PSE Healthy Energy
Physicians Scientists & Engineers

Mt. Pleasant Township
Board of Supervisors
Municipal Office
31 McCarrell Road
Hickory, PA 15340

13 May 2016

RE: Proposed Well Pad Near Fort Cherry School District Campus

Dear Township Supervisors,

We write to you in regard to the proposed permitting of the most recent Range Resources well pad near the Fort Cherry School District campus. As you know, there has been much discussion concerning the potential impacts of shale gas development to the environment and human health. While there is still a limited amount of epidemiology that assesses associations between risk factors and health outcomes, there is a growing body of peer-reviewed science that provides ample evidence of hazards, elevated risks, and associated health outcomes [1–4]. These hazards are of particular concern to our most vulnerable populations, including children, who may be disproportionately exposed and adversely affected [5].

The peer-review process is the cornerstone of scientific inquiry. Our organization, PSE Healthy Energy (www.psehealthyenergy.org), is committed to providing citizens and policymakers with objective, evidence-based information on energy production methods. Towards this end we have compiled a near exhaustive database of *all* the peer-reviewed articles on shale gas development. This library is open to the public and can be accessed at http://www.psehealthyenergy.org/site/view/1180. We have learned several very important points about the environmental and public health implications of shale gas development in the creation and review of this collection of scientific literature.

First, there are clear, well-defined pathways of exposure from shale gas operations to human populations, including air, water, and soil. Numerous investigations have linked modern natural gas operations to surface and groundwater contamination in Pennsylvania; this is well documented in the peer-reviewed literature [6–9] and in PA DEP reporting [10]. Emissions of health damaging air pollutants such as aromatic hydrocarbons, nitrogen oxides (NO_x), volatile organic compounds (VOCs) and other ground-level ozone (smog) precursors occur throughout the life cycle of shale gas development. Research has shown that at least five air pollutants associated with shale gas (benzene, formaldehyde, ozone, particulate matter, silica dust) produce well known respiratory health effects in children [11].

Air pollution is caused not only from activities in and around the wellhead, but also from the transportation of water, sand, and chemicals to and from the well pads, from separator tanks, compressor stations, and other ancillary processes. Although a well pad may not be directly adjacent to a particular population, air pollutant emissions can extend beyond its immediate vicinity. Studies suggest trucking and other activities deliver significant impacts not only on local air quality [12], but also on regional air quality [13]. Air pollutants known to be health damaging have been measured in concentrations elevated enough to contribute to an excess public health burden for human populations living near natural gas operations [14–16]. Benzene has been

identified as a major contributor to elevated cancer risks from air emissions associated with the development of natural gas [15]. Previous studies have identified an association between this hazardous air pollutant and childhood leukemia [16].

There are a number of other considerations as well. Besides air and water pollution, the shale gas industry also brings heavy truck traffic (over 1,000 truck trips for each well for a high-volume hydraulic fracturing event), noise and light pollution, and a number of other probable ramifications that affect community wellness, such as traffic accidents, social stress, and anxiety [18]. Noise pollution is a particularly relevant concern for schools, as evidence has suggested that noise can impact children's cognitive function in a number of ways and can be detrimental to comprehension, memory, and attention/perception [19,20].

The science has grown tremendously in the past several years and the research community is now beginning to understand the implications of this industry for the environment and human populations. Of the nearly 760 peer-reviewed journal papers contained in the aforementioned database, more than 640 (84%) have been published since the beginning of 2013 and over 60 papers have already been published this year. There are still significant information gaps that would provide better evidence on the relative safety of shale gas development and new data will continue to emerge. However, based on the available evidence, precautionary measures are warranted with regard to the permitting of new wells in close proximity to schools.

The issue of determining a safe distance to develop shale gas from sensitive receptors is complex. However, evidence suggests an increased risk for nearby populations, particularly in areas with larger quantities of well pads. Several studies suggest a greater prevalence of some adverse birth outcomes for neonates born to mothers living in areas of higher density or closer proximity to natural gas development [21–23]. Qualitative case studies have also suggested harm to human and animals populations [24,25]. The epidemiology is still limited and it is difficult to draw firm conclusions about the extent of health burdens attributable to shale gas development. However, as the scientific literature suggests, there are clear pathways of exposure as well as some evidence to suggest elevated health risks and associated health outcomes. In addition, numerous reports of common health symptoms have been independently surfacing throughout the United States in areas with active natural gas development. Unfortunately, some of these reports involve children, who effectively serve as sentinels for adverse health outcomes.

Children are a particularly vulnerable population who may exhibit different health outcomes from adults when exposed to environmental pollution [26,27]. From an exposure perspective, children drink more water, breath more air per unit body weight than adults, and often put objects and their hands into their mouths more frequently than adults. For this reason, children can be more exposed to environmental pollution. Additionally, children are less able to metabolize and excrete environmental chemicals and their young ages provide longer durations for diseases with long latency periods to develop. Because of these differences children warrant greater protection from environmental risks and therefore greater precaution in natural gas permitting decisions.

Finally, it is worth bearing in mind that there is no scientific way to determine the optimal distance between shale gas operations and schools; this is ultimately a question that involves a complex set of value judgments [28]. Science can, however, inform our decisions by identifying hazards and quantifying risks, creating an empirical foundation from which rational decisions can be made. Simply put, a greater quantity of well pads surrounding a particular population will

elevate their risk of adverse health outcomes. Given the body of scientific literature that is now available, we believe policy makers should exercise the utmost precaution when making decisions that could potentially impact our most vulnerable populations.

Our organization, PSE Healthy Energy, is dedicated to supplying evidence-based, scientific information and resources on unconventional shale oil and gas development, renewable energy, and other novel energy technologies to a variety of stakeholders. PSE's mission is to bring scientific transparency to important public policy issues surrounding such methods by generating, organizing, translating, and disseminating objective, evidence-based information.

In addition to the bibliography mentioned earlier in this letter, we are more than willing to offer our own research and expertise on this subject. We maintain formal affiliations and partnerships with faculty members across a range of disciplines at a number of national institutions, including Cornell University, Weill Cornell Medicine, Stanford University, George Washington University, and The University of California, Berkeley. We invite you to visit our website at www.psehealthyenergy.org, where we provide high-quality resources and analyses on shale gas development and other forms of energy production.

If you have any questions, please do not hesitate to contact us. Thank you for your time.

Sincerely,

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