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THE ASSEMBLY
STATE OF NEW YORK
ALBANY

CHAIR
Higher Education Committee

COMMITTEES
Environmental Conservation
Rules
Ways & Means

**Testimony of Assemblymember Deborah J. Glick
Before the New York City Council
Regarding Natural Gas Drilling in the City's Upstate Watershed**

September 10, 2008

As a New York State Assemblymember representing portions of Lower Manhattan and as a member of the Assembly's Environmental Conservation Committee, I am very concerned about projected plans for natural gas drilling in the Catskills/Delaware Watershed Area, particularly as ninety percent of New York City's drinking water comes from this area. This issue came to my attention this spring when a bill regarding well-spacing appeared before the Assembly for a vote with very little time to review the issue. The legislation would allow wells to be located closer together making it easier for wide-scale drilling to occur in the watershed area. Given the potentially serious ramifications that drilling could have on New York City's water supply, I believed that an in-depth examination of the issue was necessary. Therefore, although the bill passed, I voted against it because I thought there was not enough time for sufficient investigation, debate and discussion.

In July, I sent a letter to Emily Lloyd, Commissioner of the Department of Environmental Protection (DEP), in which I voiced my concerns about drilling for natural gas in New York City's watershed area and asked what authority the City has to regulate the drilling in this area. I also asked if the City could guarantee that gas drilling in this area will not contaminate New York City's water supply. I am still waiting for a response from DEP and I believe that these questions must be answered immediately to ensure that New York City's water supply is protected.

Geologists have known about the natural gas in the Marcellus Shale for years, but now with skyrocketing gas prices and technological advances in drilling there is a renewed interest in extracting it. A new method of drilling is being used in the Marcellus called "fracking" - short for fracturing. This involves drilling horizontally through the bedrock for up to a mile and cracking it open with high-pressure blasts of water, sand and chemicals in order to release the gas. In this process, significant volumes of wastewater are produced. Disposal of this wastewater has been an ongoing challenge for communities where fracking has occurred.

Although drilling and the pursuit of drilling in the Marcellus Shale is in its early stages and it may be too early to measure its environmental impacts, drilling in similar shales has proved that extracting natural gas by fracking can have disastrous consequences to the air, water, public health, wildlife, and the integrity of local communities. Pollution from gas exploration and

production has involved known carcinogens, reproductive toxicants, and other toxic chemicals like arsenic, hydrogen sulfide, mercury and volatile compounds including benzene and xylene.

Exacerbating the environmental and health concerns already mentioned is the fact that the U.S. Energy Act of 2005 exempted oil and gas companies from the Clean Water Act, the Safe Drinking Water Act, the Superfund Law, as well as community right-to-know laws. In regard to the community right-to-know laws, companies can withhold information about the chemicals they use in the fracking process, claiming them proprietary information.

We cannot be too cautious about the environmental consequences of drilling for natural gas, especially given the potential effect it could have on the upstate reservoirs and watershed that provide New York City's drinking water. It is of paramount importance that we act to protect New York City's watershed. Therefore, I support Council Member Gennaro's call for the State to put a moratorium on gas exploration in the Catskills/Delaware Watershed Area until the environmental impact is fully assessed.

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The Council of the City of New York
New York City Hall
Committee on Environment Protection
250 Broadway
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FOR THE RECORD

September 9, 2008

To: Council member James Gennaro

Re: Oversight Hearing – Natural Gas Drilling in the New York City Drinking Watershed

From: Theo Colborn, PhD

In response to your letter of August 27, 2008 in which you invited me to attend and testify during a hearing on Natural Gas Drilling in the New York City Watershed, I regret that I will not be able to attend. Instead I am submitting pertinent data that the Committee on Environmental Protection should be aware of concerning chemicals that are used during natural gas operations.

I was born and raised in northern New Jersey and for 15 years prior to moving to Colorado in 1964, I lived in Sussex County. I am very familiar with New York City's watershed and the headwaters of the Delaware River. My curriculum vitae is attached for your review. (Attachment A.)

I am certain that you have been told by natural gas developers that they "know how to do it right" and they will pose no threat to what is possibly the most precious asset New York City and the State of New York possess, your watersheds. I also know that you are being told that gas production in the East is, and will be, different than what has taken place in the West and therefore what has happened in the West has no relevance to gas development in the East. I disagree.

Keep in mind that as natural gas activity in the West began to spread beyond the vast expanses of relatively uninhabited BLM land, it encroached upon our watersheds, our municipalities, our homes, and most unexpectedly, began to impact the quality of our air-sheds. The western experience should be taken seriously by those in the East. Many western communities and counties were not prepared for the impacts, as the US EPA's authority and oversight rapidly disappeared and gas rigs started to move into their neighborhoods. What has happened here is just a prelude to what can happen in the more heavily populated New York City watershed.

It is not too late for New York City to start addressing the human and environmental health impacts that suddenly surface when drilling commences near residences and in municipal watersheds. And most important early on, the council must take into consideration the disturbing evidence from the West about the local and long-range increases in ozone as natural gas activity increases, and what that will mean in terms of New York City meeting EPA ozone compliance levels. To assist your Committee in its determinations, TEDX is providing the following commentary and documents for your docket that my staff and I have produced over the past six years while natural gas production boomed in the western half of Colorado.

I encourage New York City to err on the side of caution and to seriously consider the number and volumes of toxic chemicals that are going to be introduced into the Marcellus Shale Natural Gas Field as natural gas operations commence. You are in a position to establish precedent for municipalities, counties, and states across the nation in your deliberations this week.

As the attachments will make clear, full disclosure must be instituted or lives will be lost due to lack of exposure information for emergency medical responders, which is necessary to protect and treat workers and citizens. Your watershed and many household drinking water wells could be lost. Water treatment plants are not designed to deal with chemicals of this nature. Water quality monitoring will be useless if testing is not designed to detect the chemicals that are in use.

In the West, where states are beginning to anticipate the closure of wells, we are just beginning to hit the tip of the iceberg for what we have done. To date, there is no clear explanation as to how so many of the chemicals now being reported in the reserve pits got there. What little information is available concerning pit contents is still more than sufficient to be a cause for concern. In my New Mexico testimony, when asked by the Hearing officer about the chemicals found in the pits about to be closed, I had to admit that **if the pattern of chemical pollutants found in pits continues to be the same across the country as more pits are tested prior to closure, it would appear that every well pad will eventually become a superfund site.** New Mexico is faced with this dilemma today in its southeastern and northwestern oil fields and it looks like the tax payers are responsible for the bill.

It is extremely important that both New York City and New York State require full disclosure of the chemicals that are being shipped into and/or being used in its watersheds. Preventive measures must be taken to provide full protection of watersheds and public health. This can only be accomplished through full disclosure of all the chemicals in all the products being used, and full disclosure of where and how much of each chemical is used in each operation, and how the residuals will be disposed of.

The mismatch between what can be eked out about the chemicals that are being introduced into the gas fields and what is turning up in the environment around well pads emphasizes the need for full disclosure of all products and chemicals to be used prior to operations commencing.

Thank you for your consideration. Do not hesitate to call me if you have questions or need more information. I can be reached at 970 527 6548.

Yours truly,

Theo Colborn, PhD
President

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List of Attachments with Narratives

Attachment A. Curriculum Vitae, Theo Colborn, Ph.D.

Attachment B. AN ANALYSIS OF POSSIBLE INCREASES IN EXPOSURE TO TOXIC CHEMICALS IN DELTA COUNTY COLORADO WATER RESOURCES AS THE RESULT OF GUNNISON ENERGY'S PROPOSED COAL BED METHANE ACTIVITY 10/22/02

This is a letter I submitted to the regional US Forest Service and BLM managers who were issuing permits to Gunnison Energy Corporation (now known as Oxbow) to drill gas wells on the Grand Mesa, the source of water for hundreds of families and farms below. Two years later a woman called to tell me that she had developed a rare adrenal tumor while breast feeding her baby and had found my letter in the government docket. Along with the tumor, her adrenal gland had to be removed and she was worried about her daughter, whom she had breast fed over the 18 months while the tumor was growing. She wanted to know if I thought the damage to her family's domestic water well during a fracturing event could have released 2-butoxyethanol (2-BE) into their water. She read in my memo that 2-BE causes rare adrenal tumors in female laboratory animals as well as a number of other health effects.

At first, the company (ENCANA) and the Colorado Oil and Gas Conservation Commission (COGCC) denied that 2-BE was ever used during frac'ing. After several months of deliberation in 2005, ENCANA and the COGCC admitted that 2-BE had been used while frac'ing a nearby gas well on the day her well blew up. Her drinking water well was less than 1000 feet from well G33 where the frac'ing took place. Four years after the incident the company agreed to test the water from her well for 2-BE, which, not surprisingly, was negative. (See the physical characteristics and health effects of 2-BE described in my letter.) If the operator prior to frac'ing had reported fully to the COGCC what it intended to use, household water wells that erupted in the vicinity of the well pad could have been tested for 2-BE immediately and the residents could have been informed.

Attachment C. CHEMICALS USED TO PRODUCE AND DELIVER NATURAL GAS:
COLORADO 02/06/08

For several years, the Oil and Gas Accountability Project (OGAP) and others have been sending TEDX the Material Safety Data Sheets (MSDS) from products used in natural gas and oil operations around the West. We were also sent MSDSs that were released following accidents and spills. Attachment C is TEDX's most current list of chemicals used in Colorado. It is important to note that 67 of the chemicals on this list are designated as hazardous by at least one of six Federal Laws.

Attachment D. ANALYSIS OF CHEMICALS USED IN NATURAL GAS PRODUCTION:
COLORADO 02/06/08

This attachment provides an analysis and comments concerning the chemicals listed in the Colorado inventory, in which we found 215 products containing 278 chemicals. We broke out the

health effects associated with each chemical into 14 categories (based on standard use in government reports) to describe toxicological/health endpoints. In our comments we provide three graphs that depict the frequency at which those health effects are associated with the chemicals used in natural gas operations. Taking pathway of exposure into consideration we broke out the water soluble chemicals and the volatile chemicals to provide a better picture of the hazards involved. For example, 70% of the 278 chemicals on the list can cause skin and eye irritation and sensory organ damage. Looking only at the 124 chemicals that are water soluble, the percent jumps to more than 85%. (See www.endocrinedisruption.org for lists and summaries for other western states.)

It is important to understand that the Occupational Safety and Health Administration (OSHA) provides a boiler plate form as guidance for what should be included on a Material Safety Data Sheet (MSDS). Information presented on an MSDS is the sole responsibility of the product manufacturer. Unfortunately, OSHA is not structured to review the MSDSs before they are attached to a product. What appears on the MSDSs is solely what the manufacturer of the product chooses to reveal. As a result TEDX can in no way state that our list of chemicals in use in any state is complete or accurate.

For emphasis, I am inserting here items 6 through 10 from Attachment D that cover the difficulty of determining what is in the products that are being used in natural gas operations.

6. Several reasons led to the lack of data about the health effects of some of the products and chemicals on the spread sheet:

- (a) Some products list no ingredients.*
- (b) Some products provide only a general description of the content, such as "plasticizer", "polymer" etc.*
- (c) Some products list some or all of the ingredients as "proprietary".*
- (d) No health effect data were found for a particular chemical or product.*

7. Much of the information about the composition of the products on the list comes from a Material Safety Data Sheet (MSDS). Ingredients on MSDSs are sometimes labeled as "proprietary", or "no hazardous ingredients" even when there are significant health effects listed on the MSDS.

8. Some of the citations used to establish the health effects of the chemicals on this list are old, dating back to the 1970's and 80's. In several cases data were derived from abstracts, not the full report or manuscript. In other cases, citations were taken from toxic chemical databases, such as TOXNET, ChemID, etc. Many reports submitted to the US Environmental Protection Agency by the manufacturer to register a chemical are not accessible. In some cases it is impossible to track down any health effect for a chemical, especially when the manufacturer provides no Chemical Abstracts Service (CAS) number.

9. No health effects were found for 59 of the chemicals on the list. Of these, only 14 had been assigned a CAS number which facilitates searching the literature. We found no health related literature for these chemicals. It was impossible to determine the safety of the other 45 chemicals either because they were listed as mixtures, proprietary, or unspecified (10), or had chemical names that were so general that the specific chemical could not be identified (35).

10. From early on, as new products were added to the list, the sequence of the categories in the pattern of the percentages has shifted only slightly. Looking at data from other states, the pattern also holds. It is expected that slight changes in sequence from one position to another will continue to occur as more products and chemicals are entered into the database.

Attachments E and F provide examples of the dilemma other states in the West have faced and to emphasize the importance for full disclosure where human health and life support systems are at risk. These Attachments are also provided to emphasize the need to have the chemical information available immediately in the case of accidents or spills. To accomplish this, the chemical information must be accessible prior to the commencement of operations.

Attachment E FRAC'ING SPILL GRAPH

A week or more following reports in newspapers about a "frac'ing mixing truck" accident with civilian vehicles in Garfield County, Colorado, TEDX was sent the MSDSs. It was estimated that a total of 318 gallons had spilled by the side of the road. This attachment provides a breakout of the health effects of the 15 chemicals reported on the product MSDSs for that spill. Seven of the chemicals were volatile and could have been inhaled at the time of the accident. They posed possible effects in at least 5 of the nine health categories on the figure. And the four chemicals that were water soluble posed a possible health threat in all nine health categories. In this case, the State Patrol was the first responder at the scene.

Attachment F. PERCENT OF ADVERSE HEALTH EFFECTS ASSOCIATED WITH DRILLING BLOWOUT

TEDX received an urgent request in August 2006 for information about 20 products that were used in a routine drilling operation in Crosby, Wyoming, during which the well blew out at a depth of 8,000 ft. The company involved gave the local authorities the MSDSs for the products they used to drill, which were then sent to us. It took 57 hours to get the blowout under control while muds and fumes blew back up the well. They were seeping out of cuts along a county road and from two large cracks in the earth that extended from the well pad toward a nearby housing development. People were trapped in their homes and could not go outside because of the fumes.

TEDX presents these data in response to industry's statements that their drilling chemicals are only soap, guar gum, and water and/or are organic and safe. These data reveal that the chemicals used to increase the efficiency of drilling muds can pose serious health problems and should be among those chemicals that are fully disclosed.

It is important to note here that this well was shut down permanently. Upon closure, Wyoming came up with a comprehensive, long-term recovery and remediation plan that could provide a model for Colorado and other states. TEDX was impressed with the thoroughness and long-term considerations that went into the plans. (See URL: http://deq.state.wy.us/volremedi/downloads/Web%20Notices/Windsor%20Well_Clark/Work%20Plan%20FINAL%20020108.pdf)

Attachment G POTENTIAL HEALTH EFFECTS OF RESIDUES IN SIX NEW MEXICO OIL AND GAS DRILLING RESERVE PITS BASED ON COMPOUNDS DETECTED IN AT LEAST ONE SAMPLE.

In November 2007 I was asked to testify during hearings by the New Mexico Oil and Gas Commission that was in the process of writing new regulations on pit closures. The results provided in this attachment were based on industry's own test results from 6 New Mexico reserve pits that were in the process of shutting down. The 42 chemicals that were detected produced a pattern of higher frequencies of health categories than anything TEDX had discovered thus far. TEDX found that 34 of the 42 chemicals detected in the pits were not on the list of 224 chemicals used to produce gas and oil in New Mexico. (See TEDX's website www.endocrinedisruption.org)

for the complete list, and analysis and summary of the chemicals used in New Mexico.) Many of the chemicals in the pits were at concentrations well above state and federal safety levels. We further discovered that the chemical analytical protocols used to test the pit residues looked for only 8 chemicals on the New Mexico list.

Attachment H NUMBER OF CHEMICALS DETECTED IN RESERVE PITS FOR SIX WELLS IN NEW MEXICO THAT APPEAR ON NATIONAL TOXIC CHEMICALS LISTS

This attachment is based on the percent of the 42 chemicals found in the 6 pits that are on the superfund or CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act Summary Data for 2005 Priority List of Hazardous Substances) and EPCRA (Emergency Planning and Community Right to Know Act Section 313 Chemical List for Reporting year 2006 including Toxic Chemical Categories) and EPCRA List of Lists: Consolidated List of Chemicals Subject to the Emergency Planning and Community Right to Know Act (EPCRA) and Section 112(r) of the Clean Air Act.

It is apparent that full disclosure must be required for all chemicals that are used during any part of operations to produce natural gas. The chemicals reported on MSDSs and Tier II reports do not fully account for what is being detected in the New Mexico pits.

Attachment I CHEMICALS IN URS FIELD ACTIVITIES REPORT FOR CHARACTERIZATION OF PIT SOLIDS AND FLUIDS IN COLORADO ENERGY FIELDS

To emphasize how little is known about what is being introduced into the land, water, and air during natural gas operations and the need for full disclosure, TEDX is presenting Attachment I. This document shows the results of the recent, industry-funded report by the Colorado Oil and Gas Association (COGA). In this effort chemicals were measured in pit fluids and solids, drilling, frac'ing, and flowback fluids, produced water, and background soil across four natural gas basins in Colorado. URS, the company that did the chemical analysis, listed 159 chemicals along with the concentrations at which they were found in the samples. Only 20 of these chemicals are listed in the COGCC's **Table 910-1 Contaminants of Concern Allowable Concentrations Draft Rules**. We should like to point out that 2-BE was found in every basin in 25 samples at levels that exceed the Minimal Risk Levels (MRLs) outlined in the Agency for Toxic Substances and Disease registry (ATSDR) Toxicological Profile for that substance. 2-BE is found in six of the products on TEDX's most recent inventory for Colorado. Yet, 2-BE is not on the COGCC list of contaminants of concern.

Attachment J USEPA REGION 8 LETTER TO WYOMING BLM DIRECTOR RE: PINEDALE ANTICLINE OIL & GAS PROJECT

In closing, I recommend that the New York City Council consider evidence from the West demonstrating that the production of natural gas with all its ancillary mobile and stationary activities leads to the release of vast amounts of volatile organic compounds and nitrogen oxides. These gases along with particulate matter lead to the production of tropospheric ozone. Elevated ozone levels are now being detected in the West associated with natural gas activity. The EPA Region 8 letter in this attachment describes a situation where the gaseous emissions associated with only 642 active natural gas wells led to surprisingly high ozone readings in the Pinedale Wyoming Anticline Gas Field. Last winter Pinedale peaked at 122 ppb. Like so many municipalities along the northeastern seacoast, New York City already has trouble meeting EPA ozone compliance levels.

tc September 9, 2008.

Theo Colborn, PhD
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October 22, 2002

Allen Belt
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Robert Storch
United States Forest Service
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RE: An Analysis of Possible Increases in Exposure to Toxic Chemicals in Delta County, Colorado Water Resources as the Result of Gunnison Energy's Proposed Coal Bed Methane Extraction Activity

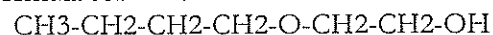
BACKGROUND

Gunnison Energy is proposing to extract coal bed methane in Delta County, Colorado. In its notices to the public it makes claims that "...the threats posed by hydraulic fracturing of CBM wells to USDWs [US drinking water supplies] are low and do not justify additional study." They also claim that the "...fluids used to extract coal bed methane from the ground do not substantially threaten public health."¹ The following addresses these claims and looks at possible direct and indirect health effects of CBM extraction on the citizens, domestic animals, and wildlife in Delta County.

THE FRACTURING FLUIDS

Gunnison Energy proposes to use a solvent, ethylene glycol monobutyl ether (2-butoxyethanol), hereafter designated as 2-BE, in a liquid fracturing mixture to facilitate the extraction of coal bed methane in Delta County. 2-BE will be present in the liquid component of the fluid at approximately 7 ppm (parts per million) based on data provided to Delta County Commissioners following three local Area Planning Committee meetings by Gunnison Energy Corporation (GEC), May 29, 2002.

The structural formula for 2-BE is:



2-BE is a highly soluble, colorless liquid with a very faint, ether-like odor.² At the concentration it is to be used in Delta County, it might not be detectable through odor or taste. 2-BE has low volatility, vaporizes slowly when mixed with water, and remains well dissolved throughout the water column.² Photolysis (degradation by sunlight) is not a factor in the breakdown of 2-BE. It mobilizes in soil and can easily leach into groundwater.² Because of these characteristics, it could remain entrapped underground for years and eventually migrate to a domestic well or to a surfacing spring. This contaminated water in

some cases might not reach wells, springs, and rivers in Delta County until long after GEC will have gone out of business.

The half-life of 2-BE in natural surface waters ranges from 7 to 28 days.² With an aerobic bio-degradation rate this slow, humans, wildlife and domestic animals could come into direct contact with 2-BE through ingestion, inhalation, dermal sorption, and the eye in its liquid or vapor form as the entrapped water reaches the surface. Aerobic biodegradation requires oxygen and therefore the deeper 2-BE is injected underground the longer it will persist. To date the aerobic biodegradation breakdown products of 2-BE have not been identified. The chemistry to detect the glycol ethers, including 2-BE, in environmental samples is very difficult and therefore there are few laboratories with the ability to accurately quantify its presence.²

DIRECT HEALTH EFFECTS OF 2-BE

Immediate/Direct

Following inhalation or swallowing, 2-BE is distributed rapidly to all tissues in the body via the blood stream in laboratory animals. When applied directly to the skin, 2-BE is rapidly absorbed.² In solution, it is absorbed more rapidly. It is broken down to its toxic component, 2-butoxyacetic acid (BAA) in both humans and laboratory animals following all three exposure pathways³. Breakdown and excretion of BAA through the urine is identical regardless of the pathway of exposure according to laboratory studies³ No laboratory studies could be found that assessed cumulative effects from simultaneous ingestion, inhalation, and dermal exposure to 2-BE, which could be the scenario in Delta County.

Hemolytic Effects - Primary

The most critical direct effect of 2-BE as the result of laboratory studies is its impact on red blood cells. It causes hemolysis (breakdown of red blood cells) by dissolving the fat in the cell membrane and causing the membrane to break down. 2-BE causes hematuria (blood in the urine) and blood in the feces. Blood appears in the urine as a result of kidney damage which can eventually lead to kidney failure. It is especially toxic to the spleen, the bones in the spinal column, and bone marrow (where new blood cells are formed) and the liver, where chemicals are detoxified (broken down for easy excretion from the body).² Chronic exposure can cause anemia, and in laboratory animals it leads to insufficient blood supply, cold extremities, and tail necrosis (a condition where the tail rots away.)⁴

Other Effects - Secondary

In a sub-chronic study over a period of 14 weeks, mice exposed to 2-BE exhibited the hemolytic effects mentioned above as well as a number of secondary problems involving the spleen and liver, and degeneration of kidney tubules.⁵ In addition, females were more sensitive to fore-stomach necrosis, ulceration, and inflammation occurring at half the dose required to cause the same problems in males. Female fertility was also significantly reduced in mice because of embryo mortality.⁶ In this study, the dead embryos were discarded, and as a result, the prenatal effects of 2-BE on the embryos were not determined.

EPA recommends that 2-BE be classified as a mild eye irritant.³ However, a recent study published after EPA reached this classification could lead to a higher risk classification. Using oral exposure in rats, severe damage to the eye was discovered that led to retinal

detachment, photoreceptor degeneration and occlusion resulting from multiple thrombosis of the blood vessels in the eye.⁷ In this study, females were more susceptible.

With few exceptions most of the evidence mentioned above was derived from inhalation studies. All of the studies used standard, high-dose testing protocols to detect obvious birth defects and organ damage, cancer, mutations, convulsions, and skin and eye irritation. No long-term, multigenerational, chronic oral studies at environmentally relevant concentrations are available that could rule out prenatal damage.

Immunotoxicity

Early studies suggested that perhaps 2-BE does not affect the immune system^{8,9}; more recent studies using more sophisticated measures and lower doses have determined otherwise. In an early immunotoxicity study, the lowest doses significantly increased the natural killer (NK) cell response in males and females, and the highest doses induced no response.⁹ The investigators never did find the lowest dose at which there would be no effect. However, they did not consider this an indication of adversity.

In another study, rats exposed to 2-BE in water for 21 days showed no structural effects in the liver or the testes, however their livers were significantly heavier and the animals experienced reduced body weight even at the lowest dose. However, they were surprised to find that at the lowest 2-BE dose NK cell responses were increased. A more recent study exposing female mice topically for 4 days once again confirmed the elevated NK cell response.¹⁰

A 2002 study reports that 2-BE at unusually low doses inhibits a normal contact hypersensitivity response in female mice.¹¹

Carcinogenicity

At the end of a two year chronic bioassay, elevated numbers of combined malignant and non-malignant tumors of the adrenal gland were reported in female rats and male and female mice.⁵ Low survival rates in the male mice in this study may have been the result of the high rate of liver cancers in the exposed animals.⁵ This study revealed that long-term exposure to 2-BE often led to liver toxicity before the hemolytic effects were discernible.⁵

No human epidemiological studies are available to assess the potential carcinogenicity of 2-BE. However, from the results of laboratory studies, using Guidelines for Carcinogenic Risk Assessment (1986), 2-BE has been classified by the USEPA as a *possible human carcinogen*.³

SENSITIVE POPULATIONS

A number of laboratory studies confirmed that aging increases susceptibility to the effects of 2-BE. Older animals have reduced ability to metabolize the toxic metabolite BAA and this, combined with reduced kidney function that accompanies aging reduces their ability to excrete it in the urine.³

Females are more susceptible to the hematological effects in laboratory animal and human studies. There is an obvious gender and age sensitivity to 2-BE in humans as determined from accidental poisonings with females being more sensitive. In addition, among humans there may be sub-populations that might be more sensitive than others.³

A list of risk factors for people exposed to 2-BE includes those:

- (1) using the pharmaceuticals hydralazine, dilantin, chloramphenicol, and sulfonamides;
- (2) with infections, such as herpes, malaria, parasites, and rubella;
- (3) with a family history of gallstones, cholecystectomy, jaundice, Rh and APO positive;
- (4) with iron deficiency; and
- (5) with systemic illnesses, such as cardiac, gastrointestinal, liver, and kidney disease, and hypothyroidism.^{3,12}

From a wildlife and domestic animal perspective, it is important to note that a variety of studies with laboratory animals revealed that some species are more sensitive to 2-BE than others.³ For example, rats are more sensitive than mice to the toxic effects of 2-BE on the liver. No studies were found using wildlife or domestic animals.

INDIRECT HEALTH EFFECTS OF 2-BE

2-BE is widely used as an emulsifying agent and as a solvent for mineral oils². This makes it an excellent candidate for releasing the natural, oily, coal-tar hydrocarbons found in coal that have been recognized for over a century to cause cancer.

CUMULATIVE AND AGGREGATE HEALTH HAZARDS

As mentioned above, no cumulative exposure studies have been done that evaluate the simultaneous impact of ingestion, inhalation, and topical exposure to 2-BE, which could be the mode of exposure to residents in Delta County. If 2-BE comes directly into the home via a well it will be used for drinking, bathing, showering, and doing laundry and dishes. Laboratory studies have revealed that in the case of bathing or applying 2-BE to the skin, it is readily absorbed through the skin rather than volatilizing. If water containing 2-BE is heated, as it comes out of the tap some of the 2-BE will off-gas into the home environment. Most of the studies mentioned above used inhalation as the pathway of exposure to 2-BE. Inhalation of 2-BE in the home could become a problem. For example, concern about exposure to the volatile by-products (trihalomethanes or THMs) in chlorine treated tap water¹³ led to the discovery that taking a bath or a shower can lead to excessively high dose exposure to THMs. This exposure can exceed the level of exposure from drinking the water and add to the dose from drinking the water. Because of the volatility of 2-BE, the same pathway of exposure could become of concern for Delta County residents if 2-BE reaches their wells and especially if the water is heated.

Of increasing concern by federal health agencies are the *unpredictable*, interactive effects of mixtures of chemicals.¹⁴ Under the scenario described in Gunnison Energy's prospectus, the concentrations of three classes of chemicals that are toxic individually at very low concentrations could become introduced or increased in the environment of Delta County. These include (1) the trace elements arsenic, molybdenum, and selenium, already a problem in Delta county, (2) a synthetic solvent, 2-BE, and (3) the polyaromatic hydrocarbons and coal tars found in coal beds. Arsenic, 2-BE, and aromatic coal bed tar derivatives are known carcinogens. In aggregate, whether their effects would be additive or synergistic has not been determined. However, in one study, the authors were surprised to find that 2-BE potentiated the lethality of low level exposure to another toxicant, a bacterially produced lipopolysaccharide (LPS) that is found in the human gut under certain conditions.⁸

Additional contamination of potable water could come from the impurities in the 2-BE product used in the extraction process. Commercial grade 2-BE can range in impurities depending upon the production process, manufacturer, and grade of the solvent. One impurity, sodium hydroxide (lye), a strong caustic, might possibly contribute to the alkalinity of the water. It was discovered in one product at 0.25%. Even high grade 2-BE with greater than 99% purity can contain 0.2% w/w ethylene glycol (anti-freeze), diethylene glycol, and diethyl monobutyl ether, sister compounds to 2-BE with much higher toxicity.²

ENVIRONMENTAL EFFECTS

Increased salinity

2-BE leaves an alkaline residue upon evaporation which might slightly add to the alkalinity problem that increases as surface water approaches the lower reaches of Delta County. Because of the solubility of sodium salts they can travel long distances in rivers and could increase the salinity problem in the Colorado River downstream.

Locally, any additional water that increases the salinity could also increase the mobilization of some of the alkaline soluble, problem elements such as arsenic and selenium, already posing health risks in Delta County. Health advisories are already in effect for Sweitzer Lake warning people not to eat the fish because of the high levels of selenium in the fish tissue.

A peer reviewed report by the US Forest Service on the threat of increased selenium contamination in the Mancos and La Plata River drainages describes a scenario similar to the Gunnison River drainage in Delta County where selenium is already at levels of concern.¹⁵ The hazards include threats to wetlands, aquatic habitat, invertebrates, fish, birds and other wildlife reproduction. Delta County is in a unique and fragile situation – (1) it already has the natural geological existence of selenium, (2) its local hydrology that has been embellished and complicated through extensive irrigation activity, and (3) a climate prone to drought.

There is a growing collection of scientific papers on the adverse health effects of selenium in wildlife exposed to elevated concentrations of selenium in seep-like situations (natural and human-induced) in the West. Waterfowl, fish, and invertebrates have experienced decreased hatching success and increased birth defects as a result of exposure in the egg. Chicks of avocets, stilts, ducks, coots, etc. have been found with crossed bills, missing eyes, and other deformities in aquatic systems where irrigation run off water collects.

HEALTH RISKS TO BE TAKEN INTO CONSIDERATION

Although no standard has been established yet for 2-BE in drinking water, in 1993 the EPA set a minimum risk level (MRL) for 2-BE at 0.07 mg/kg/day based on an adult 70 kg male drinking two liters of water a day. This value is based on liver toxicity studies in rats and not on more sensitive immune, developmental, and functional health effects that have become of concern over the past decade. In 1998 EPA derived a reference dose RfD for 2-BE at 0.5 mg/kg/day for non-cancer effects. This is based on lifetime exposure. EPA admits “Since drinking water exposures are highly complex and variable, a simplifying assumption was used in all simulations”. EPA had no human data to derive its value.³

GEC is planning to inject fluid into the ground in Delta County at 7 ppm. If this fluid reaches the taps in Delta County at that concentration, it will be providing 0.2 mg/kg/day

per two liters of water, approximately three times higher than the MRL and a little more than half the RfD.

RECOMMENDATIONS

1. First and most important, it is imperative to understand the hydrology of Delta County better. In addition, the complex diversions of potable water for irrigation and domestic use throughout the county must be factored into this knowledge.
2. Second, it is imperative to determine the current concentrations of the toxic chemicals in the coal bed water to be released during extraction prior to introducing the fracturing liquids. This must include the entire scope of trace elements from alkaline to acid based derivatives in both their dissolved and suspended form. In addition, the entire scope of polyaromatic hydrocarbons (both parent and alkylated forms) in the underground coal bed water should be quantified prior to any activity. Because of the toxicity of the elements and compounds of concern, detection limits throughout this monitoring should be no higher than a part per trillion. Information such as this will allow for determining if the fracturing liquid releases additional toxic components, and in the case of the PAHs, through dissolution by the 2-BE.
3. Throughout the mining life of the well, the underground fluid with which it will interface should be monitored on a regular basis for its toxic components. See those components mentioned in Number 2. If the concentrations of the contaminants decrease, this could indicate that precious potable subsurface or surface water is being drained from above. This provides an approach for detecting dewatering before too much potable water is lost.
4. If exploration begins, GEC must keep daily inventories of the total amount of fracturing liquid injected, including the exact amount of each component in the fluid.
5. GEC should be required to retrieve all surfacing liquid for containment. The volume of the retrieved liquid should be reported and the concentrations of the chemicals in that liquid quantified on a regular basis for auditing purposes to account for the toxic chemicals that were introduced under Number 4.
5. GEC's plans for disposal of this toxic liquid should be presented to the residents of Delta County for approval before any leases are approved.
6. Any changes in the composition of the fracturing liquid must be reported to the citizens of Delta County for consideration before the liquid is used.
7. If GEC should find that it needs or wants to use anything other than sand for propping, it must provide to the citizens of Delta County for consideration all the components in the alternative material before the material is used. The purity of the alternative products used must be provided as well. Trade names will not be acceptable.

¹ The Daily Sentinel, Sunday, September 8, 2002. p. 8C

² Agency for Toxic Substances and Disease Registry . US Department of Health and Human Services. (1998) Toxicological Profile of 2-Butoxyethanol and 2-Butoxyethanol Acetate.

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- ³ US Environmental Protection Agency. Toxicological Review of Ethylene Glycol Monobutyl Ether (EGBE) In Support of Summary Information on the Integrated Risk Information System (IRIS), October 1999
- ⁴ Nyska A, Maronpot RR, PH Long, JH Roycroft, JR Hailey, GS Traylor, BI Ghanayem (1999) Disseminated thrombosis and bone infarction in female rats following inhalation exposure to 2-butoxyethanol. *Toxicol Pathol* 27(3):287-294.
- ⁵ National Toxicology Program (NTP). 1998 NTP Technical report on the toxicology and carcinogenesis studies of 2-butoxyethanol (Cas No. 111-76-2) in F344/N rats and B6C3F1 mice (inhalation studies). US Department of Health and Human Services, Public Health Service, National Institutes of Health, Research Triangle Park, NC NTP TR 484. NIH Draft Publ. No. 98 -3974.
- ⁶ Heindel JJ, Gulati, DK, Russell, VS, et al. (1990) assessment of ethylene glycol monobutyl and monoethyl ether reproductive toxicity using a continuous breeding protocol in Swiss CD-1 mice. *Fundam Appl Toxicol* 15:683-696.
- ⁷ Nyska A, RR Maronpot, BI Ghanayam. (1999) Ocular thrombosis and retinal degeneration induced in female F344 rats by 2-butoxyethanol. *Hum Exp. Toxicol* 18(9):577-582.
- ⁸ Smialowicz, RJ, Williams, WC, Riddle, MM. et al. (1992). Comparative immunosuppression of various glycol ethers orally administered to Fischer 344 rats. *Fundam Appl Toxicol* 18:621-627.
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- ¹⁰ Singh P, Zhao S, Blaylock RL. (2001). Topical exposure to 2-butoxyethanol alters immune responses in female BALB/c mice. *Int Jrl Toxicol* 20:383-390.
- ¹¹ Singh P, Morris B, Zhao S, Blaylock RL. (2002) Suppression of the contact hypersensitivity response following topical exposure to 2-butoxyethanol in female BALB/c mice. *Int Jrl Toxicol*, 21:107-115.
- ¹² (Berliner N, Duffy, TP, Abelson HT. (1999) Approach to adult and child anemia. In: Hoffman, R ed. *Hematology: Basic Principles and Practice*. 2nd ed. New York, NY: Churchill Livingstone, pp.468-483.
- ¹³ Nester AM, Singer PC, Ashley DL, Lynberg MC, Mendola P, Langlois PH, Nichols JR. (2002). Comparison of trihalomethanes in tap water and blood. *Env Sc Techn*. 36(8):1692-1698.
- ¹⁴ Department of Health and Human Services, Agency for Toxic Substances and Disease Registry , (2001). *Guidance Manual for the Assessment of Joint Toxic Action of Chemical Mixtures*. Draft for Public Comment.
- ¹⁵ Lemly AD (1997). Environmental hazard of selenium in the Animas La Plata water development project. *Ecotoxicol Environ Safety* 37:92-96.

