

**Natural Gas Drilling: Pennsylvania's Perspective
The States' Regulation of the Natural Gas Industry**

Testimony of
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Members of the Committee, thank you for the opportunity to provide testimony on behalf of the Commonwealth of Pennsylvania, Department of Environmental Protection.

The potential of the Marcellus Shale play has captured the world's attention. Indeed, not since Edwin Drake drilled North America's first commercial oil well in 1859 have so many focused their attention on Pennsylvania as an opportunity for oil and gas development. Increased well drilling has also brought with it unfounded skepticism about Pennsylvania's ability to properly oversee the oil and gas industry.

I say unfounded because just last year the head of EPA's Drinking Water Program said publically that "I have no information that states aren't doing a good job already [regulating fracing]." That is certainly the case for Pennsylvania. Also, our regulatory program was recently evaluated by the independent, non-profit, multi-stakeholder State Review of Oil and Natural Gas Environmental Regulations organization (STRONGER) and received positive marks. STRONGER was only recently recognized by the United States Department of Energy Shale Gas Subcommittee's August 2011 draft report on Shale Gas development as an "exceptionally meritorious" mechanism for improving the availability and usefulness of shale gas information among constituencies. According to STRONGER, "the Pennsylvania program is, over all, well-managed, professional and meeting its program objectives." I would go beyond that and say that Pennsylvania has done an exceptional job managing the new challenges that shale gas development presents while allowing our citizens to enjoy the enormous benefits created by this industry.

There has been a misconception that the hydraulic fracturing of wells can or has caused contamination of water wells. This is false. First, hydraulic fracturing is only a temporary feature of natural gas development which lasts a few weeks. Hydraulic fracturing of wells is not new in Pennsylvania; it has been going on here since about the 1950s and has been standard practice since about the 1980s. In 2010, the head of EPA's drinking water program, Steve Heare, said that despite claims by environmental organizations, he had not seen any documented cases that the hydro-fracing process was contaminating water supplies. EPA Administrator Lisa Jackson said the exact same thing in her May 24 testimony before the U.S. House Committee on Oversight and Government Reform. In a January 2010 article in Platts Gas Daily, Energy Secretary Stephen Chu said that hydraulic fracturing is safe and lawmakers should be cautious in

their efforts to restrict it. My predecessor, former DEP Sec. John Hanger, told Reuters in October 2010 that “Pennsylvania has not had one case in which the fluids used to break off the gas from 5,000 to 8,000 feet underground have returned to contaminate groundwater.” Even the limited recent Duke Study of Dimock, Susquehanna County, water samples reports that there was no evidence of fracturing fluids in any sample from any of the 68 wells they tested. The study states, “[w]e found no evidence for contamination of drinking-water samples with deep brines or fracturing fluids.”

Our ability to unlock the huge clean burning energy source contained in unconventional shale formations will transform Pennsylvania into an energy exporter and move our nation toward energy independence. In addition, we are looking at an economic and energy transformation. We have already seen tens of thousands of new jobs here in Pennsylvania from the industry itself as well as from new industries spawned to support it. These are good paying career jobs in many fields. And that is just the start. There will be hundreds of thousands more good paying skilled and unskilled jobs in a variety of sectors.

While interest in the economic and energy possibilities of the Marcellus is high, my job is to protect public safety and the environment and to do so based on sound science and not fiction or fear. Unfortunately, we have seen some examples of very suspect science lately in this area. There are many examples but let me point out four prominent ones: (1) the May 2011 Duke University Paper regarding methane in Pennsylvania water wells in Dimock; (2) the April 2011 Robert Howarth Paper regarding Greenhouse Gases and Marcellus Shale; and (3) the April 16, 2011 United States House of Representatives Democrats Report, “Chemicals Used In Hydraulic Fracturing” and; (4) EPA’s *Greenhouse Gas Emissions Reporting From The Petroleum and Natural Gas Industry: Background Technical Support Document*, 2010.

Our experts as well as other experts are studying all these materials and I will not belabor all the deficiencies with these various reports here but I will highlight a few.

The Duke paper seems to be based on only a few selected samples in a selected area with previously documented problems. This would indicate that the study itself is statistically and technically biased. Also, the fact is that the methane in the area being seen is the product of the shallower, Upper Devonian formation which is about 1,000 to 3,000 feet deep, not the deeper shale formations which are about 7,000 feet deep. Yet the Paper improperly attempts to link the source to the deeper Marcellus Shale. Finally, the authors of the study have inexplicably declined DEP’s reasonable request that they share with us their data and their sample locations. This in itself raises credibility questions.

Also, the unbiased real facts are coming in which refute Duke. In October 2011 the Center For Rural Pennsylvania issued its comprehensive study entitled “The Impact of Marcellus Gas Drilling on Rural Drinking Water Supplies”. The Center is a bipartisan bicameral legislative agency of the Pennsylvania Legislature. The study was conducted by the Penn State University’s College of Agricultural Science. Major findings of the Study include the following:

- Statistical analyses of post-drilling versus pre-drilling water chemistry did not suggest major influences from gas well drilling or fracking on nearby water wells.
- Analyses of the data from both phases of this study generally showed a lack of statistically significant changes in water quality parameters due to Marcellus drilling or fracking when comparing pre- to post-drilling elements of water quality.
- Noting the Duke Study; here dissolved methane did increase at one drilled site but this site also had a moderate level of methane before drilling occurred. Dissolved methane did not increase at fracked sites and was not correlated to the distance to the nearest Marcellus well site.
- Re methane: the research found no statistically significant increases in methane levels after drilling and no significant correlation to distance from drilling.
- Statistical analyses did not suggest major influences of gas well drilling on the water quality of nearby water wells, as evidenced by a lack of statistically significant increases in pollutants that are most prominent in drilling water fluids, such as TDS, chloride, sodium, sulfate, barium, and strontium.
- Results of the water quality parameters measured in this Study do not indicate any obvious influence from fracking in gas wells nearby private water well quality. Data from a limited number of wells also did not suggest a negative influence of fracking on dissolved methane in water wells.

