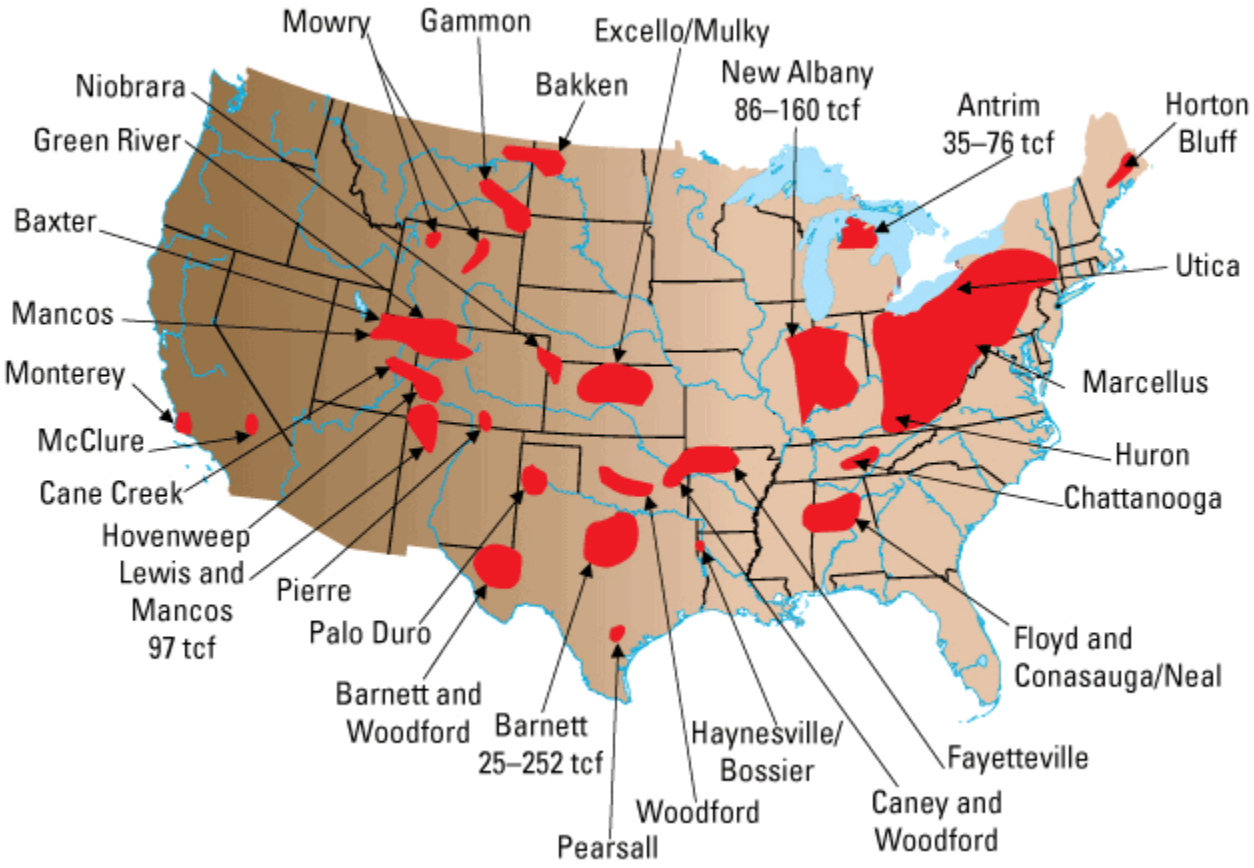
FREQUENTLY ASKED QUESTIONS

(from the website: www.un-naturalgas.org)

WHAT IS NATURAL GAS?

Natural gas is a gaseous fossil fuel consisting primarily of methane but including significant quantities of ethane, propane, butane, and pentane—heavier hydrocarbons removed prior to use as a consumer fuel —as well as carbon dioxide, nitrogen, helium and hydrogen sulfide.[1] Fossil natural gas is found in oil fields (associated) either dissolved or isolated in natural gas fields (non-associated), and in coal beds (as coalbed methane).



US gas plays

Natural gas is often informally referred to as simply gas, especially when compared to other energy sources such as electricity. Before natural gas can be used as a fuel, it must undergo extensive processing to remove almost all materials other than methane. The by-products of that processing include ethane, propane, butanes, pentanes and higher molecular weight hydrocarbons, elemental sulfur, and sometimes helium and nitrogen. - http://en.wikipedia.org/wiki/Natural_gas

Recently, individuals and companies with a financial stake in natural gas production have been engaged in an effort to re-brand natural gas as an 'alternative' fuel. Since in English the word 'alternative' describes any option that isn't the standard or default, and natural gas is not the standard fuel for, say, cars and trucks, no one can write them a ticket for their highly elastic use of

the word and concept. However, by the definition of the term as it has been used for decades, natural gas is not an alternative fuel. "Alternative fuels, also known as non-conventional fuels, are any materials or substances that can be used as a fuel, other than conventional fuels. Conventional fuels include: fossil fuels (petroleum (oil), coal, propane, and natural gas), and nuclear materials such as uranium. Some well known alternative fuels include biodiesel, bioalcohol (methanol, ethanol, butanol), chemically stored electricity (batteries and fuel cells), hydrogen, non-fossil methane, non-fossil natural gas, vegetable oil and other biomass sources." - http://en.wikipedia.org/wiki/Alternative_fuel

In fact, natural gas is just another highly polluting hydrocarbon and conventional - that is, non-alternative - fuel like oil, to which it is closely related and with which it is frequently found. Further, extracting natural gas and transporting it to markets takes huge amounts of, you guessed it, (imported) oil.

WHAT'S HYDRAULIC FRACTURING?

Hydraulic fracturing, as used for natural gas extraction, is the process by which water, frequently mixed with proppants and chemicals, is forced down a well bore at extremely high pressure in order to create or expand fractures to release gas from the rock formation in which it is trapped. Proppants are small particles such as sand or synthetic beads, that hold open the newly-created fractures so that released gas can flow towards the well. The process is also known as fracking, hydrofracking, or any of several other variants.

With the creation or restoration of fractures, the surface area of the formation exposed to the borehole is increased and the fracture provides a conductive path connecting the now-freed gas to the well. Thus, hydraulic fracturing effectively increases the rate that fluids can be produced from the reservoir formations.

This process has made it economically viable to extract natural gas from formations in which the gas is trapped so tightly in very small bubbles or pores that very little would naturally flow to the well. "In order to retrieve gas at a commercially profitable rate, most tight-gas reservoirs need to be fractured."

The main industrial use of hydraulic fracturing, and the purpose for which the technique was developed, is in stimulating production from oil and gas wells.[1][2][3] Hydraulic fracturing is also applied to stimulating groundwater wells,[4] preconditioning rock for caving or inducing rock to cave in mining,[5] as a means of enhancing waste remediation processes (usually hydrocarbon waste or spills), to dispose of waste by injection into suitable deep rock formations, and as a method to measure the stress in the earth.