ATTACHMENT C

TEDX

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Chemicals Used to Produce and Deliver Natural Gas: Colorado
2-6-08

Chemical	CAS #	Chemical	CAS #
(2-BE) Ethylene glycol monobutyl ether	111-76-2	Chromium	7440-47-3
1,2-Bromo-2-nitropropane-1,3-Diol (2-Bromo-2-nitro-1,3-propanediol or Bronopol)	52-51-7	Chromium (III) compounds (as Cr)	
1,6-Hexanediamine	124-09-4	Chromium acetate	1066-30-4
1-methoxy-2-propanol	107-98-2	Chromium III	16065-83-1
1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs, inner salts	61789-40-0	Citric acid	77-92-9
2-(2-Methoxyethoxy)ethanol	111-77-3	Cobalt	7440-48-4
2-(Thiocyanomethylthio) benzothiazole (TCMTB)	21564-17-0	Combustable liquid	Unspecified
2,2',2"-Nitrilotriethanol	102-71-6	Contains no hazardous substances	
2,2-Dibromo-3-Nitrilopropionamide (DBNPA)	10222-01-2	Copper	7440-50-8
2-acrylamide-2-propane sulfonic acid and N,N-dimethyl acrylamide copolymer		Copper iodide	7681-65-4
2-Bromo-3-Nitrilopropionamide	1113-55-9	Cottonseed hulls	
2-ethylhexanol	104-76-7	Crystalline silica (Silicon dioxide)	7631-86-9
2-Propenamide, polymer with 2-propenoic ammonium salt	26100-47-0	Crystalline Silica, cristobalite	14464-46-1
5-chloro-2-methyl-4-isothiazolin-3-one	26172-55-4	Crystalline Silica, quartz	14808-60-7
Acetic acid	64-19-7	Crystalline Silica, tridymite	15468-32-3
Acrylamide	79-06-1	Deionized Water	7732-18-5
Adipic acid	124-04-9	Diammonium phosphate	7783-28-0
Alcohols, C10-16, ethoxylated with 6.5 EO (Alcohols, C10-16, ethoxylate)	68002-97-1	Dicalcium silicate	10034-77-2
Aluminium dicalcium iron pentaoxide	12068-35-8	Diesel	Unspecified
Aluminum oxide	1344-28-1	Diesel 2	68476-34-6
Aluminum tristearate	637-12-7	Diethylene glycol	111-46-6
Ammonium bisulfite	10192-30-0	Diethylene glycol monobutyl ether	112-34-5
Ammonium persulfate	7727-54-0	Dimethyl formamide	68-12-2
Amoco NT-45 process oil [Diesel 2]	64742-46-7	Dipropylene glycol monomethyl ether	34590-94-8
Anionic polyacrylamide		Distillates (petroleum) hydrotreated light; kerosine-unspecified	
Anionic surfactants		Distillates (petroleum), hydrotreated (mild) heavy naphthenic	64742-52-5
Antimony	7440-36-0	Distillates (petroleum), hydrotreated (mild) heavy paraffinic	64742-54-7
Aqueous emulsion of diethylpolysiloxane		Dodecylbenzene sulfonic acid	27176-87-0
Aqueous suspension of cellulose	proprietary	Drakeol	8042-47-5
Aromatic naphtha, Type I (light) (Light aromatic solvent)	64742-95-6	EDTA/Copper chelate	60-00-04
Aromatic solvent		EO-C7-9-iso, C8 rich-alcohols	78330-19-5
Arsenic	7440-38-2	EO-C9-11-iso, C10-rich alcohols	78330-20-8
Asphaltite (Gilsonite)	12002-43-6	Ester Salt	Unspecified
Attapulgit clay	12174-11-7	Ethanol (Acetylenic alcohol)	64-17-5
Barite (BaSO4)	7727-43-7	Ethoxylated 4-nonylphenol	26027-38-3
Barium	7440-39-3	Ethoxylated alcohol	68439-50-9
Bentonite	1302-78-9	Ethoxylated alcohol linear (1)	Proprietary
Benzyl chloride	100-44-7	Ethoxylated alcohol linear (2)	Proprietary
Blend of vegetable & polymer fibers		Ethoxylated alcohol linear (3)	Proprietary
Boric acid	10043-35-3	Ethoxylated nonylphenol	9016-45-9
Boric oxide	1303-86-2	Ethoxylated nonylphenol (branched)	68412-54-4
Butanol (N-butyl alcohol, Butan-1-OL, 1-Butanol)	71-36-3	Ethyl benzene	100-41-4
Cadmium	7440-43-9	Ethyl octynol	5877-42-9
Calcium aluminate	12042-78-3	Ethylene glycol	107-21-1
Calcium carbonate (sized)	471-34-1	Ethylene oxide	75-21-8
Calcium chloride	10043-52-4	Fatty acid soap	70321-73-2
Calcium hydroxide	1305-62-0	Fatty acids, C18-unsat, dimers, compds. With diethylenetriamine-tall-oil fatty acid reaction products	68647-57-4
Calcium oxide	1305-78-8	Ferrous sulfate	7720-78-7
Carbon	7440-44-0	Ferrous sulfate (Monohydrate ferrous sulfate)	17375-41-6
Carboxylic acids	Proprietary	Fluoride	16984-48-8
Carboxymethyl hydroxypropyl guar gum		Fly ash	
Carboxymethylhydroxy-propyl guar blend	Mixture	Formamide	75-12-7
Cationic polymer		Formic acid	64-18-6
Cedar fiber - processed		Formic Acid Sodium Salt (Sodium Formate)	141-53-7
Cellophane (polymer)		Fumaric Acid	110-17-8

Cellulase enzyme	unspecified	Galactomannan	11078-30-1
Cellulose	9004-34-6	Gas oils (petroleum), vacuum, hydrocracked, hydroisomerized, hydrogenated, C 15-30, branched and cyclic, high viscosity	178603-64-0
Cellulose derivative		Gas oils (petroleum), vacuum, hydrocracked, hydroisomerized, hydrogenated, C 20-40, branched and cyclic, high viscosity	178603-65-1
Cellulose material			
Gas oils (petroleum), vacuum, hydrocracked, hydroisomerized, hydrogenated, C 25-55, branched and cyclic, high viscosity	178603-66-2	Nut hulls	
Gilsonite (<i>Asphaltite</i>)	12002-43-6		
Glutaraldehyde	111-30-8	Oxidized tall oil	Unspecified
Glyceride esters		Oxyalkalated alcohol (1)	proprietary
Glycerin Mist (glycerol)	56-81-5	Oxyalkalated alcohol (2)	proprietary
Glycerol		Oxyalkylated Alcohol	unspecified
Glyoxal	107-22-2	Oxyalkylated alkyl alcohol (1)	proprietary
Graphite	7782-42-5	Oxyalkylated fatty alcohol salt	
Ground cellulosic material (ground walnut shells)		Oxyalkylated phenolic resin	
Ground pecan shells		Paraffinic solvent	
Guar Gum	Proprietary	Petroleum distillate	
Guar gum	9000-30-0	Petroleum distillate	Proprietary
Guar Gum blend	mixture	Petroleum distillate hydrotreated light	64742-47-8
Gypsum	7778-18-9	Petroleum product	445411-73-4
Gypsum respirable fraction	13397-24-5	Petroleum solvent	ID: P04500000
Haloalkyl heteropolyethylene salt	Proprietary	Phosphogypsum	13397-24-5
Heavy aromatic petroleum naphtha (aromatic solvent)	64742-94-5	Phosphonium, tetrakis(hydroxymethyl)-sulfate	55566-30-8
High molecular weight polymer		Pine oil	8002-09-3
High pH conventional enzymes		Plasticizers	
Hulls		Polyacrylamide	9003-05-8
		Polyacrylamide/polyacrylate copolymer (Copolymer of acrylamide & sodium acrylate)	25085-02-3
Hydrocarbon black solid	12002-43-5	Polyacrylate	9003-01-4
Hydrochloric Acid (HCl)	7647-01-0	Polyaminated fatty acid	Unspecified
Hydrofluoric Acid	7664-39-3	Polyaminated fatty acid surfactants	
Hydrotreated heavy petroleum naphtha	64742-48-9	Polyether polyol	
Hydroxyethylcellulose	9004-62-0	Polyethylene glycol	25322-68-3
Hydroxypropyl guar blend	Mixture	Polyglycerols	
Hydroxypropylcellulose	9004-64-2	Polyglycol ether	Unspecified
Inert material		Polymers	
Inorganic borate	Proprietary	Polypropylene (C6H6)N	9003-07-0
Inorganic salts		Polypropylene glycols	
Iron	7439-89-6	Polysaccharide polymers in suspension	
Isoalkane fluid		Polysaccharide	
Isobutyl alcohol (2-methyl-1-propanol)	78-83-1	Polysaccharide ("Carbohydrate")	
Isopropanol (Propan-2-OL)	67-63-0	Polyvinyl acetate copolymer	
Kerosene	8008-20-6	Polyvinyl alcohol [AlcoteX 17F-H]	9002-89-5
Latex base		Potassium carbonate	584-08-7
Lead	7439-92-1	Potassium chloride	7447-40-7
Light aromatic solvent		Potassium hydroxide	1310-58-3
Lignite	129521-66-0	Potassium persulfate	7727-21-1
Lignosulfonate	8062-15-5		
Lignosulfonic acid, chromium salt	9066-50-6		
Lubricating oils (petroleum), C15- 30, hydrotreated neutral oil-based	72623-86-0	Potassium sulfate	7778-80-5
Lubricating oils (petroleum), C20- 50, hydrotreated neutral oil-based	72623-87-1	Propargyl alcohol (Prop-2-YN-1-OL	107-19-7
Lubricating oils (petroleum), C20- 50, hydrotreated neutral oil-based, high-viscosity	72623-85-9	Propene polymer	
Lubricating oils, (petroleum), C15-30, hydrotreated neutral oil-based, contg. solvent deasphalted residual oil	72623-84-8	Proprietary	
Magnesium oxide	1309-48-4	Proprietary	
Mercury	7439-97-6	Proprietary complex organic solution	
Methanol	67-56-1	Proprietary ingredients	
		Prydinium, 1-(Phenylmethyl)-, ethyl methyl derivatives, Chlorides	68909-18-2
Methyl salicylate	119-36-8	Quaternary ammonium compounds	
Methyl-4-isothiazolin	2682-20-4	Quaternary ammonium compound	proprietary
Methylene bis(thiocyanate)	6317-18-6	Quaternary ammonium salts	unspecified
Mica	12001-26-2	Recycled newsprint	
Modified lignosulfonate		Resin	
Modified polysaccharide or Pregelatinized cornstarch or starch	9005-25-8	Sodium acid pyrophosphate	7758-16-9
Monoethanolamine	141-43-5	Sodium aluminate	1302-42-7
Monofilament fiber		Sodium aluminum phosphate	7785-88-8
Monopentaerythritol	115-77-5		
N,N-dimethylformamide and 2-acrylamido-2-methylpropane sulfonic acid copolymer		Sodium asphalt sulfonate	68201-32-1
NaHCO3	144-55-8	Sodium carbonate (<i>Soda ash</i>)	497-19-8
Naphthalene	91-20-3	Sodium carboxymethylcellulose (<i>Polyanionic cellulose</i>)	9004-32-4

Natural fibers		Terpene	
Nickel	7440-02-0	Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione (Dazomet)	533-74-4
Nitrogen	7727-37-9	Tetramethyl ammonium chloride	75-57-0
Non-hazardous and other components below reportable levels		Tetrasodium ethylenediaminetetraacetate	64-02-8
Non-regulated components		Thiourea	62-56-6
n-propyl alcohol	71-23-8	Tricalcium silicate	12168-85-3
Sodium hydroxide	1310-73-2	Trimethylbenzene	25551-13-7
Sodium ligninsulfonate	8061-51-6	Trisodium nitrilotriacetate	5064-31-3
Sodium persulfate	7775-27-1	Unknown	
Sodium polyacrylate	9003-04-7	Vanadium	7440-62-2
Sodium polyacrylate polymer		Walnut hulls	977069-77-4
Sodium sulfate	7757-82-6	Wood by-product	
Sodium tetraborate decahydrate (Borax)	1303-96-4	Xanthan Gum	11138-66-2
Softwood dust		Xylene	1330-20-7
Styrene	100-42-5	Zinc	7440-66-6
Substituted alcohol	Proprietary	Zinc Carbonate	3486-35-9
Substituted alcohol	Proprietary	Zirconium nitrate	13746-89-9
Sulfomethylated quebracho	68201-64-9	Zirconium sulfate	14644-61-2
Sulfomethylated tannin	Proprietary		
Sulfonic acid salt (organosulfur)			
Surfactant			
Synthetic copolymer			

ATTACHMENT D

TEDX
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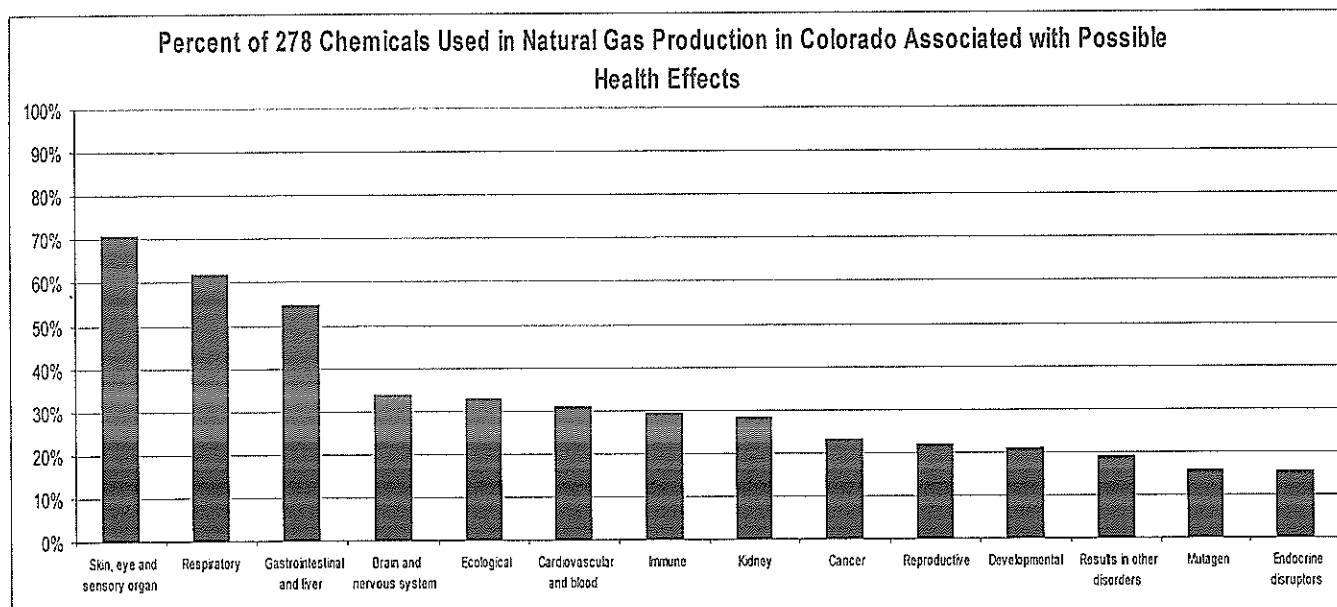
ANALYSIS OF CHEMICALS USED IN NATURAL GAS PRODUCTION: COLORADO

February 6, 2008

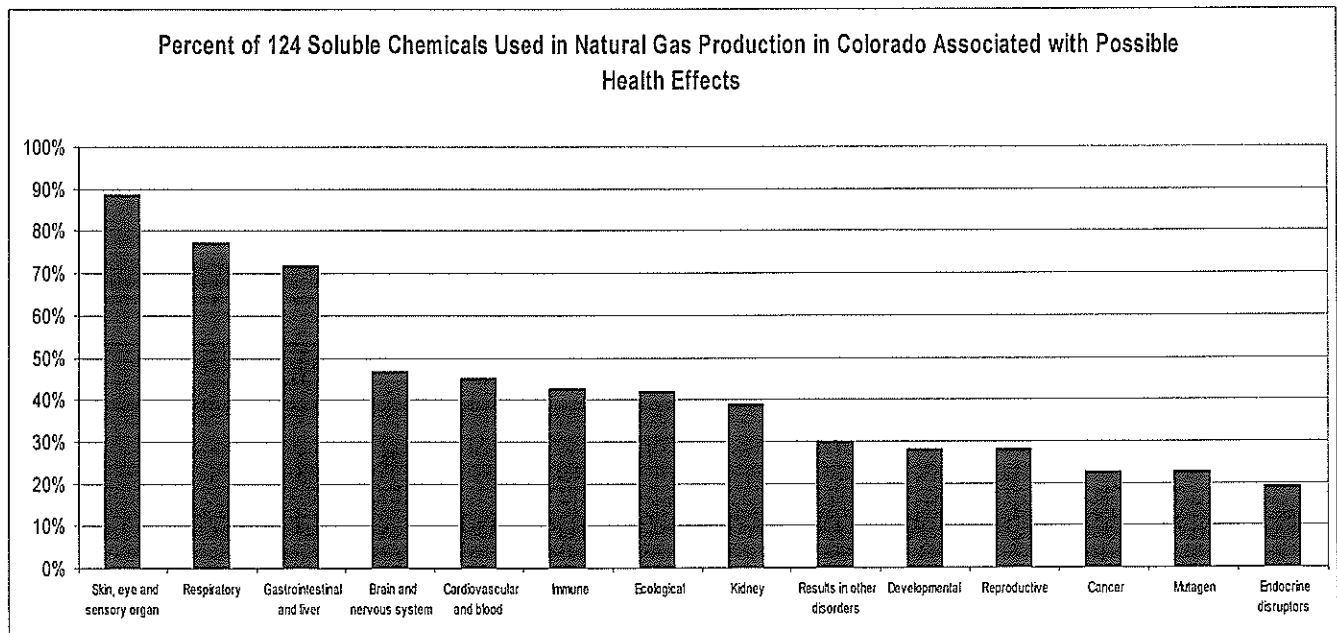
Introduction

This project was designed to explore the health effects of the products and chemicals used in operations to produce natural gas in Colorado. It provides a glimpse at the pattern(s) of possible health hazards for those living in regions where gas development is taking place. The names of the products and chemicals were entered in an EXCEL spreadsheet for easy sorting and searching. Health impacts for chemicals were researched and fell into 14 categories based on standard use in government toxicological literature. We make no claim that this list is complete.

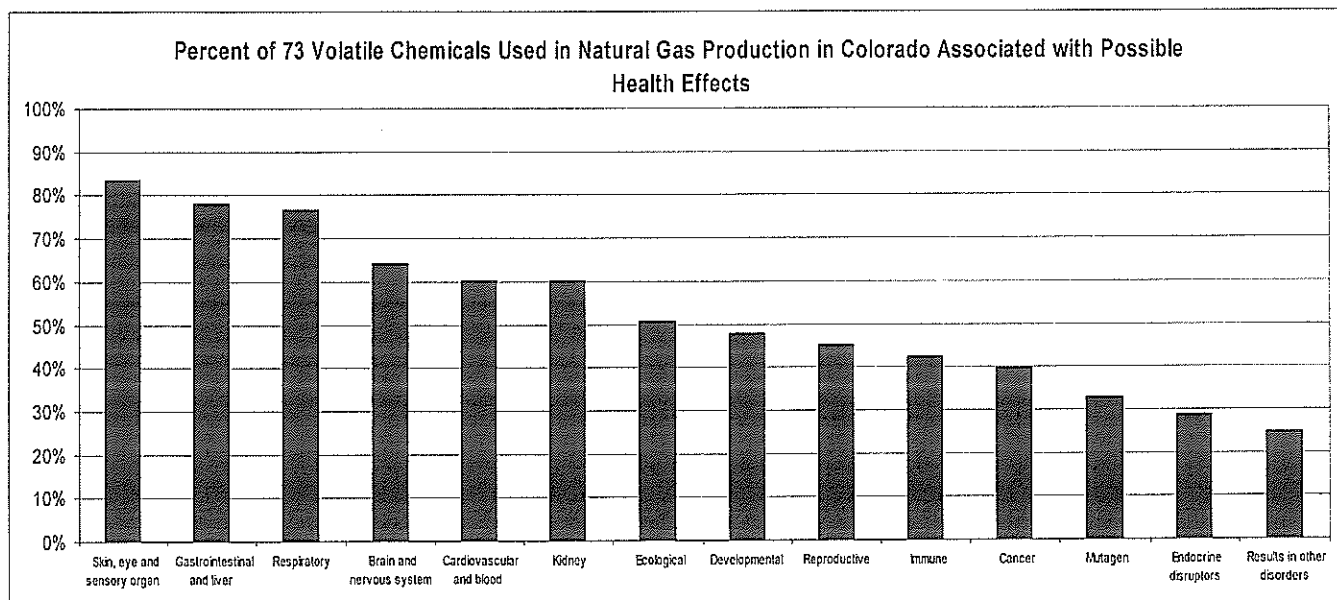
1. The 215 products contain at least 278 chemicals.
2. Ninety-three percent of the products have one or more adverse health effects. Of these, 19% have one to three possible health effects, and 81% have between four and fourteen possible health effects. Twenty-five products have 14 adverse health effects.
3. Upon plotting the percent of chemicals in each health category, a pattern emerged of the possible health effects for the 278 chemicals. The four categories with the highest exposure risk are (1) eyes, skin, and sensory organs; (2) respiratory system; (3) gastrointestinal tract and liver; and (4) brain and nervous system.



4. One hundred twenty-four chemicals were water soluble. The four categories with the highest exposure risk are (1) eyes, skin, and other sensory organs; (2) respiratory system; (3) gastrointestinal tract and liver; and (4) the brain and nervous system.



5. Seventy-three chemicals were volatile. The four categories with the highest exposure risk are (1) eyes, skin, and other sensory organs; (2) gastrointestinal tract and liver; (3) respiratory system; and (4) the brain and nervous system.



6. Several reasons led to the lack of data about the health effects of some of the products and chemicals on the spread sheet:

- (a) Some products list no ingredients.

- (b) Some products provide only a general description of the content, such as “plasticizer”, “polymer” etc.
- (c) Some products list some or all of the ingredients as “proprietary”.
- (d) No health effect data were found for a particular chemical or product.

7. Much of the information about the composition of the products on the list comes from a Material Safety Data Sheet (MSDS). Ingredients on MSDSs are sometimes labeled as “proprietary”, or “no hazardous ingredients” even when there are significant health effects listed on the MSDS.

8. Some of the citations used to establish the health effects of the chemicals on this list are old, dating back to the 1970’s and 80’s. In several cases data were derived from abstracts, not the full report or manuscript. In other cases, citations were taken from toxic chemical databases, such as TOXNET, Chem ID, etc. Many reports submitted to the US Environmental Protection Agency by the manufacturer to register a chemical are not accessible. In some cases it is impossible to track down any health effect for a chemical, especially when the manufacturer provides no Chemical Abstracts Service (CAS) number.

9. No health effects were found for 59 of the chemicals on the list. Of these, only 14 had been assigned a CAS number which facilitates searching the literature. We found no health related literature for these chemicals. It was impossible to determine the safety of the other 45 chemicals either because they were listed as mixtures, proprietary, or unspecified (10), or had chemical names that were so general that the specific chemical could not be identified (35).

10. From early on, as new products were added to the list, the sequence of the categories in the pattern of the percentages has shifted only slightly. Looking at data from other states, the pattern also holds. It is expected that slight changes in sequence from one position to another will continue to occur as more products and chemicals are entered into the database.

For Further Consideration

MSDSs are designed to inform those who handle, ship, and use the product(s) about the products’ physical and chemical characteristics, and its direct/immediate health effects to prevent injury. The sheets are also designed to inform emergency response crews in case of accidents or spills. The data in the MSDSs do not generally take into consideration the health impacts resulting from chronic or long-term, continuous, and/or intermittent exposure. Many products that have MSDSs have not gone through a rigorous and extensive scientific peer-review process that would permit conclusions to be drawn about “safe” and/or “hazardous” exposure levels.

The use of respirators, goggles and gloves is advised on many of the MSDSs for products on this list. This indicates serious, acute toxicity problems that are not being addressed in the recovery process when the chemicals come back to the surface. It also raises concern over possible hazards posed to those living in regions where gas production is taking place.

The product manufacturers are responsible for the MSDSs, which are based on a form provided by the Occupational Safety Health Administration (OSHA). OSHA provides no review or approval of the sheets, which are often sketchy and may provide health effects information for only one or two chemicals in a product. In many cases the chemicals listed equal less than 100% of the product. In the case of mixtures, the health effects warnings are often not chemical-specific.

Some of the chemicals on this list have been tested for lethality and acute toxicity based on short-term contact looking for possible ecological damage. The tests are done to find out how long it would take to kill 50% of the organisms within a predetermined time limit, such as 24, 48, or 96 hours. The results of these tests are presented as the lethal concentration (LC50) or lethal dose (LD50). The tests are used for precautionary label notations in order to reduce immediate harmful effects on “non-target” organisms such as invertebrates, algae, beneficial insects, fish, etc. in the food web. These tests are not intended to provide information about long-term exposure effects and they do not exclude the fact that other health effects can occur.

Background

Prior to use, these products must be shipped to and stored somewhere before being transported to the well site. They pose a hazard on highways, roads, and rail systems, as well as to communities near the storage facilities.

During the well-drilling stage, underground water, drilling muds, and cuttings of rock and debris from the well bore surface are deposited in production pits on the well pad. After development ceases on a pad and the well(s) goes into production, the residues in the production pits are often bulldozed over. It is impossible to predict how long the buried chemicals will remain in place. Highly persistent and mobile chemicals could migrate from these pits into underground water resources, or gradually surface over time.

Fracturing, frac’ing, and stimulation are terms used to describe a process commonly used to facilitate the release of the gas and improve production. In this process approximately a million gallons of fluid, under extremely high pressure, are injected underground, and, with explosives, create mini-earthquakes that open up fractures in the strata being mined. The gas industry claims that 70% of the material it injects underground is retrieved. While the fate of the remaining 30% is unknown, the recovered materials are often placed in holding pits on the surface and allowed to evaporate. This activity results in highly toxic chemicals being released in the air. New technology is now available to re-inject the recovered frac’ing fluid either on site, or pipe it to a central re-injection well. Where the fluids sit in open pits, their condensed residuals are taken off-site and dealt with in two ways: (1) they can be re-injected in the ground, or (2) they can be “land farmed” in which they are incorporated into the soil through disking. Here, toxic metals and silica fines would continually build up in the disked soils and could be mobilized on dust particles. At some locations, because of regional differences in geology and technology, 100% of the injected frac’ing fluids may remain underground.

For the life of a gas well in most regions, water may be stripped from the gas before it enters the delivery pipeline. Each gas well has a condensate water tank where this contaminated water is stored. In some instances the condensate water is re-injected on site or piped to a central re-injection well. In other instances, water levels are monitored in the condensate tanks and the water trucked to large open-pit, waste facilities where the water and volatile chemicals escape into the air. This will continue until the well stops producing gas, which could be as long as 20 to 25 years.

Discussion

The physical characteristics of a chemical can contribute to its becoming a chemical of concern, as well as its application or use. For example, crystalline silica is reported in 33 products on this list ranging from <1% to 30% of the total composition. It poses its hazard as a respirable dust that lodges permanently in the lungs and can cause silicosis, emphysema, obstructive airway diseases, and lymph node fibrosis. It is not captured in either the water-soluble or volatile pathways in this analysis. It poses

a long-term, delayed health hazard similar to asbestos, but can rapidly turn into malignant lung cancer. It is reported in both drilling and fracturing products. Oftentimes, the cuttings captured in drill pad reserve pits are used to produce berms or as fill on the pad. Over time, silica in the drilling muds could become airborne as dust along with other toxic compounds. The MSDSs recommend the use of respirators and goggles when handling the silica-containing products when dust is formed.

The foamer and solvent, 2-butoxyethanol (2-BE), is reported in 6 products on the list ranging from 5 to 40% of the total composition. 2-BE is captured in both the water-soluble and volatile pathways in this analysis. It is highly soluble (miscible) in water, colorless, and odorless at low concentrations, and evaporates at room temperature. It has a number of unusual health impacts that would baffle physicians and veterinarians and also causes several kinds of rare cancers. If it were to penetrate a drinking water source, exposure could be through ingestion, inhalation, and the skin.

The products labeled as biocides on the list are extremely toxic and with good reason. Bacterial activity in well casings, pipes and joints can be highly corrosive, costly, and dangerous. Bacteria can also alter the chemical structure of polymers and make them useless. Nonetheless, when these products return to the surface either through deliberate retrieval processes, or accidentally, they pose a significant danger to workers and those living near the well and evaporation ponds. They can also sterilize the soil and inhibit normal bacterial and plant growth for many years.

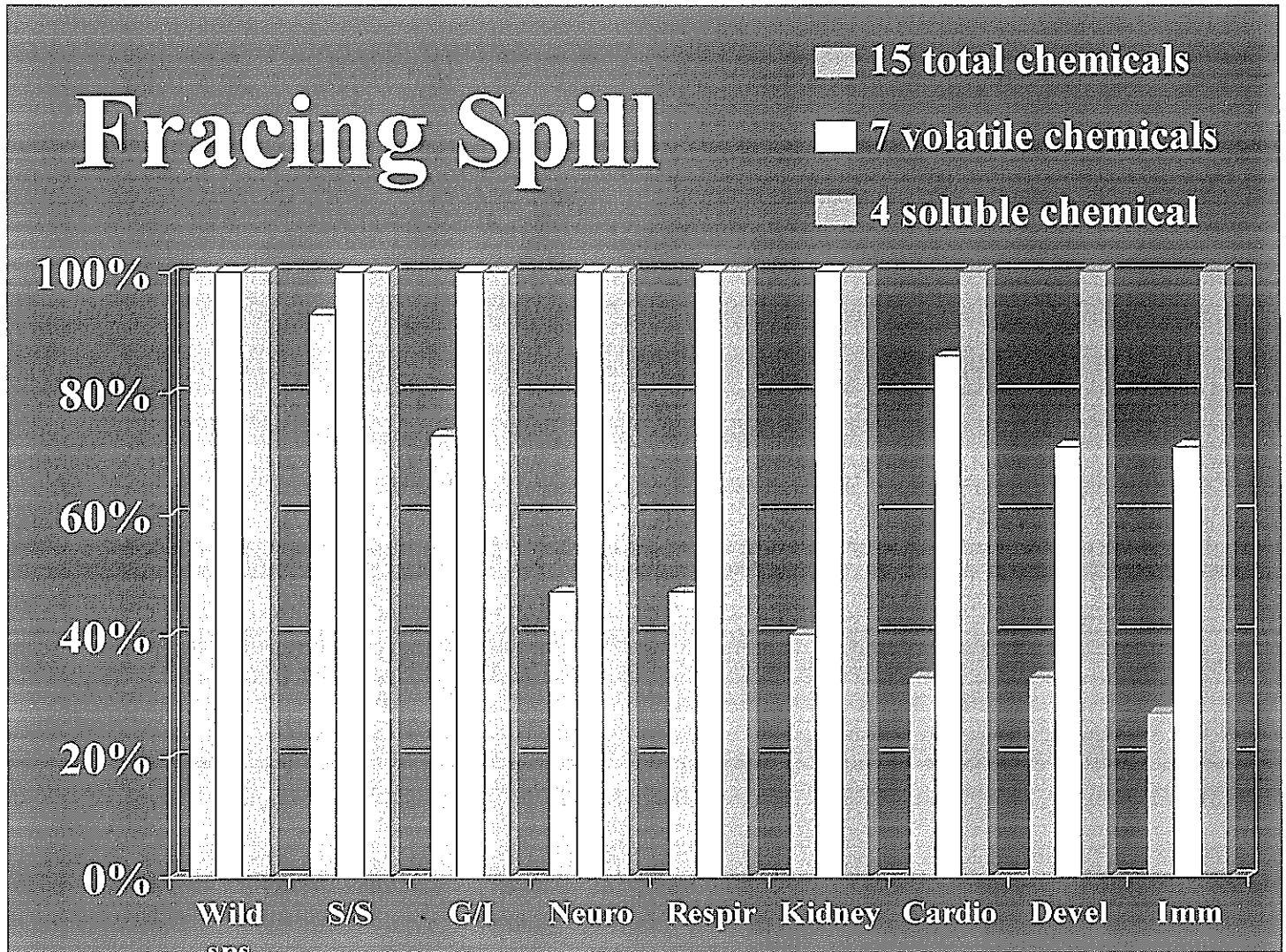
Among the 93% of products on the list with adverse health effects, 42% contain chemicals that have the potential to disturb the endocrine system, expressed as problems of the thyroid, pancreas, and gonads to mention a few. Like many categories at lower risk of exposure, the effects may not become apparent until years after exposure. Health problems in other lower risk categories such as kidney, reproductive problems, and cancer may not be diagnosed until years later.

A number of chemicals on this list are toxic when encountered in high concentrations. Exposure route, such as ingestion, inhalation, or through the skin, can delay or shorten reaction time. The long term effects of the chemicals of this nature cannot be predicted. Because only a small percentage of the total composition of most of the products on this list is available, it is not possible to determine if the chemicals are harmless in their application. In addition, under the present system, there are not enough data to determine the safety of products that contain mixtures of relatively "benign" ingredients and unknown chemicals, when the actual percentage composition is not provided.

Cumulative exposure impacts cannot be addressed in this analysis. The EXCEL spreadsheet provides a hint of the combinations and permutations of mixtures possible and the possible aggregate exposure. Each drilling and fracturing incident is custom-designed depending on the geology, depth, and resource available. The chemicals and products used, and the amounts or volumes used can differ from well to well. In addition, the fluids or vehicles that make up the full composition of a product are frequently not provided and nowhere are there data accounting for the fluids that make up the million gallons of fracturing fluid. The only way to get a realistic picture of what is being introduced into watersheds, air, and soil is to keep complete records on each specific well site (state, county, township, section, etc.), the formulation of the products used at each stage of development and production and their weight and/or volume, the total volume injected underground and recovered, the depths at which material/mixtures were injected, the amount and composition of the recovered liquids, and their disposal method and location.

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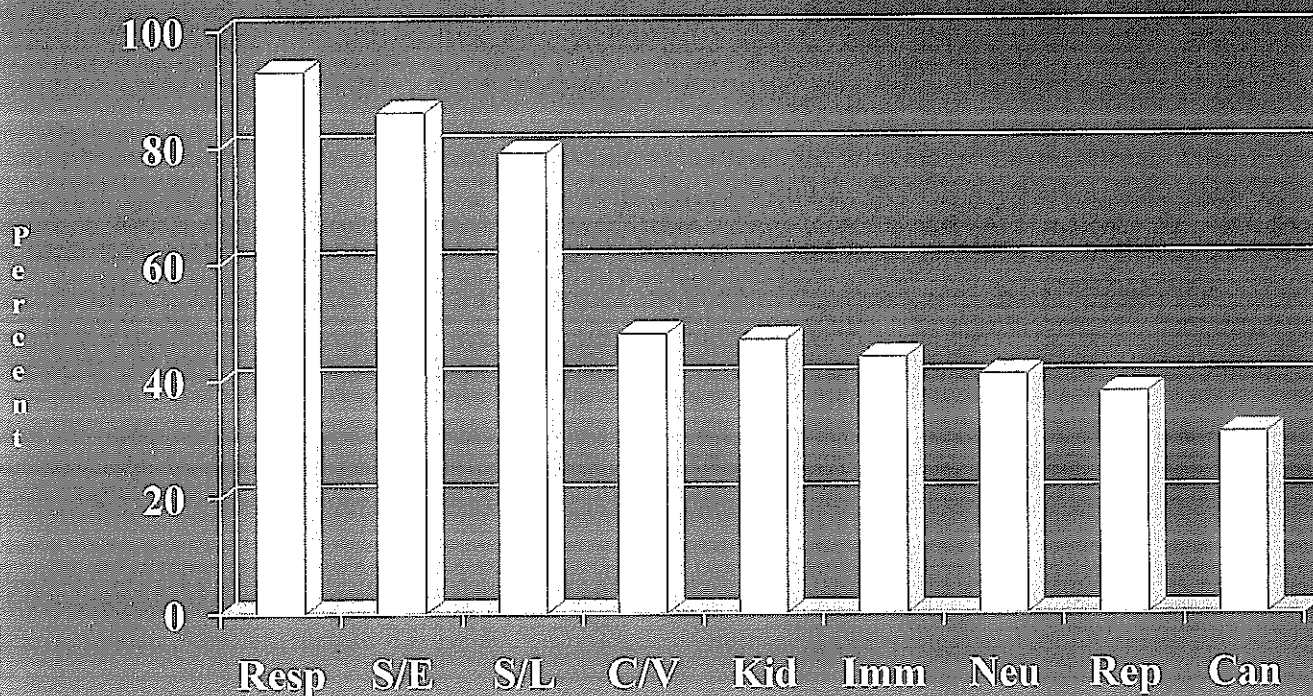
Garfield County, Colorado



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Crosby 25-3 Well – Windsor Energy, Park County Wyoming

Percent of Adverse Health Effects Associated with Drilling Blowout 20 products containing 29 chemicals



ATTACHMENT G

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Potential Health Effects of Residues in 6 New Mexico Oil and Gas Drilling Reserve Pits Based on Compounds Detected in at Least One Sample Revised November 15, 2007

List of Substances Detected

The following substances were detected in six drilling reserve pits in the San Juan Basin of northwestern New Mexico and the Permian Basin of southeast New Mexico. An industry committee comprised of 19 oil and gas companies that operate in New Mexico sponsored a sampling and analysis program (SAP) of pit solids. The SAP was completed by a third party consultant and analytical laboratory. The SAP focused on drilling/reserve pits prior to closure.

This list was amended on November 15, 2007 after discovering that the laboratory doing the analysis admitted it purposefully added nine chemicals (listed below) to the samples prior to testing. This amended document is a reanalysis of the chemicals in the reserve pits excluding those added by industry.

