

# Developing the Marcellus Shale

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## **Environmental Policy and Planning Recommendations for the Development of the Marcellus Shale Play in Pennsylvania**

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**A Report of  
Findings and Recommendations**

*Based on:*

**The Pennsylvania Marcellus Shale Policy Conference  
Pittsburgh, Pennsylvania**

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**July 2010**

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### **Report Authors and Editors:**

John W. Ubinger, Esq.  
John J. Walliser, Esq.  
Christopher Hall, Esq.  
Robert Oltmanns



130 Locust Street, Suite 200, Harrisburg, PA 17101  
22 Terminal Way, Pittsburgh, PA 15219  
123 Chestnut Street, Suite 401, Philadelphia, PA 19106  
175 Main Street, Luzerne, PA 18709  
Box 172, Allegheny College, Meadville, PA 16335

[www.pecpa.org](http://www.pecpa.org)

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## **DISCLAIMER**

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This report contains the recommendations of the Pennsylvania Environmental Council following the Marcellus Shale Policy Conference. While this conference event was co-sponsored by Duquesne University, they were not a contributor to this report nor have they endorsed the recommendations contained herein.

We also wish to emphasize that these recommendations do not represent any consensus by participants at the conference.

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# PREFACE

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## About the Report

The Marcellus Shale natural gas reserve represents an extraordinary environmental and economic opportunity – and challenge – for Pennsylvania. Without question, this is a once-in-a-lifetime situation, and one that is already underway.

There is general consensus that “business as usual” in Marcellus Shale natural gas operations, as well as its current regulatory oversight, is not equal to the scale and scope of this development, and that simply applying conventional solutions to these significant challenges will result in adverse consequences to all stakeholders in the process.

For this reason, the Pennsylvania Environmental Council (PEC) and Duquesne University co-sponsored the Pennsylvania Marcellus Shale Policy Conference (the “Conference”) in Pittsburgh on May 3-4, 2010. This forum brought together key stakeholders, regulators, industry officials, environmental advocates, civic and municipal leaders, and others to engage in a public participation dialogue. The goal of this process was to identify the key issues, challenges and opportunities in the effective and sustainable development of a Marcellus Shale gas industry in Pennsylvania.

This report represents PEC’s findings and conclusions from that public dialogue, allowing for further research and analysis. We note that these recommendations are not intended to represent any consensus positions taken by participants at the Conference.

The policy recommendations contained herein are intended to serve as the basis for new legislation and regulation designed to identify a framework whereby this vast natural resource can be developed for the benefit of America’s energy portfolio, the private sector, and key stakeholders, while at the same time safeguarding the future prosperity of communities and the natural environment in Pennsylvania for current and future generations to come.

*The Marcellus Shale natural gas reserve arguably represents the largest environmental and economic opportunity-and challenge-for Pennsylvania.*

## **Why We Must “Get It Right”: Energy in America and Pennsylvania’s Historical Legacy**

Pennsylvania has long been rich in the natural resources needed for energy, industrial growth and economic expansion in America.

From colonial times, the Commonwealth’s abundant timber and subsequently discovered coal, oil and gas reserves were readily harvested to provide fuel, building materials and raw material critical to the Industrial Revolution. The bounty of such resources seemed endless at the time, and gave rise to an insatiable appetite for consumption.

The history of Pennsylvania’s role in America’s Industrial Revolution is well documented. At the same time the legacy of the environmental degradation is readily apparent; both in the landscape of the Commonwealth, and the continuing expenditure of substantial public funds for the mitigation of threats to health and safety and the restoration of degraded land and water. There is much said in the current political discourse about the burden that we are imposing on future generations, just as we are part of the “future generation” that has inherited the burden of the environmental legacy of the Industrial Revolution.

Prior to the colonization of Pennsylvania, it was estimated that “Penn’s Woods” covered nearly 90 percent of the Commonwealth.<sup>1</sup> In the nineteenth century, Pennsylvania welcomed the logging industry which provided lumber and timber for building towns, cities and railroads all over the eastern United States.<sup>2</sup> By the 1920s Pennsylvania had lost approximately 60 percent of its forest land, leaving barren landscapes devastated by erosion and wildfires.<sup>3</sup> A century after the establishment of the Forestry Commission of Pennsylvania in 1893, 60 percent of the Commonwealth is forest land once again.<sup>4</sup>

From the outset of the Industrial Revolution, coal extraction was humming at a fever pace at the surface and deep beneath the ground. Coal was “king”, for use as both an energy source and a feedstock for the steel industry. Widespread coal consumption left a trail of environmental devastation in its path – first in air quality, and later in acidic waterways and scarred landscapes all over Pennsylvania. Even today, 5,510 miles of streams throughout the Commonwealth are so heavily polluted from mine drainage that it will take at least several more generations for their natural condition to be restored.

The exploitation of the Commonwealth’s oil and gas reservoirs began in the middle of the nineteenth century. According to the Pennsylvania Department of Environmental Protection (DEP), as many as 350,000 oil and gas wells have been drilled in the Commonwealth since Col. Edwin Drake drilled the

first oil well here near Titusville in 1859. Drilling permits for new oil and gas wells were not required until 1956, and the requirement to register existing wells was not instituted until 1985.<sup>5</sup> The status of many wells drilled and abandoned before the institution of permitting and registration requirements is unknown; DEP estimates that more than one-half of the wells drilled in the Commonwealth (approximately 184,000 wells) are unknown as to location and status.<sup>6</sup>

Indeed, Pennsylvania's rich history has been paralleled by its unique role in America's energy future. Wood, coal, petroleum, and natural gas have all been rooted in Pennsylvania's industrial past and have been inextricably linked to the natural environment that so inspired America's forefathers centuries ago. And Penn's Woods has paid an enormous price for the development of those energy resources – a price that has taken generations and untold fortunes to recover from. That recovery is far from over.

If the lessons from Pennsylvania's historic past have taught us anything, it's that we cannot allow such a price to be levied on future generations ever again.

## **The Marcellus Shale**

The Pennsylvania Marcellus Shale reserve is one of the most significant domestic energy discoveries in decades. With somewhere between 250 and 500 trillion cubic feet of natural gas, the Marcellus Shale formation is one of the largest unconventional on-shore gas deposits in the world.

Conservative estimates of the available reserves contained in Pennsylvania alone indicate that there is at least a 40 to 50 year supply of natural gas available for near-term extraction. Other estimates set the supply at as much as 80 years or more. Deeper formations, including the Utica Shale, could extend the deep shale extraction period into the next century.

It is widely considered that the Marcellus Shale play offers an abundant fuel to help bridge the gap between today's energy portfolio and a future supply that reflects both a reduced carbon footprint and reduced dependence on foreign sources of energy.

There is both a national security interest as well as a private sector interest in this extraordinary resource, setting the stage for a truly unique opportunity for economic development, energy security, private sector profitability and public revenue generation.

At the same time, however, it's important to understand that the horizontal drilling and extraction methods needed to develop deep shale are inherently more complex than conventional methods. The ability to produce natural gas from deep shale formations such as the Marcellus Shale at an economic scale is the result of a relatively recent, innovative combination of technologies that enable deep horizontal drilling and hydraulic fracturing of shale formations to extract natural gas. (Wells developed by employing hydraulic fracturing, or "fracking," to stimulate the extraction of gas from the formation are commonly referred to as "unconventional wells.") The fracking component of Marcellus Shale formation well development involves the high-pressure injection of three to five million gallons (on average) of water treated with certain chemical additives as well as the on-site management of this injected "frack water," which is commonly referred to as "flowback" water. Frack water may also return to the surface over a longer period of time as a component of "produced" water.

The mechanical and technical requirements of drilling and gas operations at unconventional Marcellus Shale wells are more costly and intricate, and have higher potential risk than conventional extraction efforts typically employed in the past. The recent devastation caused by offshore drilling in the Gulf of Mexico (April 2010) is a reminder that using complex technologies in oil and gas extraction can sometimes have consequences that are destructive, costly and even deadly.

In Pennsylvania, there already have been incidents involving water supply well contamination, a fire in an onsite flowback impoundment, and a well blowout during the fracking process which resulted in the off-site release of frack water. There are also concerns regarding forest fragmentation and other adverse environmental and local community impacts arising from the scale of activities required to develop an unconventional deep shale formation well.

## The Promise of a New Industry

Developed with discretion and foresight, the Marcellus Shale can hold the promise of “once in a generation” benefits for Pennsylvania.

