



## House Environmental Resources and Energy Committee Chairman Camille "Bud" George's Update:

### Issues related to Marcellus Shale Gas Drilling in Pennsylvania

The Department of Environmental Protection has issued more than 1,300 permits for 2009, with more to be issued in the coming years. No study yet exists on the environmental or human health impacts of the Marcellus Shale gas development in Pennsylvania. This update outlines issues that should be examined.<sup>1</sup>

#### 1. **Disclosure of the chemical fluids used in hydraulic fracturing products**

According to DEP, the companies providing the fluid products used to fracture the Marcellus Shale have disclosed all the constituent chemicals for those products, but they have not fully disclosed the composition and concentration percentages of those chemicals, claiming trade secret.<sup>2</sup> Although DEP has Material Safety Data Sheet (MSDS) on the products used by the chemical companies, the Chemical Abstracts Service (CAS) registry number is withheld on several chemical components on MSDSs. For example, the MSDS for a frac product called Corrosion Inhibitor A261 contains 8 chemical compounds, but the CAS numbers for four of the compounds are withheld on trade secret ground. The CAS number identifies chemical elements, organic and inorganic compounds, metals, alloys, isotopes, polymers, among others, providing the necessary information to test the contaminated water.<sup>3</sup> DEP has updated information on 59 chemicals and 45 frac fluid products from 5 vendors, with various hazardous toxins including carcinogens, biocides, pesticides, acids, metals, and other poisonous components.<sup>4</sup> New York has complete information on 152 chemicals and partial information on 45 chemicals, and will require full disclosure including the concentration percentages of the chemicals.<sup>5</sup>

Recently, natural gas companies, such as Chesapeake and Range Resources, responding to the growing national public concern—including a one-year moratorium on the fracture drilling in New Mexico and an unofficial moratorium in New York, have called on the chemical companies to fully disclose the chemical compositions of the frac fluids, dismissing as "silly" the trade secret claim made by the chemical companies.<sup>6</sup> These frac fluids are exempted from the disclosure requirement of the federal Safe Drinking Water Act. Because of this exemption, EPA until recently has not investigated whether hydraulic fracturing may have played a role in any water contamination incidents, but there is pending federal legislation to remove this so-called "Halliburton exemption."<sup>7</sup>

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<sup>1</sup> This update does not address issues currently being addressed by DEP such as the wastewater management and treatment programs (including the TDS regulation) and the surface water quantity management.

<sup>2</sup> *Draft Supplemental Generic Environmental Impact Statement*, Ch. 5, p. 51, *NY Dept. of Env'tl Conservation*.

<sup>3</sup> <http://www.cas.org/expertise/cascontent/registry/regsys.html#q2>

<sup>4</sup> <http://www.dep.state.pa.us/dep/deputate/minres/oilgas/FractListing.pdf>.

<sup>5</sup> *Draft Supplemental Generic Environmental Impact Statement*, Ch. 5, p. 42, *NY Dept. of Env'tl Conservation*.

<sup>6</sup> <http://www.propublica.org/feature/gas-execs-call-for-disclosure-of-chemicals-used-in-hydraulic-fracturing-102>.

<sup>7</sup> <http://casey.senate.gov/newsroom/press/release/?id=3D78271C-E412-4B63-95B8-419E75CE2BB6>.

The industry claims that there have been no confirmed cases of groundwater contamination from hydraulic fracturing, but this is questionable because it is difficult to establish causation without knowing the specific chemical formula and concentrations of the frac fluids. EPA is now studying a link between the fracturing of a shale formation in Wyoming (ranging in depths from 1,300 ft to 6,000 ft) and the heavy saturation of benzene found in the nearby residential water wells.<sup>8</sup> DEP has not independently verified the companies' disclosures of the frac fluids for accuracy and completeness.

## **2. Casing and cementing of well-bores**

The primary safeguards against groundwater contamination during the hydraulic fracturing procedure are well casing and cementing.<sup>9</sup> A proper protection requires installing multiple layers of protective steel casing and cement (conductor casing, surface casing, intermediate casing where necessary, and production casing) to protect freshwater aquifers and to ensure that the producing zone is isolated from the overlying formations. Currently, DEP's cementing requirements apply only to surface and coal protective casings. In preventing fluid movement from deeper zones into ground water resources, the quality of the cement job that fills the gap between the wall of the drilled hole and the steel pipe—called the annular space—is of critical importance, necessitating inspection of the casing and cementing of well-bores.<sup>10</sup> However, DEP currently relies on the well operator to report any defects in casing or cementing.<sup>11</sup> Although DEP "intends to" inspect each well during each of the phases of siting, drilling, casing, cementing, completing, altering and stimulating a well, such inspection is subject to DEP's budget constraints.<sup>12</sup> It is unclear whether the 37 additional inspectors whom DEP will hire will be sufficient to cover over 2000 Marcellus Shale permitted wells that are expected for 2010.