1,2,4-Trimethylbenzene	Iron	Uranium
1,3,5-Trimethylbenzene	Isopropylbenzene	Zinc
1-Methylnaphthalene	Lead	Oil and Grease
2-Butanone	m+p-Xylene	Radium 226
2-Methylnaphthalene	Manganese	Radium 228
3+4 Methylphenol	Mercury	Chloride
Acetone	Methylene chloride	Sulfate
Arsenic	Naphthalene	
Barium	N-Butylbenzene	
Benzene	N-Propylbenzene	
Benzo(a)pyrene	O-xylene	Substances eliminated
Cadmium	Pentachlorophenol	<i>Dibromofluoromethane</i>
Carbon disulfide	Phenol	<i>2-Fluorophenol</i>
Chromium	P-Isopropyltoluene	<i>2,3,4-Trifluorotoluene</i>
Copper	Sec-butylbenzene	<i>2,4,6-Tribromophenol</i>
Cyanide, total	Selenium	<i>2-Fluorobiphenyl</i>
Diesel range organics	Silver	<i>4-Bromofluorobenzene</i>
Ethylbenzene	Tert-butylbenzene	<i>Decachlorobiphenyl</i>
Fluoride	Tetrachloroethene	<i>O-Terphenyl</i>
Gasoline range organics	Toluene	<i>Tetrachloro-m-xylene</i>

Possible health effects associated with the 42 substances detected in 6 New Mexico drilling reserve pits

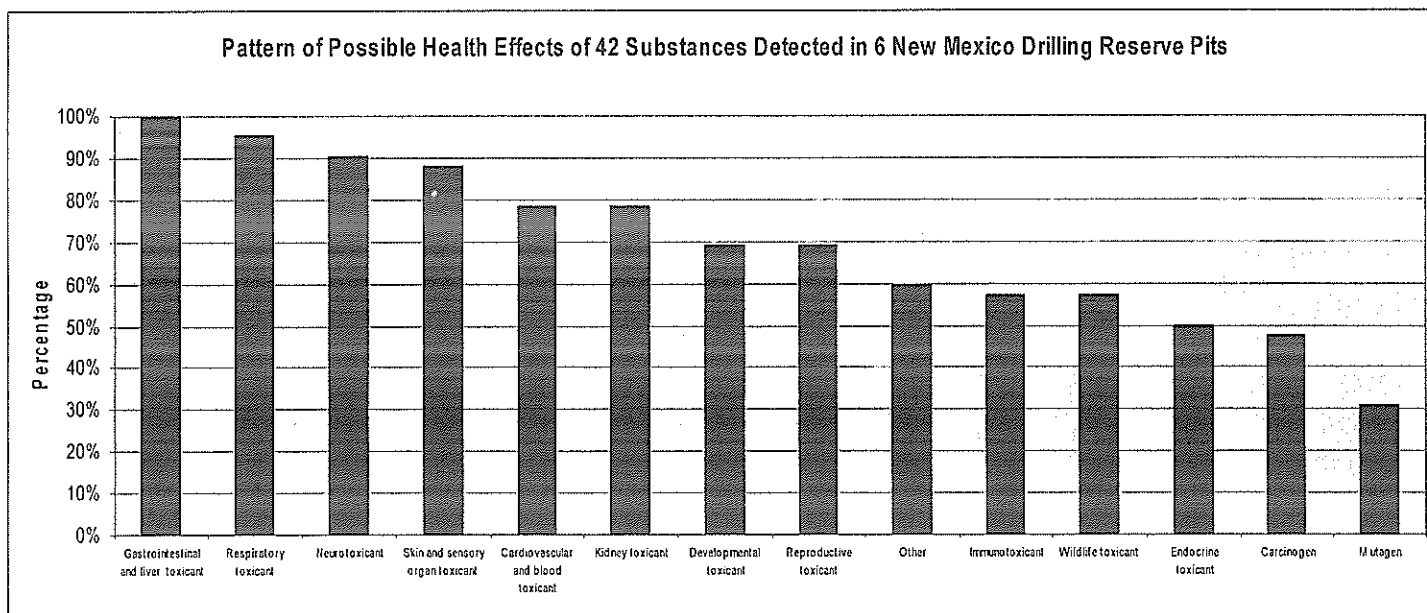
Percentage	Number	Effect
100%	42	gastrointestinal and liver toxicants
95%	40	respiratory toxicants
90%	38	neurotoxicants
88%	37	skin and sensory organ toxicants
79%	33	cardiovascular and blood toxicants
79%	33	kidney toxicants
69%	29	developmental toxicants
69%	29	reproductive toxicants
60%	25	result in other disorders
57%	24	immunotoxicants
57%	24	wildlife toxicants
50%	21	endocrine disruptors
48%	20	carcinogens
31%	13	mutagens

Possible health effects associated with 24 (57%) volatile substances in 6 drilling reserve pits in New Mexico:

Percentage	Number	Effect
100%	24	gastrointestinal and liver toxicants
96%	23	respiratory toxicants
96%	23	skin and sensory organ toxicants
92%	22	neurotoxicants
83%	20	kidney toxicants
79%	19	cardiovascular and blood toxicants
79%	19	developmental toxicants
75%	18	wildlife toxicants
75%	18	result in other disorders
67%	16	reproductive toxicants
63%	15	immunotoxicants
54%	13	carcinogens
54%	13	endocrine disruptors
42%	10	mutagens

Possible health effects associated with 4 (10%) soluble substances in 6 New Mexico drilling reserve pits

Percentage	Number	Effect
100%	4	cardiovascular and blood toxicants
100%	4	gastrointestinal and liver toxicants
100%	4	kidney toxicants
100%	4	neurotoxicants
100%	4	reproductive toxicants
100%	4	respiratory toxicants
100%	4	skin and sensory organ toxicants
75%	3	developmental toxicants
75%	3	endocrine disruptors
75%	3	wildlife toxicants
75%	3	result in other disorders
50%	2	carcinogens
50%	2	mutagens
50%	2	immunotoxicants



ATTACHMENT G

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Potential Health Effects of Residues in 6 New Mexico Oil and Gas Drilling Reserve Pits Based on Compounds Detected in at Least One Sample Revised November 15, 2007

List of Substances Detected

The following substances were detected in six drilling reserve pits in the San Juan Basin of northwestern New Mexico and the Permian Basin of southeast New Mexico. An industry committee comprised of 19 oil and gas companies that operate in New Mexico sponsored a sampling and analysis program (SAP) of pit solids. The SAP was completed by a third party consultant and analytical laboratory. The SAP focused on drilling/reserve pits prior to closure.

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1,3,5-Trimethylbenzene	Isopropylbenzene	Zinc
1-Methylnaphthalene	Lead	Oil and Grease
2-Butanone	m+p-Xylene	Radium 226
2-Methylnaphthalene	Manganese	Radium 228
3+4 Methylphenol	Mercury	Chloride
Acetone	Methylene chloride	Sulfate
Arsenic	Naphthalene	
Barium	N-Butylbenzene	
Benzene	N-Propylbenzene	
Benzo(a)pyrene	O-xylene	Substances eliminated
Cadmium	Pentachlorophenol	<i>Dibromofluoromethane</i>
Carbon disulfide	Phenol	<i>2-Fluorophenol</i>
Chromium	P-Isopropyltoluene	<i>2,3,4-Trifluorotoluene</i>
Copper	Sec-butylbenzene	<i>2,4,6-Tribromophenol</i>
Cyanide, total	Selenium	<i>2-Fluorobiphenyl</i>
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Fluoride	Tetrachloroethene	<i>O-Terphenyl</i>
Gasoline range organics	Toluene	<i>Tetrachloro-m-xylene</i>

Possible health effects associated with the 42 substances detected in 6 New Mexico drilling reserve pits

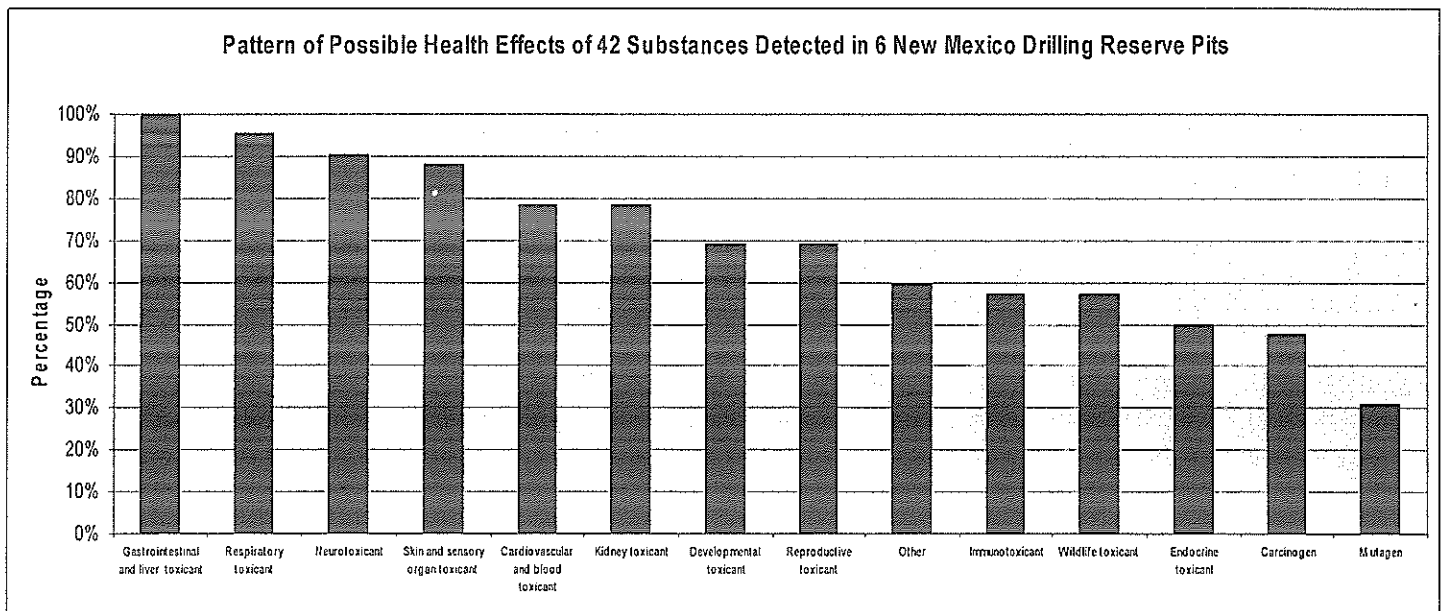
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79%	33	kidney toxicants
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69%	29	reproductive toxicants
60%	25	result in other disorders
57%	24	immunotoxicants
57%	24	wildlife toxicants
50%	21	endocrine disruptors
48%	20	carcinogens
31%	13	mutagens

Possible health effects associated with 24 (57%) volatile substances in 6 drilling reserve pits in New Mexico:

Percentage	Number	Effect
100%	24	gastrointestinal and liver toxicants
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96%	23	skin and sensory organ toxicants
92%	22	neurotoxicants
83%	20	kidney toxicants
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75%	18	wildlife toxicants
75%	18	result in other disorders
67%	16	reproductive toxicants
63%	15	immunotoxicants
54%	13	carcinogens
54%	13	endocrine disruptors
42%	10	mutagens

Possible health effects associated with 4 (10%) soluble substances in 6 New Mexico drilling reserve pits

Percentage	Number	Effect
100%	4	cardiovascular and blood toxicants
100%	4	gastrointestinal and liver toxicants
100%	4	kidney toxicants
100%	4	neurotoxicants
100%	4	reproductive toxicants
100%	4	respiratory toxicants
100%	4	skin and sensory organ toxicants
75%	3	developmental toxicants
75%	3	endocrine disruptors
75%	3	wildlife toxicants
75%	3	result in other disorders
50%	2	carcinogens
50%	2	mutagens
50%	2	immunotoxicants



ATTACHMENT H

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Number of chemicals detected in reserve pits for 6 wells in New Mexico that appear on national toxic chemicals lists Amended document November 15, 2007

This list was amended on November 15, 2007 after discovering that the laboratory doing the analysis admitted it purposefully added nine chemicals to the samples prior to testing. This amended document is a reanalysis of the chemicals in the reserve pits excluding those added by industry.

Toxic chemicals lists and the 42 chemicals detected

LIST	# of chemicals on list	Percentage
CERCLA 2005	39	93%
EPCRA 2006	26	62%
EPCRA List of Lists	29	69%

Chemicals not on any toxics list:

2-Methylnaphthalene
Diesel range organics¹
Gasoline range organics¹

¹ Too general to be included on lists that categorize by CAS numbers

Toxic chemicals lists and the 11 chemicals detected over state limits

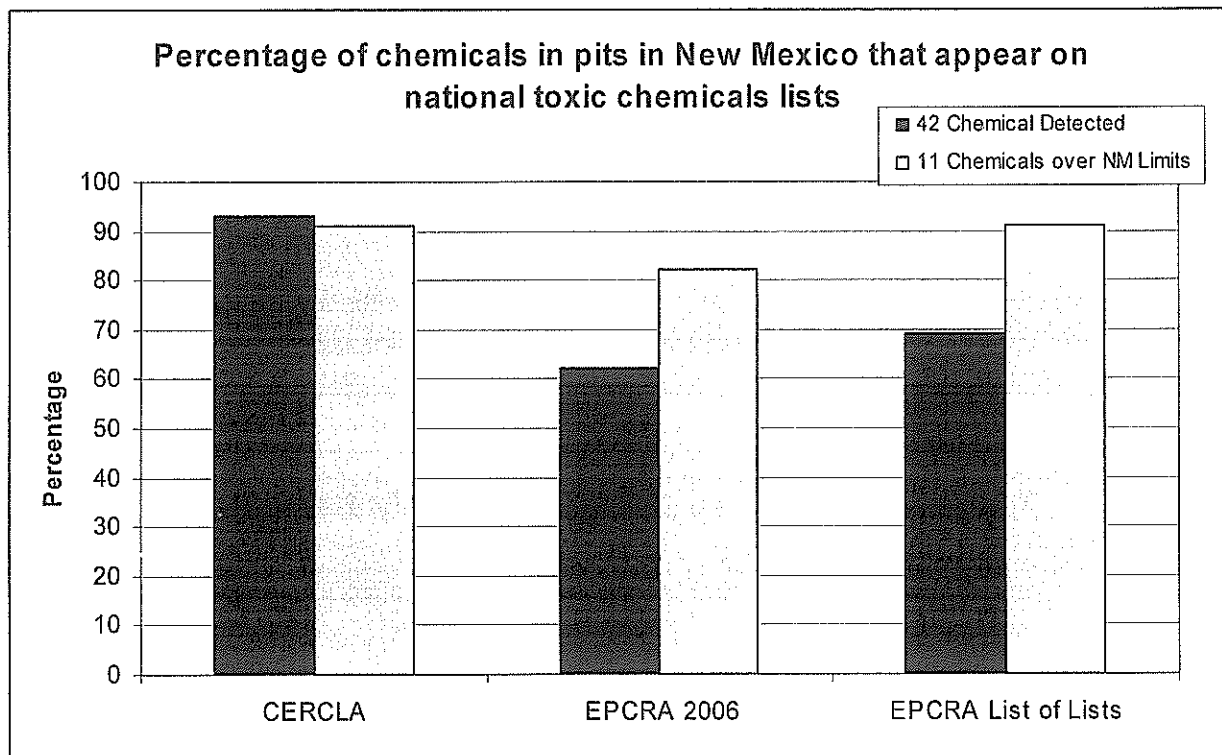
LIST	# of chemicals on list	Percentage
CERCLA 2005	10	91%
EPCRA 2006	9	81.8%
EPCRA List of Lists	10	91%

Chemicals not on any toxics list:

Diesel range organics¹

¹ Too general to be included on lists that categorize by CAS numbers

CERCLA 2005: Comprehensive Environmental Response, Compensation, and Liability Act
Summary Data for 2005 Priority List of Hazardous Substances
EPCRA 2006: Emergency Planning & Community Right to Know Act Section 313 Chemical
List For Reporting Year 2006 (including Toxic Chemical Categories)
EPCRA List of Lists: Consolidated List of Chemicals Subject to the Emergency Planning and
Community Right-To-Know Act (EPCRA) and Section 112(r) of the Clean Air Act



ATTACHMENT I

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Chemicals in URS Field Activities Report for Characterization of Pit Solids and Fluids in Colorado Energy Fields, May 14, 2008¹

	Chemical	CAS #		Chemical	CAS #
1	(2-BE) Ethylene glycol monobutyl ether	111-76-2	43	3-Methylheptane	589-81-1
2	.Alpha.,.alpha.,4-trimethyl 3-cyclohexene-1-methan	10482-56-1	44	3-Methylhexane	589-34-4
3	.Alpha.-caryophyllene1	6753-98-6	45	3-Methylpentane	96-14-0
4	.Beta.-pinene1	127-91-3	46	3-Methyl-tetradecane1	18435-22-8
5	1-(2-Butoxyethoxy)-ethanol	54446-78-5	47	4-(Methoxymethyl)phenol1	5355-17-9
6	1-(2-Methoxypropoxy)-2-propanol1	13429-07-7	48	4,4'-(1-Methylethylidene)biphenol	80-05-7
7	1-(2-Propenyloxy)-2-propanol1	21460-36-6	49	4,4'-Methylenbis-phenol1	620-92-8
8	1,1,3-Trimethylcyclohexane	3073-66-3	50	4b,5,6,7,8,8a,9,10-Octahydro-4b,8,2-phenanthrenol1	511-15-9
9	1,2,3,4-Tetrahydro-5-methyl-naphthalene1	2809-64-5	51	4-Hydroxy-3-methoxy-5-nitro-benzaldehyde1	6635-20-7
10	1,2,3,4-Tetrahydro-naphthalene	119-64-2	52	4-Hydroxy-3-nitrobenzaldehyde1	3011-34-5
11	1,3-Butadiene	106-99-0	53	4-Methyl-octane	2216-34-4
12	1,4,5-Trimethyl-naphthalene	2131-41-1	54	4-Nitrophenol	100-02-7
13	1,4-Dioxane	123-91-1	55	5-Methyl-undecane	1632-70-8
14	1,4-Methanoazulene, decahydro-4,8,8-trimethyl-9-me	475-20-7	56	9-Octadecenamide, (z)-	301-02-0
15	1-Butoxy-2-propanol1	5131-66-8	57	Acetaldehyde	75-07-0
16	1-Methylethyl ester nitric acid	1712-64-7	58	Acetyl triethyl citrate1	77-89-4
17	1r-.Alpha.-pinene1	7785-70-8	59	Anthracene	120-12-7
18	1s-.Alpha.-pinene1	7785-26-4	60	Antimony, Dissolved	7440-36-0
19	2-(2-Methoxyethoxy)ethanol	111-77-3	61	Arsenic	7440-38-2
20	2,2'-Dithiobisethanol	1892-29-1	62	Barium	7440-39-3
21	2,2'-Methylenebis-phenol1	2467-02-9	63	Benzene	71-43-2
22	2,3,4,4a,10,10a-Hexahydro-6-hydroxy-1,9(1h)-phenan	511-05-7	64	Bis(2-ethylhexyl)phthalate	117-81-7
23	2,3-Dihydro-5,7-dihydroxy-2,4h-1-bensopyran-4-one1	480-39-7	65	Boron	7440-42-8
24	2,4-Dimethylphenol	105-67-9	66	Bromodichloromethane	75-27-4
25	2,4-Dinitro-6-methoxy-phenol1	4097-63-6	67	Bromoform	75-25-2
26	2,4-Dinitrophenol	51-28-5	68	Butanal	123-72-8
27	2,5,8,11,14-Pentaoxahexadecan -16-ol1	23778-52-1A	69	Butanoic Acid1	107-92-6
28	2,6,10-Trimethylpentadecane	3892-00-0	70	Butanol (N-butyl alcohol, Butan-1-OL, 1-Butanol)	71-36-3
29	2,6-Bis(1-methylethyl)-benzenamine	24544-04-5	71	Cadmium	7440-43-9
30	2,6-Dimethoxybenzoquinone1	530-55-2	72	Caprolactam	105-60-2
31	2,6-Dimethyloctane	2051-30-1	73	Chloroform	67-66-3
32	2-[(2-Ethylhexyl)oxy]-ethanol1	1559-35-9	74	Chromium (unknown if III or IV)	7440-47-3
33	2-[(4-Hydroxyphenyl)methyl]-phenol1	2467-03-0	75	Chrysene	218-01-9
34	2-Ethylhexanoic acid	149-57-5	76	Copper	7440-50-8
35	2-ethylhexanol	104-76-7	77	Cyclohexane	110-82-7
36	2-Methylbutane1	78-78-4A	78	Cyclohexanol	108-93-0
37	2-Methylheptane	592-27-8	79	Decahydro-2-methyl-naphthalene	2958-76-1
38	2-Methylhexane	591-76-4	80	Decahydronaphthalene	91-17-8
39	2-Methylpentane	107-83-5	81	Decane	124-18-5
40	2-Methylphenol	95-48-7	82	Decanoic acid	334-48-5
41	3,7-Dimethyl-1,6-octadien-3-ol1	78-70-6	83	Dibromo acetic acid	631-64-1
42	3-Carene	13466-78-9	84	Dibromochloromethane	124-48-1

¹ Colorado Oil and Gas Association, Rebuttal Statement Exhibits 10-2, Colorado Oil and Gas Conservation Commission Hearing Docket #0803-RM-02 (2008). Available at: <http://cogcc.state.co.us/RuleMaking/2007RuleMaking.cfm>

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8

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<http://www.epa.gov/region08>

February 14, 2008

Ref: EPR-N

Mr. Robert A. Bennett, State Director
Bureau of Land Management
Wyoming State Office
5353 Yellowstone Road
Cheyenne, Wyoming 82009

Re: Revised Draft Supplemental Environmental Impact
Statement for the Pinedale Anticline Oil and Gas
Exploration and Development Project
Sublette County, Wyoming CEQ #20070542

Dear Mr. Bennett:

In accordance with our responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA), 42 U.S.C. Section 4332(2)(C), and Section 309 of the Clean Air Act, 42 U.S.C. Section 7609, the U.S. Environmental Protection Agency Region 8 (EPA) has reviewed the Revised Draft Supplemental Environmental Impact Statement for the Bureau of Land Management's (BLM) proposed Pinedale Anticline Oil and Gas Exploration and Development Project (Revised Draft SEIS). The Revised Draft SEIS provides additional alternatives and impacts analyses in response to changes to the preferred alternative and to comments received on the December 2006 Draft SEIS.

The Revised Draft SEIS supplements a previous EIS and a 2000 Record of Decision authorizing up to 700 producing wells in the Pinedale Anticline Project Area (PAPA). The Revised Draft SEIS assesses both the site-specific and cumulative environmental impacts of year-round drilling, completions, and production of up to 4,399 additional natural gas wells on up to 12,885 acres of new disturbance. The year-round drilling is proposed within certain areas of the PAPA that coincide with big game crucial winter habitats and greater sage-grouse seasonal habitats. The PAPA encompasses 198,037 acres and is located directly south of Pinedale, Wyoming, in Sublette County. The Bridger-Teton National Forest is located west, north, and east of the PAPA and comes within 2.3 miles of the PAPA boundary. In addition, the PAPA is located approximately 11 miles west of the Bridger Wilderness Area. The Bridger Wilderness Area is a federal Class I area under the Clean Air Act, requiring special protection of air quality and air quality related values, such as visibility.

The Revised Draft SEIS considers five alternatives in detail. The preferred alternative consists of up to 4,399 additional wells on up to 12,885 acres of new surface disturbance by the year 2025. The drilling and completions within big game crucial winter habitats would occur year-round within concentrated development areas centered in a core area on the Anticline Crest. The Proposed Action also includes installation of a liquids gathering system in the central and southern portions of the PAPA complementing the existing liquids gathering system in the northern portion of the PAPA. Tier 2 equivalent emission controls would be installed on 29 out of 48 drilling rigs at peak drilling in 2009. The proponent's new Proposed Alternative is similar to the Preferred Action in that it consists of the same project components including 4,399 additional wells on up to 12,885 acres of disturbance. However, the core development area considered under the Preferred Alternative is different spatially from the Proposed Action and includes a potential development area (PDA). With the PDA, the Preferred Alternative has the potential for year-round development on 70,200 acres, over 60% greater than the core development area proposed under the Proposed Action. In addition to the Proposed Action and Preferred Alternative, the Revised Draft SEIS considers two other action alternatives that differ primarily in areas where year-round development may occur; installation of liquids gathering systems; and air quality mitigation measures. The Revised Draft SEIS also includes a No Action Alternative, which is based on elements set forth in the 2000 Pinedale Anticline Record of Decision (ROD).

EPA Region 8 has reviewed the Revised Draft SEIS and has three primary concerns, which are briefly highlighted in this letter: air quality impacts to visibility and ozone, and groundwater impacts. The enclosed "Detailed Comments" provides more discussion of our concerns regarding these issues as well as our comments on the proposal's impacts to surface water quality and wetlands.

AIR QUALITY IMPACTS - VISIBILITY

The Revised Draft SEIS discloses the significant and unanticipated impacts to visibility that occurred since implementation of the 2000 Pinedale Anticline ROD. The NO_x emissions from all sources operating in the PAPA in 2005 were five times the analysis threshold set in the 2000 Pinedale Anticline ROD (Revised Draft SEIS, page 3-70). For visibility, the 2005 emissions led to a modeled 45 days of visibility impairment greater than 1.0 deciview (dv) at the Class I Bridger Wilderness Area, 5 days at the Class I Fitzpatrick Wilderness Area, and additional days at other regional Class I areas (Revised Draft SEIS, page 3-73). Under the No Action scenario (ie., where development occurs under the provisions of the 2000 ROD) predicted 2007 visibility impacts are even higher than the 2005 predictions, with 62 days above 1.0 dv at Bridger Wilderness Area, 8 days at Fitzpatrick Wilderness Area, and additional days at other regional Class I and sensitive Class II areas (Revised Draft SEIS, page 4-78). Given the unforeseen and significant impacts that have occurred from the development of the 642 producing oil and gas wells approved under the 2000 Pinedale Anticline ROD, EPA recommends the Revised Draft SEIS identify effective and enforceable mitigation strategies to ensure environmental protection as the proposed 4,399 additional wells on the Pinedale Anticline are developed. EPA also recommends the Revised Draft SEIS provides a plan to mitigate the significant air quality environmental impacts resulting from the existing oil and gas development on the PAPA.

EPA and the Wyoming Department of Environmental Quality (WDEQ) participated on the Air Quality Stakeholders group that provided early guidance and comments to the BLM on the air quality modeling and visibility mitigation plan included in the December 2006 Draft SEIS. The air quality analysis and a substantial part of the visibility mitigation plan negotiated for the December 2006 Draft SEIS have been carried forward to this Revised Draft SEIS. However, the mitigation plan included in this Revised Draft SEIS includes significant modifications of the original commitments. EPA is concerned these modifications weaken the plan's ultimate goal and create uncertainty about achieving the ultimate goal of zero days of visibility impairment at Bridger Wilderness Area. The modified commitments suggest reluctance to commit to the full mitigation plan and have eroded EPA's confidence that the goal of zero days will be achieved. Without further specificity on how the ultimate goal will be achieved, EPA believes that the proposed project will result in at least ten days of visibility impairment at the federal Class I Bridger Wilderness Area. EPA considers ten days of visibility impairment greater than 1.0 dv a significant, adverse impact to air quality.

AIR QUALITY IMPACTS - OZONE

The Revised Draft SEIS updates the ozone analysis with a current state-of-science photochemical grid model. This level of analysis is particularly important given the elevated ozone levels that have been recorded at ambient air monitoring stations neighboring the PAPA. The BLM modeling analysis predicts ozone concentrations approaching EPA's current National Ambient Air Quality Standard (NAAQS). Specifically, ozone concentrations for the Proposed Action are predicted to be 0.0782 ppm near the PAPA. For Alternative C with the 80 percent reduction in drill rig emissions, ozone concentrations are predicted to be 0.0765 ppm near the PAPA (Alternative C is similar to BLM's Preferred Alternative). However, the Revised Draft SEIS does not provide analysis of ozone concentrations for the first five years prior to full implementation of the 80 percent reduction in drill rig emissions under the Preferred Alternative air quality mitigation strategy. The performance evaluation of the photochemical model supported the model's reliability in predicting ozone but also noted a small underestimation bias. With predicted ozone concentrations approaching the current standard and an underestimation bias in the model, EPA is concerned about the potential environmental and health impacts associated with the projected 0.0782 and 0.0765 ppm ozone concentrations. This concern is further substantiated by the elevated ozone concentrations above the current 0.08 ppm standard recorded at ambient air monitoring stations near the PAPA in 2005 and 2006. In addition, natural gas development and production under the Preferred Alternative is anticipated to continue until 2065.

In view of the ozone levels monitored, modeled and predicted, EPA recommends that an air quality mitigation strategy be developed to address these potentially significant air quality and health impacts. The SEIS should also include modeled demonstrations that the proposed action will not incrementally contribute to violations of a NAAQS. In addition, EPA is currently reviewing the national primary and secondary standards for ozone. This project may be affected if EPA determines that a revision to the current ozone standard is necessary and appropriate. Consequently, EPA may have further comments on the project's ozone analysis after the final rule is issued.

GROUNDWATER

The Revised Draft SEIS includes important new information on groundwater monitoring in the PAPA. The monitoring data suggest that current drilling and production activities on the PAPA have contributed to contamination of an aquifer used as a drinking water source. Existing benzene contamination exceeding the Drinking Water Standard (maximum concentration level or MCL) in two wells was attributed to oil and gas exploration activities in the Revised Draft SEIS. Further, benzene and other hydrocarbons have been detected in 88 of the approximately 230 water supply wells monitored. The Revised Draft SEIS does not disclose the monitored concentrations; it is, therefore, unknown how much the monitored concentrations are above or below the MCL. Based upon the extent of contamination of these two wells completed in an aquifer used as a source of drinking water and benzene contamination in approximately one third of the other wells monitored, EPA is concerned about the significance of existing and potential future impacts associated with activities in the PAPA. EPA believes that such impacts are environmentally unsatisfactory.

The Revised Draft SEIS provides only raw data. EPA believes the Revised Draft SEIS does not provide an adequate analysis of the effects of the expanded well field on groundwater; nor does it discuss the potential effectiveness of the proposed mitigation measures. Although the 2000 Pinedale Anticline ROD required all wells within one mile of proposed development be monitored on an annual basis, there is no documentation of how many wells exist within this defined buffer area nor can it be documented that monitoring took place in the defined areas. The Wyoming State Engineer has identified 4000 points of use within the PAPA. While some of these points of use may be duplicates, monitoring has taken place in only approximately 230 wells. The full extent of the benzene and hydrocarbon contamination in the PAPA has not been comprehensively evaluated. Although there are distinct aquifers in this area described in the Revised Draft SEIS, information on impacts and potential mitigation measures were generalized across all of the aquifers. Further, the Revised Draft SEIS acknowledges the source of the widespread low concentration detections (lower than the MCL) is not known (Revised Draft SEIS, page 3-85). EPA recommends that a more clear understanding of the extent of the benzene and hydrocarbon contamination, the aquifers, and the source of contamination is needed to develop effective mitigation measures.

The Revised Draft SEIS provides mitigation measures intended to reduce impacts to groundwater. These measures, however, were not identified as necessary nor were they evaluated as to their effectiveness in any of the alternatives. As the source of the widespread contamination remains unclear, it is difficult to identify and implement appropriate and effective mitigation measures to protect valued groundwater supplies. EPA recommends that where impacts have occurred or may reasonably be expected to occur to groundwater sources as a result of oil and gas production, including but not limited to hydraulic fracturing practices, an effective and enforceable mitigation plan should be developed. The mitigation plan could specifically include plans for replacement of quality water to water users if necessary.

EPA's RATING

Consistent with section 309 of the Clean Air Act, it is EPA's responsibility to provide an independent review and evaluation of the potential environmental impacts of this project. In accordance with our policies and procedures for reviews under NEPA and Section 309 of the Clean Air Act, EPA is rating this Revised Draft SEIS as "Environmentally Unsatisfactory – Inadequate Information" (EU-3) because our review has identified significant, adverse, long-term impacts to air quality and groundwater quality. The "EU" rating is based on potential adverse impacts to visibility in federal Class I areas without adequate mitigation; the extent of groundwater contamination in the PAPA where development has already occurred; and EPA's concern about further potential groundwater contamination impacts that may occur with the proposed project. Some of this contamination exceeds National Drinking Water Quality Standards. In addition, EPA is currently reviewing the national primary and secondary standards for ozone. This review will be completed by March 12, 2008. Should the ozone standard be revised, EPA may have additional comments on the SEIS and project. These impacts are of sufficient magnitude that the proposed action should not proceed as proposed. Further, the "EU" rating makes this project a candidate for referral to the Council on Environmental Quality (CEQ) if the unsatisfactory impacts we identified are not resolved. The rating of "3" is based on the lack of adequate information to characterize existing groundwater contamination or the extent of potential groundwater impacts from the proposed action. The Revised Draft SEIS also does not contain adequate analyses from air quality modeling to disclose the predicted ozone concentration under varying emission scenarios. This "3" rating indicates EPA's belief that the Draft EIS is not adequate for purposes of our NEPA and/or Section 309 review, and thus, should be formally revised and made available for public comment in a supplemental or revised Draft EIS. The "3" rating also makes this project a potential candidate for referral to CEQ. In addition to EPA's detailed comments on the Revised Draft SEIS, a full description of EPA's EIS rating system is enclosed.

If you have any questions regarding our comments or this rating, please contact Larry Svoboda, Region 8 NEPA Program Director, at 303-312-6004, or Carol Campbell, Acting Assistant Regional Administrator of Ecosystems, Protection and Remediation at 303-312-6340.

Sincerely,

/signed/

Robert E. Roberts
Regional Administrator

cc: John Corra, Wyoming Department of Environmental Quality
Chuck Otto, BLM Pinedale Field Office Manager

Enclosures

**Detailed Comments by the Region 8 Environmental Protection Agency for the
Draft Supplemental Environmental Impact Statement (SEIS)
Pinedale Anticline Oil and Gas Exploration and Development Project
Sublette County, Wyoming**

Air Quality – Visibility

The Clean Air Act requires special protection of air quality and air quality related values (such as visibility) in many of the nation's wilderness areas and national parks. Subpart II of Part C of the Clean Air Act prescribes a program specifically for the protection of visibility in federal Class I areas and establishes "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory class I federal areas which impairment results from man-made air pollution." EPA's implementing regulations require states to submit implementation plans that contain such measures as are necessary to make reasonable progress towards the national requirements, and that states establish reasonable progress goals toward improving visibility on the worst days and preventing further degradation in visibility during the best days. Actions by BLM that lack adequate mitigation of potential visibility impacts could impede Wyoming's and neighboring states' ability to submit State Implementation Plans that meet the Clean Air Act requirements.

In addition to its visibility provisions, the Clean Air Act contains general provisions for a Prevention of Significant Deterioration (PSD) program designed to protect federal Class I areas from air quality degradation under Subpart I of Part C. The PSD program places an affirmative responsibility on federal land managers to protect air quality in many of the most important national parks and wilderness areas in the nation from human-caused pollution. The Wilderness Act further directs the federal land management agencies to protect the wilderness character of those areas designated as wilderness. In that Act, Congress recognized the importance of preserving designated areas in their natural condition and declared a policy to "secure for the American people of present and future generations the benefits of an enduring resource of wilderness."

As stated on page 4-74 of the Revised Draft SEIS, "BLM considers a 1.0 deciview (dv) change to be a significance threshold for visibility impairment," which is consistent with other federal agencies' approach to visibility protection. Pursuant to the Clean Air Act and other provisions of law, EPA and the Federal Land Managers have developed regulations, guidance, and technical tools including models and data that land managers can use to help protect air quality in federal Class I areas. One of these is a guidance document from the Federal Land Managers' Air Quality Related Values Workgroup (FLAG), a workgroup that the federal land managers formed to develop a more consistent approach to evaluate air pollution effects on the areas that they manage. The FLAG guidance document states that impacts greater than 1.0 dv would be considered perceptible and significant for new source review purposes, and EPA supports efforts by the Federal Land Managers to coordinate and streamline their participation in

permitting. EPA has not adopted the 1.0 dv threshold into rules governing the requirements for federal or state New Source Review programs.

The Revised Draft SEIS includes analysis of modeled visibility impacts for both the current level of development in 2005 and the proposed project development through 2023. In Chapter 3.11, the Revised Draft SEIS discusses the visibility analysis conducted for 2005 and discloses the impacts of development that have occurred since BLM's 2000 Pinedale Anticline ROD. This analysis was conducted because the level of development since 2000 led to emissions that significantly exceeded those analyzed in the earlier EIS, triggering additional analysis under the 2000 Pinedale Anticline ROD. The visibility modeling analysis for the 2005 level of development predicts 45 days per year of visibility change greater than the 1.0 dv threshold at the Bridger Wilderness Area, five days per year at the Fitzpatrick Wilderness Area, and additional days at other regional Class I and sensitive Class II areas. Under the No Action scenario where development occurs under the provisions of the 2000 ROD, predicted 2007 visibility impacts are even higher with 62 days above 1.0 dv at Bridger Wilderness Area, 8 days at Fitzpatrick Wilderness Area and additional days at other regional Class I and sensitive Class II areas.

The BLM Preferred Alternative (Alternative D) proposes an air quality mitigation plan that attempts to reduce visibility impacts to Federal Class I areas from both the existing development and the proposed development. Detailed in Section 4.9.3.5 of the Revised Draft SEIS, the air quality mitigation plan provides for a two-phased approach to minimizing visibility impacts. Phase I mitigation would initiate after issuance of the ROD and would require operators to reduce project induced visibility impairment to 2005 levels. Immediately following Phase I, Phase II would require operators to reduce drill rig emissions by 80 percent over four years. The intervening years (years two through five) would have stepped 20 percent decreases in NO_x emissions with corresponding decreases in the number of days of impairment in the Class I areas. The ultimate goal of Phase II mitigation is zero days of visibility impairment at Bridger Wilderness Area. However, after the five-year period and the 80 percent reduction in NO_x emissions from drilling rigs, the Bridger Wilderness area is projected to have at least 10 days of impairment (greater than 1.0 dv) with impairment at other nearby Class I areas as well. During the first five years the proposed project will not meet the intent of Section 169A of the Clean Air Act (CAA) Amendments of 1977, which requires the "prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Federal Class I areas which impairment results from man-made air pollution."

EPA fully supports the ultimate goal of Phase II air quality mitigation: zero days of visibility impairment over 1.0 dv at the Bridger Wilderness Area. However, EPA is concerned that the commitment to achieve the goal has been weakened with the significant modifications of the original commitments. Specifically, EPA is concerned that the addition of "practicable" in the commitment for "using any and all practicable means with full consideration of all resources" and the addition of "technically and economically practicable" create uncertainty and doubt that the ultimate goal will be achieved. The modified commitments suggest reluctance to commit to the full mitigation plan and have eroded EPA's confidence that the goal of zero days will be achieved. Without further specificity on how the ultimate goal will be achieved, EPA

believes the proposed project will result in at least ten days of visibility impairment at the federal class I Bridger Wilderness Area. EPA considers ten days of visibility impairment greater than 1.0 dv a significant, adverse impact to air quality. EPA recommends BLM strengthen the language and include more specific details in the air quality mitigation plan to ensure the goal of zero days of impairment is met within a scheduled timeframe. Specifically, EPA recommends that the Revised SEIS include the air quality mitigation commitments set forth in the December 2006 Draft SEIS that if modeling cannot demonstrate achievement of this goal within five years of the ROD being signed, the Operators, BLM, EPA, and WDEQ would jointly agree to a mitigation plan that complies with the goal of zero days, using any and all available means.

Air Quality – Ozone Analysis

EPA commends BLM for updating the Ozone (O₃) analysis using the photochemical grid model, CAMx. The Revised Draft SEIS discloses summary results from air modeling conducted for the proposed Pinedale Anticline project and other cumulative emission sources. The maximum predicted ozone impacts using the EPA guidance approach occur near the PAPA. For Alternative C (Alternative C is similar to BLM's Preferred Alternative) with the 80 percent reduction in drill rig emissions, ozone concentrations are predicted to be 0.0765 ppm near the PAPA. The Revised Draft SEIS does not provide analysis of ozone concentrations for the first five years prior to full implementation of the 80 percent reduction in drill rig emissions under the air quality mitigation strategy. The performance evaluation of the photochemical model supported the model's reliability in predicting ozone but also noted a small underestimation bias. With predicted ozone concentrations approaching the current standard and an underestimation bias in the model, EPA is concerned with the health impacts associated with the projected 0.0782 and 0.0765 ppm ozone concentrations with this proposed project. This concern is further substantiated by the elevated ozone concentrations above the current 0.08 ppm ozone standard recorded at Sublette County ambient air monitoring stations in 2005 and 2006.

