



March 30, 2018

Commissioners  
Delaware River Basin Commission  
PO Box 7360  
West Trenton NJ 08628-9522

**Re: Proposed Special Regulations Part 440 and related documents**

Dear Commissioners:

Please accept these comments on behalf of Catskill Mountainkeeper regarding the Delaware River Basin Commission's "Proposed Special Regulations Part 440 – Hydraulic Fracturing in Shale and Other Formations," also announced as "Proposed Amendments to the Administrative Manual and Special Regulations Regarding Hydraulic Fracturing Activities; [and] Additional Clarifying Amendments; 18 CFR Parts 401 and 440."

Catskill Mountainkeeper is a registered 501(c)(3) non-profit organization that advocates for the Catskills region. CMK works with and represents a network of concerned citizens in areas within and surrounding the Delaware River Basin. Through the DRBC's online portal for submission of comments on the proposed regulations, Catskill Mountainkeeper has submitted 2,182 comments collected on behalf of these citizens. We offer here additional comments on specific aspects of the proposed regulations, focused primarily on the hazards of introducing fracking wastes, as well as wastes from conventional oil and gas wells, into the waters of the Basin, including drinking supply waters.

Catskill Mountainkeeper acknowledges and deeply respects the foundational obligations of the Delaware River Basin Commission: to protect water quality in the Delaware River Basin and thereby protect human health and wellbeing. We therefore applaud the careful attention to water quality threats from hydraulic fracturing (fracking) evidenced in the proposed amendments to existing DRBC regulations. We thoroughly endorse the Commission's decision to ban hydraulic fracturing in the Basin, as incompatible with the Commission's mission, due to numerous, irremediable, potential mechanisms for water contamination, including but not limited to well bore casing failure, cement bond failure, casing and pipeline corrosion, spills (during drilling, storage, and transportation), intentional and unintentional releases, pressure bulb events, and seepage over time. These mechanisms lead to widely known and, in 2018, very well documented adverse impacts on water quality,<sup>1</sup> which the proposed amendments reference and address in the

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<sup>1</sup> Concerned Health Professionals of New York & Physicians for Social Responsibility. (2018, March). Compendium of scientific, medical, and media findings demonstrating risks and harms of fracking (unconventional gas and oil extraction), 5th ed. (accessed online 3/30/2018 at <http://concernedhealthny.org/compendium>): see Water contamination, pp. 48ff.

proposed ban on fracking. Research reports also increasingly document the related adverse impacts on ecological systems and human health that follow from contamination of water, air, and soils near fracking activities and fracking infrastructure, such as compressor stations, pipelines, pigging stations, and natural gas-fired power plants.<sup>2</sup>

In addition, we urge the Commission to take note of the uncontrolled character of fracking's underground explosions and resulting induced seismicity, that is, earthquakes caused by both fracking itself and by underground injection of wastewater. The primary action of fracking, that is, setting off high-pressure explosions underground and injecting slippery fluids, is described by engineers working for the oil and gas industry – and by text in the proposed amendments – as taking place in shale formations that are “separated from potential freshwater aquifers by thousands of feet of sandstones and shales of moderate to low permeability.”<sup>3</sup> However, precise seismologic recordings at the most carefully studied fracking wells in the world, in Greene County, Pennsylvania, contradict such assertions by recording multiple, long induced fractures that extend above the hypothesized “frac barrier.”<sup>4</sup> Research conducted earlier this year in New York on hydrocarbon and brine migration<sup>5</sup> confirms earlier modeling studies<sup>6</sup> that faulting creates pathways for migration from deep shale layers to shallower aquifers. Not surprisingly, fracking activity itself can cause earthquakes, as has been seen across the United States and in Canada, and as close to the Delaware River Basin as Lawrence County, Pennsylvania.<sup>7</sup>

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<sup>2</sup> Ibid.: see Public health effects, measured directly, pp. 114ff.

