

Marcellus Well Drilling 101:

An in-depth discussion of state regulations and the drilling process

A public presentation took place on October 19th, 2010 at the Honesdale High School Auditorium in Honesdale, Pennsylvania. The presentation, which was co-sponsored by the Wayne County Oil and Gas Task Force and Penn State University, was titled ‘*Marcellus Drilling 101: An in-depth discussion of state regulations and the drilling process*’. The event, which lasted about two and a half hours, was attended by approximately 125 people.

Dave Messersmith, of the Penn State Cooperative Extension and Chairman of the ‘Outreach sub-committee’ of the Wayne County Oil and Gas Task Force began the evening by outlining the structure of the meeting and summarizing Penn State’s efforts in regard to the Marcellus shale. Mr. Messersmith then introduced the presenters and explained the agenda for the evening, which consisted of three phases; the first of which was an overview of the drilling process by Pete Chacon, a drilling engineer from Newfield Exploration. The second phase of the presentation consisted of an overview of state regulation of Marcellus well drilling by Jennifer Means, a program manager from the Oil & Gas Program for the eastern region of the Pennsylvania Department of Environmental Protection (PA DEP). Lastly, the event concluded with a question and answer session.

Mr. Messersmith also introduced Edward Coar, Director of the Wayne County Planning Department and Chairman of the Wayne County Oil and Gas Task Force. Mr. Coar discussed the structure and mission of the Task Force. He indicated the Task Force is comprised of and driven by various sub-committees. He indicated that educational outreach programs are a very important part of the Task Force’s mission.

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The first speaker, Pete Chacon, indicated that his presentation would be a “middle of the road type presentation”, which meant the discussion would not touch on higher-level energy concepts, policies or issues, nor would it delve into the specific details involved with drilling of an individual well. The presentation instead focused on a general overview of the drilling process from well siting considerations to well drilling and completion and eventual reclamation of the site. Mr. Chacon stressed three main concepts:

- *‘The Well Process’* – He indicated that there are processes and systems throughout. The various stages involve plans and systems designed with input from many technical experts. The process itself is very repetitious in nature and the ultimate result is a well that is done right, Chacon pointed out.
- *‘Regulations’* – Mr. Chacon stated that regulations are infused into the drilling process and there are multiple levels of inspections and oversight throughout.
- *‘Moving Forward’* – Mr. Chacon commented on the descriptions of the economic potential of development of the Marcellus shale. He stated that employment opportunities will be presented throughout the process and those opportunities will encompass many different educational and employment backgrounds. Mr. Chacon indicated the economic opportunities will be realized by following the process in the right manner, which includes using the best management practices and taking care of the environment.

Mr. Chacon next described the drilling process from beginning to end for one hypothetical well. The drilling process, as outlined by Mr. Chacon included the following steps:

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- The development team, which includes those with geological expertise, determines a task order for the drilling team to deliver a lateral in a specified area to develop the required amount of acreage.
- The drilling team has a range of about a square mile in which to develop a surface site to target the specified Marcellus area. They will first look at areas that would not be good candidates for site development. The site selection process will attempt to identify sensitive areas such as wetlands or areas flagged by the Pennsylvania Natural Diversity Inventory (PNDI) that would not be favorable for siting in order to avoid these areas. The PNDI search comprises searches of various agencies, such as The PA Fish & Boat Commission, US Fish and Wildlife Service and the PA Department of Conservation & Natural Resources, to name a few. The site selection process utilizes the expertise of various consultants, such as wetland specialists, surveyors, and engineers etc., who also complete field checks on the ground.
- The site selection process also considers the applicable state regulations that could affect siting. The regulations include items such as: erosion and sedimentation (Chapter 102), waste regulations (Chapters 78 & 91), oil and gas regulations (Act 223), road use and access (PA Department of Transportation) and the PA Clean Streams Act.
- When a suitable surface site is selected, the land department notifies the landowners that people will be onsite to stake the proposed location. The specific site is scrutinized further to ensure it is an acceptable location for the well pad. To meet Pennsylvania requirements, a third-party consultant identifies all water well sources within 1,000 feet of the proposed location. The owners of the identified water sources are notified of the intent to drill.

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- The next step is to complete the 'Permit Application'. Mr. Chacon displayed an example of a permit application on the screen. The permit application identifies the results of the site reconnaissance. The permit application also includes a map of the proposed site and proof of notification of water well owners within 1,000 feet of the intent to drill.
- Upon PA DEP approval of the permit application, the next step is to prepare an erosion and sedimentation control plan (E & S) and a grading plan. These documents form the basis for the construction of the well pad. Examples of these plans were shown to the audience. The E & S plan is required to be displayed at the site for inspection purposes. The E & S controls are put in place prior to any earth disturbance at the site.
- If any timber removal is required, the timber is first appraised. The landowner is then paid the value of the cut timber. In addition, the landowner is able to retain the timber for use or resale.
- Mr. Chacon then described some details for construction of the well pad itself. Typically, water quality inspectors frequently visit the site during this stage of the process. Prior to initiation of the drilling of the well, the PA DEP must be notified at least 48 hours in advance. Mr. Chacon described the initiation of the drilling process, in which a relatively small rig is used initially, and subsequently, a larger rig is moved into place to complete the remainder of the drilling. Mr. Chacon pointed out that Newfield Exploration utilizes two sets of casing for their gas wells. He stated the use of multiple casings goes beyond what is typically required and this is done to protect from shallow gas migration into the water table from the main well bore.