In view of the ozone levels monitored, modeled and predicted, EPA recommends that an air quality mitigation strategy be developed to address not only NO_x sources, but include measures to control other O₃ forming precursors such as volatile organic compounds (VOCs) and formaldehyde. The SEIS should also include modeled demonstrations that the proposed action will not incrementally contribute to violations of a NAAQS. In addition, EPA is currently reviewing the national primary and secondary standards for ozone. This project may be affected if EPA determines that a revision to the current ozone standard is necessary and appropriate. Consequently, EPA may have further comments on the project's ozone analysis after the final rule is issued.

Detailed Ozone Comments

1. The design value predictions for the reported modeling for Alternative C (Alternative C is similar to BLM's Preferred Alternative) were based on an 80 percent NO_x reduction in the PAPA after four years with intervening years of 20 percent stepped decreases in NO_x emissions. For the intervening years, predicted O₃ design value concentrations have not been reported. These values may be considerably higher and EPA recommends they be reported in the SEIS.
2. Figure 4-4 of Appendix H of the Air Quality Impact Analysis Technical Support Document for the Revised Draft SEIS upper right map depiction for Alternative C (Alternative C is similar to Alternative D, BLM's Preferred Alternative) presents the predicted difference in O₃ design value impacts from Alternative C with Phase II mitigation to the base case scenarios. Please clarify the location of the maximum impact location from this figure. Furthermore, the difference of 5.5 ppb presented in Figure 4-4 is not represented in Table 4-1 of Appendix H. EPA recommends the maximum predicted O₃ concentration near the PAPA and approximate location of these impacts be presented in the SEIS.
3. Ozone concentrations were predicted for cumulative sources in the PAPA and surrounding areas. EPA recommends the SEIS disclose ozone concentrations for PAPA specific sources in order to determine the direct project impacts. In addition, EPA recommends the analysis disclose the absolute modeled results in addition to the results calculated under EPA's guidance approach.
4. Section 5.2.2.1. EPA Guidance Ozone - Projection Approach EPA guidance for projecting future ozone concentrations using relative reduction factors to scale current observed ozone design values is required for State Implementation Plan (SIP) modeling in urban non-attainment areas. The approach is useful in the context of the current study; however, the ozone monitoring network is very sparse compared to urban monitoring networks. For this reason EPA recommends the absolute model prediction of maximum ozone concentrations be presented in addition to the "scaled" modeled attainment test (MATS) results used in SIP modeling.

Groundwater

The Revised Draft SEIS includes significant new information on groundwater monitoring that was completed under a monitoring program established under the 2000 Pinedale Anticline ROD. The monitoring data suggest that current drilling and production activities on the PAPA have contributed to contamination of an aquifer used as a drinking water source. Benzene and other hydrocarbons have been detected in 88 of the approximately 230 water supply wells monitored or 38 percent of the wells tested. Existing benzene contamination exceeding the Drinking Water Standard (maximum concentration level or MCL) in two wells was attributed to oil and gas exploration activities in the Revised Draft SEIS. The Revised Draft SEIS does not disclose the monitored concentrations; it is, therefore, unknown how much the monitored

concentrations are above or below the MCL. Based upon the extent of contamination of these two wells completed in an aquifer used as a source of drinking water and benzene contamination in approximately one third of the other wells monitored, EPA is concerned about the significance of existing and potential future impacts associated with activities in the PAPA. EPA believes that such impacts are environmentally unsatisfactory.

While the monitoring data suggest significant impacts to groundwater have occurred in the PAPA, insufficient information has been provided to fully understand the nature of the existing contamination and the potential for additional groundwater contamination from the proposed action. Although the 2000 Pinedale ROD required that all wells within one mile of proposed development be monitored on an annual basis, there is no documentation of how many wells are within this defined buffer area nor is it documented that monitoring took place in the defined areas. The Wyoming State Engineer has identified 4000 points of use within the PAPA. While some of these points of use may be duplicates, monitoring has taken place in only approximately 230 wells. The full extent of the benzene and hydrocarbon contamination in the PAPA has not been comprehensively evaluated. In addition, although there are five distinct aquifers in this area described in the Revised Draft SEIS, information on impacts and potential mitigation measures were generalized across all of the aquifers.

The Revised Draft SEIS provides mitigation measures intended to reduce impacts to groundwater. These measures, however, were only identified as potential requirements and were not evaluated as to their effectiveness in any of the alternatives. As the source of the widespread low concentration detections remains unclear, it is difficult to identify and implement effective mitigation measures to protect valued groundwater supplies without understanding of the source of contamination. EPA recommends that where impacts have occurred or may reasonably be expected to occur to groundwater sources as a result of oil and gas production, including but not limited to hydraulic fracturing practices, an effective and enforceable mitigation plan should be developed. The mitigation plan could specifically include plans for replacement of quality water to water users if necessary.

Based on the information included in the Revised Draft SEIS, EPA recommends BLM develop a monitoring plan sufficient to characterize each of the aquifers throughout the PAPA. Use of industrial water wells, not designed for monitoring purposes, provides inadequate information to identify and mitigate groundwater problems. We suggest that monitoring methods approved by the Wyoming DEQ be used to ensure Quality Control over the monitoring process, including proper drilling methods and casing. Furthermore, each new well within the PAPA should be logged and sampled during drilling preventing any cross-contamination with industrial uses. EPA also suggests the Revised SEIS include a map identifying the approximately 230 wells that have been tested; the wells with detectable levels of benzene and other hydrocarbons; and the wells with benzene concentrations above the MCL.

EPA believes it is important to sustain and protect quality drinking water supplies in times of increased demand for water and especially in times of drought. Rather than using potable grade water for drilling, EPA recommends BLM consider and evaluate non-potable alternative drilling water sources in the Revised SEIS. The Fort Union Formation at a slightly

deeper depth is an aquifer with adequate quality for industrial purposes but is not of high enough quality for a water supply at this time. In addition, reuse of produced water is also demonstrated within the PAPA and could potentially be an appropriate alternative for industrial water supply.

Finally, EPA recommends the Revised SEIS include a more detailed analysis of cumulative groundwater impacts. EPA is aware of additional groundwater contamination that has occurred in the Jonah field directly south and adjacent of the Pinedale Anticline. The drilling water well in the Jonah field has monitored levels of benzene of 615 ug/l at a depth of over 900 feet with lower concentrations near surface. This information should be disclosed to the public in addition to any other existing monitoring analyses for the area.

No Action Alternative

As previously mentioned in EPA's April 6, 2007, comments on the Draft SEIS, NEPA requires analysis of a No Action Alternative in order to establish an environmental impacts baseline for comparison with the Proposed Action. In the December 2006 Draft SEIS and in this Revised Draft SEIS, BLM analyzes the No Action Alternative in terms of continuing with the present course of action until that action is changed (i.e., approving wells under the 2000 ROD until approval of a new ROD). The Revised Draft SEIS states there is "uncertainty" with regard to the 2000 ROD. Any uncertainty should be resolved by examining the extent of development actually analyzed in the Pinedale Anticline Oil and Gas Exploration and Development Project EIS, that is, impacts associated with the development of 700 producing natural gas wells over a 10 to 15 year time period. EPA believes that this scenario should be the basis for the No Action Alternative rather than the No Action Alternative considered in the Revised Draft SEIS which includes the development of an additional 1,139 wells for a total of approximately 1,800 wells by the year 2011. EPA recommends the No Action Alternative and baseline analysis be revised to accurately reflect the 700 producing well scenario analyzed in the initial Pinedale Anticline EIS and implemented in the 2000 ROD.

Surface Water, Water Quality, and Aquatic Habitat

In the Revised Draft SEIS's executive summary, it is acknowledged that sediment yields will be substantially increased above current conditions in six hydrologic sub-watersheds that coincide with the Anticline Crest. This conclusion is substantiated by the *Erosion Modeling, Sediment Transport Modeling and Salt Loading Technical Report* prepared by HydroGEO which was presented in Table 4.14-4 in the previous Draft SEIS (December 2006). This important finding and the table illustrating the diverse and varied effects in different subwatersheds should be re-inserted in the Revised Draft SEIS. This information provides insight and geographic pattern to a potentially significant environmental effect, and EPA recommends that this Table and a discussion of its findings should be a part of this analysis. According to the model, the average annual sediment yield would increase by 73% in the New Fork River – Alkali Creek, 102% in Mack Reservoir and 26% in the Sand Draw-Alkali Creek sub-watersheds in 2023 (under the worst case modeling scenario with no reclamation). Yet, Chapter 4.14 concludes these substantial increases in sediment yield are not expected to result in "significant" impact to surface water resources under any of the alternatives. It appears this conclusion is reached based

on a finding that the increased sediment loading, although substantial, would not impair the designated uses for these waters. The Revised Draft SEIS does not clearly explain the basis for this conclusion. EPA strongly recommends that the Revised SEIS clarify how the projected increased sediment yields are translated into projected compliance with Wyoming's narrative water quality standard for settleable solids, which states:

“In all Wyoming surface waters, substances attributable to or influenced by the activities of man that will settle to form sludge, bank or bottom deposits shall not be present in quantities which could result in significant aesthetic degradation, significant degradation of habitat for aquatic life or adversely affect public waters supplies, agricultural or industrial water use, plant life or wildlife.”

It is also clear from the Revised Draft SEIS that avoiding adverse effects to the designated uses will rely on “extensive” use of Best Management Practices (BMPs) to prevent erosion, as well as timely reclamation. To ensure adverse effects to surface water quality are avoided, EPA recommends the Revised SEIS identify: 1) the target and the threshold of change (e.g., percent change of fines, or in suspended sediment) from the target being used to determine compliance with the designated uses assigned to these waters; and 2) the level of effectiveness for the applicable BMPs; 3) the process that will be used to ensure effective implementation and maintenance of those BMPs (i.e., ongoing and future monitoring of effectiveness and implementation enforcement); 4) and how sufficient reclamation will be accomplished and monitored given the ambient ecological conditions.

The Revised Draft SEIS notes that a number of waters within the Anticline Crest are prime sport fisheries. Measures of impact to these aquatic communities from increased sediment yield could be based on either change in biological condition or change in bedded sediments (% fines). The Revised Draft SEIS notes that a report by EcoAnalysts, Inc. (2005) concluded “... there has been no discernable change in ... invertebrate biology indices between 2000 and 2005.” EPA recommends the Revised SEIS provide more detail about this analysis as well as the general approach to and results of the monitoring conducted by the Sublette County Conservation District (SCCD). For example, is the biological monitoring approach used similar to, or consistent with, the Wyoming DEQ's bioassessment protocol? [see: Wyoming DEQ's *Redevelopment of the Wyoming Stream Integrity Index (WSII) for Assessing the Biological Condition of Wadeable Streams in Wyoming*]. At a minimum, EPA recommends the discussion include information about the biological metrics or index used, the basis for their derivation and application, and level of precision by which these analyses are able to define thresholds that would avoid “significant degradation of habitat for aquatic life” under Wyoming's narrative standard.

Once a target and threshold of change from the target have been identified, EPA recommends BLM implement a comprehensive water monitoring plan to ensure the BMPs are successfully mitigating the impacts from increased sedimentation and that the identified target is being met. At a minimum, we recommend that BLM establish a monitoring program in the most sensitive watersheds and the watersheds most likely to be impacted. EPA is concerned that such monitoring is not already ongoing, and looks forward to BLM establishing an effective

monitoring program and utilizing the results from those monitoring efforts to direct reclamation resources and efforts.

It is best to involve a system of BMPs that targets each stage of the erosion process to ensure success from construction activities. The most efficient approach involves minimizing the potential sources of sediment from the outset. This means limiting the extent and duration of land disturbance to the minimum needed, and protecting surfaces once they are exposed. BMPs should also involve controlling the amount of runoff and its ability to carry sediment by diverting incoming flows and impeding internally generated flows. And finally, BMPs should involve retaining sediment that is picked up on the project site through the use of sediment-capturing devices. On most sites successful erosion and sedimentation control requires a combination of structural and vegetative practices. Above all BMPs are best performed using advance planning, good scheduling and maintenance.

In the 2000 Pinedale Anticline ROD, BLM committed to implementing a monitoring program to ensure that the Green and New Fork Rivers continue to support their designated uses. Yet, the Draft SEIS indicates that it is not known if significant impact has occurred to surface water. EPA recommends BLM include a discussion of the surface monitoring program, any obstacles in implementing the program, and any monitored results in the Revised SEIS. Further, the Revised SEIS should analyze the potential for underground aquifer interaction with surface water and the potential resulting impacts should the benzene and hydrocarbon contamination reach these high value prime fisheries.

Wetlands

As noted in the Revised Draft SEIS, certain wetlands are subject to protection pursuant to the Clean Water Act and Executive Order 11990. The Clean Water Act (CWA) Section 404 regulates discharge of dredged or fill material into “waters of the United States,” including jurisdictional wetlands. Under CWA Section 404, permits for such discharges are generally issued by the U.S. Army Corps of Engineers, in accordance with EPA’s CWA Section 404(b)(1) guidelines. These guidelines require, among other provisions, that no discharge of dredged or fill material shall be permitted unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic ecosystem (40 CFR 230.10(d)). In addition, Executive Order 11990 – Protection of Wetlands (May 24, 1977) states in pertinent part as follows: “Section 1. (a) Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency’s responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; and (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities. (b) This Order does not apply to the issuance by Federal agencies of permits, licenses, or allocations to private parties for activities involving wetlands on non-Federal property.” It should be noted that Executive Order 11990 is not limited to wetlands regulated under the Clean Water Act.

EPA considers the protection, improvement, and restoration of wetlands and riparian areas to be a high priority. Executive Order 11990 directs all Federal Agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. EPA recommends that, consistent with the Executive Order, indirect draining of, or direct disturbance of, wetland areas should be avoided if at all possible. If disturbance is unavoidable, BLM should commit to replace in kind such impacted wetlands and to a level that fully restores wetland function and value. Due to the time it can take to adequately reclaim disturbed wetlands and the potential life of this project, BLM may consider requiring mitigation to begin concurrent with the disturbance.

The Revised Draft SEIS provides updated information on potential impacts to wetlands from the Proposed Action and Preferred Alternative. An additional 183.9 acres of disturbance in riparian forest and riparian shrub vegetation are predicted, yet no mitigation for wetland and riparian resources has been identified (page 4-129). EPA recommends that the Revised SEIS discuss BLM's approach to implementing federal wetland policies and legal requirements in the continued development of the PAPA. In particular, EPA recommends the Revised SEIS clearly explain how BLM will be mitigating the loss and disturbance of wetlands and streams within and adjacent to the PAPA under Executive Order 11990. EPA is available to provide guidance and work with BLM towards development of a mitigation plan for the Revised SEIS and development of an implementation plan.

Greenhouse Gas Emissions

EPA believes the greenhouse gases section in the Final SEIS should be expanded, keeping in mind that there are currently no EPA regulatory standards directly limiting greenhouse gas emissions¹. While methane represents only 8 percent of the U.S. greenhouse gas emissions, it is 23 times more effective as a greenhouse gas than carbon dioxide. Oil and natural gas systems are the biggest contributor to methane emissions in the U.S., accounting for 26 percent of the total (EPA's Natural Gas Star Program and the US Emissions Inventory 2007: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2005). EPA recommends that to the extent possible the Revised SEIS estimate and disclose the amount of methane and carbon dioxide emissions associated with each alternative in carbon dioxide-equivalent terms. As a point of comparison, EPA recommends the Revised SEIS consider utilizing a greenhouse gas equivalencies calculator to translate greenhouse gas emissions into terms that are easier to conceptualize. For example, a comparison of emissions to a range of other greenhouse gas

¹ Since issuance of the April 2, 2007 Supreme Court opinion in *Massachusetts, et. al. v. EPA*, 127 S. Ct. 1438, 549 U.S. __ (2007), EPA has begun to develop regulations to address greenhouse gas emissions from motor vehicles and fuels under the direction of the President's May 14, 2007 Executive Order and relevant Clean Air Act authorities. The Agency continues to evaluate the potential effects of the Court's decision with respect to addressing emissions of greenhouse gases under other provisions of the Clean Air Act. Thus, neither this comment letter nor the EIS for an individual project reflects, and should not be construed as reflecting, the type of judgment that might form the basis for a positive or negative finding under any provision of the Clean Air Act.

emitting sectors (www.epa.gov/solar/energy-resources/calculator.html).

As part of a cumulative impact analysis, in the event the GHG emissions associated with the project are significant, EPA recommends the Revised SEIS compare annual projected greenhouse gas emissions from the proposed project to annual emissions from other existing and reasonably foreseeable future projects. In addition, we recommend that the Revised SEIS compare the annual greenhouse gas emissions from the proposed project to estimated annual greenhouse gas emissions at a regional, national, and global scale. Emissions of greenhouse gases in the United States have been quantified by the U.S. Department of Energy and EPA in publications released in 2007. EPA recommends that the cumulative impacts analysis also include a general, qualitative discussion of the anticipated effects of climate change, including potential effects at a regional level.

The Revised SEIS should also identify possible mitigation measures that may be implemented to reduce and capture methane gas and reduce potential impacts. There are a number of voluntary, cost-effective technologies and practices to reduce and off-set greenhouse gas emissions. Through EPA's Natural Gas STAR (www.epa.gov/gasstar), EPA works with companies that produce, process, transmit and distribute natural gas to identify and promote the implementation of cost-effective technologies and practices to reduce emissions of methane, a potent greenhouse gas.

Accountability for Implementation of Effective Mitigation Measures

The Revised Draft SEIS discloses the significant and unanticipated impacts to groundwater, air quality and wildlife that have occurred since implementation of the 2000 Pinedale Anticline ROD. Of particular concern:

- Benzene and other hydrocarbons have been detected in 88 of approximately 230 water supply wells sampled since monitoring began in 2004 (Revised Draft SEIS, page 3-84).
- Elevated ozone concentrations above the current National Ambient Air Quality Standard (NAAQS) have been recorded at Sublette County ambient air monitoring stations in 2005 and 2006 (Revised Draft SEIS, Table 3.11-2) and ground-level ozone concentrations have also increased.
- For 2005 “actual” emissions, a modeled 45 days of visibility impairment greater than 1.0 dv has occurred at the Class I Bridger Wilderness Area, 5 days at the Class I Fitzpatrick Wilderness Area, and additional days at other regional Class I areas (Revised Draft SEIS, page 3-73). For 2007, the predicted impacts to visibility are even higher with 62 days of visibility impairment predicted for the Bridger Wilderness Area (Revised Draft SEIS, page 4-78).
- Sage grouse male counts have declined by 51 percent on leks near the PAPA that were heavily impacted by gas wells from one year prior to well development in 1999 through 2004 (Revised Draft SEIS, page 3-135, Holloran, 2005).

Given the unforeseen and significant impacts that have occurred from the development of the 642 producing oil and gas wells approved under the 2000 Pinedale Anticline ROD, EPA believes that it is of the utmost importance that the Revised Draft SEIS identify effective and enforceable mitigation strategies to ensure environmental and public health protection as the proposed 4,399 additional wells on the Pinedale Anticline are developed. The Revised Draft SEIS should also develop a plan to mitigate the significant environmental impacts resulting from the oil and gas development that has already occurred on the PAPA. While the Revised Draft SEIS includes many of the necessary components that provide a starting point for mitigation, EPA recommends each of the mitigation plans include a mechanism for public accountability, such as stakeholder forums and/or annual status reports. Public accountability can be an important tool in ensuring mitigation targets are met in a timely manner.

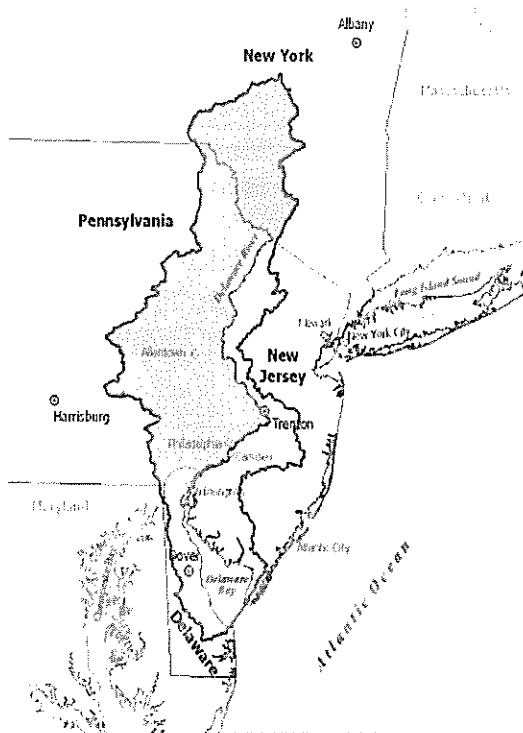
**Testimony of Robert Tudor
Deputy Executive Director, Delaware River Basin Commission**

**Before the
Committee on Environmental Protection
The Council of the City of New York**

September 10, 2008

Good afternoon Mr. Chairman and members of the Committee. I am Bob Tudor, Deputy Executive Director of the Delaware River Basin Commission (DRBC). Thank you for this opportunity to speak to you today about Natural Gas Drilling in the New York City Drinking Water Watershed, a very important topic not only to the City, but to the entire interstate basin community.

I hope to concisely present the DRBC's role in regulating natural gas drilling and facilitating coordination among New York State, the Commonwealth of Pennsylvania and a wide array of parties interested in this activity. Before I get started, however, I want to note that *the intent of the Delaware River Basin Commission is not to prevent natural gas drilling, but rather to ensure that proper environmental controls are provided to safeguard our basin's water resources.*



Basin Background

The Delaware is the longest un-dammed river east of the Mississippi, extending 330 miles from the Catskill Mountains of New York State to the mouth of the Delaware Bay where it meets the Atlantic Ocean. The river is fed by 216 tributaries, the largest being the Schuylkill and Lehigh rivers in Pennsylvania.

In all, the basin contains 13,539 square miles, draining parts of Pennsylvania (6,422 square miles or 50.3 percent of the basin's total land area); New Jersey (2,969 square miles, or 23.3%); New York (2,362 square miles, 18.5%); and Delaware (1,004 square miles, 7.9%). Included in the total area number is the 782 square-mile Delaware Bay, which lies roughly half in New Jersey and half in Delaware.

Nearly 15 million people (approximately five percent of the nation's population) rely on the waters of the Delaware River Basin for drinking and industrial use, but the watershed drains only

four-tenths of one percent of the total continental U.S. land area. The 15 million figure includes about seven million people in the New York City area and northern New Jersey who live outside the basin. New York City gets roughly half its water from three large reservoirs located on tributaries in the upper Delaware region and the City of Philadelphia gets 100% of its water supply directly from the Delaware and Schuylkill rivers.

Congress and the President have included three reaches of the Delaware in the National Wild and Scenic Rivers System. One section extends 73 miles from the confluence of the river's East and West branches at Hancock, N.Y. downstream to Milrift, Pa.; the second is a 40-mile stretch from just south of Port Jervis, N.Y. downstream to the Delaware Water Gap near Stroudsburg, Pa. Both were added in 1978. The Lower Delaware Wild and Scenic Rivers Act, signed into law on November 1, 2000, added a 38.9-mile section of the main stem Delaware (and about 28 miles of selected tributaries) to the national system, linking the Delaware Water Gap and Washington Crossing, Pa., just upstream of Trenton, N.J. According to the National Park Service's web site, the U.S. has 3.5 million miles of rivers, but only 11,434 river miles (just over one-quarter of one percent) are included in the National Wild and Scenic Rivers System. *Given this fact, I believe it is truly noteworthy that about 153 miles, or three-quarters of the non-tidal Delaware River above Trenton, N.J., is now included in the National Wild and Scenic Rivers System*

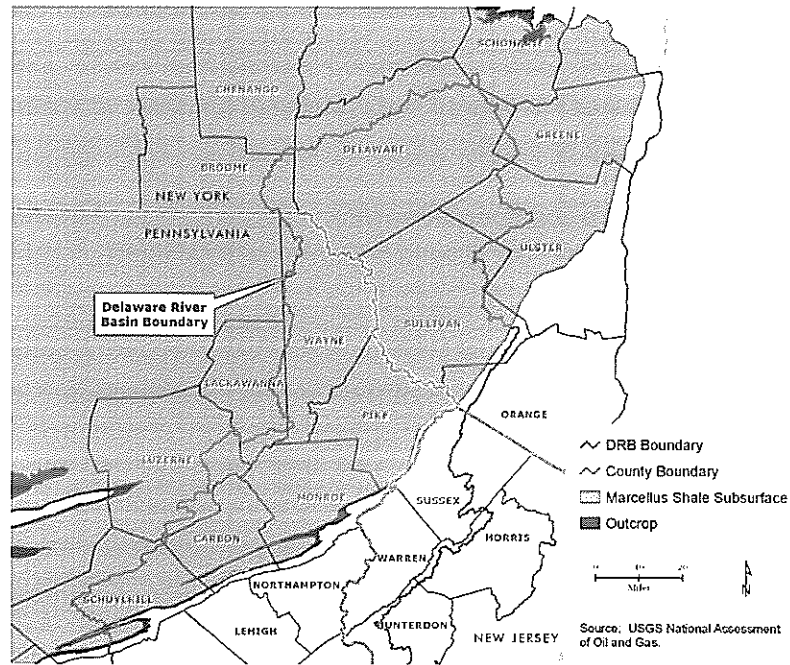
The DRBC is an interstate/federal compact agency with a mission to manage water resources without regard to political boundaries. There are five Commissioners – the governors of the four basin states and a two-star general in the U.S. Army Corps of Engineers who was appointed by the President as the federal government's representative. DRBC has regulatory, as well as management, planning and resource development authorities. The Compact creating the DRBC in 1961 marked the first time in our nation's history that the federal government and a group of states joined together as equal partners in a river basin planning, development and regulatory agency.

Commission programs include water quality protection, water supply allocation, regulatory review (permitting), water conservation initiatives, watershed planning, drought management, flood loss reduction, and recreation.

In short, the DRBC shares a common interest with the City of New York in "Keeping the Clean Water Clean", especially in headwater/watershed lands in the upper Delaware River Basin.

Natural Gas Drilling Background

Much of the new drilling interest taking place in northeastern Pennsylvania and southern New York is targeted at reaching the natural gas found in the Marcellus Shale formation, which underlies about 36 percent of the Delaware River Basin. Because Marcellus Shale is considered a tight geologic formation, natural gas deposits were not previously thought to be practically and economically mineable using traditional techniques. New horizontal drilling and extraction methods, coupled with higher energy costs, have given energy companies reason to take a new interest in mining the natural gas deposits within the Marcellus Shale.



Extent of Marcellus Shale Formation in the Delaware River Basin

However, these new extraction methods require large amounts of fresh water to fracture the formation to release the natural gas. A significant amount of water used in the extraction process is recovered, but this “frac water” includes natural gas and chemicals added to facilitate the extraction process, as well as brine and other constituents released from the formation.

Why Is The DRBC Involved?

The DRBC is a federal-interstate compact government agency that was formed by concurrent legislation enacted in 1961 by the United States and the four basin states (Pennsylvania, New York, New Jersey, and Delaware). Its five members include the basin state governors and a federal government representative appointed by the president.

The commission has legal authority over both water quality and water quantity-related issues throughout the basin. Section 3.8 of the Delaware River Basin Compact which created the DRBC provides in part: “No project having a substantial effect on the water resources of the basin shall hereafter be undertaken by any person, corporation or governmental authority unless it shall have been first submitted to and approved by the commission ...”

In connection with natural gas drilling, the commission has identified three major areas of concern:

1. Gas drilling projects in the Marcellus Shale or other formations may have a substantial effect on the water resources of the basin by reducing the flow in streams and/or aquifers used to supply the significant amounts of fresh water needed in the natural gas mining process.
2. On-site drilling operations may potentially add, discharge or cause the release of pollutants into the ground water or surface water.
3. The recovered “frac water” must be treated and disposed of properly.

In accordance with Section 3.8 of the Compact and Section 2.3.4.E of the DRBC’s Rules of Practice and Procedure, a project sponsor may not commence any withdrawal of ground or surface water from the basin, drill any well, construct any impoundment or other associated appurtenances, discharge to the ground waters or surface waters of the basin or otherwise undertake a project until the sponsor has applied for and received approval from the commission.

On the subject of ground water availability, thus far none of the companies that have met with the DRBC has proposed to utilize on-site ground water wells drilled specifically as a source for their project water needs, and the discussions to date have focused on surface water sources. DRBC will review the proposed withdrawal scenario (either ground or surface) and will recommend the proposal for approval only if it complies with the commission’s water withdrawal review criteria. Notwithstanding the amount of water withdrawn, natural gas drilling projects in the Marcellus Shale formation are subject to review and approval by the DRBC because the commission has jurisdiction over multiple aspects of these projects. For example, as part of its review, the DRBC will require the applicant to indicate its disposal strategy for the “frac water.” A project will not be recommended for approval if the disposal strategy outlined by its sponsor does not comply with the commission's rules and regulations.

Recent DRBC Activities

DRBC is currently working with other regulatory and scientific agencies at the federal and state levels to refine review criteria. Although DRBC’s authority is separate from the states’ authorities, the commission is working with Pennsylvania and New York to coordinate agency actions and minimize unnecessary duplication of effort in the issuance of DRBC permits or “dockets” to natural gas drilling companies. Companies must obtain applicable state approvals as well as approval by the DRBC. DRBC dockets are not expected to be issued to individual property owners who may have sold or leased the natural resource rights to a natural gas drilling company *with one exception*: the commission may require property owners to obtain DRBC approval if they propose to supply more than 100,000 gallons per day or more during any 30 consecutive day period from a ground and/or surface water source that has not been previously docketed by the commission.

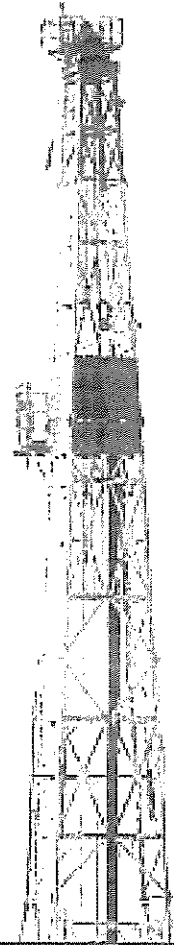
DRBC staff members have met with industry representatives and held pre-application meetings with several natural gas drilling companies or their consultants to answer questions and explain the commission's regulatory review process. However, so far no natural gas drilling company has actually submitted a project application to the DRBC for review. To date, commission staff is aware of only one natural gas well that has been drilled in the Marcellus Shale formation in the basin; DRBC has issued the company an enforcement letter to address its failure to obtain DRBC approval before drilling this well, and has sent a separate letter notifying the company that it needs to submit an application for commission approval of future gas extraction activities at the site or elsewhere within the basin.

Future DRBC Activities

Once an application for a natural gas well drilling project is submitted, commission staff will review the proposal and may require additional information. DRBC staff then will determine whether the project complies with the commission's rules and regulations and make a recommendation to the five commissioners. The decision to approve or deny a docket is made by majority vote of the commissioners at a duly noticed public hearing, not by the DRBC staff. The commission does not get involved in the private negotiations taking place between natural gas drilling companies and private property owners. However, property owners are advised to seek appropriate technical and legal representation to ensure that they obtain adequate protection of their property. The commission also recommends that any company proposing to drill natural gas wells in the Marcellus Shale formation contact DRBC staff to schedule a pre-application meeting.

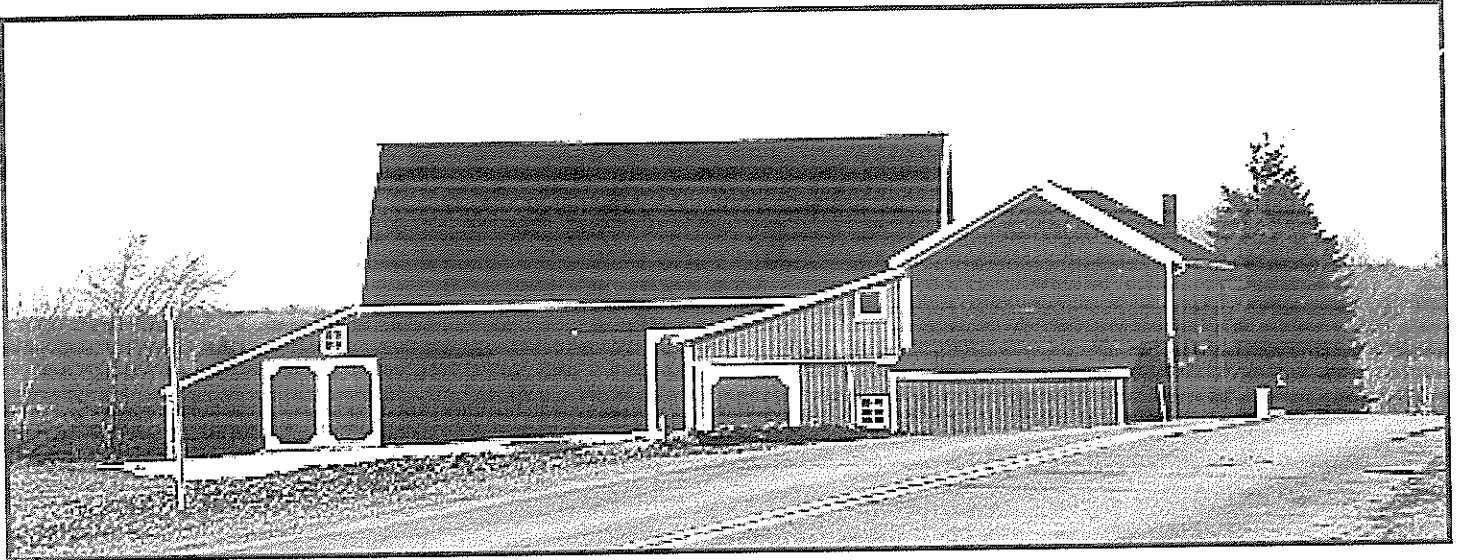
Homegrown Energy

The Facts About Natural Gas Exploration of the Marcellus Shale



Independent
Oil & Gas Association
of New York

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Introduction

At a time when energy costs are spiraling out of control and the price of everything from bread to milk is skyrocketing, we must find ways to reduce our expenditures on fuel – and New York State’s natural gas wells are an economically viable option.

Drilling for natural gas is not new to New York. In 1821, the first gas well was drilled in Fredonia New York and, to date, more than 75,000 oil and natural gas wells have been drilled. Approximately 14,000 of these are still active and have had an excellent track record on environmental compliance and safety standards.

The Marcellus Shale is one of the largest natural gas fields in North America, and its scope is expanding. It has the potential to generate a multi-billion-dollar direct impact on the economy, with multiplier effects rippling through virtually all regional industries.

In 2002, a U.S. Geological Survey estimated that the Marcellus Shale formation held 30.7 trillion cubic feet (tcf) of natural gas – a colossal amount for the U.S. considering that the U.S. consumes about 23 tcf of natural gas per year, but only produces about 19 tcf.

But according to a recent study, which takes into account the technological advances made in the

industry from 2002 to the present, the Marcellus formation could hold a volume up as high as 500 tcf – more than 16 times the old estimate.

A report from the Penn State Workforce Education and Development Initiative estimates that for each \$1 billion of royalty income generated by the Marcellus Shale reserves, the State could gain 7,880 jobs this year, and close to 8,000 next year.

Currently New York must import 95 percent of its natural gas from other states including the southwest. Now is the time for change. We have an opportunity to supply New York – and the rest of America – with a proven energy source that is not only clean burning and has a low carbon-content, but is also homegrown and will reduce our reliance on others by giving us our own source of low-cost energy.

This tremendous resource will yield new economic development opportunities and create substantial job growth. This is the time to embrace this opportunity, not shy away from it.

**Brad Gill,
Executive Director of the Independent Oil and
Gas Association**

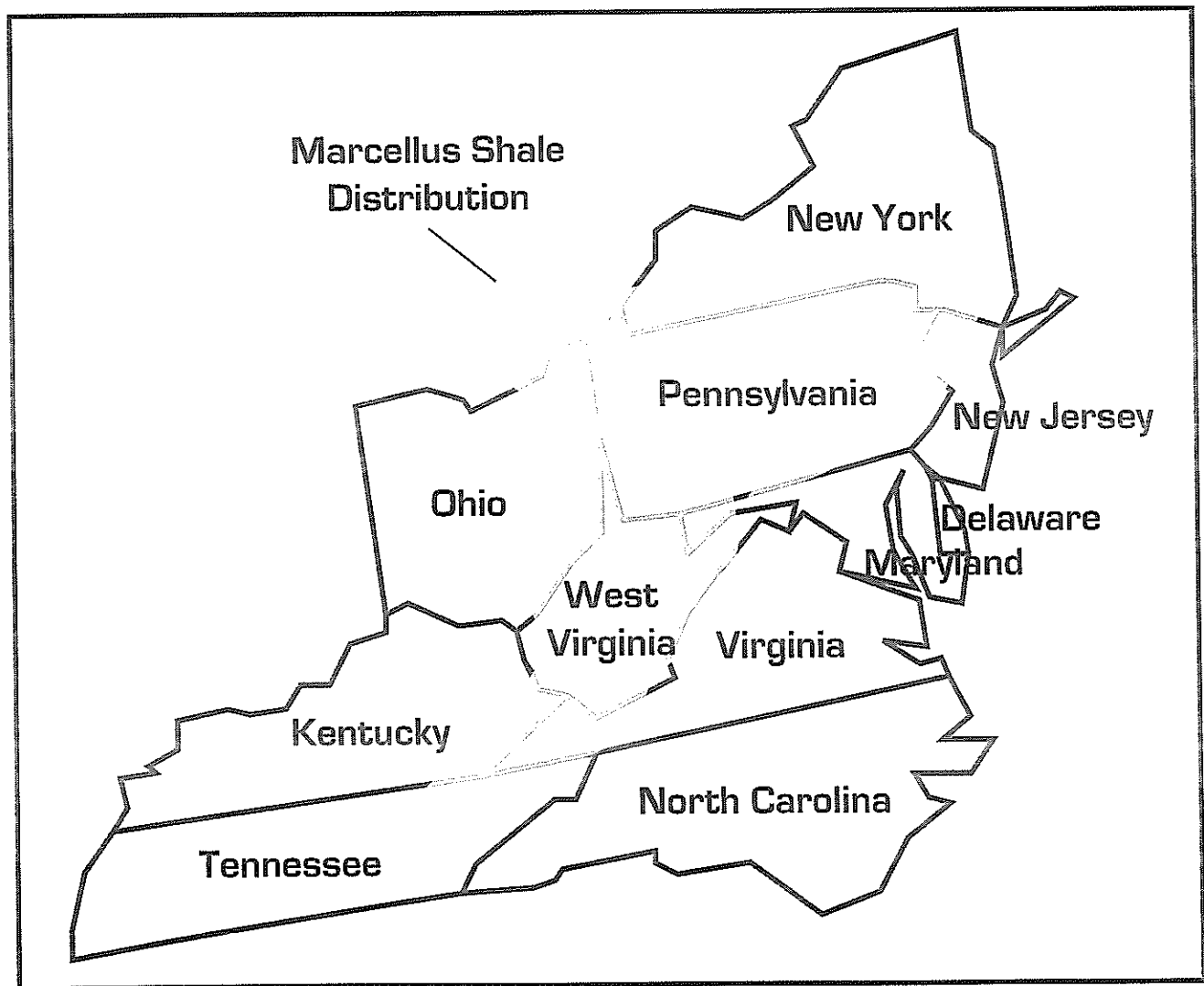
Marcellus Shale Overview

The Devonian Marcellus Formation (or Marcellus Shale) lies 300 to 6,000 feet below the Allegheny Plateau Region of North America and covers 54,000 square miles, running through Ohio, West Virginia, across Pennsylvania and into New York's Southern Tier. The formation also touches small areas of Maryland, Kentucky, Tennessee, and Virginia. It gets its name from the original exposed portion of shale (outcropping) found near Marcellus, New York during a geological survey in 1839.

