up to two years.[6]

Geologists have long known that due to the porosity of the shale, it had a high likelihood of containing more free gas in fractures [7] but until recently very little of the gas was considered recoverable.[8] What has changed is that today's record high energy prices make recovery of the natural gas look much more attractive from an economic standpoint.[9]

To extract the energy from so deep in the bowels of the earth, a relatively new and unconventional process known as horizontal drilling combined with hydraulic fracturing will be employed.[10] Horizontal drilling, was principally developed by Halliburton Corporation, and has only been employed in New York State since the 1980s but is not discussed in the 1992 Department of Environmental Conservation's Generic Environmental Impact Statement on the Gas, Oil and Solution Mining Regulatory Program.[11] While employed for decades in the West, hydraulic fracturing is so new to New York that the Department of Environmental Conservation's Generic Environmental Impact Statement of 1992 only mentions it twice in passing.[12] Because natural gas mining is new to the New York City Watershed, very little is known about what will be required of gas companies seeking to drill in or near sources of New York City drinking water.

### **III. Statutory Authority for Gas and Oil Mining in the New York City Watershed**

The Department of Environmental Conservation has primary authority over and responsibility for mining activities in the State of New York pursuant to Article 23 of the Environmental Conservation Law and its regulations, at 6 NYCRR §§ 550-554. This authority covers site preparation, operation, drilling, waste disposal, plugging and abandonment of wells, underground storage and voluntary and compulsory integration of adjacent interests. The program is intended to make efficient use of mineral resources. There is no mention in the statute's declaration of policy about protection of public health or the environment in the process.[13]

In 1992 the Department of Environmental Conservation ("DEC") issued a Final Generic Environmental Impact Statement ("GEIS") on the Gas, Oil and Solution Mining Regulatory Program. The sixteen year old GEIS and the underlying law as it pertains to statewide spacing for oil and gas wells was stale and in need of updating. When Governor Paterson recently signed a DEC sponsored law to update the statewide gas and well spacing statute to allow more efficient siting of wells, he also directed that the GEIS be updated as well.[14]

In his approval message Governor Paterson acknowledged that concerns had been voiced about the potential for limited environmental review pursuant to the State Environmental Quality Review Act and the potential impacts on groundwater from the use and disposal of millions of gallons of contaminated process water.[15] As a result in his message he directed an update of the 1992 Final Generic Environmental Impact Statement and vowed that proper environmental

review would take place.[16] The Governor also indicated that DEC would be looking at existing regulations, jurisdiction over water withdrawals, staff resources and legal and regulatory compliance that will be implicated by increased drilling activity from as many as ten thousand new wells, each possibly using as much as three to five millions gallons of potable water.[17]

It is appropriate that DEC examine these areas because a review of applicable regulatory authority indicates that New York is ill-prepared for significantly increased mineral extraction activities and particularly ill-prepared for gas drilling in the watershed. For example, DEC has no regulations, policies or guidelines governing slurry injection, subsurface injection or annular disposal of drilling wastes or reserve –pit wastes--common disposal methods, according to the United States Department of Energy.[18] Furthermore New York's Water Resources Law requires DEC permits for potable water supply, agricultural irrigation, small watershed protection districts or multipurpose projects authorized by a general plan consistent with local and regional water resources planning and development.[19] A large range of water-using activities are not covered by the statute. In particular, no mention is made in the statute of permits to facilitate use of the state potable water resources for natural gas drilling.[20] This is significant because although some shale development has resulted in modest water use, Marcellus shale exploitation is expected to use millions of gallons of water in each of five to seven development stages.

The sixteen year old Generic FEIS is instructive on our state of preparedness. It claims that one of the goals of the Oil, Gas and Solution Mining Regulatory Program is to prevent environmentally damaging drilling, operating and plugging practices and that the regulations prevent pollution, escape, migration and commingling of oil, gas, brine and fresh water.[21] However unless the FGEIS changes, there will be limited environmental review of natural gas drilling projects. The "Major Conclusions of the Application of the State Environmental Quality Review Act to the Oil, Gas and Solution Mining Law" section of the FGEIS states that upon final approval of this generic environmental impact statement, (1) no further SEQRA compliance is required on Site Specific Projects carried out in accordance with the general conditions in the findings statement, (2) an EAF and negative declaration must be prepared only if a proposed action is not addressed in the GEIS and will not result in any significant adverse impacts, (3) a supplemental environmental impacts statement may have to be prepared if the proposed action is not addressed in the GEIS and will result in one or more significant adverse impacts, (4) a supplemental findings statement must be prepared only if the proposed action is adequately addressed in the GEIS but not in the Findings Statement of the GEIS.[22] Based upon these conclusions, environmental review would appear to be truncated in most cases.

