



Manhattan Borough President

**Scott M. Stringer**

February 2009

## **UNCALCULATED RISK:**

*How plans to drill for gas in Upstate New York  
could threaten New York City's water system*



## ABOUT MANHATTAN BOROUGH PRESIDENT SCOTT M. STRINGER

**SCOTT M. STRINGER**, a native New Yorker, is the 26th Manhattan Borough President. Since taking office at the start of 2006, he has dedicated himself to making Manhattan more affordable, livable ... and breathable – preserving the sense of neighborhood for the 1.6 million residents of what is best known as a world capital of culture and commerce.

The foundation for much of the borough president's work is the change he's brought to Manhattan's community boards. Energizing these formal institutions of neighborhood democracy was a top priority of Stringer's upon becoming borough president. A new merit selection process, combined with an infusion of badly needed resources – such as dedicating to each board a graduate student from the city's architecture and planning schools – has served to strengthen the voice of Manhattan's neighborhoods in debates over city planning.

The impact of this reform is already visible around the borough: A rezoned West Harlem will maintain the neighborhood's character and increase its stock of affordable housing while benefiting economically from Columbia University's expansion. New commitments for public schools in the Flatiron district, East Midtown and other neighborhoods are part of a larger plan to add school seats before, not after, high-rise residential towers crowd classrooms with additional students.

Stringer's community-based approach also has succeeded in accelerating New York's urban greening effort. The borough president has launched "Go Green" campaigns in three Manhattan neighborhoods – East Harlem, the Lower East Side, and Washington Heights – to improve residents' health, and to serve as a model for other environmentally neglected neighborhoods. East Harlem now has new farmers' markets, a growing number of street trees, its own Go Green cookbook, and is looking forward to a stand alone, state-of-the-art asthma treatment center created with the goal of reducing asthma hospitalizations by 50 percent.

Stringer has redoubled his longtime commitment to public safety. When New York City's building boom claimed the lives of 15 construction workers, he forced changes at the Department of Buildings. When a child was killed falling from a broken elevator in a New York City Housing Authority building, the borough president discovered that a simple, already-required device could have prevented the tragedy, and that the housing authority's own inspectors had given unsatisfactory ratings to some three-quarters of its elevators.

Continuing his career-long fight for affordable housing, Stringer conducted the first ever borough-wide survey identifying vacant lots and abandoned buildings, and then worked with state legislators to enact new tax incentives that will encourage development of these properties.

Stringer has authored a number of ground-breaking policy reports on issues of importance to every New Yorker, including parental involvement in our public schools, nursing home emergency preparedness, transportation, paid leave for employees, school overcrowding, and wasteful tax breaks for fast food restaurant and gas stations.

Prior to being elected borough president, Stringer served for thirteen years in the State Assembly, where he authored legislation to protect victims of domestic violence, led the successful fight to end "empty-seat voting" in Albany, and voted against every attempt to weaken rent regulations. The New York Times credited him as having "a sterling reputation as a catalyst for reform."

## ACKNOWLEDGMENTS

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Borough President Stringer also wishes to thank a number of outside readers who are not responsible for the report's content or conclusions, but who generously agreed to review and comment on the report, including the Natural Resources Defense Council, Earthjustice, Riverkeeper, Sierra Club, Environmental Defense Fund, Professor Geoffrey Thyne, and the office of Representative Maurice Hinchey (D-NY).

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## EXECUTIVE SUMMARY

This report from Manhattan Borough President Scott M. Stringer is intended to better inform New York's lawmakers and the public about the potential risks associated with a method of drilling for natural gas called "hydraulic fracturing." If approved later this year, this drilling technique could be employed throughout New York State on a massive scale.

Presented here are some two dozen examples of alarming incidents from nine states around the nation which must be part of New York's discussion about whether to proceed with hydraulic fracturing. As these examples reflect, there are many environmental and public health hazards implicated by this means of extracting natural gas, and the hazards threaten New Yorkers from Hobart in Delaware County, to Harlem in Upper Manhattan.

However, for the 1.6 million New Yorkers represented by the Manhattan Borough President, one danger posed by hydraulic fracturing is paramount: The risk to New York City's water supply.

Ninety percent of our city's water comes from the largest unfiltered surface water system in the world. (Only four other municipalities in the country drink unfiltered water.) As a result, New York City's water is of great quality and also is highly vulnerable to contamination.

With the stakes so high, we cannot dismiss the documented cases of environmental dangers connected to hydraulic fracturing, as unearthed by Pro Publica and other enterprise journalists: a water well in Wyoming with a concentration of benzene 1,500 times the level safe for human consumption; a house in Bainbridge, Ohio that exploded in a fiery ball; and contaminated wells discovered just two months ago right across the New York State line in Dimock, Pennsylvania. Many similar incidents are presented on the following pages.

As with most environmental matters – especially where there may be substantial revenues available to private concerns and local governments – there are differences of opinion about the dangers posed by this drilling technique. But on this, there is no dispute: despite the enormous stakes, there has been far too little public discussion of this issue in New York City.

In part, this is due to the decision by the state Department of Environmental Conservation to not include New York City among the venues where the first public meetings were held to discuss the environmental impact of hydraulic fracturing. This is an oversight that can and must be corrected.

Until the experiences of other states are fully considered, and until the people of New York City are properly engaged on this matter of vital concern to them, Borough President Stringer is calling for a moratorium on the issuance of drilling permits. In addition, the Borough President calls for a ban on drilling in the city's watershed.

Other recommendations made in this report focus on safeguards that could mitigate potential risks and possibly allow drilling to move forward on safer footing. These include: disclosing the ingredients of "frac-fluid"; tracking the movement of "frac-fluid" with the use of so-called "tracer" chemicals; and exploring the use of safer versions of "frac-fluid" now employed in off-shore drilling.

This report is released against the backdrop of an overpowering need throughout the state for new engines of job creation, economic growth, and tax revenue. And the dangers highlighted here, though supported by considerable evidence, remain the subject of debate.

And still, the decision to proceed with hydraulic fracturing must turn on the long term interests of all New Yorkers and be informed by our best judgment and a thorough discussion of the benefits and risks. The goal of this report is to advance that discussion.

# UNCALCULATED RISK:

## How plans to drill for gas in Upstate New York could threaten New York City's water system

*"The history of New York's water supply system could be titled a City of Two Tales. Initially, over the span of more than a century, it was a tale of visionary municipal leaders and innovative feats of engineering. The expanding metropolis created, incrementally, a far-flung infrastructure to provide the water essential to the city's growth and preeminence. However, it is also a tale, on our more recent era, of woeful shortsightedness, breathtaking neglect, bureaucratic corner-cutting, and the dismal failure to maintain the very system that sustains the life of the city."*

– Gail Schaffer, former New York Secretary of State, January, 2009

### THE RISK TO NEW YORK CITY

Massive drilling for natural gas may be about to arrive in New York, if the state allows it. Upstate New York, as it turns out, sits atop what may be one of the largest natural gas deposits in the world.

There is much potential gain from natural gas drilling, which could create new jobs, produce an abundant new supply of domestic fossil fuel, and boost a lagging tax base. The natural gas deposits are thought to be so rich that some believe they could yield up to a billion dollars a year in tax revenue alone for the state.<sup>1</sup>

The financial boom, however, could wind up blowing up in New Yorkers' faces. The biggest potential danger from the drilling process – which is called hydraulic fracturing – would be to New York City's water system. There are fears that what is often called the best water in the world could be exposed to a toxic cocktail.

Drilling could begin as early as this year, after the New York State Department of Environmental Conservation completes a study of its environmental impact, which is scheduled for the summer. Farmland that was leasing for less than \$100 an acre two years ago was driven up by speculators a year later to as much as \$2,500<sup>2</sup>, dozens of companies are making plans, and many have already applied for permits to drill such wells – one about ten miles from the New York City watershed.<sup>3</sup> The watershed is the region that is spread out over parts of five pristine upstate counties which supplies the city with its water.