The shale itself is a fine-grained sedimentary rock that is formed when quartz and clay minerals or mud are compacted by pressure over an extended period of time. Shale has a very compressed layer structure and such low permeability that it releases

gas very slowly. Shale is rich in organic material and sufficiently brittle but rigid enough to maintain open fractures. Natural gas found in shale is held in its own natural fractures, pore spaces, and on the surface of the organic material is released over time as the pressure in the shale decreases.

The Marcellus shale layer becomes thicker from west to east beginning at about 50 feet in Ohio to more than 100 feet thick in Pennsylvania and New York. Geologists have known about the gas here for years, but the shale has been virtually impossible to permeate – until now. Thanks to recent improvements in horizontal drilling and hydraulic fracturing, and an upturn in the price of natural gas, recovering natural gas in the Marcellus formation has become a viable option.

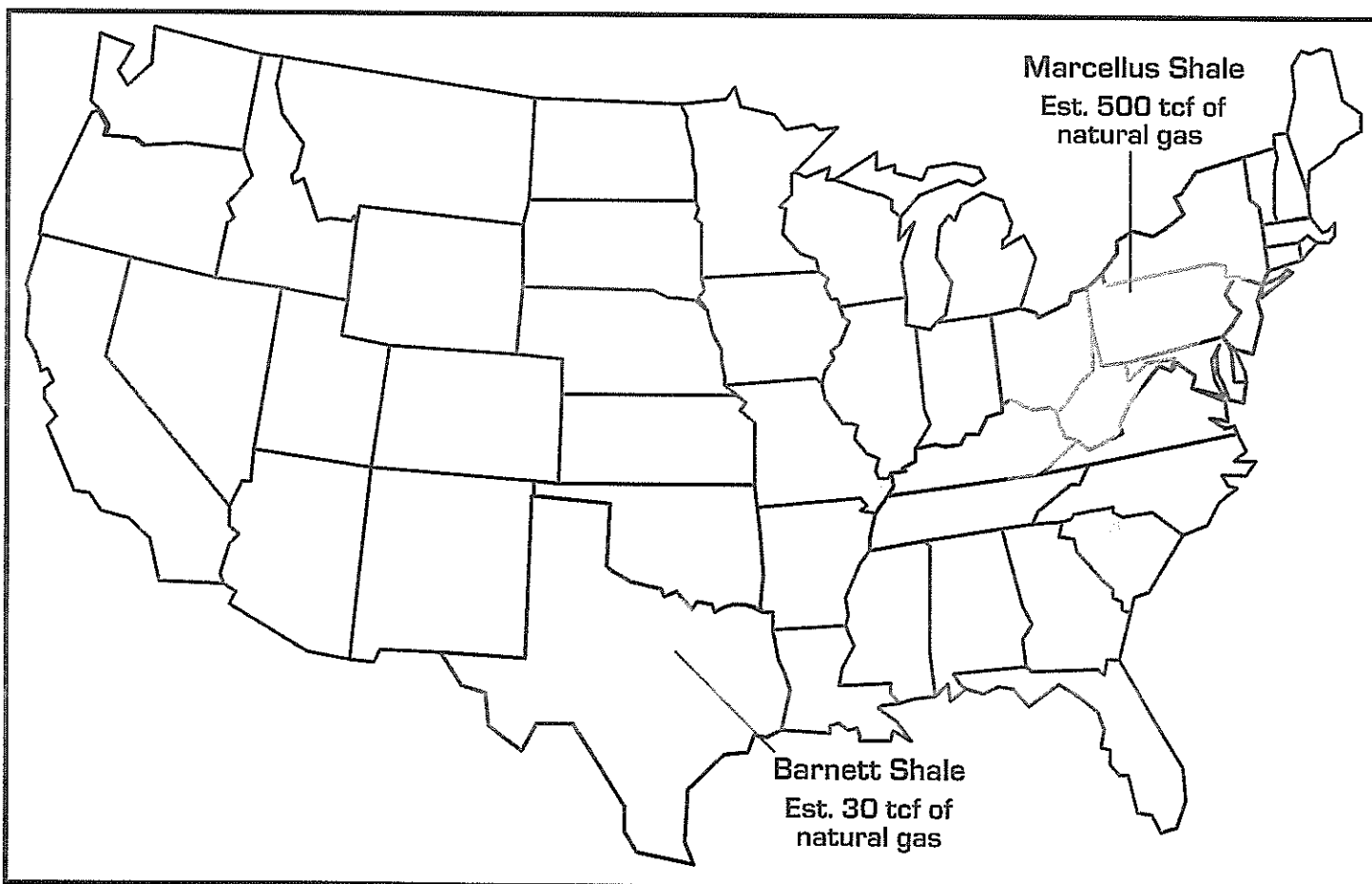


Economic Benefits of the Marcellus Shale

Coined America's next super giant in natural gas production, the Marcellus Shale formation is twice the size of the Barnett Shale of Texas, which until recently was regarded as the largest shale formation in the U.S. Research conducted by Pennsylvania State University and the State University of New York at Fredonia suggests that the Marcellus formation may contain more than 500 trillion cubic feet (tcf) of natural gas. Utilizing some of the same new drilling technology that has been used in the Barnett Shale, perhaps 10 percent of that gas – 50 tcf – might be recoverable, maybe more. That volume of natural gas would be enough to meet demand for all of the U.S. for about two years – an estimated value of one trillion dollars.

The Barnett Shale formation, which stretches from Dallas to west of the city of Fort Worth and covers

approximately 5,000 square miles, can be used to forecast the economic benefits that Marcellus Shale formation could yield. To date, the Barnett Shale formation has generated thousands of jobs and tens of billions of dollars in investments. The field has yielded 2.5 tcf of natural gas, and is widely estimated to contain as much as 30 tcf of natural gas resources. Further, the total effects of Barnett Shale activity (based on year-end 2007 levels) were found to include \$8.2 billion in annual output, \$2.4 billion in annual retail sales, and 83,823 permanent jobs. This level represents a significant gain from the prior year – more than 50% from the estimated impact of almost \$5.2 billion in annual output and 55,385 permanent jobs in 2006. Based upon this, it is reasonable to predict huge economic benefits for New York if the Marcellus Shale formation is developed.



The Facts about Hydraulic Fracturing

Application of hydraulic fracturing techniques, to increase oil and gas recovery, is estimated to account for 30 percent of U.S. recoverable oil and gas reserves and has been responsible for the addition of more than 7 billion barrels of oil and 600 trillion cubic feet of natural gas to meet the nation's energy needs.

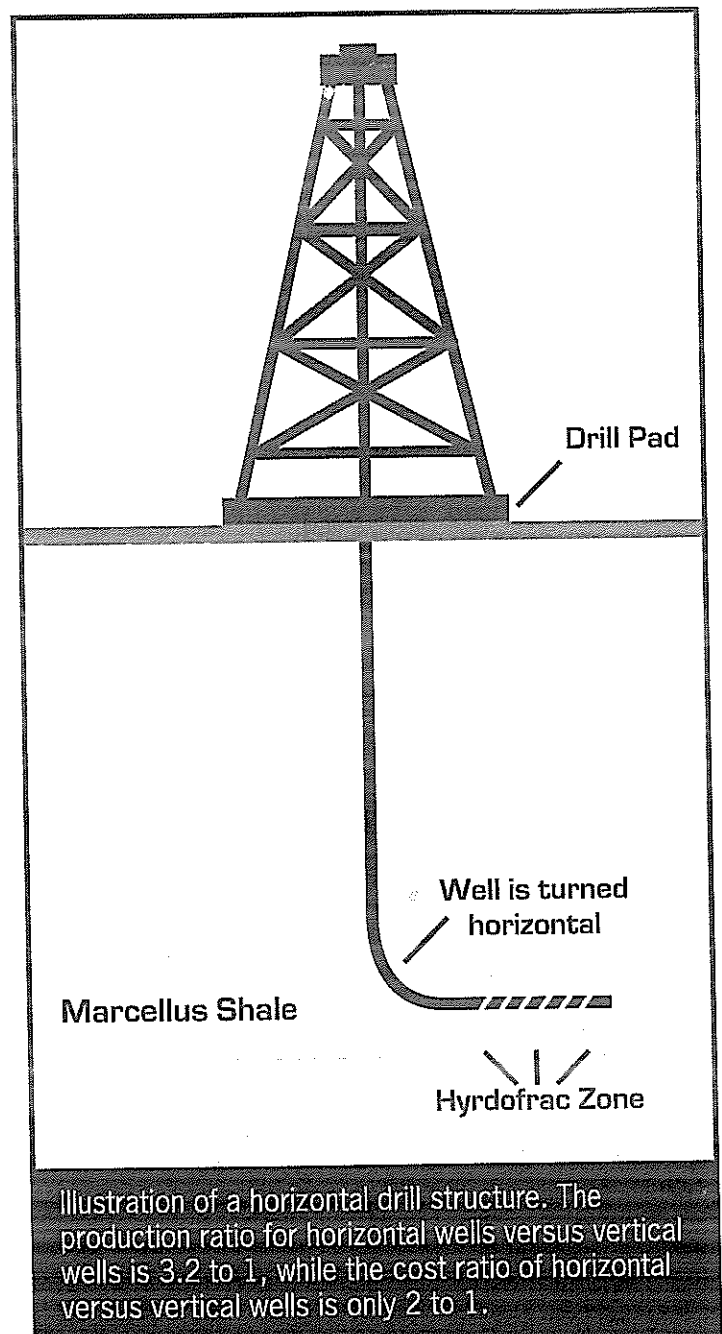
Horizontal Drilling

Horizontal drilling is a technique often used to help encourage natural gas production. Unlike traditional vertical drilling techniques, horizontal drilling is more economical, as multiple wells may originate from the same "drill pad" (the use of which is required under a new law in New York), and has the ability to extract more production from the well. Horizontal drilling provides great access with a smaller footprint on the surface. Multiple horizontal wells from a single drilling pad could drain 200-640 acres disturbing very little of the natural habitat above.

In this technique, drilling begins with a central vertical wellbore descending to just above the Marcellus Shale. At that point, the drill makes a gradual 90 degree turn and drills horizontally for up to 3,000 feet.

The first phase of the drilling is designed to protect ground water aquifers. An initial wellbore is drilled well below aquifer levels. Thick steel pipe is then placed in the hole and sealed with cement on the outside of the pipe. With the fresh water zones now protected from invasion, drilling recommences to the deeper zones of interest and when this depth is reached, a second string of steel pipe is run inside the first and additional cement is used to provide a permanent seal. This procedure will now allow for a double wall of steel plus cement protecting the fresh water zones from any chance of contamination. The design for this pipe and integrity of the well exceeds all specifications by regulatory authorities.

After penetrating the shale, the rock must be hydraulically fractured, or "fraced", to maximize the production of natural gas from the Marcellus Shale. A fracture stimulation fluid comprised of fresh water, sand, and additives is injected into the well under high pressure to enhance fractures in the rock and free more gas. These fractures start at the wellbore and extend as much as several hundred feet into the shale.



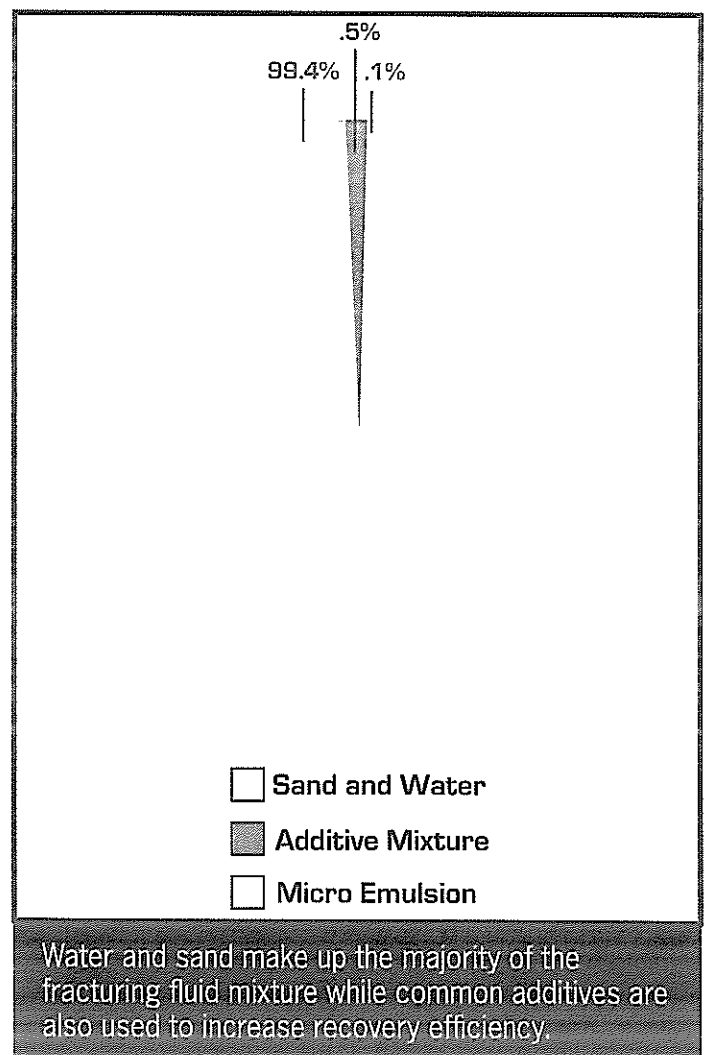
The Facts about Hydraulic Fracturing

The Process of Hydraulic Fracturing

The vast majority of the nation's newly drilled natural gas wells do not produce gas at sufficient rates to make a well economically viable. Hydraulic fracturing is a technique used to allow natural gas to move more freely from the rock pores where it is trapped to a producing well so it can be brought to the surface at higher rates. This technique is done by sealing off a portion of the well and fracturing fluids under very high pressure into the isolated portion of the hole. The high pressure fractures the rock and pushes the fractures open. This technology was developed in the late 1940s and has been continuously improved upon since that time.

During hydraulic fracturing, "fracturing fluids" consisting primarily of water and sand are injected into the producing formation under high pressure. Sand, a "propping agent", is pumped into the fractures to keep the rock from closing when the pumping pressure is released, allowing the natural gas to migrate from the rock pores to the surface wellbore. Water and sand typically make up 99.5 percent of the liquid phase of fracturing fluids. The remaining .5 percent contains three primary additives: A friction reducer, similar to Canola oil, which thickens the liquid; and a bactericide, like Chlorine used in swimming pools and hot tubs to kill bacteria. The fracture fluid also contains a 0.1

percent portion of a micro emulsion element, a lubricant, similar to those found in personal care products. This additive ensures coating of the formation and effective fracture fluid recovery.



Minimizing the Environmental Impact

Beyond full compliance with all applicable state and federal environmental rules and regulations, IOGA of New York recommends that its members perform extensive supervision and inspections during all phases of operations from surveying, drilling, and pipeline construction through production and final reclamation.

Our members have exemplary safety and environmental records and work to ensure that all property and roads are ultimately restored to equivalent or better condition that they were when exploration operations began.

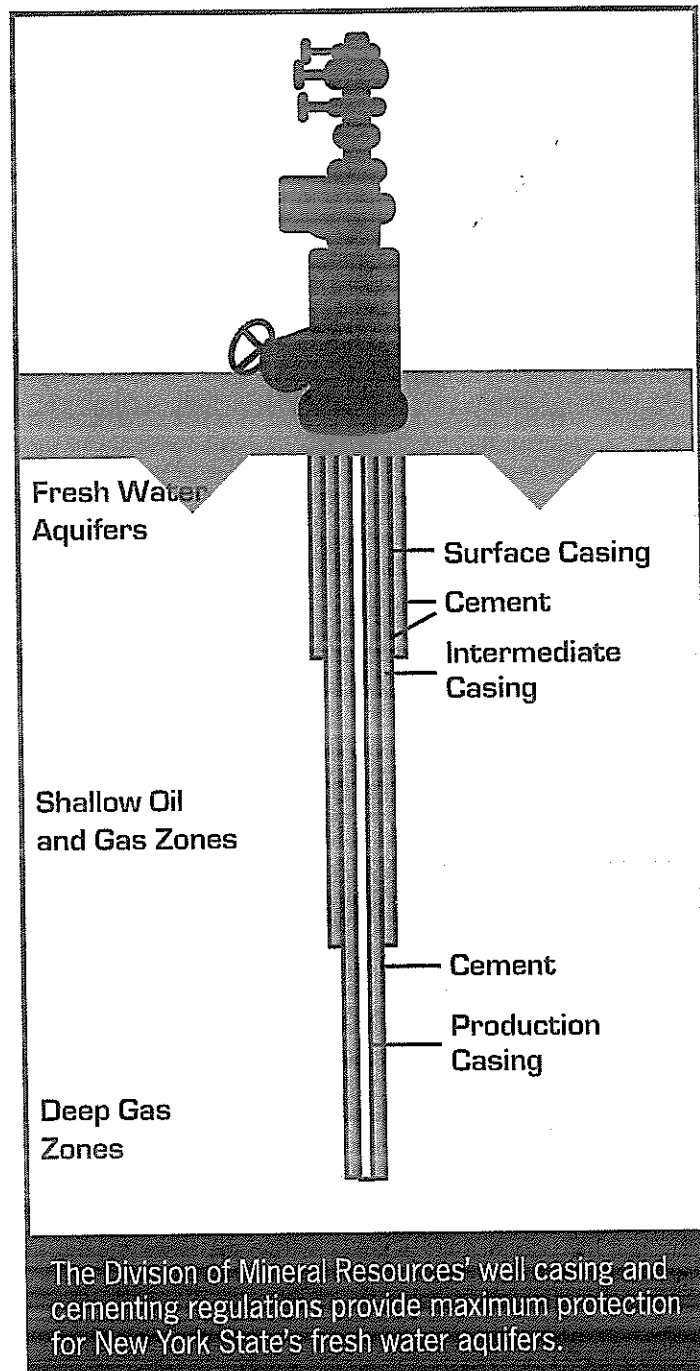
Noise and Traffic

During the drilling and fracing period, there will be an unavoidable increased flow of traffic, with the potential for dust and noise due to heavy equipment in the area. To minimize the adverse impact to local communities, dirt roads are sprayed with water and calcium to keep dust down. In order to mitigate traffic disruptions, movement schedules are provided to local fire districts, emergency services centers, and traffic departments. Activities are scheduled around school bussing hours and community events whenever possible and on roads that will not be damaged by these temporary conditions.

Water Use, Storage and Disposal

All natural gas operators currently using or planning to use water to develop natural gas wells in the Marcellus Shale formation in the Susquehanna watershed must have approval from the Susquehanna River Basin Commission (SRBC). The same is true in the Delaware River watershed which requires approval from the Delaware River Basin Commission (DRBC). Both the SRBC and the DRBC make frequent well site inspections, monitor all water withdrawals and handle the disposal of

all fluids. Cease and desist orders have and will be issued to companies not in compliance with either the SRBC's or DRBC's stringent standards. The SRBC's and DRBC's approval process is a critical step in environmental protection while supporting the development of a potentially viable energy source.



Regulatory Guidance

New York's Oil and Gas Regulatory Program

Hydraulic fracturing has been used for decades in New York. In 1963, the State's oil and gas regulatory program was established and has been through two substantial revisions – the first in 1981 and the second as recently as 2005. Since that time, the program has effectively protected New York's ground water and drinking water sources. This has been accomplished through the administration of this comprehensive program by the State's Department of Environmental Conservation (DEC) through a permitting program and regulations that mitigate, to the greatest extent possible, any potential environmental impact of drilling and well operation.

To protect the environment during and after oil and gas extraction, DEC imposes strict drilling permit requirements that inhibit oil spills, prevent ground water contamination and require proper disposal for all wastes and proper containment of drilling and fracturing fluids. Drilling permits also protect groundwater by mandating a casing and cementing program for each well, which prevents the flow of oil, gas or salt water between underground formations. Drilling rules and regulations require setbacks from municipal water wells, surface water bodies and streams. Further, the DEC reviews all oil and gas drilling permits in accordance with the State Environmental Quality Review Act (SEQR) to ensure that the environmental impact of resource extraction will be mitigated to the greatest extent possible. The end result is effective oversight of hydraulic fracturing and ample protection of the State's ground water and drinking water sources.

Safe Drinking Water Act

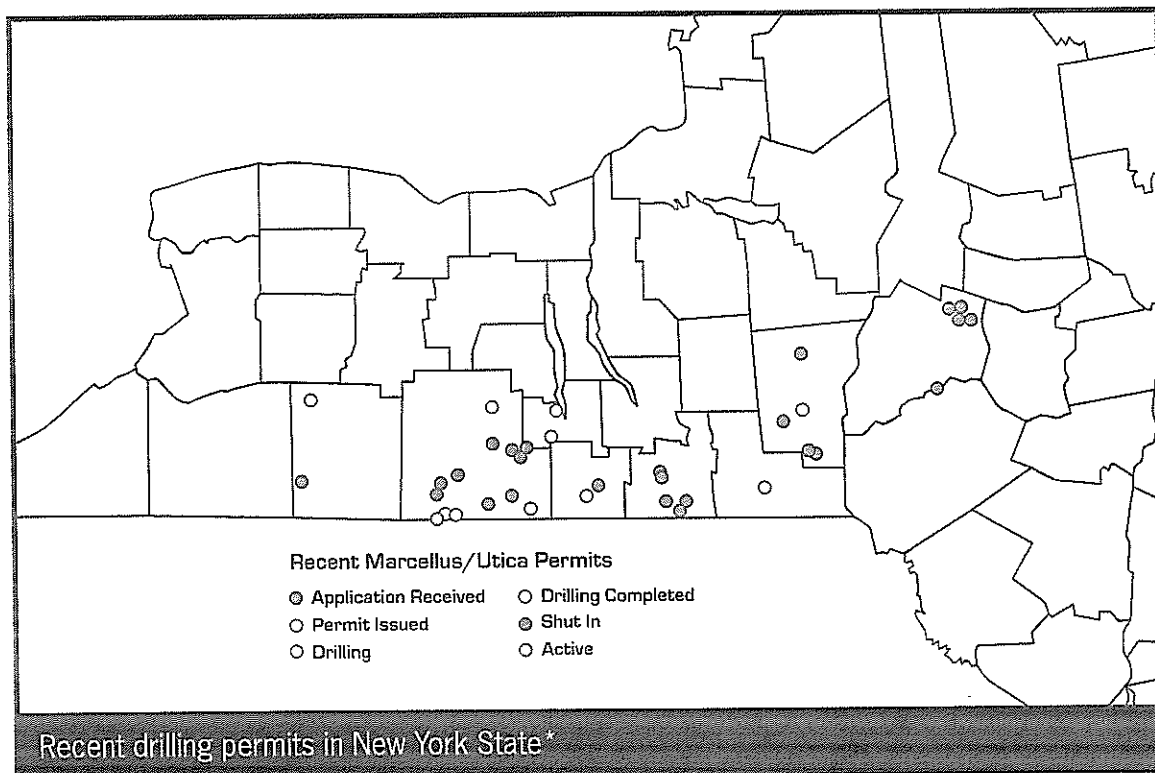
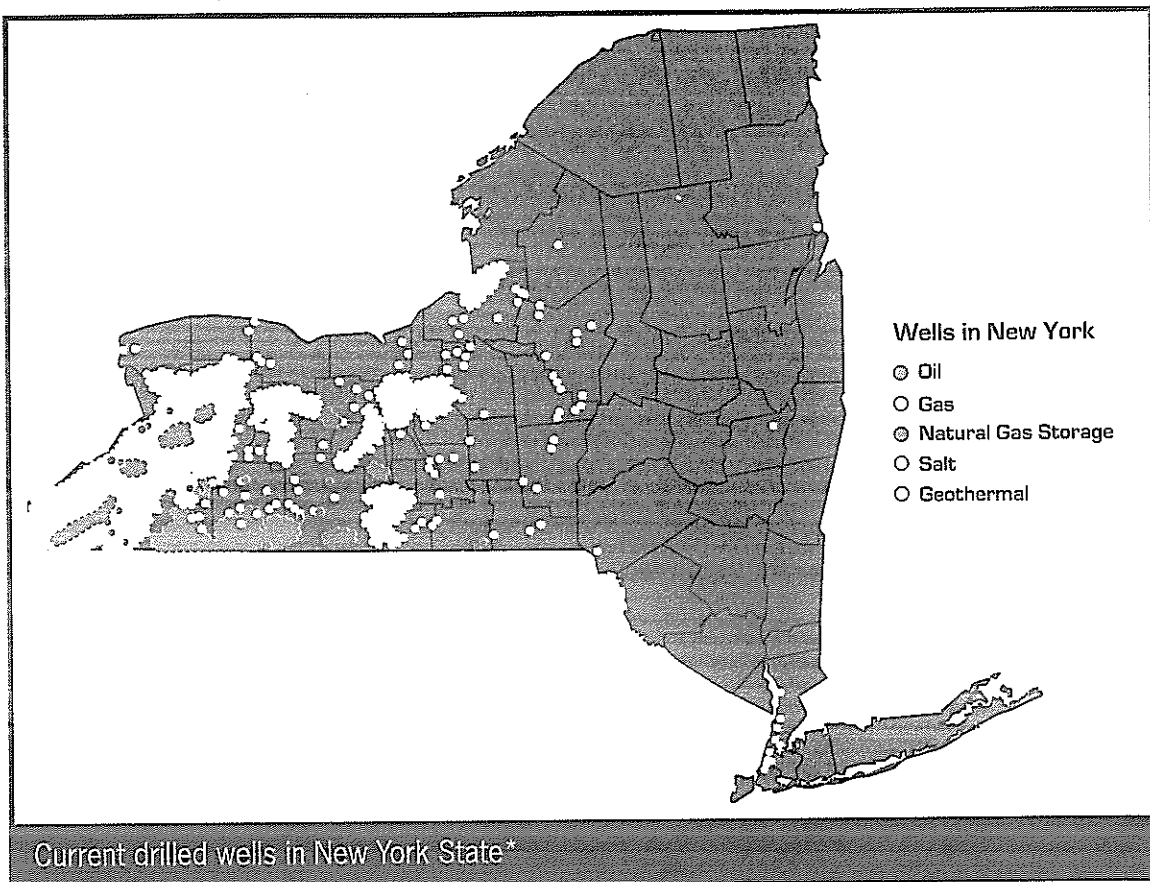
Congress enacted the Safe Drinking Water Act (SDWA) in 1974. By then, hydraulic fracturing had been used for 25 years with no environmental problems. Under the SDWA, states developed

extensive underground injection control (UIC) programs to manage liquid wastes and produced waters. These programs addressed injected liquids, including those intended to remain in underground geologic formations however they did not include hydraulic fracturing.

In 1980, Congress recognized that many states had their own injection programs in place, so they modified the SDWA to give states the option of gaining federal "primacy" for existing injection programs based on the demonstrated effectiveness of state oil and gas UIC programs. And even though hydraulic fracturing was not covered under the UIC program, litigation in the 1990s made Congress realize they needed to clarify the hydraulic fracturing issue.

The Energy Policy Act of 2005 (EPAAct) addressed hydraulic fracturing by preserving the state regulatory system that has worked so effectively for the past half century. EPAAct spelled out that the SDWA was not the appropriate law for regulating hydraulic fracturing with one exception. During the previous referenced analysis of environmental risk from hydraulic fracturing, EPA hypothesized that the use of diesel fuel as a solvent in the fracturing process of coalbeds might pose a risk. While no incidents of actual damage were identified, Congress preserved the option for the application of the SDWA for regulation of hydraulic fracturing if diesel fuel was utilized.

When the Ground Water Protection Council (GWPC), an association of state regulators, studied the environmental risk of hydraulic fracturing, they found one complaint in the over 10,000 coalbed methane wells reviewed. Subsequently, EPA initiated its own study of coalbed methane hydraulic fracturing environmental risks. EPA released its completed study in June 2004. This study confirmed that there are no significant environmental risks from hydraulic fracturing when properly executed.



*Maps recreated from New York State Department of Environmental Conservation presentation, Marcellus Shale Exploration - Energy Development and the Environment, 6/15/08

Additional Marcellus Shale Resources

MarcellusFacts.com - Informational Blog about the Marcellus Shale

Website: <http://www.marcellusfacts.com>

Marcellus Shale - Appalachian Basin Natural Gas Play

Website: <http://energy.com/articles/marcellus-shale.shtml>

ShaleBlog.com - News about Natural Gas from Shale

Website: <http://shaleblog.com/category/marcellus-shale/>

New York State Department of Environmental Conservation – Marcellus Shale Information

Website: <http://www.dec.ny.gov/energy/46288.html>

Cornell Cooperative Extension Natural Gas Exploration and Leasing Resources for New York State

Website: <http://blogs.cce.cornell.edu/gasleasing/>

Times Herald-Record - Drilling for Dollars: The Rush for Gas in Sullivan County

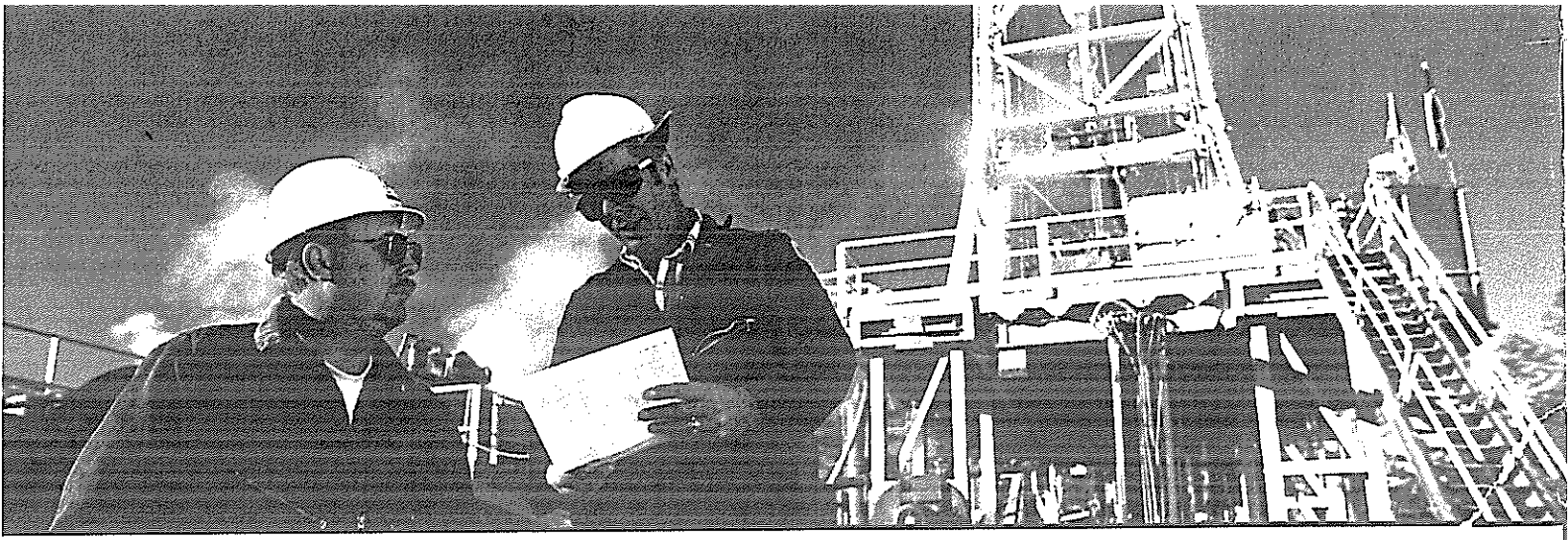
Website: <http://www.recordonline.com/apps/pbcs.dll/section?Category=NEWS58>

DRBC – Natural Gas Drilling in the Marcellus Shale Formation

Website: <http://www.state.nj.us/drbc/naturalgas.htm>

SRBC - Marcellus Shale and Natural Gas Well Development

Website: <http://www.srbrc.net/programs/projreviewmarcellus.htm>



About IOGA of New York

IOGA of New York is a trade association, founded in 1980, to protect, foster, and advance the common interests of oil and gas producers, professionals, and related industries in the State of New York.

Comprised of members from numerous states throughout the country, we represent most of the larger oil and gas operators and producers in New York State, as well as many smaller independent companies.

Our association aggressively interacts with local, state and federal agencies and

representatives regarding regulations and issues affecting the oil and natural gas industry in New York State.

IOGA of NY takes great pride in its commitment to members by organizing informative workshops, seminars, and technical meetings in an effort to provide educational opportunities and promote technology transfer within the industry.

To learn more about IOGA, visit our website at <http://www.iogany.org>

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**Independent
Oil & Gas Association**
of New York

Testimony of Bruce Baizel, Senior Staff Attorney

Oil & Gas Accountability Project,

a program of Earthworks

P.O. Box 1102

Durango, Colorado 81302

for the

Committee on Environmental Protection,

James F. Gennaro, Chair

Council of the City of New York

September 10, 2008

I. Introduction

Thank you for the opportunity to present testimony related to Natural Gas Drilling in the New York City Drinking Water Watershed. I am the Senior Staff Attorney for the Oil & Gas Accountability Project (OGAP), a program of Earthworks. Our mission is to work with communities to address and reduce the impacts of oil and gas development.

My testimony is based upon OGAP's experience with oil and gas development during the past decade. In particular, I am drawing upon my experience as an appointed member of the New Mexico Governor's Pit Rule Task Force, OGAP's formal participation in three sets of state rulemakings covering all aspects of oil and gas development over the past 3 years and OGAP's development of, and support for, successful surface owner protection legislation in Colorado and New Mexico.

In addition, my testimony draws upon OGAP staff research and involvement in EPA processes regarding coalbed methane development and hydraulic fracturing. During this involvement, OGAP staff prepared Our Drinking Water at Risk (2005) and The Oil and Gas Industry's Exclusions and Exemptions to Major Environmental Statutes (2007).

We have also produced the Oil and Gas at Your Door? A Landowner's Guide to Oil and Gas Development (2nd Ed., 2005), the preeminent guide for landowners facing the prospect of oil and gas development on their land.

Finally, in response to numerous inquiries from individuals, organizations and local governments, OGAP produced Marcellus Gas Shale – A Report (2008) earlier this year, which discusses what can be expected from gas development in the Marcellus shale.

My testimony will first address the three main risks to water posed by gas development: well drilling and production, hydraulic fracturing and transportation of fluids to and from the wellsite. I will then briefly describe some specific incidents that illustrate these risks in a number of different states. Then, I will briefly discuss the current New York regulations most applicable to the risks associated with gas development. Finally, I will present some of the solutions that other municipalities and states have developed to try to address these risks.

II. Contamination Risks to Water from Gas Development

It is important to keep in mind that gas development is an industrial activity. The operations associated with gas development, no matter where they take place, generally follow a similar pattern of scope and intensity. It is also important to keep in mind that gas development will take place over a 20 to 30 year time frame. It is not a simple, once in and out kind of operation, particularly in the case of the Marcellus shale.

There are a number of potential environmental and public health impacts associated with each stage of gas development – exploration, drilling, production, treatment of the gas, and plugging and abandonment of wells. These impacts include loss of land value due to surface disturbance, contamination of ground and/or surface waters, human or animal

health effects related to ground and/or surface water contamination, erosion or sedimentation, loss of wildlife habitat, and air and soil degradation.

Based upon experience with gas development elsewhere, the most important risks from the perspective of protecting the New York City water supply are those that might result in the release of hydrocarbons and other contaminants to the land surface, into soils and groundwater or into surface waters. Releases of these contaminants may occur in a single event, such as a spill, or over longer periods of time, through seepage from drilling or fracturing pits, or from slow leaks in pipes and storage tanks. Spills are the most common type of release and may be small or large in volume. These spills and seepage result from human error, equipment failure, transportation accidents, improperly designed containment facilities, vandalism, or natural phenomena, such as floods or storm events.

These releases and subsequent contamination are not just theoretical, but are real events that have been documented across the gas fields of the United States today. For example, New Mexico has experienced significant impacts to its water resources from oil and gas development. Between 1992 and 2000, the New Mexico Oil Conservation Division (OCD) documented over 700 groundwater contamination events due to oil and gas development.¹ As a consequence, New Mexico has recently completed a revision of its rules related to drilling and fracturing fluids and how oil and gas wastes are handled following the completion of a well. The experience in New Mexico has led to a far stronger emphasis in regulation on prevention of the risks of contamination, and a shifting of the liability and cost of contamination from the public to the gas company.

The New Mexico experience, based upon testing, has also shown that many of the contaminants released by oil and gas development are hazardous and even toxic to public health and the environment. The New Mexico OCD conducted an analysis of drilling and production pits in 2007 and found that many of these pits contained high enough levels of heavy metals and other hazardous constituents, e.g., naphthalene, benzene, and toluene, to be considered Superfund Sites.² In fact, a report prepared by the OCD staff stated that: “except for the RCRA Exemption, ... constituents were present at concentrations that would be characteristically hazardous at other sites”.³

There has been a similar experience in Colorado. OGAP’s review of that state’s database, as part of a formal rulemaking proceeding, found that over 1500 reported spills/releases have occurred since January of 2003. Of these 1500, over 20% have impacted ground and/or surface water.⁴ The oil and gas industry submitted its own study to the Colorado Oil and Gas Conservation Commission this past summer. The industry’s testing results

¹ New Mexico oil Conservation Division, *Generalized Record of Ground Water Impact Sites*, September 30, 2005. Available at: <http://www.emnrd.state.nm.us/ocd/Statistics.htm>.