Various forms of hydraulic fracturing have been developed for differing circumstances. The one now causing intense concern here in New York is known as 'high-volume hydraulic fracturing' (HVHF), and 'slick water fracturing.' In this method, millions of gallons of initially clean water per well are intentionally contaminated with the addition of a wide range and large volume of very toxic chemical additives. This technique combines "water with a friction-reducing chemical additive which allows the water to be pumped faster into the formation. Water fracs don't use any polymers to thicken and the amount of proppant used is significantly less than that of gels. Slick water fracs

work very well in low-permeability reservoirs, and they have been the primary instrument that has opened up unconventional plays like the Texas Barnett Shale. In addition to the cost advantage, water fracs require less cleanup and provide longer fractures...In order to effectively select the right combination and concentrations of frac fluid and propping agents, geologists must know a lot about a reservoir. To create the right approach to a frac job, geologists gather information from well logs about a variety of factors such as porosity, permeability, saturation levels, pressure and temperature gradients. Using this information, geologists run scenarios through 2D or 3D reservoir models to predict the outcomes of various approaches." - http://www.enermaxinc.com/hydraulic-fracturing/

Despite these precautions, the process doesn't always go according to intention. Regarding a subsurface trespass case before the Supreme Court of Texas, the Fort Worth Business Press reported the following: "The problem is, however, that fracture stimulation isn't a precise science...in some ways, cracking the shale [predictably] could be thought of as trying to hammer a dinner plate into equal pieces...'You may plan a fracture that will go 1,000 feet and it might go 2,000 feet or 400 feet, ' said John S. Lowe, a professor of energy law at Southern Methodist University's Dedman School of Law."...'How do you prove any fracing was correct or incorrect in an area that is not precise to begin with?' asked [John] Holden [a partner at Dallas-based Jackson Walker LLP]...'Either side has to prove what's going on down below, and that's hard for both sides.'...Lowe said, 'You can bring the scientific evidence, the scientific testing to see whether or not a trespass has occurred but I'm not sure you can rely on it 100 percent.'" Fort Worth Business Press, July 7, 2008

This uncertainty about how exactly to plan and carry out a fracturing job according to the often obscure details about the site geology as well as that of the surrounding area is one reason to be skeptical about the appropriateness of the technique. Not only do underground formations respectively contain or separate 'good' and 'bad' groundwater, they also obviously harbor many naturally-occurring toxic substances, such as those routinely found in association with oil and gas. In the US alone, there are thousands of instances of groundwater contamination from hydraulic fracturing operations over a wide range of geological and reservoir conditions; to most of us, common sense suggests that any technology that could exploit existing weaknesses in formations or is known or theorized to have unpredictable results, with demonstrable adverse consequences, should be examined with a high degree of scientific skepticism.

HOW ABOUT HORIZONTAL DRILLING?

Horizontal drilling, or directional drilling, is promoted as a way to avoid intensive surface disturbance such as that which was common in earlier hydrocarbon booms. (See picture at left.) While this is a desirable goal, horizontal drilling is not without its own impacts. These impacts are compounded dramatically when horizontal drilling is combined with hydraulic fracturing.

First, multiple wells drilled from a common pad, as is expected with horizontal drilling, require a much larger drill pad, as acknowledged in the draft scope of the DEC's Supplemental Generic Environmental Impact Statement (dsSGEIS), section 2.1.4. Larger drill pads disturb more contiguous surface area and result in more surface runoff from one location. Second, it is horizontal drilling in tight shale that at least in part creates the distinction between conventional hydraulic fracturing and high-volume hydraulic fracturing (HVHF) because of the vastly greater quantities of water used to drill and fracture the vastly greater length of very resistant rock.

Though proponents claim that horizontal drilling will reduce the number of wells that must be drilled to access a given area in the target formation, in fact, New York State regulations continue to allow for wells to be spaced only 40 acres apart, which translates to 16 wells per square mile.

Horizontal drilling also makes it possible for drillers to remove gas from the property of a landowner who does not want to sell her or his gas reserves, even though the landowner denies the drillers access to the surface of his property. This is done through a DEC-mediated form of eminent domain called "compulsory integration." (See below.)

WELL SPACING

From the dsSGEIS, section 2.1.6:
"The number of wells that may exist per square mile is dictated by reservoir geology and productivity, mineral rights distribution, and statutory well spacing requirements set forth in ECL Article 23, Title 5, as amended in 2008...The statute provides three statewide spacing options for shale wells:
"**Vertical wells** –
Statewide spacing for vertical shale wells provides for one well per 40-acre spacing unit. (A spacing unit is the geographic area assigned to the well for the purposes of sharing costs and production.) This is the spacing requirement that has historically governed most gas well drilling in the State, and as mentioned above, many square miles of Chautauqua, Seneca and Cayuga counties have been developed on this spacing. One well per 40 acres equates to 16 wells per square mile (i.e., 640 acres). Infill wells, resulting in more than one well per 40 acres, may be drilled upon justification to the Department that they are necessary to efficiently recover gas reserves.

Jonah Basin, 40-acre spacing

"**Horizontal wells in single-well spacing units** –
Statewide spacing for horizontal wells where only one well will be drilled at the surface site provides for one well per 40 acres, plus the necessary and sufficient acreage to maintain a 330-foot setback between the wellbore in the target formation and the spacing unit boundary. This provision does not provide for infill wells, so the distance between wellbores [ed. note: in this spacing situation] will always be at least 660 feet. Surface locations may be slightly closer together because of the need to begin turning the wellbore some distance above the target formation. However, it is likely that this scenario will result in fewer than 16 surface locations per square mile. This conclusion is based on the fact that the horizontal leg of each wellbore within the target formation is likely to be longer than 1,320 feet, which is the distance that would result in a 40-acre rectangular spacing unit. Therefore, spacing units are likely to be larger than 40 acres, and fewer than 16 will fit within a square mile. Although the wells are horizontal, [single-well] well pads during both the drilling and production phases will be similar in size to those for vertical wells. Hence, horizontal shale drilling with one well per pad would not be expected to result in a well density greater than that contemplated when the GEIS and its Findings were finalized in 1992.

"**Horizontal wells with multiple wells drilled from common pads** -
The third statewide spacing option for shale wells provides, initially, for spacing units of up to 640 acres with all the horizontal wells in the unit drilled from a common well pad. While vertical infill wells may be drilled from separate surface locations, with justification, a far smaller proportion of vertical infill wells than 15 per 640-acre unit is expected. Therefore, fewer than 16 separate locations within a square mile area will be affected. Nevertheless, to accommodate multiple wells and wellheads, the initial well pad from which multiple horizontal wells will be drilled will be larger than is typical for single-well pads. With respect to overall environmental impact, however, the larger surface area of the well pad will be offset by the need to construct a single access road and gathering system to service wells on the pad. The size of a multiple well pad will likely be substantially smaller than the cumulative number of acres that would be necessary to accommodate the same number of single-well pads within the same area...
"The statute provides for variances from statewide spacing, with justification, which could result in a greater well density."