The Study also found some elevated bromide levels in some wells. But, the authors note in this regard that there is no drinking water standard for bromide so such increased concentrations observed alone do not represent a direct health concern. Thus, the authors encourage additional study on this subject.

The United States House of Representatives Democrats paper fails to state what it is not. It is not a toxicological review of chemicals used in fracking and it does not provide a sound scientific assessment of exposures, exposure pathways or risks to human health that might be associated with such theoretical exposure. The paper also fails to note that the fluid that is its subject is over 98% water and sand with only small amounts of the chemicals it attempts to characterize. The paper creates misimpressions by focusing on total liquid volumes and not the amounts or volumes of any additives in the liquid. The paper also is very loose with respect to its use, or misuse, of the label “carcinogen.” For example, the paper talks about “diesel fuel” and “sulfuric acid” as carcinogens. However, both have been associated as carcinogens only via the air pathway; in the form of mist in the air for sulfuric acid and as exhaust fumes for diesel fuel.

Robert Howarth is a Cornell University scientist who published a “study” regarding the greenhouse gas impacts of shale gas development. Howarth’s supposed study has been rejected by almost every legitimate source in the scientific community. Even Howarth himself admits that the data in his study is, his words, “limited”, “unpublished”, “really low quality”, “lousy” and from “weird PowerPoints.” Joe Nocera of the New York

Times points out that even the Environmental Defense Fund has estimates of methane gas emissions that are 75% lower than Howarth's.

In August 2011, Carnegie Mellon University (CMU) published a study, partially funded by the Sierra Club, which demonstrates conclusively that Howarth's conclusions are false, irresponsible and unscientific. The CMU study is a comprehensive life cycle analysis which concludes, among other things, that "natural gas from the Marcellus Shale has generally lower life cycle GHG emissions than coal for production of electricity" and that "natural gas provides lower greenhouse emission for all cases studied whether the gas is derived from Marcellus shale or the average 2008 domestic natural gas system" Also, interesting is that the CMU study concludes that although "green completions" and capturing gas for market that would otherwise be flared or vented could reduce emissions associated with the completion process, "these preproduction emissions, however, are not substantial contributors to the life cycle [emissions] estimates." As lead CMU researcher Paulina Jaramillo said, "we don't think [Howarth] is using credible data and some of the assumptions [Howarth] makes are biased. And the comparison [Howarth] makes at the end, my biggest problem, is wrong."

The fundamental deficiencies of EPA's *Greenhouse Gas Emissions Reporting Technical Document* were recently very well documented in an August 2011 report released by the very well respected energy consulting firm IHS CERA entitled, aptly, "*Mismeasuring Methane: Estimating Greenhouse Gas Emissions From Upstream Natural Gas Development*." The EPA's 2010 *Technical Guidance* inexplicably revised upward by an order of magnitude the prior emissions estimates for GHGs from this industry from studies on this topic from just a few years ago. IHS CERA explains the magnitude of the flaws in EPA's approach. As IHS CERA points out, EPA's methodology behind its 2010 study lacks rigor and should not be used as a basis for analysis or decision making. EPA, bizarrely, based its estimates on methane emissions from well completions from data samples of methane captured (i.e., not emitted) during well completions. Also, EPA based its conclusions on just a couple of slide presentations. Aside from the fundamental deficiency of using incomplete and unreliable data, IHS CERA points out that EPA did not even do the math correctly with the data it did choose to use and that EPA's assumptions in doing the math were unsupported in the real world. As a result, "the overall amount of methane that EPA assumes is emitted during well completion activities does not pass a basic test of reasonableness."

This Report would seem to confirm that life cycle GHG emissions from unconventional shale operations are similar to current domestic gas operations and that natural gas, as a fuel, presents tremendous opportunities to achieve cleaner air since it emits virtually no particulate matter and much lower amounts of other parameters.

The IHS CERA Report also discusses the Howarth Report. IHS CERA shows, to the extent any further showing on this were necessary, that the Howarth Report is not technically or factually supportable. Indeed, appended to the IHS CERA report is a piece by an IHS CERA principal, Pete Stark, that specifically takes Howarth to task for "misusing and seriously distorting" a previous IHS CERA article published by Mr. Stark. The release of the CMU Study and the IHS CERA Study in such close proximity in time prompted a colorful remark by my immediate predecessor as DEP Secretary, John

Hanger, who had this to say, “bit by bit the Howarth Study is being consigned to the junk heap.”

Pennsylvania’s Regulatory Program

Pennsylvania regulates oil and gas well operations under several statutes including the Oil and Gas Act, the Clean Streams Law, the Air Pollution Control Act, the Dam Safety and Encroachments Act and the Solid Waste Management Act. As described in more detail below, this network of laws and their associated regulations provides the Department of Environmental Protection (DEP) with the tools it needs to comprehensively regulate everything associated with oil and gas development - from locating the well site, site preparation, drilling the well, fresh water withdrawals and water storage, wastewater management, and site restoration.

Simply put, because of our long history of oil and gas development and comprehensive regulatory structure, Pennsylvania does not need federal intervention to ensure an appropriate balance between resource development and environmental protection is struck.

Well Site Location

The Oil and Gas Act (58 P.S. §§ 601.101 *et. seq*) is the primary law governing well drilling in Pennsylvania. With the exception of wells drilled through workable coal seams, there are no spacing requirements for Marcellus Shale wells. Although spacing restrictions do not generally apply, the Oil and Gas Act, the Dam Safety and Encroachments Act (32 P.S. §§ 693.1 *et. seq*) and the Clean Streams Law (35 P.S. §§ 691.1 *et seq*) regulate where well sites may be located and how the site should be constructed.

