

Comments to
Delaware Riverkeeper Network on

**The Delaware River Basin Commission's
Draft Proposed Natural Gas Development
Regulations**

April 11, 2011

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The DRBC Draft Natural Gas Development Regulations (Draft Regulations) are a step forward in the regulation of natural gas wells in the Delaware Basin. They are helpful in a multijurisdictional system that contains four states, numerous counties and additional local entities that can regulate portions of gas well development, although there needs to be additional focus on harmonizing the regulations from separate states to bring them up to the same regulatory level. The potential for impacts from gas well development on the Delaware River watershed, its people, wildlife and general environment is substantial. The statements below highlight areas where the Draft Regulations need to be improved before they are finalized to ensure that the regulations adequately protect the Delaware River watershed. The opinions stated herein are stated with a reasonable degree of scientific and professional certainty:

1. **The relationship between the Commission’s regulatory responsibility and that of New York and Pennsylvania is not clear.** While DRBC has stated a desire to avoid regulatory overlap where possible, there are provisions in the regulations that have protections that may not be present in the laws and regulations of the member states and/or may have a different level of protection or requirements due to the special considerations associated with the Delaware River Basin. An example is the bonding authority and bonding instruments that are explicitly indicated in the Draft Regulations. Thus, the Commission should provide clarity that the Draft Regulations are in addition to any state regulations that may be in force. Residents in the Delaware River Basin as well as the interested public should be able to expect that the Draft Regulations can be enforced in New York and Pennsylvania, in addition to the other Basin states. This is a particular concern since the regulations in New York and Pennsylvania are still evolving.

Recommendation: The Commission should explicitly state that its Natural Gas Development regulations apply to all areas of the Delaware Basin, even when other jurisdictions have applicable regulatory or legislative requirements.

2. **Protecting surface and groundwater from degradation from severely contaminated produced water is a priority of these regulations (Sec. 7.5 (a) (1)), but the Draft Regulations do not specify an analyte list of substances to be measured in potentially affected domestic wells or in the produced water.** The contaminants in produced water consist of naturally occurring contaminants (e.g. radium, salts, hydrocarbons) and additives used in hydraulic fracturing well development. The additives consist of a wide range of substances that may vary with the specific well driller and/or the conditions at a site. While the regulations do require that these substances be disclosed, there is apparently no requirement for specific measurement or identification of these substances in surrounding wells, or in the produced water. This potential list of additives is indeed long and contains a complex variety of compounds used in hydraulic fracturing (see one list from the New York Supplemental Generic Environmental Impact Statement On The Oil, Gas and Solution Mining Regulatory Program, beginning on page 6-19). For example, acrylonitrile was recently identified in water contaminated from hydraulic fracturing wells, presumably from use as a component of acrylonitrile-butadiene-styrene in-situ polymerization to increase the utility of a propping agent.¹ No attempt was made to measure this

¹ Acrylonitrile **CAS ID #: 107-13-1, Affected Organ Systems:** Developmental (effects during periods when organs are developing) , Hematological (Blood Forming), Neurological (Nervous System), Reproductive (Producing Children; **Cancer Effects:** Reasonably Anticipated to be Human Carcinogens; **Chemical Classification:** None; **Summary:** Acrylonitrile is a colorless, liquid, man-made chemical with a sharp, onion- or garlic-like odor. It can be dissolved in water and evaporates quickly. Acrylonitrile is used

compound in surrounding water wells prior to establishment of the gas wells, and consequently it was unclear if this very unusual contaminant came from the hydraulically fractured well development or from some other source. Because this toxic compound is so unusual, it is highly unlikely it came from a source other than the hydraulic fracturing treatment. Many other additives, transformation products or even products produced during hydraulic fracturing may also be present, and should be on the list of potential contaminants to be measured.

Recommendation: The Commission should clarify the specific contaminants that will be measured (including before, during and after proposed gas development) in domestic water wells and produced water, and this list should be based on the contaminants in the formation water, as well as the additives used in the hydraulic fracturing process and potential compounds formed during the fracturing process.. The Commission should also give itself the ability to require additional analytes be measured as the need may arise.