<sup>3</sup> Delaware River Basin Commission. 18 CFR Parts 401 and 440: Proposed Amendments to the Administrative Manual and Special Regulations Regarding Natural Gas Development Activities; Additional Clarifying Amendments

<sup>4</sup> Hammack, R., Harbert, W., Sharma, S., Stewart, B. W., Capo, R. C., Wall, A. J., . . . Veloski, G. (2014). An evaluation of fracture growth and gas/fluid migration as horizontal Marcellus Shale gas wells are hydraulically fractured in Greene County, Pennsylvania. *NETL-TRS-3-2014: EPAct Technical Report Series. US Dept of Energy, National Energy Technology Laboratory*: Pittsburgh PA. Retrieved from [http://www.netl.doe.gov/File%20Library/Research/onsite%20research/publications/NETL-TRS-3-2014\\_Greene-County-Site\\_20140915\\_1\\_1.pdf](http://www.netl.doe.gov/File%20Library/Research/onsite%20research/publications/NETL-TRS-3-2014_Greene-County-Site_20140915_1_1.pdf)

<sup>5</sup> Kreuzer, RL et al. (2018). Structural and Hydrogeological Controls on Hydrocarbon and Brine Migration into Drinking Water Aquifers in Southern New York. *Groundwater*. 56. 10.1111/gwat.12638.

<sup>6</sup> Myers, T. (2012). Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers. *Groundwater*, 50: 872-882. doi: [10.1111/j.1745-6584.2012.00933.x](https://doi.org/10.1111/j.1745-6584.2012.00933.x) (accessed online 3/30/2018 at <https://www.scribd.com/document/244283158/Wiley-Contaminant-pathways-fr-hydraulically-fract-shale-1-pdf>)

<sup>7</sup> In Pennsylvania, the Department of Environment Protection (DEP) announced early in 2017 that a series of small earthquakes in Lawrence County had been induced by fracturing of wells in the Utica Shale (<http://powersource.post-gazette.com/powersource/policy-powersource/2017/02/16/DEP-Pennsylvania-Lawrence-County-earthquakes-appear-linked-to-fracking-Hilcorp-Energy/stories/201702160176>). DEP officials held a webinar to discuss the situation and formulate “procedures to reduce seismic risk going forward,” but no formal report or regulatory changes have yet been made public (<http://www.ahs.dep.pa.gov/NewsRoomPublic/articleviewer.aspx?id=21145&typeid=1>).

The deliberations of the Commissioners and the draft regulations should reflect these facts. Moreover, since injecting fracking waste underground poses more risk than fracking in terms of generating earthquakes and carries greater risk of contamination of water with a wider variety of toxic compounds, the proposed amendments should directly address induced seismicity and explicitly ban any underground injection of fracking wastewater in the Delaware River Basin.

Non-gaseous oil and gas waste products fall roughly into two categories: liquid waste and solid waste (we will not address gaseous wastes, which include methane, radon, and volatile aromatic compounds but do not generally pose a direct threat to water quality). Both liquid and solid forms of fracking waste, as well as waste from conventional oil and gas development, can contain toxic chemicals, hydrocarbons, brines, heavy metals, and radioactive contaminants. The toxic chemicals originate primarily in the “fracking fluid” injected underground to fracture and keep open natural gas bearing shale deposits, while the hydrocarbons, brines, heavy metals, and radioactive contaminants originate from targeted deep shale layers, or in the case of conventional wells, from sandstone layers. In simple terms, the fracking fluids dissolve the heavy metals and radioactive elements, mobilizing them and potentially contaminating any waste that emerges from the well, whether liquid, solid, or semi-solid material. As described by the United States Environmental Protection Agency (EPA), “Radioactive wastes from oil and gas drilling take the form of produced water, drilling mud, sludge, slimes, or evaporation ponds and pits. It can also concentrate in the mineral scales that form in pipes (pipe scale), storage tanks, or other extraction equipment.”<sup>8</sup>