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- Drilling commences ‘on air’ down to the ‘kick off point’ or point where drilling is to begin horizontally. At this point, the drilling process switches over to a fluid based system to complete the horizontal portion of the well bore. The horizontal portion can measure up to about 10,000 feet. At this point, Mr. Chacon showed some illustrations of the drilling process from the ‘Teeple’ site in Wayne County.
- Mr. Chacon then described the ‘stimulation’ and completion processes. The completion process can be comprised of between 3 to 20 different stages. A picture and an aerial photo were shown to the audience to illustrate what the site looks like during the ‘fracing’ process. The well is ‘fraced’ out a distance of approximately 300’ from the horizontal well bore. The ‘frac’ spacing along the horizontal well bore is approximately 600’.
- After completing the stimulation of the well through the ‘fracing’ process, the reclamation process begins. The size of the well pad footprint is gradually reduced and the entire well site is regraded. Typically, the landowner is involved in this stage of the process to provide input on the manner in which the site is to be reclaimed. The reclamation process includes soil sampling, water sampling and timber assessments in order to evaluate any problems. The site is limed, fertilized and seeded. It is a requirement to have 70% of the vegetation restored to the reclaimed area within 270 days of completion of the well bore.

Jennifer Means, the second and final speaker of the evening, began her presentation with an overview of DEP’s regulatory oversight in regard to the oil and gas industry. Until recently there have only been two regional oil and gas offices in the State and both of these offices were located in western Pennsylvania. About two years ago an eastern oil and gas regional office was established in Williamsport. There are also regional field offices located in Tioga County,

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Lackawanna County and Centre County. There are 45 counties in the eastern region. Of those 45 counties, 22 have new or active wells and 6 counties in the eastern region also have gas storage fields. The eastern regional staff is comprised of 50 positions in total, 43 of which are currently filled. DEP is in the process of filling the remaining vacant positions. Ms. Means gave an overview of the different sections of the oil and gas program and their respective responsibilities.

The first set of requirements discussed by Ms. Means pertained to stormwater. She stated that soil disturbance of five acres or more requires an Erosion and Sedimentation Control General Permit. Those surface disturbance permits are issued through the Williamsport office. Since the Williamsport office was originally set up as a field compliance office and they are still trying to fulfill its staffing requirements, the actual gas well drilling permits are currently processed by DEP's Meadville office. After construction of the well pad is completed there can still be issues involving post construction storm water runoff due to soil compaction. In order to address these potential issues, the well drillers are also required to submit a Post Construction Stormwater Management Plan, which details how stormwater will be managed.

Ms. Means indicated that another area that involves surface permitting is for stream and/or wetland encroachment. Permits are required for disturbance of any stream or wetland habitats. The permit can either be a 'General Permit' or a 'Joint Permit'. The type of permit required is dependent upon the size and location of the project.

Another area that requires oversight from the DEP is water use, according to Ms. Means. This is due to the large amounts of water used during the hydraulic fracturing process. In order to address issues and concerns associated with water usage, a 'Water Management Plan' (WMP)

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is required. The DEP does not regulate or issue permits for water withdrawals for industrial uses. It is stated in the gas well permit application that the well cannot be ‘fraced’ until the applicant receives approval of the ‘Water Management Plan’ from the DEP. In addition, the DEP will not approve a ‘Water Management Plan’ until the applicant has approval for water withdrawal from the appropriate river basin commission. In this area of the State, this is either the Susquehanna River Basin Commission (SRBC) or the Delaware River Basin Commission (DRBC).

As stated earlier, the actual drilling permits are currently issued through another DEP office, but the eastern regional office does have oil and gas inspectors onsite throughout the various stages of the drilling process. One of the current concerns is the potential impact to freshwater aquifers during the drilling process. According to Ms. Means, it is the DEP’s observation thus far that the ‘fracing’ process has not directly caused any water supply issues. The problems with water supply impacts can occur when the freshwater aquifer is first encountered during the vertical drilling process. It is the DEP’s responsibility to conduct inspections and investigate any complaints of problems with water supply that were potentially caused by gas drilling. If a freshwater well is located within 1,000 feet of a gas well and problems are encountered within 6 months of when the well was drilled, then the driller is presumed liable. The burden of proof is on the driller to demonstrate they are not responsible for the problem, according to Ms. Means. If the well is outside of the 1,000-foot radius or outside of the 6-month period, the burden of proof is on the DEP. She stated further that the lack of pre-drill water quality data could make it difficult to determine if the water quality problem was pre-existing or if it could be attributed to the drilling of the well.