- **Industry** – This formation has already proven to be the most significant new opportunity in the gas industry since the Barnett Shale discovery in Texas a decade ago. According to the industry,<sup>7</sup> the Barnett Shale play is estimated to account for 8% of the total economic output of the Fort Worth region and more than 83,000 jobs. The same estimates place generated tax revenues (direct and indirect) at more than \$715 million for the State of Texas, resulting in \$10 billion in economic activity. As the pace of Marcellus Shale development increases over time, the economic impact throughout Pennsylvania may rival or even exceed that of the Barnett Shale region in Texas.
- **State Government** – At the same time, revenues to the state – ranging from mineral lease payments and royalties on state land to direct and indirect tax revenue – comes at a time of state budget shortfalls and pressure to generate new sources of revenue. As of the publication of this report, the Commonwealth of Pennsylvania is contemplating a severance tax that would be applied to wellhead production on natural gas extraction operations statewide.
- **Local Government** – Arguably the greatest impact is on local government, for it is at the local level where job creation, economic development, as well as adverse impacts will be most profound. Just as the coal and steel industries gave rise to towns and municipalities throughout Pennsylvania, the Marcellus Shale industry will likely be transformative to many small, rural communities across the Commonwealth. Recent assessments have shown significant employment opportunities during natural gas well development; it remains to be seen, however, how many of the created jobs will be long-term, local employment opportunities.<sup>8</sup> In addition, without appropriate measures to account for the impacts to the physical and social infrastructure of local communities, the impacts of shale gas extraction and related development over both the short and long-term could be disproportionate to the economic advantages, which is an unacceptable outcome.

- **Land Owners** – Similarly, private land owners stand to realize a “once in a lifetime” financial gain as dozens of exploration and development interests stake their claim on gas rights throughout the Commonwealth. Property values in prime drilling locations throughout Pennsylvania have escalated dramatically, and have presented these property owners with a window of opportunity for cashing in on planned gas extraction.

## **Challenges**

Many of the activities involved in the development of a Marcellus Shale formation well (e.g. drilling, casing, hydraulic fracturing and well control measures) have evolved over time in the context of technology for vertical well development. The innovation which enables and encourages the development of these so-called “unconventional” shale formation wells, from the oil and gas industry’s perspective, is the combination of vertical and horizontal well drilling technology. The development of a horizontal shale formation well through the innovative combination of existing methodologies substantially increases the complexity and scale of the operation, as well as the magnitude of potential adverse effects in the event of an accident or failure. In addition, the presence of the Marcellus Shale formation over such a large portion of Pennsylvania presents the prospect of a very large number of well development sites; it is estimated that as many as 35,000 to 50,000 wells can be drilled into the Marcellus Shale formation by 2030.<sup>9</sup>

## **Current Oil and Gas Regulatory Format in Pennsylvania**

The oil and gas regulatory structure in Pennsylvania was created for vertical well development and is not adequate to manage the escalating development of horizontal shale formation well development throughout our Commonwealth. For example, the existing regulatory structure insufficiently covers activities such as the withdrawal, transport, underground injection, and subsequent management of the high volumes of water required to hydraulically fracture a deep Marcellus Shale formation well. The current regulations are not designed to obtain timely and sufficient information to make well-informed decisions concerning the siting of well pads or to build a database identifying cumulative impacts of well development activities on the scale projected by the oil and gas industry.

The industry has made great strides in leading innovation, but the regulatory framework must address the complexities created by the pressure of time, scale, cost and technology.

Given the extraordinary opportunities and challenges associated with Marcellus Shale gas extraction, it is incumbent upon key stakeholders to take whatever steps are necessary to ensure the safe and reliable development of this resource in a way that does not repeat the mistakes of the past.

There is no time to lose.

# SCOPE OF THE REPORT

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## Basis for Recommendations

As stated before, Pennsylvania's existing oil and gas regulatory framework does not anticipate directional drilling and related unconventional well development activities. The sheer magnitude of these innovative practices, in addition to the size of the operations, leads PEC to conclude that unconventional gas development cannot be properly regulated in the current regulatory environment.

The recommendations in this report, if followed, will require substantive change to multiple Pennsylvania regulatory programs, including statutory amendment. Viewed solely from a procedural standpoint—absent the sheer complexity of the issues involved – this slate of proposed recommendations appears daunting. However, Pennsylvania has only limited time to properly manage Marcellus Shale development. As has been learned from past resource extraction, the failure to adopt sufficient and fair protections at the onset will result in significant environmental impacts and long-term costs in the future.

The single most important part of any regulation or the implementation of the requirements set forth is planning. Pennsylvania has the opportunity to learn from other states and countries that have recently developed shale reserves, as well as learning from our own past history with natural resources development.

The following guiding principles were used by PEC in the formation of the recommendations herein:

- **Adaptive Management** – While the recommendations as a whole propose significant changes, we do not believe these changes are the end of the process. The industry will continue to develop; new technologies will be deployed; and the state will have more complete assessments of the effects on environmental and community resources. These progressions will require the cumulative regulatory program applicable to Marcellus Shale extraction to continuously evolve in kind.

*Pennsylvania has the opportunity to learn from other states and countries who have recently developed shale reserves, as well as learning from our own past history with natural resources development.*

No final rulemaking or statutory enactment should be viewed as a conclusion to the process.

- **Informed Decision Making** – This principle is a corollary to adaptive management. Many of the Report’s recommendations do not look to new command and control standards; rather, they rely on better informational development and assessment. With a rapidly expanding industry and DEP struggling to keep pace in light of staff and funding constraints, it is essential that the management process ensures that sufficient cumulative, as well as site and activity-specific, considerations are in hand prior to approval of any well operation. Structured correctly, this informational development can also benefit the industry in a number of respects.
- **Comprehensive Planning and Stakeholder Input** – Every effort should be made to assess potential cumulative impacts from proposed well development; not only from individual sites but also from a broader perspective. Communities in proximity to well and infrastructure development should be afforded input into the review process to ensure consistency between agency action and local protection efforts. This process should be well understood by all parties, and be fair and timely.
- **Predictable Process; Incentives for Co-Benefits** – The regulatory program should be predictable and applied consistently. Incentives should be given to industry members who can advance environmental co-benefits in their well operations.
- **Best Management Practices** – It is incumbent on the industry, above and beyond the point of regulation, to employ its own set of best management practices to ensure that extraction, storage and delivery incidents are avoided to the greatest extent possible. If the industry is going to be a long-term presence in our Commonwealth it must act accordingly consistent with recognized principles of sustainable development.
- **Quick Adoption** – It is acknowledged that substantial revisions and additions to Pennsylvania’s statutory, regulatory and policy structure are required to adequately regulate unconventional shale gas wells. At the same time, it is recognized that the legislative and rulemaking processes will take time. In light of the appetite of the oil and gas industry to put the infrastructure in place to produce and deliver natural gas from the Marcellus Shale formation, it is imperative that all relevant parties put the requisite structure in place as expeditiously as reasonably possible with agreed upon deadlines for progress. All interested parties should work collaboratively to identify standards and practices that will lead to a model

regulatory program and be willing to follow such standards and practices voluntarily in advance of codification in legislation, regulations and/or agency policy. This will not only expedite the achievement of sound practices but also provide a period of time to “road-test” the practices before formally codified, thereby reducing the possibility of missteps in the formal legislative and regulatory processes

Another fundamental principle to this report, although not delineated in the subsequent recommendations, is proper certification and training. The full life cycle of natural gas well operations, from exploration to delivery, is a complex industrial and technological process. It is essential that the industry ensures that all involved employees and contractors have relevant experience and, as appropriate, professional license or certification.

## **Structure of the Report**

This report begins with broader considerations that should be in place before individual well development activity occurs – namely, how should Pennsylvania account for regional and comprehensive impacts from independent activities.

It then addresses how Pennsylvania should establish sufficient baseline information and assessments prior to approving at-site operations. Included in this discussion are broader siting considerations that should be applied once the DEP is informed of site-specific characteristics.

Once sufficient information is in place to guide the permitting process, the Report identifies existing issues associated with managing the full life cycle of well operations. These issues affect the natural and built environment, and draw upon lessons learned from other industry sectors that are applicable to natural gas extraction and delivery.

The report then incorporates important associated issues with well operations, including the notion of pooling and how the Commonwealth has advanced extraction on state lands.

Finally, this report suggests a framework for implementing the recommendations outlined below.

We have intentionally limited the focus of this report to statutory and regulatory policy issues. As such, we do not address social and public health impacts from Marcellus Shale development. While very important, we felt these issues were not fully discussed at the Conference and are more appropriately addressed in a separate study.

# COMPREHENSIVE PLANNING FOR THE MARCELLUS SHALE

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Extraction and delivery of gas from the Marcellus Shale Reserve, and perhaps other shale gas formations that are known to exist in Pennsylvania, will unfold over many decades, so the full extent and impact of this activity is unknown. For this very reason Pennsylvania should approach management in a comprehensive fashion, mindful of potential, long-term cumulative impacts to the natural and built environment.

Our current regulatory process – which authorizes activities on a permit-by-permit basis irrespective of other activity – falls short of this goal. Nor does the current process strive for the proactive identification, development and application of best management practices that promote the Commonwealth's goal of protecting the environment and public health, safety and welfare now and in the future.