² New Mexico Oil Conservation Division, *Analytical Results of OCD’s Pit Sampling Program* (2007). Available at: <http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>.

³ New Mexico Oil Conservation Division Presentation by Staff at Pit Hearing #14015, Exhibit #15, *OCD’s 2007 Pit Sampling Program: What is in that pit?* (November 2007).

⁴ Oil & Gas Accountability Project, *Colorado Oil and Gas Industry Spills: A Review of COGCC Data (January 2003-March 2008)*, April 23, 2008. Available at: <http://www.ogap.org>.

were above state groundwater standards for benzene and toluene for samples taken in each of the four major oil and gas development basins.⁵

Impacts to water sources from the transportation of produced water, waste pit contents and hydraulic fracturing (fracing) fluids are also of great concern. According to Schlumberger, an oil and gas service company, for almost all gas shale wells the rock around the wellbore must be stimulated or hydraulically fractured before a well can produce significant amounts of gas.⁶ This fracturing process, as well as others during the life of a well, requires hundreds of large trucks to haul the stimulating and fracing constituents. Not only does this impact the roads and residents with noise and dust, but it also creates the inevitable consequences of trucking accidents - accidents that can involve large volumes of hazardous materials.

For example, residents in the area of the Barnett shale in Parker County, Texas are already experiencing tremendous amounts of truck traffic – approximately 100 trucks per day in a neighborhood that, as yet, only has 10 wells drilled out of the 30 planned for development. Citizens living in older gas fields, such as those in Colorado, also know the consequences of heavy truck traffic on their neighborhoods and water resources. In 2005, a Halliburton truck released over 300 gallons of acid into the Colorado River when the truck overturned. In 2006, another Halliburton truck spilled diesel fuel into the Colorado River as a result of an accident.⁷

III. Specific Incidents

The following incidents illustrate that the spills and releases occur in a variety of ways, through drilling, waste pits and hydraulic fracturing, affecting both people and their water.

Hydraulic Fracturing: A couple in Garfield County, Colorado had their water well explode after fracturing activities began on the neighboring property (approximately 1000 feet from their house). They could light their water on fire because of the high levels of methane, although the agency initialing maintained that the methane was naturally occurring. It wasn't until the impacted woman developed a rare adrenal gland tumor and pursued her case with the legal help, and the assistance of a scientist, that more tests were

⁵ Colorado Oil and Gas Association, Rebuttal Statement Exhibits 10 - 5 & 10 - 6, Colorado Oil and Gas Conservation Commission Hearing Docket #0803-RM-02 (2008). Available at: <http://cogcc.state.co.us/RuleMaking/2007RuleMaking.cfm>.

⁶ Oil & Gas Accountability Project, *Shale Gas: Focus on the Marcellus Shale* (May 2008). Available at: <http://www.ogap.org>.

⁷ Department of Homeland Security, *Dept. of Homeland Security Daily Open Source Infrastructure Report* (November 11, 2006). Available at: http://osd.gov.com/osd/200611_November/DHS_Daily_Report_2006-11-22.pdf.

completed showing that methane and other chemicals, including 2-BE, had in fact gotten into their water because of the drilling and fracturing activities.⁸

Drilling and Fracturing Fluids from Pits: A rancher in southwest Colorado came home a day after a well had just been completed on the neighboring property, approximately 400 feet from his house. He took a drink of water from his kitchen sink and immediately spit it out because of the bad taste. The regulating agency in Colorado determined that an unlined drilling pit had been used and that fluids from that pit had contaminated the rancher's domestic water well. Another Coloradoan recently visited his hunting cabin in the western part of the state to find that his water well had been contaminated. The gentleman took a drink of water from his tap and immediately felt a burning sensation in his mouth and throat. He was taken to the hospital for treatment, as testing of his water revealed that it contained benzene – a known carcinogen. The regulating agency has issued notices of alleged violation to several companies and the exact source of contamination remains under investigation.⁹

Waste Drilling Fluids: This past winter, as a result of at least four pit-related leaks near the Garden Gulch area in northwest Colorado, a frozen waterfall of pit sludge threatened the land and irrigation surface waters of area residents, and would eventually make its way into the Parachute Creek watershed. The release came from leaks at the bottom of pits and traveled through fractured shale until it reemerged as a frozen waterfall over a cliff. This winter spill only came to light as a result of a fly-over by a private plane. The regulating agency has confirmed that the spills were from pits, has issued notices of alleged violation, and is working towards remediation.¹⁰

Water Well Contamination: On August 26, 2008, the Pinedale (Wyoming) Anticline Working Group released its annual report on area ground and surface water quality for the Pinedale gas field. The report revealed that a number of water wells in the area were contaminated. The Sublette County Conservation District (SCCD) performed the yearly analysis, testing for a number of chemicals, including chloride, fluoride, sulfate, and total dissolved solids. Beginning in spring 2008, some wells were also tested for total petroleum hydrocarbons (TPH), which measures the diesel range organics (DRO) and gasoline range organics (GRO) of the water.

In its annual report, the SCCD gave results from 257 samples, taken from 220 wells. These included industrial wells, stock wells and domestic wells. 23 percent were above accepted limits for drinking water.¹¹

⁸ Oil & Gas Accountability Project, *Oil & Gas at Your Door? A Landowners Guide to Oil and Gas Development*, pg. IV 23 – IV 25 (2005).

⁹ Article pertaining to the contamination can be found at:
<http://www.postindependent.com/article/20080701/VALLEYNEWS/270473249/1001&parentprofile=1074>

¹⁰ Article pertaining to the spills in the Garden Gulch area can be found at:
<http://www.postindependent.com/article/20080315/VALLEYNEWS/877853434>

¹¹ Article pertaining to the contaminated wells in Pinedale, WY can be found at:
http://www.pinedaleroundup.com/V2_news_articles.php?heading=0&story_id=788&page=72.

House Explosion and Hydraulic Fracturing: On December 15, 2007, the Geauga County Emergency Management Agency notified an Ohio Department of Natural Resources, Division of Mineral Resources Management (DMRM) Inspector that there was an explosion at a house in Geauga County, Ohio. Two residents in the house at the time of the explosion were not injured, but the house was significantly damaged.

The Bainbridge Township Fire Department and Dominion East Ohio personnel recognized that natural gas was entering homes via water wells. The DMRM subsequently determined that accumulation and confinement of deep, high-pressure gas in the surface-production casing annulus of a recently drilled gas well resulted in the migration of gas into natural fractures in the bedrock below the base of the cemented surface casing. The pressure associated with the hydraulic fracturing of the well contributed to the gas migrating vertically through fractures into the overlying aquifers before exiting the aquifers through local water wells.¹²

IV. Brief Assessment of NY Regulations

OGAP staff has recently begun a detailed review of New York's oil and gas regulations, as compared with other state regulations. Our initial review indicates that the current New York state oil and gas regulations do not seem adequate to protect public health and the environment. Comprehensive regulations that require operators to maintain chemical inventories, residential setbacks, best management practices, and exclusionary buffer zones are currently in use around the country. These regulations are not in place in New York and should be incorporated into the New York regulatory scheme prior to development in the Marcellus Shale.

Specifically, the current setback for public water sources provided in 6 NYCRR § 553.2 is 50 feet. The incidents mentioned above clearly show that contaminants can travel considerably farther than 50 feet. Colorado is currently considering a buffer zone of 300 feet within municipal watersheds, Proposed Rule 317B, based on these incidents and many others that have threatened the quality of ground and surface water sources.¹³

Further, the regulations for waste pits provided in 6 NYCRR § 554.1 do not address drilling fluids. Waste pits that contain drilling fluids do not have to be lined, cleaned up and wastes disposed of in a permitted facility, or even monitored for potential seepage into groundwater sources. As was found in studies conducted by Colorado and New Mexico, drilling fluids move very rapidly, in air or in soil and water, can be hazardous and can be very expensive to clean up, if not properly managed. New Mexico has implemented considerably stricter standards for all waste pits, which have almost

¹² Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio, September 1, 2008, Ohio Department of Natural Resources Division of Mineral Resources Management.

¹³ Information regarding the proposed Colorado oil and gas regulations can be found at: <http://cogcc.state.co.us/>.

effectively eliminated them completely from the southwestern part of the state. Colorado is in the process of overhauling all of its rules, including those that apply to waste pits.

There are currently over 14,000 active wells in the state of New York.¹⁴ This number is expected to grow exponentially over the next 30 years, as the Marcellus shale begins to be developed. While OGAP could not get a firm confirmation of staffing levels from the Bureau of Oil and Gas Regulation, we believe that there are three compliance and environmental enforcement staff. If the Marcellus shale develops quickly, it is physically impossible for this level of staffing to adequately handle this level of growth, particularly given that the current NY regulations are based on a reactive standard rather than a proactive one.

V. Possible Approaches

In thinking about possible approaches to protecting New York City's drinking water, there are a number of suggestions that can be made, based upon experience elsewhere.

1. A Voice at the Table. At the most general level, municipalities and landowners have consistently found that they need a direct voice in the permit process. As with most states, the New York Bureau of Oil and Gas's mission is mostly focused on the development of the resource, not on protecting drinking water. It would be a mistake to expect otherwise. Therefore, the user of the water needs to establish a formal role in any drilling permit application process. Trying to get others to protect the water, or trying to influence how permits are administered after the fact does not result in good protection.

2. Prevention first. The hydrocarbons and chemicals at the heart of this industrial activity are notoriously mobile and (often) hazardous to health. Trying to chase down benzene, salts, heavy metals or polymers once they have been released into the soil or water is difficult, expensive and often unsuccessful. Therefore, building prevention measures into any gas drilling regulations is the most effective approach to protecting the water resource.

Two items in particular are critical to reducing the risk of contamination of water. First, the use of pitless drilling systems (sometimes called closed-loop drilling systems) should be mandatory within the city's drinking water watershed. The use of drilling mud or fracing fluid pits is not operationally required, is one of the single biggest contamination risks and represents a significant liability risk for the operator.¹⁵ Lovington, New Mexico, Palisade and Grand Junction, Colorado, and now the state of Colorado have required pitless drilling or are about to require pitless drilling.

Second, any drilling regulations must require that the drilling site and related facilities be cleaned up to 'multiple-use' standards upon completion of gas development. By this, I mean incorporating any state hazardous waste numeric standards, for constituents such as hydrocarbons, chlorides, and heavy metals, in particular, into the gas drilling closure

¹⁴ <http://www.dec.ny.gov/energy/205.html>.

¹⁵ Oil & Gas Accountability Project, *Closed-loop drilling systems – a cost-effective alternative to pits* (2007). Available at: <http://www.earthworksaction.org/alternativestopits.cfm#CLOSEDLOOP>

regulations. Experience in other states has shown very clearly that having such a clean-up standard at the end of the line focuses the operator's attention on his operations during the life of the well. In order to avoid heavy clean-up costs down the road, the operators find ways to minimize their waste production and handling in salutary ways, which has the effect of reducing the risks of contamination to water resources, for example. After all, a gas well's life is only 20 to 30 years, not forever. So it is reasonable to expect that the site should be maintained and then left available for any other subsequent use once the well is gone.

3. Build in buffers. Despite the best planning and intentions, accidents and releases will still happen during gas development. Recognizing this, regulators and governments are trying to put in place mechanisms that build in physical or temporal separation between the source of contamination and the significant public resource that needs protection. These buffers provide additional opportunities for remediation efforts to be successful, when there has been a spill or release. They accomplish this by putting in place 'no drill' setbacks along watercourses and around water wells.

With the developments in drilling technology that allow directional and horizontal drilling to much greater distances, the use of setbacks is now feasible in a way that was not thinkable when all drilling was simply vertical. Operators can and do move their drilling sites away from watercourses, residences, schools, etc. and still can reach the gas resource.

4. Be prepared. Given the industrial nature of gas development, governments should expect to have to respond to accidents. We increasingly see the involvement of emergency response personnel, whether to a gas well blowout, a gas field worker doused in drilling fluids or fire department personnel responding to a tanker truck lying on its side in a stream. In each of these instances, it is crucial that the responders have some idea of the nature and characteristics of any chemicals or constituents involved. That is why the State of Colorado is on the verge of requiring operators to maintain a chemical inventory for each well site. That is why La Plata County and Siltree County are doing the same. It is simply good safety practice.

In the medium term, there is also discussion of requiring the use of 'green' drilling and fracturing fluids. That would help to avoid some of the potential risks to water, workers and adjacent residents. However, we, at OGAP, have not yet seen a well-developed example of this in a regulatory format, although some operators claim the use of 'green' drilling fluids and the offshore drilling regulatory program has some helpful components already in place.¹⁶ It may be that New York City would want to explore this concept with the state to help protect its drinking water.

5. Speed is not the answer. The pace of gas drilling and development is largely a function of an operator's need to generate the largest volume of gas as quickly as possible. We have heard hours of testimony from the supermajor oil companies to small

¹⁶ Information on the availability of "green" drilling fluids at:
<http://web.ead.anl.gov/dwm/techdesc/lower/index.cfm>.

independents, and they all admit this fact. The ultimate volume of gas recovered does not differ significantly if the pace of development is slower; the operators may simply not generate as much revenue in the early part of a gas field's development.

As a consequence, New York City may want to explore with the state the ideas of clustering gas development and phasing it over time. By clustering, I mean focusing permit approvals within a fairly focused area, and not simply allowing drilling everywhere at once. By phasing, I mean requiring the full development of the focused area before allowing development to move into other areas. Otherwise, the development pattern is driven by uncoordinated individual operators and their short-term revenue needs. This nearly always results in increased impacts to water, air, communities and wildlife.

6. Federal regulatory support may be helpful. As OGAP and others have noted, the Energy Policy Act of 2005 exempted hydraulic fracturing from federal regulation under the Safe Drinking Water Act (SDWA).¹⁷ Industry has often confirmed that hydraulic fracturing occurs at least once at 90% of all oil and gas wells. If the experience in the Barnett shale is any guide, each Marcellus shale gas well will require multiple hydraulic fractures over the life of the well. Given the range of chemicals involved, the high pressures used and the potential hazards associated with these chemicals, it may be prudent for New York City to look for assistance in regulating hydraulic fracturing not only with the state, but also with Congress.

Thank you for your time and attention, and I would be glad to answer any questions that you might have.

¹⁷ Oil & Gas Accountability Project, *The Oil and Gas Industry's Exclusions and Exemptions to Major Environmental Statutes* (2007). Available at <http://www.ogap.org>.

Statement of Dusty Horwitt, JD*Senior Analyst for Public Lands, Environmental Working Group*

Oversight Hearing on Natural Gas Drilling in the New York City Watershed
Before the New York City Council Committee on Environmental Protection
Wednesday, September 10, 2008 at 1:00 p.m.

Submitted for the Record

Introduction

Mr. Chairman, distinguished Members of the Committee: My name is Dusty Horwitt, and I am a Senior Analyst for Public Lands at Environmental Working Group (EWG), a nonprofit research and advocacy organization based in Washington, DC, and Oakland, California. I thank the members of the Committee for this opportunity to testify.

For the last several years, Environmental Working Group has used government and industry records to track a virtually unprecedented increase in oil and gas drilling in the Western United States. Higher prices for oil and particularly natural gas have sparked this rush to drill as has the Bush Administration by aggressively promoting energy development on federal land.

To provide some idea of how big this boom is, and what might be in store for New York and other eastern states, consider that between 2001 and 2006 the number of wells drilled on Western lands averaged 12,400 per year, the highest number in at least 25 years and higher even than the 8,200 wells drilled annually during the 1980s when the Reagan Administration opened vast areas of the West to energy companies.

Until recently, seeing a drilling boom like this in New York or other eastern states would have seemed about as likely as Brett Favre coming to play for the New York Jets. But thanks in large part to hydraulic fracturing, the boom is here, and New York City's water quality could be in grave danger.

Environmental Working Group is not opposed to all natural gas drilling. But due to the highly polluting nature of the oil and gas industry, the likelihood that thousands of wells could be drilled, and the multi-billion-dollar cost of building a treatment facility to clean up contaminated water, we strongly recommend that New York officials not allow any drilling in New York City's watershed.

Hydraulic Fracturing

Gas companies have already begun to drill in New York, attracted by a formation known as the Marcellus Shale, located under New York, Kentucky, Maryland, Ohio, Pennsylvania, Virginia and West Virginia. Geologists believe it may contain as much as two years worth of U.S. consumption of natural gas. In New York, the shale extends

under a large portion of the state from Albany to Buffalo including the upstate areas that hold New York City's drinking water supply.

The state Department of Environmental Conservation's website shows that some wells are already operating in the Marcellus Shale west of New York City's watershed. Platt's Oilgram News recently reported that companies have been actively leasing land in Sullivan and Delaware counties that include reservoirs that supply New York City's drinking water. In Sullivan County, Cabot Oil & Gas and another company, Chesapeake, had leased a combined 4,522 acres as of July 30; the county did not lease any acres last year. Delaware County had leased at least 17,000 acres this year. A spokesman for the DEC told Platt's that the state had already issued 500 permits to drill this year compared to 507 in all of 2007. (The state issued some permits for substances other than oil and gas.)

Shale is what is known in the natural gas industry as an "unconventional deposit," with pores in the formation so tight that gas flow is slow or the gas is tightly adhered to the rock. Both conditions are likely to be present in shale formations. To extract natural gas from shale, companies have used a process known as hydraulic fracturing to increase flow of the gas combined with horizontal, rather than vertical, drilling.

In hydraulic fracturing, companies inject water laced with toxic chemicals under high pressure to break open rock formations allowing more natural gas or oil to flow up the drilling pipe. Companies also inject acid to dissolve the rock to increase the flow of natural gas or oil -- a process known as "acidizing" or, if the acid is injected under high-pressure to fracture the rock, "acid fracturing." In addition, companies inject "proppants" such as sand to prevent the fracture from closing.

Though it is used to tap unconventional deposits, hydraulic fracturing has become standard practice for virtually all oil and natural gas wells. Victor Carrillo, a representative for the Interstate Oil and Gas Compact Commission, told Congress in 2005 that 90 percent of the United States' oil and gas wells are hydraulically fractured.

It is at best unclear what might happen if hydraulic fracturing fluids are injected underground. One industry report from 2003 found that "even if natural barriers, such as dense shale layers, separate the different fluid zones and a good cement job exists, shales can heave and fracture near the wellbore. As a result of production, the pressure differential across these shales allows fluid to migrate through the wellbore. More often, this type of failure is associated with stimulation attempts. Fractures break through the shale layer, or acids dissolve channels through it." The report also noted that "an improperly designed or poorly performed stimulation treatment can allow a hydraulic fracture to enter a water zone."

Heavy Chemical Use at Drilling Sites

Gas drilling presents other serious risks to New York City's drinking water. Drilling

operations are large and messy involving drilling rigs and other heavy equipment, dozens of tanker trucks to haul toxic chemicals and contaminated water, extensive pipelines, noisy compressors and waste pits full of polluted and unknown fluids. Western states have documented thousands of spills and leaks from gas drilling, at least some of which have contaminated water supplies. No matter how careful the industry says it will be, accidents are inevitable.

Between 2003 and 2008, the Colorado Oil and Gas Conservation Commission recorded more than 1,500 chemical spills by the oil and gas industry. The Oil and Gas Accountability Project found that of these 1,500, 20 percent contaminated water and seven percent polluted surface water.

A recent Environmental Working Group analysis of oil and gas drilling in Colorado found that these operations use at least 65 chemicals listed or regulated as hazardous compounds under federal environmental laws. As we noted in a recent letter to mayor Bloomberg and Governor Paterson, if any of these 65 chemicals were emitted or discharged from an industrial facility, reporting to the U.S. Environmental Protection Agency would be mandatory, and in most cases permits would require strict pollution limits and companies would be subject to specific cleanup standards. But when these same chemicals are used at a natural gas well, they are exempt from permitting, reporting requirements and cleanup standards under the Clean Air Act, the Clean Water Act, the Toxic Release Inventory, and Superfund.

If natural gas drilling operations are allowed to proceed in the New York City watershed, some of these chemicals will be used. The only uncertainty is which ones.

That is because companies typically guard the identity of the chemicals they use as a trade secret. This spring, the Durango (Colorado) Herald reported that a nurse became gravely ill after being exposed to fracturing fluids that had spilled on a natural gas worker she was treating. As the nurse suffered from liver failure, heart failure and respiratory failure, the company that manufactured the fracturing fluid refused to tell her doctor what was in it, citing the need to protect trade secrets. The doctor had to guess how to treat his patient (she later recovered).

Vast Amounts of Water, Chemicals

Hydraulic fracturing, which will almost certainly be used in the proposed drilling operations, can require a staggering amount of water and equipment. The industry publication Oilfield Review reported in 1995 that a fracturing operation could involve as many as 40 vehicles, a million gallons of fluid and three million pounds of sand. Here is a photo of a fracturing operation in the Barnett Shale near Houston, Texas. This photo is from a PowerPoint presentation given this year by a representative of Texas-based Dale Resources and is available on the website of Barnett Shale News. You can see the scale of the operation with well over 40 vehicles pictured. Here is a close-up of the same operation. The Dale Resources presentation suggested that in the Barnett shale, companies may use up to four million gallons of fluid for hydraulic fracturing.

These numbers are consistent with what we found in a recent analysis of drilling in Colorado. According to records from Englewood, Colorado-based IHS Energy, Delta Petroleum Corp. injected a natural gas well in Mesa County, Colorado with one of the highest volumes of fluid in the state. Between April 14, 2007 when Delta drilled the well and November 6, 2007 when drilling was completed, the Denver-based company injected the well with 1.4 million gallons of unknown fluids and acid and 361 tons of sand (IHS 2008). The records also show that between February 3, 2004 and June 28, 2004, Canada-based Encana injected a natural gas well in Garfield County with 1 million gallons of fluid and 454 tons of sand (IHS 2008).

Overall, the IHS records show that as of this May, there were 9,037 wells in Colorado that received 431.7 million gallons of treatments with fluids. Most of the treatments are listed as fracturing or acid treatments (IHS 2008). These figures likely significantly understate the total number of wells treated and the gallons of fluid used.

Water Supply, Quality Concerns

The sheer volume of water used highlights another concern for New York City's drinking water. If permitted to drill, companies could extract water from New York's watershed for hydraulic fracturing that would otherwise be used for drinking. The Susquehanna River Basin Commission that has jurisdiction over an area of New York, Pennsylvania and Maryland, part of which borders the watershed for New York City's drinking water, will begin requiring natural gas companies to receive a permit before withdrawing any quantity of water from the Basin. Officials have expressed serious concerns that gas operations may cause local streams to dry up completely.

An equally large concern is water quality. Earlier this year, Environmental Working Group and the Colorado-based organization, The Endocrine Disruption Exchange (TEDX) found that in Colorado, natural gas companies were using at least 65 chemicals that are listed as hazardous under six major federal laws designed to protect Americans from toxic substances including the Clean Air Act, Clean Water Act and Superfund. At least some of these chemicals are used in hydraulic fracturing operations. I have attached a list to my testimony.

EWG and TEDX found that natural gas companies use both methanol and naphthalene in Colorado. A Freedom of Information Act request from the Oil and Gas Accountability Project revealed that the U.S. Environmental Protection Agency had identified these chemicals as among those that companies inject into underground drinking water sources in fracturing operations at concentrations that may pose risks to human health.

The 65 chemicals we identified are associated with a range of health effects from skin and eye irritation to nervous system and brain problems. Of the chemicals, 95 percent can cause skin, eye, and sensory reactions; 90 percent have respiratory

effects that include asthma, sore throats, and chronic sinus and upper and lower respiratory infections; 75 percent affect the nervous system, causing headaches, unexplained tingling, numbness and pain in the extremities, blackouts, and convulsions; more than 70 percent can cause more long-term effects such as cardiovascular, kidney and immune system disorders; and approximately 45 percent are associated with cancer.

Some of these substances may be used in the Marcellus Shale formation that companies are planning to drill in New York. The Independent Oil and Gas Association of West Virginia has reported that a fracturing method called "slickwater" is one of three methods best used to extract gas from the Marcellus shale. At least two companies, Range Resources and Cabot Oil and Gas Corporation, say that they have used slickwater to fracture wells in the Marcellus shale. Dale Resources has indicated that slickwater is used in Texas' Barnett shale and has suggested that the operations may include biocides, friction reducers, scale inhibitors and surfactants.

EWG and TEDX found that several of these substances are used in Colorado and listed as hazardous under federal laws. For example, naphthalene and methanol are used in biocides; ethylene glycol and hydrochloric acid are used in scale inhibitors; and butanol and ethylene glycol monobutyl ether (2-BE) are used in surfactants.

Chemicals Veiled in Secrecy

And yet, companies are not required to disclose the chemicals they use under federal or state law whether in New York or in the Western United States, and the companies are exempt from federal laws that would set standards for the use of these chemicals. Among the exemptions is a waiver for hydraulic fracturing under the Safe Drinking Water Act (SDWA) passed as part of the 2005 Energy Bill. The SDWA sets standards for underground injection of toxic substances and prohibits the polluting of underground sources of drinking water.

In addition, natural gas companies typically guard the identity of their chemicals as a trade secret. TEDX identified the chemicals and other substances used in oil and gas drilling through Tier II reports that companies are required to file with emergency first responders under the Emergency Planning and Community Right-to-Know Act; Material Safety Data Sheets (MSDS) that companies are required to file with first responders by the Occupational Safety and Health Administration (OSHA), environmental impact statements written by the Bureau of Land Management and Forest Service; and accident reports completed by first responders.

While these data sources provide a glimpse of the chemicals used by energy companies, the sources are incomplete. Companies sometimes list names of products described in general terms such as "plasticizer" or "crosslinker." Data on the products' chemical ingredients is often missing. Sometimes product labels state "proprietary." The documents do not reveal -- nor are they designed to reveal -- what volumes or concentrations of the chemicals are used in the drilling and fracturing process. The MSDSs are designed to protect employees and first responders in the

case of an accident and focus on acute exposure, but the information on the sheets often does not reflect the health impacts from long-term exposure.

Fracturing Behavior: Could Surface Water be Contaminated?

It is at best uncertain what might happen if chemicals are injected underground. One industry report from 2003 found that improper fracturing can cause fracturing fluids to enter a water zone, and the Oil and Gas Accountability Project has identified several uncertainties with fracturing behavior underground including how far the fractures will extend.

One recent case in Colorado shows that at least some substances from drilling can affect not only groundwater but also surface water. In March and April 2004, the Rocky Mountain News reported that natural gas seeping from a well drilled by Encana contaminated drinking water 3,500 feet away in Garfield County, Colorado, forcing local residents to drink bottled water. The Colorado Oil and Gas Conservation Commission (COGCC) determined that the contamination came from an improperly cemented well. Encana had drilled four wells within a mile of the gas leak.

Inspectors found high levels of toxic benzene in the water the day after residents noticed unusual bubbles in Divide Creek. A report prepared for Garfield County found that the contamination also included methane gas and toxic toluene, ethylbenzene and xyleneithin. In August 2004, the COGCC fined Encana a record \$371,200 and imposed a moratorium on drilling within a two-mile radius of the seep. It was not clear if the well had been fractured, but hydraulic fracturing is common in the area.

At the very least, New York and other states should have a better understanding of fracturing behavior including whether fracturing could impact underground sources of drinking water and whether such underground fluids could affect surface water.

Other Concerns: Waste Pits and Spills

There is also the problem of waste pits and spills from which chemicals could leak into ground or surface water supplies. Often, after companies inject fracturing fluids, they remove the fluids and dump them in a pit near the drilling rig. The pits can also be used to store so-called "produced water," or groundwater that is extracted in the drilling process. According to the U.S. Geological Survey, produced water can contain dissolved salts, hydrocarbons, trace metals, and radionuclides. New Mexico documented 800 cases of groundwater contamination by the oil and gas industry of which about half were due to waste pits.

In addition, chemicals can spill during hydraulic fracturing or other drilling operations. The nurse who nearly died this year in Durango, Colorado, was treating a natural gas worker who had fracing chemicals spilled on his clothing. The spill occurred on Indian land and was not required to be reported to the state. Between 2003 and 2008, the Colorado Oil and Gas Conservation Commission recorded more than 1,500 spills, 20 percent of which polluted water supplies.

Tweeti Blancett, who operates a ranch in New Mexico with her husband that has been in the Blancett family since the 1870s, says that natural gas operations including waste pits and fracturing have negatively affected her water supply.

"My water when it comes up, ninety-seven percent of the time, it's deadly," she said. "It's full of heavy metals, petroleum products and things you don't even want to talk about."

"We didn't know we were going to have these problems when they started drilling out here," she said, adding that New York officials "have an open invitation to come to the ranch," for a tour. "You don't want what we have."

Oscar Simpson, a representative for the National Wildlife Federation who spent nearly 20 years working for the state of New Mexico enforcing standards for the oil and gas industry and drinking water, says that drilling in the watershed for New York City's drinking water is simply too risky and should not be permitted. Simpson called contamination from oil and gas drilling "a continuous problem from beginning to end."

Recommendations

New York should adopt standards to ensure that natural gas drilling is safe:

- Water supplies for drinking, agricultural and other uses should be fully protected from potential impacts from drilling and/or hydrofracing operations; no permits should be issued for operations that could negatively affect water quantity or quality.
- That means no drilling in the watershed for New York City's water supply.
- The state should prohibit the use of chemicals that could compromise the quality of water supplies and that are not demonstrated to be safe for humans and the environment.
- Before drilling begins, companies should make public the chemicals they plan to use through several outlets including the state's web site and local first responders, and the state should approve the use of each chemical; in making public the chemicals they plan to use, companies should list each ingredient in every chemical product.
- Once drilling begins, the state should maintain the availability of these lists of approved chemicals for each natural gas well to increase public knowledge and for immediate access in the case of accidents or spills.
- Once drilling begins with approved chemicals, companies should provide advance notice and secure approval before using additional chemicals.
- The state should approve a plan to protect both water quality and water quantity to ensure that existing and future water needs are met.

New York should follow the example of Klickitat County in Washington State that recently required Delta Petroleum to disclose the chemicals the company would use before drilling in Klickitat County. The county also required Delta to give local officials three days advance notice before adding new chemicals to its operations. Under the agreement, the company provided a list of 76 substances to Klickitat County, some of which appear to be product names rather than more informative chemical ingredients of the products. Klickitat County also prohibited the use of several substances including 2-BE, also known as 2-butoxyethanol or ethylene glycol monobutyl ether, a chemical found in at least six products used by natural gas companies in Colorado and listed as hazardous under the Clean Air Act.

If Klickitat County, Washington, can require a natural gas company to operate under these standards, New York can – and should – enact standards that are at least as strong. Thank you for the opportunity to testify. I look forward to your questions.

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Colorado's Chemical Injection: Appendix



Number of 65 Chemicals Used by Colorado Natural Gas Industry Listed Under 6 Federal Pollution Protection Laws

CLEAN AIR ACT: 27 CHEMICALS LISTED UNDER §112(B)(1), §112(R), §202(A)

- (2-BE) Ethylene glycol monobutyl ether
- 1-methoxy-2-propanol
- 2-(2-Methoxyethoxy)ethanol
- 2,2',2''-Nitrilotriethanol
- Acetic acid
- Acrylamide
- Benzyl chloride
- Diethylene glycol
- Diethylene glycol monobutyl ether
- Dimethyl formamide
- Ethyl benzene
- Ethylene glycol
- Ethylene oxide
- Formamide
- Formic acid
- Fumaric Acid
- Glutaraldehyde
- Glycerin Mist (glycerol)
- Glyoxal
- Hydrochloric Acid (HCl)
- Hydrofluoric Acid
- Methanol
- Monoethanolamine
- Monopentaerythritol
- Naphthalene
- Styrene
- Xylene

CLEAN WATER ACT: 22 CHEMICALS LISTED UNDER §311(B)(2)(A)

- Acetic acid
- Adipic Acid
- Ammonium bisulfite

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- Benzyl chloride
- Calcium hydroxide
- Calcium oxide
- Chromium acetate
- Dodecylbenzene sulfonic acid
- Ethyl benzene
- Ferrous sulfate
- Formic acid
- Fumaric Acid
- Hydrochloric Acid (HCl)
- Hydrofluoric Acid
- Naphthalene
- Potassium hydroxide
- Sodium hydroxide
- Styrene
- Xylene
- Zinc Carbonate
- Zirconium nitrate
- Zirconium sulfate

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (SUPERFUND), 38
CHEMICALS LISTED UNDER 40 CFR 302.4:

- Acetic acid
- Acrylamide
- Adipic Acid
- Ammonium bisulfite
- Antimony
- Arsenic
- Barium
- Benzyl chloride
- Butanol (N-butyl alcohol, Butan-1-OL)
- Cadmium
- Chromium
- Cobalt
- Copper
- Dimethyl formamide
- Dodecylbenzene sulfonic acid
- Ethyl benzene
- Ethylene glycol
- Ethylene oxide
- Ferrous sulfate
- Formic acid
- Fumaric Acid
- Hydrochloric Acid (HCl)
- Hydrofluoric Acid
- Isobutyl alcohol (2-methyl-1-propanol)
- Lead
- Mercury
- Methanol
- Naphthalene
- Nickel
- Potassium hydroxide
- Propargyl alcohol (Prop-2-YN-1-OL)
- Sodium hydroxide
- Styrene
- Thiourea
- Vanadium
- Xylene
- Zinc
- Zinc Carbonate
- Zirconium nitrate
- Zirconium sulfate

RESOURCE CONSERVATION AND RECOVERY ACT: 11 CHEMICALS LISTED

- Acrylamide
- Butanol (N-butyl alcohol, Butan-1-OL)
- Ethylene oxide
- Formic acid

- Hydrofluoric Acid
- Isobutyl alcohol (2-methyl-1-propanol)
- Mercury
- Methanol
- Naphthalene
- Thiourea
- Xylene

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT: 30 CHEMICALS LISTED UNDER §110, §302(A)

- 2-(Thiocyanomethylthio) benzothiazole (TCMTB)
- Acrylamide
- Antimony
- Arsenic
- Barium
- Benzyl chloride
- Butanol (N-butyl alcohol, Butan-1-OL)
- Cadmium
- Chromium
- Cobalt
- Copper
- Dimethyl formamide
- Ethanol (Acetylenic alcohol)
- Ethyl benzene
- Ethylene glycol
- Ethylene oxide
- Fluoride
- Hydrochloric Acid (HCl)
- Hydrofluoric Acid
- Isopropanol (Propan-2-OL)
- Lead
- Mercury
- Methanol
- Naphthalene
- Nickel
- Styrene
- Thiourea
- Vanadium
- Xylene
- Zinc

TOXICS RELEASE INVENTORY: 36 CHEMICALS LISTED

- 1,2-Bromo-2-nitropropane-1,3-Diol (2-Bromo-2-nitro-1,3-propanediol or Bronopol)
- 2,2-Dibromo-3-Nitrilopropionamide (DBNPA)
- Acrylamide
- Aluminum Oxide
- Antimony
- Arsenic
- Barite (BaSO₄)
- Barium
- Benzyl chloride
- Butanol (N-butyl alcohol, Butan-1-OL)
- Cadmium
- Chromium
- Cobalt
- Copper
- Dimethyl formamide
- Ethyl benzene
- Ethylene glycol
- Ethylene oxide
- Formic acid
- Hydrochloric Acid (HCl)
- Hydrofluoric Acid
- Isopropanol (Propan-2-OL)
- Lead
- Mercury
- Methanol
- Naphthalene
- Nickel

- Propargyl alcohol (Prop-2-YN-1-OL)
- Sodium hydroxide
- Sodium sulfate
- Styrene
- Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione (Dazomet)
- Thiourea
- Vanadium
- Xylene
- Zinc

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RIVERKEEPER.

Testimony of: James L. Simpson, Staff Attorney, Riverkeeper, Inc.

New York City Council

Committee on Environmental Protection Hearing:

Oversight – Natural Gas Drilling in the New York City Drinking Water Watershed

September 10, 2008

As one of the signatories to the 1997 New York City Watershed Memorandum of Agreement (MOA), and in keeping with our mission to safeguard the ecology integrity of the Hudson River, and the New York City drinking water supply watershed, Riverkeeper welcomes the opportunity to participate in this hearing.

If we are to transform our energy policy away from dirty coal and dependence upon foreign oil, natural gas may be a reasonable and necessary interim option. However, natural gas development is progressing across the vast Marcellus Shale at a pace and scale no one ever envisioned.

Lost in the rush for access to this mineral reserve is the fact that the entire West-of-Hudson portion of the New York City watershed sits on top of the Marcellus Shale.¹ The much admired New York City drinking water system is a modern wonder of the world. The New York City watershed comprises roughly 4.2% of the state's land, yet supplies unfiltered drinking water to over 9 million New Yorkers on a daily basis. Surface water collects in large reservoirs and travels via gravity through tunnels and aqueducts to the taps of consumers upstate and in New York City, which receives 1.2 billion gallons daily. The inimitable taste of New York pizza and bagels is but one benefit of this award winning tap water. In short, the New York City Watershed is the city's greatest capital asset and the state's most precious natural resource.

Natural Gas Drilling – The Process and Impacts

Hydraulic fracturing involves the high-pressure injection of millions of gallons of water, sand and toxic chemicals into horizontal wells at depths over 1 mile below ground. After the “fracking” process, the water and chemicals must be recovered and delivered to a suitable treatment center. While we need to learn more about the “fracking” process to understand its environmental impacts fully and support the State's decision to conduct a supplemental environmental review, we already know that natural gas exploration brings with it a whole host of activities and apparatus that are unacceptable within this pristine natural resource. A web of pipelines to transport the gas and noisy compressors to push

¹ See Exhibit A (Large Map of Marcellus Shale Formation – NYS Dept. of Environmental Conservation, available at, <http://www.dec.ny.gov/energy/46381.html>).

gas from wells through the pipeline system will be needed; large drilling pads capable of handling several wells will be constructed; and hundreds of tanker trucks will be used to haul in water and to remove waste water. All of this upheaval and disruptive surface activity that would accompany any drilling process, occurring in a watershed infamous for heavy flooding and where all surface runoff flows into New York City's unfiltered water supply, is not acceptable. Moreover, allowing this activity would be reckless in the context of the filtration avoidance determination (FAD) and the prospect of the city paying for a \$10 billion filtration plant (with \$300 million in annual operating costs) should the FAD be revoked.

