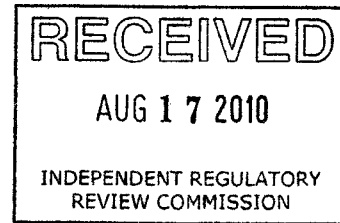


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8-6-10

Comments to:

Pennsylvania Environmental Quality Board and
Pennsylvania Department of Environmental Protection regarding
"Public Input Sought on Proposals to Strengthen Oil and Gas Well Protections"

From:

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My comments are supportive of the research of Dr. Cynthia Walter. Our family is concerned about air emissions from various drilling structures which are not being adequately monitored for benzene, the migration of fracking toxins into groundwater and drinking water, leakage of toxins from holding pits into surrounding farmland and residential areas, and explosions that could spew toxins over large residential areas. We are in dire need of a moratorium until Pennsylvania has instituted protective regulations.

1. COMMENT:

I support the document, "Recommendations for Pennsylvania's Proposed Changes to Oil and Gas Well Construction Regulations Report to Earthjustice and Sierra Club", (Prepared by: Harvey Consulting, LLC. March, 2010) **The Harvey Recommendations are a step in the right direction, but not sufficient to enable the DEP to carry out its mission to protect Pennsylvania's environment.**

EXPLANATION:

Improvements to DEP Proposed Regulation Changes: The proposed DEP regulation changes left many gaps and the recommendations from Harvey Consulting begin to fill some of those gaps. The Harvey recommendations appear to be based on broad, relevant engineering training and experience, they are well documented with appropriate citations, and are endorsed by a wide array of organizations with a long history in protecting the environment (Earthjustice, Sierra Club, Trout Unlimited, Citizens for Pennsylvania's Future, Clean Water Action, Delaware Riverkeeper Network, NYH2O, Pennsylvania Forest Coalition, Protecting Our Waters, Three Rivers Waterkeeper (PA)).

Large Gaps in the Knowledge of Marcellus Shale Gas Extraction Prevent Responsible Regulation: The technology to drill and extract gas from formations such as the Marcellus shale is so new that government agencies can only guess that the materials and procedures stated in a permit application are the best option for obtaining the gas reserve. For example, Kargbo et al. (2010) describe a range of alternatives to using 5-10 million gallons of water for each fracturing procedure. One effective alternative, dry frac, uses CO₂ and N₂, consumes almost no freshwater, and produces less waste. In a short time, the DEP may rewrite regulations to require alternatives such as these and prohibit hydrofracturing. (Also see Comments 2 and 4 below.)

In addition, environmental effects of the currently popular drilling methods have not been studied. For example, we have no monitoring data regarding the migration of drilling additives or gas in the wide variety of sedimentary layers throughout PA, we have no knowledge of the impacts of exposure to multiple drilling additives simultaneously, we do not know the extent of radionucleotides released in drilling waste water or migrating underground after drilling, etc. (See Comments 2, 3 and 4 below.)

2. COMMENT:

Regulations should be based on scientific publications and evaluated using scientific studies.

EXPLANATION:

The DEP Claim: The DEP web site states the following: “proposed regulatory changes will substantially improve the safety of oil and gas wells across Pennsylvania and protect the state’s water resources from contamination.”¹ The proposed regulations must be accompanied by citations to documents the public can review. In addition, the DEP must substantiate the claim that these changes will improve safety and protect water, using solid scientific evidence made available to the public in a timely fashion.

Studies of Gas Drilling Impacts are Lacking: Peer reviewed science is seriously lacking regarding effects of procedures used in Marcellus shale operations. The 2010 American Chemical Society article by EPA scientists, Kargbo, Wilhelm and Campbell, stands as the only scientific article that reviews environmental effects, mostly citing preliminary government reports and news stories. Other documents such as the 2009 US DOE and Ground Water Protection Council 100-page paper uses 300 citations and contains a 20-page section that discusses environmental impacts, but there is not one reference to a scientific environmental study. Searches of the periodical literature produce no peer-reviewed scientific articles on environmental impacts. I conclude that relevant environmental impact studies simply do not exist for the impacts of Marcellus shale gas extraction. This data gap presents a high risk for environmental harm given the intensity of drilling indicated by the many permits already granted and the rate of new submissions.