Despite the bland but not legally binding language and the vague reassurances about what is and is not "likely", it's easy to envision the planned destruction to which the DEC is an accessory and accomplice: the alteration of a rural & agricultural landscape into an industrial zone. If 640 acres sounds like plenty of room for 16 wells, it is not: with 16 wells per square mile, a driver traveling a 2-mile stretch of road could pass 64 gas wells at various stages from drilling through production, and all the entrance roads that access them. While not all of the 16 wells per square mile would likely be visible on that one journey, many would be, along with many wells further distant. At such well densities, tanker and heavy construction equipment traffic servicing well sites would be heavy, so our driver would be trying to avoid collision with large vehicles ahead of, following, and oncoming, while dodging the potholes on the battered road. She would also be breathing diesel fumes from the traffic as well as the exhaust from compressors that pressurize the fracturing process and those that drive gas down the pipelines.

According to the OGAP report Shale Gas: Focus on the Marcellus Shale, (see sidebar) none of this is as unlikely as we'd like to think:

Initially, when a new natural gas field is developed, well spacing depends on the state's regulations. It is common for operators to be allowed one well per section (640 acres) or drilling unit, unless they can prove to state regulators that more wells are required to extract as much of the gas resource as possible.
According to the Oil and Gas Investor, "As plays become further developed and the reservoir is better understood, downspacing begins."
This is starting to occur in the Barnett shale. While many wells are spaced at 160 acres, Devon Energy is starting to infill – as of March, 2008, the company announced it had drilled 57 wells at 40-acre spacing (or, according to the company, 500 feet apart), and that it plans to drill pilot wells at 20-acre spacing this year (according to the company, that's 250 feet apart). In 2006, Devon was already drilling horizontal wells at 20-acre spacing; presumably, the 2008 pilot wells are being drilled in a different part of the Barnett shale.
Devon Energy is not the only company drilling wells closer together. According to Denbury Resources, "wells in the Barnett Shale were initially drilled by spacing horizontal wells approximately 1,500' apart and drilling 3,000' to 4,500' laterals. As our development progressed we began testing wells at various spacings of 750' and subsequently 500' along with other operators in the Barnett. . .We have recently begun testing well spacings less than 500'.

EMINENT DOMAIN

Perhaps a landowner objects to having his neighborhood turned into an industrial zone. Another doesn't want to risk the safety of her water supply. A family with children is unwilling to allow them to be subjected to heavy traffic hazards or air pollution. A couple seeks to preserve the quiet they hoped to retire to. A homeowner is concerned about her property value declining in the presence of industrial activity. A person afflicted with COPD or other lung disorder fears the effects of VOC's or particulate pollution on their already-compromised ability to breathe. Someone on a fixed income sees that road damage from drilling traffic has increased the property tax burden in other areas. For any of these reasons and more, landowners might decide to discourage gas drilling in their neighborhood by refusing to sign a lease. However, if other property owners in the spacing unit have signed leases, compulsory integration is likely to be employed. Compulsory integration is the eminent domain process by which drillers are given access by the state to the gas an owner does not wish to sell. According to the DEC's dsSGEIS, referenced above, "A spacing unit is the geographic area assigned to the well for the purposes of sharing costs and production. ECL §23-0501(2) requires that the applicant control the oil and gas rights for 60% of the acreage in a spacing unit for a permit to be issued. Uncontrolled acreage is addressed through the compulsory integration process set forth in ECL §23-0901(3)."

Through this compulsory integration process mediated by the DEC, the state gives the drilling company the right to take the unwilling seller's mineral resource, with some, non-negotiable, compensation.

What this means is that the DEC, maintained by public tax dollars, acts as the strongarm for private industry. The effect is that property owners who are threatened with the probability of eminent domain proceedings are more likely to give in and sign a lease against their will and to their detriment. See Is Your Unleased Property Facing Compulsory Integration?

Allowing compulsory integration to proceed may still be the most financially rewarding option for a landowner, and an experienced attorney can help property owners decide which of several compulsory integration options ("royalty owner", "participating owner", or "non-participating owner") is best for a given situation. Fundamentally, however, everything is wrong when the state eagerly brokers a process by which one party's private property rights are violated and manipulated in favor of another (much bigger) party's financial interests.

WATER CONSUMPTION & DISPOSAL

Estimates of the amount of clean, potable water to drill and hydraulically fracture a single horizontal well in the Marcellus Shale range from 1 to 5 million gallons. This water is typically procured by drillers through surface water withdrawals. In some areas of New York State, surface water withdrawals are regulated by river basin commissions such as the Delaware River Basin Commission (DRBC) and Susquehanna River Basin Commission (SRBC). In other areas, there is no regulating body that adequately addresses surface water withdrawals. NYSDEC regulations only prohibit the "draining" of surface waters, so in areas not regulated by river basin commissions, drillers have used public access points to make repeated withdrawals from privately owned waters and wetlands for which they did not have permission. This is to say, if you and 3 neighbors share a lake outside the jurisdiction of one of the RBCs and one of your neighbors gives permission for - or perhaps simply doesn't notice or object to - tanker truck water withdrawals made from his property, all the owners will suffer a loss of water volume that may have consequences ranging from damage to aesthetic & recreational values, to reduction of water available for home fire protection, to effects on fish and wildlife. This constitutes theft of "the commons" - that is, something that belongs to everyone - for the private use of a single entity.

The SRBC is on record that its job is "not to protect, but to manage, water" in what it euphemistically terms a "balancing act." This so-called "balancing act," in which the demand for polluting and unsustainable amounts of hydrocarbon energy are assigned extra importance and the extraordinary value of clean, drinkable water that sustains communities, agriculture, and wildlife - and for which there is no substitute - is simultaneously accorded less gravity, is a compromise routinely made by regulating bodies, all of whom are subjected to extreme political pressure to yield to the force of money. A representative of the DRBC said "Well, we need the energy" as justification for their non-committal - at least as far as water protection goes - position. There is some evidence that river basin commissions have exaggerated the water usage of other users and industries in an attempt to downplay the significance of the volumes of water required for HD/HVHF.

River basin commissions have huge jurisdictions and for awareness of what withdrawals are being made, depend on drillers and water services companies to apply for permits. In the story linked in the first paragraph of this section, the Zunnos didn't know about the SRBC, nor did the DEC inform the Zunnos of the SRBC's jurisdiction over the protected wetland.

Water must be trucked from the source to the drill site. See How Many Truckloads to Service a Well?

Once at the site water is used for both drilling the wellbore and subsequently fracturing the target formation. For both drilling and fracturing, a wide array of toxic chemicals are added to the water.

The chemicals used in the fracking process are particularly suspect and have attracted scientific scrutiny for their role in endocrine disruption and carcinogenesis. Somewhere between 20 and 40 percent of the millions of gallons of contaminated water returns to the surface, leaving 60-80% in the ground. Despite industry assurances to the contrary, there is significant evidence that contaminated frack water left in the ground may present a hazard to groundwater in the fractured bedrock geology common in much of the US. Perhaps the many documented incidents of groundwater contamination related to hydraulic fracturing activity can be attributed in part to pressure-induced disturbance and exacerbation of naturally - occurring fractures and pressurized movement of fluids through them.