Site specific environmental assessments will still be required for drilling state parklands, agricultural districts or wells less than two thousand feet from a municipal water supply well.[23] Environmental review will also not address gas pipelines or gathering lines because the Public Service commission has safety and siting jurisdiction.[24] Ironically, the Public Service Commission exempts gathering lines from the class of underground facilities that must be protected from damage.[25]

In all cases the Department of Environmental Conservation intends to assert lead WNB agency status pursuant to SEQRA.[26] While there could be exceptions to the lead agency determination for a floodplain or wetland permit[27], DEC intends to actively seek lead agency designation as the agency with the broadest governmental powers.[28]

The authority to impose rules over water use and disposal in connection with gas drilling is also granted to the Susquehanna River Basin Commission and the Delaware River Basin Commission. Both commissions have nearly identical powers. Thirty-six percent of the Marcellus shale formation underlies the Delaware River Basin. The Delaware River Basin Commission is a federal–interstate compact government agency including the states of Pennsylvania, New York, New Jersey and Delaware. The Delaware River Basin Commission requires a permit to withdraw surface or groundwater, to construct any impoundment or to discharge any surface or groundwater.[29] The Susquehanna River Basin controls access to water in a 27,500 square

mile region. The Susquehanna River Basin Commission along with New York, Maryland and Pennsylvania have developed draft regulations for natural gas well development projects.[30] The draft rules require permits for consumptive water use for natural gas development and proof that all produced fluids, including brines have been properly treated and disposed pursuant to applicable state and federal law.[31]

The federal government also has authority under several federal laws to address the impacts from natural gas drilling, although the oil and gas industry has been effective at obtaining exemptions for oil and gas exploration and production activities from regulation as part of the underground injection program of the Safe Drinking Water Act.[32] Oil and gas exploration exemptions from regulation at the federal level can also be found in the Clean Air Act,[33] and the Clean Water Act.[34]

Finally New York City has authority to make rules and regulation for the protection from contamination of any supplies of potable water, subject to the approval of the State Department of Health.[35] New York City already has rules and regulation applicable to its watershed[36]but they, unfortunately, make no mention of gas or oil drilling activities.[37]

#### **IV. What is Hydraulic Fracturing?**

An important issue from the standpoint of environmental protection is the chemicals used in the hydraulic fracturing process. Horizontal wells were drilled in the past in shale formations but most were not considered commercial successes because they did not produce at commercial rates.[38] These wells needed stimulation, defined by DEC as “increasing a zone’s permeability by increasing the porosity and permeability or inducing fractures”.[39] Recent advances in stimulation have made these wells commercially productive, but the advances come with a cost. Traditionally, gas wells were stimulated by injecting water and sand deep into the Earth under high pressure to fracture the bedrock. However, many gas companies now also use fracture fluids or “fracking” chemicals in addition to water and sand that include hydrochloric acid, nitrogen, biocides, surfacants, friction reducers and other chemicals.[40] While the contents of the fracturing fluids has not been fully disclosed, and DEC is currently seeking information on the composition, volume and form of each component of fracturing fluid with concentrations expressed in grams per liter, a Colorado group, The Endocrine Exchange, has researched the chemicals used in gas shale fracturing operations in the west and has identified some health effects associated with their use should potable water be contaminated with these fluids.[41] If these chemicals reach our drinking water supply they can potentially have significant adverse health effects.

Hydraulic fracturing fluids are composed of a mixture of water, sand, and chemicals that help to fracture geologic formations and stimulate oil and gas production. The chemicals to be used during the hydraulic fracturing are of concern because this process will take place within the watershed for New York City’s drinking water supply. Hydraulic fracturing fluids are suspected to have caused contaminated drinking water in some communities in Alabama, Arkansas, New Mexico, Colorado, Kansas, Montana, Virginia, Washington, West Virginia, and Wyoming where extensive hydraulic fracturing has taken place[42]. In some cases regulatory actions have even been taken.[43] Energy companies may use a wide range of concentrations and types of chemicals, with varying implications for the safety of nearby drinking water supplies.