As unconventional gas development practices rapidly expand across Pennsylvania, an effective process is needed to assure long-term environmental protection and public welfare. Time is of the essence; the industry will not pause for debate on new program adaptation.

As learned at the Conference in May, the success of the industry relies in part on consistency and predictability to support long-term investment and operation plans. What's more, as is discussed in more detail in this report, impacted local governments also depend upon predictability and advance planning in order to effectively implement their own comprehensive plans.

Other states have made noteworthy advances in this regard. For example, Colorado, a state with experience in unconventional gas reserves, went through a concentrated process to formulate a new regulatory framework to provide greater protection through advance planning. This experience is instructive for Pennsylvania.

*As unconventional gas development practices rapidly expand across Pennsylvania, an effective process is needed to assure long-term environmental protection and public welfare.*

In the Spring of 2009, Colorado's newly adopted regulations became effective for all oil and gas operations within their state.<sup>10</sup> Within the regulations Colorado implemented a new well permitting process called a Comprehensive Drilling Plan (CDP). Under this voluntary program, the CDP allows one or more well operators to initiate a comprehensive permit application review process as an alternative to only submitting individual permit applications. Multiple well site operations proposed and/or reasonably foreseeable by the permit applicant(s) in an identified geographic region within a geologic basin are afforded the same comprehensive permit application. The CDP promotes efficient and effective well siting based on cumulative regionally proposed well development.

The Colorado regulations set forth that, when submitting a CDP:

*“Operators are encouraged to submit the most detailed information practicable about the future activities in the geographic area covered by the Comprehensive Drilling Plan. Detailed information is more likely to lead to identification of specific impacts and agreement regarding measures to minimize adverse impacts.”*

The CDP allows for input and comments from the Colorado Division of Wildlife, Division of Public Health and Environment, local government, the Colorado Oil and Gas Commission, and landowners directly impacted by the proposed development in order to address their respective interests; furthering review of cumulative impacts of the industrial development in a given region. As an added incentive, an approved CDP is valid for six (6) years, so additional proposed operations submitted as part of this application may have an expedited permit review process. While the CDP is touted as a benefit to operators for reasons of efficiency and long-term operations planning, the CDP is also a benefit to the State and other interested parties toward better protection of the environment, wildlife, and public health, safety and welfare.

### **Recommendation**

**Pennsylvania should adopt an advance planning process similar to Colorado's Comprehensive Drilling Plan to assure implementation of best management practices and community input in natural gas resource development.**

Statutory revisions to the Oil and Gas Act will be required to properly allow DEP the ability to best develop a long-term comprehensive planning and permit process. Examples of necessary changes include allowing approved permits to remain valid for longer than one year, and providing DEP sufficient time to notify and hold a key-stakeholder meeting prior to issuing a plan and subsequent permits.

DEP should develop a planning and pre-permit baseline assessment process (the latter discussed in more detail, below), working with key stakeholders for technical guidance. For example, CDPs could be developed on a regional basis or, as suggested by industry representatives at the Conference, be defined by the characteristics of the natural gas being extracted (which dictates different extraction methods).

While the CDP process should not prevail over site-specific assessment and determination as discussed below, it provides an inclusive and information-driven process to advance well development while accounting for long-term considerations. The CDP process also affords industry a degree of assurance on site feasibility as it develops its own long range capital investment strategy and implements operational planning in particular areas.

The following section addresses site-specific considerations and requirements.

# PRE-PERMITTING AND SITE ASSESSMENT CONSIDERATIONS

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## Siting Criteria

The surface impacts of Marcellus Shale gas extraction and delivery can be mitigated through better siting of gas wells and their related infrastructure. What is known of the immediate surface impacts from Marcellus Shale gas development is that in order to develop a well, several acres of land must be developed for a drilling pad (which itself likely hosts multiple wells); plus additional acreage for high traffic access roads, gathering systems, compressor and processing stations, water impoundments and other related infrastructure.

Siting of wells and other infrastructure are managed by state statute,<sup>11</sup> implementing regulations,<sup>12</sup> and Technical Guidance Documents<sup>13</sup> which provide suggested best management practices.

However, these suggested best management practices are general in nature and in some instances may be waived by DEP. Information gathering in support of permit approval is a weak point in the current permit application process, and does not account for broader regional considerations. As learned at the Conference, Pennsylvania could require more detailed site analyses from the operator regarding the location of proposed development in relation to environmentally sensitive or public resource areas.

The Susquehanna River Basin Commission (SRBC), for example, may require that applicants provide information on the anticipated impact of the proposed project on the recreation, wildlife habitat, the natural environment as well as cultural or archaeological sites, among other regionally important aspects.<sup>14</sup>

***Pennsylvania can and should do better. Broader ecological considerations – including habitat fragmentation, proliferation of invasive species, and aquatic uses – should be inherent in the siting process.***

New York's Department of Conservation (DEC) mandates even more information in an Environmental Assessment Form required to accompany each application for a Permit to Drill, Deepen, Plug Back or Convert a Well (the Form sets forth a long list of environmental resources to be identified near the proposed well site.<sup>15</sup>) Additionally, the New York DEC also determined in its 1992 Generic Environmental Impact Statement that "issuance of a drilling permit for a location in a State Parkland, in an Agricultural District, or within 2,000 feet of a municipal water supply well... may be significant and requires a site-specific State Environmental Quality Review determination (environmental impact study)."<sup>16</sup>

Pennsylvania has recently taken steps to recognize that certain environmentally sensitive areas may require greater protective measures. Proposed rulemaking for Title 25 Pa Code Chapter 78 (Section 78.75(a): Area of Alternative Methods) sets forth that:

*"(a) The Department may designate an area of alternative methods if the Department determines that well drilling requirements beyond those provided in this chapter are necessary to drill, operate or plug a well in a safe and environmentally protective manner."*

On May 17, 2010 the Pennsylvania Environmental Quality Board (EQB) reviewed and approved this proposed rulemaking, and it will now be forwarded to the Attorney General's office for determination before publication in the Pennsylvania Bulletin.<sup>17</sup> While this proposed amendment is a start, it is only small step compared with what other jurisdictions have done.

Pennsylvania can and should do better. Broader ecological considerations – including habitat fragmentation, proliferation of invasive species, and aquatic uses – should be inherent in the siting process.

In addition, special consideration should be given to well operations that occur in proximity to water bodies (natural or man-made) that are utilized for drinking water (e.g. reservoirs and lakes) where even one individual adverse impact can have tremendous, perhaps irreparable, economic and social cost. Concepts used in other regulatory programs such as the Surface Mining Conservation and Reclamation Act,<sup>18</sup> where areas are deemed unsuitable for extraction when in proximity to large scale water supplies, may be appropriate for oil and gas controls. Further, Drinking Water Suppliers should specifically be given notice and opportunity to comment on any proposed permit plan or application within a certain distance of identified storage or source areas.

Again, against the backdrop of large scale drilling, infrastructure and facility development, these considerations are critical to Pennsylvania's long-term environmental health.

## Pre-Drilling Site Assessments

Currently the regulatory structure covering drilling of natural gas wells requires limited site-specific information in the permit application process<sup>19</sup> and an incentive, although not a requirement, to collect baseline water quality information prior to the commencement of drilling.<sup>20</sup> However, the scale, complexity and potential impacts from the drilling and hydraulic fracturing of horizontal natural gas production wells into the Marcellus Shale formation, and potentially other shale formations, warrants a pre-permit application process that accounts for a more in-depth analysis of site specific conditions.

It is well documented that naturally occurring and man-made constituents, as well as the migration of methane, from hydraulic fracturing can affect surface and ground water quality. There are also documented cases of natural gas migration into structures – posing substantial risk of property damage and threat to human safety. The sources and pathways of such constituents can occur naturally or be activity-induced, including old or abandoned wells.

It must be acknowledged that all systems – design, construction and operational – are vulnerable to occasional failure. In addition, the mere act of boring a well is subject to a degree of unavoidable geologic uncertainty. The potential impacts from such failures or unknown conditions can be serious; persist for extended periods of time; and, in some cases, may be irreparable. While both the industry and DEP are making efforts to address these issues, more is needed.

Conceptually, the level of site specific information that should be required prior to the issuance of a permit to develop a natural gas well by means of horizontal drilling and hydraulic fracturing should be based on an “all appropriate inquiry standard.” Such a standard has been developed before through negotiated rulemaking as part of the federal brownfields redevelopment program.<sup>21</sup> Not all of the specific elements of the federal brownfield “all appropriate inquiry” standard are or should be made applicable to the natural gas well development scenario; however, a number of the elements, if properly adapted, should be incorporated into a site-specific information gathering process.