The frack water that is returned to the surface is pumped into a holding pond where it is hazardous in the short term: Plastic liners tear or are punctured, impoundment walls may give way, heavy rains may cause the fluids to overflow into soils and nearby waterbodies. Even if no mishaps occur, heavy tanker traffic is required to truck the water away and in the meantime, volatile chemicals evaporate into the air with adverse effects on air quality and human health.

Once removed from the holding pond, frack water presents insurmountable disposal problems in the long term. Proposed solutions include trucking the waste water to treatment facilities. However, in New York State, no specialized treatment facilities exist, and drillers and government agencies have sought to direct waste water to municipal water treatment plants, which are not prepared to remove and render harmless - as if any process could - the lethal combination of powerfully toxic chemicals in the water. Another proposed solution is underground injection, also known as Deep Injection Well Disposal. In this process, a deep wellbore - perhaps an unproductive gas well - is used as a reservoir into which millions upon millions of gallons of poisoned water is pumped into the ground. Underground injection is a process supported by big industry, which lacks other ways to deal with large volume of wastes, but despite the success of industry efforts to co-opt government agencies so that the method remains legal, it also remains controversial and has been documented to cause groundwater contamination and even earthquakes.

In late 2008, water waste from gas drilling operations in Pennsylvania which was released into the Monongahela River from treatment plants resulted in high levels of total dissolved solids (TDS) in the river, which was already stressed by drought. Apparently, industrial water users such as power plants, not government agencies, were the first to notice high levels of TDS, which are destructive to equipment, in their intake water. While the public was reassured that the water was safe to drink, people were nonetheless encouraged to use bottled water instead of municipal water supplies drawn from the river.

AIR QUALITY

YouTube playlist of videos on air quality problems created by gas industry activities
New study: Air quality, DISH, Texas

TOXINS

There are two basic categories of toxic substances related to gas drilling: first, chemicals intentionally introduced to the process; second, materials that occur naturally in deep strata (layers of rock and water), but do not constitute a hazard to human or environmental health until they are disturbed. A third category may result from the potential for chemical reactions to form new compounds when human-introduced and naturally-occurring substances come into contact with each other due to the drilling and fracking processes.

Chemicals used intentionally for drilling and fracturing:
Both the drilling and fracking processes require chemical additives that serve as friction reducers, biocides, surfactants and scale inhibitors. The specific chemicals used are determined by the process and the requirements of the job. While hundreds of very dangerous chemicals have been identified as components of fracking fluids in the western part of the US, where the geology is different, the exact chemicals that may be used in drilling and fracturing the Marcellus Shale are unknown at this time.

However, the Pennsylvania Department of Environmental Protection provided a list of chemicals, known to them to be used in hydraulic fracturing in Pennsylvania, to The River Reporter, a newspaper based in Sullivan County, New York. The list was evaluated by The Endocrine Disruption Exchange. Of the 54 chemicals listed, 21 are readily airborne, and 34 are soluble, meaning they travel through water. A majority of the chemicals are known to have health effects even as single ingredients. (It is well-established that combinations of toxic chemicals are even more toxic than their component single chemicals.) Heath effect categories included gastrointestinal & liver, respiratory, skin, eye and sensory organ, cardiovascular & blood, brain & nervous system, kidney, immune, developmental, reproductive, mutagen, endocrine disruptors, cancer, & "other."

Naturally-occurring substances exposed during the process:
OGAP's Marcellus Shale report says:

> Marcellus shales are known, in some regions, to contain acid-producing minerals such as pyrite and sulfides.
>
> The Pennsylvania Department of Conservation and Natural Resources publishes a map that indicates which formations are likely to contain acid-forming minerals. The lower part of the Marcellus formation is on the map.
>
> In 2003, an exit ramp was being constructed to the Mifflin County, PA, Industrial Park. The roadcut exposed the Marcellus Formation. Shortly after excavation, acidic, iron-rich water began to flow out of the exposed Marcellus. Pyrite, an iron sulfide formed under reducing (no oxygen) conditions, was deemed to be the source of the acid drainage.
>
> When pyrite is exposed to air and water, it breaks down and forms sulfuric acid and iron hydroxide – a phenomenon well known in the mining industry. The acid-producing reaction occurs as long as the pyrite continues to be exposed to air and water. If these conditions persist, acid will be produced until all of the sulfide in the rock is used up. At some mining

sites, it is predicted that acid will be generated for hundreds or even thousands of years from the sulfide mineral waste created during the mining process.

While the amount of acid-generating rock material removed during the drilling of the Marcellus shale would be very minimal compared to the amount of material exposed during a mining operation, the drill cuttings may still contain enough pyrite to cause problems. The weathering of pyretic shales can result in "acid generation, metal mobility, and salinization of ground and surface water."

Metal mobility is caused because the acidic drainage can dissolve toxic metals (e.g., copper, aluminum, cadmium, arsenic, lead and mercury) that are present in the surrounding rock or soil. Black shales, like the Barnett, Marcellus, Fayetteville, New Albany and others, are often enriched in trace metals. The U.S. Geological Survey has found high concentrations of arsenic, cobalt, chromium, molybdenum, nickel, vanadium and zinc in stream sediments near outcrops of pyrite-rich Devonian black shale.

If toxic metals are mobilized, the metals could move through the soil and contaminate surface or groundwater.

It is possible that the potential for some Marcellus shale drill cuttings to generate acid and mobilize metals in rock or soil may preclude them from being buried on-site or land spread. To address this, for example, according to the Pennsylvania Code:
§ 78.63 (b) A person may not dispose of residual waste, including contaminated drill cuttings, at the well site unless the concentration of contaminants in the leachate from the waste does not exceed the maximum concentration stated in § 261.24 Table I (relating to characteristic of toxicity).

HEALTH ISSUES

Health is a casualty on the fast track to gas drilling

Essay - July 16, 2008 by Rebecca Clarren

The 20 miles of interstate highway between the small towns of Silt and Parachute in western Colorado slice through a landscape of sagebrush and mesas. There are few exits through this section of Garfield County, where the local population of deer and elk rivals the number of ranchers, retirees and others who live here.

Susan Haire, 55 and a small-scale rancher, lived on top of one of the surrounding mesas for nearly a decade, but she says that in the last year, the landscape turned against her. When she drove down this stretch of highway, her nose bled, her eyes burned and her head pounded. She began wearing a respirator to clean the air in her car.

"I felt like an alien, like I didn't fit into my own environment," says Haire. "It's horrifying

what's happening here. The changes that have happened in the past 18 months are so dramatic, it's just a nightmare."

Haire's doctor blamed her ill health on the changes that occurred around her: In the last two years, gas companies have drilled over 600 natural gas wells. Every few feet, 150-foot-tall drill rigs — all flying American flags — rise upwards into the sky. Banks of rectangular huts with five-foot diameter fans sit back from the road, pumping and moving the gas into underground pipelines.

Haire's experience isn't unique. Veteran oil and gas lawyer Lance Astrella of Denver, who has built a career fighting the industry on behalf of citizens, says he has talked with dozens of people who blame their health problems on the surge of new gas wells. Between January and March of this year, eight people called the Garfield County oil and gas department to complain about air quality. They asked about black smoke and strong chemical odors that they worried could make them sick.