Section 601.205 of the Oil and Gas Act prohibits operators from developing a well site within 100 feet of any stream, spring or body of water that is identified on a topo map (small intermittent or head water streams are not always identified). In addition, the site may not be located within 200 feet of buildings or water wells. The department may waive these restrictions if additional protective measures are included as conditions to the well permit. Typical conditions include additional erosion and sediment control measures and measures to deal with the additional fresh water that will be encountered while drilling.

25 Pa. Code Chapter 105 (the Dam Safety and Encroachment regulations) requires well operators to obtain an encroachment permit if a well site or other support facility (such as an access road or water withdrawal pad) is located within a FEMA designated floodway. If FEMA has not designated a floodway (as can be the case for small streams), the operator must obtain a permit if the facility will be within 50 feet of a stream. For Chapter 105 purposes, a stream is anything that has a defined bed and bank – this is much more inclusive than the Oil and Gas Act provisions.

Finally, locating well sites within a floodplain may be regulated by municipalities through the Flood Plain Management Act. Certain ordinances promulgated through this statute are not preempted by the Oil and Gas Act. 58 P.S. § 601.602.

Site Development

Developing a well site outside the location restrictions of the Oil and Gas Act and the Dam Safety and Encroachments Act is regulated under the Clean Streams Law through the Department's erosion and sediment control program.

Stormwater runoff is the leading cause of stream impairment in Pennsylvania. To address this problem, DEP has developed a comprehensive stormwater management program. Pursuant to 25 Pa. Code Chapter 102, all earth disturbance activities must employ "best management practices" like silt fences and road side culverts to control erosion and manage stormwater. Relative to building sites in floodplains, pits and impoundments used to store waste material may not be used if the bottom of the pit will be within 20 inches of the ground water table. 25 Pa. Code § 78.56. In floodplains, the ground water table will be close to the surface and therefore, drilling wastes would need to be contained in tanks if a pit could not be used.

If well site construction will disturb more than 5,000 square feet or has the potential to discharge sediment to High Quality or Exceptional Value waters (so classified pursuant to 25 Pa. Code Chapter 93), the operator must develop and implement an erosion and sediment control plan. This E&S plan must be kept on site for review by DEP. If development of the well site, access roads and other related facilities will disturb 5 or more acres, the operator must obtain erosion and sediment control permit before the site can be developed.

Well Drilling

Drilling any well – even a water well – has the potential to impact fresh groundwater. While this potential may exist, such an impact is not acceptable. Protecting groundwater supplies is of utmost importance and the Oil and Gas Act is particularly strict in this regard. If a well operator impacts a water supply (by pollution or diminution), they *must* restore or replace it and pay for any increased costs of maintaining or operating the replacement supply. 58 P.S. § 601.208.

In fact, if an oil or gas well is drilled within 1,000 feet of a water supply and the water supply becomes polluted within 6 months of drilling, the operator is *presumed* to have caused the pollution unless they took a water sample that demonstrates the pollution was present before the oil or gas well was drilled. 58 P.S. § 601.208(c). Needless to say, taking a pre-drilling water sample from all supplies within 1000 feet of a gas well should be a standard business practice.

Of course, the goal is to avoid groundwater impacts in the first place. To that end, DEP recently promulgated new regulations that significantly strengthen our well construction standards. These new regulations accomplish five things.

First, the regulations will establish more stringent well construction standards for all new wells drilled in Pennsylvania. Second, the regulations impose new requirements on operators to inspect existing wells and report their findings to the Department. Third, the

regulations codify existing caselaw on water supply replacement requirements and clearly describe an operator's responsibilities if they contaminate or diminish a water supply. Fourth, the regulations impose a duty on operators to investigate complaints of gas migration and to mitigate any hazards found in the course of the investigation. Finally, the regulations require reporting of chemicals used to hydraulically fracture wells.

Below is a brief description of the significant new requirements in 25 Pa. Code Chapter 78.

I. New Well Drilling

Properly cementing and casing a well is critical to preventing gas migration. Prior to drilling a well, operators will now be required to develop a casing and cementing plan that shows how the well will be drilled and completed. Use of centralizers (which keep the casing centered in the well bore) must be used at prescribed locations to insure that cement is evenly distributed between the casing and the well bore. Cement meeting ASTM criteria for oil and gas wells must be used. Documentation of the cement quality and cementing practices used at the well must be available for Department inspection.

When cementing a well, if cement is not returned to the surface the operator must install a second string of casing for an added layer of protection. If cement is returned to the surface and the operator intends to only use surface casing (Marcellus operators typically use surface, intermediate and production casing), the operator must demonstrate that any gas, oil and produced fluids cannot leave the well bore.

Used or welded casing must be pressure tested. Casing strings attached to heavy duty blow-out preventers (such as Marcellus intermediate casing) must also be pressure tested.

II. Existing Wells

Operators must inspect all of their wells quarterly and report the findings of the inspections to the Department annually. If defective casing, evidence of leaks, or if excessive pressure within the well bore is discovered, the operator must immediately notify the Department and take corrective action.

III. Water Supply Replacement

The Oil and Gas Act requires any operator who contaminates or diminishes a water supply to restore or replace the supply with one that is adequate in quantity and quality for the purposes served. Case law on these requirements has defined when an operator must provide compensation for increased operation and maintenance costs (when costs are more than a de minimus amount) and for what duration (in perpetuity). The regulations codify these and other relevant holdings to clearly describe the operator's responsibility.