The proposed EPA study to be concluded in 2012 is a step in the right direction. This is too little too late, however, for the many thousands of PA citizens that live downhill from over 4600 wells currently permitted in PA alone.

We need scientifically valid monitoring of the natural environment (e.g. water, land, vegetation, wildlife) the built environment (e.g., water wells and pipes, household water, buildings, roads), and economics (e.g., short vs. long-term jobs, farming, industries that use water, tourism, hunting, fishing, etc.). The DEP, universities and qualified consulting firms could conduct such studies using a separate collection of funds provided by the gas industry. We cannot allow the industry to contract the studies because findings could be sequestered, as is much information in this large, competitive industry.

3..COMMENT:

Regulations should require testing of household and relevant water supplies sufficient to establish a consistent baseline of water quantity and quality before drilling, during drilling and 2 years after the last drilling operation is completed.

EXPLANATION:

a.The DEP Mission and Evidence: Protecting water supplies is a primary mission for the DEP, because water is a primary feature of environmental quality. This agency must prove they have fulfilled this goal by giving citizens the evidence they need to document any impacts from gas company operations.

¹ PA DEP Description of proposed regulation changes posted 7-21-10
<http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=12984&typeid=1>

b..Sampling Time Frame: Water supplies in PA are highly influenced by seasonal cycles and precipitation. This requires multiple samples distributed in time before, during and after drilling. The earlier notion of requiring only 6 months post drilling for gas drilling company responsibilities for water quality indicates profound ignorance of the basics of hydrology in a seasonal climate. Testing must occur multiple times over two years post drilling for many reasons:

- (1) PA watersheds experience extreme drought and high precipitation periods throughout our temperate climate regime that will impact both well water quantity and quality.
- (2) PA geology consists of highly diverse sedimentary layers with variable permeability to water and gases and contains harmful substances (e.g., toxic heavy metals and radioactive substances²) that may take time to migrate into water supplies³ after drilling disturbed the deposits.
- (3) PA topography is irregular, resulting in a complex mix of surface runoff, infiltration, and discharges from aquifers linked underground for miles.
- (4) The long history of mining and development in PA have disrupted surface and ground water flows in ways scientists do not fully understand, thus engineers cannot predict the risk of groundwater contamination.

c..Water Supplies Beyond Drinking Water: Water supplies beyond drinking water must be monitored and replaced if harmed for several reasons:

- (1) Harmful components in household water used for showering has been proven in many studies to readily transfer directly into the body through the lungs and skin, sometimes with more severe impacts than drinking the same water supply.
- (2) Water quality for household use, animal care, and small industries is required to maintaining property values and community stability.
- (3) Water quality for animals determines their health, market value, safety and use as food, whether the animals are domestic or wild, such as deer or fish.

d..Water Quantity and Quality: Water quantities must be documented as well as qualities for these reasons:

- (1) Many residences, farms and small businesses use a mix of water supplies, and loss or reduction in well water, springs, and/or streams can have a severe financial impact due to the cost of delivered water via municipal or private sources for household use, farm animal care, small businesses, etc..
- (2) Reductions in the volume and/or reliability of community water supplies will cause substantial harm to community economics, stability, development, and the reputation of the community for years. Investment and community business initiatives take years to develop. Thus, even if a

² Kargbo, D.M., R.G. Wilhelm and D.J. Campbell. 2010. Natural gas plays in the Marcellus shale: challenges and potential opportunities. Environmental Science and Technology publication on line.