Critics say health hazards from the wells don't stop with air pollution. They point to a process called hydraulic fracturing, whereby a gas company injects into the ground a mix of water, sand and chemicals that include carcinogens such as benzene, arsenic and lead. Developed by Halliburton, hydraulic fracturing, commonly called "frac'ing," loosens the rock and maximizes the flow of gas to the surface. But up to 40 percent of the fracturing fluids remains in the formation, according to studies conducted by the Environmental Protection Agency and the oil and gas industry. That means that toxic fluids could seep into the surrounding soil, groundwater and into water wells.

In Garfield County, there are at least 2 trillion cubic feet of natural gas in the tight sand and coal bed formations below, according to gas companies and industry geologists. Over the next eight years, over 10,000 additional wells are slated for drilling in the county. Today, federal and state agencies in Wyoming, Colorado and New Mexico are issuing more permits to drill for gas than ever before, and doing it as quickly as possible, under orders from Washington. The Bush administration says finding energy at home is critical to reducing foreign imports and ensuring national security, and in the aftermath of Hurricane Katrina, Congress has pushed to increase energy sources beyond the reach of the coastline.

Despite the potential for health problems from unregulated pollution, neither the Centers for Disease Control nor the Environmental Protection Agency is conducting long-term public health studies connected to all this drilling. So no one knows how natural gas development may be polluting the air or water or affecting human health.

In the meantime, Haire — who just moved to Texas for her health — and the neighbors she left behind, aren't lone voices: In 2004, a group of 18 top public health experts alerted the EPA and Interior Department officials that accelerated oil and gas drilling in the West was taking place without adequate regard for human health. The warning was not heeded.

One agency staffer, who plans to retire soon, speaks out bluntly: "It's a catch-22: If the EPA doesn't study the health impacts, then there's no proof anything dangerous happening is happening. That's irrational and corrupt," says Wes Wilson, an environmental engineer with

the EPA's Denver office for the past 32 years. He calls his agency's position sad: "We used to investigate mysteries and now we're not. It's kind of like we're being paid off with our generous salaries. The American public would be shocked if they knew we (at EPA) make six figures, and we basically sit around and do nothing." PA's Denver office for the past 32 years. He calls his agency's position sad: "We used to investigate mysteries and now we're not. It's kind of like we're being paid off with our generous salaries. The American public would be shocked if they knew we (at EPA) make six figures, and we basically sit around and do nothing."

- High Country News
Rebecca Clarren is a contributor to Writers on the Range, a service of High Country News (hcn.org). She writes about health and environmental issues in Portland, Oregon.

Potential Exposure-Related Human Health Effects of Oil and Gas Development
In September, 2008, experts at the University of Colorado School of Public Health completed a review of data and scientific articles about the health effects of oil and gas drilling and production on neighboring communities. They found that the chemicals being used and produced pose a potential health risk to local residents, and recommended a thorough health impact assessment before expansion of oil and gas activities. Their findings are detailed in these two papers.

hea_08091702a.pdf White Paper
hea_08091702b.pdf Literature Review
hea_08091702c.pdf Literature Review Appendices

WHAT ABOUT NYC'S WATER?

New York City's Department of Environmental Protection is deeply concerned about the effect of industrial scale gas drilling in the watershed that supplies its reservoirs, as evidenced by the following excerpts (emphasis ours):

Testimony of Acting Commissioner Steven W. Lawitts
New York City Department of Environmental Protection (DEP)
before the Council of the City of New York Committee on Environmental Protection
concerning Oversight - Natural Gas Drilling Within the New York City Watershed: Part 2
Hearing Room, 250 Broadway

December 12, 2008

...We are all here today because we believe there is nothing more important than protecting New York City's drinking water, an irreplaceable resource for half the citizens of New York State.

The Bloomberg Administration has consistently stated that protection of the watershed and water supply infrastructure is our highest priority. Former Commissioner Emily Lloyd's July

18 letter to New York State Department of Environmental Conservation Commissioner Pete Grannis made the following preliminary recommendations: a drilling exclusion zone around infrastructure and reservoirs; a formal structure for DEP involvement in well-permit reviews and inspections in the watershed; and a technical working group to develop regional conditions for the New York City watershed.

...DEP looks forward to working closely with Commissioner Grannis and his staff to ensure that the Supplemental Generic Environmental Impact Statement (SGEIS), now in the scoping phase, fully discloses any potential environmental risks to our water supply system posed by natural gas exploration and extraction in the Catskill and Delaware Watersheds.

We have reviewed the draft Scope for the SGEIS and generated comments, which we have submitted to the New York State Department of Environmental Conservation (DEC) this morning... As you know, DEP operates and maintains tunnels, aqueducts and shafts within and outside the watershed. These tunnels often operate under high pressure which reduces the likelihood of contamination from operations such as natural gas drilling. However, inadvertent penetration or contamination resulting from drilling operations could significantly affect the City's ability to provide high quality drinking water.

As set forth in our comments, our primary water quality concern stems from the use of drilling chemicals. The Scope indicates that approximately 99% of the estimated two million gallons needed to develop one well is pure water. However, that equates to approximately 20,000 gallons of unknown chemicals per well site. One of the common chemicals associated with contamination from natural gas drilling is benzene, for which the ambient groundwater standard is one part per billion. We are therefore calling for full identification of the chemicals used in drilling and an assessment of their potential impacts.

... There are no applications for well drilling within the watershed right now, but there are 835 active applications State-wide to date in 2008 as opposed to 652 in 2007. Five of the applications for drilling in the Marcellus shale are in the Town of Hancock, a town outside of the New York City Watershed but through which a portion of the City's West Delaware Tunnel passes. DEC has shared the locations of the proposed wells with us and the nearest one is roughly seven miles away from the tunnel - a distance that we currently believe does not pose a threat to our water supply. However, we intend to closely collaborate with DEC on those applications and ensure, with support of our consulting engineer, that any risks that these proposed wells may pose are identified before the permitting process goes forward.

Natural gas extraction via hydraulic fracturing involves a complicated set of activities that may pose great risks to the ecology of the surrounding area and to the water supply system operated by DEP, which provides high-quality drinking water to approximately half of New York State's population, including eight million residents of New York City. For example, to create the wellhead and access roads the surface of the land has to be disturbed, which creates a risk of soil runoff into the streams that feed our reservoirs. The vehicles and equipment used to extract or transport natural gas have to be fueled, possibly through on-site storage, which also creates a risk of leaks or spills. The fracturing fluid itself is composed of hazardous compounds that, if released into the environment, could pose a very grave threat to water quality. The waste fluid pumped out of the wells after fracturing is often stored on site in open

waste pits that are also subject to leaks and spills.

... As many of you know, the water from these watersheds, both located in the Catskill Mountains, is of quality so high that DEP has been granted a 10-year Filtration Avoidance Determination from the United States Environmental Protection Agency. However, if the economic incentive to extract natural gas from the Catskill and Delaware Watersheds is very great, the scale of road building, fuel storage and waste handling could dramatically increase to the point that the long term sustainability of a high-quality water supply to the City of New York from the Catskills may be jeopardized. These impacts must be analyzed in the SGEIS.