Some examples of adaptable elements of the “all appropriate inquiry” standard are as follows:

- **Reviews of historical sources, such as chain of title documents, aerial photographs, building department records, and land-use records, to determine previous uses and occupancies of the real property within the production unit and adjacent properties** – Such searches have become routine practice for acquiring interests in real property and, with current electronic database resources, are easily accomplished in a cost effective manner. Further such preliminary inquiries make subsequent inquiries more cost effective.
- **Reviews of federal, state, and local government environmental records** – Such a review would disclose the presence of previously permitted extraction activities within the production unit as well as other site conditions brought to the attention of a governmental authority. This information will disclose such relevant information as the presence of contamination from prior activities, the presence and regulatory status of existing registered oil and gas wells, and other potential conditions which may be sources or pathways of exposure for water contaminants or migrating natural gas.
- **Interviews with past and present owners, operators, and occupants of the real property within the production unit and adjacent properties for the purpose of gathering information about site conditions not found in other records** – Information from such interviews will disclose the presence of site conditions not recorded in public records or governmental files. Of particular relevance is information relating to unregistered oil and gas wells and other unpermitted or otherwise unknown site conditions which may pose sources and pathways of exposure for water contaminants or migrating natural gas.
- **Visual inspections of area of the production unit and of adjoining properties** – A visual inspection of the surface area of the production unit plus an appropriate area adjacent to the perimeter of the production unit by a competent environmental professional will identify surface manifestations of prior activity on the site (e.g. well risers, gathering lines, earth disturbances indicating prior excavations).

Currently there are a number of disputed claims by property owners concerning the source of contamination of water supplies, and in some cases the intrusion of natural gas into structures as the result of Marcellus Shale gas well developments. In addition to acquiring relevant information for a more well-informed permit process, the institution of the proposed all appropriate inquiry process will avoid or dramatically reduce disputes

concerning the source of contamination or natural gas migration by property owners.

The proposed information gathering process also has the potential to provide opportunities for co-benefits throughout the long-term projected life-cycle of shale gas development in Pennsylvania. For example, as noted in the Preface, there are an estimated 184,000 undocumented oil and gas wells throughout the Commonwealth. The presence of unplugged wells provide preferential pathways for the migration of contaminants and natural gas to ground or surface water, and to enclosed structures, and thereby pose potential threats to both the environment and human safety.

In 1992 the Pennsylvania Oil and Gas Act was amended to establish an “orphan well plugging program for wells abandoned before 1985.” According to DEP, as of December 2007 about 8,700 abandoned wells have been reported and classified as orphan wells. Over the three year period January 2004 through December 2006, DEP contracted for the plugging of 425 orphan wells at an average plugging cost of approximately \$9,650.00 per well.<sup>22</sup>

The pace of locating and plugging orphan wells could be dramatically increased by the systematic collection and recording of the location and status of pre-existing unregistered oil and gas wells through the permit process for new shale formation wells, combined with the establishment of a program to incentivize the permit applicant to decommission and plug the discovered wells as part of the development of the shale gas well. Because the well developer is already mobilized to the site, the average cost of the plugging of orphan wells should be less than the historic average.

The routine collection of other site-specific data over the long-term duration of the shale formation well development process will also provide a meaningful database for assessing the cumulative impacts of future natural gas development in the Commonwealth, thereby enabling the application of adaptive governance of this natural resource extraction activity.

### **Recommendation**

**A two-phase permit process should be adopted to drill or alter a well. The first phase is focused on obtaining and documenting site specific information and would culminate in a determination by DEP that the site is appropriate for well development. The second phase would be the final authorization to commence well-drilling activities.**

The specifications of the Phase I permit application process should be developed by DEP with input from stakeholders. To the greatest extent possible, this process should identify other existing models of field data collection that are adaptable to shale formation gas well development. For example, the U. S. Environmental Protection Agency (EPA) recognizes two best practice standards formulated by ASTM International Standards as compliant with the “all appropriate inquiry” standard.<sup>23</sup> Consideration of these ASTM standards and possibly other models is relevant for purposes of formulating the contemplated Phase I data gathering process for Marcellus Shale well development.

Following sufficient field experience and adjustment based on that experience, a determination of what, if any, revisions should be made to the Environmental Quality Board’s oil and gas regulations can be made at that time consistent with our adaptive management principle.

The siting of impoundments, particularly in relation to riparian areas and floodplains, is an additional concern. Recent reporting has found numerous occurrences of leakages and spills of treated hydraulic fractewater.<sup>24</sup> In the Dam Safety and Encroachments Act<sup>25</sup> and its implementing regulations,<sup>26</sup> Pennsylvania addresses the siting of impoundments and other ancillary facilities related to well development practices in the vicinity of floodplains. These regulations require a permit to site such features in floodplains.<sup>27</sup> However, given technological advances, such as the ability to site centralized well pads and drill wells thousands of feet in every direction, there is limited justification to permit the siting of any facilities in a floodplain other than perhaps gathering lines and/or pipelines.

## **Basis for Recommendation**

PEC recognizes the importance of an efficient and predictable permit application process. The recommended two-phase approach to natural gas well drilling will require additional information gathering and increase the cost of the permit application process; however, given the nature of the horizontal drilling and hydraulic fracturing, and scale of natural gas production that will be realized for a generation or longer, the recommended information gathering process is a sound measure for all stakeholders.

From the Commonwealth’s perspective, the additional information will reduce the occurrence of unintended environmental and community impacts related to contamination of waters and the potential migration of natural gas through otherwise unknown pathways. It will also provide a basis to identify high risk

areas not suitable for well development, at least without special precautionary measures. DEP already applies this fundamental approach in its mining program, whereby areas may be designated as unsuitable for mining. From the exploration and production industry's perspective, it will establish baseline information that will be available to identify pre-existing conditions not associated with its activities and thereby avoid claims. There also may be the opportunity for realizing co-benefits which are discussed below.

From the industry's perspective, the two-phase process should not decrease the efficiency of the permit process if there is a clear specification of the Phase I information requirements and a reasonable time limit for DEP to review and act on the Phase I application. Furthermore, the first phase information gathering and regulatory approval process should not delay the commencement of well development activities. With proper advance planning and rig scheduling, the completion of the Phase I process could occur well before the scheduled mobilization of equipment to commence the well development process. With the regulatory review and approval of the Phase I permit application completed in advance, the Phase II permit application would serve as the authorization to proceed with well development which should be issued on a relatively short turn-around basis.

# ADDITIONAL PERMITTING PROCESS CONSIDERATIONS

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## Managing Permit Applications with Limited Time, Staff and Training

The current and anticipated volume of permit applications is overwhelming to current DEP staffing. By the end of 2010, Pennsylvania is expected to employ approximately 193 staff members for permit application review. From January 1<sup>st</sup> through June 4<sup>th</sup> of this year, 3,200 permit applications for well drilling (Marcellus and non-Marcellus) were submitted. After an operator files a complete permit application, DEP has only forty five (45) days to review and approve or deny the permit.<sup>28</sup> This overburden has already led to deficient review of permit applications as was raised by the Chesapeake Bay Foundation in successful appeals of three erosion and sedimentation control permits, which were subsequently revoked.<sup>29</sup> If a pre-application baseline assessment were performed and submitted to DEP as proposed above, then a streamlined 45-day process may be appropriate.

In addition to requiring more site-specific information, utilizing a comprehensive planning process (as discussed above) would provide permitting staff with the operator's long-term regional development plans. Long range development plans, in combination with the above specific site assessment recommendations, would allow for efficient and comprehensive permit application review process.

Further concern is caused by the fact that, over the past several years, the difficult economic climate has driven state government to reduce funding to both DEP and DCNR. Though DEP is adding staff to its Oil and Gas Program, it has been expressed that many staff lack sufficient training and expertise with the nature of unconventional gas development. The unfortunate reality is that staff training is typically one of the first items cut when agency funding reductions are put into play.

*PEC encourages the General Assembly and Governor to ensure that sufficient funding is available...to ensure that DEP staff are sufficiently trained to implement and enforce the regulatory regime.*

Because Marcellus Shale gas extraction is likely to be the predominant area where new or repositioned staff are utilized in program management, PEC encourages the General Assembly and Governor to ensure that sufficient funding is available – but not merely at the expense of program needs – to ensure that DEP staff are sufficiently trained to implement and enforce the regulatory regime. A sufficiently trained Oil and Gas Program staff also benefits the industry as permits can be more quickly and qualitatively assessed.

## **Local Government Comment on Proposed Development**

The current permitting process does not provide advance notice of proposed well development activities to local governments. During the proposed pre-application baseline assessment and regional cumulative planning period, local governments that will be directly impacted by the proposed development should be provided with information about the proposal and should have a prescribed period within which to comment.

Local governments require long-term planning in order to effectively manage their land use controls and comprehensive plans. Oil and gas well development activities place significant stress on municipal and county infrastructure, especially roads. The current well-by-well permitting process does not provide local governments nor the Commonwealth with any predictability as to future operations, or an assessment of potential impacts.

