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Fracking in New York: The Potential Impact on Drinking Water Resources

Christopher Adam Rodilosso

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Christopher A. Rodilosso[1]

I. Introduction

The United States is predicted to surpass Saudi Arabia as the world's leading oil producer in only eight years because of hydraulic fracturing, also known as "fracking."[2] The thought of American energy independence is riveting; however, many environmentally conscious people are questioning whether the juice is worth the squeeze. They question whether energy resources and benefits to the economy outweigh the potential destruction that fracking may have on the environment. "In the end, our society will be defined not only by what we create but by what we refuse to destroy."[3] Many people feel that irreversible environmental damage does not have a price tag, while others place a higher value on energy independence and economic growth. The issue is often characterized as environment versus economy.

There is no doubt that fracking would create jobs in the State of New York.[4] One study estimates that if New York permitted fracking it could gain $11.4 billion in economic output and $1.4 billion in tax revenues over a 10-year period.[5] The current unemployment rate in New York is relatively high at 8.2 percent.[6] This number would go down if fracking was allowed in New York. As further evidence of fracking's potential for job creation, the United States has added

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[2] Spencer Irvine, *North Dakota Fracking Revolution Ushers in U.S. Energy Independence*, ACCURACY IN MEDIA (Apr. 18, 2013), http://www.aim.org/on-target-blog/north-dakota-fracking-revolution-ushers-in-u-s-energy-independence/#.

[3] MARGARET MINER & HUGH RAWSON, THE OXFORD DICTIONARY OF AMERICAN QUOTATIONS 149 (2ND ED. 2006).

[4] Dan Fastenberg, *Is Fracking A Solution to the Jobs Crisis? Separating Facts From Spin,* AOL JOBS (Oct. 2, 2012), http://jobs.aol.com/articles/2012/10/02/is-fracking-a-solution-to-the-jobs-crisis-separating-facts-from/.

[5] DIANA FURCHTGOTT-ROTH, REGULATING TO DISASTER: HOW GREEN JOBS POLICIES ARE POISONING AMERICA'S ECONOMY 13 (2012).

[6] *NYS Economy Adds 14,000 Private Sector Jobs in March 2013,* NEW YORK STATE DEPARTMENT OF LABOR, http://labor.ny.gov/stats/pressreleases/pruistat.shtm

approximately 2.7 million jobs since 2002; the exploration of shale-embedded oil and natural gas are responsible for over 1 million of those.[7]

In the Bakken region, the area where fracking occurs in North Dakota, unemployment is 1 percent.[8] Starting salaries working at an oil rig in this area are reported to be around $120,000 per year.[9] A truck driver in the region told a reporter, "If you can't find a job here there's something wrong with you."[10] The Bakken area does not feel the effects of the existing economic stagnation. In fact, there is a shortage, hence demand, for six-figure salary truck driving jobs.[11] While oil companies and business tycoons would undoubtedly profit off fracking, there is something appealing about the reports of well-paid truck drivers and oil rig workers. These "big jobs in small towns" could really help those who need it the most.[12]

While keeping the economic upside in mind, the focus of this research paper will be on the potential impact that fracking has on water supplies. There is currently a moratorium on fracking in New York, and this research aims to determine whether it is New York's best interest to lift the moratorium. Careful attention will be paid to the ways that fracking may lead to contamination in water supplies. The question then becomes whether the risks of water contamination are too high for New York fracking to be permitted at all, or whether fracking can be regulated to a safe enough point at which it becomes worthwhile.

II. Fossil Fuel Formation

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[7] Tim Mullaney, *Want a job? Look to the Energy field,* USA TODAY Oct. 5, 2012, http://www.usatoday.com/story/money/business/2012/09/30/energy-jobs-growing/1598801/.
[8] John Mauldin, *Peak Oil or Peak Energy? A Happy Solution Millenium Wave Advisors,* ADVISOR PERSPECTIVES Dec. 11, 2012, http://www.advisorperspectives.com/commentaries/millennium_121112.php.
[9] *Id.*
[10] Mark Mardell, *Will the rise of the rest mean the decline of the US?,* BBC NEWS Apr. 28, 2013, http://www.bbc.co.uk/news/world-us-canada-22319136.
[11] Jackie Yamanaka, *Regional Oil Boom Exacerbates Truck Driver Shortage,* WNYC June 20, 2011, http://www.wnyc.org/blogs/transportation-nation/2011/jun/20/regional-oil-boom-exacerbates-truck-driver-shortage/.
[12] Mullaney, *supra* note 7.

Before explaining what the method of fracking is, it is helpful to have a basic knowledge of the resources that are being extracted. The resources being extracted through fracking are called fossil fuels; fracking involves the extraction of crude oil and natural gas.[13] Fossil fuels are hydrocarbons (they are made from the two elements hydrogen and carbon); thus, they contain a high level of carbon, and the burning of fossil fuels by humans is the most significant source of carbon dioxide emissions.[14]

These important hydrocarbons, crude oil and natural gas, are formed by the remains of microscopic plants (algae) and animals (plankton) that died in the ocean between 10 and 600 million years ago.[15] While alive, the organisms absorbed energy from the sun that was stored in their bodies as carbon molecules.[16] After these organisms died, they sank into the ocean floor's sand and mud.[17] Layer upon layer of sediment, plants and bacteria formed.[18] Due to the absence of oxygen in such layers, the organisms went through a process that formed organic material called kerogen.[19] The organic material mixed with sediments and created fine-grained shale, or source rock.[20] As new layers formed, they exerted extreme pressure and heat on the source rock.[21] The heat and pressure change kerogen, the organic material, into crude oil and natural gas.[22] On land, a similar process occurred in which dead plants formed into coal.[23]

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[13] CRUDE OIL AND NATURAL GAS FORMATION, BP (2008), http://www.bp.com/assets/bp_internet/australia/corporate_australia/STAGING/local_assets/downloads_pdfs/b/bp_module02_print.pdfx.
[14] *Fossil Fuel*, SCIENCE DAILY, http://www.sciencedaily.com/articles/f/fossil_fuel.htm.
[15] Craig Freudenrich, *How Oil Drilling Works*, HOW STUFF WORKS, http://science.howstuffworks.com/environmental/energy/oil-drilling1.htm.
[16] *How Are Oil/Natural Gas Formed?,* ADVENTURES IN ENERGY, http://www.adventuresinenergy.org/What-are-Oil-and-Natural-Gas/How-Are-Oil-Natural-Gas-Formed.html.
[17] Freudenrich, *supra* note 15.
[18] *How Are Oil/Natural Gas Formed?*, *supra* note 16.
[19] CRUDE OIL AND NATURAL GAS FORMATION, *supra* note 13.
[20] Freudenrich, *supra* note 15.
[21] *Id.*
[22] CRUDE OIL AND NATURAL GAS FORMATION, *supra* note 13.
[23] *Id.*