The composition and concentration of the fracturing fluids to be used in New York has not been made public. Without information on which chemicals will be used and in what concentrations, the precise public health risk of using hydraulic fracturing fluids within the watershed of New York City’s drinking water is unknown. Known health risks exist, however, for many of the chemicals that are often found in these fluids. The Oil and Gas Accountability Project found that a 2002 draft of an EPA study on hydraulic fracturing[44] showed that nine hazardous chemicals that are found in fluids are frequently injected underground at levels that exceed water quality standards[45]. Benzene, phenanthrenes, naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, fluorenes,

aromatics, ethylene glycol, and methanol were all found to exceed an applicable water quality standard.

All of these chemicals are associated with health risks when ingested, inhaled, or absorbed through the skin.

\* Benzene is a known carcinogen in humans, causing increased incidence of leukemia[46]. Chronic exposure to benzene can also cause blood disorders and female infertility as well as low birth weight and other fetal development problems for babies whose mothers have been exposed. Acute effects of benzene exposure can include skin, eye, and respiratory tract irritation, dizziness, headaches, vomiting, and convulsions. Because of its high toxicity, the EPA has set its Maximum Contaminant Level goal in drinking water at zero[47].

\* Phenanthrenes and fluorenes are members of a class of chemicals known as Polycyclic Aromatic Hydrocarbons. These chemicals are considered problematic because of their persistence in the environment; health effects on humans that the individual chemicals in this group have not been conclusively determined, but they do cause tumors to develop in animals[48].

\* Naphthalene is considered a possible carcinogen by the EPA, and has been shown to cause hemolytic anemia, damage to the liver, and cataracts, as well as neurological damage and anemia in infants[49].

\* "Aromatics" refers to an array of chemicals, some of which are carcinogenic or have other adverse health effects. The EPA's report does not specify which aromatics are found in hydraulic fracturing fluids, further pointing to the need for full information about which chemicals will be used for hydraulic fracturing in the Marcellus Shale.

\* Chronic exposure to ethylene glycol, which is also used in brake fluids and as antifreeze, can cause respiratory tract irritation and may cause kidney and liver problems[50].

\* Methanol exposure can cause headaches, dizziness, giddiness, insomnia, nausea, gastric disturbances, conjunctivitis, visual disturbances, and blindness[51].

Exposure to many of the chemicals that are found in hydraulic fluids can occur through inhalation, ingestion, and contact with the skin. While the primary means of exposure from contaminated drinking water may be through ingestion, residents of homes whose drinking water is contaminated are likely to be exposed to these chemicals through multiple pathways. Through bathing and washing, residents can absorb contaminants through the skin, and hot showers may cause the chemicals in contaminated water to vaporize, leading to exposure through inhalation[52]. Only benzene is listed as a contaminant that is regulated under the Safe Drinking Water Act[53], but other water quality standards such as the EPA's Risk-Based Concentration tables and the Massachusetts Contingency Plan's standards for groundwater contamination, have listed them as contaminants[54]. In addition, several of these chemicals that are not listed by the EPA as water contaminants are listed as air toxics under the Clean Air Act Amendments of 1990[55]. Drinking water that is contaminated with these chemicals may, therefore pose a threat to human health, even when the chemicals in question are not regulated by the Safe Drinking Water Act.

Once the bedrock has been fractured and the natural gas released, the fracturing fluids are pumped out of the well although they are not all recovered.[56] Anywhere from 20 to 40% of the fracturing fluids remain behind.[57] The recovered fracturing fluids are a waste product.[58] Therefore disposal of the hydraulic fracturing fluid waste is of paramount concern. Currently it is not clear that the capacity exists to safely treat or dispose of the quantity of contaminated fluids anticipated to be generated. Respecting the fluids that are left behind, it is possible that surface and groundwater could be contaminated if fracturing fluids escape, or seep through inadequately lined pits or overflow the pits as a result of storm water runoff.[59] There is no scientific evidence to support a conclusion that concentrations of hydraulic fracturing fluids that remain trapped in fractured formations are safe and do not threaten groundwater.[60] If groundwater is contaminated and hydrologically connected to surface waters through springs, that contaminated process water might reach New York City watersheds and reservoirs. Similarly, if runoff from snow melts or rain and flood events overflow impoundments, irreparable damage may be done to

streams and surface waters. Should New York City's watershed become contaminated in this quest for short-term gas drilling profits, the cost to filter New York's work would exceed ten billion dollars.[61] This is a cost that we cannot risk incurring.