Providing municipalities with a proposed long-term regional well development plan (akin to the Comprehensive Drilling Plan process discussed above) would allow communities to comment on, and better prepare for, the cumulative anticipated impacts of unconventional well development practices. For example, local governments should be permitted to identify or suggest preferred routes in the community capable of handling the significant truck traffic involved with unconventional gas well development. This effort would also provide regional predictability to the industry.

The proposed process of notifying local government of proposed development and allowing a period for comment is already in place in other regulatory frameworks, such as in the Solid Waste Management Act (“SWMA”).<sup>30</sup> Within the SWMA, notices to the municipalities of the application for a waste disposal permit is required to be received by the impacted municipalities 60 days before DEP may issue or deny the permit. This process gives the municipalities a statutorily specified time to submit comments and requires DEP to publish a response to comments as part of the administrative record in the permit application process.

While some counties in Pennsylvania are becoming proactive in establishing task forces to try to meet the challenges of Marcellus Shale development, communities should not be set at a disadvantage in terms of well development and infrastructure information – a revised permit process should include local governments with sufficient information in advance of operation approval so that they may have effective input in the process and appropriate opportunity to minimize impacts.

# MANAGING THE LIFE CYCLE OF WELL OPERATIONS

## Casing and Cementing

New casing and cementing regulations are necessary in order to adapt to the new technology used in unconventional well drilling and development practices in use throughout Pennsylvania today. The techniques used in unconventional well development include underground injection of fracking materials at high pressures; additionally, gas recovered from the target formations tends to be at extremely high pressures. These unconventional conditions vary greatly from traditional well-drilling environments. Pennsylvania has already witnessed individual events of blown or faulty casing leading to gas migration into water wells.<sup>31</sup> DEP has been engaged in proposed rulemaking<sup>32</sup> with new material and design specifications, as well as performance testing, for casing and cementing at well sites. At the time of this report, this proposed rulemaking has been advanced by the Environmental Quality Board (EQB).

*Given that...unfortunate events are already occurring, and that better management practices are available and employed by the same companies in other shale gas states, then Pennsylvania should similarly update its casing and cementing requirements.*

### Recommendation

**Until this rulemaking is final PEC believes it is premature to recommend additional measures, but PEC believes the proposed rulemaking as currently written represents a necessary advance in the state's protection program. However, if subsequent contamination or blow-out events prove that even these standards are inadequate, the principle of adaptive management should guide DEP toward an expedited strengthening of the regulatory program.**

## Drilling Waste

In all oil and gas well practices during the drilling process, drill cuttings and related fluids produced during drilling may be stored on-site in pits or tanks until drilling is completed. The storage, transportation and disposal of wastes is regulated by the Solid Waste Management Act<sup>33</sup> and related implementing regulations.<sup>34</sup> Once collected, the wastes, now considered residual waste, may be taken off site to a proper disposal site, disposed of on-site in pits,<sup>35</sup> or disposed of through land application techniques.<sup>36</sup> While these practices are no different between traditional and unconventional well development, the volume and constituents of concern in the wastes may differ significantly, including potential higher concentrations of naturally-occurring radioactive material (NORM) in the Marcellus Shale formation.<sup>37</sup> Accordingly, those regulations should be revised to incorporate the new unconventional practices and any resultant constituents of concern.

### Recommendation

**Pennsylvania's waste handling and storage regulations for drilling activities (included in the Oil and Gas Act and Solid Waste Management Act) should be reviewed in light of the exponential increase in the volume of wastes, including special attention to NORM characteristics and the potential requirement of Waste Management Plans to address capacity concerns. Contaminated and hazardous wastes should be disposed of pursuant to established guidance only at permitted facilities.**

Wastewater is more specifically addressed in the following section (Hydraulic Fracturing and Water Management)

# HYDRAULIC FRACTURING AND WATER MANAGEMENT

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The extraction of natural gas in the Marcellus Shale requires significant use of another natural resource: water. In fact the sheer volume of water use is what makes Marcellus Shale development “unconventional,” and in kind, Pennsylvania’s ability to manage water use in relation to this burgeoning industry has proven to be far from adequate. With freshwater use needs averaging two to seven million gallons per well (and with multiple wells per site), the need is great for new authority to establish an effective and complete water management program.

The industry is making significant strides to reduce its demand for freshwater withdrawals for individual well operations. Similarly, it has also reduced its wastewater volumes. Still, the exponential increase in well development across the state has placed tremendous strain on the state’s water resources. The need for an effective and complete water program is essential and should be of the highest priority.

*With freshwater use needs averaging two to seven million gallons per well...the need for an effective and complete water program is essential and should be of the highest priority.*

## Withdrawal

DEP does not have full authority to manage water withdrawals from surface and ground water sources. While the state does have reporting requirements for higher volume users, these requirements are used for information purposes only.

The Susquehanna and Delaware River basins are both subject to interstate compacts governing water quantity and quality issues, and the respective Commissions charged with administering those compacts have taken proactive steps toward managing water use in relation to Marcellus Shale development. The SRBC has already developed a comprehensive review and management program for industry withdrawals.<sup>38</sup> At the time of this report, the Delaware River Basin Commission has issued a temporary moratorium on new reviews and approvals until it completes its own program. The Ohio River basin, much of which covers the Marcellus Shale formation, has no corresponding authority to addressing water use and withdrawals.

While DEP now requires a Water Management Plan in its well development permitting, this plan is prepared pursuant to general guidance, does not require approval, and is of limited utility.

### **Recommendation**

**Pennsylvania should grant statutory authority to DEP for water withdrawal management regulations. DEP should develop withdrawal standards for Marcellus Shale development based upon the protocol developed and informational requirements of SRBC.**

The SRBC program has proven itself as a model; having been developed in consultation with industry, their program accounts for cumulative impacts and multiple source withdrawals and requires ecological flow analysis with resulting information made openly available to the public. The state should have the ability to limit or prohibit source withdrawals that pose significant adverse impact to personal, commercial or ecological uses.

### **Water Use**

Once water is transferred for treatment and use at a well site, a new set of considerations comes into play. Fracturing (or “frack”), flowback, and produced waters each contain numerous additives and contaminants and, as such, warrant special handling and control.

Flowback and produced waters are stored on-site in pit impoundments or steel tanks. Impoundment incidents (such as seepage, odors, and ignition) have already occurred in Pennsylvania, which does not currently require surface or groundwater monitoring in the vicinity of storage areas.

As mentioned earlier in this Report, another concern is contamination of water supplies from geologic disturbances during the drilling process. A critical information gap exists with respect to this issue – no pre-drilling baseline data exists to identify or confirm contamination events. This information gap is exaggerated by the fact that Pennsylvania does not have standards in place for establishing or operating private water wells. Thus, we do not know if problems exist before gas well development occurs, or what the true nature and extent of any resulting impacts might be. While other regulatory programs require baseline water source assessment prior to activity (e.g. the underground mining program per the Surface Mining Conservation and Reclamation Act<sup>39</sup>), the current oil and gas program lacks this degree of information and assurance.

### **Recommendation**

**Pennsylvania should follow the lead of other shale gas states and require frequent monitoring (both baseline and post-well development) and periodic reporting of surface and groundwater quality in proximity to well sites. Baseline data and monitoring points should guide routine, periodic post-well development data collection.**

**Further, DEP should ensure that PPC (Preparedness, Prevention and Contingency) Plans for well operations are complete and adequately address ground and surface water contamination issues.**

As the protection of private water supply wells is of paramount concern toward protection of public health, safety and welfare, we further believe that Pennsylvania should revisit the idea of developing legislation to manage the construction and maintenance of private water supply wells. Pennsylvania remains one of the few states without private well regulations, and while such efforts have met broad and concerted opposition in the past, the quick expansion of natural gas development may prompt renewed interest in the concept.

### **Wastewater Disposal**

The salinity of wastewater from Marcellus Shale extraction operations can be up to ten times greater than sea water, and up to one-third of the volume of this wastewater can consist of Total Dissolved Solids (TDS).

Even before the development of a single Marcellus Shale well, Pennsylvania's waterways are already significantly impaired. The 2010 Pennsylvania Integrated Water Quality Monitoring and Assessment Report<sup>40</sup> has identified more than 19,000 miles of rivers and streams that do not meet clean water standards and an estimated 5,500 miles are polluted by abandoned mine drainage, which itself can stress assimilative capacity for TDS. There are no inexpensive or immediate solutions to these existing problems, and wastewater from Marcellus Shale operations only compounds the challenge.

Public wastewater facilities do not have the capacity to treat flowback and produced wastewater from Marcellus operations other than through dilution (which does not reduce the mass loading of TDS), nor do public drinking

water facilities have the capability to treat TDS in their source water. The industry has made significant strides in recycling flowback water and new technology is creating additional avenues for reducing the total volume of high TDS wastewater from natural gas development operations as well as other sources. However, relative to the rapid expansion of Marcellus Shale well development in Pennsylvania, the overall volume of industrial wastewater is significantly increasing.