The toxic nature of these waste materials has been well described, despite laws protecting the proprietary nature of the fracking fluids. Produced waters commonly exhibit highly elevated concentrations of bromide, chloride, hardness as calcium carbonate, total dissolved solids, barium, boron, calcium, iron, lithium, magnesium, manganese, potassium, sodium, and strontium. Furthermore, these fluids sometimes also include many additional chemicals including, but not limited to the following: pyridine, ethylbenzene; benzene; toluene; xylenes; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene, arsenic; assorted phthalates; assorted metals; fluorene; phenol; 2-propanol; butyl alcohol; propylene glycol; ethanol; phenanthrene and other chemical compounds.” Other drilling mud and fluid contaminants of note include aluminum, titanium, 2-butanone, and 1,2,4-trimethylbenzene.<sup>9</sup>

Many of these waste products should be quite familiar to us, having been identified as contaminants in soil, sediment, and water at a hazardous waste site that later came to be known as the Love Canal Superfund site in Niagara Falls, New York. The Love Canal property, having been used in the 1930s and 1940s as a landfill for the disposal of over 21,000 tons of various chemical wastes, contaminated nearby groundwater, which then rose to the surface and drained into the Niagara River, contaminating it, as well. Contaminants also migrated from the landfill to

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<sup>8</sup>[http://www.mde.maryland.gov/programs/Land/mining/marcellus/Documents/EPA\\_Radioactive\\_Wastes\\_from\\_Oil\\_Gas\\_Drilling\(2012\).pdf](http://www.mde.maryland.gov/programs/Land/mining/marcellus/Documents/EPA_Radioactive_Wastes_from_Oil_Gas_Drilling(2012).pdf) (accessed online 3/30/2018).

<sup>9</sup> See, for example, Hayes, 2009: Sampling and Analysis of Water Streams Associated with the Development of Marcellus Shale Gas, accessed online 3/30/2018 at <https://www.scribd.com/document/111953961/Sampling-and-Analysis-of-Water-Streams>

local sewers, which drained into nearby creeks. Eventually, approximately 950 families had to be evacuated from the area surrounding the landfill. Contamination at the site ultimately led to the passage of Federal Superfund legislation.

Radiation was not a major concern at the Love Canal Superfund site, but it is of major concern in regard to fracking waste from the Marcellus Shale. In 2014, a group of leading public health experts wrote to Governor Cuomo, urging his administration to “conduct studies and a human health risk assessment of the occurrence of radon and radium during drilling for natural gas before deciding whether to allow drilling in New York’s portion of the Marcellus shale or the distribution to New Yorkers of Marcellus shale gas containing unhealthy levels of radon” and “to make public any and all data collected about the presence of these two carcinogenic elements in Marcellus shale drilling.”<sup>10</sup>

Multiple studies have found that waste from fracking can be radioactive — and in some cases, highly radioactive. A report from the United States Geological Survey (USGS) documented that wastewater from unconventionally drilled wells in Pennsylvania and conventionally drilled wells in New York contained thousands of times more radioactivity than the federal limit for drinking water and hundreds of times more radioactivity than allowed by the Nuclear Regulatory Commission for nuclear plant discharges.<sup>11</sup> In 2011, the USGS reported that waste water from oil and gas wells in New York and Pennsylvania, including those in the Marcellus shale, show distinctly higher levels of radium than those reported for other formations.<sup>12</sup>

A study from Penn State’s Department of Geosciences also found that fracking wastewater contains high levels of radium, along with the toxic heavy metal barium.<sup>13</sup> Horizontally drilled wells are more likely to produce high levels of radioactive waste than other types of wells, because the horizontal pipe is exposed throughout its roughly mile-long length to whatever levels of radiation are present in the deep shale layers. As summarized by the EPA, “Radionuclides in these wastes [from oil and gas drilling] are primarily radium-226, radium-228, and radon gas. The radon is released to the atmosphere, while the produced water and mud containing radium are placed in ponds or pits for evaporation, re-use, or recovery.”<sup>14</sup> The EPA goes on to say that the people most likely to be exposed to this source of radiation are “workers at the site.” That may be true, yet the EPA’s guidance to workers should give us pause, especially as it applies *a fortiori* to the general public. Under a heading “What you can do to protect yourself,” the EPA advises as follows: “Do not re-use or bring home discarded equipment or material such as pipes, devices, bricks, rocks, or **water**” (emphasis added); “Limit exposures and disturbance of the