IV. Gas Migration Response

The new regulations impose a duty on operators to immediately investigate a gas migration complaint and to notify the Department if they receive such a complaint. If natural gas is found at elevated levels (10% of the lower explosive limit) the operator must immediately notify emergency responders and initiate mitigation measures (including advisories and controlling access to the area).

V. Reporting Requirements

The practice of hydraulic fracturing has drawn considerable attention recently. One of the primary concerns involves the chemicals used during the process. DEP's new regulations require operators to disclose the chemical additives and the hazardous constituents of those additives on a well by well basis. While DEP has never observed any evidence that hydraulic fracturing has directly contaminated fresh groundwater despite tens of thousands of wells being "fraced" over the past several decades, mandating public disclosure of the chemicals used in the process should end much of the controversy surrounding the subject.

Water Withdrawal

While the volume of water to frac a Marcellus well is greater than the amount required to frac traditional wells in Pennsylvania, the Marcellus industry's use of water is miniscule in comparison with other energy sources and other sources in general. Marcellus fracing is the smallest major user in Pennsylvania using only 0.2% of the daily water withdrawn which ranks it ninth of the top nine water users in the state. Marcellus drilling uses only 1.9 million gallons per day (MGD). This is in stark contrast to power plants which use 6.43 *billion* gallons per day (BGD). Other major uses include public water suppliers (1.42 BGD); industrial users (770 MGD); aquaculture (524 MGD); private water wells (152 MGD); mining (95.7 MGD); livestock (61.8 MGD); and irrigation (24.3 MGD). Thus, shale gas drilling is a very efficient energy production source measured as a function of water usage.

I have attached a graphic which dramatically illustrates this which was prepared by the PA Fish and Boat Commission.

There are three entities charged with protecting water quality by managing water withdrawals in Pennsylvania - DEP, the Susquehanna River Basin Commission and the Delaware River Basin Commission. DEP is on the forefront of protecting headwaters of the Commonwealth's streams in areas outside the Basin Commission jurisdiction by requiring operators to adhere to water management plans which governs their water withdrawal practices. The Basin Commissions were formed by a compact between the federal government, Pennsylvania and neighboring states within the respective watersheds. If a Marcellus well is drilled within the Susquehanna or Delaware River watershed, DEP and Commission approval of the operator's water management plan must be obtained before construction of the well site can begin. If the well is located outside those two river basins, only DEP approval is necessary.

The water management plan is based on low flow conditions and describes where water will be withdrawn how much water will be needed and the amount of water that will be taken at any one time. Evaluation of the plan involves looking both upstream and downstream to assess cumulative impacts, taking into account all other withdrawals and discharges and their impact on the resource, particularly during low flow periods.

Generally speaking, if the water withdrawal is less than 10 percent of the natural or continuously augmented 7-day, 10-year low flow (Q7-10) of the stream or river, a passby (a restriction on the ability to take water during low flow conditions) will not be required. Q7-10 is the lowest average, consecutive 7-day flow that would occur with a frequency or recurrence interval of one in ten years. A 10-year low flow event has a 10 percent chance of occurring in any one year. Accepted hydrologic practices must be used to determine the Q7-10 flow.¹

Once approved, the plan is valid for each location for five years. Although the Commonwealth has ample water resources, operators will need to cooperate to make sure that access to water is available as more and more plans are submitted for headwater streams.

Water and Wastewater Storage

Once an operator gets the water needed to frac a well, the question becomes where to put it? Even more important, where to put the wastewater that is returned to the surface (called flowback)? A new development with Marcellus wells is the advent of centralized impoundments. Unlike pits located immediately adjacent to the well, centralized impoundments use dam like structures to hold enough water to service multiple wells over an extended period of time. These impoundments can store freshwater, and more increasingly, flowback from a frac job.

Under DEP's dam safety regulations, small freshwater impoundments – similar to a farmer's pond - do not need a permit. However, Marcellus impoundments can hold over 15 million gallons and if they store wastewater, must be permitted and constructed according to DEP standards. Key standards include two impervious 40 mil liners with a leak detection zone and groundwater monitoring wells around the impoundment. Impoundments located where a breach could threaten public safety must undergo a much more stringent engineering review.

Wastewater Management

The most significant issue facing Marcellus operators today is wastewater treatment and disposal. Operators report that approximately 15% of the water used to frac a well is returned to the surface during the initial flowback period. The Department has seen an increase in reuse of this wastewater – industry wide approximately 80% of the flowback

¹ Policy No. 2003-01 Guidelines For Using and Determining Passby Flows and Conservation Releases For Surface-Water and Ground-Water Withdrawal Approvals, November 8, 2002.

is used on another frac job. Thus, the total volume of wastewater that must be disposed is a small fraction of the volume needed to frac the well.

Still, flowback from Marcellus frac jobs contain pollutants of concern – particularly high levels of dissolved salts. Indeed, flowback water is several times saltier than sea water. Thus, Total Dissolved Solids (TDS) represent a growing concern for the Commonwealth's waterways and the Department has developed a proactive strategy to address this concern before widespread impacts are felt.

The best solution for disposing of high TDS wastewater is deep well injection. Unfortunately, the best geology in Pennsylvania for this method of waste disposal is being used for gas storage. Exploration for new injection sites is ongoing but not commercially available yet.

Therefore, the current preference for flowback water disposal is through existing DEP approved wastewater treatment plants. These plants typically do not have the technology necessary to remove TDS from the effluent and instead rely on dilution. The DEP's recently promulgated Chapter 95 regulations completely address the cumulative impacts of oil and gas wastewater discharges.