Again, there appears to be an information gap which is paramount to the Commonwealth's ability to properly regulate. While the industry advises that much of the flowback water is recycled, current estimates are that flowback water only accounts for approximately 20% of all fracwater volume injected into the well. A substantial part of the remaining 80%, known as produced water, returns to the surface over the life of the well. Produced water may have a very high TDS concentration, in addition to concentrations of other sub-surface minerals and NORM. The produced water is not recycled for other fracking operations, but is disposed.

At the time of this report, the DEP is advancing final rulemaking to amend 25 PA Code 95 (Wastewater Treatment Requirements) with new natural gas industry wastewater standards (set at 500 mg/L).<sup>41</sup> West Virginia is currently advancing similar standard revisions to its own program.

### **Recommendation**

**The final rulemaking to amend Chapter 95 is a significant and necessary step, and final approval of the proposal in the near term is essential. Though there are very real associated costs, effective abatement or treatment of the increasing volume of flowback wastewater from the Marcellus Shale play is not optional for Pennsylvania or its waterways.**

In time, as informational resources increase and better data is obtained concerning assimilative capacity of individual waterways, this standard may be revisited and equal standards applied to all industrial and commercial sectors. Additionally, subsequent rulemaking should look for ways to incentivize the development and use of alternative water treatment technologies.

## **Compliance, Monitoring and Enforcement**

Leakage of frack and flowback water has already occurred in multiple instances across Pennsylvania from occurrences such as human error, equipment malfunction, poor siting of equipment, and other operational causes that cannot be prevented through regulation alone. Consistency of monitoring by the state and industry, along with proper certification of all operators on site, is essential to minimizing these inherent risks.

### **Recommendation**

**Credible inspection and enforcement programs must be implemented by DEP. In addition, the industry should formally develop and adopt best management practices for day-to-day operations, including the activities of subcontractors. These operations should be performed by properly certified personnel, as appropriate.**

# POST-WELL DEVELOPMENT MONITORING AND DATA COLLECTION

The development of the Marcellus Shale formation through horizontal drilling and hydraulic fracturing in Pennsylvania dates back to 2003. However, based on well permits issued, Marcellus well development activity did not start in earnest until late 2008 and 2009. According to DEP statistics, 476 permits for Marcellus Shale wells were issued in 2008 and 1,984 permits were issued in 2009. Recent projections estimate that the number of Marcellus Shale wells drilled will increase annually from approximately 1,600 wells in 2010 to approximately 3,500 wells in 2020.<sup>42</sup>

Based on published information related to unconventional shale gas well development that has been occurring for longer periods of time, (i.e, the Barnett Shale gas play in metropolitan Fort Worth, Texas which commenced in 1999), there is a concern that the cumulative impact of large-scale shale gas development in Pennsylvania will cause environmental and human health impacts. However, at this point in the trajectory of shale gas development there is an insufficient amount of empirical data to determine the nature and degree of severity of such potential cumulative impacts.

The development of a regulatory structure to protect human health and the environment over the course of shale gas development in the Commonwealth is imperative and should be based on the principle of adaptive management; but this principle requires affirmative efforts to develop sound, publicly accessible databases of empirical evidence. The resulting data should drive future regulatory review and amendment; including the consideration of potential collective operations emission standards for air permitting.

*The development of a regulatory structure to protect human health and the environment over the course of shale gas development in the Commonwealth is imperative and should be based on the principle of adaptive management.*

**Recommendation**

**DEP should also develop a regulatory standard for long-term routine ambient air quality monitoring recordkeeping and reporting to assess the need for air emission controls for emissions from point sources and fugitive sources at unconventional shale gas pads and other air emission sources (e.g. compressor stations, flowback impoundments) associated with the production and delivery of natural gas.**

DEP is currently deploying pilot Air Emission Monitoring Networks throughout the state. PEC supports this effort and encourages the Department to not only consider emissions in relation to prevailing emission standards, but also in light of potential public health impacts resulting from prolonged exposure or cumulative emissions.

# FINANCIAL ASSURANCE

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The current statutory mechanism for providing financial assurance for the decommissioning of oil and gas wells is obsolete and inadequate to cover well decommissioning, site reclamation and potential post reclamation responsibilities, particularly wells developed in the Marcellus Shale formation.

Section 215 of the Oil and Gas Act specifies that the owner or operator of an oil or gas well shall file a bond with the DEP in the amount of \$2,500 per well or a blanket bond in the amount of \$25,000 for all wells in Pennsylvania enumerated in the bond to assure the availability of funds to cover the cost of compliance with the drilling, water supply replacement, restoration and plugging requirements in the act. Section 215 also authorizes the Environmental Quality Board (EQB) to adjust the bond amount specifications to reflect the cost to the Commonwealth to perform well plugging. Section 303 of the Oil and Gas Regulations<sup>43</sup> currently specifies the statutorily prescribed amounts.

At the Conference, DEP Secretary John Hanger identified these bonding specifications as one of the areas of the existing oil and gas regulatory structure that must be strengthened to assure the proper decommissioning and reclamation of Marcellus Shale formation wells and ancillary facilities. PEC concurs with that assessment.

The revision of the existing bond structure may be accomplished either through EQB rule-making or through legislation. There are no proposed amendments pending before the EQB to revise the bonding provisions in Chapter 78 of the Pennsylvania Code. At least one bill has been introduced to the Pennsylvania House of Representatives to amend a number of the provisions of the Oil and Gas Act, including the bonding specifications of Section 215.<sup>44</sup>

PEC believes that it is important to offer a financial assurance mechanism that is more adaptive than the traditional bond instruments prescribed in Section 215 of the Oil and Gas Act. Additionally, there should be an increase in the dollar amount of financial assurance available to the Commonwealth if a well owner/operator defaults on its regulatory obligation to decommission wells and ancillary facilities, reclaim the site and perform any post reclamation activities that might be required. PEC further believes that the

*A trust-based mechanism should be more adaptable than bonds over the life cycle of a Marcellus Shale well development and take advantage of economies of scale for the major developers of Marcellus Shale production units.*

alternative financial assurance mechanism established by DEP in the surface mining program is a model which could be adapted to the oil and gas program.

This alternative financial assurance mechanism is based on the establishment of a trust fund. A surface mine permittee wishing to avail itself of the alternative financial assurance program has the option of establishing a stand-alone trust with a third-party trustee or participate in a Master Trust established by the Clean Streams Foundation. The trust is funded in accordance with tailored specifications set forth in a consent order and an agreement between DEP and the permittee or other responsible party. This program is described on the DEP website.<sup>45</sup>

DEP has accumulated considerable experience with the application of an innovative alternative financial assurance mechanism in the surface mining program. Building on that experience, PEC believes that a trust-based alternative to bonding can be adapted from the surface mining program.

A trust-based mechanism should be more adaptable than bonds over the life cycle of a Marcellus Shale well development and take advantage of economies of scale for the major developers of Marcellus Shale production units. The prospect of having trust assets returned to the well developer should also create the incentive to perform the requisite decommissioning and reclamation activities promptly and more completely so as to reduce the potential for post reclamation activities.

Among the key questions to be considered in the establishment of a trust structure are:

- Should the trust fund cover responsibilities in addition to plugging and reclamation (e.g., operation and maintenance of post construction erosion and sediment BMPs; water replacement responsibilities, if any; required routine monitoring, if any)?
- Utilization of a Centralized Master Trust (such as the Clean Streams Foundation) vs. Commercial Trustees
- Transfers of ownership/responsibility over the life-cycle of the well
- Principles for determining the trust balance for major players
- Formula for funding
- Criteria for draw-down or reduction in fund by developer
- Administrative fees

**Recommendation**

**PEC recommends that a stakeholders group be convened to create the structure of a trust-based alternative to the bonding system currently prescribed by the Oil and Gas Act.**

# OTHER CONSIDERATIONS

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## Pooling and Midstream Operations

Pooling is a term used in the oil and gas industry to define the consolidation of neighboring units of mineral rights into large unitized tracts of developable mineral pools. Pooling can also be a term used to address the consolidation and sharing of ancillary well development, gathering, production, and gas processing infrastructure for the purpose of reducing surface impacts of well development, production and delivery. Pennsylvania's current regulatory framework does not address pooling in regards to Marcellus Shale or other unconventional gas reserves, and does not address pooling of infrastructure.

Pooling of mineral rights can benefit operators via cost savings, such as consolidation of well pads and related well development infrastructure. Thus the pooling of mineral rights, if adopted in Pennsylvania, should reduce surface impacts. Consolidation and pooling of well development, production and delivery infrastructure should likewise reduce surface impacts.

There is precedent authority under the Pennsylvania Oil and Gas Conservation Law<sup>46</sup> to address pooling of mineral rights. However, this law only applies to extraction activities at depths below the Onondaga horizon – as Marcellus Shale and other unconventional shale plays are above the Onondaga horizon, the Oil and Gas Conservation Law is not applicable.