Factors including the level of pressure and heat, as well as the type of biomass, would determine if the organic material became oil or natural gas.[24] Areas with greater heat produced lighter oil.[25] If the heat was really great and the biomass was composed mostly of plant material, then natural gas was formed.[26] The oil and natural gas would then travel through small pores in the surrounding rock.[27] Some oil and natural gas traveled up to the surface and escape in what is called a surface seep; other deposits migrate until they are trapped between layers of rock and clay; such trapped deposits are where humans find oil and natural gas.[28]

Thus, the hydrocarbons are formed in source rock, but underground pressures squeeze the hydrocarbons out of the source rock and into reservoir rocks.[29] Reservoir rocks are thus places in which the oil and natural gas migrate to underground.[30] Sandstones are the most common type of reservoir rock, as they have room inside itself to trap oil, like a sponge.[31] Sandstones are grains of sand packed together; there are small spaces in between the grains of sand called pore spaces.[32] Oil and natural gas fit into these pore spaces.[33] Hence, sandstones are considered "porous" which means that oil can move freely through them.[34] On the contrary, cap rocks, such as shale, do not have room inside for oil and natural gas to move through.[35] They are impermeable. As oil and natural gas naturally move upward toward areas of less pressure, cap

[24] *How Are Oil/Natural Gas Formed?, supra* note 16.
[25] *Id.*
[26] *Id.*
[27] *Id.*
[28] *Id.*
[29] *Id.*
[30] *Hydrocarbon Systems*, PALEONTOLOGICAL RESEARCH INSTITUTION, http://www.priweb.org/ed/pgws/systems/reservoir/reservoir.html.
[31] *Id.*
[32] *Id.*
[33] *Id.*
[34] *Hydrocarbon Systems*, PALEONTOLOGICAL RESEARCH INSTITUTION, http://www.priweb.org/ed/pgws/systems/seal/seal.html.
[35] *Id.*

rocks act as barriers preventing the fossil fuels from escaping horizontally or vertically.[36] Such rocks are important for trapping the fossil fuels in a contained area for extraction; you can't drill for oil and natural gas if there aren't non-porous rock formations trapping the fossil fuels. Thus, oil and gas reservoirs are underground pools of hydrocarbons contained within porous rocks, of which are trapped in various geologic formations of impermeable cap rocks.[37]

In sum, in order to have an area from which oil and natural gas may be extracted, there must be a combination of source rock, reservoir rock and cap rock. Simplified, the cap rock is the top layer, the reservoir rock is the middle layer, and the source rock is at the bottom.

III. The Method of Hydraulic Fracturing

Hyraulic fracturing is a technique used by oil and gas companies to increase the flow of crude oil or natural gas into a wellbore.[38] The wellbore, a component of an oil well, is the actual hole in which natural gas and oil flow into in order to be extracted. Fracking is used to increase the flow of fossil fuels into the wellbore when there are dense, low-permeable geologic formations, such as tight sands and shales that make it difficult or impossible to extract the trapped hydrocarbons.[39] Fracking is the human invention that intentionally creates fractures in such low-permeable rock formations by pumping water, sand and chemicals at high pressures.[40] This creates fractures in the surrounding, oil and gas bearing rock formation and such fractures can extend hundreds of feet.[41] After the desired fractures have been made, the pumping of fracking fluids ceases and the pressure of the rock formations cause the fracking fluid to return to the surface, which is known as flowback.[42] The sand in the fracking fluid that was pumped

[36] *Id.*
[37] *Id.*
[38] *What is fracking?,* THE FRACKING OF AMERICA, http://www.frackingofamerica.com/.
[39] *Id.*
[40] *Id.*
[41] *Id.*
[42] *Id.*

down the well remains underground and serves to keep the new fractures from closing when the pumping stops.[43] Such fractures now provide avenues for oil and gas to more easily flow through and into the wellbore.[44]

The concern today is about fracking in combination with horizontal drilling. Horizontal drilling allows driller to explore a much larger area.[45] The following is a more detailed description of the process of hydraulic fracturing used in conjunction with horizontal drilling:

It begins by drilling an initial hole deep into the earth.[46] This is done by attaching a long bit, varying from diameter from 5 to 50 inches, to a drilling string.[47] The wellbore from the vertical drilling must go beyond the fresh water supply.[48] Once it is determined that the drilling has gone below the water supply, pipe that is slightly smaller in diameter than the hole is inserted.[49] Cement is then injected down in order to surround the pipe with cement.[50] This is typically a 3-inch think cement wall which is supposed to provide extra protection beyond the steel pipe that it encases.[51] This initial string of pipe and cement is supposed to protect the fresh water.[52] After it is set, the longer vertical hole is drilled.[53] This could reach levels at a depth several miles below the fresh water.[54] The drilling then turns horizontal at the "kickoff point," in similar fashion to the way that the letter "J" curves.[55] The remainder of the hole is drilled and

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[43] *Id.*
[44] *What is fracking?,* THE FRACKING OF AMERICA, http://www.frackingofamerica.com/.
[45] *Hydraulic Fracturing: The Impact,* OKLAHOMA'S OIL & NATURAL GAS PRODUCERS & ROYALTY OWNERS, http://www.oerb.com/?tabid=336.
[46] *Id.*
[47] *Id.*
[48] *Id.*
[49] *Id.*
[50] *Id.*
[51] *Hydraulic Fracturing: The Impact,* OKLAHOMA'S OIL & NATURAL GAS PRODUCERS & ROYALTY OWNERS, http://www.oerb.com/?tabid=336.
[52] *Id.*
[53] *Id.*
[54] *Id.*
[55] *Id.*

another string of pipe is inserted to the end of the wellbore.[56] This steel casing is also surrounded with cement.[57] Once this final casing has been installed, the drilling rig is removed and preparations are made for "well completion."[58]

The first step in "well completion" is creating the connection between the horizontal casing and the reservoir rock.[59] This is done by lowering a perforating gun down the wellbore.[60] The perforating gun fires shaped explosive charges.[61] This creates holes through the casing, cement, and into the targeted reservoir rock; thus, the connection between the reservoir and wellbore is made.[62] The perforating gun is then removed and fracking begins, which consists of pumping sand, water and chemicals at high pressures into deep underground reservoir formations.[63] The chemicals are typically used to prevent the formation of bacteria and to help transport the sand.[64] The chemicals typically make up between 0.1 and 0.5 percent of fracking fluid volume.[65] Trucks carry the fracking fluid and pump it into the wellbore.[66] The fluid goes out through the perforations discussed above.[67] Fractures in the oil and gas reservoir rock are thus created.[68] The sand is in the fracking fluid stay within the fractures and help keep them open.[69] Sand grains, or sometimes ceramic beads, that are used to hold open the fractures are

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[56] *Id.*
[57] *Hydraulic Fracturing: The Impact,* OKLAHOMA'S OIL & NATURAL GAS PRODUCERS & ROYALTY OWNERS, http://www.oerb.com/?tabid=336.
[58] *Id.*
[59] *Id.*
[60] *Id.*
[61] *Id.*
[62] *Id.*
[63] *Hydraulic Fracturing: The Impact,* OKLAHOMA'S OIL & NATURAL GAS PRODUCERS & ROYALTY OWNERS, http://www.oerb.com/?tabid=336.
[64] *Id.*
[65] *Id.*
[66] *Id.*
[67] *Id.*
[68] *Id.*
[69] *Hydraulic Fracturing: The Impact,* OKLAHOMA'S OIL & NATURAL GAS PRODUCERS & ROYALTY OWNERS, http://www.oerb.com/?tabid=336.

