November 19, 2013

A Citizen's Recommendation
RE: K & H application for Injection Well Permit, Athens County, Ohio

To: Athens County Commissioners
Ohio Dept. of Natural Resources Division of Oil and Gas
USEPA
S.R. Debbie Phillips

The hazards associated with recent hydraulic fracturing methods are numerous. The potential danger to our limited drinking water supplies are self evident. The dangers associated with seismic activity are less well known.

My concern for this issue began in the winter of 2007-8 while perusing the USGS online list of recent earthquakes in the eastern US. I noticed a remarkable trend of relatively small (1.0-3.8) earthquakes in the Guy, Arkansas area. Knowing this area as a relatively active seismic zone still did not account for the large number. My first guess was mining of some sort, but when I went to Google maps and inserted the latitude and longitude of a random sample of the quakes I could see in satellite view many large rectangular cleared areas. Most had bright blue spots, either round or rectangular, which under maximum magnification appeared to be containment ponds. I could see rows of semi trucks on many of these cleared pads and large buildings. In comparison with the few houses and barns nearby, these pads appeared to be many acres in size and of an industrial nature. A few clicks later on a search of Guy, Arkansas, and I discovered the existence of modern hydrofracking.

The following year the media picked up the earthquake epidemic and the word 'fracking' became well known. In another two years a study was done which proved the correlation of hydrofracking and seismic activity.

> [Horton, S., 2012, Disposal of hydrofracking waste fluid by injection into subsurface aquifers triggers earthquake swarm in central Arkansas with potential for damaging earthquake: Seismological Research Letters, v. 83, p. 250-260, doil:10.1785/gssrl.83.2.250.]

Since then, this new type of oil and gas exploration has moved closer to our area and with it the need to dispose of the byproduct; a highly toxic mix of often unknown ingredients.

Observations:

1) Increased seismicity has followed the commencement of injection of hydrofracking fluids.

The recent Youngstown, Ohio study by W. Y. Kim, [Journal of Geophysical Research Soil Earth, Vol. 118, 3506-3518, doi:10.1002/jgrb.50247,2013; and entitled Induced seismicity associated with fluid injection into a deep well in Youngstown, Ohio, by Won-Young Kim, and published July 19., 2013] states on page 3506: "Over 109 small earthquakes (Mw 0.4-3.9) were detected during January 2011 to February 2012 in the Youngstown, Ohio area, where there were no known earthquakes in the past."

On page 3517: "The first detected earthquake (Mw 1.2) occurred on 11 January 2011, 13 days after commencement of injection at Northstar 1 well."

2) High pressure and large volume are not required to induce seismicity.

Kim, page 3517 states "…Total injection volume was a very small quantity when it started to trigger an earthquake, and the injection pressure was relatively low, and hence, there must have been nearly direct fluid conduits to the ENE-WSW trending fault very close to the injection wellbore,…"

3) Underlying faults need to be identified prior to permitting.

Kim, page 3515, Sec. 5.1 Migration of Seismicity from East to West states; "The trending of seismicity along a WSW-ENE line indicates the existence of a fractured Precambrian rock in the form of en echelon (ie; closely-spaced, parallel or subparallel, overlapping or step-like minor structural features) rectangular faults as conduits of fluid migration." And "…Deep basement fault(s) in the study area may act as vertical fluid conduits and provides a hydraulic connection between the fluid disposal well injection depths and the earthquake source depths."

4) The onset of seismic activity may occur years after commencement of injection.

As stated in the paper entitled 'Potentially induced earthquakes in Oklahoma, USA: Links between wastewater injection and the 2011 Mw 5.7 earthquake sequence.' And referred to herein as Kennan, et al. [Katie M. Keranen, Heather M. Savage, Geoffrey A. Abers and Elizabeth S. Cochran], the scientists show that the 5.7 earthquake recorded in November 2011 was induced by long term injection of fluids into an initially stable geologic formation.

Page 699 states:

"Significantly, this case indicates that decades-long lags between the commencement of fluid injection and the onset of induced earthquakes are possible, and modifies our common criteria for fluid-induced events."
Page 702 states "The 2011 Prague, Oklahoma earthquakes necessitate reconsideration of the maximum possible size of injection –induced earthquakes, and of the time scale considered diagnostic of induced seismitcy. Typically, a response of seismitcy to injection within months has been sought to diagnose earthquake triggering (Raleigh et al., 1976; Davis and Frohlich, 1993). Here we present a potential case of fluid injection into isolated pockets resulting in seismicty delayed by nearly 20 yr. from the initiation of injection, and by 5 yr following the most substantial increase in wellhead pressure."

5) Seismic activity may persist for years after injection ceases.
Kim, from the Youngstown study, states on page 3515:
"…the largest earthquakes postdated the end of injection at other sites such as Ashtabula, Ohio and RMA near Denver, Colorado. At RMA, the largest earthquake, Mw 5.2 occurred on 10 April 1967, more than a year after injection ceased on Feb. 1966. [Healy, J.H. , Rubey, W.W., and Griggs, D.T., 1968, The Denver earthquakes: Science, v. 161, p. 1301-1310, doi:10.1126/scenice.161.3848.1301.]

6) Seismic events can damage private property and endanger citizens
Keranen et al. Page 699 states "…the 5.7 quake was the largest instrumentally recorded in Oklahoma. It created shaking up to intensity VIII in the epicentral region, destroyed 14 homes, damaged many other buildings, injured 2 people and bucked pavement." [US Geological Survey, 2011]."

Recommendation:
That maximum measures be taken to protect the lives and property of citizens from the potential increase in seismicity associated with injection wells. In order to achieve this goal it is recommended that:
Oversight for Ohio's injection well program should rest with the USEPA rather than with the ODNR. The ODNR does not require sufficient geologic data from the applicant prior to commencement of injection. The USEPA uses 40 CFR 146.22 (a) as criteria when permitting:
"All new class 11 wells shall be sited in such a fashion that they inject into a formation which is separated from any USDW **by a confining zone that is free of known open faults or fractures within the area of review."**

'Known' faults or fractures must be determined **before** permitting to ensure the geologic stability of the area in question before the application is granted.

In conclusion;
To permit, drill, and inject hydrofracking fluid is a false, negligent and potentially dangerous method for determining the geologic stability needed for safe hazardous waste disposal. The cost of determining underlying geologic structures, the monitoring of seismic activity and the monitoring of ground and surface water for contaminants should be borne by the entity hoping to profit from the enterprise.

Charlotte Wachtel
Athens County, Ohio

cc. Athens County Commissioners
City of Athens
Ms. Susan Hedman, Regional Administrator USEPA Region 5
Debbie Phillips Ohio House of Representatives