³ Kargbo, D.M., R.G. Wilhelm and D.J. Campbell. 2010. Natural gas plays in the Marcellus shale: challenges and potential opportunities. Environmental Science and Technology publication on line.

water problem eventually becomes resolved, the community will not recover economically for years.

4. COMMENT:

Regulations should “clearly define a drilling company’s responsibility for responding to gas migration issues”⁴ **and** the movement of substances introduced by the company (e.g. fracturing additives) and substances released from natural deposits as a result of gas extraction activities. **Regulations must specify methods and the use of independent testing companies for monitoring methane, introduced chemicals (e.g., fracturing additives) and potentially released substances (e.g., radionucleotides, heavy metals and salts) in drilling wastewater, surrounding soils and streams and citizen water supplies, homes and workplaces before, during and 2 years after drilling operations have ended.**

EXPLANATION:

a..Gas migration poses both acute and chronic hazards. The explosive nature of natural gas and its acute toxicity in humans and animals requires response times of hours (e.g. within 24 hrs.) when a leak is suspected. This response must include notification and action on the part of the company, the affected households and the local emergency aid providers. The chronic toxicity of low level methane exposure is also serious; thus, the DEP must specify scientifically valid methods and the use of independent testing companies to monitor the air outside and inside homes and workplaces before, during and after drilling operations.

b..Fracturing additives should be regulated as substances deposited into the ground that pose known and unknown health hazards.

Numerous citations estimate up to 8 million gallons of hydrofracturing water remains in the ground after each fracturing event. Fracturing requires 5-10 million gallons of liquid and 15 -80% of drilling fluids is not recovered.⁵ Thus fracturing additives are effectively being disposed into the ground. This should make these fluids regulated under numerous laws and regulations **beyond** 25 Pa. Code Chapter 78 (40 Pa. Bull. 623 (Jan. 30, 2010)). The list of partially-named compounds used at a drill site was released by the industry and posted by the PA DEP on 6-1-10. This list is no substitute, however, for complete disclosure of the concentrations and total amounts of fully named chemical compounds pumped into each well. Several of the listed compounds are toxic and/or carcinogenic and can impact organisms at very low concentrations, individually. Their toxicological effects in combinations are not known. Principles of toxicology and studies of similar substances (e.g., surfactants) combined with hydrocarbons (e.g., moderately toxic pesticides) often result in increased combined toxicity because substances have increased uptake and mobility in the body.⁶ The exact effects, however, are often not predictable, and can be subtle. For example, certain man-made substances act in extremely low concentrations to disrupt

⁴PA DEP Description of proposed regulation changes posted 7-21-10
<http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=12984&typeid=1>

⁵Kargbo, D.M., R.G. Wilhelm and D.J. Campbell. 2010. Natural gas plays in the Marcellus shale: challenges and potential opportunities. Environmental Science and Technology publication on line.

⁶ Altenburger R., W. Boedeker, M. Faust and L. H. Grimme. 1996. Regulations for combined effects of pollutants: Consequences from risk assessment in aquatic toxicology. Food and Chemical Toxicology Volume 34: 1155-1157.

development and reproduction because they mimic hormones such as estrogen.⁷ In sum, the additives in hydrofracturing pose unknown risks to the general public, drilling workers and wildlife.

c. Drilling and fracturing release radioactive materials, toxic metals, and salts previously locked in PA sediments.