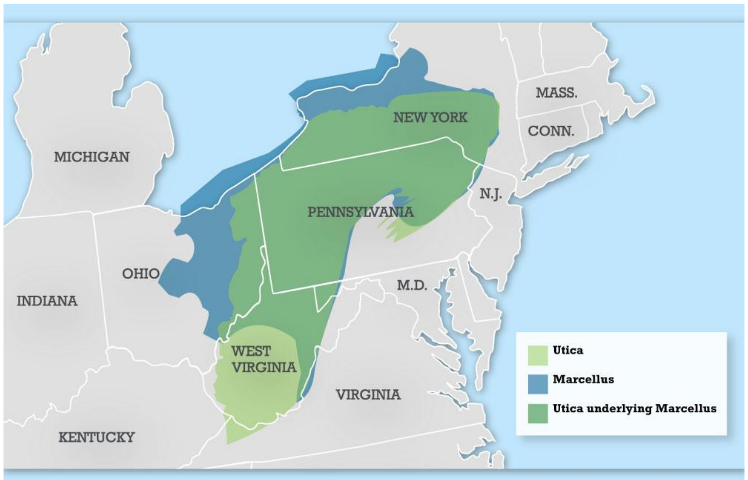
referred to as "proppants."[70] The cracks are relatively small but open avenues for previously trapped oil and gas to travel to the wellbore more easily.[71]

The first "stimulation segment" is the furthest down the horizontal wellbore and is sectioned off using a specially designed plug.[72] The perforating guns are then used to perforate the next segment along the wellbore.[73] This next segment is hydraulically fractured in the same manner.[74] The process is repeated along the entire wellbore, which can extend several miles.[75] After stimulation is complete, the isolation plugs are drilled through and the flow begins.[76] First water, then oil and natural gas flow into the horizontal casing and up through the wellbore.[77] Between 15 and 50 percent of the fracturing fluid is typically recovered and can be recycled for other drilling operations or disposed; oil wells may produce oil and natural gas for 20 to 40 years.[78] When it is decided that all the oil and natural gas that can be economically recovered from a reservoir has occurred, then work is supposed to commence on restoring the land to the way it once was.[79] Wells are filled with cement, pipes are cut several feet below the ground, surface equipment is removed, and drilling pads are filled with dirt.[80]

IV. **<u>Threat to Water Supply</u>**

[70] STUDY OF THE POTENTIAL IMPACTS OF HYDRAULIC FRACTURING ON DRINKING WATER RESOURCES PROGRESS REPORT, EPA 5 (Dec. 2012), http://www2.epa.gov/sites/production/files/documents/hf-report20121214.pdf [hereinafter *EPA FRACKING STUDY*].
[71] *Hydraulic Fracturing: The Impact,* OKLAHOMA'S OIL & NATURAL GAS PRODUCERS & ROYALTY OWNERS, http://www.oerb.com/?tabid=336.
[72] *Id.*
[73] *Id.*
[74] *Id.*
[75] *Id.*
[76] *Id.*
[77] *Hydraulic Fracturing: The Impact,* OKLAHOMA'S OIL & NATURAL GAS PRODUCERS & ROYALTY OWNERS, http://www.oerb.com/?tabid=336.
[78] *Id.*
[79] *Id.*
[80] *Id.*

Concerns have increased in recent years over the threat that fracking has on drinking water because of our modern ability to extract oil and natural gas from unconventional reservoirs, such as shale, tight sands, and coalbeds.[81] The pertinent rock formations of concern



in New York are the Marcellus and Utica shale.[82]In the United States, the Utica shale extends through New York, Pennsylvania, Ohio, West Virgina, Maryland, Virgina, Tennessee, and Kentucky; the Marcellus shale extends through New York, Pennsylvania, West Virgina, Ohio, and Maryland.[83] The Utica shale is located a few thousand feet below the Marcellus shale and drilling through these layers began in the early 2000's.[84]

The EPA identifies five stages of the "hydraulic fracturing water cycle," in which there is potential for interaction between the fracking process and drinking water resources:[85] (1) water acquisition; (2) chemical mixing; (3) well injection; (4) flowback and produced water (wastewaters); and (5) wastewater treatment and waste disposal.[86]It is important to assess each stage and identify the potential threats each has on drinking water resources.

1. <u>Water Acquisition</u>

[81] EPA FRACKING STUDY, *supra* note 70.
[82] *What other questions might people have about fracking and leases or mineral rights?*, SHALE GAS REPORTER, http://shalegasreporter.com/shale-faq.
[83]EPA FRACKING STUDY, *supra* note 70.
[84] *What other questions might people have about fracking and leases or mineral rights?*, *supra* note 82.
[85] EPA FRACKING STUDY, *supra* note 70, at 8.
[86] *EPA's Study of Hydraulic Fracturing and its Potential Impact on Drinking Water Resources,* EPA, http://www2.epa.gov/hfstudy.

IMAGE: *Marcellus and Utica Shale Formation,* MARCELLUS COALITION , http://marcelluscoalition.org/pa-map/.

Water acquisition is the first stage in which a large volume of water must be extracted in order to create the fracking fluid.[87] The issue is determining the possible impacts of large volume water withdrawals from ground and surface waters on drinking water resources.[88]

The first concern involves the impact of high volume hydraulic fracturing (HVHF) water acquisition on water availability. Fracking fluids are typically 90 percent water based.[89] The features of the rock formation and the design of the production well dictate the amount of water required in any given well.[90] Shale gas production can require up to 13 million gallons of water, while other productions have required as low as 65,000 gallons.[91] The amount, however, is typically between 4 million and 6 million gallons.[92] To get a sense of these volumes, approximately 50,000 people use 5 million gallons of water per day.[93] The source of the water may be ground water, surface water, or treated wastewater.[94] For example, ground water is acquired from a well, surface water is acquired from a river, and treated wastewater comes from former fracking fluid that has gone through a wastewater treatment plant.[95]

There have already been complaints from distressed landowners in Dimmit County, Texas regarding this matter.[96] This southern Texas location is one of the most oil abundant areas in the state.[97] Despite this, the land is extremely dry and often too dry to grow crops.[98] Dimmit

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87 EPA FRACKING STUDY, *supra* note 70, at 14.
88 *Id.*
89 *Id.*
90 *Id.*
91 *Id.*
92 Kate Galbraith, *As Fracking Increases, So Do Fears About Water Supply*, N.Y. TIMES Mar. 7 2013, http://www.nytimes.com/2013/03/08/us/as-fracking-in-texas-increases-so-do-water-supply-fears.html?pagewanted=all.
93 EPA FRACKING STUDY, *supra* note 70, at 14.
94 *Id.*
95 *Id.*
96 Galbraith, *supra* note 92.
97 *Id*.
98 *Id.*

County averages only 22 inches of rain per year.[99] Essex County, NJ, in contrast, averages 50 inches of rain per year.[100] In addition to Dimmit County's low-precipitation problem, fracking operations have made it even more difficult for farmers here to water their crops.[101] In acquiring water for fracking, Dimmit County drillers have strained the local aquifer considerably.[102]

One local who relies on ground water for farming experienced the strain first-hand.[103] From 2009 to 2013, he experienced a decrease in one of his well's water production by two-thirds.[104] A study was conducted by this farmer's groundwater district and it concluded that fracking reduced the amount of water in the Carrizo-Wilcox Aquifer by what amounts to one-third of the aquifer's recharge.[105] Recharge is the amount of water an aquifer regains from precipitation.[106] This is a significant reduction of available groundwater, especially for a consistently dry area.