- 3. While the Commission apparently defers standards for well construction, at least partially to New York and Pennsylvania, there are several critical components of well construction and water storage that are not regulated by some or all of the states of the Basin. These issues are apparently not considered and are not included in the Draft Regulations; as a result they are left unaddressed during well construction and water management projects in some or all of the states.** For example, storage of highly contaminated produced water is not discussed in the Draft Regulations. The quality of the liners in open basins, the leak detection mechanisms and the dismantling of the basins are not considered in these regulations. Liner leakage is a major problem whenever contaminated water is stored for any length of time, and even a small leakage of the highly contaminated produced water could present a major environmental problem. This example and many other technical components of well construction and associated activities are not adequately covered in the Draft Regulations.

Recommendation: The Commission should carefully consider how all aspects of well construction will be regulated, including in those jurisdictions where regulation is not delegated to the state, and ensure that the regulations are drafted and implemented in such a way as to ensure an appropriate level of regulation for each construction activity. Specifically, well construction standards, based on best practices, should be established for all areas under the authority of the Delaware River Commission.

- 4. According to the Draft Regulations, the very large volumes of highly contaminated water produced from the hydraulic fracturing operations will either be reused or sent to treatment facilities. There is apparently no requirement to determine the degree of contamination of those waters nor any indication of how the water will be “treated”.** Assuming the composition of these waters is similar to other produced waters in the Marcellus Shale deposit, the water is highly contaminated, particularly with salt and radioactivity. “Treatment” of these waters is not defined in the regulations, and while this water will not be released undiluted directly to surface or ground water in the Delaware Basin, it may be diluted into another waste water and released, or released somewhere else into a surface water that is subject to weaker standards. Removal of salts from this waste water is very difficult and expensive, and, if salts are removed, the process will probably require use of membrane systems to recover the majority of the water. However, this will leave large amounts of salty brines for disposal and will require further treatment for safe management/disposal. The acceptable treatment options should be specified, including how the residual concentrate will be managed.

to make other chemicals such as plastics, synthetic rubber, and acrylic fibers. A mixture of acrylonitrile and carbon tetrachloride was used as a pesticide in the past; however, all pesticide uses have stopped. <http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=78>

However, it is reasonable to assume that most of the “treatment” will consist of simple dilution into another wastewater to meet the requirements of Section 7.6 of the proposed regulations. The radioactive component is also particularly challenging, since any “treatment” of the waste water to remove the radioactive components (e.g. radium) will result in a more concentrated (but lower volume) waste with proportionally higher radioactivity. The radioactive elements do not “go away”, but are simply concentrated in some other form if removed from the produced water. Naturally Occurring Radioactive Materials (NORM) are either not regulated or poorly regulated, and proposals have emerged to allow discharge this saline and radioactive water directly into a saline environment. The data on the toxicity of radioactive materials to marine and estuarine ecosystems are scant, and the Commission should prohibit any discharge of produced water into any estuarine systems, due to this issue. While the U.S. Environmental Protection Agency has the authority to regulate NORM, it generally has not done so, and this regulatory gap may not prohibit discharge of saline materials containing radium and other radionuclides into marine environments.

Recommendation: The Commission should establish standards for treatment and disposal of hydraulic fracturing waste waters produced in the Delaware Basin, that prohibit discharge of poorly treated wastewater into any surface water or underground system that is not geologically isolated from usable water, even if this “treatment” will be conducted outside of the Delaware Basin. The Commission should also prohibit discharge of wastewater that may carry radioactive materials to the estuarine and marine waters of the Basin due to the toxicity of these materials to marine and estuarine ecosystems.

- 5. Reuse of produced water for a subsequent hydraulic fracturing operation requires increased regulatory oversight.** As discussed above, the produced water is highly contaminated, and any spills will be problematic, and threaten both surface and groundwater. Reuse of this contaminated produced water will also generally increase the contaminant load in the produced water in the subsequent well, both from additives and the other contaminants because there will be no dilution of the contaminants. If a leak occurs in the top few hundred feet in the well being fractured, the leak will contain very contaminated water under high pressure, and even a small leak can release large amounts of contaminants that can degrade usable domestic water. The Draft Regulations do not provide a mechanism for the well drillers or the Commission to know there is a leak, except by the observation of increased salt loads in domestic water in the years and decades ahead. Leak detection systems that could be used to detect a leak rapidly in usable aquifers should be identified and required.

Recommendation: The Commission should examine this question in some detail and require the Best Available Technology for leak detection during hydraulic fracturing when produced water is used for the fracturing process. The Commission should also require best available technology in well construction practices and well log data requirements to safeguard fresh water.