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<sup>1</sup>"Hydrofracking: toxic gas drilling technique". Albany Times Union, 7-22-08  
<http://timesunion.com/AspStories/story.asp?storyID=705332>

<sup>2</sup>"Gas drilling stirs questions of risk to water in Southern Tier". Ithaca Journal, 6-16-08  
<http://www.theithacajournal.com/apps/pbcs.dll/article?AID=/20080616/NEWS01/806160323/1002/NEWS01>

<sup>3</sup>"DEC files notice on Hancock gas well permits". The River Reporter, 1-29-09  
<http://www.riverreporter.com/issues/09-01-29/news-dec.html>

Among the many unanswered questions facing New York is: Where will all the fresh water needed for the drilling come from, and where will the contaminated wastewater from the drilling go?

And how will the experience in New York of the drilling process known as hydraulic fracturing be different from what it has been in other states? In at least nine states, there has been a scary record of spills, contamination, explosions, even a massive theft of water that sounds like something out of the Wild West.

## EXTRACTING THE NATURAL GAS

The natural gas in New York exists as deep down as 6,000 – 9,000 feet below the surface, in a rock formation called the Marcellus Shale, which runs all the way from West Virginia and lies beneath 28 counties in New York State, from a part of Orange County in the Southeast to a part of Erie County in the West.

Gary Lash, a professor of structural geology at the State University of New York at Fredonia, recently estimated the potential reserves buried within the Marcellus Shale at 1,300 trillion cubic feet of natural gas, of which he estimates about 400 trillion could be recovered for use.<sup>4</sup> To put this in perspective, the United States produces a total of 20 trillion cubic feet of natural gas annually.

In the past, the rock was too hard; the gas was too deep down, and the process too expensive to be worth extracting it. But the rise in gas prices and the mounting energy crisis over the last few years has helped spur advances in the technology of hydraulic fracturing, which was first used commercially in 1949 by Halliburton.

Now, after vertically drilling a hole (the surface gas well), the drilling company starts drilling horizontally, using a mix of water, sand and chemicals known as “frac-fluid.”<sup>5</sup> The mixture is pounded against the rock under extremely high pressure, until the rock cracks, or fractures. The gas escapes through the tiny cracks that have been created in the rock, and flows up to the surface gas well.<sup>6</sup>

This process can require millions of gallons of fresh water per well. The waste water it generates is considered by the United States Department of Energy to be one of the most toxic industrial byproducts produced by gas and oil drilling.<sup>7</sup>

The greatest fear is that the drilling will contaminate the New York City watershed.

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<sup>4</sup>“Natural gas reserves could be huge”. Buffalo Business Journal, 1-9-09

<http://buffalo.bizjournals.com/buffalo/stories/2009/01/12/story2.html>. & February 24, 2009 e-mail correspondence with Gary Lash.

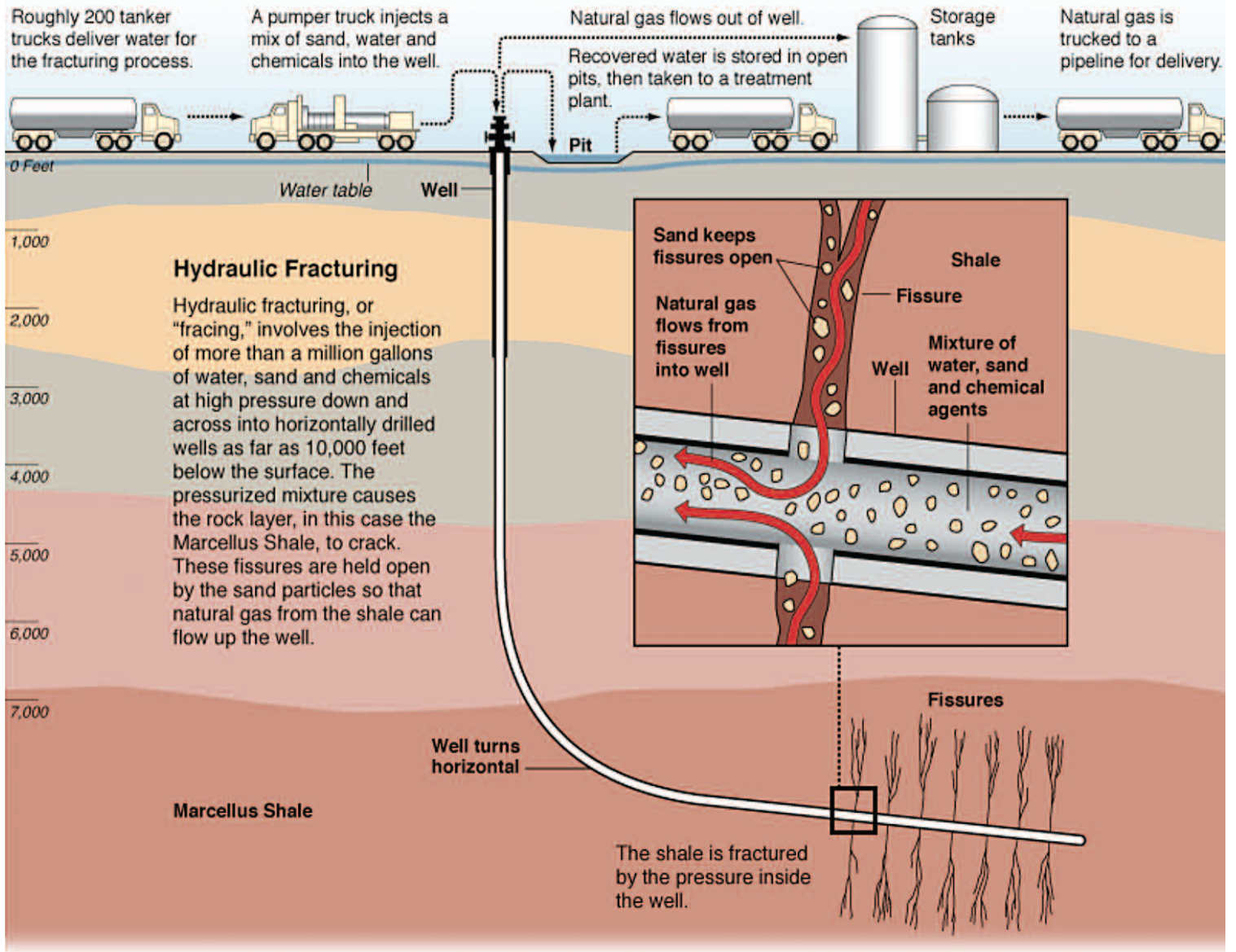
<sup>5</sup> According to the National Park Service, “fracture fluids typically contain materials such as demulsifiers, corrosion inhibitors, friction reducers, clay stabilizers, scale inhibitors, biocides, breaker aids, mutual solvents, alcohols, surfactants, anti-foam agents, defoamers, viscosity stabilizers, iron control agents, diverters, emulsifiers, foamers, oxygen scavengers, pH control agents, and buffers.”

<sup>6</sup> Each well can contain several “fracks”, multiplying the amount of water needed.