Proponents of fracking may point to studies that indicate that fracking consumes less than 1 percent of the total water in Texas.[107] This is less than the percentage of water used by agriculture and less than the amount used for watering lawns.[108] However, these statistics apply to the entire state of Texas.[109] In areas with extensive drilling, like Dimmit County, the percentage of water that is used for fracking is in the double digits and continuing to grow.[110] In 2011, Texas used a greater amount of water for fracking compared to the amount of oil that was

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[99] *Dimmit County*, TEXAS STATE HISTORICAL ASSOCIATION, http://www.tshaonline.org/handbook/online/articles/hcd09.
[100] *Essex County Weather*, USA.COM, http://www.usa.com/essex-county-nj-weather.htm#HistoricalPrecipitation.
[101] Galbraith, *supra* note 92.
[102] *Id.*
[103] *Id.*
[104] *Id.*
[105] *Id.*
[106] *Id.*
[107] Galbraith, *supra* note 92.
[108] *Id.*
[109] *Id.*
[110] *Id.*

produced; 632 million barrels of water were used for fracking that year and 441 million barrels of oil and natural gas was produced.[111]

Recent industry trends indicate a shift to using treated wastewaters.[112] "Companies are springing up to offer recycling, and some drillers are able to use brackish water, but those technologies are often not cost-effective."[113] In order to mitigate the potential risks of water acquisition on drinking water supplies, there needs to be laws in place requiring drillers to use treated wastewaters as their water source for fracking fluids. If drillers continue to strain aquifers to acquire water for fracking, then more towns that are prone to dry seasons will undoubtedly feel the effects.

2. Chemical Mixing

The next issue is determining the possible impacts of surface spills of fracking fluids on drinking water resources.[114] Once the water is onsite, it is mixed with chemicals and proppants in order to create the fracking fluid.[115] The chemicals mixed in serve the purpose of optimizing the fluid's performance, such as its viscosity and pH.[116] About 1 percent of fracking fluids are composed of such chemicals.[117] For example, a shale gas well requiring 5 million gallons of fluid has 50,000 gallons of chemicals in it.[118]

Fracking operations are large operations and require supplies, equipment, water and vehicles.[119] The storage, mixing and pumping of fracking fluids could result in spills and leaks.[120] Such fluids could end up in nearby surface water bodies, or even seep into the ground

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[111] *Id.*
[112] EPA FRACKING STUDY, *supra* note 70, at 14.
[113] Galbraith, *supra* note 92.
[114] EPA FRACKING STUDY, *supra* note 70, at 15.
[115] *Id.*
[116] *Id.*
[117] *Id.*
[118] *Id.*
[119] *Id.*at 16.
[120] EPA FRACKING STUDY, *supra* note 70, at 16.

and into ground water that is close to the surface.[121] In either scenario, the chemicals may end up in drinking water resources.[122] The EPA is in the process of investigating reported spills and determining the toxicity of the spilled chemicals.[123]

Relevant to this stage is the Energy Policy Act of 2005.[124] This legislation contained a provision that has come to be known as the Halliburton Loophole because Dick Cheney, the former CEO of Halliburton, was instrumental in getting it passed.[125] The obvious ulterior motive is that Halliburton profits from lenient fracking regulations, as they have a large stake in the industry.[126] The Halliburton Loophole exempts fracking operations from the Safe Drinking Water Act; this law authorizes the EPA to regulate toxic chemical injections into the ground.[127] Thus, drilling companies do not have to disclose the chemicals used in fracking operations.[128] Such chemicals would normally have to be disclosed under clean water laws.[129] Environmental researchers, as a result, do not know what chemicals to test for when there is a suspected contamination in the water supply.[130] Furthermore, without federal regulation there are simply fewer researchers to perform such tests.[131]

Fracking has been "granted the environmental equivalent of diplomatic immunity" and is exempt from even more regulations.[132] Such exemptions include the Clean Water Act, Clean Air Act, Superfund Act, and National Environmental Policy Act.[133] Fracking is also exempt from

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[121] *Id.*
[122] *Id.*
[123] *Id.*
[124] SANDRA STEINGRABER, RAISING ELIJAH 13 (2012) (discussing the special amendment to the 2005 Energy Policy Act that excludes fracking from the Safe Drinking Water Act).
[125] ROBERT CLAYTON BUICK, HOW TO START WAR FOR PROFIT 43 (2011).
[126] *Id.*
[127] STEINGRABER, *supra* note 124.
[128] *Id.*
[129] *Id.*
[130] *Id.*
[131] *Id.*
[132] *Id.*
[133] STEINGRABER, *supra* note 124.

federal right-to-know laws, meaning natural gas operations do not report their air and water emissions.[134]

Even the average person who is pro-fracking should not favor these exemptions. It has zero benefit except to drilling companies who don't have to answer questions about their fracking fluid. Laws should always err on the side of transparency, and this is an area where transparency is very important. For example, if fracking ever results in water contamination, first aid responders and medical professionals need to be aware about the chemicals in order to properly treat those affected. The more that people are educated on the subject, the more prepared everyone becomes in the event of contamination. Furthermore, disclosure of the chemicals will help educate the public on what exactly is going on during fracking. It will allow scientists to conduct more extensive research, which could even lead to safer fracking fluids.

3. Well Injection

The next issue is determining the possible impacts of the injection and fracturing process on drinking water resources. At this next stage, the fracking fluid is pumped down the well at high pressures so that it creates fractures in the underground rock formations.[135] Production wells are often designed in order to have the most efficient drainage of oil and natural gas reservoirs; as discussed above, this means starting vertical and then moving in a horizontal direction.[136] Fracking can be used, however, in both horizontal and vertical well completions.[137] Horizontal wells are typically used in formations including tight sandstones, carbonate rock and shales; vertical wells are used for conventional production and coalbed methane.[138]

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[134] *Id.*
[135] EPA FRACKING STUDY, *supra* note 70, at 16.
[136] *Id.*
[137] *Id.* at 17.
[138] *Id.*

This stage is probably the most concerning regarding water supply contamination. While the first two stages present risks to the water supply from above surface spills, this stage could result in long-lasting, underground seepage. There are two main concerns with regards to well injection. The first concern is that it may result in drinking water contamination due to a well construction failure; the second concern is that the induced fractures intersect with already existing natural fractures (or man-made features such as abandoned wells), which act as a channel to drinking water resources.[139]