- 6. The use of 1000 ft and 2000 ft radii as limits of monitoring groundwater wells is insufficient to protect domestic sources of water.** When groundwater movement is slow, certain radius limits may be sufficient for detecting the movement of contaminated water. However, naturally occurring gaseous hydrocarbons can move very rapidly under pressure from a fractured shale system. The radius of the well measurements should be extended at least to the distance of the underground fractured systems. For methane and other constituents in the natural gas that may vent, the monitoring of groundwater wells (both to secure baseline data and to assess potential contamination after drilling begins) will provide the earliest detection of released contaminants and should be required as an essential first step. The number of domestic wells sampled for natural gas emission should be sufficient to establish that any methane (or other hydrocarbons present in natural gas) determined subsequent to establishment of the well will presumptively indicate contamination of the domestic water source by the well driller – and in fact if contamination is found there should be a presumption that it is caused by the well drilling, a presumption that can only be rebutted with demonstrable data provided by the drillers. This monitoring, determination and presumption will protect both the domestic well owner, as well as

the well driller, since it will establish the quality of water that exists prior to establishment of the well and offer clarity of responsibility that will ensure quick and efficient response.

Recommendation: The Commission should require well sampling of wells at least to the radius of the underground fracturing, plus a reasonable distance beyond that radius, to establish a baseline of methane and other constituents in natural gas, prior to hydraulic fracturing, and mandate continuing sampling thereafter. If contamination is found in a well where pre-drill data indicates no such contamination, there should be a presumption of responsibility on the driller that can only be rebutted with demonstrable data that can prove the contrary.

7. **The standards for reclamation for the well-heads and associated disturbances are not clear, and should be clarified in the final regulations.** Some of the potentially greatest impacts on surface and groundwater quality stem from the roads and developed areas that are constructed that allow access to a site, as well as the specific site's development. Although these sites will be bonded, it is unclear if access roads will be included in the determination of costs for restoration. Specific reclamation requirements should be established, including storage and protection of topsoil, recontouring of slopes, and removal and complete reclamation of access roads to these drill pads. The reclamation requirements should also include a thorough analysis of the soils surrounding the sites to determine if there have been spills of produced water or other substances used during the production of gas. Timelines for reclamation should also be established following closure of the gas wells. Definitions of closure of a well should also be established, including the lack of production from a well for a specified amount of time. If a well is put into suspension, how long will that suspension be allowed prior to initiation of restoration of the site? How will the bond be modified over time to cover costs that may be unanticipated? Is \$125,000 sufficient to close a site and associated roads? When the costs of restoring a site are clearly higher than the present bond, does the Commission have the ability to increase the bond amount? Should additional insurance, above the bond, be required to cover the additional costs that are unknown at present? These questions need to be studied, answered and addressed in the Regulations prior to their being made final.

Recommendation: The Commission should clarify the standards for closure and restoration of these well sites, and the time frame for reclamation/restoration of the roads, drill pads and other disturbances created in connection with the wells and related facilities.

8. **Water quality impacts may not be observed for many years, and perhaps well after the production companies have left the area. Funding for routine monitoring, conducted at least once a year, should be required of the gas companies for a minimum 30 years (and perhaps longer, depending on hydrologic conditions) into the future to provide domestic well owners and downstream users/residents of potentially affected waterways have assurance that their water is not being degraded by slow-moving contaminant sources.** Salts and natural gas constituents are likely to travel the most rapidly and the water analyses may not be extensive, but if salts or natural gas constituents are observed in a domestic well or surface water body, then further investigation should be required to determine the source of the contamination, well into the future.

Recommendation: The Commission should establish a fund for water quality analysis of a limited number of analytes to allow a determination if domestic water or surface streams in the defined area has been impacted by hydraulic fracturing. This fund should receive contributions from the companies that drill the wells sufficient to have a source of continuing funds for at least 30 years.

9. **In recent years, odors have become a serious problem around gas wells, from gas emissions, stored water, and burning of the gas for power generation at the site.** Release of gases from a site can be a serious source of contamination to surface waters and residents in

the surrounding areas². Odors are not always easy to control, identify or regulate, but the burden of proof needs to be placed on the well driller and operator if surrounding residents detect odors. These can contain highly odorous (and toxic) sulfides, and a variety of organics, including benzene, and need to be regulated.

Recommendation: The Commission should add a regulation on odor and gas emission control, including a requirement that odors be identified, a protocol adopted for evaluating and documenting human health effects of an odor as odors occur, and the source controlled.

² Sumi, Lisa, (2007) "Report on Air Sampling conducted in Monroe, Conecuh and Escambia Counties, Alabama, [August 1-5, 2005].