Beyond the Oil and Gas Conservation Law, there is no program in Pennsylvania for unitization, pooling, or spacing of unconventional wells in order to prohibit waste, create a pool to incorporate implicated reserves, or space wells in a manner that would promote efficiency, reduce surface impacts, and protect correlative rights.

There are many examples of other state pooling regulations which Pennsylvania might consider regarding the pooling of mineral rights; especially as to the functioning of the commission or agency which hears pooling requests, the parties which are able to request pooling, the risks or

*Pooling of well development infrastructure would reduce surface impacts, benefit industry via cost savings (as learned from industry representatives at the Conference), and would allow the Commonwealth to appropriately address anticipated impacts...*

penalties as to non-consenting parties to the pooling order, and as to the incentives in place to promote voluntary pooling.

There are also examples from other states which support and promote the pooling of infrastructure to reduce surface impacts. Colorado's laws address pooling by stating that “[t]he commingling of production from multiple formations or wells is encouraged in order to maximize the efficient use of wellbores and to minimize the surface disturbance from oil and gas operations.”<sup>47</sup> Colorado's rules further provide that “[w]here practicable, operators shall consolidate facilities and pipeline rights-of-way in order to minimize adverse impacts to wildlife resources, including fragmentation of wildlife habitat, as well as cumulative impacts.”<sup>48</sup>

As is discussed throughout this report, region-wide comprehensive planning and pre-permitting baseline site assessments as to siting of well development activities and related facilities will allow for an assessment of the cumulative long term impacts of unconventional shale gas plays. Consolidation and/or pooling of infrastructure should be incorporated into this suggested approach. Pooling of well development infrastructure would reduce surface impacts, benefit industry via cost savings (as learned from industry representatives at the Conference), and would allow the Commonwealth to appropriately address anticipated impacts of same.

### **Recommendation**

**PEC recommends that Pennsylvania adopt new legislation and/or update existing legislation to include Marcellus Shale and other similar unconventional gas plays within pooling laws, provided that measures are also adopted to incentivize and require the consolidation of surface infrastructure from multiple wells (and indeed multiple operators).**

If the industry receives the benefit of pooling options for mineral rights, it should equally be required to minimize surface impacts. Colorado provides examples through its rules<sup>49</sup> that gathering lines and other facilities be consolidated and shared by operators to reduce surface and cumulative impacts. Pennsylvania should involve key stakeholders in this discussion in order to provide appropriate technical guidance. This may be an issue for the Pennsylvania PUC to address, pending the outcome of their hearings on determining jurisdiction over mid-stream facilities including gathering lines.

## **Marcellus Shale Development on State Land**

The issue of leasing state-owned land for Marcellus Shale development has been controversial, primarily for two reasons: (1) the leasing has been driven by the need for general revenue at a time of continuing state budget deficits; and (2) the leasing has been done primarily on state forest lands. In fact, the state has been diverting revenue from the Oil & Gas Lease Fund to help balance the state budget.

The Pennsylvania Department of Conservation and Natural Resources (DCNR) has leased 137,896 acres of state forest land over the past two years for Marcellus Shale development. This leasing has been performed pursuant to directives from the Governor and General Assembly to reach prescribed annual revenue targets. While DCNR has made efforts with limited time and resources to ensure that leasing does not adversely impact critical resource and recreational uses, it remains to be seen what the full significance of this development will be for the state's public land.

Legislation has been introduced in the General Assembly that would place a temporary moratorium on any additional state forest land leasing until a complete environmental and community impact study can be performed by DCNR. Many organizations – including PEC – have been supportive of this proposal. Other legislation has been introduced that would direct future leasing to other state lands which do not pose quite the resource-sensitivity concerns that state forest lands do.

These different considerations are instructive for an additional reason: unlike the state forest system, the state owns only a minority of the mineral estates underlying state park lands. As such, DCNR has limited legal authority to manage the pace or extent of development of Marcellus Shale under those lands.

### **Recommendations**

- Pennsylvania's state forest and park systems represent a century of public and private investment in protecting natural resources and ensuring public access. Decisions affecting these lands should not be driven solely by the need for revenue.**

### **Recommendations (continued)**

- The Commonwealth should impose a temporary moratorium on the leasing of *additional* state forest land (i.e. the moratorium should not affect existing, valid leases) until a comprehensive environmental and community impact assessment can be completed. Sufficient time must be afforded for performance of this assessment so that impacts can be fully realized and understood. This assessment should guide the extent of future development, if any, on state forest land.
- The Commonwealth should proactively work with the natural gas industry and mineral rights owners to address concerns relating to natural gas extraction under state park lands. Factoring in site-specific considerations, the state and industry should design and implement best management practices to avoid unnecessary or adverse impacts to state park lands.

# ADVANCING PENNSYLVANIA'S PROGRAM: RECOMMENDED NEXT STEPS

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While DEP has been making significant strides to catch up to the unconventional shale gas industry's practices, they are limited in their authority and the rulemaking processes can be time consuming. Additionally, the General Assembly requires a lengthy process before it can pass legislation addressing the new unconventional shale gas practices and providing DEP with additional and appropriate authority. Moreover, the participation of the industry, local governments, environmental interests, and other involved stakeholders is both inefficient as well as ancillary to the current process.

To date DEP has no option but to advance rulemaking in piecemeal fashion, rather than developing a comprehensive change to the entire framework. All the while, they are issuing new permits for drilling.

*Pennsylvania should look to quickly adapt its oil and gas management program to better account for the scale of unconventional operations, and unique issues inherent in the Marcellus Shale formation.*

## Recommendation

**PEC recommends that a stakeholder process be established to develop language-ready statutory and rulemaking packages that update and expand Pennsylvania's environmental management framework. The issues and recommendations presented in this report should be a core focus. This process should be advanced quickly given growing concerns relating to current and future issues cited with the standing management regime. The General Assembly and Administration should commit to prompt consideration and action on the resulting product of the process.**

While it would require a somewhat novel and expedited approach to rulemaking, Pennsylvania should look to quickly adapt its oil and gas management program to better account for the scale of unconventional operations, and unique issues inherent in the Marcellus Shale formation. Other states with shale gas reserves have demonstrated that comprehensive revision to an environmental management program is, in fact, possible.<sup>50</sup>

The piecemeal fashion of current regulatory development has proven slow despite the rapid expansion of the industry, and insufficient in relation to comprehensive and regional concerns. The unconventional nature of Marcellus Shale requires an unconventional approach, but one that is comprehensive, careful and inclusive to accomplish best outcomes for all Pennsylvanians.

# CONCLUSION

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The purpose of the Pennsylvania Marcellus Shale Policy Conference was to identify and interpret the best practices in the development of deep shale resources. Through this, stakeholders throughout Pennsylvania would have available to them guidelines for statutory and regulatory measures that, if enacted, would help ensure that the Commonwealth had learned all that it could from industry, government, the affected communities, municipalities, as well as other states that have come before us in the management of this industry.

The findings of this report are just such an interpretation. They reflect the thoughtful and detailed consideration of the input provided from the principals, decision-makers and industry experts who shared their experience and perspectives on the Pennsylvania Marcellus Shale. As such, the Pennsylvania Environmental Council respectfully submits that these findings and recommendations represent a framework for action that cannot and should not be overlooked.

Throughout Pennsylvania's history, our natural resources have been exploited for industrial purposes without the benefit of careful consideration and forethought. The price paid in exchange for this rapaciousness can never be fully calculated, yet remains evident in the forests, waterways, and communities and that cost has been shouldered by generations that followed the development.

More recently, accidents at drilling rigs have captured the attention of the news media, regulators and Pennsylvania citizens. These incidents cannot and should not be ignored – they highlight the need for prompt and effective reform.

At the time of this report, the spot market for natural gas is considered to be temporarily undervalued, with gas prices approaching \$4.50 per million cubic feet. Even at that low price, the Marcellus Shale represents a natural resource whose development can be valued at \$1-2 billion (in 2010 dollars) in Pennsylvania. Considered in this context, PEC urges that a long-term view of development be adopted which allows all stakeholders to realize the benefits of the resource while safeguarding the health and safety of our citizens and

*Throughout Pennsylvania's history, our natural resources have been exploited for industrial purposes without the benefit of careful consideration and forethought. More recently, accidents at drilling rigs...highlight the need for prompt and effective reform.*

the environment that has still not yet fully recovered from past resource development movements.

Pennsylvania has an extraordinary opportunity to enact the nation's best body of laws governing the extraction of a vast natural resource. Such action would effectively legislate the nation's best practices and make them the standard by which the Marcellus Shale is developed and provides the benefits to the Commonwealth that have been heralded as the promise of this new industry.