Dimock Township is located in northeastern Pennsylvania and lying underneath this rural community is the heart of the Marcellus Shale.[140] Residents in Dimock generally struggle financially; the average income per person is $14,702[141] and unemployment was recently reported to be 14 percent.[142] Several years ago Cabot Oil and Gas began knocking on doors and offering Dimock residents 25 dollars per acre for 5-year drilling rights; included in the offer was a share of royalties from the shale gas obtained.[143] One resident's husband was working overtime, being a farmer by day and diner chef by night when Cabot showed up at their door.[144] "It seemed like God's provenance. We really were having a tough time then – that day. We thought it was salvation. Any ray of hope here is a big deal."[145]

Cabot's wells in Dimock Township produce nearly 60 million dollars of natural gas per year.[146] The energy resources and economic gain, however, came at a high cost. In 2009,

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[139] *Id.*
[140] JAMES SALZMAN, DRINKING WATER: A HISTORY 80 (2012).
[141] *Dimock, PA salary statistics*, METASALARY, http://www.metasalary.com/citydetails.php?state=PA&id=%20Dimock.
[142] SALZMAN, *supra* note 140, at 81.
[143] *Id.*
[144] *Id.*
[145] *Id.*
[146] *Id.*

residents began to complain of contaminated drinking water wells.[147] Methane had in fact penetrated their drinking water supply not so long after Cabot had begun its operations.[148] The contamination was eerily evidenced by residents being able to ignite their running faucet water.[149] In addition to flammable drinking water, the hair on pets and farm animals suddenly started shedding, kids developed sores on their legs, and parents were suffering from headaches.[150]

Cabot initially denied any correlation between its drilling and the methane contamination, claiming the methane occurred naturally in the water before the fracking began.[151] However, Pennsylvania's Department of Environmental Protection rejected Cabot's defense and concluded that the drilling company was the cause.[152] Cabot was directed to install methane gas detectors and alternate drinking water sources for certain residents.[153] Cabot was fined $120,000 and Pennsylvania imposed a moratorium on drilling new wells in Dimock.[154] As a way to mitigate the risk of future incidents, Cabot began adding a layer of cement around the well piping.[155]

Dimock wasn't the only incident of inadequate well casing leading to water contamination.[156] In a Cleveland suburb, there was a buildup of methane in the basement of a resident's home.[157] One night at this home there was "shattering windows, blowing doors two feet from their hinges and igniting a small fire in a violent flash. The [family was] jolted out of

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[147] *Id.*
[148] SALZMAN, *supra* note 140, at 81.
[149] *Id.*
[150] ALEX PRUD'HOMME, THE RIPPLE EFFECT: THE FATE OF FRESHWATER IN THE TWENTY-FIRST CENTURY 284 (2011).
[151] SALZMAN, *supra* note 140, at 81.
[152] *Id.*
[153] *Id.*
[154] PRUD'HOMME, *supra* note 150.
[155] SALZMAN, *supra* note 140, at 81.
[156] *Id.*
[157] *Id.*

bed, and lifted clear off the ground."[158] The Ohio Department of Natural Resources concluded that inadequate concrete casing of a nearby fracking operation had resulted in methane leaking near the surface.[159]

Furthermore, the Proceedings of the National Academy of Sciences (PNAS) is a prestigious scientific journal that only publishes peer-reviewed articles.[160] PNAS published a Duke University study that linked natural gas hydraulic fracturing with higher levels of methane in surrounding water supplies.[161] The researchers compared water found near fracking operations against water found further away.[162] Water wells near fracking sites were defined as within 1 kilometer.[163] The group tested 68 drinking water wells in northeastern Pennsylvania and southern New York state.[164] The study showed significantly higher levels of methane in water collected near fracking jobs.[165]

The defense of drillers is that methane occurs naturally in water.[166] This is true, as the study showed that most of the wells tested did contain some methane; however, water samples originating from wells closest to fracking operations had on average 17 times more methane than water wells further away from drilling.[167] Such a level of methane is considered dangerous by the U.S. government and requires "hazard mitigation" action.[168]

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[158] *Id.*
[159] *Id.*
[160] *Proceedings of the National Academy of Sciences,* RED ORBIT, http://www.redorbit.com/education/reference_library/science_1/journals/1112543797/proceedings-of-the-national-academy-of-sciences/.
[161] Stephen G. Osborn et al., *Methane contamination of drinking water accompanying gas-well drilling and hydraulic fracturing,* DUKE UNIV. STUDY, http://www.propublica.org/documents/item/methane-contamination-of-drinking-water-accompanying-gas-well-drilling.
[162] *Id.*
[163] *Id.*
[164] *Id.*
[165] *Id.*
[166] *Id.*
[167] Osborn, *supra* note 161.
[168] *Id.*

The Duke study showed that a special form of methane, called thermogenic methane, existed in samples closest to fracking sites.[169] Thermogenic methane is only found deep within the earth's crust.[170] It has a different chemical structure than biogenic methane, which exists naturally close to the surface from biological decay.[171] The study concluded that inadequate concrete casing of the drilling rigs was the most likely cause of thermogenic methane leaking into water supplies.[172]

The study does not rule out the position that natural gas could be traveling upward through natural or manmade fractures, despite there being close to a mile of earth between the bottom of the aquifers and the fractured shale rock.[173] There is a real possibility that underground pathways exist that lead upward to water supplies and fracking enables natural gas to enter such pathways.[174]

In addition to thermogenic methane, other gases were detected in water samples.[175] Ethane, another component of natural gas, was found in 81 percent of water samples taken from wells close to fracking sites.[176] Ethane was found in only 9 percent of water wells further away from fracking sites.[177] This is yet another indication that fracking operations enable natural gas to find its way to water supplies.

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[169] *Id.*
[170] *Id.*
[171] *Id.*
[172] *Id.*
[173] Osborn, *supra* note 161.
[174] *Id.*
[175] Abraham Lustgarten, *Scientific Study Links Falmmable Drinking Water to Fracking*, PRO PUBLICA (May 9, 2011), http://www.propublica.org/article/scientific-study-links-flammable-drinking-water-to-fracking/single#republish.
[176] *Id.*
[177] *Id.*

The study interestingly did not find any traces of fracking fluids in the waters tested.[178] This lends support to drillers' position that the fluids are injected to levels much deeper than shallow aquifers.[179] One researcher said it is "unlikely" that fracking fluids can escape underground and into water supplies.[180] This position, however, is not agreed upon by everyone. In 2009, EPA officials found that 3 water wells in Wyoming tested positive for a chemical used in fracking fluids.[181] Over 200 natural gas wells had been drilled in the area beforehand.[182] The EPA never officially concluded, however, that the contamination was due to fracking.[183]

The ways in which the natural gas could move underground toward water supplies include: underground pressures displacing the natural gas; natural gas traveling through new fractures created by the fracking process; or leaks in the well casing.[184] No matter what the medium of contamination is, the study indicates a clear correlation between fracking operations and underground natural gas seepage.[185]