This new rule is the first of its kind in the country and limits the discharge of TDS to drinking water standards from new or expanded facilities that take oil and gas wastewater. This means that new discharges cannot exceed 250 mg/l for chlorides and that drinking water supplies will never be impaired because of oil and gas drilling. The process of eliminating the TDS will also remove radium – which has been the subject of recent articles. Thus, in addition to reducing the contaminants discharged to our streams, the new Chapter 95 rule will increase the use of recycled water, promote the development of alternative forms of disposal and perhaps promote the use of alternative sources of fracturing fluid.

Drinking Water Protection.

I outlined in my April 6, 2011 letter to EPA Region III Administrator Garvin, over the past three years the Commonwealth has been very pro-active in protecting potential sources of drinking water. In addition to the Chapter 95 TDS regulations discussed above there are other measures being implemented. DEP recently announced the results of our in-stream water quality monitoring for radioactive material in seven of the Commonwealth's rivers. All samples showed levels at or below the normal naturally occurring background levels of gross alpha and gross beta radiation. Those tests were conducted in November and December of 2010 at stations downstream of wastewater treatment plants that accept flowback and production water from Marcellus Shale drilling. These sampling stations were installed last fall specifically for the purpose of monitoring stream quality for potential impacts from unconventional gas drilling operations. The raw water river samples were collected above public water suppliers' intakes where the water receives further treatment.

The seven river testing stations are located at the Monongahela at Charleroi in Washington County; South Fork Ten Mile Creek in Greene County; Conemaugh in

Indiana County; Allegheny at Kennerdell in Venango County; Beaver in Beaver County; Tioga in Tioga County; and the West Branch of the Susquehanna in Lycoming County. These stations were chosen because of their proximity to public water supply intakes and at the time, were located downstream of facilities permitted to or proposing to discharge oil and gas wastewater. Future monitoring will include monthly sampling at the Monongahela; South Fork Ten Mile; Allegheny; and Beaver sites and every other month at the remaining three sites. Moreover, gross alpha and gross beta testing was added to a second water quality network station on the Monongahela, in March 2011. This site is further downstream in Allegheny County. All of the results will be frequently evaluated and available to the public via EPA's Modernized STORET database.

There is more. Pennsylvania DEP has taken measures to have additional monitoring of finished water at 14 public water supplies with surface water intakes downstream from wastewater treatment facilities that accept Marcellus wastewater. On March 11, 2011, under Pennsylvania regulation 25 *Pa Code* §109.302, we directed a letter to public water suppliers that have surface water intakes located downstream of one or more facilities that are accepting Marcellus wastewater to immediately conduct testing of radionuclides (i.e., radioactivity) and other parameters including TDS, pH, alkalinity, chloride, sulfate and bromide. A copy of that letter and the list of recipients are enclosed.

In addition, Pennsylvania DEP, on March 18, 2011, under Pennsylvania regulation 25 *Pa Code* §92a.61(g), sent letters to 25 Publicly Owned Treatment Works and Centralized Waste Treatment facilities that currently accept this wastewater calling for immediate twice monthly effluent monitoring for radionuclides and other parameters including TDS, pH, alkalinity, chloride, sulfate, bromide, gross alpha, radium 226 & 228, and uranium.

DEP has shown it is ready, willing and able to act in other important and decisive ways to protect drinking water also. On April 19, 2011, at the direction of Governor Tom Corbett, I called on all Marcellus Shale natural gas drilling operators to cease by May 19 delivering wastewater from shale gas extraction to 15 facilities that then accepted it under an exemption from being covered by last year's Total Dissolved Solids (TDS) regulations. The next day the industry publically stated its commitment to compliance. From what we can see today a dramatic sea change has occurred in Pennsylvania on this as we have virtually overnight gone from millions of gallons being delivered to those facilities and discharged to virtually none. Of course we are still in the process of verifying both from the supply side and the demand side and we will continue to do so as we are seeing full cooperation all of the time. In that regard we sent a letter in July 2011 to approximately 88 drilling operators seeking their certification that they are no longer using any of the "grandfathered" facilities for wastewater from deep gas production. On the demand side, several NPDES permits are in-house for renewal and those renewed permits, if appropriate, will contain specific numerical limits for total dissolved solids.

Some Monday morning quarterbacks questioned DEP's method saying that it should have "ordered" compliance back in April. But any orders would have likely resulted in protracted litigation. We got compliance in 28 hours instead of 28 months.

We have done more. In November, DEP offered new technical guidance designed to ensure compliance with updated wastewater treatment regulations. This guidance explains revisions to Title 25 Chapter 95 of the Pennsylvania Code that require new or expanded sources of natural gas wastewater to treat the wastewater to the federal drinking water standard of less than 500 milligrams per liter of total dissolved solids prior to discharge.

This technical guidance is yet another step in Pennsylvania's continuing efforts to protect Pennsylvania's water resources. The document clearly communicates to any facility seeking to increase its discharge of treated wastewater or to any facility seeking to start accepting wastewater that they must meet certain obligations. The guidance also clarifies that all facilities that accept shale gas extraction wastewater that has not been fully pre-treated to meet the discharge requirements and develop and implement a radiation protection plan. Such facilities must also monitor for radium, uranium and gross alpha in their effluent.

Air Quality Protection

Natural gas holds great promise as a clean burning fuel which could greatly reduce air emissions associated with electricity production and transportation. It has been recognized that combustion of natural gas as either a fuel for generating electricity or a transportation fuel can have very beneficial impacts on air quality. With that being said, Pennsylvania is proactive in minimizing any potential adverse air impacts from extracting this resource.

Pennsylvania has ample authority under our Pennsylvania Air Pollution Control Act and our air regulations to regulate air emissions from Marcellus Shale gas extraction and processing operations and that is exactly what we do. We focus on minimizing emissions of, for example, nitrogen oxides, carbon monoxide, particulate matter, hazardous air pollutants, and volatile organic compounds (VOC) during the drilling, fracturing, gas collection and processing stages.