(1). Over a century of mining in PA provides thousands of examples in which slight changes in deep sedimentary layers due to human disturbances release radioactive materials (e.g., radium, thorium and uranium), toxic heavy metals (e.g., aluminum, arsenic, cadmium, cobalt, copper, lead, manganese, mercury, nickel, and zinc), and salts (e.g., sodium chloride, magnesium chloride). Recent reports confirm these same three types of substances are released in Marcellus shale drilling areas.⁸ The DEP lists only some of these substances for recommended testing in drilling waste water and only loosely recommends citizens test their own water supplies for some substances. Instead, radioactivity, heavy metals and salts should be listed for required testing and reporting to the DEP, qualified water treatment destinations and citizens. The DEP should specify the testing procedures and the use of qualified independent companies to monitor a designated area before during and 2 years after drilling. The monitoring area should include chemical and radioactivity tests for surface and well water in impacted zones, drilling waste water, soils surrounding the waste water impoundments, and radon gas tests in of the air in homes and workplaces. In addition, regulations should require testing for radioactivity and radon gas in homes and workplaces before, during and 2 years after drilling.

- (a) **Radioactive Substances:** The excerpt from Kargbo et al (2010) illustrates that simple sampling of composited cuttings does not properly reflect the real hazards from Marcellus shale operations.

“Field and sample surveys on composited Marcellus rock cuttings and cores indicate background levels of radioactivity that are of low exposure concern for workers or the general public associated with Marcellus cuttings (13). However, in a recent article (17), New York’s Department of Environmental Conservation (NYDEC) reported that thirteen samples of wastewater from Marcellus Shale gas extraction contained levels of radium-226 (226Ra) as high as 267 times the safe disposal limit and thousands of times the limit safe for people to drink. The New York Department of Health (NYDOH) analyzed three Marcellus Shale production brine samples and found elevated gross alpha (α), gross beta (β), and 226Ra in the production brine (18). Devonian-age shales contain naturally occurring radioactive material (NORM), such as uranium (U) and thorium (Th) and their daughter products, 226Ra and 228Ra (19). The Marcellus Shale is considered to have elevated levels of NORMs (20). NORMs that have been concentrated or exposed to the accessible environment as a result of human activities, such as mineral extraction, are defined by the EPA as technologically enhanced NORM (TENORM) (19). TENORM may be concentrated because of (1) temperature and pressure changes during oil and gas production, (2) 226Ra and 228Ra in produced waters reacting with barium sulfate (BaSO₄) to form a scale in well tubulars and surface equipment, (3) 226Ra and 228Ra occurring in sludge that accumulates in pits and tanks, and (4) NORM occurring as radon (Rn) gas in the natural gas stream (21).”

⁷ Campbell C., S. E. Borglin, F. B. Green, A. Grayson, E. Wozel and W. T. Stringfellow 2006. Biologically directed environmental monitoring, fate, and transport of estrogenic endocrine disrupting compounds in water: A review . *Chemosphere* 65: 1265-1280

⁸ Kargbo, D.M., R.G. Wilhelm and D.J. Campbell. 2010. Natural gas plays in the Marcellus shale: challenges and potential opportunities. *Environmental Science and Technology* publication on line.

Humans can be exposed to radioactivity through proximity to substances that emit radiation (e.g., gamma rays), through inhalation and through ingestion of water or food containing radioactive substances; these radioactive substances then accumulate in the organism. For example, fish muscles can concentrate radioactive elements up to 950 times background levels (i.e. a fish in a stream with 1 mg/liter radium can contain 950 mg/liter radium in its muscles).⁹

- (b) Heavy metals are a common contaminant in water and soil in PA after any physical disturbance of deep sedimentary strata. Marcellus shale drilling has proven to be no exception. Heavy metals are known toxins to humans, wildlife and plants at extremely low concentrations. For example, the US EPA sets drinking water levels for arsenic at 0.01 mg/liter.¹⁰ Lead in water above 0.005 mg/liter results in blood lead above 10-15 micrograms/dL¹¹. Such lead concentrations in newborns and infants result in learning and behavior problems and reduced success years later in school.¹²
- (c) Salts are released from the many strata that were deposited when ancient seas that once covered PA. Relatively low amounts of these ancient sea salts can kill many freshwater organisms by disrupting their water balance. Also, a temporary increase in salt concentrations can stimulate the growth of unusual aquatic organisms that seriously disrupt the freshwater ecosystem. For example, the fish kill in 2009 in Dunkard Creek, on the PA - West Virginia border was linked to a harmful saltwater organism (golden algae, *Prymnesium parvum*) that appeared after salty water from coal mines was discharged into the stream by Consol Energy.¹³

5. COMMENT:

Drilling operations should be designed to maintain air quality in compliance with EPA ozone standards. This will require monitoring of ozone and ozone forming substances before and during drilling and hydrofracturing stages.