Methane contamination from drilling has been reported by officials in three states: Colorado, Ohio and Pennsylvania.[186] Methane is not regulated in drinking water and the limited research available doesn't conclude that it is harmful to drink.[187] Methane is certainly dangerous, however, when it collects in enclosed spaces as it can lead to asphyxiation or explosions.[188]

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178 Osborn, *supra* note 161.
179 *Id.*
180 Lustgarten, *supra* note 175.
181 Abraham Lustgarten, *EPA: Chemicals Found in Wyo. Drinking Water Might Be From Fracking*, PRO PUBLICA (Aug. 25, 2009), http://www.propublica.org/article/epa-chemicals-found-in-wyo.-drinking-water-might-be-from-fracking-825.
182 *Id.*
183 *Id.*
184 Lustgarten, *supra* note 175.
185 Osborn, *supra* note 161.
186 Abraham Lustgarten, *Officials in Three States Pin Water Woes on Gas Drilling*, PRO PUBLICA (April 26, 2009), http://www.propublica.org/article/officials-in-three-states-pin-water-woes-on-gas-drilling-426.
187 Lustgarten, *supra* note 175.
188 *Id.*

The law in Pennsylvania says that drilling companies are liable for drinking water contamination that occurs within 1,000 feet of a gas well.[189] The Duke researchers found that the contamination extended to approximately 3,000 feet.[190] If New York is going to lift the ban on fracking, it would be prudent to have laws that make drillers liable for water contamination within a radius that extends at least 3,000 feet.

4. Flowback and Produced Water (Wastewaters)

The next issue is determining the possible impacts of surface spills of wastewaters on drinking water resources.[191] At this stage, the pressure of the injection is reduced so that the direction of the fluid flow reverses.[192] Flowback and produced water are then recovered.[193] "Flowback" refers to the initial fluid returned to the surface after fracking has occurred, while "produced water" is the fluid returned to the surface after the well has been placed into production.[194] Together, the two are called "wastewater."[195] Wastewater includes the chemicals that were injected with the fracking fluid, substances occurring naturally underground, and hydrocarbons.[196] The fluids are then separated from any oil and gas produced.[197] The wastewater is then stored onsite in either tanks or an open pit.[198]

The onsite transfer and storage of wastewater may result in spills or leaks.[199] Such accidental releases may reach nearby drinking water resources.[200] Since drilling companies are not required to disclose the chemicals in fracking fluid, the impact of wastewater

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189 *Id.*
190 *Id.*
191 EPA FRACKING STUDY, *supra* note 70, at 18.
192 *Id.*
193 *Id.*
194 *Id.*
195 *Id.*
196 *Id.*
197 EPA FRACKING STUDY, *supra* note 70, at 18.
198 *Id.*
199 *Id.*

contamination on drinking water supplies is unknown. As discussed above during the chemical mixing stage, it is crucial that laws are implemented that require disclosure of chemicals. This will help the public prepare for incidents that result in wastewaters contaminating the drinking water supply.

5. Wastewater Treatment and Waste Disposal

The next issue is similar to the previous one and it is determining the possible impacts of inadequate treatment of fracking wastewaters on drinking water resources.[201] It is estimated that between 10 and 70 percent of the injected fracking fluid is recovered.[202] For example, between 500,000 and 3.5 million gallons of wastewater will be recovered for a fracking operation that requires 5 million gallons of fracking fluid.[203] The wastewater is typically handled in one of three ways: (1) disposed of into deep underground injection control wells; (2) treated and discharged into surface water bodies; or (3) treated and reused.[204]

The first option of disposing into underground injection control wells means shooting radioactive waste into the earth. This is sketchy on its face. The EPA lists two ways that the injected fluids could potentially migrate to underground drinking water sources:[205] (1) failure of the well; or (2) improperly plugged or completed wells or other pathways near the well.[206] Such risks parallel the dangers of well injection during the fracking process. The first occurs if there are leaks in the well casing.[207] Like fracking fluid well injection, one way to mitigate this risk is

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200 *Id.*
201 *Id.* at 19.
202 *Id.*
203 EPA FRACKING STUDY, *supra* note 70, at 19.
204 *Id.*
205 CLASS I UNDERGROUND INJECTION CONTROL PROGRAM: STUDY OF THE RISKS ASSOCIATED WITH CLASS I UNDERGROUND INJECTION WELLS, EPA (Mar. 2001), http://www.epa.gov/ogwdw/uic/pdfs/study_uic-class1_study_risks_class1.pdf [hereinafter *INJECTION CONTROL STUDY*].
206 *Id.*
207 *Id.*

by adding a layer of cement around the casing.[208] The second risk is that underground pathways near the injection control well may allow the wastewater to channel its way to drinking water resources.[209] Such pathways are most common in areas that have been drilled for oil and gas.[210] As these risks are already present in the gas extraction stages of fracking, this method of wastewater disposal seems to intensify an already existing risk. Disposal should not intensify an existing risk but avoid risk as much as possible; injection control wells are a poor option.

The next option for wastewater treatment is sending the waste to a treatment plant, followed by discharging the treated wastewater into surface water bodies, such as rivers.[211] This raises the concern of inadequate treatment practices.[212] An extensive study of wastewater found that it contains dangerously high levels of radioactivity.[213] Many treatment plants are not adequately prepared to deal with such toxic wastewaters.[214] The questionably-treated wastewater is then disposed of into rivers and may cause problems for the downstream drinking water plants.[215] After fracking operations began in Pennsylvania, several downstream drinking water plants reported irregularly high levels of solid materials, sodium and chloride.[216]

Furthermore, The New York Times uncovered an EPA study that revealed that more than 1.3 billion gallons of toxic wastewater were produced by Pennsylvania over a three-year period.[217] The treatment plants that received the wastewater were not equipped to remove various toxins from the drilling waste.[218] Wastewater from 116 such Pennsylvania wells had

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[208] SALZMAN, *supra* note 140.
[209] INJECTION CONTROL STUDY, *supra* note 205.
[210] *Id.*
[211] EPA FRACKING STUDY, *supra* note 70, at 20.
[212] *Id.*
[213] BUICK, *supra* note 125.
[214] *Id.*
[215] BRAD LINSCOTT, RENEWABLE ENERGY 125 (2011).
[216] *Id.*
[217] BUICK, *supra* note 125.
[218] *Id.*

levels of radium, or other radioactive materials, 100 times higher than levels set by federal drinking water standards; in addition, wastewater from 15 such wells contained 1,000 times the acceptable level of radioactive material.[219]

Disclosure is again crucial here. The more disclosure there is about the composition of the fracking fluid, the more research that can be done. This will result in treatment plant progress and better technologies for handling wastewater.