DEP took the proactive step of launching a short-term ambient air quality sampling initiative in the southwest, northeast and northcentral regions of Pennsylvania in April 2010. This initiative focused on natural gas extraction stages including drilling operations, fracing operations where wastewater was being produced, the flaring of gas for production and gas compression facilities. While concentrations of certain natural gas constituents were detected during these studies DEP did not identify concentrations of any compound that would likely trigger air-related health issues associated with Marcellus Shale activities. DEP also tested for carbon monoxide, nitrogen dioxide, sulfur dioxide and ozone, but did not detect concentrations above National Ambient Air Quality Standards at any of the sampling sites. DEP is currently developing a protocol for a long-term sampling effort to examine the potential chronic impact of emissions from natural gas operations.

Additionally, DEP intends to develop a comprehensive emissions inventory for natural gas operations under its existing statutory and regulatory framework. This data will allow

the Department to develop an accurate inventory to support air quality planning activities including revisions to the Commonwealth's State Implementation Plan (SIP) to achieve and maintain the health-based federal national ambient air quality standards including ozone, fine particulate matter and the recently promulgated 1-hour nitrogen dioxide and sulfur dioxide standards.

Pennsylvania's air quality regulatory program has been in effect since 1972. Our air quality program includes various tools such as Plan Approvals, Operating Permits and General Permits. A Plan Approval is a permission to construct a particular source. The complement to the Plan Approval is the Operating Permit. An operator must obtain an Operating Permit for the source covered by the Plan Approval once the source is actually constructed. To obtain an Operating Permit the operator must demonstrate that the facility was constructed pursuant to all the terms and conditions of the Plan Approval. In some cases, such as what our regulations refer to as "source of minor significance" or where the source's operations can be regulated under standard conditions (what we call a General Permit), an individual Plan Approval or Operating Permit is not required. Many operations are still regulated under one or more General Permits. A General Permit is used for sources that the Department determines can be regulated under standardized specifications or conditions applicable across the board.

DEP's air regulatory program for this industry has been in effect for over a decade. Currently, certain oil and gas exploration and production activities are not subject to individual Plan Approval/Operating Permit requirements. On February 26, 2011, the Department provided a 90-day public comment period on the proposed revisions to list of exemptions currently in effect that would make the current exemption for certain oil and gas exploration and production activities conditional. We are in the process of reviewing the stakeholder comments to this proposal.

Owners and operators of natural gas-fired production or recovery operations, which includes compressor stations and their components such as internal combustion engines, gas dehydration units, crude oil or brine storage tanks, vents and other equipment, which are non-major sources, are subject to regulation under what we call the GP-5. The formal title of the GP-5 is General Plan Approval and General Operating Permit for "Natural Gas, Coal, Coal Bed Methane or Gob Gas Production or Recovery Facilities".

The Department's written approval is required before construction of any operation which is subject to the GP-5 requirement. The applicant is required to submit in advance detailed information regarding every piece of equipment covered by the permit. The serial number and specific design parameters of each piece of equipment is required. The applicant also must identify the compliance demonstration methods to be used for engines, dehydrators/reboilers and tanks. We also require estimates of fugitive VOC and hazardous air pollutant (HAP) emissions from connectors, flanges, open-ended lines, pump seals, valves, compressor seals, relief valves, diaphragms, drains, meters and other components. In addition, the holder of the GP-5 authorization is subject to comprehensive performance testing, verification and monitoring, recordkeeping and reporting requirements.

The GP-5 itself requires the operation of the facility to be in compliance with the prevailing Best Available Technology for air emissions control so as to be in compliance with certain emissions limits which are contained in the GP-5 for NO_x, VOCs, CO, visible emissions, and malodors. The GP-5 applies to smaller engines, those between 100 and 1,500 horsepower. Engines which are larger would need to obtain a Plan Approval and Operating Permit.

DEP has issued authorizations for the construction and operation of approximately 260 natural-gas fired compressor stations across the Commonwealth. DEP just recently, on March 26, 2011, published minor GP-5 revisions which will encourage owners and operators to install and operate cleaner burning and more efficient engines and/or limit hours of operation to lower emissions.

DEP, in consultation with outside experts, is considering proposed revisions to GP-5 which would expand the applicability of the general permit to cover additional sources and activities including wellheads and other emissions units located at natural gas production and processing facilities. The revised GP-5 could cover spark ignition internal combustion engines, condensate tanks, storage vessels, glycol dehydrators, re-boilers, de-propanizers, and equipment leaks. It would make sense to harmonize the GP-5 with the newly promulgated federal EPA proposed and soon to become final New Source Performance Standards (NSPS) applicable to the oil and gas exploration and production sector. The proposed NSPS was published at the end of July 2011 and EPA is under a court ordered deadline to issue the NSPS in final form in early 2012. Thus, we hope to have a proposed revision to our GP-5 published for public comments by sometime in the fall to be able to issue it in final form after EPA issues its final NSPS Regulations.

If the circumstances will not support coverage by the GP-5 (larger facilities or engines larger than 1,500 horsepower) an Air Quality Plan Approval and Operating Permit is required for new sources or modifications to existing sources. For what the law labels “major sources,” those that emit 100 tons or more per year of a regulated parameter, they are subject to the “New Source Review” permitting process which the Department administers. Air emissions from different physical locations can be “aggregated” together for calculation of applicability of the threshold if such locations are owned by the same company and are located “contiguous and adjacent” to each other.

Nonroad truck mounted internal combustion engines are frequently used in this industry, especially in association with actual drilling operations. These engines are frequently moving from one site to another. These sources can emit NO_x and VOCs. Nonroad engines are subject to federal standards. In 2005, the Department issued the General Plan Approval and/or General Operating Permit for Nonroad Engines (GP -11). The GP-11 is the Commonwealth’s embodiment of the federal requirements for nonroad engines and authorizes construction, modification, operation and the subsequent relocation of such engines. On February 26, 2011, DEP solicited comments on a proposed revised GP-11. The revision is aimed at having the GP-11 cover operation of nonroad engines at multiple temporary locations. Stakeholder comments on the proposed GP-11 revisions are currently under review.