EXPLANATION:

Elevated ozone concentrations have been reported in gas drilling areas, in association with the gases vented from active wells and the numerous motors needed for drilling and hydrofracturing.¹⁴ These engines release substances that produce ground level ozone. "In early February, 2008, officials detected ozone levels of 122 parts per billion in Boulder CO. State officials say the general public should avoid strenuous or extended outdoor activity when levels surpass 105 parts per billion. DEQ officials say the increased ozone levels are due, at least in part, to oil and gas drilling on the Pinedale Anticline and the

⁹ Smith, K. 1992. An overview of naturally occurring radioactive materials (NORM) in the petroleum industry . Argonne National Laboratory and US Department of Energy.

¹⁰ Lubin, J.H., L. E. Beane Freeman , K. P. Cantor. 2007. Inorganic Arsenic in Drinking Water: An Evolving Public Health Concern. Journal of the National Cancer Institute Advance Access 99:906-7.

¹¹ Fertmann, R., S. Hentschel, D. Dengler, U. Janssen and A. Lommel. 2004. Lead exposure by drinking water: an epidemiological study in Hamburg, Germany. International Journal of Hygiene and Environmental Health 207: 235-244 and

¹² National Research Council. 1993. Measuring Lead Exposure in Infants, Children and Other Sensitive Populations. Washington, DC: National Academy of Sciences.

¹³ <http://www.dep.wv.gov/WWE/watershed/wqmonitoring/Pages/DunkardCreekFishKillInformation.aspx>

¹⁴ <http://deq.state.wy.us/aqd/Ozone%20Nonattainment%20Information.asp>

Jonah Field.¹⁵ EPA regulations place a maximum ozone concentration at 60-70 parts per billion (ppb) because ozone is extremely toxic to all living organisms; for example, ozone can trigger life threatening reactions in people with respiratory and heart conditions, impede breathing in healthy people and reduce plant growth.¹⁶

6. COMMENT:

Regulations should specify circumstances when venting of gas wells is allowed and when it is prohibited.

EXPLANATION:

Methane gas and other substances released during venting are harmful at many levels:

- a. Methane and certain substances introduced in hydrofracturing(e.g., benzene, toluene, xylene) are explosive and/or flammable.
- b. Other substances likely to be present in shale gases (e.g., hydrogen sulfide, carbon monoxide, carbon dioxide) and volatiles introduced in hydrofracturing (e.g., toluene, benzene, xylene) are toxic and can reach levels that harm workers, farm animals or residents.
- c. Methane is 25 times more potent than carbon dioxide as a greenhouse gas.

Regulations could be written to specify conditions that allow venting and/or burning of gases when the risk of explosion is greater than the risk of other hazards. Companies can install alternatives to venting that will work in all but temporary, emergency circumstances.

7. COMMENT:

Regulations should specify all aspects of waste water handing as follows:

- a. **protect from leakage using a liner and a secondary impermeable layer and prevent access with a secure cover over the pond**
- b. **fully document all hazardous substance concentrations for haulers**
- c. **fully document radioactivity and concentrations of all substances for treatment facilities.**

EXPLANATION

Waste water from drilling and hydrofracturing has been documented to contain radioactive substances, heavy metals, salts and numerous introduced compounds (e.g., acids, biocides, surfactants, volatiles)¹⁷