In granting New York City an unprecedented ten-year Filtration Avoidance Determination (FAD) for the Catskill and Delaware Watersheds, the US Environmental Protection Agency recognized the robustness of our Watershed Protection Program, the cornerstone of which is land acquisition. Aside from the environmental impacts from natural gas drilling, newly available mineral resources could make it more difficult to acquire watershed land. Land owners may be less likely to sell if they can sell natural gas leases with the potential for future royalties; potential for natural gas could drive up appraisals and the cost of obtaining land from owners who are willing to sell; and New York City may want to avoid buying land or conservation easements on properties that have a natural gas lease, further limiting the real estate market.

For these reasons, the draft SGEIS should include evaluation of the potential for natural gas drilling to disrupt the programs, controls, protections and institutional relationships that are required by the FAD and embodied in the 1997 Watershed Memorandum of Agreement, to which DEC is a signatory. The draft Scope states that the draft SGEIS will evaluate impacts in the New York City watershed "with consideration of the fact that New York City controls a substantial amount of the acreage surrounding the reservoirs through fee ownership or conservation easements so that drilling would not occur on such acreage without the City's permission." This misleadingly implies that the City can control natural gas drilling in the watershed through its land ownership or conservation easements. In fact, most land in the watershed is privately owned, and controls for watershed protection are achieved through a combination of regulation, land acquisition, infrastructure investments, and partnership programs with watershed communities. Moreover, State enforcement is an important element of natural gas drilling outside of the watershed, and the same should be true within the City's watershed. The nature of property ownership should not alter the mandate of the State to vigorously protect the State's natural resources, including its water resources. The final SGEIS must clarify these relationships and constraints.

...In closing, thank you for the opportunity to testify on natural gas extraction in New York City's Watersheds in the Catskill Mountains, an activity that DEP views with great concern.

Prudent observers may wonder, if New York City believes a minimum one-mile buffer zone between drilling activity and their reservoir system is necessary to protect their water supply, why similar protections for all other residents of New York State are not under consideration.

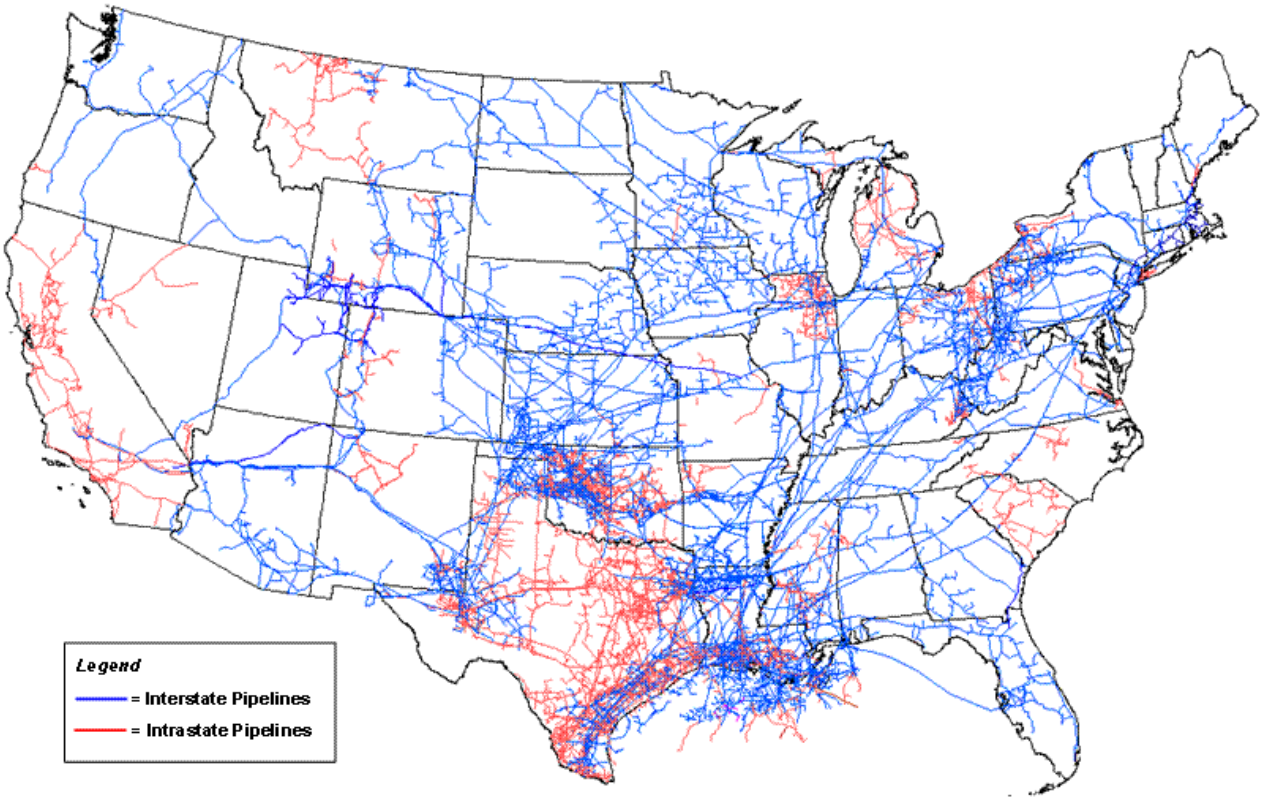
Some environmental organizations have sought to place special emphasis on preserving the integrity of New York City's water supply, while devoting much less time and focus to the

protection of other watersheds across New York State. While we acknowledge that various interested entities may feel restricted to acting primarily or even exclusively on behalf of their own constituencies, the position of Chenango Delaware Otsego Gas is:

Chenango Delaware Otsego Gas Group Position on Selective Protections by the State of New York:

CDOG opposes any New York State natural gas drilling legislation or agency regulation that effectively provides separate and unequal environmental protection, for different people, different counties, or different watersheds within New York State. A gas extraction industry process that is considered too environmentally unsafe to be used within a particular watershed (e.g. New York City's) is not safe for use in any other watershed; and therefore should not be permitted for use anywhere within this state.

PIPELINES



Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Division, Gas Transportation Information System

Gas wells don't exist in isolation. There has to be a way to move the gas from wells to processing and to the customer, and that way is pipelines, large and small. Wikipedia: oil & natural gas pipelines
Eminent domain: what's happening to DISH, Texas

Pipeline rights-of-way take up a huge amount of space and are often created through eminent domain proceedings.

And once pipelines are in place it becomes exceedingly difficult to stop industrial-scale well development.

The infrastructure is aging: For years Matt Simmons, the only Peak Oil activist among the oil & gas industry elite, has been warning about, besides peak oil, the aging energy delivery infrastructure:

"If the world wants to keep using energy from oil and gas, it will have to rebuild the infrastructure and the cost of doing this could rival the combined cost of the World War II war machine, the post-war Marshall Plan that rebuilt Europe, and the post-war buildout of the U.S. interstate highway system."