Inconsistencies with 1997 MOA

In the MOA all the parties (including New York State and New York City) agreed that "the New York City water supply is an extremely valuable natural resource that must be protected in a comprehensive manner."²

All the parties also agreed that economic development within the watershed communities must be consistent with watershed protection.³ However, no economic development is less consistent with watershed protection than this. Furthermore, the MOA did not contemplate and does not protect the economic vitality of out-of-state gas companies.

All parties also agreed to maintain and enhance the social character of the watershed towns.⁴ As I described, natural gas drilling brings with a whole host of activities that would be incruent with the social character of the watershed towns.

Justifications for Designating the NYC Watershed Off-limits for Drilling

In addition to the MOA's requirements, I want to touch briefly on just two traditional themes and underpinnings of environmental law that provide sound basis and justification for designating the NYC Watershed off-limits for natural gas drilling

1. Theodore Roosevelt – Foresight and Wise Use

One hundred years ago President Theodore Roosevelt said that the "prosperity of our people depends directly on the energy and intelligence with which our natural resources are used."⁵ Roosevelt had convened a Conference of Governors at the White House to discuss conservation and the proper use of natural resources. The country was faced with an exponential growth in industrial progress, and Roosevelt proclaimed the need for foresight and wise use of our natural resources as a duty to posterity.

² 1997 NYC Watershed Memorandum of Agreement, ¶ 5.

³ MOA, ¶ 6.

⁴ MOA, ¶ 6.

⁵ See PROCEEDINGS OF A CONFERENCE OF GOVERNORS IN THE WHITE HOUSE, MAY 13-15, 1908 (Gov. Printing Office) (1909) [hereinafter CONFERENCE OF GOVERNORS] at 7.

The need for foresight and planning in the use of natural resources is just as relevant today as it was in Roosevelt's time. There can be no better example than a watershed that supplies unfiltered drinking water to over half of New York's population. To that end, Riverkeeper played a lead role in negotiating and drafting the MOA, praised internationally as a model for watershed protection. Designating the watershed off-limits would heed Roosevelt's call for wise use of this natural resource, particularly when the New York City watershed is such a small percentage of New York's portion of the Marcellus Shale.

2. The Tragedy of Commons:

In 1968 a little known biology professor named Garret Hardin from the University of California, Santa Barbara published an article in Science magazine.⁶ Its premise was that there is a class of problems to which there are no technological solutions. Nuclear war, population growth, and pollution are common examples. Hardin himself used an example of herdsman grazing cattle on an open common. He noted that each individual herdsman, being a rational actor, will try to exploit the pasture as much as possible, until the point when it is useless to all.

The tragedy of the commons teaches that there is a need for regulation in situations where individual rational decisions eventually will produce collectively irrational results.

We must strive to ensure that out-of-state gas companies do not try to privatize the commons that is the New York City watershed and exploit it for their own private gain, to the detriment of all New Yorkers.

Conclusion

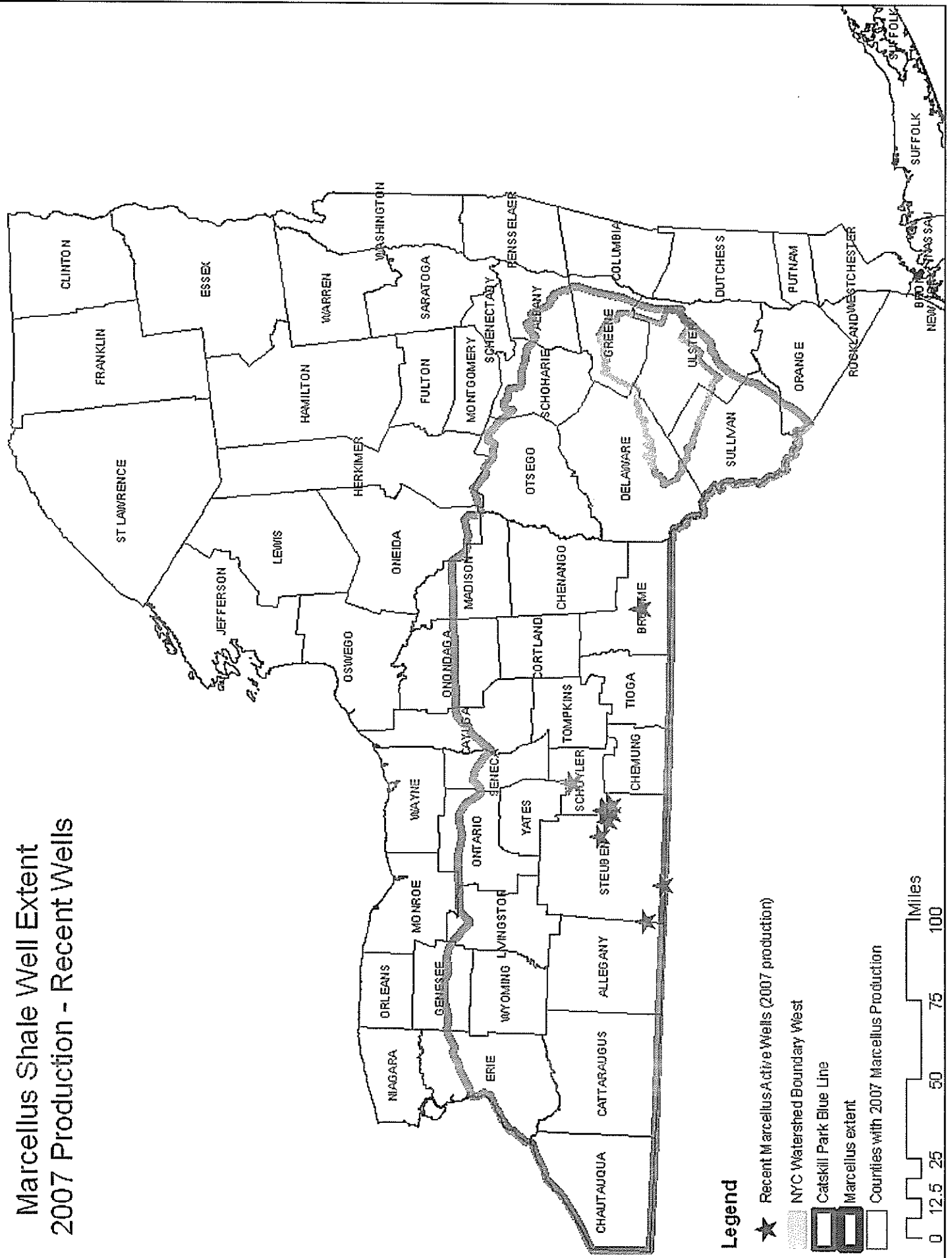
Riverkeeper thanks the City Council for the opportunity to participate in today's hearing and your attention to this very important issue.

⁶ Garret Hardin, *The Tragedy of the Commons*, in SCIENCE MAGAZINE'S STATE OF THE PLANET 2006-2007 115 (Donald Kennedy, ed., 2006).

EXHIBIT A

Large Map of Marcellus Shale Formation – NYS Dept. of Environmental Conservation
available at, <http://www.dec.ny.gov/energy/46381.html>

Marcellus Shale Well Extent 2007 Production - Recent Wells





NATURAL RESOURCES DEFENSE COUNCIL

**STATEMENT OF THE NATURAL RESOURCES DEFENSE COUNCIL
BEFORE THE NEW YORK CITY COUNCIL
ENVIRONMENTAL PROTECTION COMMITTEE
RE: INDUSTRIAL GAS DRILLING WITHIN THE NYC WATERSHED
SEPTEMBER 10, 2008**

Good afternoon, Chairman Gennaro and members of the Committee. My name is Eric A. Goldstein, and I am an attorney with the Natural Resources Defense Council, Inc. ("NRDC"). As you know, NRDC is a national, non-profit legal and scientific organization that has been active on a wide range of environmental issues including water quality protection since shortly after the organization was founded in 1970. We have a team of lawyers, scientists and other specialists devoted exclusively to safeguarding New York's environment and to improving the quality of city life. In recent years, this team has focused considerable attention on protecting the quality and cost of the downstate drinking water supply.

With me today is attorney Kate Sinding, who is leading NRDC's statewide response to the wide-ranging environmental issues associated with industrial gas drilling in New York. We are pleased to be here today to share with the Committee our grave concerns over and preliminary recommendations for addressing threats posed by the prospect of widespread industrial gas drilling in the New York City watershed.

At the outset, we want to state very clearly that NRDC does not oppose gas drilling across-the-board. To the contrary, we recognize the benefits of natural gas as a transition fuel in the national effort to decrease America's reliance on coal and oil. We also know, however, that increased gas drilling in New York State can and must be accompanied by enhanced environmental safeguards, careful oversight and vigorous enforcement of laws and rules designed to protect our state's natural resources. And we believe that there are certain areas of the state -- including the Catskill/Delaware watershed, which supplies water to half the state's population -- that because of their exceptional environmental importance should be placed off limits to industrial gas drilling.

New York's Catskill/Delaware watershed is a priceless and irreplaceable resource that is the source of 90% of the drinking water for 9 million downstate New Yorkers. Because of the rural nature of this watershed and the generally high quality of the source waters, New York's Catskill/Delaware supply is one of only five major water supply systems in the United States that has received waivers from the federal Safe Drinking Water Act requirement that all surface drinking water supplies be filtered prior to delivery to the tap as a necessary measure to protect the public from waterborne disease. Building filtration facilities for the Catskill/Delaware system would likely cost more than 6 to 10 billion dollars, which would trigger dramatic increases in water rates for City ratepayers. Accordingly, there are compelling economic reasons for the City to do

everything within its power to safeguard its unfiltered Catskill/Delaware water supply from the pollution threats posed by industrial gas drilling.

And make no mistake about it -- industrial gas drilling is an inherently pollution-generating activity. In the gas drilling process known as hydraulic fracturing (or "fracking"), more than a million gallons of water, mixed with chemicals and sand, is injected at high pressure at each individual well deep into underground rock, so as to separate gas from shale. This process requires huge volumes of water and produces large amounts of contaminated water at the end of the drilling process, presenting both water supply problems and wastewater disposal challenges. (These problems are in addition to other, non-water quality concerns such as air pollution generated locally, vastly increased truck traffic, visual impacts, etc.)

In Pennsylvania, where gas drilling operations have been rapidly advancing, water quality concerns have already been identified. Earlier this year, that state's Department of Environmental Protection ordered two natural gas drilling companies to suspend a portion of their operations for violating Pennsylvania's Clean Streams Law. (See "Commonwealth of Pennsylvania, News Release: DEP Orders Partial Shutdown of Two Natural Gas Drilling Operations In Lycoming County," dated 5/30/08.) And in New Mexico, Governor Bill Richardson has recently issued an executive order that extends by six months an existing moratorium on new oil and gas drilling in Santa Fe County and the Galisteo Basin to allow more time for fact-gathering and rule-making to safeguard water aquifers and other resources in this ecologically fragile area. (See Governor Bill Richardson Executive Order 2008-038, dated July 14, 2008.)

To its credit, the City's Department of Environmental Protection has written to Governor David Paterson, in response to the Governor's signing of the "Oil and Gas Spacing Bill," and has urged that the State recognize the Catskill/Delaware watershed as "a unique resource requiring special protection...." And Governor Paterson, in signing the new law, committed the state to undertake the preparation of a new Generic Environmental Impact Statement to assess gas drilling in the near future. But more, much more, is needed -- especially with energy corporations and land speculators already buying up drilling rights for up to \$3,000 an acre across parts of western New York.

NRDC offers three preliminary recommendations for City Council action:

- First, we recommend that you call upon Governor Paterson and his administration to impose a moratorium on the issuance of any new gas drilling permits within the state until a final Generic Environmental Impact Statement is prepared for the State's new gas drilling program, and to formally place the Catskill/Delaware watershed permanently off-limits to industrial gas drilling. The moratorium request would be consistent with actions being taken in New Mexico and elsewhere and would be designed to advance the common-sense idea that necessary resource-protection safeguards should be put into place before gas drilling permits are issued. And the moratorium would be perfectly

appropriate given the large number of technical and operational questions that have not yet been answered.

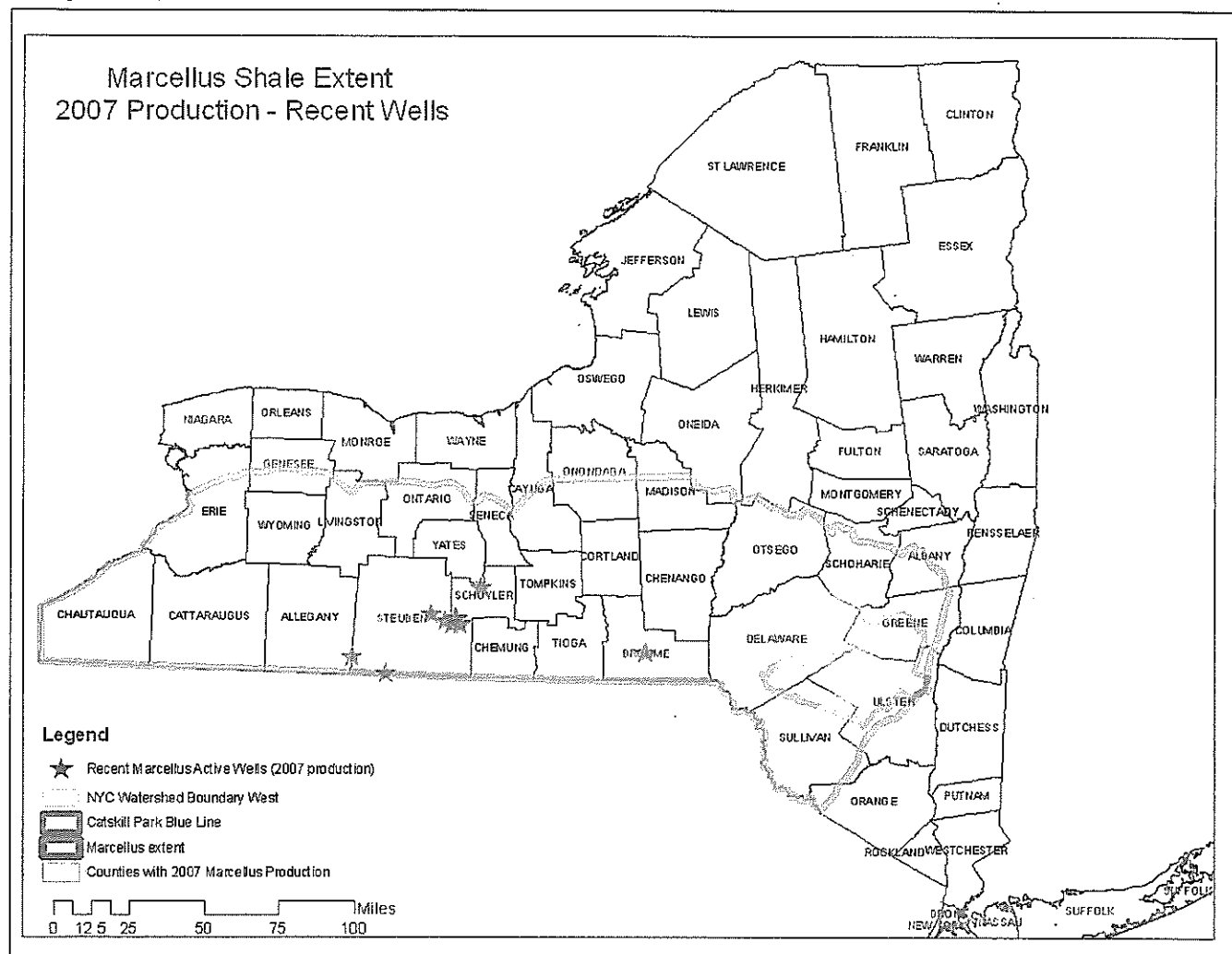
- Second, in addition to requesting that Governor Paterson place the watershed off limits to gas drilling, we recommend that you use your good offices to work with the City's Department of Environmental Protection to amend the City's watershed rules so as to explicitly prohibit industrial gas drilling within the Catskill/Delaware watershed. Authority for the City to take such action is set forth in section 1100 of the State's Public Health Law. That section authorizes the City's Commissioner of Environmental Protection to adopt rules and regulations, subject to state approval, designed "for the protection from contamination of any or all public supplies of potable waters and their sources" within the upstate watershed. Significantly, if the City were to prohibit industrial gas drilling within the Catskill/Delaware watershed boundary, this would in no way restrict drilling in the vast majority of the New York State portion of the Marcellus Shale. (The Marcellus Shale extends over 54,000 square miles -- slightly larger than the state of Florida -- from western New York to West Virginia; the Catskill/Delaware watershed is approximately 2,000 square miles. In New York State, the Marcellus Shale covers all or parts of 30 counties; prohibitions on gas drilling in the Catskill/Delaware watershed would affect portions of 5 counties, leaving most of the Marcellus Shale area in New York -- aside from any other water resource areas warranting special protection -- available for drilling following completion of the Generic Environmental Impact Statement and adoption of enhanced safeguards to protect the state's natural resources.)
- Third, we ask that you urge Governor Paterson to insure that the State Health Department serves as a co-lead agency with the State Department of Environmental Conservation in the forthcoming development of the Generic Environmental Impact Statement for the gas drilling initiative. It is the State Health Department that now has primacy, or primary enforcement authority, in cooperation with the U.S. Environmental Protection Agency, over New York City's filtration avoidance determination. It is essential that the state agency whose decision could compel New York City to build a \$10 billion dollar Catskill/Delaware filtration plant should be fully involved in the planning and analysis of the environmental review process for gas drilling.

We thank you, Chairman Gennaro, for holding this hearing and for your strong efforts to protect the quality and cost of the New York City water supply. We look forward to working with you to advance our common objectives in coming months, while there is still time for City and state officials to take protective action and avert the most pressing threat to the downstate drinking water supply.



NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

Large Map of Marcellus Shale Formation



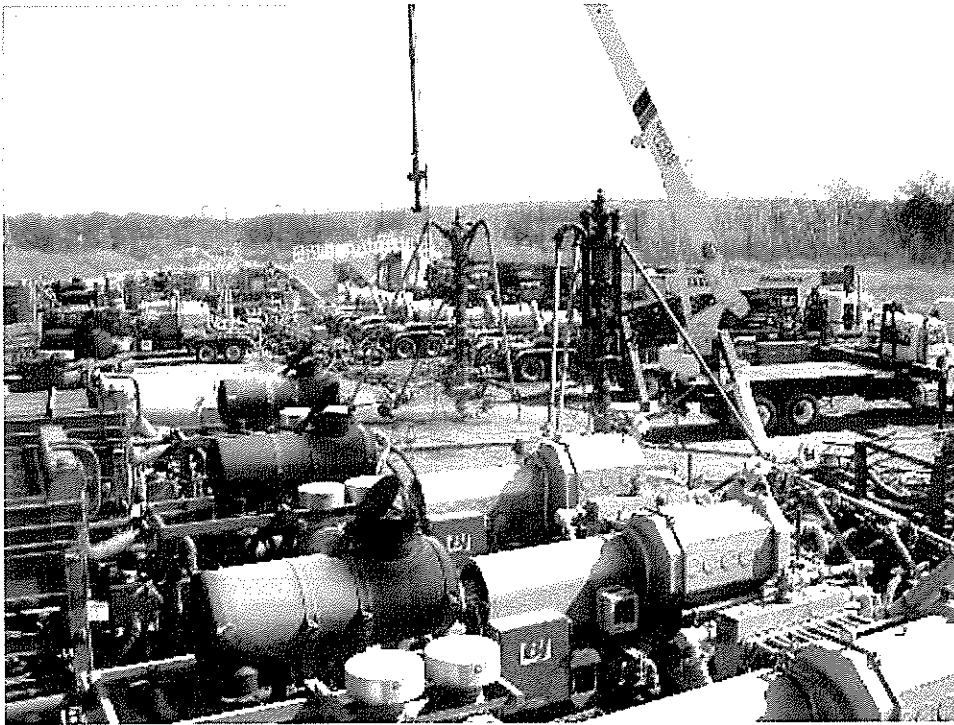
Crawford, La Sans

From: Goldstein, Eric
Sent: Wednesday, September 10, 2008 12:57 PM
To: Crawford, La Sans
Subject: Horizontal fracking - Barnett Shale pics

HERE ARE TWO PICTURES OF A GAS DRILLING SITE, EMPLOYING THE HORIZONTAL FRACTURING PROCESS, IN THE BARNETT SHALE OF TEXAS.



<http://www.barnettshalenews.com/documents/GarySchein-FtWorthBusinessPress-ShaleCompletions-022908.pdf>





**US Oil & Gas
Association**



FOR THE RECORD

**Statement of the American Petroleum Institute,
Independent Petroleum Association of America
and U.S. Oil and Gas Association
to the New York City Council Environmental Protection Committee
Oversight Hearing - Natural Gas Drilling in the New York City Drinking Water
Watershed**

September 10, 2008

Introduction

The American Petroleum Institute ("API"), Independent Petroleum Association of America ("IPAA") and the U.S. Oil and Gas Association ("USOGA") (collectively the "Associations") appreciate the opportunity to provide this statement in connection with the Committee's oversight hearing with respect to projected development of natural gas supplies in the Marcellus Shale. As representatives of the Nation's natural gas and oil industry, the Associations have a great deal of interest in the issue of hydraulic fracturing in New York and other states across the nation.

API is a nationwide trade association representing over 400 member companies involved in all aspects of the oil and gas industry in the United States, including exploration and production of oil and gas resources. IPAA represents thousands of independent oil and natural gas producers across the country. IPAA's members develop 90% of domestic oil and gas wells. USOGA's members represent all segments of the oil and gas industry, including major oil and gas companies and independent oil and gas producers as well as others. We work to secure

reliable access to the nation's valuable hydrocarbon resources in order that they may be developed, produced and supplied in an environmentally responsible manner. We are dedicated to improving the compatibility of our activities with the environment, while developing the resources in an economically sound manner – ultimately helping this nation strive toward energy independence. The members of the Associations have extensive experience with oil and gas drilling techniques of the type that would be used in the Marcellus Shale and with the numerous steps taken by the oil and gas industry to protect drinking water supplies.

The Associations believe that development of natural gas resources in the Marcellus Shale will not pose any significant risk to the drinking water supplies of New York City. In particular, the Associations do not believe that hydraulic fracturing of gas wells poses a threat to those drinking water supplies.

Background on Hydraulic Fracturing

Hydraulic fracturing is an increasingly important part of energy production in the United States. Application of hydraulic fracturing to increase recovery is estimated to account for 30% of recoverable oil and gas reserves in the U.S. and has been responsible for the addition of more than 7 billion barrels of oil and 600 trillion cubic feet of natural gas to meet the nation's energy needs. Hydraulic fracturing is needed to make many wells productive. The National Petroleum Council has estimated that 60% to 80% of all wells drilled in the United States in the next ten years will require fracturing in order to remain profitable. This is certainly true of wells that may be drilled in the Marcellus Shale.

The process used to hydraulically fracture formations that contain oil or gas has been understood in general terms and applied for over 50 years, and has been continually improved and made more effective and efficient as a result of many years of experience and significant

research efforts. In essence, hydraulic fracturing entails the use of high pressure pumps to force fluid down the well and into the formation. The intent is to pump viscous fluids into the well bore at pressures sufficient to create cracks or fissures in the rock formation containing the oil or gas in order to improve the flow characteristics of the formation. The entire process may take anywhere from 15 minutes to several hours.

The process is preceded by careful planning of a particular hydraulic fracturing job in order to maximize the effectiveness of the operation in increasing the flow of oil or gas to the well bore. The field operations are initiated when fluids are forced into the well at a rate that causes the pressure in the well bore to exceed the breakdown pressure of the formation. When this pressure is exceeded, a fracture opens and the injected fluid begins moving outward, away from the well. In most formations, the fluid pressure opens a single fracture that propagates away from the well as two wings that extend in opposite directions.

In order to be effective, the fracture must be kept open when the pressure is relaxed. This is accomplished by introducing a proppant (usually sand) that is conveyed into the fracture by the viscous fluid. Once the proppant is in place, the fluid is meant to break back down to its more liquid, less viscous state, after which it flows more freely. The pumping is then stopped and fluids flow back to the well bore while the proppants remain in place; through this process much of the fluid that was initially pumped down the well bore to create the fractures is subsequently removed. If the fluids were allowed to stay in the reservoir, they would themselves become impediments to the freer flow of oil and gas reserves, which would of course defeat the entire purpose of the fracturing job. As fluids are removed, the oil or gas begins to move through the fractures to the well bore and the oil or gas flows out of the well bore to processing facilities. Throughout this process well casing (including both surface casing and production casing) and

cement prevents the fluids and other materials in the well bore from escaping into shallow formations that may include drinking water aquifers or other formations that have not been targeted for production.

Overall, water typically makes up over 95% of the aqueous phase of the fracturing fluid system. Proppants, another significant ingredient, are normally in the form of sand. There are a number of other constituents that may be added to fracturing fluids to perform a variety of functions depending on the characteristics of the formation being fractured. These constituents are intended to help ensure the effectiveness of the fracturing operations.

Hydraulic Fracturing Does Not Pose a Threat to Drinking Water Supplies

Despite allegations to the contrary, there is no confirmed evidence that hydraulic fracturing has resulted in the contamination of drinking water supplies. The U.S. Environmental Protection Agency (“EPA”) and state regulators have previously studied the potential impacts of hydraulic fracturing on underground drinking water sources and have found no confirmed evidence of any contamination of drinking water wells in connection with hydraulic fracturing operations despite the fact that many thousands of hydraulic fracturing operations have been undertaken over the last 60 years. One such study was conducted by the Ground Water Protection Council (“GWPC”), an organization of federal and state regulators and others concerned with groundwater quality, which surveyed state agencies responsible for oil and gas production in 1998 and found no evidence of any contamination of drinking water supplies or increased risk to human health due to the hydraulic fracturing of coalbed methane (“CBM”) wells even though the responding agencies indicated that over 10,000 CBM wells had been completed in their respective states. See “Survey Results on Inventory and Extent of Hydraulic Fracturing in Coalbed Methane Wells in the Producing States,” GWPC (Dec. 15, 1998). Similar

to the GWPC efforts, the Interstate Oil and Gas Compact Commission conducted its own survey of member states in 2002 and again found no evidence of contamination of drinking water supplies as a result of hydraulic fracturing operations. See “States Experience With Hydraulic Fracturing: A Survey of the Interstate Oil and Gas Compact Commission,” IOGCC (July 2002).

Most recently, EPA completed a study of the potential impacts of hydraulic fracturing of CBM wells on drinking water supplies; the Agency has, in fact, characterized this study as the most extensive review of the potential impacts of hydraulic fracturing on public health ever undertaken. See “Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs,” EPA Office of Water (June 2004) (“EPA Study Report”). As part of this study, EPA reviewed information about alleged incidents of drinking water well contamination believed by the affected parties to be associated with hydraulic fracturing or other CBM development activities. Based on its review, the Agency found that, although thousands of CBM wells are fractured annually, there were “no confirmed cases that are linked to fracturing fluid injection into CBM wells or subsequent underground movement of fracturing fluids.” *Id.* at ES-1. Consequently, EPA concluded that hydraulic fracturing of CBM wells poses little or no threat to underground sources of drinking water (“USDWs”). EPA also concluded that any risks to USDWs associated with other types of formations – such as shales – would likely be even less given that coalbeds tend to be shallower than other formations and that hydraulic fracturing of formations such as shales would generally take place at greater depths and would therefore be even further removed from drinking water sources than fracturing operations in coalbeds.

In short, every study that has examined the potential impacts of hydraulic fracturing operations on drinking water wells has concluded that there is simply no persuasive evidence that

any of the many thousands of hydraulic fracturing operations that have been conducted throughout the country have contaminated drinking water supplies.

The lack of any demonstrated impact on drinking water as a result of hydraulic fracturing is not at all surprising in light of the nature of hydraulic fracturing activities and numerous factors that weigh against any significant migration of fracturing fluids toward drinking water wells. In fact, employing well-accepted drilling techniques that have been used for many years, the majority of hydraulic fracturing activities take place at depths far below any groundwater sources that could reasonably be considered drinking water sources. In the case of the Marcellus Shale, the shale formations that would be hydraulically fractured are generally found at depths of more than a mile below the surface.

At the same time, companies that are engaged in drilling and completing oil and gas wells use various acknowledged well construction practices such as zonal isolation techniques that help to ensure that fluids in the well bore will not come in contact with groundwater at shallow depths that may serve as a source of water for drinking water wells. For example, the casing program for each well typically is planned and maintained to prevent any migration of oil, gas or water from one formation to another that may result in the degradation of groundwater. Surface casing is generally run to a depth below all known drinking water aquifers and the surface casing must be set in or through an impervious formation. Surface casing is usually cemented from the bottom of the casing to the surface. Thus, the very nature of the typical oil and gas well construction process itself suggests that hydraulic fracturing would virtually never pose any threat to drinking water sources.

Moreover, a number of other factors contribute to the lack of impacts from hydraulic fracturing operations. For example, after the fluids enter the formation being fractured, they

become substantially diluted. In addition, once fracturing operations are completed the well operator begins to pump out groundwater as well as oil or gas, removing as much as 82% of the fracturing fluids in the process. EPA Study Report at 3-11, 4-15. As long as oil or gas continues to be pumped out of the well – a period that could extend 30 years or more – any remaining fluids within the capture zone of the well will generally be drawn toward the oil or gas well by the pumping and are unlikely to migrate away from the vicinity of the well. Moreover, as the EPA study found, the fluids that remain in the formation may be affected by several other factors: some chemicals may be naturally broken down or biodegraded; some chemicals may be adsorbed onto the rock formation, meaning that the chemicals will not be pulled back in the direction of the well by pumping but also will not migrate away from the well; and some fluids may become trapped in the rock formation and will not migrate in the direction of drinking water wells. *Id.* at 4-16 to 4-17. The nature of the surrounding formations also may serve to confine further the fracturing fluids to the formations in which they were initially placed. As the EPA report recognizes, in some cases formations of shale or other relatively impermeable rock may form barriers to any migration of fracturing fluids from deep formations where fracturing usually takes place to shallow formations that may serve as drinking water sources. *Id.* at 7-3. In light of these various factors and the distance that typically separates an oil or gas well and any drinking water well, it is quite unlikely that any fracturing fluids would even approach a drinking water well or a surface aquifer.

Moreover, regulatory programs are already in place to protect drinking water sources. Like all states with oil and gas development, New York State has an extensive regulatory program in place that governs oil and gas drilling and production. The regulations promulgated by the New York State Department of Conservation require, among other things, that operators

obtain a permit from the Department prior to engaging in any drilling activity. Each permit includes conditions designed to prevent gas or other materials from escaping from wells such as the use of surface casing and cementing. Permits issued by the Department also contain conditions requiring proper disposal of wastes associated with oil and gas drilling. In short, the state regulatory program provides further assurances that oil and gas development will not harm the City's drinking water supplies.

Conclusion

In light of the nature of hydraulic fracturing and the conditions under which it occurs as well as the regulations and other protections in place, the Associations believe that hydraulic fracturing of Marcellus Shale wells will not pose a threat to New York City's drinking water supplies and that development of the Marcellus Shale gas resources in general can and will be undertaken in a way that allows development of this important energy resource in a manner that will not result in any contamination of the City's drinking water.



JAMES F. BRENNAN
44TH Assembly District
Kings County

THE ASSEMBLY
STATE OF NEW YORK
ALBANY

CHAIR
Committee on Cities

COMMITTEES
Codes
Corporations, Authorities
and Commissions
Education
Real Property Taxation

TESTIMONY BY ASSEMBLYMEMBER JAMES F. BRENNAN
AT EMERGENCY PUBLIC HEARING
ON PROJECTED NATURAL GAS DRILLING IN NYC WATERSHED
HELD BY NEW YORK CITY COUNCIL
ENVIRONMENTAL PROTECTION COMMITTEE
WEDNESDAY, SEPTEMBER 10th, 2008

Thank you for holding this hearing, which should draw attention to a potentially serious threat to the New York City water supply from the Catskills.

In June of this year, I introduced a bill in the State Assembly [A.11527] that, if passed, would have enacted a moratorium on the issuance of permits for gas and oil drilling in New York State for two years. It directed the State Department of Environmental Conservation to "study the need for environmental protection related to the drilling of oil and gas wells in this state." Unfortunately, no action was taken prior to the end of session, but many environmental groups have taken notice of this measure and expressed their support.

Next year I will reintroduce that bill. I will amend this bill to permanently prohibit drilling for gas or oil in the New York City watershed to protect water and air quality, and human health. That includes parts of 5 counties including Delaware, Greene, Schoharie, Sullivan and Ulster counties in the Marcellus Shale region. In addition the bill would halt issuance of any permits for well drilling in the state until a complete environmental review is done by the State Department of Environmental Conservation.

With gas prices at near record levels and the rise of the horizontal drilling technique to extract underground deposits of natural gas, drilling companies have been emboldened. They believe that there is a very large untapped supply of natural gas in the Marcellus Shale formation that extends across the Southern border of upstate New York. With many of that region's landowners looking for a way to supplement their income,

these companies have been signing leases with landowners to allow them to drill wells on their property, including areas near and within the New York City watershed. [See attached map]

This summer, while approving legislation to change the required well spacing, the Governor directed the State Department of Environmental Conservation to update its Environmental Impact Statement on gas drilling to reflect concerns that might arise from horizontal drilling as a method of extraction. This method that has recently become more economical and preferred by the companies now coming to New York State.

Horizontal drilling to break up the underground shale requires millions of gallons of water mixed with sand and toxic chemicals forced through the rock under great pressure. Companies that use this method claim that this mixture is proprietary information and they do not need to disclose what chemicals are being used or how they are being recovered. A Bureau of Land Management 1998 Environmental Impact Statement lists the hazardous substances potentially used as gelling agents in fracturing the shale. They include such toxic substances as benzene, toluene, naphthalene and MTBE. While the industry claims that these are recaptured and properly disposed of, very small quantities of these substances can contaminate millions of gallons of water. For example, only 28 tablespoons of MTBE could contaminate millions of gallons of ground water at a concentration that would cause it to be unusable.

Clean, potable water is of utmost concern. We cannot take a chance with the source of safe drinking water for over 9 million people who depend on it

daily in New York City. We must be sure that the New York City watershed area, as well as the entire Delaware River Basin, which supplies drinking water to a population area of 15 million, is protected from any possible contamination. I am sponsoring a bill to do that.

The economic realities for New York City are enormous. Should there be any question about contamination of the water from its upstate watershed, the federal government will require the water to be sent through a filtration system. The City estimates that building such a system would cost \$10 - \$12 billion dollars in today's dollars. We cannot take this chance. I urge your support of my legislation to protect the New York City watershed.



July 18, 2008

**DEPARTMENT OF
ENVIRONMENTAL
PROTECTION**

59-17 Junction Boulevard
Flushing, New York 11375

**Emily Lloyd
Commissioner**

Honorable Alexander B. Grannis
Commissioner
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-7012

Re: S.8169-A/A – Oil and Gas Spacing Bill

Tel: (718) 595-6565
Fax: (718) 595-3525
Elloyd@dep.nyc.gov

Dear Commissioner Grannis:

Thank you for the recent letter your staff sent DEP regarding the intent and potential implications of Senate Bill 8169-A, the "Oil and Gas Spacing Bill." Although the letter clarified many aspects of the proposed legislation, DEP still has several significant questions and concerns about the legislation as well as the regulation of gas mining within the New York City watershed.

As you know, the entirety of the City's West-of-Hudson Watershed sits atop a portion of the large, multi-state Marcellus Shale formation, a mineral reserve that some have estimated to hold enough natural gas to supply the entire country for two years. As the proposed legislation recognizes, horizontal drilling has seen significant technological advances in recent years, and access to these substantial reserves is now more feasible – both technically and economically – than ever before.

Given the current interest in the Marcellus Shale formation, and the high potential for the introduction of exploratory natural gas drilling in the watershed, aspects of the legislation are of concern to DEP. In addition, we have listened to significant concerns from environmental advocates and stakeholders statewide. Both our own analysis of the potential risks associated with this activity, and questions raised by the environmental community, lead us to have remaining concerns about this bill.

We understand DEC's desire to streamline the administrative process necessary to determine the appropriate size of the spacing units from which wells recover natural gas. We also understand the potential economic benefits increased mining and drilling could have for New York State. We are not advocating a veto of the bill; rather we seek to work with DEC to ensure that the New York City watershed is recognized as a unique resource requiring special protection before this activity is authorized within the City's watershed. By so doing, the concerns of all parties, including the environmental advocates, can be adequately addressed.



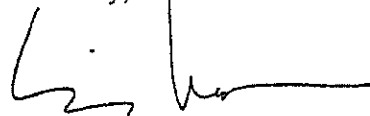
Government Information
and Services for NYC

We ask that you agree to the following specific recommendations and concerns:

- 1) Formation of a technical working group to develop permit conditions that would apply to natural gas exploration activities in the watershed. The membership should include DEP, DEC, the New York State Department of Health, USEPA, and watershed and environmental groups. There is precedent for this type of "regional condition" in the State's Municipal Separate Storm Sewer System (MS4) SPDES program.
 - 2) A commitment, memorialized in an MOU, to consult DEP when reviewing drilling permit applications in the watershed and incorporate DEP's concerns into an enforceable DEC permit.
 - 3) A commitment from DEC to provide adequate staffing to undertake cooperative inspections of well sites in the watershed with DEP.
 - 4) Creation of a drilling exclusion zone within a 1-mile buffer to all NYC water supply infrastructure including reservoirs, tunnels, shafts and other appurtenances.
 - 5) Confirmation that all proposed drilling projects will continue to go through the State Environmental Quality Review Act (SEQRA) process, and that there will be opportunity for public review and comment of any determinations made under SEQRA. Though the July 15, 2008 letter from DEC Deputy Commissioner Gruskin suggested that all proposed drilling projects will continue to go through the SEQRA process, it is New York City's understanding that while applicants must prepare a DEC Division of Mineral Resources well permitting environmental assessment form ("EAF"), there is no opportunity for public review and comment on that EAF. If this is correct, we seek an additional level of review for the permitting of this activity within the City's watershed.
 - 6) Disclosure by applicants for drilling permits of all chemicals used in drilling activities in the watershed.
-
- 7) Clarification from DEC whether SPDES permits are required for drilling activities. A July 15, 2008 letter to DEP from DEC Deputy Commissioner Gruskin implied that SPDES permits would be required, but that is not the current understanding of DEP staff.
 - 8) An affirmation from DEC or the Attorney General that the natural gas exploration and extraction are not exempt from the City's Watershed Rules and Regulations.