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<sup>10</sup> <http://concernedhealthny.org/wp-content/uploads/2014/05/CuomoLetter-RadiationHazards20140508.pdf> (accessed online 3/30/2018)

<sup>11</sup> Rowan, EL et al. Radium Content of Oil- and Gas-Field Produced Waters in the Northern Appalachian Basin (USA): Summary and Discussion of Data. USGS Scientific Investigations Report 2011–5135 (accessed online 3/30/2018 at <https://pubs.usgs.gov/sir/2011/5135/pdf/sir2011-5135.pdf>)

<sup>12</sup> E.L. Rowan and T.F. Kraemer, U.S. Geological Survey, Radon-222 Content of Natural Gas Samples from Upper and Middle Devonian Sandstone and Shale Reservoirs in Pennsylvania: Preliminary Data, 2012. (Accessed online 3/30/2018 at <http://pubs.usgs.gov/of/2012/1159>)

<sup>13</sup> Haluszczak, LO, et al. Geochemical evaluation of flowback brine from Marcellus gas wells in Pennsylvania, USA. *Appl. Geochem.* (2012). (accessed online 3/30/2018 at <http://dx.doi.org/10.1016/j.apgeochem.2012.10.002>)

<sup>14</sup> <http://www.epa.gov/radtown/drilling-waste.html> (accessed online 3/30/2018)

production site and any abandoned equipment”; and “Do not handle, dispose or re-use abandoned equipment used at drilling sites.”

The public is exposed to wastes from oil and gas development through several mechanisms: 1) fluids delivered to treatment plants unable to remove the contaminants; 2) waste materials inadequately contained at landfills; 3) legally authorized applications to roads and fields; 4) intentional, illegal dumping in fields and streams; 5) toxic spills during transport; 6) leaching from toxic wastes buried underground; and 7) direct contamination of drinking water sources from fracking activities. Almost all of these routes of contamination pose a threat to areas that can be far removed from the site of fracking or conventional oil and gas activities.

Given the toxic composition of fracking waste, which can include brines (with elevated levels of chloride, total dissolved solids, sodium, calcium and magnesium), unknown fracking agents, heavy metals, and radioactive materials, the regulations should, rather than invite case-by-case analysis on individual docket (see *Sections 440.5(f) through (h)*), unequivocally ban the importation of fracking and other oil and gas waste into the Basin, until and unless safe mechanisms of transporting fracking waste are devised and treatment mechanisms and plants become available that provide adequate and effective removal of all regularly encountered toxins in fracking waste, prior to such waste entering the Basin. Moreover, since brines from conventional wells also present major contaminant issues, we urge the Commission to take this opportunity to ban the importation of produced waters and solid waste from both conventional and unconventional wells.

Fracking wastes are materials clearly recognizable in other circumstances as “hazardous wastes”; indeed, many of them are found on the EPA’s list of “Priority Chemicals” to be eliminated from or substantially reduced through limiting production, or at a minimum, recovered or recycled. Unfortunately, under federal law, fracking wastes are not treated as hazardous wastes due to exemptions that use the power of pencil and paper – and the human imagination – to wipe out almost all legal obligation to protect the public from what would otherwise be preventable, highly toxic, and potentially lethal exposures. The DRBC should not utilize the Delaware River Basin as a means to relieve the oil and gas industry of its obligations to handle its wastes without harming the public. The DRBC’s revised regulations should prohibit the transport of oil and gas waste or waste by-products into the Basin for treatment, discharge, disposal, or storage purposes; prohibit the acceptance of wastewater from oil or natural gas extraction activities at wastewater facilities and landfills in the Basin; and as far as possible under existing federal laws and regulations, treat waste as hazardous waste on the basis of its hazardous characteristics, without regard to its origin.