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Another issue that has required much time of DEP staff is fluids management, according to Ms. Means. This includes materials used in the ‘fracing’ process and other material used onsite during the day-to-day operations of the drillers, such as hydraulic fluid or fuel. It is not uncommon to have spills and releases at the sites due to their busy nature. The spills typically encountered, although they require much staff time to ensure they have been properly cleaned up, have been of a size that is usually confined to the well pad. In her experience the operators are using site liners and other containment methods to contain any potential on-site releases.

One of the main requirements that companies have in regard to fluid management is a ‘Preparedness, Prevention and Contingency Plan’ (PPC). This plan details the steps to be completed if there is an issue with release of fluids on site. There is also the potential for issues resulting from materials stored in impoundments regardless of whether they are used for the drill cuttings or ‘flowback’ from ‘fracing’ the well. Since there have been issues with impoundments leaking, many companies are using tank collection instead of impoundments for collection of ‘flowback’. Certain types of impoundments could require permitting. If a centralized ‘flowback’ impoundment were to be utilized for the collection of well ‘flowback’ from more than one well, special permitting would be required.

The next area of concern is the issue of wastewater disposal, according to Ms. Means. The largest volume of wastewater is comprised of well ‘flowback’. This ‘flowback’ needs to be disposed of at a specially permitted facility as not all treatment facilities are equipped to treat this wastewater. Ms. Means stated that at this time, there are a few facilities that are allowed to accept the wastewater, but most of the ‘flowback’ is being transported to the western part of the state. Many of the companies are now recycling or reusing the ‘flowback’. She is hearing that

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approximately 10 – 20 % of the water used in the ‘fracing’ process is returning as ‘flowback’ wastewater. She indicated that many of the companies are transporting this wastewater to another site and then mixing it with freshwater to proceed with ‘fracing’ a new well. DEP is encouraging this practice, according to Ms. Means. This practice of ‘flowback’ reuse reduces the amount of freshwater needed at the next drilling site and it reduces the amount of wastewater that needs to be disposed of and/or treated.

The biggest issue the DEP is dealing with currently is stray gas migration, especially in Bradford County. This involves the migration of methane gas through the subsurface geology as it has been observed bubbling up in water wells, springs and/or streams. She indicated that better well construction casing and cementing is needed to help alleviate this problem as well as paying more attention to the specific regional geology, since there are many pre-existing faults and fractures. She stated that the multiple string casing design referred to by Pete Chacon is a better design and there have been fewer problems where that type of design has been utilized.

Ms. Means commented that there is some pending legislation and regulatory changes that would deal specifically with the issue of gas migration. The potential regulatory changes would focus on four main areas:

- Protection and replacement of water supplies
- New well casing and cementing standards
- Required pressure testing
- Stray gas response if there is an incidence where stray gas is identified

In terms of the increase in Marcellus shale permitting activity over the past several years, Ms. Means stated that the number of issued Marcellus permits statewide in 2007 was 71

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compared to more than 2,000 Marcellus permits, which have already been issued by September 1st in 2010. Of the Marcellus permits issued statewide, the bulk of those permits were issued in the eastern region. In Wayne County, 18 wells have been permitted over the last 3 years. Of those permitted wells, a total of 17 are Marcellus formation wells, according to Ms. Means, and the one remaining was an Oriskany formation well. As she understands it, 7 of the 18 permitted wells have been drilled. It is also her understanding that none of them have been ‘fraced’ yet.

Ms. Means spoke of some of the challenges they have faced over the past few years as a new regional office. The first challenge mentioned was staffing. They are still trying to fill staff positions associated with building a new program. A second challenge is the increasing rate of gas field activity and volume. According to Ms. Means the activity increased at a pace greater than anyone had expected. Some other challenges they have faced include technological advances, changes in gas drilling methods and also shifts in the cultural practices of the drillers.

The program concluded with a question and answer session, which lasted approximately one hour. The audience asked more than 30 questions of presenters Pete Chacon and Jennifer Means. Al Owens and Gene Linscomb of Hess Corp. also joined the two presenters in answering questions from the audience. Below is a sampling of questions that were presented:

- How many feet thick is the Marcellus shale at the Crum & Teeple sites? Pete Chacon replied that the Marcellus shale is approximately between 400’ to 650 / 700’ thick at these sites.
- How long is the average permit timeline? Jennifer Means indicated that the average drill permit period is 45 days. Other related permits could require longer processing periods.
- Where will Hess take the Wayne County wastewater fluids that are not recycled? Al Owens indicated that any wastewater from the Delaware River basin could not be taken into the Susquehanna River basin, so it would have to be transported to the western part of the State. This is a potential logistical problem and they are looking into some other possible options.