<sup>7</sup> “Natural gas drilling: is New York ready?” WNYC, 7-22-08

<http://www.wnyc.org/news/articles/104157>

Image 1. – The hydraulic fracturing process



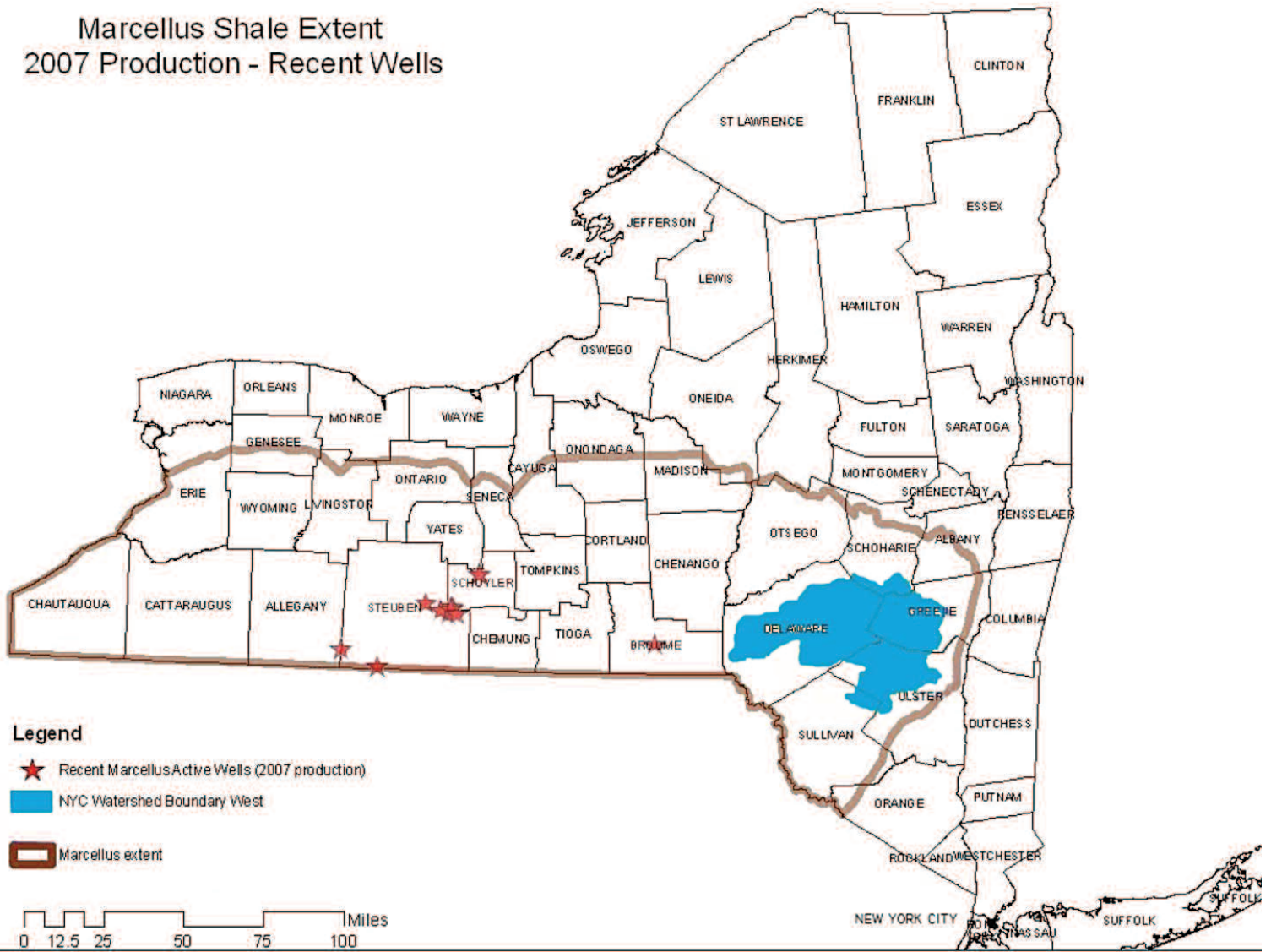
Graphic by Al Granberg

Source: Propublica, <http://www.propublica.org/special/hydraulic-fracturing>



Image 2. – The Marcellus Shale and the New York City Watershed

Marcellus Shale Extent  
2007 Production - Recent Wells



## THE BEST WATER IN THE WORLD

New York City's water is delivered from the largest unfiltered surface water system in the world. There are only four other municipalities in the country that do not have to filter their drinking water. New York's is of such high quality that it frequently wins blind taste tests against other municipal waters.<sup>8</sup> Residents, visitors and workers rely on this watershed for the 1.2 billion gallons of water that are consumed in New York City each day.<sup>9</sup> Mayor Bloomberg has noted that New York City's development as a world center for business and culture was due in part to its superior water supply.<sup>10</sup>

The New York City watershed spans 2,000 square miles and requires little mechanical pumping, thanks to an efficient gravity system.<sup>11</sup> Ninety percent of the city's water comes from reservoirs in the Catskill/Delaware watershed, which sits on the eastern edge of the Marcellus Shale.<sup>15</sup> The other ten percent is from the far closer Croton Watershed, for which the city, under a court order, is building one of the largest water filtration plants in the world, at a cost of more than three billion dollars. In 2007, the Environmental Protection Agency waived New York City's requirement to filter water from the Catskill/Delaware watershed until 2017.

To protect the unfiltered portion of the water supply, New York City has enacted a large scale land acquisition program to keep the streams, estuaries and lakes in the Catskills/Delaware region free from potential contaminants. New York City Council Member, James Gennaro has noted that "in total, New York City has spent more than \$2 billion to protect its watershed and we certainly don't want to waste the \$2 billion that is invested, nor be required to filter our water after it may become polluted by others for their profit at a huge cost to city residents."<sup>13</sup> Similarly, Eric Goldstein of the Natural Resources Defense Council argues that "the cornerstone of filtration avoidance is pollution prevention. That's the simple concept that says we're going to try to prevent pollution from entering the water supply before the pollution occurs rather than trying to clean it up at the end of the line."<sup>14</sup>

The key reason for the quality of the city's water supply – the fact that 90 percent of the supply is delivered to taps unfiltered – also makes this water extraordinarily susceptible to contamination. Should the watershed be polluted in the interim by toxic drilling chemicals and require immediate filtration, it has been suggested that constructing a second water filtration plant could cost as much as \$20 billion.<sup>15</sup>

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<sup>8</sup> Department of Environmental Protection press release, 8-26-08

[http://www.nyc.gov/html/dep/html/press\\_releases/08-18pr.shtml](http://www.nyc.gov/html/dep/html/press_releases/08-18pr.shtml)

<sup>9</sup> "NYC's drinking water wins state test". Crain's New York Business, 8-27-08

<http://www.craigslist.com/article/20080827/FREE/808279995>

<sup>10</sup> Mayor's Office press release, 8-9-06

[http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor\\_press\\_release&catID=1194&doc\\_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2006b%2Fpr286-06.html&cc=unused1978&rc=1194&ndi=1](http://www.nyc.gov/portal/site/nycgov/menuitem.c0935b9a57bb4ef3daf2f1c701c789a0/index.jsp?pageID=mayor_press_release&catID=1194&doc_name=http%3A%2F%2Fwww.nyc.gov%2Fhtml%2Fom%2Fhtml%2F2006b%2Fpr286-06.html&cc=unused1978&rc=1194&ndi=1)

<sup>11</sup> "Bringing water to the City". The Stamford Review, Winter 2009

<http://www.stamfordreview.com/inside.php>

<sup>12</sup> "Natural gas drilling: is New York ready?" WNYC, 7-22-08

<http://www.wnyc.org/news/articles/104157>

<sup>13</sup> City Council hearing transcript. Committee on Environmental Protection, 12-12-08, pg 5

<sup>14</sup> City Council hearing transcript. Committee on Environmental Protection, 10-10-08, pg 94

<sup>15</sup> "City pols call drilling plan a biodisaster". New York Daily News, 9-10-08

[http://www.nydailynews.com/ny\\_local/2008/09/10/2008-09-10-city-pols-call-drilling-plan-a-biodisast.html](http://www.nydailynews.com/ny_local/2008/09/10/2008-09-10-city-pols-call-drilling-plan-a-biodisast.html)

During the years it would take to complete the filtration, New Yorkers would be forced to find other sources of water. The affluent might be able to afford reasonable alternatives, but the burden of supplying fresh water to New Yorkers of lesser means would cost billions and strain all levels of government. It could be, in short, a catastrophe of epic proportions.

## NEW YORK STATE RESPONSE

How is the state government handling the possible drilling in the Marcellus Shale?

A bill setting certain technical requirements pertaining to the amount of spacing between wells became law in the summer of 2008.<sup>16</sup> In signing the bill, Governor David Paterson also ordered a Supplemental Generic Environmental Impact Statement to address the environmental impacts of horizontal drilling and high volume hydraulic fracturing. According to a press release issued by the governor's office, "the update will occur as part of a public process that ensures that concerns raised by residents who could be affected by drilling activities are heard and considered."

However, when officials of the New York State Department of Environmental Conservation held an initial round of public meetings to address the potential environmental impacts of hydraulic fracturing, they held sessions only in Allegany, Bath, Elmira, Binghamton, Oneonta and Lake Sheldrake. In seeking stakeholder comments, the state agency omitted the largest block of state residents who could be affected – residents of New York City.

In February, 2009, the agency released the Final Scope for the Marcellus Shale Study, the second of four documents that will culminate in the publication of a final Supplemental Generic Environmental Impact Statement scheduled for summer, 2009.