Enforcement

Pennsylvania DEP has been very strong on enforcement of rules and regulations in this industry. DEP has shown just this calendar year its agility and decisiveness on the enforcement front in issuing two cease and desist orders as a team within hours when it was appropriate to do so. In one case we issued a “cease drilling order” for non-Marcellus well drilling and in the other case we ordered a stop to pre-drilling well pad preparatory activities which were resulting in sediment being released into a nearby stream upstream of one of the various water intakes of a local water authority. In the latter case we received a letter of thanks from the local water authority for DEP’s “immediate” and “prompt response” in doing so. The water authority went on to write “[t]his situation has reinforced our belief that the interest and importance of our water source is of utmost importance to all and that Pennsylvania Department of Environmental Protection works hard to sustain this valuable resource”.

In response to the April 20, 2011 well equipment failure and resultant loss of control of a well in LeRoy Township, Bradford County DEP issued an NOV just two days later dated April 22, 2011 in which it required the operator to answer many questions about the incident itself and its root cause and insisting that the company remain on stand-down from well development activities until it could provide DEP technical personnel sufficient assurances that there would be no repeat of the event there or elsewhere. DEP also asked the following important question: why it took nearly 12 hours to address the uncontrolled release of fluids from the well. After three weeks in which the company was in stand-down our technical staff did report to me that they had been provided adequate assurances and the company then did restart well development operations. However, we have more. We have a commitment by the operator that it will from now on engage and use local well control professionals in the very unlikely event that a future well control incident at one of its wells would occur in Pennsylvania. DEP had not asked for that particular measure in its April 22, 2011 NOV but we insisted on this during subsequent discussions and we achieved it.

In May 2011 DEP announced more than \$1 million in penalties against an operator to address violations in Bradford and Washington Counties. Through two Consent Orders and Agreement (COA) with Chesapeake, DEP collected \$900,000 for contaminating private water supplies in Bradford County, \$200,000 of which must be donated to the department’s well plugging fund; and another \$188,000 for the February 23, 2011, tank fire at a drilling site in Avella, Washington County. The Bradford matter was the highest single penalty ever assessed against any oil and gas operator in the history of the program. In the Washington County matter the fines assessed were the highest allowed by the Oil and Gas Act.

The Pennsylvania Marcellus Shale Advisory Commission Report

I was honored to be a member of the Governor’s Marcellus Shale Advisory Commission and co-chair of its Public Health, Safety & Environmental Protection Subcommittee. The Commission assembled experts from within the environmental, conservation, state and local government, academic and natural gas industry communities and its charge was to identify, prioritize and craft a set of comprehensive strategic recommendations regarding

the safe, efficient and environmentally responsible extraction and use of unconventional gas reserves in Pennsylvania.

I can testify personally that the process itself was remarkable. The Commission's approach was grounded in sound science, data and facts, not fiction, emotion or profits. I witnessed an amazing consensus building exercise among representatives of different backgrounds outlooks and opinions. The Commission was transparent in its business. There were 5 full Commission public meetings and 16 work group public meetings. There were 60 expert presentations and 100 citizen presentations. There were hundreds of communications to the Commission from the public.

The final report of the Commission is 137 pages long and contains 96 recommendations.

The United States Department of Energy (DOE) Shale Gas Production Subcommittee August 2011 Ninety-Day Report

In August 2011 the Shale Gas Subcommittee of the United States Secretary of Energy Advisory Board issued its "Ninety-Day" Report. The Board was charged "with identifying measures that can be taken to reduce the environmental impact and improve the safety of shale gas production." The Report contains many conclusions and observations that show Pennsylvania is out in front.

The DOE Report recognizes the significant contribution domestic natural gas is and will play in the future in domestic energy supply. It recognizes that real jobs have been created in the sector.

The DOE Report touts the adoption of best practices for well construction, especially casing and cementing. Pennsylvania's Chapter 78 regulations cover that topic and the industry and the Department have been in ongoing discussions on that topic for some time.

The DOE Report recognizes what I discussed at the beginning of this testimony, *i.e.*, the gap between real science and experience and perception regarding drilling and production of domestic natural gas. In that regard the DOE Report acknowledges the small or minimal risk that fracking itself poses to groundwater. At the same time, it notes the need to protect groundwater resources. I have discussed the lengths that Pennsylvania is already going in that regard.

The DOE Report recognizes the need to maintain collaborative relationships among industry, regulators and the public. The Report suggests there be collaboration among industry and government and the public to educate and gather real data regarding experience as we move forward. This is an effort that we have been undertaking in Pennsylvania for a long time.

The DOE Report, as did our Shale Advisory Commission, notes that local impacts should be considered and accounted for.

The DOE Report also notes as an important issue the potential air related issues associated with this resource and recommends that data be developed to get a handle on that topic and that it be dealt with so as to avoid negative air pollution impacts from the extraction of this resource. I have already discussed Pennsylvania's multi-faceted approach in that area.