V. Threat to New York City Water Supply

New York City provides drinking water to nearly 9 million people.[220] New York City drinking water originates from watersheds that cover an area of 1,900 miles in the Catskill Mountains and Hudson River Valley.[221] The Catskill and Delaware watersheds mix in the Kensico reservoir, discharge into the Hillview reservoir, and is then distributed throughout the city via two main water arteries: City Water Tunnels No. 1 and No. 2.[222] Tunnel No. 1 extends 18 miles from Hillview Reservoir in Yonkers down under the Bronx and Manhattan and into Brooklyn.[223] It carries 500 to 600 million gallons of water per day.[224] Tunnel No. 2 begins from Hillview Reservoir and runs under the Bronx, East River, Queens, and Brooklyn where it connects with Tunnel No. 1.[225] These two tunnels deliver the majority of the 1.3 billion gallons of water consumed every day in New York City.[226]

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[219] *Id.*
[220] PRUD'HOMME, *supra* note 150, at 350.
[221] *New York City Water Supply*, EPA, http://www.epa.gov/region2/water/nycshed/supply.htm.
[222] PRUD'HOMME, *supra* note 150, at 350.
[223] *Id.*
[224] *Id.*
[225] *Id.*
[226] *Id.*

New York City has some of the cleanest municipal drinking water in the world.[227] If fracking results in contamination of the New York City watershed, "there will be no way to undo the damage."[228] The New York City Department of Environmental Protection does not use water filtration systems; it relies on natural filtration and keeping the water clean at the source.[229] Only a few chemicals are added to kill remaining pathogens and to strengthen tooth enamel.[230] Thus, keeping the watershed contamination-free is extremely important. If drilling operations ultimately move toward areas close to the New York City watershed, there is the possibility that natural gas could leak into these sources. The closer that fracking operations are in relation to the New York City watershed, the higher the probabilities of contamination; as discussed above, contamination occurs via chemical spills, well construction failure, underground fracture intersection, and by wastewater disposal.[231]

New York City Mayor Michael Bloomberg has financially and politically supported "responsible" extraction of natural gas.[232] He supports regulated fracking for reasons such as lower utility bills, economic growth, the reduction of the nation's dependence on coal, and the reduction of greenhouse gas emissions.[233] Natural gas already supplies 57 percent of New York City's energy.[234] Bloomberg donated $6 million to the Environmental Defense Fund in order help secure regulations in 14 states that make up 85 percent of potential gas reserves. Bloomberg's support comes at a time when Governor Cuomo is deciding the near future of New

[227] Steve Kastenbaum, *Fracking in New York: Risk vs. Reward,* CNN (May 2, 2012), http://www.cnn.com/2012/03/09/us/new-york-fracking.
[228] PRUD'HOMME, *supra* note 150, at 350.
[229] Kastenbaum, *supra* note 227.
[230] *Id.*
[231] Lustgarten, *supra* note 175.
[232] Mireya Navarro, *Bloomberg Backs 'Responsible' Extraction of Gas and Pays to Help Set Up Rules,* N.Y. TIMES Aug. 24, 2013, http://www.nytimes.com/2012/08/25/nyregion/bloomberg-backs-gas-drilling-with-rules-to-protect-the-environment.html.
[233] *Id.*
[234] *Id.*

York fracking.[235] Bloomberg has made it clear that he opposes fracking near New York City's watershed in upstate New York.[236] New York State has already agreed to ban fracking in the New York City watershed if the statewide moratorium is ultimately lifted.[237]

Bloomberg has also advocated for protecting other water supplies in New York, even those not leading to New York City.[238] However, Bloomberg probably knows that such a position isn't so simple. If the goal was to protect all water supplies, then there would be an outright ban on fracking. Fracking presents an inherent risk to water supplies. Opposing fracking near New York City's watershed, while simultaneously advocating for safe fracking in New York State, is fairly hypocritical. Rightfully so, Bloomberg doesn't want New York City's water supply to be put at any risk; an incident could result in contaminated water for millions of people. With that said, by supporting "responsible" fracking, Bloomberg is asking New York citizens outside of the boroughs to take the risk. The fact that Mayor Bloomberg says he supports protecting other New York state water supplies is not very meaningful since fracking presents an inherent risk to the water supply. When asked about Mayor Bloomberg's stance on fracking, Mayor Matthew Ryan of Binghamton, New York said, "His water is protected. Ours isn't."

VI. New York Law

In 2008, New York State declared a moratorium on fracking in order to allow time for an assessment on the potential environmental impact.[239] Such an assessment, initially ordered in 2008 by former New York Governor David Paterson, will determine the fate of fracking of New

[235] *Id.*
[236] *Id.*
[237] *Id.*
[238] Mireya Navarro, *Bloomberg Backs 'Responsible' Extraction of Gas and Pays to Help Set Up Rules*, N.Y. TIMES Aug. 24, 2013, http://www.nytimes.com/2012/08/25/nyregion/bloomberg-backs-gas-drilling-with-rules-to-protect-the-environment.html.
[239] DAVID SOLL, EMPIRE OF WATER: AN ENVIRONMENTAL AND POLITICAL HISTORY OF THE NEW YORK CITY WATER SUPPLY 202 (2013).

York.[240] The environmental assessment was undertaken by the New York State Department of Environmental Conservation and is formally known as the Generic Environmental Impact Statement (GEIS).[241] This assessment is required under New York law under the New York State Environmental Quality Review Act (SEQRA).[242] SEQRA is a state regulation that requires government officials to prepare an environmental impact statement for actions that may have a "significant adverse impact on the environment."[243]

The GEIS was completed in 2009; however, the public's negative response caused Governor Paterson to extend the moratorium and order additional studies in the form of a Supplemental Generic Environmental Impact Statement (SGEIS).[244] The SGEIS was released to the public in 2011 but the public's comment period in 2012 caused the DEC to hold off on issuing permits.[245] The DEC then declared that it would not implement the SGEIS until the New York State Department of Health (DOH) has reviewed and approved it.[246]

The DOH must assess whether the DEC proposed regulations for high volume fracking are adequate to protect human health.[247] If the DOH concludes that potential health impacts have been sufficiently mitigated, then the DEC will issue a "positive" findings statement and allowing the DEC to issue fracking permits shortly thereafter.[248]

Say, for example, the fracking ban is ultimately lifted. High volume fracking begins to take place, and, as a result, numerous cases of water contamination are reported. People get sick

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[240] FURCHTGOTT-ROTH, *supra* note 5.
[241] Susan M. Campbell & John Turrenttini, *New York State Faces a Turning Point in Debate over Natural Gas Fracking*, BLOOMBERG LAW, http://about.bloomberglaw.com/practitioner-contributions/new-york-state-faces-a-turning-point-in-debate-over-natural-gas-fracking/.
[242] 6 N.Y.C.R.R. § 617.1. (Westlaw 2013).
[243] *Id.*
[244] FURCHTGOTT-ROTH, *supra* note 5.
[245] *What the Future Holds for Fracking in NY*, LAW 360, http://www.law360.com/environmental/articles/431061/what-the-future-holds-for-fracking-in-ny.
[246] *Id.*
[247] Jon Campbell, *Future unclear as New York fracking debate drags on*, DEMOCRAT AND CHRONICLE Mar. 15, 2013, www.democratandchronicle.com/article/20130315/NEWS01/303150065/New-York-fracking.
[248] *What the Future Holds for Fracking in NY, supra* note 245.

and the public health is in jeopardy because of fracking. Finger pointing starts to happen and the DOH is accused of acting negligently in approving the new SGEIS. Well, all the delays by the Department of Health in approving the new SGEIS make them appear less at fault. Delays in approval indicate that careful consideration occurred. It adds to their documented, good faith attempt to protect the public health from inadequate fracking regulations. The delays and apparent careful analysis of the new SGEIS make the DOH less accountable if something serious, such as water contamination, were to happen in the future. Whether or not they are genuinely looking out for the best health interests of New York inhabitants is up for debate.