The agency says in the February document that it will be studying further "the potential impacts" from high-volume hydraulic fracturing on:

"(1) water withdrawals, (2) transportation of water to the site, (3) the use of additives in the water to enhance the hydraulic fracturing process, (4) space and facilities required at the well site to ensure proper handling of water and additives, (5) removal of spent fracturing fluid from the well site and its ultimate disposition and (6) potential impacts at well sites where multiple wells will be drilled during a three-year period".

The agency received 3,770 written statements from stakeholders across the state in reaction to this document - testament to the degree of alarm that New Yorkers are feeling.

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<sup>16</sup> **A10526/S08169**, a bill introduced by Assembly member William L. Parment (D, North Harmony) and Senator Catherine Young (R, Olean) addresses technical issues connected to drilling activity. The bill was signed into law by Governor David Paterson on July 23, 2008.

## FEDERAL AND INDUSTRY RESPONSE

Industry representatives dismiss horror stories associated with hydraulic fracturing as lacking conclusive evidence. Red Cavaney, President and Chief Executive of the American Petroleum Institute summed up the industry position in a recent letter to the New York Times, saying “studies by the Environmental Protection Agency and the Ground Water Protection Council have not identified a single instance of ground water contamination [from hydraulic fracturing].”<sup>17</sup>

They point to a report by the Environmental Protection Agency in 2004 which states that “based on the information collected and reviewed, EPA has concluded that the injection of hydraulic fracturing fluids into CBM [coal-based methane] wells poses little or no threat to USDWs [underground sources of drinking water] and does not justify additional study at this time.”<sup>18</sup>

Some were baffled with this conclusion, which seemed to contradict some of the content in the report (see section below). An expert within the EPA itself called the report “scientifically unsound” and has cautioned that the findings “do not appear to be based on objective and impartial information.”<sup>19</sup>

Yet some industry advocates, including a representative from a law firm that boasts a prominent national practice in energy,<sup>20</sup> continue to rely on these findings as a key rationale for the position that hydraulic fracturing poses no environmental threat.<sup>21</sup>

An article in the Los Angeles Times suggested that the agency’s conclusions had as much to do with politics as science. It reprinted portions of an email in which the Environmental Protection Agency suggested language for the group’s final comprehensive report:

“the EPA recognizes this issue raises concerns and is conducting an investigation to evaluate the potential risks to... drinking water”<sup>22</sup>

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<sup>17</sup> Letter to the Editor, Red Cavaney, 10-19-08

<http://www.nytimes.com/2008/10/20/opinion/lweb20water.html?partner=rssnyt&emc=rss>

<sup>18</sup> Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs, Report by the Environmental Protection Agency, Executive Summary, p.1, June, 2004

<sup>19</sup> Letter of EPA geological engineer Weston Wilson to members of Congress, 10-8-04.

<http://latimes.image2.trb.com/lanews/media/acrobat/2004-10/14647025.pdf>

<sup>20</sup> K&L Gates website, offices:

<http://www.klgates.com/locations/detail.aspx?office=2>

<sup>21</sup> “Junk science meets hydraulic fracturing: Unfounded environmental scare threatens energy development”. K&L Gates Toxic Tort and Energy & Utilities Alert, December, 2008

[http://www.klgates.com/files/Publication/d69bdfea-547d-4ec9-9a3e-0b92b913370b/Presentation/PublicationAttachment/93e30dac-e7ba-4a85-be44-00c3247478ff/TAA\\_123008.pdf](http://www.klgates.com/files/Publication/d69bdfea-547d-4ec9-9a3e-0b92b913370b/Presentation/PublicationAttachment/93e30dac-e7ba-4a85-be44-00c3247478ff/TAA_123008.pdf)

<sup>22</sup> “Halliburton’s interests assisted by White House”. The Los Angeles Times, 10-14-04

<http://www.latimes.com/news/nationworld/nation/la-na-hamburger14oct14-04,0,383106.story>

The Office of the Vice President, the article said, deleted this sentence from the final report. The article suggested that “Cheney’s office was involved in discussions about how fracturing should be portrayed in the report, and that it resisted EPA attempts to include concerns about its effects on the environment.”<sup>23</sup>

Three years earlier, an August, 2001 Los Angeles Times article describing consultations of the White House National Energy Policy Development Group convened by former Vice President Dick Cheney – who prior to holding a position in the Bush administration served for five years as Halliburton’s CEO – reported that discussions of environmental consequences linked to hydraulic fracturing requested by the Environmental Protection Agency were removed from meeting agendas.<sup>24</sup>

The specific chemical mixtures used for hydraulic fracturing are industrial trade secrets and thus even officials in the Environmental Protection Agency do not know for sure what exactly is in the frac-fluid.

The only thing that can be said for sure about the effects of hydraulic fracturing on human health is that not enough is known. As Environmental Protection Agency toxicologist Susan Griffin recently noted, “if you don’t know what you are looking for, it is hard to do analysis.”<sup>25</sup>

State authorities in Colorado demanded the chemical recipe from Halliburton and were initially rebuffed with threats to pull all drilling operations out of the state. However, a compromise was reached in which Halliburton would disclose the composition of chemicals that are stored in containers that are 50 gallons or more in size to state authorities (but not to the public).<sup>26</sup>

While this compromise sounds reasonable, Business Week magazine has reported that because chemicals used for hydraulic fracturing are often stored in quantities smaller than 50 gallons, some ingredients still will not have to be disclosed. In testimony before the Colorado Oil and Gas Conservation Commission, a Halliburton executive defended their decision to shield the composition of frac-fluid from the public saying, “it is much like asking Coca-Cola to disclose the formula of Coke.”<sup>27</sup>

“There’s a real dearth of baseline information” says geology professor Geoffrey Thyne, “I don’t think any fracking expert would tell you that we are 100 percent sure where the fractures go. No one has studied how often there are lateral leaks into nearby aquifers. People kind of figure that the government is looking out for them, and if there was a real problem, some expert would come forward and say so. Unfortunately, because no one’s studying this, it might be a while.”<sup>28</sup>

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<sup>23</sup> Ibid

<sup>24</sup> “Bush’s energy plan bares industry clout”. The Los Angeles Times, 8-26-01  
<http://articles.latimes.com/2001/aug/26/news/mn-38530>

<sup>25</sup> “Boom in gas drilling fuels contamination concerns in Colorado”, Christian Science Monitor, 2-5-09  
<http://features.csmonitor.com/environment/2009/02/05/boom-in-gas-drilling-fuels-contamination-concerns-in-colorado/>

<sup>26</sup> “Does natural gas drilling endanger water supplies?” Business Week, 11-11-08  
[http://www.businessweek.com/magazine/content/08\\_47/b4109000334640.htm?chan=top+news\\_top+news+index+-+temp\\_news+%2B+analysis](http://www.businessweek.com/magazine/content/08_47/b4109000334640.htm?chan=top+news_top+news+index+-+temp_news+%2B+analysis)

<sup>27</sup> “A toxic spew?” Newsweek, 8-20-08  
<http://www.newsweek.com/id/154394>

<sup>28</sup> “EPA to citizens: Frack you”. Salon.com, 5-5-06  
<http://www.salon.com/news/feature/2006/05/05/fracking/>

# THE EXPERIENCE WITH HYDRAULIC FRACTURING NATIONALLY

## Toxic Effects of Known Chemicals

While few are privy to the precise formula of frac-fluid, even the 2004 report by the Environmental Protection Agency did survey the potential health effects of the chemicals known to be used in the drilling process. Some of the gels in the frac-fluid can include boric acid and theylene glycol, which the report said in their undiluted form “can cause kidney, liver, heart, blood, and brain damage through prolonged or repeated exposure.”<sup>29</sup>

The table below, taken from the 2004 EPA report, maps out the hazards and toxicological effects of some of the known chemical agents that have been reported as frac-fluid ingredients.