Governor Corbett's Legislative Initiative

From the Marcellus Shale Advisory Commission Report, Governor Corbett crafted a robust initiative the legislative parts of which he sent to the Pennsylvania Legislature in October 2011. His initiative is very specific and detailed. It contains various components including environmental protection, transparency, and enforcement provisions. The environmental protection provisions include, among other things: (1) increased setbacks of well sites from private water wells, public water supplies and watercourses; (2) increased bonding; (3) cradle to grave wastewater tracking; and (4) expanded area of liability presumption. The initiative includes these items to bolster transparency: (1) increased requirements for notification of gas well siting; (2) increased disclosure of chemicals used in the fracturing process and web posting on DEP's website of this information (much of which is available now through the company's websites or FracFocus); (3) requirements for disclosure of other information such as drilling logs and if methane was encountered during drilling. As for enforcement, the initiative: (1) enhances the "bad actor" provisions of state law which ban repeat offenders from working in the Commonwealth; (2) increased penalty amounts for violations; and (3) requires 24 hour advanced notice of key events in the drilling process including cementing, pressure testing and fracturing.

The Myths About the So-Called "Halliburton Loophole" and the FRAC Act

While some say that the so-called Halliburton Loophole is behind what they perceive as a sinister plot to exempt fracturing from the Safe Drinking Water Act (SDWA) and allow the pollution of drinking water, the facts are different.

First the context. Fracturing is a temporary process of pumping fluids underground for the purpose of extraction of natural gas from deep formations. Indeed, the initial fracturing process lasts a few days and while the well may have to be periodically re-fractured, the life span of a producing well can be a century. In addition, the fracturing process is separate and apart from the drilling process. In fact, the fracturing process, by definition, occurs after the drilling of the well is complete. Also, fracturing happens very deep below the surface. For Marcellus and other unconventional gas bearing rock formations, this occurs at about at least 5,000 to 8,000 feet below the surface or more. Fresh groundwater, on the other hand, is located from about less than 600 feet below the surface.

Now the history. Hydraulic fracturing has never been regulated by the federal government. It has always been a matter of state regulation. EPA has never intended or thought that fracturing is or should be subject to the SDWA's Underground Injection Well program. It has never before even expressed an interest in regulating the generations old practice of energy extraction *via* hydraulic fracturing under the SDWA Underground

Injection Well program. Instead, EPA, before now, has always been of the mind that the practice was well regulated by the various states in which it was taking place.

In 1997, a court case from the federal appeals court for the Eleventh Circuit issued an opinion involving the state of Alabama, while not finding that fracking was any threat whatsoever, for the first time ever, said that underground emplacement of fluids for the purpose of extraction of gas from coal beds, which are quite shallow compared to Marcellus and other unconventional gas bearing formations, was subject to the federal UIC program. The aberrational case was not binding nationwide; only in the territory governed by that federal court. In response to this court decision, EPA studied the fracking process and it issued a report in 2004 which concluded that fracking poses little or no threat to drinking water. EPA also concluded then that no further study of this process was scientifically justified.

Just like EPA, the United States Congress has never intended that hydraulic fracturing should be subject to the SDWA's Underground Injection Well program. So, in 2005, in the face of the aberrational court decision from the Eleventh Circuit, Congress sought to reassert and reaffirm, through the bipartisan Energy Policy Act of 2005, what had always been its policy, *i.e.*, fracking for energy extraction was not regulated federally by the SDWA's Underground Injection Well program.

It is myth to assert that this was pushed solely by Vice President Dick Cheney. In fact, this provision of the Energy Policy Act of 2005 garnered bipartisan support. It won 74 yeas in the Senate. Included among its supporters there was Ken Salazar, the current Secretary of the Interior who was then a Senator from Colorado and the current President of the United States, Barack Obama, then the junior Senator from Illinois. In the House, 75 Democrats and 200 Republicans voted for the Bill including the top Democrat members of both the Energy and Commerce and Natural Resources Committees.

Now for the facts about drinking water and surface water protection. The Energy Policy Act of 2005 has no impact whatsoever on the state and federal laws that prohibit oil and gas extraction operations from causing surface water or ground water pollution. The whole of oil and gas operations are subject to the federal Water Pollution Control Act and is prohibited from causing pollution to the waters of the United States. In Pennsylvania, all aspects of oil and gas exploration and extraction, including drilling and fracking operations, are regulated by the state's Oil and Gas Act, the Clean Streams Law and our water protection regulations. The fact is that the so-called and misnamed "Halliburton Loophole" in no way diminishes the statutory and regulatory coverage of our laws as applied to gas extraction.

Hazardous chemicals are not being injected into the drinking water as some say. As mentioned, hydraulic fracking occurs at great depth; about 5,000 to 8,000 feet in Pennsylvania. Fresh groundwater is located a few hundred feet below the surface. So the activity occurs thousands of feet of solid bedrock below where water aquifers are located. Also, fracking fluid is comprised of on average 99.51% water and sand. The rest are components in common everyday uses such as food additives and cosmetics. As a Harrisburg newspaper story succinctly described this false paradigm recently,

Industry representatives say the chemicals are the same as you'd find under your kitchen sink, but Surra said "You don't want to take the stuff from under your kitchen sink and mix it in a glass of water you're going to drink, and that's basically what's going on." But it's not.

'Citizens Shale Commission' Weighs In On Marcellus Policy, Harrisburg Patriot News, Monday October 24, 2011 (emphasis added).

In conclusion, the case for the FRAC Act has not been made. In fact its proponents neglect, forget or misrepresent the history behind the relationship between fracking and the SDWA UIC program. They fail to mention or account for the fact that the current President of the United States and current Interior Secretary supported the Energy Policy Act of 2005 and that never before the appeals court case did either the Executive or the Legislative Branch intend or assert that fracking for energy extraction was within the SDWA UIC program. Also, the Act has nothing to do with potential contamination of drinking water supplies. The Act does not deal with well construction, cementing and cementing practices. Pennsylvania's state regulations do that.

Conclusion

The Marcellus Shale play along with other domestic unconventional resources can transform world energy markets. This potential will only be realized by avoiding the mistakes of the past. Pennsylvania is already showing that the balance of environmental protection and the development of this world class resource are being accomplished.