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STATEMENT TO DELAWARE RIVER BASIN COMMISSION

The following remarks supplement spoken comments I made Tuesday evening, January 23, 2018 in Waymart, Pennsylvania. I intend for these statements, while nontechnical, to argue in large part from a defensible scientific perspective.

I strongly insist that all activities connected to hydrofractured gas have no place within the Delaware watershed, and urge the Commission to uphold full exclusion of such activities on a permanent basis. The reason for my position is that local, regional, and global pollution impacts are, on all honestly acquired and presented evidence, unacceptably high.

1. Some physical and geographic aspects of fracking

Industry claims that hydrofracturing is a "safe" process proven over many decades are misleading. Comparability with "traditional" fracking is extremely tenuous, as the original practice was to insert a somewhat modest volume of fluid (water, sand and chemicals) at rather low pressure into a relatively small conventional well so as to eke out some additional production toward the end of the well's economically useful life. On all these metrics – scale of drilling, volume of water consumed, and pressures employed – unconventional fossil fuel development has such a massive footprint that I would call attempts to identify it with the precursor protocol deliberately deceptive.

Let me compare and contrast two high-yield, high-profile instances of unconventional fossil fuel extraction now ongoing in the United States. In Pennsylvania, the ambition to extract Marcellus shale gas materialized in the 1990s at the earliest. The real ramp-up was in the second half of the first decade of the 2000s, with massive actualization on and below the ground reached around 2010. The other case I'll bring up is Baaken oil, principally in North Dakota. In North Dakota, the mineral resource sought is roughly three miles underground. The area is much less populated than Pennsylvania, even rural Pennsylvania – presumably an advantage as inevitable pollution affects fewer people and the touted employment boost shows up more vividly. It is also much drier, decidedly disadvantageous as billions going on trillions of gallons of water must be brought in from outside and upon subjection to the prescribed process irremediably polluted. Natural gas, the precious clean and green bridge fuel we are told about, isn't so precious in the Baaken. There, the gas is just a byproduct of the heavy oil being pumped. Most of it is flared – profligately burned on a huge scale. So huge, nighttime satellite photography shows Baaken at its peak glowing bright as Minneapolis, almost rivaling Chicago. Pennsylvania fracked gas is also, deliberately as well as accidentally, flared though not on such a scale. A few wells have blown up. Pennsylvania's Marcellus extraction region has little in common with Baaken hydrologically or topographically. But the most germane contrast pertinent to fracking as such is that Marcellus shale gas comes from about a mile down, one-third as deep as Baaken oil, while hydrofracturing pressures applied in the Marcellus zone are fully five times greater.

A mile deep may sound too far for concern to the unthoughtful, incurious, and inobservant. Fracking promoters tell us don't worry, just trust the (industry-hired) experts; after all, energy needs are intense! Within and outside the gas extraction area, popular opinion on the acceptability of fracking, whether on environmental grounds or as a boost for jobs and the economy, is divided. In a grossly more uneven split, an enormous majority of energy customers do not see the increasingly vast unconventional fossil fuel projects that supply them, and this asymmetry probably factors into "out of sight, out of

mind" blandishments sufficing, for a surprisingly long period already, to perpetuate the spread of an evidently questionable development. With disinterested, competent science and adequate public information playing scant roles in its inception, high-pressure hydrofracturing on an industrial scale has arrived, with corollary factors including

- acres-big pad sizes
- long-distance horizontal drilling
- literally thousands of heavy truck trips per well
- endless need for new fossil fuel infrastructure, including "gathering" lines, transmission pipelines, compressor stations

2. Methane

Methane is a potent greenhouse gas with much stronger short-term impact than carbon dioxide, but shorter residence time in the atmosphere. I suspect that ever since people began to exploit gas for energy, ongoing, generally large methane releases into the airshed have inseparably accompanied the process. Efforts to verify this for the historical past would be a mostly academic exercise. What is certain, on the contemporary scene, is that every time investigators have looked for fugitive or purposefully released methane, they have found multiplicatively more than previous estimates gave them cause to infer.

The methane factor undercuts assertions that natural gas is a clean fuel. Measuring only CO^2 released at point of combustion to rank comparative atmospheric forcing effects among the various fossil fuel categories has been standard practice. On this basis, gas has been promoted and sold as an efficient, environmentally desirable alternative to oil or coal. But relying on this calculation downplays or rounds down the adverse contribution of methane releases.

The claim is on the table that natural gas from fracking has similar climate impact to coal. With many variables in play, I will let this assertion stand as debatable. At best, however, the gas infrastructure now expanding in large-scale hydrofracturing regions is forcing adoption of a dubious energy modality with only a thin margin of environmental preferability over coal.

3. Water impacts

The Commission has regulatory authority over water withdrawals and wastewater disposal or injection in the Delaware watershed. Any proposal for industrial use should elicit concern – I would say skepticism. The Marcellus gas industry, as it seeks authorized access to withdraw and/or dump water, should undergo rigorous public and regulatory scrutiny. By a narrow interpretation of the Commission's purview, regulators must consider objective scientific data to gauge the impact of high-volume withdrawals and volatile water level fluctuations on aquatic life, other ecological indicators, and overall water quality. They also have authority over ground injections and discharges into surface water.