Product	Chemical Composition Information <sup>1</sup>	Hazards Information	Toxicological Information <sup>2</sup>	Ecological Information
Linear gel delivery system	1) 30-60% by wt. Guar gum derivative 2) 60-100% by wt. Diesel	<ul style="list-style-type: none"> <li>• Harmful if swallowed</li> <li>• Combustible</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic effects/Carcinogenicity – contains diesel, a petroleum distillate and known carcinogen</li> <li>• Causes eye, skin, respiratory irritation</li> <li>• Can cause skin disorders</li> <li>• Can be fatal if ingested</li> </ul>	Slowly biodegradable
Water gelling agent	1) 60-100% by wt. Guar gum 2) 5-10% by wt. Water 3) 0.5-1.5% by wt. Fumaric acid	None	May be mildly irritating to eyes	Biodegradable
Linear gel polymer	1) <2% by wt. Fumaric acid 2) <2% by wt. Adipic acid	Flammable vapors	Can cause eye, skin and respiratory tract irritation	Not determined
Linear gel polymer slurry	1) 30-60% by wt. Diesel oil #2	<ul style="list-style-type: none"> <li>• Causes irritation if swallowed</li> <li>• Flammable</li> </ul>	<ul style="list-style-type: none"> <li>• Carcinogenicity – Possible cancer hazard based on animal data; diesel is listed as a category 3 carcinogen in EC Annex I</li> <li>• May cause pain, redness, dermatitis</li> </ul>	Partially biodegradable
Crosslinker	1) 10-30% by wt. Boric Acid 2) 10-30% by wt. Ethylene Glycol 3) 10-30% by wt. Monoethanolamine	<ul style="list-style-type: none"> <li>• Harmful if swallowed</li> <li>• Combustible</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic effects/Carcinogenicity D5 may cause liver, heart, brain reproductive system and kidney damage, birth defects (embryo and fetus toxicity)</li> <li>• Causes eye, skin, respiratory irritation</li> <li>• Can cause skin disorders and eye ailments</li> </ul>	Not determined
Crosslinker	1) 10-30% by wt. Sodium tetraborate decahydrate	May be mildly irritating: <ul style="list-style-type: none"> <li>• to eyes and skin</li> <li>• if swallowed</li> </ul>	May be mildly irritating	<ul style="list-style-type: none"> <li>• Partially biodegradable</li> <li>• Low fish toxicity</li> </ul>
Foaming agent	1) 10-30% by wt. Isopropanol 2) 10-30% by wt. Salt of alkyl amines 3) 1-5% by wt. Diethanolamine	<ul style="list-style-type: none"> <li>• Harmful if swallowed</li> <li>• Highly flammable</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic effects/Carcinogenicity – may cause liver and kidney effects</li> <li>• Causes eye, skin, respiratory irritation</li> <li>• Can cause skin disorders and eye ailments</li> </ul>	Not determined
Foaming agent	1) 10-30% by wt. Ethanol 2) 10-30% by wt. 2-Butoxyethanol 3) 25-55% by wt. Ester salt 4) 0.1-1% by wt. Polyglycol ether 5) 10-30% by wt. Water	Harmful if swallowed or absorbed through skin	<ul style="list-style-type: none"> <li>• May cause nausea, headache, narcoosis</li> <li>• May be mildly irritating</li> </ul>	Harmful to aquatic organisms
Acid treatment - hydrochloric acid	1) 30-60% by wt. Hydrochloric acid	<ul style="list-style-type: none"> <li>• May cause eye, skin and respiratory burns</li> <li>• Harmful if swallowed</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic effects/Carcinogenicity – prolonged exposure can cause erosion of teeth</li> <li>• Causes severe burns, and skin disorders</li> </ul>	Not determined
Acid treatment - formic acid	1) 85% by wt. Formic acid	<ul style="list-style-type: none"> <li>• May cause mouth, throat, stomach, skin and respiratory tract burns</li> <li>• May cause genetic changes</li> </ul>	<ul style="list-style-type: none"> <li>• May cause heritable genetic damage in humans</li> <li>• Causes severe burns</li> <li>• Causes tissue damage</li> </ul>	Not determined
Breaker Fluid	1) 60-100% by wt. Diammonium peroxodisulphate	<ul style="list-style-type: none"> <li>• May cause respiratory tract, eye or skin irritation</li> <li>• Harmful if swallowed</li> </ul>	May cause redness, discomfort, pain, coughing, dermatitis	Not determined

<sup>29</sup> US Environmental Protection Agency, “Evaluation of Impact to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs.” Chapter 4, p.5, June 2004

Table 4-1: Characteristics of Undiluted Chemicals Found in Hydraulic Fracturing Fluids (Based on MSDSs)

Product	Chemical Composition Information <sup>1</sup>	Hazards Information	Toxicological Information <sup>2</sup>	Ecological Information
Microbicide	1) 60-100% by wt. 2-Bromo-2 nitro,3-propanedol	<ul style="list-style-type: none"> <li>• May cause eye and skin irritation</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic effects/Carcinogenicity – not determined</li> <li>• Can cause permanent eye damage, skin disorders, abdominal pain, nausea, and diarrhea if ingested</li> </ul>	Not determined
Biocide	1) 60-100% by wt. 2,2-Dibromo-3-nitropropionamide 2) 1-5% by wt. 2-Bromo-3-nitropropionamide	<ul style="list-style-type: none"> <li>• Causes severe burns</li> <li>• Harmful if swallowed</li> <li>• May cause skin irritation; may cause allergic reaction upon repeated skin exposure</li> </ul>	<ul style="list-style-type: none"> <li>• Harmful if swallowed; large amounts may cause illness</li> <li>• Irritant; may cause pain or discomfort to mouth, throat, stomach; may cause pain, redness, dermatitis</li> </ul>	Not determined
Acid corrosion inhibitor	1) 30-60% by wt. Methanol 2) 5-10% by wt. Propargyl alcohol	<ul style="list-style-type: none"> <li>• May cause eye and skin irritation, headache, dizziness, blindness and central nervous system effects</li> <li>• May be fatal if swallowed</li> <li>• Flammable</li> </ul>	<ul style="list-style-type: none"> <li>• Chronic effects/Carcinogenicity – may cause eye, blood, lung, liver, kidney, heart, central nervous system and spleen damage</li> <li>• Causes severe eye, skin, respiratory irritation</li> <li>• Can cause skin disorders</li> </ul>	Not determined
Acid corrosion inhibitor	1) 30-60% by wt. Pyridinium, 1-(Phenylmethyl)-, Ethyl methyl derivatives, Chlorides 2) 15% by wt. Thiourea 3) 5-10% Propan-2-ol 4) 1-5% Poly(oxy-1,2-ethanediyl)-nonylphenyl-hydroxy 5) 10-30% Water	<ul style="list-style-type: none"> <li>• Cancer hazard (risk depends on duration and level of exposure)</li> <li>• Causes severe burns to respiratory tract, eyes, skin</li> <li>• Harmful if swallowed or absorbed through skin</li> </ul>	<ul style="list-style-type: none"> <li>• Carcinogenicity – Thiourea is known to cause cancer in animals, and possibly causes cancer in humans</li> <li>• Corrosive - short exposure can injure lungs, throat, and mucous membranes; can cause burns, pain, redness swelling and tissue damage</li> </ul>	<ul style="list-style-type: none"> <li>• Toxic to aquatic organisms</li> <li>• Partially biodegradable</li> </ul>

<sup>1</sup> Information presented is for the pure product, which is significantly diluted prior to injection. MSDS chemical composition percentages may total more than 100%.  
<sup>2</sup> Toxicity is concentration dependent.

In addition, scientists at The Endocrine Disruption Exchange (TEDX) in Paonia, CO have been able to independently obtain frac-fluid samples and have found some 250 different chemicals, 92 percent of which had one or more health effects including skin and sensory organ toxicity, respiratory problems, neuro-toxicity and gastrointestinal and liver damage.<sup>30</sup>

As Steven Lawitts, the acting Commissioner of the New York City Department of Environment Protection, noted at a recent City Council hearing, “the fracturing fluid itself is composed of hazardous compounds that, if released into the environment, could pose a very grave threat to water supply and water quality.”<sup>31</sup>

<sup>30</sup> The chemicals on this list include carcinogens such as benzene, formaldehyde, ethylene glycol, hydrochloric acid, N,N-dimethyl formamide, Gluteraldehyde and bleach.

Written testimony of Theo Colborn, PhD, before the House Committee on Oversight and Government Reform, 10-31-07. [http://s3.amazonaws.com/propublica/assets/natural\\_gas/colburn\\_testimony\\_071025.pdf](http://s3.amazonaws.com/propublica/assets/natural_gas/colburn_testimony_071025.pdf)

<sup>31</sup> City Council hearing transcript. Committee on Environmental Protection 12-12-08, pg 14.