The question that follows this cynical chain of reasoning is why the DOH would simply want to give off the appearance of acting on the best interests of the public health, as opposed to genuinely acting on the public's best health interests. The cynic would say that it is simply money and politics. There is a lot of money to be made in New York if the fracking ban was to be lifted. This is not even debated. Not only would the state of New York benefit financially through taxation, but various groups of people would also make a profit such as landowners, energy companies, transportation businesses, drill manufacturers, and construction workers. White collar professionals, such as lawyers and bankers, would also be required for facilitating the opening of new businesses. Take it a step further and doctors and health insurance companies could indirectly profit from the health issues that may arise. With all the money at stake, you have to wonder whether the DOH is being politically coerced into approving the new SGEIS. The level and method of coercion will probably never be known, but you can rest assured that the DOH knows what is at stake for New York's economy.

VII. Conclusion

Throughout history, drinking water has been the exception and not the norm. In 1900, an American had a 1 in 20 chance of dying from a gastrointestinal infection before the age of 70. In 1990, this became a 1 in 2 million chance.[249] This demonstrates America's technological progress and attentiveness toward public safety. It also demonstrates the frailty of the human body and the importance of clean drinking water. Exposing water supplies to greater risks of contamination is a step backwards for human health. Undoing the progress that has been made in regards to providing Americans with clean water would be a tragedy.

One response from those concerned with clean water is to increase water supplies. This is achieved by adding to the number of reservoirs, canals and pipelines. Essentially, it's a push for what has been done in the 19th and 20th century but with 21st century technology and hindsight.[250] Other clean water advocates believe in a much different approach. Such persons feel that we should be conserving existing water supplies, while limiting the demand of such supplies through technology, regulation, price incentives and public education.[251]

No matter the method, there needs to be greater attention to making sure water supplies stay contamination free. This requires environmentally conscious laws, along with adequate financial backing to enforce such laws. In 2010, the Obama administration granted the EPA with $10.5 billion per year, a 34 percent increase from 2009, and its largest budget in history.[252] This is a step in the right direction. To ensure clean water supplies, it is crucial to have well-funded agencies enforcing regulations such as the Safe Drinking Water Act.[253] Of course, such agencies first need the legal authority to enforce the Safe Drinking Water Act. Thus, the prerequisite to

[249] SALZMAN, *supra* note 140.
[250] PRUD'HOMME, *supra* note 150.
[251] *Id.*
[252] *Id.*
[253] *Id.*

well-funded fracking enforcement is the repeal of the Halliburton Loophole; such repeal would give the EPA the authority to oversee fracking operations.

Lifting the fracking ban is tempting from an economic perspective, but the risks are real and potentially devastating. Fishermen from the Gulf Coast know this all too well. The BP oil spill resulted in the mass destruction of reefs and fish. It wrecked the livelihood and income for many families. "This is the first time in generations we have had our waters taken from us. Our businesses and community has collapsed,"[254] said one fisherman. Another said, "Our community has lived off of the water and now our community is dead."[255] Despite the very different scenarios, such statements should serve as warnings to New Yorkers. People of New York don't necessarily make their livelihood through fishing, but they rely on clean water in ways that are likely taken for granted. Clean water has never been "taken" from New York but fracking poses that risk. What do the nearly 9 million people of New York City do if the water becomes unsuitable for consumption? You can't hang out at home and live off the land in the concrete jungle; urban residents rely on the clean tap water. Contamination would simply result in chaos. It would be 9 million people either fleeing the city or fighting over whatever amount of clean water was left. While fishermen "live off the water" in order to make a living, we all live off clean water. If it is taken away, there would be chaos and it would be the worst in densely populated areas such as New York City.

If fracking is going to be done, it has to be done with an abundance of caution. There are multiple regulations that New York should include in its SGEIS to ensure "safe" fracking. First of all, the Halliburton Loophole needs to be repealed and companies should be required to fully

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[254] Jesse Muhammad, *Still suffering after BP oil spill, fishermen fear extinction,* THE FINAL CALL June 21, 2012, http://www.finalcall.com/artman/publish/National_News_2/article_8964.shtml.
[255] *Id.*

disclose the substances being used in fracking fluid.[256] This will allow the public and scientific community to fully assess the risks that such chemicals pose.[257] There should also be full disclosure of where fracking operations are going to occur. Such disclosures should be made available to the public online without the need for a public records request.[258] Public health officials can then have easy access to information on the chemicals being used and details on where the fracking occurred.[259] Tests on water quality can be performed before and after fracking occurs to determine if fracking caused water contamination. Furthermore, if someone gets sick from contaminated water, then first responders and medical professionals need to know what was in the water in order to conduct proper treatment.[260] Disclosure is also important with regards to the wastewater. It will enable the public and scientific community to analyze the most effective ways of disposal. Wastewater treatment plants will better understand how to treat the wastewater and dispose of it.[261]

In addition to disclosure requirements, there are other laws that will make fracking less of a threat to water supplies. There should be laws requiring overly cautious distances from well sites to occupied homes or buildings.[262] Such distances requirements should apply to streams, rivers, lakes and reservoirs.[263] There should be also be stringent laws governing well construction.[264] The standards should be very high as to minimize the risk of a well failure.

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[256] Matthew McFeeley, *State Hydraulic Fracturing Disclosure Rules and Enforceent,* NRDC (July 2012), http://www.nrdc.org/energy/files/Fracking-Disclosure-IB.pdf.
[257] *Id.*
[258] *Id.*
[259] *Id.*
[260] *Id.*
[261] *Id.*
[262] Mary Esch, *New York Fracking Rules: Regulators Taking Public Comments on Revised Gas Drilling Regulations,* HUFFINGTON POST (Dec. 9, 2012), http://www.huffingtonpost.com/2012/12/09/new-york-fracking-rules_n_2267409.html.
[263] Corey Mattson, *Dear Representatives: Fracking is Unsafe,* JUST BLONO (Apr. 17, 2013), http://justblono.org/2013/04/17/dear-representatives-fracking-is-unsafe/.
[264] McFeeley, *supra* note 256.

Furthermore, there should be attention to spill and leak containment.[265] Fracking fluids and the extracted fossil fuels should be contained and transported by machinery that meets high standards.

In light of the risks and the limited ability to mitigate such risks, the decision on fracking does in many ways boil down to the debate of environment versus economy. I think it would be premature for New York to lift the ban on fracking. Although the technology is available and ready to go, it is too early to know for sure the impacts on the drinking water. There are too many question marks. There is speculation on both sides as to its safety, but there is not enough evidence out there. New York needs to wait until more research has been conducted. Lifting the moratorium today would be hasty and irresponsible.

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[265] *Id.*