## **V. Surface and Groundwater Impacts of Gas Drilling In the Marcellus Shale**

There have been no applications to drill for natural gas in the New York City watershed yet but dozens have been filed in the Southern Tier of New York just this summer, according to the DEC website. There have also been many wells drilled in Marcellus shale in Pennsylvania, including fourteen in Susquehanna County[62] and what has happened there is instructive. There have already been cases of blowouts and groundwater contamination [63] unpermitted water withdrawals[64] and emergency enforcement actions.[65] It is also certain there will be applications to drill in the New York watershed since at least twelve oil and gas companies have acquired more than six million acres of land for drilling in the Marcellus shale formation—more land than in the Adirondack Park. [66] While the local impacts of natural gas drilling may well include adverse impacts to groundwater contamination, surface water and soil contamination, air pollution and noise pollution, impacts to roads, flora and fauna adverse impacts to the New York City watershed would be disastrous.

## **VII. Will Gas Drilling Upstate Threaten New York City's Filtration Avoidance Determination?**

Pursuant to the Safe Drinking Water Act (SDWA) Amendments of 1986, EPA promulgated the Surface Water Treatment Rule (SWTR), specifying the Criteria under which filtration is required as a treatment technique for public water systems supplied by a surface water source. In New York State, EPA delegated primary enforcement responsibility (primacy) of the Safe Drinking Water Act to the New York State Department of Health (NYSDOH) on September 9, 1977. In 2007 EPA ultimately determined that New York City's Delaware and Catskill public water systems continue to meet the following SWTR conditions for unfiltered surface water supply systems: source water quality conditions found at 40 CFR §141.71(a); the disinfection requirements of 40 CFR §141.72(a); and the site specific conditions found at 40 CFR §141.71(b) (1), (3), (4), (5) and (6). [67] That determination was based on careful consideration of a wide range of factors but it could change. If the Delaware and Catskill systems are impacted by significant water pollution, New York City might be required to filter its drinking water at an enormous cost. The EPA determination was described as "tentative" in a letter to New York City Watershed stakeholders and based upon the conclusion that New York City continues to have and "adequate long-term watershed protection program for the Catskill/Delaware water supply that meets the requirements of the Surface Water Treatment Rule and related federal regulation".[68] New York City must protect our watershed protection program at all cost to retain our Filtration Avoidance Determination.

## **VIII. What Can New York City Do Now: Existing Environmental Protections for New York City Drinking Water**

By statute, New York City does have authority to make rules and regulations for the protection from contamination of any or all public supplies of potable water supplies of the state subject to the approval of the Department of Health.[69] New York City can also amend its existing watershed rules. The State Water Resources Law can be amended to address large water withdrawals. Bonding requirements can also be significantly increased to cover potential impacts to the watershed but we have to act expeditiously.

Conclusion

New York City's most valuable resource is its drinking water and it is far more valuable to New York City than all the gas in the Marcellus shale or shale anywhere. We need time to make sure the oil and gas exploration and exploitation is done in the most environmentally protective manner for present generations and for future generations. As stewards of the environment, no less can be expected of us.

[1] New York City Department of Environmental Protection, New York City Winner of State Water taste Test at State Fair Today, (citing Commissioner Emily Lloyd as stating the [N]ew York City has some of the highest quality drinking water in the world. We hope that this event raises awareness of the importance of clean, high-quality drinking water and the massive investment it takes to maintain our system and keep our watershed clean".), [www.nyc.gov.html/press-releases/08/18pr.shtml](http://www.nyc.gov.html/press-releases/08/18pr.shtml)

[2] Breen, Cathleen, and James L. Simpson. "Clean Drinking Water Coalition's First Annual DEP Report Card," May 2008. URL: [http://www.riverkeeper.org/document.php/759/Full\\_Report\\_DEP.pdf](http://www.riverkeeper.org/document.php/759/Full_Report_DEP.pdf)

[3] Ilya Marritz, Bloomberg Wary of Natural Gas Drilling Near Water Supply, [www.nyc.org/news/articles/105712](http://www.nyc.org/news/articles/105712).

[4] Lisa Sumi, Shale Gas: Focus on the Marcellus Shale, Oil and Gas Accountability Project, Earthworks, May 2008.

[5] Id. at p. 3.