Simmons said the costs could be enormous–in the $50- to $100 trillion range. Triage needs to happen immediately to prioritize which links in the system are the weakest and need to be repaired or replaced first. Pipelines are old, some dating to World War II. Matt Simmons: Rust Happens

Every year, pipeline explosions, residential or industrial, kill:
Why are we still using this stuff?
Partial list of pipeline explosions in the US: natural gas & related substances
For videos on use of eminent domain for pipeline "rights"-of-way, click here

WILL I BE AFFECTED?

Regardless of whether you live in a rural area or in town, the answer is yes.

'Cost externalization' is a strategy that corporations use to maximize profits. In this context, the term describes how the injurious effects of the shale gas extraction industry will be born by individuals and communities rather than by the companies doing the extraction. For instance, shale gas extraction has documented and measurable destructive effects on air quality. But when you or your children contract an air-pollution-related disease such as asthma, it is not the industry who will bear the costs - you will. Nor will the industry bear the expense of the longer time you'll spend in traffic or higher costs for your car repair & maintenance from degraded road conditions. Likewise, many other effects of shale gas drilling, including not only health care costs but road maintenance and emergency services expenses, will increase the financial burden on local municipalities, and these costs will be born by taxpayers.

For more details, see also sections below: community & infrastructure and what local governments can do

WHAT LOCAL GOVERNMENTS CAN DO TO MINIMIZE THE NEGATIVE IMPACTS OF GAS DRILLING

Local government officials are only beginning to hear about the unanticipated consequences of gas drilling on their communities. These impacts will cost the local government money and thus affect all of us whether we signed a lease or own any land.

Town government's biggest budget item is its road/highway department. Gas drilling affects town and county roads because truck traffic carrying 800,000 to 4 million gallons of water per well and again per fracking wears out roads.

Air quality problems and noise from 24/7 drilling as well as the noise from compressor stations will impact on health when the drilling is near a school, hospital, nursing home or village.

County/town emergency and health care services will experience increased demands. This can be due to the increase in major on-the-job injuries which happen in gas drilling ,or the naturally occurring radium-226 and 228 and radon that concentrates on drilling equipment.

Fire fighting needs from chemicals fires and gas eruptions which require different kinds of responses than brush and house fires.

There is the additional use of schools for families of drilling workers and the impact of increased demand for rental housing which drives up the price for local renters.

And there is the impact on water systems, including municipal water, underground aquifer, individual wells, as well as our ponds, lakes and rivers. Those impacts include both the sheer volume of water being pumped out of current water sources to use in the drilling process and the occasional damage to water systems (wells, aquifers, ground water) when the drilling fluids get into those systems.

The safety and welfare of the general population are not protected by the best-crafted leases, nor by higher levels of government. Local government needs to act to protect the general population. Federal laws exempt the gas industry from The Clean Air Act, The Clean Water Act, and The Safe Drinking Water Act. The State Department of Environmental Conservation claims they are protecting us, saying "Our regulations are as strong as the federal government's". But that is saying zero.

The DEC says that the Oil, Gas and Solution Mining Law precludes the enforcement of local laws in the area of oil and gas regulation except local roads and real property taxes. (Environmental Conservation Law §23-0303(2).) However, this fails to note that gas drilling has to follow all the laws that aren't specific to gas drilling. For example, we are not precluded from enforcing speed limits, negligent conduct and other legal rights. Moreover this law has not faced legal challenge since 1992, when the scale of gas drilling was much different.

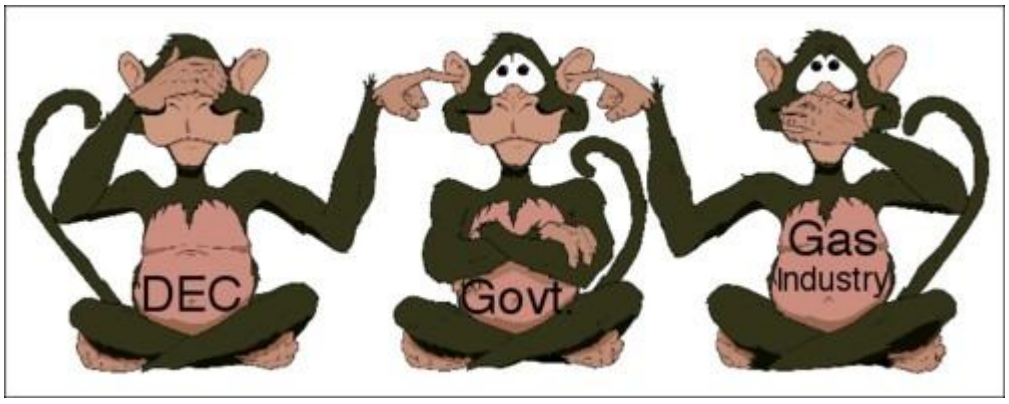
The DEC is trying to discourage local governments from using moratoriums to delay the drilling until the Towns put needed protections in place.

Several communities in Sullivan County have nevertheless passed 6 month moratoriums. The gas companies had years to make their business plans; local government should have a year to make plans to prevent the hidden costs of drilling from being borne by the community rather than the gas companies.

Some lawyers say that a moratorium probably won't be upheld if the gas companies challenge them. These lawyers often represent landowners or gas companies in negotiating leases. Their interest is to have the drilling happen as soon as possible so they get their fees sooner. But the fact is that municipal lawyers use moratoriums regularly to allow their communities to study, investigate and determine whether new laws are needed to minimize the negative impact of some development. A moratorium does not prevent the gas drilling indefinitely. It only pauses it for a reasonable time while the local government considers what, if any, rules, bonding requirements, etc. need to be put in place.

ECL §23-0303(2) also doesn't mean we can't delay the gas drilling until we do pass local laws that are allowed such as on roads and taxes. Just because we cannot stop it from happening does not mean we have to sit idly by while our safety and health take a back seat to the gas industry's profit margins.

WHAT SHOULD LOCAL GOVERNMENTS DO BEFORE THE GAS DRILLING STARTS?



Officials: don't be the 'monkey in the middle'

Develop a land and water inventory guide by collecting baseline data. Other communities with experience in hosting gas drilling say that is crucial because you will not be able to prove damages to water, air, etc if you cannot show what the status was before the drilling.

Implement community impact fees for schools and roads, e.g. assess taxes of number of trucks/day and weight.

Require bonding for pits and reservoirs. The chemicals used in the fracking solution will either be trucked out or left to evaporate in reservoirs. There should be a special license to handle hazardous

waste. Require steel linings rather than plastic linings for the open pits that hold drilling water which contains various chemicals, biocides and fracking fluids.

Require reclamation bonds. Bonding to plug abandoned wells, which costs $15,000-$20,000 if there is no contamination. More than $100,000 if there is spill/contamination.

Require emission monitoring of road dust and ozone from flaring.

Implement a "reverse 911" system where there is a way to call/alert people of a chemical spill or fire.

Define mandatory set backs from schools, houses, roads and streams as we would from porn shops, rock concerts or any (other) pollution-emitting industry.