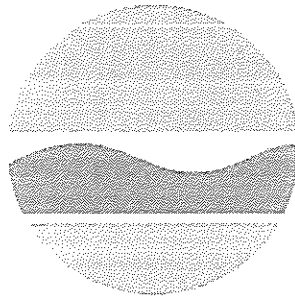
I know you share our concern for protecting the water supply system that provides drinking water to more than nine million New Yorkers, so I am optimistic that we can resolve these issues. I will contact you next week to discuss next steps.

Sincerely,



Emily Lloyd

c: Stuart F. Gruskin



**Testimony of
Alexander B. Grannis, Commissioner
New York State Department of Environmental Conservation**

**New York City Council
Committee on Environmental Protection Hearing:**

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

September 10, 2008

Thank you for the opportunity to participate in this hearing. New York State, the Department of Environmental Conservation (DEC) and New York City have been longtime partners in protecting the city's watershed, and we are fully and absolutely committed to maintaining this relationship and ensuring the continuation of the filtration avoidance determination. The potential for natural gas drilling in the Marcellus Shale formation within the watershed does not alter DEC's position in any way. We will not permit any drilling to take place that presents any threat to the City's drinking water supply.

I both understand and share the Council's concern for the City's watershed. On a daily basis many of DEC's divisions play an important role in protecting the watershed - the Divisions of Water, Fish and Wildlife, and Lands and Forests - and our law enforcement officers are involved in safeguarding this invaluable asset. The reason I am here today is to assure you and the residents of New York City that Governor Paterson and I are fully committed to protecting this resource, and that as we move forward to meet our regulatory obligations under the State's mineral resources program, we will continue our longstanding policies of protection and vigilance with respect to the city's watershed.

As there has been a significant amount of misinformation circulated regarding this matter, it's important to reinforce a number of facts:

First, DEC has not received any applications for Marcellus Shale horizontal drilling in the New York City watershed. Accordingly, there is no imminent threat of harm to the city's water supply and most certainly no "emergency" action is needed. Even if we were to receive an application, no permits will be issued until the completion of a full environmental review specific to the special sensitivities of the City's watershed.

Next, you need to know that the new law relating to the way that "well spacing units" are established has nothing to do with the environmental review that is required before drilling permits are issued. Every application to drill an oil or gas well undergoes an individual environmental review, and any suggestion that applying uniform well spacing rules to horizontal drilling somehow changes that policy, or acts to allow drilling in the City's watershed, is simply false.

As you know, at Governor Paterson's direction when signing the spacing bill, DEC has initiated a public process to supplement the existing generic environmental impact statement (GEIS) that currently governs all oil and gas drilling activities in the State. The supplement will include consideration of the specific impacts relating to the proposed high water volume hydraulic fracturing in the Marcellus formation.

We are currently preparing what is known as a scoping document to guide this undertaking and, over the next few months, will be holding public hearings across the State, first on the completeness of the scoping document and then on the resulting draft supplement to the GEIS to consider impacts unique to this technology, including of course any potential impacts on watersheds. I encourage and welcome the members of the City Council to participate in these hearings to ensure that all concerns specific to New York City's watershed are fully addressed in this public process.

While we are focusing on Marcellus Shale issues, it is important to recognize that DEC has administered a successful, decades long regulatory program for oil and gas drilling that carefully protects New York's environment while achieving the public policy goal of enabling property owners to take advantage of the mineral resources under their properties. Today, there are approximately 13,000 active oil and gas wells in New York. Virtually all of these involve drilling through aquifers, and as a result of DEC's strict regulatory regime, including stringent well casing requirements which isolate the drilling operation from any ground water, water supplies are fully protected. Any suggestion that these standards and requirements may be relaxed, or will not be applicable should deep horizontal shale drilling be proposed in the City's watershed or anywhere else in the State, is utterly baseless.

At DEC, we have been preparing to address horizontal drilling in the Marcellus Shale since the exploration companies began expressing an interest in New York opportunities. We have been clear from the outset about the need for strict environmental protections specific to the potential impacts of the proposed drilling in this formation. Leading our concerns is the vast amount of water needed for the shale fracturing operations (hydro-fracking), including its sources, its management during the fracking operation and its safe disposition at its conclusion. As a condition of obtaining a permit, it is our intention to require that all fluids and additives used in the drilling process be identified, and properly and safely handled during and after drilling. Under our industrial waste hauling regulations, any waste fluids will need to be properly transported and legally disposed of in a permitted treatment facility. Our focus, as is the case in our oversight of all drilling operations, will be on protecting surface as well as groundwater.

While there are reports of a significant amount of leasing activity by gas companies and their agents, we have received only a handful of permit applications for horizontal drilling in the Marcellus Shale. As I noted earlier, none of these are for drilling in the New York City watershed. As a result, we are in a position where we can conduct the careful and deliberate public process we believe necessary to examine potential environmental impacts of horizontal drilling in this formation, and take the appropriate regulatory actions to continue to ensure that gas drilling in New York State, including drilling in the New York City watershed, is conducted in an environmentally sound way, without risk to surface water or groundwater.

Here's the bottom line: we would not issue a drilling permit today if a proposed well threatened the City's or any other watershed, and we will not issue a drilling permit in the future if the proposed well threatens the City's or any other watershed. The City Council and every interested party will have the opportunity to vet our work and raise any technical, legal, and policy concerns that it has regarding drilling in the city watershed as our process to supplement the GEIS moves forward. I look forward to your participation in those proceedings.

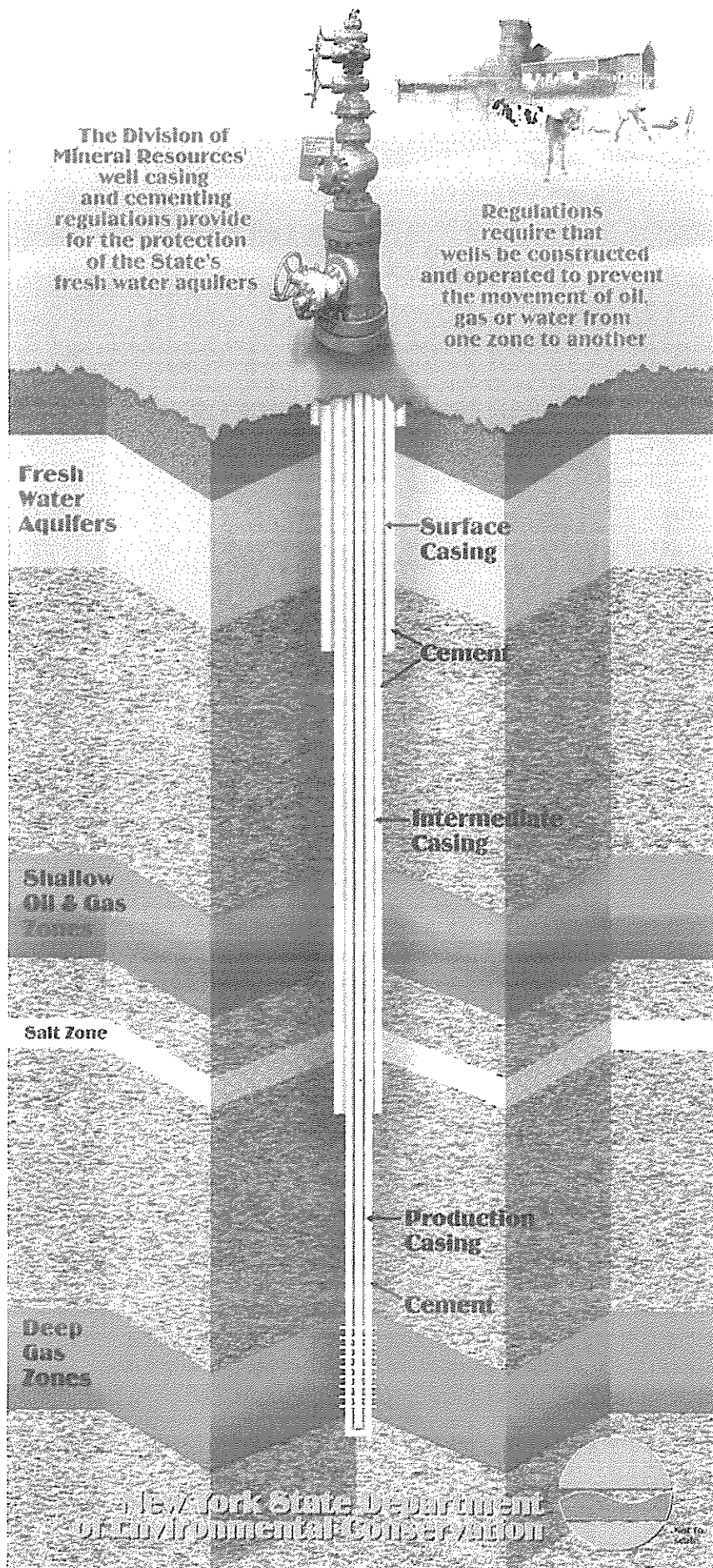
In closing, I want to direct your attention to a new web page, accessible from DEC's home page (www.dec.ny.gov) that covers many of the issues specific to drilling in the Marcellus Shale. The GEIS for drilling in the State is also available on that page which outlines the strict requirements that we adhere to, along with links to other information about our regulatory program and the environmental safeguards for oil and gas drilling. Again, I appreciate the chance to discuss this

Groundwater Protection

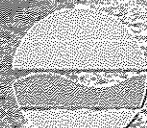
Well Casing and Cementing Program

The Division of Mineral Resources' well casing and cementing regulations provide for the protection of the State's fresh water aquifers

Regulations require that wells be constructed and operated to prevent the movement of oil, gas or water from one zone to another



New York State Department
of Environmental Conservation





September 10, 2008

DEPARTMENT OF
ENVIRONMENTAL
PROTECTION

9-17 Juncoson Boulevard
Astoria, New York 11923

Emily Lloyd
Commissioner

Hon. James Gennaro
Chair
Committee on Environmental Protection
The Council of the City of New York
City Hall
New York, NY 10007

Dear Chairman Gennaro:

Thank you for your invitation to testify before the Committee on Environmental Protection at its hearing on September 10, 2008, concerning drilling for natural gas in the City's watershed. As you know, both Deputy Commissioner Paul Rush and I will be in Washington, D.C. on September 10 and are not available to testify at the hearing. However, I appreciate your interest in this issue and I wanted to share with you DEP's views on this matter.

As most of us are now aware, the entire west-of-Hudson watershed sits atop a portion of a geological formation known as the Marcellus Shale, which lies one mile or more beneath portions of New York, Ohio, Pennsylvania and West Virginia, as well as a few other states. Because of its depth and because of the expected yields from Marcellus Shale wells, the industry did not regard Marcellus Shale deposits as a promising area for exploration. That situation appears to have shifted over the last five years, probably because of the increasing costs of energy as well as advances in hydraulic fracturing, a drilling technology that involves jets of sand-laden high pressure water which are used to fracture the rock containing natural gas deposits.

DEP encourages the exploration of clean energy alternatives and supports economic development in the watershed. However, protecting the water supply for nearly half of New York State is of paramount importance. DEP has serious concerns about the potential for adverse impacts from the use of hydraulic fracturing in our unfiltered Catskill and Delaware watersheds. Given the potentially disruptive nature of hydraulic fracturing and appurtenant activities such as road building, waste disposal and water consumption, we are approaching the issue with extreme caution.

Because there are no natural gas wells currently in the watershed, DEP does not have extensive knowledge of -- let alone practical, firsthand experience with -- the impacts of drilling and how those impacts can be controlled. We are in the process of soliciting a consultant engineer to provide expert advice on the various impacts associated with natural gas drilling and the available technologies to mitigate these impacts. We expect to engage such a consultant within the next few weeks.

In a July 18, 2008 letter to New York State Department of Environmental Conservation (NYSDEC) Commissioner Grannis, we made eight specific recommendations to minimize the threat posed by natural gas drilling. We do not know that these steps will be adequate or sufficient for long-term protection of the watershed, but we believe they are critical first steps. Those eight recommendations are:

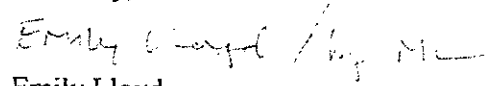
1. Formation of a technical working group to develop permit conditions that would apply to natural gas exploration and extraction activities. The membership should include DEP, NYSDEC, the New York State Department of Health, the United States Environmental Protection Agency and watershed and environmental groups. There is precedent for this type of regional condition in the State's Municipal Separate Storm Sewer System permit.
2. A commitment, memorialized in a Memorandum of Understanding, to consult DEP when reviewing drilling permit applications in the watershed and to incorporate DEP's concerns into an enforceable NYSDEC permit.
3. A commitment from NYSDEC to provide adequate staffing to undertake cooperative inspections of well sites in the watershed with DEP.
4. Creating of a drilling exclusion zone within a one mile buffer to all DEP water supply infrastructure including reservoirs, tunnels, shafts and appurtenances.
5. Confirmation that all proposed drilling projects will continue to go through the State Environmental Quality Review Act (SEQRA) process and that there will be opportunity for public review and comment for any determinations made under SEQRA. In a July 15, 2008 letter from NYSDEC, Deputy Commissioner Gruskin suggested that all proposed drilling projects will continue to go through the SEQRA process. New York City understands that while applicants must prepare a NYSDEC Division of Mineral Resources well permitting environmental assessment form, there is no opportunity for public review and comment on that assessment form. If this is correct, we seek an additional level of review for the permitting of this activity within the City's watershed.
6. Disclosure by applicants for drilling permits of all chemicals used in drilling activities in the watershed.
7. Clarification from NYSDEC whether State Pollutant Discharge Elimination System permits are required for drilling activities.

September 10, 2008
Page 3 of 3

8. An affirmation from NYSDEC or the Attorney General that the Watershed Rules and Regulations apply to natural gas exploration and extraction in the watershed.

Although it is my understanding that NYSDEC has not yet received any applications for permits for exploratory wells in the Catskill and Delaware watersheds, it is our expectation that applications will be forthcoming. Commissioner Grannis has assured us that NYSDEC will work cooperatively with DEP to make sure that no applications are approved that pose a risk to the integrity of the state's largest source of potable water.

Sincerely,


Emily Lloyd

JOE LEVINE 128 16TH STREET BROOKLYN, NY 11215

To The NYC Council – Environmental Protection Committee
Natural Gas Drilling in the NYC Drinking Water Watershed
September 10, 2008

Dear Members of the Committee;

My name is Joe Levine, I am an architect. I live with my family in Brooklyn, and I am lucky to have property on the Upper Delaware River, fed by the Cannonsville and Pepacton reservoirs. The NYC Watershed is located within the boundaries of the Upper Delaware River Basin Watershed.

Thank you for the opportunity to speak today. I would first like to applaud Council Chair James Gennaro and State Assemblymember James Brennan, whose response to the proposed gas drilling in the watershed displays vision, leadership and a vital understanding of the ramifications of the industrial process of hydraulic fracturing and gas extraction on the environment in general and specifically our precious water.

Nine months ago we became aware of gas industry plans to drill ten's of thousands of wells in the NYC and Upper Delaware River Watershed area. My family then embarked on an unbelievable and often depressing educational journey into the gas extraction industry. We joined with several neighbors and formed a grass roots, non-profit citizen's organization called Damascus Citizens for Sustainability.

We learned that the 2005 Energy Act, legalized Halliburton's drilling and fracturing technology, by giving the O&G industry exemptions from existing environmental regulations including the Clean Air, Clean Water, Safe Drinking Water, Right-to-Know, and Super Fund Acts.

This Act facilitated the recent rampage in deep gas extraction and hydro-fracturing that has destroyed great swaths of previously protected, premier animal migration and environmentally sensitive lands out west, causing poisoning of the water and air, resulting in untold illness and plummeting property values.

I recently saw previews of the Josh Fox documentary filmed in Texas, Colorado and Wyoming, PA and NY, "Rage against Nature". It depicts an assault on the natural environment where we will be taking care of friends or relatives who have tumors, cancer, respiratory illness, or some other weird medical condition. The landscape is battered and industrial.

We organized a series of interviews in Hickory, PA, where landowners, characterized the drilling as a "military campaign", and were left with polluted water and air, and un-farmable land.

The most extensive work on this subject has been led by Dr. Theo Colborn, the internationally recognized expert on the health effects of gas drilling, and president of the Endocrine Exchange. They have proven the "cause and effect" of chemical introduction to the ground water and aquifer systems as a result of gas drilling. Dr. Colborn has told me that based upon models from Colorado and other western states, gas production upstate will cause air pollution and ozone levels in NYC to exceed federal regulations for clean air standards.

Last October, Dr. Colborn testified before The House Committee on Oversight and Government Reform on the Applicability of Federal Requirements to Protect Public Health and the Environment from Oil and Gas Development.

I submit this compilation of documents for your use, which includes Dr. Colborn's testimony. Dr. Colborn is 82 and still travels around the country testifying at various state commissions. I believe it would be important to have her here to discuss gas drilling with this Committee as part of its due diligence process.

It is critically important to learn from what occurred out west. There are now models and a track record that cannot be ignored. The northeast is the first region that has had the opportunity to address this issue before the damage is done.

Based upon O&G industry models and our state regulations, they will drill more than 25,000 wells, and by some estimates as many as 50,000, in the Upper Delaware Watershed. They will build roads and clear 150,000 to 250,000 acres of forests throughout the region. They will consume and poison 200 billion gallons of water and half will remain in the ground while the other half requires the most advanced filtration systems available at considerable cost. Gas drilling is inherently poisonous because the injection of toxic chemicals into the ground is required.

The Upper Delaware is a Federally designated Wild and Scenic River and National Treasure. It's ridiculous to contemplate it's destruction for what will amount to only a few years of interim energy supply while we continue to put off meaningful progress on sustainable energy technology. I urge this committee to follow the recommendations of Councilman Gennaro and Assemblyman Brennan and demand a permanent ban on drilling in the NYC and Delaware River Watersheds.

If we are going to give up our water, we must ask "for what price". We seem to be giving up so much these days. It would make sense to draw the line at our water.

Thank you,

Joe Levine

DamascusCitizens.org



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Statement for the Committee on Environmental Protection
The Council of the City of New York
September 10, 2008

Oversight – Natural Gas Drilling in the New York City Drinking Water Watershed

Delaware Riverkeeper Network urges New York City to employ its regulatory powers through NYC Department of Environmental Protection's rules (i.e. Chapter 18) that govern the watersheds that drain to the City's reservoirs. Our comment focuses on the three reservoirs located in the Delaware River watershed, known as the Catskill/Delaware system.

These reservoirs in the Delaware's headwaters make it possible for New York City to withdraw up to 800 million gallons of Delaware River water per day and their massive storage capacity affect the ecological health and flows of the streams below the dams and the entire Delaware River's main stem as well as the communities downstream that also depend upon the River for drinking water. As a result, managing these reservoirs has long been subject to vigorous debate.

The City's Watershed Program that was adopted to protect the water quality of the reservoirs has been a national, indeed an international, success story. By strictly controlling land use and stream discharges in the contributing watersheds of the reservoirs, including cleaning up existing pollution sources, New York City has been able to preserve the exceptionally high water quality of its drinking water, making it the largest unfiltered drinking water supply in the nation, according to Jim Dezolt of NYSDEC.¹ Delaware Riverkeeper Network has supported the watershed program since its inception. Cleaning up pollution in headwater streams and comprehensively managing land use has benefited the entire Delaware River. How the flow has been managed has been problematic in terms of fish and wildlife impacts, especially for the streams below the dams, and the controversy has led most recently to the new flow management plan that is presently under scrutiny.

Natural gas drilling, development and production threaten this success story in two major ways:

¹ Testimony of Jim Dezolt, Director, Division of Water, NYSDEC, before NYS Legislature, Assembly Standing Committee on Environmental Conservation, August 6, 2008, page10.

- First, water quality is directly at risk due to practices employed in the Marcellus Shale formation, which underlies the city's watershed lands. Hydraulic fracturing fluids, which contain chemicals, are used to develop each gas well. Drilling muds and produced water from the development process, add a host of contaminants to the mix of wastewater and solids. Due to the amount of water used to hydrofrack or "frack" these wells, the amount of wastewater produced will be huge and there are multiple opportunities for release into the watershed (through pits or storage tanks on site, when the well is blown, through nonpoint source pollution and stormwater runoff, unintended groundwater aquifer contact, and through deposition on water from ventilation of chemicals to the air). The situation is complicated by the Congressional exemption of the fracking fluids from the Safe Drinking Water Act – an exemption protested by some scientists.

Stormwater runoff is a key piece of the water quality issue that will affect the reservoirs. Because of exemptions granted to the oil and gas industry from some provisions of the Clean Water Act, nonpoint source pollution from runoff that will result from the land disturbance, vegetation removal, and forest cover fragmentation that accompanies each well (such as 3-5 acre well pad, access roads, storage basins or containers, quarrying for road materials, and feeder pipeline to export gas), will be a significant source of degradation to the reservoirs. The Delaware River Basin Commission (DRBC) will be exercising stormwater management under its Special Protection Waters (SPW) program for the Upper Delaware Wild and Scenic River. However, SPW does not apply to lands above the City's three reservoirs. NYCDEP is responsible there for stormwater management. The most conservative and economically responsible approach for DEP will be to ban all well drilling in the watershed drainage area in order to prevent water quality impacts, both point and nonpoint source.

- Second, water quantity will be substantially affected because of the 2 to 7 million gallons of water that will be used to "frack" each well. This is considered a consumptive use so its impact will compound cumulatively, like an out of basin transfer. If well development proceeds at the scale geologists project is optimal, this could mean a permanent removal of billions of gallons of water. Where will this water come from? If from streams that feed the reservoirs or the reservoirs themselves, the potential to reduce available water is alarming. These withdrawals can directly deplete the available water supply for the City. Considering ongoing losses due to the aqueduct leaks and the impending shut down for repairs, the planned additional releases to the Delaware River from the reservoirs under the Flexible Flow Management Plan, and the unpredictability and labile nature of weather patterns (including drought) due to global climate change, reliable reservoir supply is already at risk. It seems essential that NYC protect what it has so deeply invested in with the Delaware River reservoir system and ban all well drilling and the withdrawal of water from the reservoir and its watershed.

Finally, the streams below the reservoirs are completely defined by them, both in terms of quality and flow and the NYC reservoirs affect 25% of the Delaware River at Montague. **This means that what happens in the NYC Watershed does not stay in the NYC Watershed.** It defines the flow and the ecology of the river, all life and the communities that are dependent upon the river downstream. The magnitude of degradation of the Delaware River by natural gas development in the NYC Watershed is huge. And it can be prevented. NYC has the power to prevent the erosion of its accomplished watershed program and save not only the city's water supply but also provide much needed protection to the at-risk Delaware River and its outstanding natural resources. Delaware Riverkeeper Network urges you to ban natural gas well drilling and production in the NYC Watershed.

Thank you for the opportunity to comment today.

Maya K. van Rossum, the Delaware Riverkeeper

Tracy Carluccio, Deputy Director, Delaware Riverkeeper Network

Remarks of Alfred Magnus
New York City Council
September 10, 2008

I am a New York City resident but also own land within the watershed. I'd like to address three points that I haven't heard addressed by city officials before today.

The first point is that it is my understanding that if drilling is banned in particular areas, landowners must be compensated for royalties lost. According to published data:

- The Marcellus Shale formation is thought to have at least 70 billion cubic feet of gas in place per square mile.
- The Utica formation is thought to have at least 30 billion cubic feet per square mile.
- At least 20% of this gas is thought to be recoverable.
- The minimum permitted landowner royalty in New York State is 12.5%.
- There are over 900 square miles of privately owned land in the Catskill and Delaware Watersheds.
- Finally, natural gas has lately been selling at \$8 per thousand cubic feet or more.

Doing some very straightforward calculations with this data, I get an estimated landowner compensation cost of \$18 billion. I am not a professional geologist or economist, but all the numbers I've cited are from people with proper credentials. Of course, New York City needs to develop a much more accurate estimate than I just made. But there is no doubt that the total compensation would be huge.

Is this really the best way to spend billions of New York City taxpayer dollars? Wouldn't it be better to finance a system that relies on thorough inspections to make gas drilling in New York State even safer than it has been to date? Incidentally my understanding is that New York State, which is already a major producer of gas, has a far better safety record to date than many other states.

Second, new techniques such as closed loop drilling dramatically reduce the amount of waste water that needs to be stored and shipped. New York State could require gas companies to use these techniques. Many of the publicized pollution incidents in Colorado and New Mexico would never have occurred if these techniques had been required. That would strike me as a very productive form of regulation, as opposed to an outright drilling ban, which would stifle economic activity upstate.

My third point is that it seems unreasonable to bring a special focus onto the New York City watershed at the expense of the remaining areas in the state containing gas reserves. Millions of people obtain their drinking water from the Susquehanna River, or from the Delaware River downstream of the New York City Watershed. Aren't they just as entitled to clean water as New York City residents?

I believe it is critical that the drinking water supplies of all those affected, whether served by the New York City system or not, be carefully protected. Therefore the state should develop and enforce rigorous rules for protecting that water. But I haven't heard any persuasive argument by New York City officials that the rules within the New York City watershed should be significantly more stringent than elsewhere. And certainly no one has made a convincing argument that only New York City water deserves the protection of an outright drilling ban.

Thank you.

Sept 10, 2008

- My name is Sue Caplan, I get my water from the reservoirs and care a great deal about the cleanliness and safety of the water supply. I also own land upstate and have been following the Marcellus shale play as it unfolds and am very happy about the economic opportunity it brings to the region and state.
- I belong to a gas leasing forum and I volunteered to bring comments from many of the participants who could not make a three hour trip into the city to be heard.
- The three most frequent comments/questions to share with this hearing committee are:

1) What analysis was used to determine a one mile buffer is the right measure of protection? Doesn't the state already have a 330 foot restriction in place (with the well set back requirements)? No drilling has occurred in the watershed and any proposals to drill must meet state DEC standards. Aren't they the more appropriate resource to determine what is safe and reasonable?

2) Secondly, if this buffer is enacted, it is essentially "taking value" from the citizens that own this land. How will the state (or city, since its city proposing the restriction) compensate them for the loss of value in the taking? Oil and Gas company estimates of the value of land over many parts of the Marcellus shale are in the range of more than \$100,000 an acre, with the landowner sharing perhaps \$20,000-40,000 an acre ultimately. That represents billions of dollars of land value held by private citizens.

3) Many on the forum talk about the root of this issue, of NYC wanting to dodge the need to build a filtration plant. A filtration plant would be a great safeguard against contamination and an important long term step in securing the safety of our water and solving the growing problem of turbidity and silt from the reservoirs. Would it be better public policy to put funds into prevention, safety and filtration rather than make a blanket one mile moratorium on drilling? This seems a knee jerk reaction.....certainly a valid concern (that is to protect our water supply) but the majority of members of our forum ask for more reasoned and balanced approach to this issue.

Thank you.

September 10, 2008

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

RE: **Early Intervention, our most vulnerable citizens and the introduction of
fracturing chemicals into our regional watershed**

Dear Committee Members:

I was born, educated and have lived in New York City my entire life. As a speech language pathologist, and child development specialist, I provide early intervention services in the home to infants and toddlers. These children suffer from the complications of premature birth, syndromes and birth defects. I teach these infants and toddlers to swallow, suck, feed and communicate.

At least two hundred forty-five "known" chemicals, many highly toxic, will enter our water system if the gas extraction process known as hydraulic fracturing is permitted in our watershed and Upper Delaware River Basin. An abridged list of some of these chemicals has been attached for your convenience, and I request that you look at it and consider the effects of these chemicals on a developing fetus, as the fetus moves, swallows and breathes them, along with amniotic fluid, while in the womb. I also request that you consider the effects of these chemicals on our infants, toddlers and developing children as they drink, bathe and eat foods prepared with water contaminated with these chemicals on a daily basis. Once many of these chemicals enter our region's water systems, either through the air, or directly through our ground water, there will be no way to remove them. The drilling process and maintenance of these wells will also release volatile organic compounds into the air, making the act of breathing toxic and damaging for not only small developing lungs, but every set of lungs downwind of them. Where then will we get sufficient clean water for more than 15 million people? How will we avert a major public health catastrophe?

If the effects of hydraulic fracturing for gas are benign, why did the oil and gas industry need the exemptions granted by Congress in 2005 from federal control under "The Safe Drinking Water Act," "The Clean Water Act," "The Clean Air Act," and "The Right to Know Act"? It is because such drilling for natural gas in shale bed areas cannot meet Federal standards, and ^{it will} not be profitable were the companies forced to meet them. Congress has effectively shifted the cost of doing business (environmental cleanup, damages to citizens' health, litigation) to the taxpayer.

We have a choice: clean water or hydraulic fracturing. The oil and gas industry wants us to believe that we can have them both, and has spent a lot of money promoting this fiction in the Delaware River Basin. The industry also wants us to believe that the destruction of our environment will bring "job growth"

and "economic development." Sure, job growth and economic development will occur—in the healthcare industry, and among allied healthcare professionals such as myself. According to the New York City Independent Budget Office, the cost of providing early intervention services in New York State and New York City (from birth to the age of 3 years) was \$451 million in 2007, with an average cost of \$26,145 per child. Is an exponential increase of this kind of spending the kind of economic growth that our elected officials envision?

Our federal government has failed us, and our state government is now trying to do the same. I beg the New York City Council to please act on behalf of our unborn, newborn, developing children, parents, and medically compromised citizens to stop this insanity.

Thank you for your consideration for our state's most vulnerable citizens.

Sincerely,



Carol E. Lawson, M.A., CCC-SLP

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Attachment: (1) EPA list of chemicals known to be used in hydraulic fracturing drilling for natural gas

N.B.: Please go to www.endocrinedisruption.org for a comprehensive list of chemicals used by oil and gas companies and their health effects (in spreadsheet form).

This is the latest available list of ingredients in fracking fluids. The EPA website doesn't have a list of fracking fluids. These ingredients have been exempted from the oversight of the EPA, from the Clean Water Act and the Clean Air Act in the 2005 Energy Bill.

EPA'S LIST OF FRACKING FLUIDS

Product	Chemical Composition of Existing Products	Concentration of Interest (ug/L)	
	Chemical Compound	Point-of-Injection	MCL, REC or MCP
Linear gel delivery system	guar gum derivative		
	diesel, which contains the following:		
	benzene	515.20	5.00
	toluene	522.00	7,000.00
	ethylbenzene	522.00	700.00
	xylene	522.00	10,000.00
	naphthalene	14,094.00	20.60
	1-methylnaphthalene	71,840.00	20 / 6,000
	2-methylnaphthalene	34,974.00	121.62
	dimethylnaphthalenes	270,570.00	na
	trimethylnaphthalenes	160,000.00	na
	fluorenes	31,320.00	2190.00
	phenanthrenes	7,830.00	300 / 50
	aromatics	574,200.00	200 / 30,000
Water Gelling Agent	guar gum		na
	water	495,049.50	na
	fumaric acid	132,337.87	na
Linear Gel Polymer	fumaric acid	529,351.49	na
	adipic acid	365,257.43	na
Gelling Agents (BLM lists)	benzene		5.00
	ethylbenzene		700.00
	methyl tert-butyl ether		2.64
	naphthalene		20.60
	polynuclear aromatic hydrocarbons (pahs)		na
	polycyclic organic matter (pom)		na
	sodium hydroxide		1,000.00
	toluene		10,000.00
	xylene		na
	boric acid	170,998.00	73,000.00
Crosslinker	ethylene glycol	na	na
	monoethanolamine	na	na
	sodium tetraborate decahydrate	na	na
Crosslinker (BLM lists)	ammonium chloride		na
	potassium hydroxide		na
	zirconium nitrate		na
	zirconium sulfate		na
	isopropanol	234,945.16	na
Foaming Agent	salt of alkyl amines	na	na
	diethanolamine	na	na
	ethanol	236,091.75	na
Foaming Agent	2-butoxyethanol	269,641.00	na
	ester salt	na	na
	polyglycol ether	na	na
	water	na	na
	glycol ethers	na	na
Foamers (BLM)	hydrochloric acid	na	na
Acid Treatment	formic acid	na	73,000.00
Acid Treatment	diisobutylamine	na	na
Breaker Fluid	ammonium persulfate	na	na
Breaker Fluids (BLM lists)	ammonium sulfate		na
	copper compounds		1,450.00
	ethylene glycol		na
	glycol ethers		na
	2-bromo-2-nitro-1,3-propanediol		na
Microbicides	2,2-dibromo-3-nitropropionamide		na
Biocides	2-bromo-3-nitropropionamide		na
Biocides	polycyclic organic matter (pom)		na
	polynuclear aromatic hydrocarbons (pahs)		na
Acid Corrosion Inhibitor	methanol	236,091.75	16,250.00
	propargyl alcohol	47,425,000.00	na
Acid Corrosion Inhibitor	pyridinium, 1-(phenylmethyl)-ethyl methyl deriv.	na	na
	thiourea	210,750,000.00	na
	propen-2-ol	59,275,000.00	na
	poly(oxy-1,2-ethanedithio)-nonylphenyl-hydroxy	na	na

na = Exceeds regulatory standard

MCL = Maximum Contaminant Level - The highest level of a contaminant that is allowed in drinking water.

REC = EPA's Risk Based Concentration Tables. (<http://www.epa.gov/reg3hwmd/risk/index.html>, developed by Region 3, serving:

Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia)

MCPs Massachusetts Contingency Plan - Risk-based ground water standards for drinking water protection chosen because

Massachusetts has developed standards for many constituents in diesel fuel. Two numbers are given (the first is drinking

water standard, the second is standard for ground-water discharging to surface water).

Testimony of

Ken Baer
91 6th Avenue
Brooklyn, NY 11217

Our city is fortunate to have one of the greatest water systems in the world. Generations ago city leaders had the foresight to develop an upstate reservoir system that was fed by an expansive watershed composed of the forests, woods and farms within about 125 miles of the city. Every day we rely on this massive system to deliver over 1.2 billion gallons of clean, fresh water to New York City. This water is so good it wins taste tests.

Over the last few decades our watershed has been in jeopardy because developers have built or want to build homes and resorts on the mountains and in the woods that **funnel and filter** the rainwater that eventually comes out of our taps. The main concern is that runoff from any development's hard surfaces will include petroleum products, salt, fertilizer containing phosphorus, herbicides and pesticides. The presence of any of these pollutants in our water supply is a problem.

The Croton system, east of the Hudson River was not adequately protected from development, and NYC entered into an agreement with the US Environmental Protection Agency to construct a massive water filtration plant in Van Cortlandt Park. The latest estimate for this project is \$2.8 billion, and the final figure will surely be higher. Every year this filtration plant will cost over \$100 million to operate.

The Catskill / Delaware system, west of the Hudson River, operates under an EPA waiver that does not require filtration. Any further development in the Cat /Del watershed will negatively impact water quality and could jeopardize any future EPA waivers. It is estimated that an investment of \$20 billion would be needed to filter the water from the Cat / Del system, and that the yearly operating expenses would approach \$1 billion.

Development has put our watershed in substantial jeopardy up to this point, but now a new threat to NYC's water supply is the enormous amount of energy in the Marcellus shale formation that extends into the Catskills. Extracting the gas from the Marcellus would use a process called hydraulic fracturing, which involves injecting about one to five million gallons of water per bore hole, along with sand and toxic chemicals.

A substantial amount of this water returns to the surface, but a lot of the contaminated water is not recovered and is left underground. It is uncertain what happens to this subterranean water which is contaminated with toxic chemicals. The contaminated production water held in ponds poses the additional possibility of ending up in our watershed when it is removed.

New York City has enough of a problem dealing with potential development in our watershed. We need to be forceful and convincing that renewable sources of energy are a practical solution to our country's energy woes, and that drilling for gas in NYC's watershed, will create mind-boggling problems. We do not want to spend billions of dollars on another filtration system.

New York City's water supply is a precious resource. **We must not allow our mountains, streams, and watershed to be despoiled by development or gas drilling.**

Thank you.

To: The New York City Council Committee on Environmental Protection
James F. Gennaro, Chair

September 10, 2008

Good afternoon, before I begin my prepared statement to the Committee, I'd like to comment that the color illustration presented today by Commissioner Grannis on p.4 of his statement shows a deceptively antiseptic looking vertical well that bears no resemblance to the reality that horizontal drilling with hydraulic fracturing presents, and for which we are meeting today.

My name is James Barth. I was born in New York City, and have been a lifelong resident. I am making this statement today in order to ask that the Council's Committee on Environmental Protection help to influence the NYS DEC and Governor Paterson to protect not only the immediate NYC Watershed, but also the entire Upper Delaware River Basin.

Carol Collier, the Executive Director of the Delaware River Basin Commission, testified before Congress on June 24, 2008 stating, "Water does not respect political boundaries. To effectively manage water resources, it must be done on the river's terms – using geographic watershed boundaries, not political subdivisions."

The Upper Delaware River Basin is designated as "Special Protection Waters". It is the source of fresh drinking water for more than 15 million people, including New York City. Currently, there exist very few meaningful restrictions on the number of potential drill sites on private property in New York and Pennsylvania. Unless action is taken, our nearly pristine Upper Delaware River Basin will be transformed into a major industrial zone, with easily as many as 26,000 well sites. We cannot allow this to happen.

The hydraulic fracturing process is inherently polluting to our water resources, our land, and our air. If this is not so, then why were the energy companies exempted from major parts of the Federal Clean Water, Federal Safe Drinking Water, and Federal Clean Air Acts? If the chemicals used in the fracturing fluid are not toxic, not carcinogenic, then why have the companies received exemptions from the Federal Right to Know Act? To quote Chairman Gennaro, "This is an activity that is completely and utterly inconsistent with a drinking water supply."

Therefore, I request that the New York City Council work with the Mayor, the NYS DEC, Governor Paterson, the Pennsylvania DEP and Governor Rendell, either through the DRBC, or on their own, to establish a ban on directional drilling/hydraulic fracturing within the Upper Delaware River Basin.

I thank Councilmember Gennaro and the Committee for the leadership they have shown on this issue. I also thank Assemblyman James Brennan and Senator Frank Padavan for announcing that they will reintroduce legislation that will help to accomplish the above goals.

Thank you.

James Barth
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