## A SCARY RECORD IN OTHER STATES

Hydraulic fracturing “will be the environmental issue of the next decade,” Al Appleton, former Commissioner of the city’s Department of Environmental Protection said recently, “and it will be the biggest thing to hit the northeast since strip mining took apart West Virginia and Eastern Kentucky. The scale of the potential damage is that great.”<sup>32</sup>

Kate Sinding, a Senior Attorney at the Natural Resources Defense Council, recently noted “there are reports of well and surface water contamination, human and animal health impacts, and air quality impacts” at drilling sites around the country. “No regulatory agency has done the work to compile all of those, so you just have a lot of individual reports collected over time. To us, all of those reports substantiate the potential risks.”<sup>33</sup>

Stories abound already of dangerous incidents in other parts of the country, including leaks and spills; water pollution; explosions; and water theft.

## LEAKS AND SPILLS IN COLORADO, NEW MEXICO, UTAH, WYOMING & WEST VIRGINIA

Some of the greatest environmental risks posed by hydraulic fracturing relate to the manner in which frac-fluids are transported and stored before and after drilling.

▪ Cathy Behr of **Durango, Colorado** had her clothes and boots soaked by a 130 gallon frac-fluid spill; she was subsequently admitted to the intensive care unit with a swollen liver, erratic blood counts and fluid filled lungs.<sup>34</sup> It reportedly took weeks for Behr’s doctor to learn the chemical composition of the frac-fluid that she was in contact with and the doctor was sworn to secrecy by the manufacturer and could not even disclose to his patient what may have caused her illness.<sup>35</sup> County Commissioners are reportedly contemplating requiring oil and gas companies to reveal to emergency medical personnel the chemical contents of frac-fluid. “It’s a public-health issue for us,” Commissioner Wally White told Newsweek. “We don’t know what the chemicals are and what can happen.”

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<sup>32</sup> “Mixing Gas and Water: Drilling in the City’s Watershed”. Gotham Gazette, 1-12-09

<http://www.gothamgazette.com/article/issueoftheweek/20090112/202/2793>

<sup>33</sup> “Natural gas rush stirs environmental concerns”. Associated Press, 11-18-08

<http://enwl.bellona.ru/pipermail/enwl-eng/2008-November/000454.html>

<sup>34</sup> “A toxic spew?” Newsweek, 8-20-08

<http://www.newsweek.com/id/154394>

<sup>35</sup> “Drill for natural gas, pollute water”. Scientific American, 11-17-08

<http://www.sciam.com/article.cfm?id=drill-for-natural-gas-pollute-water>



- In the State of **New Mexico**, Governor Bill Richardson issued an executive order which placed a moratorium on drilling in New Mexico's Galisteo Basin after finding "hundreds of cases of water contamination from unlined pits where fracking fluids and other drilling wastes are stored."<sup>36</sup> The executive order cited concerns over "whether oil and gas drilling in the Basin may negatively affect local water supplies and sources of groundwater."<sup>37</sup>
- Some 30 to 60 gallons of anhydride acid – intended to be used in hydraulic fracturing -- leaked from a tank at a Halliburton facility in **Farmington, New Mexico**. Some 200 people were evacuated from the vicinity.<sup>38</sup>
- Approximately 1.6 million gallons of used frac-fluid leaked from a waste pit near the town of **Parachute, Colorado**, soaking into the ground and eventually reaching the Colorado River, which provides the drinking water for the residents of several western states.<sup>39</sup>
- A truck carrying frac-fluids crashed in **Glenwood Springs, Colorado** en route to a natural gas well pad, spilling its contents down an embankment.<sup>40</sup> Luckily, there were no water sources nearby and thus no water contamination.
- In **Duchesne County, Utah** a pit containing 150,000 barrels of spent hydraulic fracturing fluids leaked, allowing thousands of gallons of toxic wastewater to spill onto a nearby farm. The man-made pond used to contain the fluid reportedly "lacked a secondary containment berm, which allowed the spill to extend without restriction."<sup>41</sup>
- On or around March 21, 2007 in **Atchee Wash, Utah** a lined reserve pit used to store drilling fluids used for a natural gas well leaked an estimated 1,200 gallons of drilling fluid. The leak flowed towards the White River and was halted a few hundred feet from the banks of the river by vacuum trucks. Nonetheless, state environmental officials subsequently launched an investigation into reports of a strange foam on the Green River several days after the spill. The White River empties into the Green River. Walt Baker, director of the Utah Division of Water Quality, did not rule out foaming agents found in the drilling fluid as a potential cause. Pinning down an exact cause was complicated by the fact that the Utah Division of Water Quality did not begin to conduct tests on the water until eight days after the mysterious foam was first reported.<sup>42</sup>

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<sup>36</sup> "Drill for natural gas, pollute water". Scientific American, 11-17-08

<http://www.sciam.com/article.cfm?id=drill-for-natural-gas-pollute-water>

<sup>37</sup> State of New Mexico, Executive Order 2008-004, 1-24-08

[http://www.governor.state.nm.us/orders/2008/EO\\_2008\\_004.pdf](http://www.governor.state.nm.us/orders/2008/EO_2008_004.pdf)

<sup>38</sup> "Halliburton spill results in acid cloud". The Daily Times, 6-7-06

<http://www.yourlawyer.com/articles/read/11832>

<sup>39</sup> "Colorado River may face fight of its life". San Diego Tribune, 12-21-08

<http://www3.signonsandiego.com/stories/2008/dec/21/1n21colorado211057-colorado-river-may-face-fight-i/>

<sup>40</sup> "Energy industry truck spills fluids south of Silt". Glenwood Springs Post-Independent, 10-16-07

<http://www.postindependent.com/article/20071016/VALLEYNEWS/110160042>

<sup>41</sup> "Safe disposal of dark water". Vernal Express, 1-22-09

[http://www.vernal.com/printer\\_friendly/1801323](http://www.vernal.com/printer_friendly/1801323)

<sup>42</sup> "Natural gas leak sparks investigation". The Casper Star-Tribune, 3-25-07

<http://www.trib.com/articles/2007/03/25/news/regional/7cc0bc7b476a7c2f872572a800722f02.txt>

▪ In **Clark, Wyoming** the state Department of Environmental Quality discovered benzene in a water well. An underground well casing had reportedly cracked, causing the leak. According to a groundwater supervisor with the Wyoming environmental agency, “there is no direct evidence that the gas drilling has impacted it, but it sure makes you wonder. It just seems pretty circumstantial that it’s happening.”<sup>43</sup>

▪ On June 4, 2008 an estimated 800 gallons of diesel fuel used to power a natural gas rig leaked from a tank located 350 feet from a wetland at a drilling site in **Susquehanna County, West Virginia**. Vacuum trucks and sponges were used to mitigate the damage to the contaminated wetland. Emergency responders were able to effectively handle the mess thanks to a bright red tracing fluid that had been mixed into the diesel fuel.<sup>44</sup>

## WATER POLLUTION IN ALABAMA, COLORADO, WYOMING & TEXAS

Seven states have experienced serious incidents of water contamination near hydraulic fracturing drilling sites: Alabama, Colorado, Montana, New Mexico, Ohio, Texas and Wyoming.<sup>45</sup>

Some of these incidents could have been prevented with more vigilant regulation. Others, however, appear to be accidents that even the most stringent regulations could not have prevented or anticipated.