- a. Impoundments must be secure below and above ground using a specified lining material, a secondary impermeable layer, fencing and a cover. Protections from discharges into the soil are important because leaked substances can harm future crops and surface water supplies. A fence and cover are necessary protections for people and animals because these impoundments are attractive water hazards as follows:
 - (1) the ponds can quickly appear in areas where children were previously allowed to play
 - (2) the salty water attracts livestock and deer (that are used as food for people)
 - (3) resident waterfowl quickly colonize new ponds

¹⁵ http://www.jhnewsandguide.com/article.php?art_id=2850

¹⁶ <http://www.epa.gov/ozonedesignations/2008standards/index.htm>

¹⁷ Kargbo et al. 2010.

(4) PA is on a flyway for hundreds of thousands of migrating birds that stop for water and food.

- b. Waste water hauling vehicles and drivers must be qualified and informed regarding transport of substances with the known and possible hazards in this waste water, especially if a road accident occurs. Records of hazard concentrations and volumes must accompany every vehicle.
- c. The treatment facilities must be fully informed of the concentrations of all hazardous substances including radioactivity. The hazardous substances measured for each batch of waste water as well as the total volume to be treated must be recorded. Reports for such measurements and receipt by the treatment facility should be part of the public record of the drilling operation. Waste water treatment facilities usually release treated water into streams that are possibly used for recreation such as swimming and catching fish for consumption. Waste water treatment facilities are not designed to treat radioactive substances, elevated concentrations of heavy metal or many of the introduced hydrofracturing compounds. Testing regimes for exit water may not include all of the items in drilling waste water. Consequently, some of these harmful substances could be passed through the treatment facility and released into receiving streams.

8. COMMENT:

Regulations should require **companies with current permits and drilling operations in an early stage to upgrade to the new DEP standards** if they are not already at those standards.

EXPLANATION:

At least 4611 Marcellus wells have been permitted up until now and more will be permitted before the regulations are in place. We cannot allow lower quality operations to be initiated. Companies are regularly moving new materials onto sites and adjusting procedures; therefore, moving higher grade materials and adjusting procedures to fit the new regulations is simply the cost of doing business in an evolving technology. Anything less than adopting these upgrades puts the company, the DEP, and citizens at increased levels of risk for harm.

9. COMMENT:

Drilling **operations already completed must provide details regarding how their materials and processes diverged from the new standards**, if such details are not already recorded in the permits and previously submitted reports.

EXPLANATION:

The public and the DEP have the right to know the exact well materials and procedures beyond the general descriptions that might have been in the original permit and old records. For example,

- a. Which wells do not have a record of properly pressure-testing casings?
- b. Which wells do not have oilfield-grade cement?
- c. Which wells do not have proper blowout preventers?

10.COMMENT:

Regulations should be worded to **require companies to continually upgrade well materials to the best technology available in the industry, as determined by qualified scientific review.**

EXPLANATION:

If the DEP specifies certain features now in 2010, our wells in future years will be behind advances, and new regulations will have to be proposed and reviewed, with significant delays for months or years. In contrast, the gas industry can introduce improvements over periods of months; we need to keep up. Not

all changes in technology improve safety and environmental protection, however, and some changes may simply reduce cost and may increase risk. Thus any new industry standards must be continually assessed using independent scientific review made available to the public.

11.COMMENT:

Well documents (Permit Applications, Reports, Waivers, etc.) should be posted on the DEP webpage, in a database easily used by the public.

EXPLANATION:

Well documents are currently available to the public only under very limited circumstances. Citizens must travel to the correct DEP office during daytime hours and know the specifics of the permit they wish to examine. In addition, serving individual requests is a burden to DEP staff that is better used in well inspection and verifying the statements in well management reports, such as whether waste water was properly treated in a designated facility.

Posting of well documents is a straightforward procedure. All the permit forms are presently in a Word format, thus completed documents could be easily converted to pdf or other easily posted versions with multiple searchable identifiers such as township and county, company name, GPS readings, etc.