## NOTES

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<sup>1</sup> ExplorePAhistory.com. *Chapter One: Penn's Woods.*

<http://explorepahistory.com/story.php?storyId=14&chapter=2> (March, 2010)

<sup>2</sup> PA D.C.N.R. *We don't see trees the way our forebears used to.*

<http://www.dcnr.state.pa.us/wrcp/keynotes/summer99/forests.htm> (March, 2010)

<sup>3</sup> PA D.C.N.R. *Penn's Woods: The History of Pennsylvania's Forests.*<http://www.dcnr.state.pa.us/Forestry/pennswoods.aspx> , and ExplorePAhistory.com. *Chapter One: Penn's Woods.* <http://explorepahistory.com/story.php?storyId=14&chapter=2> (March, 2010).

<sup>4</sup> *Id.*

<sup>5</sup> Department of Environmental Protection Orphan Oil and Gas Well Plugging Fact Sheet, 5500-FS-DEP1670 Rev. 4/2009

<sup>6</sup> Pennsylvania's Plan For Addressing Problem Abandoned Wells and Orphaned Wells, Department of Environmental Protection, 550-0800-001/April 10, 2000

<sup>7</sup> <http://www.askchesapeake.com/Barnett-Shale/Pages/information.aspx>

<sup>8</sup> Marcellus Shale Workforce Needs Assessment performed by Penn State University's Marcellus Shale Education and Training Center. The Assessment's direct employment estimates are 11.43 full time jobs per well during the development phase, and 0.17 during well production. Further, the Assessment found that currently about 80 percent of Marcellus jobs are being filled by out-of-state workers.

<sup>9</sup> <http://marcelluscoalition.org/wp-content/uploads/2010/05/PA-Marcellus-Updated-Economic-Impacts-5.23.10.3.pdf>

<sup>10</sup> Colorado Department of Natural Resources, Oil and Gas Conservation Commission, Practice and Procedure, 2 CCR 404-1.100, et seq.

<sup>11</sup> Oil and Gas Act, 58 PA. STAT. ANN. § 601.101, et seq.

<sup>12</sup> Title 25 Pa. Code Chapter 78: Oil and Gas Wells

<sup>13</sup> Bureau of Oil and Gas Management, PA DEP. Oil and Gas Operators Manual, Oil and Gas Management Practices, Document 550-0300-001. Available at:  
<http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8295>

<sup>14</sup> 18 C.F.R. § 806.14(b)(1)(v) (2008).

<sup>15</sup> N.Y. State Dep't of Envtl. Conservation, *Well Permitting Process: Well Permitting Requirements to Drill, Deepen, Plug Back and Convert for Oil, Gas, Solution Salt Mining and Other Regulated Wells* (last visited Apr. 1, 2010), available at: <http://www.dec.ny.gov/energy/1772.html>.

<sup>16</sup> Div. of Mineral Resources, N.Y. State Dept. of Envtl. Conservation, Draft Supplemental Generic Environmental Impact Statement On The Oil, Gas and Solution Mining Regulatory Program: Well Permit

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Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs, at 3-2 (Sept. 2009). Available at:

[http://www.dec.ny.gov/docs/materials\\_minerals\\_pdf/ogdsgeischap3.pdf](http://www.dec.ny.gov/docs/materials_minerals_pdf/ogdsgeischap3.pdf)

<sup>17</sup> PA DEP Newsroom, “Tough New Standards to Protect PA Waterways from Drilling Wastewater Take Major Step Forward. EQB Approves New TDS Regulations Strengthens Erosion and Sediment Rules Proposes New Well Construction Standards.” Available at:

<http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=11447&typeid=1>

<sup>18</sup> 52 P.S. §1396.1 et seq.

<sup>19</sup> Permit Application for Drilling or Altering a Well, 5500-PM-OG000

<sup>20</sup> 58 P.S. §601.208(d)(1) and 25 Pa Code §78.51

<sup>21</sup> 40 CFR Part 312

<sup>22</sup> Department of Environmental Protection Orphan Oil and Gas Well Plugging Fact Sheet, 5500-FS-DEP1670 Rev. 4/2009

<sup>23</sup> ASTM E1527-05 “Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process” and ASTM E2247-08 “Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process for forestland and Rural Property”

<sup>24</sup> “Deep Impact Gas Drilling Series” by The Times-Tribune ([www.thetimes-tribune.com/](http://www.thetimes-tribune.com/))

<sup>25</sup> 32 P.S. § 693.1, et seq.

<sup>26</sup> Title 25 Pa. Code Chapter 105

<sup>27</sup> Bureau of Oil and Gas Management, PA DEP. Oil and Gas Operators Manual, Oil and Gas Management Practices, Document No. 550-0300-001, Manual Chapter 3, at 8.

<http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-48242/chap3.pdf>

<sup>28</sup> 58 P.S. §601.201(e)

<sup>29</sup> [http://www.portal.state.pa.us/portal/server.pt/community/search\\_articles/14292](http://www.portal.state.pa.us/portal/server.pt/community/search_articles/14292)

<sup>30</sup> 35 P.S. § 6018.101, et seq.

<sup>31</sup> See “DEEP IMPACT DRILLING SERIES” in The Times-Tribune ([www.thetimes-tribune.com](http://www.thetimes-tribune.com)). See also June 16, 2010 Testimony of DEP Secretary John Hanger before the Pennsylvania Senate Environmental Resources & Energy Committee.

<sup>32</sup>

[http://files.dep.state.pa.us/PublicParticipation/Public%20Participation%20Center/PubPartCenterPortalFiles/Environmental%20Quality%20Board/2010/May\\_17\\_2010\\_Meeting/Oil\\_and\\_Gas/OG\\_CH\\_78\\_Proposed\\_Casing\\_Regs\\_Annex\\_A\\_4\\_11\\_2010.pdf](http://files.dep.state.pa.us/PublicParticipation/Public%20Participation%20Center/PubPartCenterPortalFiles/Environmental%20Quality%20Board/2010/May_17_2010_Meeting/Oil_and_Gas/OG_CH_78_Proposed_Casing_Regs_Annex_A_4_11_2010.pdf)

<sup>33</sup> 35 P.S. § 6018.101, et seq.

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<sup>34</sup> 25 Pa. Code § 78.61-.63

<sup>35</sup> 25 Pa. Code § 78.62

<sup>36</sup> 25 Pa. Code § 78.63

<sup>37</sup> House Environmental Resources and Energy Committee, Chairman Camille "Bud" George's Update:

Issues related to Marcellus Shale Gas Drilling in Pennsylvania. Available at:

<http://www.pahouse.com/EnvResources/documents/ER&E%20Committee%20November%20Update.pdf>

<sup>38</sup> <http://www.srbc.net/programs/projreviewmarcellus.htm>

<sup>39</sup> 52 P.S. §1396.1 et seq.

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[http://www.portal.state.pa.us/portal/server.pt/community/water\\_quality\\_standards/10556/integrated\\_water\\_quality\\_report\\_-\\_2010/682562](http://www.portal.state.pa.us/portal/server.pt/community/water_quality_standards/10556/integrated_water_quality_report_-_2010/682562)

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[http://files.dep.state.pa.us/PublicParticipation/Public%20Participation%20Center/PubPartCenterPortalFiles/Environmental%20Quality%20Board/2010/May\\_17\\_2010\\_Meeting/TDS/Annex\\_A\\_for\\_Ch\\_95.pdf](http://files.dep.state.pa.us/PublicParticipation/Public%20Participation%20Center/PubPartCenterPortalFiles/Environmental%20Quality%20Board/2010/May_17_2010_Meeting/TDS/Annex_A_for_Ch_95.pdf)

<sup>42</sup> Considine, T.J., Watson, R., Blumsack, S., *The Economic Impacts of the Pennsylvania Marcellus Shale Natural Gas Play: An Update* (The Pennsylvania State University College of Earth and Mineral Sciences Department of Energy and Mineral Engineering, May 24, 2010

<sup>43</sup> 25 Pa Code §78.303

<sup>44</sup> House Bill 2213 (P.N. 3821) of the 2009-2010 Session proposes, among other things, to raise the minimum bonding amounts from \$2,500 to \$12,000 for single conventional wells and to \$150,000 for Marcellus Shale wells utilizing hydraulic fracturing and from \$25,000 to \$240,000 for multiple wells identified in a blanket bond. Marcellus Shale wells would be ineligible for blanket bonds.

<sup>45</sup> [http://www.dep.state.pa.us/dep/deputate/minres/districts/Trust\\_Funds/TrustFundHome.htm](http://www.dep.state.pa.us/dep/deputate/minres/districts/Trust_Funds/TrustFundHome.htm)

<sup>46</sup> 58 P.S. §401 et seq.

<sup>47</sup> 2 CCR 404-1: Section 322 of the Colorado Oil and Gas Conservation Commission Amended Rules

<sup>48</sup> 2 Colo. Code Regs. § 404-1002(e)(3) (2009).

<sup>49</sup> 2 Colo. Code Regs. § 404-1002(e)(3) (2009), and 2 Colo. Code Regs § 404-322.

<sup>50</sup> For example, Colorado.

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