To provide any mechanism at this point for introducing and discharging oil and gas waste fluids, including produced water, directly into streams, estuaries, and other receiving waters in the Basin, as is proposed in the draft regulations (*Section 440.5 – Produced Water and DRBC Guidelines for Determining Background Concentrations in Surface Waters under Special Regulations, Part 440 – Hydraulic Fracturing in Shale and Other Formations*) implies a more advanced state of treatment technology than is currently available, especially in regard to

dissolved organic compounds and radioactive materials. To attempt to create a mechanism for approving such discharges as “safe” is therefore premature, unnecessary, and likely to lead to unintentional but potentially extremely harmful contamination of Basin waters.

The regulations should therefore expressly forbid transportation of oil and gas waste fluids to any site in the Basin and also forbid storage of such materials, since regularly employed “storage” mechanisms do not provide adequate containment. Materials leaching from landfills or spilled during transport will invariably flow under the pull of gravity down to surface or ground waters. Some of these materials, including the radioactive elements, can, in very small concentrations, cause serious, sometimes life-threatening illness, including tissue and organ damage, neurological disorders, leukemia and solid tumors, miscarriages, stillbirth, and congenital malformations.<sup>15</sup> Worse, in areas that have high background loads of radiation or heavy metals or that have suffered previous toxic contamination, the effects of additional contamination may be cumulative or, worse, synergistic.

Moreover, since spreading fracking waste on roads or on fields is hydrologically equivalent to pouring toxins into surface and ground water, such spreading should also be expressly prohibited in the revised regulations, as is addressed in the attached report, case study, original research, and supporting materials provided by Paul Rubin, hydrogeologist and President of HydroQuest (HydroQuestBrineSpreadingReportwithAddendas-20180329).pdf). These materials focus on the practice of disposing of fracking waste or other oil and gas waste via spreading on roads, fields, and recreation areas, which is allowed or appears to be allowed in at least two Basin states (PA and NY) through permits called “Beneficial Use Determinations” (“BUDs”). While Warren County, the site of the HydroQuest case study, is located in northwestern PA, outside of the Delaware River Basin, its use as a case study area is justified because it is representative of geologic and hydrologic conditions present throughout PA and the northeastern United States where contaminant transport outward from brine disposal sites will adversely impact surface and groundwater resources.

Based on the priority of protecting drinking water resources, Catskill Mountainkeeper also opposes those portions of the proposed regulations that would allow the withdrawal of water from the Delaware River Basin for fracking or any industrial purpose.

Finally, we address the critical issue of the Commission’s staffing and resources. To insure that the environment of the Basin and the health of its residents are protected, and to minimize costs of management and enforcement, clear prohibitions should be enacted on not only fracking activities but also the introduction or handling of fracking waste. The Commission can – and must – refrain from finalizing any proposed regulatory program and from processing and issuing permits unless and until questions about resources to enforce adopted regulations have been fully

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<sup>15</sup> Concerned Health Professionals of New York & Physicians for Social Responsibility. (2018, March). Compendium of scientific, medical, and media findings demonstrating risks and harms of fracking (unconventional gas and oil extraction), 5th ed. (accessed online 3/30/2018 at <http://concernedhealthny.org/compendium>): see Public health effects, measured directly, pp. 148ff

considered and addressed. The same commitment should be made with respect to financial assurances, bonding requirements, and any other measures that the DRBC may identify as necessary for the responsible implementation of these proposed regulations.

In summary, Catskill Mountainkeeper supports the Delaware River Basin's proposed ban on fracking activities in the Delaware River Basin, and we urge the Commission also to ban the importation, storage, or disposal of fracking waste, as well as waste from conventional oil and gas activities, in the Delaware River Basin, and to ban the use of Basin waters for fracking or any industrial purpose. Taking these actions now will continue a bright future for the waters of the Basin and the health and economy of its citizens.

Thank you for your careful attention to these comments.

Sincerely,

A handwritten signature in cursive script that reads "Kathleen Nolan, MD, MSL".

Kathleen Nolan, MD, MSL  
Senior Research Director