Hydrofracturing, with its fore- and after-effects, is providing a live demonstration across large swaths of Pennsylvania. The incidents and trends one can anticipate from widespread, often intensive Marcellus exploitation are not hypothetical; much evidence is available. As the term hydrofracturing indicates, unconventional gas utterly depends on massive volumes of water. Withdrawal is just the first step; the process involves transport, blending the fluid, injection, flowback, collection and disposal.

Adverse impacts occur at all these stages. Contaminated produced water is untreatable at typical sewer facilities. Open storage lagoons are ghastly toxic ponds. Disposal in injection wells has induced unexpected earthquakes in several locations.

An agency with professed regard for assuring the highest and best use of water would make a mockery of its mission if it allows any of the above-referenced activity. Actually, I am somewhat confident that a rising share of the citizenry will recognize the Marcellus gas rush for the mistake it has been. Shale gas, contrary to much of the hype about it, is in fact a fickle resource. Compared to conventional gas, production volumes drop quickly. Drilling more wells accelerates depletion. The anticipated industry response to flagging output is re-fracking. The Rube Goldberg configuration of interlacing pipelines emerging as a prominent element of industry planning is not a paragon of design. The coveted gas is extraordinarily volatile and corrosive. All these downside factors perversely buoy my hope that winding down the shale gas misadventure in reasonably orderly fashion may be closer on the horizon than prevailing assumptions would have it. Personally, I consider that the most responsible path still open. Meanwhile, the DRBC should adopt regulations for the watershed it oversees that disallow all ancillary Marcellus activity while also reaffirming a full ban on fracking itself.

4. Toxics

The chemicals used to lubricate fracking water are not even all known and through a legal loophole allowed to remain undisclosed “trade secrets.” Trucks wending their way along inadequate roads as the basic service providers of this industry mostly carry frackwater and post-frack “produced” water. But, as a function of scale, a noticeable number of them haul drums of extraordinarily strong toxic chemicals that operators mix into the frackwater solution at up to a 2% rate. Workers have died and more most likely will just by inadvertently inhaling a whiff from an opened or cracked drum. The drums spill, too, inflicting acute environmental damage.

5. More on the emerging sector of unconventional fossil fuels

In regard to most if not all siting of new and increasingly unconventional fossil fuel development, the full cost in climate impact and other environmental damage is not being adequately assessed. Consider the technological succession from deep mining to strip mining to mountaintop removal for coal. Or, for oil, starting in the old wildcatter days, review the many low-pressure wells and dry holes interspersed with occasional gushers and blowouts that tallied into the generations-long stretch of conventional petroleum. Now we have Deepwater Horizon, Baaken, Canadian tar sands. High-pressure hydrofracturing for gas, the matter before DRBC, is an intrinsically filthy activity with numerous accompanying endeavors that cause environmental damage and risk. The pipeline infrastructure envisioned will encounter recurrent litigation and other attempted blocking actions.

The contention that Pennsylvania and other hydrofracking states are producing a valuable “bridge fuel” that will fill energy needs during, shall we say, a leisurely transition to renewables is unsupportable. The path of massive unconventional fossil fuel promotion, in ecological terms, leads not across a bridge but over a cliff. The barriers to wider deployment of renewable energy are almost entirely not technical but rather political, a stranglehold of vested interests.

Anthropogenic atmospheric forcing is a complex global problem. This reality does not obviate the need for an expeditious exit from reliance on fossil fuels. Responsible leadership should have

foreseen this trajectory a generation or two ago. With appropriate action at that time, the transition could have been somewhat leisurely. It's too late for a soft approach now. Installing less damaging energy generation requires ceasing unconventional fossil fuel "development." Avowing the need to leave fossil fuels in the ground, in order to protect the conditions that fostered human and other life on this planet for many millennia, is spreading from the fringes of science to more mainstream experts. Unconventional fossil fuels, in particular, require an especially costly and polluting rigmarole to obtain an intrinsically dirtier, generally more volatile product than analogues from a simpler time.

6. Global situation: airshed and oceanic capacity to serve as pollution sink now exhausted

When something is inevitable, it is going to happen. Established inevitability precedes experienced effects, as some duration of lag time inheres to the process. The lag may be as brief as the interval from a trigger pull to the bullet hitting or missing its target. In the case of atmospheric forcing, the anthropogenically driven phenomenon too benignly termed "climate change," much ecological disruption is locked in but not yet experienced, although the effects already being felt are increasingly frequent and profound. The outcome and timing may be indefinite, but human adaptability is not infinite. Please bear in mind that the atmospheric forcing widely projected to occur over a century or less never took place before in less than a 10,000-year span, with millions of years for such changes closer to the norm. From this perspective, one should not find it surprising that measurements of greenhouse gas effects and other anthropogenic impacts on the ecosystem invariably overshoot projections.

I understand DRBC's limited yet tremendously important brief. I should not diverge at length into philosophical meanderings, but I cannot resist a quick closing comment. Emphasis on renewable energy and conservation, along with simple recognition that adhering to a doctrine of endless growth eventually leads to an absurd dead end, would undergird human lifeways more compatible with earthly reality. I think a move in this direction would more successfully bolster the pursuit of happiness, too.