## **3. Disposal of waste and wastewater**

a. Temporary impoundment of drilling wastewater in a pit: DEP allows the use of open pits or tanks for temporary impoundment of drilling wastewater (flowback) at the well site.<sup>13</sup> Using open pits, however, is vulnerable to mismanagement incidents (spills or rain overflows) that could lead to contamination of surface or groundwater supply. The setback and other boundary requirements are not stringent: a minimum of 100 ft from a stream, wetland or body of water (waiver of this requirement is available), and a minimum of 20 inches from the bottom of the pit to the uppermost limit of the seasonal high groundwater table.<sup>14</sup> Improper surface management of wastewater may pose a serious threat to groundwater supply. Under the current regulation, the operator can store waste fluids in an open pit up to 9 months. By contrast, New York's proposed regulation would require all

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<sup>8</sup> <http://www.propublica.org/feature/epa-chemicals-found-in-wyo-drinking-water-might-be-from-fracking-825>. See comments in the article by an EPA official on disclosure of the chemical contents.

<sup>9</sup> *Modern Shale Gas Development in the United States: A Primer* (April, 2009), p. 51, U.S. Department of Energy.

<sup>10</sup> *State Oil and Natural Gas Regulations Designed to Protect Water Resources*, p. 21, U.S. Department of Energy.

<sup>11</sup> 25 Pa. Code §78.86 (Defective casing and cementing).

<sup>12</sup> 25 Pa. Code §§78.903 (Frequency of Inspection) & 78.906 (Limitation).

<sup>13</sup> 25 Pa. Code §§78.54-57. The percentage of the fluids that return to the surface varies from 0% to 70%.

<sup>14</sup> 25 Pa. Code §78.57(c)(2).

wastewater to be stored in a steel tank. In addition, there is no inspection to ensure that the pit liner has not been breached during the storage period.

**b. Normally Occurring Radioactive Materials (NORM):** DEP allows storing certain qualified contaminated drill cuttings (rock and other mineral residues from drilling) in a lined pit at the well site.<sup>15</sup> Because the Marcellus Shale formation contains a higher level of NORM, that is, rocks and minerals containing small amounts of uranium and thorium, along with their decay elements of radium 226 and radium 228, the drilling process can bring NORM wastes to the surface. DEP is now studying the Marcellus NORM's radioactivity levels to determine its risks, while New York Department of Environmental Conservation found that NORM there posed negligible risk to workers and the general public.<sup>16</sup> But accumulation of NORM with poor monitoring and containment practices could pose a danger to human health and the environment. In Texas, over 140 sites related to the Barnett Shale drilling had to be decontaminated, and drilling equipment are routinely decontaminated of NORM. There have been incidences in Texas where operators have dumped NORM wastes on the ground to save the disposal costs.<sup>17</sup>

**c. Drilling fluids remaining in the formation:** Drilling in the Marcellus Shale requires a much larger volume of water than other drillings, up to 4 million gallons per fracturing job, and according to a DEP official, up to 100% of the drilling fluids can remain in the drilled formation. No study yet exists on the impact of large amounts of the chemical fluids remaining in the shale formation on the water supply. DEP maintain that there would be minimal, if any, impact on the water supply because the drilling occurs far below fresh water aquifers, and the fluids would be trapped in a rock formation with low permeability. But a New York study indicated that the fluids could contaminate groundwater supplies by migrating beyond the fracture zone via naturally occurring existing fractures and by propagation of induced fractures beyond the target formation.<sup>18</sup> DEP does not require a record of the amount of drilling fluids remaining in the formation.

#### **4. Bonding and Penalty**

**a. Bonding:** The operator must post a \$2,500 well-plugging bond for a single well, or \$25,000 for a blanket bond for any number of wells.<sup>19</sup> But a DEP official stated that a typical cost for plugging an abandoned well is \$10,000, or higher for a horizontal well. Therefore, the bond amount appears to be severely insufficient. A Department of Conservation and Natural Resources official indicated that operators often choose abandonment over plugging a well because forfeiting the bond is cheaper.