[6] Id. at p. 4.; Christine Buurma, Gas Drillers Hit Regulations, Wall Street Journal, July 30, 2008.

[7] Id. 2-3.; Mid-Atlantic Natural Gas Offers Threat and Promise; Review and Opinion, The Patriot News, Harrisburg, Pennsylvania, July 6, 2008.; Gas drilling and Development, Marcellus Shale Susquehanna River Basin Commission, June 12, 2008.

[8] Id. at p. 4.

[9] Ilya Marritz, Natural Gas Drilling: Is New York Ready?, [www.wnyc.org/news/articles](http://www.wnyc.org/news/articles)

[10], Kirkpatrick & Lockhart, Preston, Gates and Ellis, LLP., at p. 1., [www.klgates.com](http://www.klgates.com), 1998.

[11] Marcellus Shale, Information about gas well drilling in the Marcellus Shale, New York State Department of Environmental Conservation, [www.dec.ny.gov/energy/46288.html](http://www.dec.ny.gov/energy/46288.html)

[12] Department of Environmental Conservation Final Generic Environmental Impact Statement of the Oil, Gas and Solution Mining Regulatory Program, 1992, at 9-26 and 12-15

[13] ECL § 23-301.

[14] Approval Memorandum No. 17, Chapter 376 filed with Senate Bill 8169, entitled: "An Act to amend the environmental conservation law, in relation to statewide spacing for oil and gas wells", July 23, 2008.

[15] Id.

[16] Id.

[17] WBNG News, Binghamton, "Governor Paterson Signs Bill Updating Oil and Drilling Law; Pledges Environmental and Public Health Safeguards; wny.com, Pro Publica, citing DEC experts who calculated that over ten thousand wells will be drilled in the Upper Delaware River Basin, www.damascuscitizens.org.

[18] Drilling Waste Management Information System, State Regulations: New York, <http://web.ead.anl.gov/dwm/regs/state/newyork>.

[19] R. Timothy Weston, Development of the Marcellus Shale—Water Resource Challenges, *supra* at p. 10, (also indicating that although the statute mentions agricultural irrigation, the DEC regulations are silent on the regulation of water withdrawals for irrigation).

[20] *Id.*

[21] Department of Environmental Conservation Final Generic Environmental Impact Statement of the Oil, Gas and Solution Mining Regulatory Program, 1992, at 9. 7-1..

[22] *Id.* at p. 3-6.

[23] *Id.* at p. 3-3.

[24] *Id.*

[25] PSL §119-b(1) (d).

[26] Department of Environmental Conservation Final Generic Environmental Impact Statement of the Oil, Gas and Solution Mining Regulatory Program, 1992, at 3-8 through 3-9.

[27] *Id.*

[28] *Id.*

[29] Delaware river basin commission, Natural Gas drilling in the Marcellus Shale Gas Formation, [www.nj.gov/drbc/naturalgas.htm](http://www.nj.gov/drbc/naturalgas.htm)

[30] Brian Nearing, Three State Commission to Impose Rules on Drilling, August 15, 2008, <http://timesunion.com/ASPStories.storyprint.asp>.

[31] Susquehanna River Basin Commission, Proposed Rulemaking Natural Gas Well Development Projects, Part 806, Review and Approval of Projects, August 14, 2008.

[32] 42 U.S.C. 300h(d).

[33] 42 U.S.C. 7412 (n) (4) (A) (B).

[34] 33 U.S.C. 1342 (l) (2).

[35] Public Health Law §1100 (1).

[36] 15 RCNY 18-11 through 18-91.

[37] *Id.*

[38] Lisa Sumi, Shale Gas: Focus on the Marcellus Shale, Oil and Gas Accountability Project, Earthworks, May 2008, at pg. 7.

[39] Department of Environmental Conservation Final Generic Environmental Impact Statement of the Oil, Gas and Solution Mining Regulatory Program, 1992, Glossary at pg. 12.

[40] Id. at p. 12; Department of Environmental Conservation Final Generic Environmental Impact Statement of the Oil, Gas and Solution Mining Regulatory Program, 1992, at 9-25-28.

[41] Lisa Sumi, Shale Gas: Focus on the Marcellus Shale, at p. 12.

[42] Amy Mall, Sharon Buccino and Jeremy Nichols, Drilling Down, Protecting Western Communities from the Health and Environmental Effects of Oil and Gas Production, Natural Resources Defense Council, 2007, at p. 14 ; Lisa Sumi, Our Drinking Water At Risk: What EPA and the Oil and Gas Industry Don't Want Us to Know about Hydraulic Fracturing, Oil and Gas Accountability Project, Earthworksaction, 2005, Executive Summary.