▪ An **Alabama** family turned on their water faucet and discovered, in place of water, “long, oily strings” and a “strong sulfur smell.”<sup>46</sup> The family lived near a drill site in the Black Warrior Basin of Alabama. Another Alabama citizen wrote to the Environmental Protection Agency complaining that water used in the kitchen “contained globs of black, jelly-like grease and smelled of petroleum.”<sup>47</sup> After years of court battles with the EPA and the State of Alabama, the state regulated fracturing to reduce potential of water contamination.<sup>48</sup>

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<sup>43</sup> “Drill for natural gas, pollute water”. Scientific American, 11-17-08

<http://www.sciam.com/article.cfm?id=drill-for-natural-gas-pollute-water>

<sup>44</sup> “Diesel fuel spills at Susquehanna County natural gas drilling site”. The Scranton Times-Tribune, 6-5-08

[http://www.thetimes-tribune.com/articles/2008/06/05/local\\_news/19748150.txt](http://www.thetimes-tribune.com/articles/2008/06/05/local_news/19748150.txt)

<sup>45</sup> “Does natural gas drilling endanger water supplies?” Business Week, 11-11-08

[http://www.businessweek.com/magazine/content/08\\_47/b4109000334640.htm?chan=top+news\\_top+news+index+-+temp\\_news+%2B+analysis](http://www.businessweek.com/magazine/content/08_47/b4109000334640.htm?chan=top+news_top+news+index+-+temp_news+%2B+analysis)

<sup>46</sup> “Coal-bed methane could meet US’ entire natural gas needs for over 11 years”. Alexanders Gas and Oil Connections, 4-23-01

<http://www.gasandoil.com/goc/features/fex11712.htm>

<sup>47</sup> US Environmental Protection Agency, “Evaluation of Impact to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs.” Chapter 6, p.10, June 2004

<sup>48</sup> “Oil and gas at your door?: A landowners guide to oil and gas development”. Oil and Gas Accountability Project

<http://www.earthworksaction.org/pubs/LOGuide2005book.pdf>

▪ Several years ago a woman named Laura Amos, a resident of **Dry Hollow, Colorado**, watched while the well near her farmhouse suddenly exploded like a geyser, gushing gray water that had an ugly smell. A thousand feet from her farmhouse, an energy company had been drilling for natural gas.<sup>49</sup> Three years later, Amos was diagnosed with a rare adrenal tumor. Tests revealed that the well had been contaminated with methane gas. In 2006 Amos accepted a multi-million dollar settlement from Encana, which required that she no longer talk publicly about what happened.<sup>50</sup>

▪ In 2004, Divide Creek in **Western Colorado**, which had eleven hydraulic fracturing operations within one mile, was found to be contaminated with benzene and methane. Local resident Lisa Bracken notes that trees and other local wildlife are dying, “the land has lost its ability to sustain itself.” EnCana, the firm that conducted the drilling near the creek was levied the largest drilling-related fine in Colorado history for a gas seam that many attribute to the contamination of Divide Creek.<sup>51</sup>

▪ In **Rock Spring, Colorado** a man was hospitalized after drinking water from his tap that was later found to contain benzene. Not knowing who exactly was responsible for the contamination, the Colorado Oil and Gas Conservation Commission cited four different gas operators.<sup>52</sup>

▪ In **Pavillion, Wyoming**, resident Louis Meeks, unable to get answers from the EnCana Corporation, which owns several wells in the town that were created using hydraulic fracturing, sent samples of his drinking water to a lab for analysis. The lab discovered his drinking water contained high levels of two toxins (Diethylene and Triethylene glycols) commonly used as antifreeze in natural gas production.<sup>53</sup>

▪ Also in **Pavillion, Wyoming**, some water wells have been contaminated with a strain of iron bacteria. According to the water quality division district supervisor at the Wyoming Department of Environmental Quality, “everyone’s in agreement that the well is messed up... our working hypothesis is that the oil and gas activity has introduced something into the sub surface that has increased the bacteria in this well.”<sup>54</sup>

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<sup>49</sup> “Hydraulic Fracturing” by Laura Amos, Earthworks

<http://www.earthworksaction.org/cvLauraAmos.cfm>

<sup>50</sup> “Drill for natural gas, pollute water”. Scientific American, 11-17-08

<http://www.sciam.com/article.cfm?id=drill-for-natural-gas-pollute-water>

<sup>51</sup> “Boom in gas drilling fuels contamination concerns in Colorado”. Christian Science Monitor, 2-5-09

<http://features.csmonitor.com/environment/2009/02/05/boom-in-gas-drilling-fuels-contamination-concerns-in-colorado/>

<sup>52</sup> “Drill for natural gas, pollute water”. Scientific American, 11-17-08

<http://www.sciam.com/article.cfm?id=drill-for-natural-gas-pollute-water>

<sup>53</sup> “Looking for answers”. Casper Star-Tribune, 11-10-07

<http://www.trib.com/articles/2007/11/11/news/wyoming/f637cc3d9f0c99168725738f00065338.txt>

<sup>54</sup> “Contaminated wells concern Pavillion-area residents”. Casper Star-Tribune, 7-21-08

<http://www.trib.com/articles/2008/07/21/news/wyoming/da662aeaf6aec8b48725748c00210db4.txt>

■ In July, 2008 a water well in **Sublette County, Wyoming** was found to contain a concentration of benzene 1,500 times the level safe for human consumption. Sublette County is home to 6,000 natural gas wells, many of which have undergone hydraulic fracturing. The U.S. Bureau of Land Management has since documented various levels of contamination in 88 water wells in Sublette County. According to Scientific American, some of Sublette County's water wells were too dangerous to even be examined, "monitors showed they contained so much flammable gas that they were likely to explode."<sup>55</sup>

■ In **Hill County, Texas** a farmer found several of his goats and llamas dead. Tests revealed that his water supply was tainted with a hydrocarbon called toluene. His well – which for years had produced clean water – was reportedly within several hundred yards of two recently abandoned hydraulic fracturing jobs drilled by Williams Production-Gulf Coast Co.<sup>56</sup>

## EXPLOSIONS IN PENNSYLVANIA, OHIO, COLORADO, WYOMING & TEXAS

■ On New Year's Day, 2009, an explosion destroyed a cement slab that covered a water well in **Dimock, Pennsylvania**, an area that rests above the Marcellus Shale.<sup>57</sup> As part of its ongoing investigation to uncover the cause, the Pennsylvania Department of Environmental Protection probed recent occurrences where gas leaked inside nine water wells. The driller, Cabot Oil & Gas Corporation, is reportedly providing alternative water supplies to some of the affected homes.<sup>58</sup> When weighing the costs and benefits of drilling for the gas there, Shawn Fiorentino a Dimock township resident said, "We're all poor people around here. We thought this was going to be great for us, but we didn't expect explosions."<sup>59</sup>

■ A house in **Bainbridge, Ohio** "exploded in a fiery ball."<sup>60</sup> Investigators discovered that the tap water literally ignited, because it was full of methane. The methane had been pushed into the water, according to a subsequent study, due to pressure caused by hydraulic fracturing. According to a report on the incident issued by the Ohio Department of Natural Resources, "over pressurized gas infiltrated the local aquifers, and discharged through local water wells."<sup>61</sup>

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<sup>55</sup> "Drill for natural gas, pollute water". Scientific American, 11-17-08  
<http://www.sciam.com/article.cfm?id=drill-for-natural-gas-pollute-water>

<sup>56</sup> "Water Foul". Fort Worth Weekly, 4-30-08  
<http://www.fwweekly.com/content.asp?article=6885>

<sup>57</sup> "DEP probes blast in gas-drilling region". Scranton Times, 1-3-09,  
[http://www.scrantontimes.com/articles/2009/01/03/news/sc\\_times\\_trib.20090103.a.pg1.tt03explosion\\_s1.2204459\\_top3.txt](http://www.scrantontimes.com/articles/2009/01/03/news/sc_times_trib.20090103.a.pg1.tt03explosion_s1.2204459_top3.txt)

<sup>58</sup> "The Danger Down Below". The Scranton Times-Leader, 2-22-09.  
[http://www.timesleader.com/news/The\\_danger\\_down\\_below\\_02-22-2009.html](http://www.timesleader.com/news/The_danger_down_below_02-22-2009.html)

<sup>59</sup> "DEP Zeros in on Gas Tainting Water: Tests show source is a formation tapped for energy". Pressconnects.com, 1-30-09  
<http://www.pressconnects.com/article/20090130/NEWS01/901300332/1001/news>

<sup>60</sup> "Drill for natural gas, pollute water". Scientific American, 11-17-08  
<http://www.sciam.com/article.cfm?id=drill-for-natural-gas-pollute-water>

<sup>61</sup> "Division of Mineral Resources Management Report Conclusions about the Causation of the Aquifer Gas Invasion and Home Explosion Bainbridge Township, Geauga County". Ohio Department of Natural Resources, 5-13-08  
[http://www.bainbridgetwp.com/dynamic\\_content/special\\_reports/FinalAnalysisfromODNRCConcerningEnglishWellDrilling.pdf](http://www.bainbridgetwp.com/dynamic_content/special_reports/FinalAnalysisfromODNRCConcerningEnglishWellDrilling.pdf)