**b. Penalty:** Penalty is determined using a formula that considers many factors, but there is a perception among the environmental groups that the current level of penalty does not

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<sup>15</sup> 25 Pa. Code §78.62(Disposal of residual waste-pits).

<sup>16</sup> *New York Draft Supplemental Generic Environmental Impact Statement*, Chapter 5, page 30.

<sup>17</sup> Heinkel-Wolfe, Peggy; *Radioactive Waste Surfaces at Texas Gas Sites*, Denton Record-Chronicle, November 11, 2007. See at [http://www.flower-mound.com/env\\_resources/seismic/DMNArticle.pdf](http://www.flower-mound.com/env_resources/seismic/DMNArticle.pdf).

<sup>18</sup> Rapid Impact Assessment Report to the New York City Dept. of Env'tl. Protection, Ch.3.4.1.

<sup>19</sup> 25 Pa.Code §78.303.

deter bad or negligent behavior by the operator. Recently, Cabot Oil & Gas was fined \$58,000 for three spills within a short span of time, but was allowed to continue to operate.

## **5. Air Quality**

No study exists on the effects from large-scale drilling in the Marcellus Shale region on air quality, but such studies have been made on the Barnett Shale region in Texas. In the Barnett Shale, as of March 2009, there were a total of 10,539 active gas wells, with 5,037 more wells to be drilled.<sup>20</sup> In comparing the two formations, Barnett Shale is about 1/10 of the size of Marcellus Shale.<sup>21</sup> Given the size, the impacts on air quality from Marcellus drilling could be much more severe as the natural gas development expands.

According to a Barnett Shale study, the 2009 emissions of smog-forming compounds from all oil and gas sources were estimated at 191 tons per day (tpd) on an annual average, with peak summer emissions at 307 tpd.<sup>22</sup> Of those emissions during the summer, 165 tpd came from the five counties in the Dallas-Fort Worth metropolitan area that have significant oil and gas production. In comparison, the 2009 emission estimates for the 5-county Dallas-Fort Worth area for on-road motor vehicles were 121 tpd. The study makes it clear that concentrated, large-scale natural gas drilling operations (drilling, storage, processing, transportation) are a significant source of air pollution.

## **6. Contaminated Equipment**

One theory for the recent massive Dunkard Creek fish kill is that invasive toxic algae from Texas found its way to Pennsylvania streams through the equipment used for Marcellus Shale drilling by a Texas company. Whether or not the invasive algae was the primary cause of the fish kill, this incident, still under investigation, highlights a need for out-of-state drilling equipment to be subject to further strong inspection for contamination.<sup>23</sup>

## **7. Royalty Provision in the Lease Agreement**

The Pennsylvania Supreme Court will soon decide whether the statutory royalty of 12.5% for leasing gas rights is to be calculated after deducting post-production expenses such as processing, marketing and transportation from the producer's proceeds. As detailed in the September 2009 Committee Update, this decision could greatly impact the amount of royalty a mineral-rights owner could expect to receive. High post-production expenses could greatly reduce the royalty, and producers could inflate such expenses.<sup>24</sup>

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<sup>20</sup> Guven, B. August 26, 2009. "Analysis of AutoGC and VOC Canister Data in the DFW Area." Civil and Environmental Engineering Dept., Rice University.

<sup>21</sup> Armendariz, A. January 26, 2009. "Emissions from Natural Gas Production in the Barnett Shale Area and Opportunities for Cost Effective Improvements." Dept. of Envtl. & Civil Eng'g., Southern Methodist University.

<sup>22</sup> Armendariz, A. January 26, 2009. "Emissions from Natural Gas Production in the Barnett Shale Area and Opportunities for Cost Effective Improvements." Department of Environmental and Civil Engineering, Southern Methodist University. [http://www.edf.org/documents/9235\\_Barnett\\_Shale\\_Report.pdf](http://www.edf.org/documents/9235_Barnett_Shale_Report.pdf).

<sup>23</sup> <http://www.post-gazette.com/pg/09277/1003007-113.stm>.

<sup>24</sup> <http://www.houstontriallawyerblog.com/2009/06/articles/oil-gas-royalties/texas-oil-and-gas-royalty-trial-begins/>. Also, see Fambrough, Judon; *Hints on Negotiating An Oil and Gas Lease*, page 5, at <http://www.oilandgaslawyerblog.com/Hints%20on%20Negotiating%20an%20Oil%20and%20Gas%20Lease.pdf>.