Enact stormwater rules. Weeds and herbicides have presented problems in other states where gas drilling occurs. Since the federal government has exempted gas drilling from stormwater runoff regulations, local governments have to enact their own stormwater rules.

Prepare plans to deal with impacts arising from changing property values.

Pass Municipal watershed ordinances. The taking of water for drilling is not a one-shot deal. The industry will have 3 to 10 fracturing episodes to fully exploit each well.

- Mary Jo Long, Esq.

Other resources for local government:
Sourcewater Collaborative

WON'T THE DEC TAKE CARE OF IT?

The sad truth is that New York State's Department of Environmental Conservation is a cheerleader for the gas drilling industry and works much more closely with it than it does with citizens. DEC in fact, is mandated by Article 23 of the NYS Environmental Conservation Law to maximize the efficiency with which oil and gas are extracted. Contemplate the irony: if you wanted to put up a wind turbine on your property, you'd be responsible for preparing your own Environmental Impact Statement. But if you're the oil & gas industry, the DEC - funded by taxpayer dollars - will prepare a blanket ('generic') EIS (GEIS) for you, as it is currently doing in preparing a Supplemental Generic Environmental Impact Statement that will cover every drilling permit in the state going forward. Not once, not ever, would you as a driller seeking a permit to drill and complete a well have to undergo the cost and inconvenience of going through the EIS process yourself, like everyone else does. Sweet, eh?

State agencies find it essentially impossible to resist gas industry lobbying in the best of times. But budgetary crises provide an excuse: NY State's governor, David Paterson, at a 'town hall' meeting in Binghamton on February 11, 2009, said that drilling for natural gas in the Marcellus Shale will help bring jobs and money into the state, helping mitigate its record deficit.

HEAR NO EVIL, SEE NO EVIL, SPEAK NO EVIL

In response to a FOIL request submitted by Earthjustice, the New York State Department of Environmental Conservation (DEC) admitted that it does not require ground or surface water quality testing by the gas drilling industry and that the agency does not compile a record of drilling problems requiring follow-up. Ignorance of the facts is not the same as a clean bill of environmental health.

Since 1992, DEC has NEVER asked any gas driller to prepare an environmental impact statement ("EIS") for a proposed well permit. In DEC's view, no well ever presented a potentially significant adverse impact not covered in its 15-year-old generic EIS (GEIS). DEC does not know of any environmental problems from hydrofracking, because it has never seriously analyzed the evidence.

From the Office of General Counsel, NYSDEC in response to Earthjustice's FOIL request: "I'm unaware of an instance where an EIS was prepared. And...the Department does not require private water testing or surface water testing as a condition of a permit.

"It is possible that DEC would have a few records of this nature but only if an operator submitted them voluntarily or if there was a problem noted that required follow up by DEC. Here again, the Department does not maintain documents in a format that would facilitate a search. It would be better to identify either a well name or operator to narrow the search. Otherwise, staff will have to rely on their memory to recall whether any water testing data was made available."

Likewise, a FOIL request to the DEC from Environmental Working Group, asking for tests and test results for hydraulic fracturing chemicals in New York State waters during the past 50 years resulted in the following DEC response: "The Division of Mineral Resources does not maintain any records which are responsive to your request." See EWG press release here.

Are there recorded instances of groundwater contamination from hydraulic fracturing in New York State that the DEC could avail itself of if it was interested in the evidence? Is there scientific acknowledgment of the process by which that contamination has occurred? To both questions, YES. See Chautauqua County Dept of Health & US Interior Department Geo Survey Letters.tif (File opens with any fax viewer, such as Windows Picture and Fax Viewer)

See also:

DEC's Downing St Memo | Can We Trust the DEC? | This Is Not Your Grandfather's Gas Well

ENERGY INDEPENDENCE

When energy companies extol the benefits of natural gas as a domestically-produced fuel, they're selling an illusion: While trying to convince us that we should sacrifice our air and water in exchange for a greater domestic supply of fuel, they're simultaneously making plans to export natural gas extracted here to countries overseas - to whichever regional market pays the most.* What that means is that as soon as plants are built that allow natural gas to be liquified for transport overseas, we'll have to pay world market prices just to buy our own natural gas. Did you know the the US exports oil? - 1.8 million barrels of oil a day in May 2008? That is to say, just because it was extracted here doesn't mean it stays here. And because hydrocarbon fuels are a commodity traded in the world market, there's no separate tank that allows us to buy domestically produced oil or natural gas at a lower price. The Department of Energy's Annual Energy Outlook 2007, prepared last February by the Energy Information Administration, an independent statistical and analytical agency within DOE found drilling in Florida: "…would not have a significant impact on domestic crude oil and natural gas production or prices before 2030... Because oil prices are determined on the international market, however, any impact on average wellhead prices is expected to be insignificant." [Department of Energy's Annual Energy Outlook 2007, 2/07].

There's another facet to energy independence: Just as someone who has maxed out 10 credit cards doesn't need another one, we don't need more energy at any cost to our quality of life. We need to learn to live within our energy means - and much of the reason we have so much trouble with that is due to the close relationship between government and the energy industry. Did you know that for the years 2002-2006 Chesapeake Energy had an average tax rate of 3/10ths of a percent? If energy exploration companies didn't receive such staggering tax breaks, and their fair share was invested in real energy independence options, we would have viable options each day for living within our energy means. We might have solar panels along Route 17, the way the Autobahn in Germany does. We might have small wind turbines on our buildings. We might be riding light rail to work & shopping. It's the hydrocarbon industry, and the auto industry - which now asks to be bailed out at yet more taxpayer expense - who decades ago persuaded our government to use our tax dollars to increase their control and profits, and decrease our choices. It was their lobbying that destroyed early mass transit in the US. We'd be foolish to accept the false choice that we need to sacrifice even a little bit of our environment, let alone as much as the destructive process of HD/HVHF for natural gas will cost us, for a few years' worth of yet another polluting, global-warming-worsening, hydrocarbon energy source.

And what about true energy independence? While it would be a great good to reduce our imports of oil and natural gas - and in this regard we can make significant progress through conservation alone - it would be even better to declare our independence from greedy energy corporations who co-opt (that's a polite word for 'steal') our tax dollars, who monopolize the market & manipulate prices by inducing artificial shortages, and who keep trying to convince us that we have no other choices besides their hydrocarbon fuels that pollute at every step: production, transport, and use.

*Aubrey K. McClendon, in Chesapeake Energy's 2008 2nd quarter earnings call: "Now, we will look at investing in L&G export facilities and we are studying that right now. We've got to figure out a way to get some linkage to the world market and we are dedicated to trying to find a way to achieve that linkage...we read the papers and see that gas around the world goes for twice what it goes for here. So, my view is we make a great widget here and that widget is valued at x here and 2x around the world so we're trying to figure out a way to get it on a boat and get it to some

overseas markets as well. So, the addition of a potential linkage to world prices as well as to work natural gas in to the transportation network, I think really creates two huge value added out year markets for the industry and I'm doing all I can on both fronts."