▪ In **Huerfano County, Colorado** Ben Bounds' water pump house sustained an explosion that blew the roof off the frame of the house. The explosion has been attributed to methane that had seeped into his well from one or more of the 50 active hydraulic fracturing operations nearby. The Christian Science Monitor, who originally reported this incident, captured Bounds' frustration with the inability to independently monitor water quality near hydraulic fracturing sites. "Why are they allowed to keep this a secret? That's not right. It only seems like common sense to me that they would have to release the contents of those fluids and prove they aren't causing problems."<sup>62</sup>

▪ A natural gas well owned by Windsor Energy in **Clark, Wyoming** blew out in November, 2006, requiring the evacuation of area residents to a local community center. Shortly after the incident, the groundwater in the area was found to be contaminated<sup>63</sup>, with Windsor Energy acknowledging that this may be the result of past drilling and production activities. Additionally, local agencies reported receiving complaints about the same site for spills and illegal dumping of drilling fluids.<sup>64</sup>

▪ In **Grandview, Texas** a toilet erupted in a house that was within 100 yards of a hydraulic fracturing operation. The water was later analyzed and found to contain toluene, reportedly a common ingredient in frac-fluid which is also used in paint stripper and some types of explosives. The Harris family, owners of the erupting toilet, now spend over \$100 a week to truck in fresh water to their home.<sup>65</sup>

## WATER THEFT

Natural Gas Week, a trade publication, has noted that among the challenges facing drillers in the Marcellus Shale is where and how they will get the water needed for the process; "regulators are still trying to figure out the water permitting and disposal issues that have arisen because of the massive amounts of water needed to fracture each well."<sup>66</sup> The unauthorized removal of water from local point sources within the New York City watershed could potentially damage the city's water quality.<sup>67</sup> According to Susan Riha, Director of the New York State Water Resources Institute at Cornell University, "it's not clear to me that there is any group who is looking at the overall impact of withdrawing the amount of water that might be required for the hydro-fracing. Who is looking at the broader picture?" Hydrologist William Kappel from the U.S. Geological Survey elaborates, saying "the tremendous amounts of water used for these processes – where are you going to get it and what are you going to do with that?"<sup>69</sup>

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<sup>62</sup> "Boom in gas drilling fuels contamination concerns in Colorado". Christian Science Monitor, 2-5-09

<http://features.csmonitor.com/environment/2009/02/05/boom-in-gas-drilling-fuels-contamination-concerns-in-colorado/>

<sup>63</sup> "Monitor wells show contamination". Billings Gazette, 11-11-06

<http://billingsgazette.net/articles/2006/11/11/news/wyoming/44-monitor.txt>

<sup>64</sup> "Tests find groundwater contamination" Casper Star-Tribune, 11-15-06

<http://casperstartribune.net/articles/2006/11/17/news/wyoming/464a38b9cb90ba51872572270007f2c1.txt>

<sup>65</sup> "Controversial path to possible glut of natural gas". The Christian Science Monitor, 9-18-08

<http://features.csmonitor.com/environment/2008/09/17/controversial-path-to-possible-glut-of-natural-gas/>

<sup>66</sup> "As new gas output grows, shale frenzy shows no signs of abating". Natural Gas Week, 10-6-08.

[http://www.energyintel.com/DocumentDetail.asp?document\\_id=238744](http://www.energyintel.com/DocumentDetail.asp?document_id=238744)

<sup>67</sup> "Controversial path to possible glut of natural gas". The Christian Science Monitor, 9-18-08

<http://features.csmonitor.com/environment/2008/09/17/controversial-path-to-possible-glut-of-natural-gas/>

<sup>68</sup> "Hydrofracking: toxic gas drilling technique". Albany Times Union, 7-22-08

<http://timesunion.com/AspStories/story.asp?storyID=705332>

<sup>69</sup> Ibid.

Cases of water theft are already being reported close to home:

- In Spring 2008, the **Pennsylvania Department of Environmental Protection** shut down two hydraulic fracturing sites after discovering that drillers were siphoning off millions of gallons of fresh water from local creeks without authorization.<sup>70</sup>
- The **Susquehanna River Basin Commission**, which regulates water usage in parts of New York, Maryland and Pennsylvania, has issued two cease-and-desist orders to drillers illegally removing water and has requested that twenty-three other drill sites clarify their water usage requirements.<sup>71</sup>

## RECOMMENDATIONS

1. **Prohibit Drilling in the NYC Watershed** — Whatever arguments can be made for drilling to retrieve the natural gas from the Marcellus Shale, it simply makes no sense to risk catastrophe by drilling in the less than nine percent of the shale that lies within the New York City watershed. The damage caused by a calamitous spill or contamination in the region that supplies the city with its water could go well beyond the time and money needed to build a new water filtration plant. No regulations imaginable are stringent enough to prevent accidents, and even a single accident could cause incalculable costs to be shouldered by New Yorkers – especially those in low- and middle-income brackets. The potential risk far outweighs the limited benefits that drilling within the boundaries of the watershed would bring.
2. **Disclose Ingredients in Frac-Fluid** — The specific ingredients of the frac-fluid(s) used at a given drilling site must be disseminated among all environmental regulatory agencies, water treatment facilities, and first responders in the vicinity of that site. The industry refusal to reveal the ingredients is simply unacceptable. While it is surely important to respect intellectual property rights, it is government's first responsibility to protect lives.
3. **Track Movement of Fluids** — New York State should mandate the inclusion of “tracers” in all frac-fluids. Tracers are already used in oil tankers and explosives, and their purpose is to allow an environmental agency test to determine if the element being traced has caused a contamination or other problem. Because drilling companies have been adamant that hydraulic fracturing has never resulted in a case of water contamination, they should have no objection to adding a tracer to verify this claim in New York.
4. **Study Safer Versions of Frac Fluid** — According to University of Wyoming research scientist Geoffrey Thyne, major drilling companies have developed a “safer” frac-fluid which is used for off shore drilling. The use of this safer frac-fluid should be studied, and, if shown to be feasible, should be required for all natural gas drilling in New York State. Some may reject this proposal on the basis of higher costs, yet, given the slew of contamination issues that this report has collected and documented, this increase in cost would be merited.

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<sup>70</sup> “What lies beneath”. Environmental Science & Technology, 10-15-08

<http://pubs.acs.org/doi/full/10.1021/es802190h?cookieSet=1>

<sup>71</sup> “Controversial path to possible glut of natural gas”. The Christian Science Monitor, 9-18-08

<http://features.csmonitor.com/environment/2008/09/17/controversial-path-to-possible-glut-of-natural-gas/>

5. **Hold Hearings In New York City** -- The New York State Department of Environmental Conservation (DEC) played host to an initial round of public meetings to address the potential environmental impacts of hydraulic fracturing in five different locations across the State, none in New York City. It is now time to schedule such a public meeting in each of New York City's five boroughs.
6. **Regulate And Monitor** There must be adequate regulation, monitoring and supervision of hydraulic fracturing. To achieve this, the New York State Department of Environmental Conservation should be given a budget that allows them to maintain levels of relevant staff.
7. **Plan for Emergencies** -- A set of contingency plans should be developed by the state government in order to react to any sort of environmental contamination that may be generated by hydraulic fracturing. It should be clear who will be responsible for any necessary environmental remediation and how it will be paid for.

### **Financial Implications**

8. The New York State legislature should mandate a significant portion of the tax revenues generated from natural gas drilling to be earmarked for use in advancing Governor Paterson's 45 by 15 initiative which aims to have 30% of the state's energy consumption derive from clean renewable sources, while making a fifteen percent reduction in electricity consumption by 2015. The state's ability to realize an increased degree of energy independence hinges on the success of this ambitious initiative and tax monies generated by natural gas drilling comprise one of the most appropriate revenue streams to help the state realize this goal.
9. In instances where leases have been signed between land owners in the NYC watershed and drilling companies, an equitable process should be adapted that will allow those leases to be modified but without unduly punishing land owners or rewarding the speculative intentions of the parties that brokered these deals.



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