[43] Id.

[44] Although the EPA's Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coal bed Methane Reservoirs stated that hydraulic fracturing poses little to no threat to drinking water supplies, an agency whistleblower later revealed that information indicating the opposite had been removed from the report. Information on the toxic chemicals in hydraulic fracturing fluids comes from the Oil and Gas Accountability Project's analysis of an earlier draft of that report, which was obtained through a Freedom of Information Act request by OGAP.

[45] Oil and Gas Accountability Project, 2005. "Our Drinking Water at Risk."  
<http://www.earthworksaction.org/pubs/DrinkingWaterAtRisk.pdf>

[46] EPA. Air Toxics Web Site: Benzene. <http://www.epa.gov/ttn/atw/hlthef/benzene.html>

[47] EPA, 2003. National Primary Drinking Water Standards.  
<http://www.epa.gov/safewater/consumer/pdf/mcl.pdf>

[48] EPA, 2008. Polycyclic Aromatic Hydrocarbons.  
<http://www.epa.gov/waste/hazard/wastemin/minimize/factshts/pahs.pdf>

[49] EPA. Air Toxics Web Site: Naphthalene. <http://www.epa.gov/ttn/atw/hlthef/naphthal.html>

[50] EPA. Air Toxics Web Site: Ethylene Glycol. <http://www.epa.gov/ttn/atw/hlthef/ehty-gly.html>

[51] EPA. Air Toxics Web Site: Methanol. <http://www.epa.gov/ttn/atw/hlthef/methanol.html>

[52] Shehata, A.T, 1985. "A multi-route exposure assessment of chemically contaminated drinking water." Toxicology and Industrial Health 1(4):277-98.

[53] EPA, 2003. National Primary Drinking Water Standards.  
<http://www.epa.gov/safewater/consumer/pdf/mcl.pdf>

[54] Oil and Gas Accountability Project, 2005. "Our Drinking Water at Risk."  
<http://www.earthworksaction.org/pubs/DrinkingWaterAtRisk.pdf> at page 6.

[55] Clean Air Act, 1990. The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants.  
<http://www.epa.gov/ttn/atw/orig189.html>

[56] Amy Mall, Sharon Buccino and Jeremy Nichols, Drilling Down, Protecting Western Communities from the Health and Environmental Effects of Oil and Gas Production, Natural Resources Defense Council, 2007 at p. 1-18,

[57] Id.

[58] Lisa Sumi, *Our Drinking Water At Risk: What EPA and the Oil and Gas Industry Don't Want Us to Know about Hydraulic Fracturing*, Oil and Gas Accountability Project, Earthworksaction, 2005, at p. 20.

[59] Id. at pgs 20 and 21.

[60] Id. at p. 26.

[61] The New York Sun, *City's Drinking Water Feared Endangered: \$10B Cost Seen*, [www.nysun.com/new-york/citys-drinking-water-feared-endangered-10B-cost](http://www.nysun.com/new-york/citys-drinking-water-feared-endangered-10B-cost).

[62] Tom Kane, *A Primer on Gas Well Gold Rush, From Marcellus Shale to Horizontal Drilling*, The River Reporter, February 28, 2008.

[63] Heidi Zemach, *Gibbs Hill Homeowners Lose Water Supply after Fracking*, The Ridgeway Record, August 10, 2008.

[64] Pennsylvania Department of Environmental Protection, *DEP Orders Shutdown of Two Natural Gas Drilling Operations in Lycoming County* May 30, 2008.

[65] Pennsylvania Department of Environmental Protection, *DEP Orders Shutdown of Two Natural Gas Drilling Operations in Lycoming County* (describing the enforcement action taken against Range Resources—Appalacia LLC and Chief Oil and Gas LLC after they collected water for use in exploration without obtaining a permit).

[66] Prudent Speculations, *The Quest for Marcellus Shale Exposure*, July 17, 2008, <http://seekingalpha.com/article/85483>.

[67] New York City Filtration Avoidance Determination, United States Environmental Protection Agency, May 1997.

[68] Walter Mudgan, Director, Division of Environmental Planning and Protection, Environmental Protection Agency, Region 2, April 12, 2007.

[69] Public Health Law 1100 (1).