

TESTIMONY

House Standing Committee on Energy and Environment

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Kansas Geological Survey

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Mr. Chairman, Members of the Committee:

My name is Rex Buchanan. I am the interim director of the Kansas Geological Survey, a research and service division of the University of Kansas. I appreciate the opportunity to appear before you today to discuss the issue of induced seismicity, and the response to induced seismicity, in Kansas.

Natural seismicity, as you know, consists of naturally occurring earthquakes. Induced seismicity is earthquake activity related to human activity. It has been known for some time that some human activities, including geothermal energy production, impoundment of large reservoirs, and fluid injection into the deep subsurface, can cause earthquakes.

In general, Kansas has historically been a relatively seismically quiet state. Prior to 2000, the state has records of approximately 25 felt earthquakes since 1867, many of them related to the Humboldt Fault Zone that runs through east-central Kansas. From 1977 to 1989, the Kansas Geological Survey operated a statewide seismic network with funding from the U.S. Army Corps of Engineers and the Nuclear Regulatory Commission. Because Kansas has historically seen relatively little earthquake activity, which was confirmed by instrument recording, that network was discontinued. Today, the U.S. Geological Survey operates two permanent seismograph stations in Kansas that are part of their National Earthquake Information Center.

In 2011, Oklahoma and other parts of the midcontinent saw increased seismic activity. In the fall of 2013, several small earthquakes occurred in south-central Kansas. After consultation with the Governor, staff from the Kansas Geological Survey, Kansas Corporation Commission (which is responsible for regulating oil and gas activity in the state), and Kansas Department of Health and Environment (responsible for regulating some aspects of underground injection in the state) met regularly to analyze, study, and report on that activity.

In February 2013, the Governor appointed the KGS, KCC, and KDHE to a task force to address issues related to induced seismicity in Kansas. That task force met numerous times, drafted a response plan, held a public meeting in Wichita where it took comments on the plan, made revisions to the plan, provided another draft for public comment, then reported to the Governor's office in late September 2014. We also met regularly with

colleagues at the Oklahoma Geological Survey, the Oklahoma Corporation Commission, the U.S. Geological Survey, various industry groups, and national organizations such as the Interstate Oil and Gas Compact Commission, the Groundwater Protection Council, and the National Research Council. We also met with the Harper County Commission and the Governor in Anthony in early October, and have continued to meet regularly with the Harper County Commission in Anthony, and once with the Sumner County Commission in Wellington. The Anthony and Wellington meetings provide opportunities to hear local concerns, answer questions, and let people know about the activities of the various agencies and the task force.

Through this time, we have seen increasing seismic activity. The attached graphs show earthquake numbers and magnitudes for 2013, 2014, and so far in 2015. The strongest event was a magnitude 4.9 that occurred in Sumner County in mid-November. It was the strongest earthquake ever recorded in the state.

As you can see from the maps, this activity is centered in south-central Kansas, especially Harper County. This seismic activity correlates with an area of increased oil and gas production and disposal of large volumes of salt water. As you probably know, most oil and gas wells in Kansas produce large amounts of salt water along with oil and gas. That salt water is disposed of in wells that are typically deeper than the producing wells. Based on the seismic activity in Oklahoma and other states, and its correlation with large-volume disposal wells, the scientific and regulatory community has focused on the salt water from these disposal wells as a possible cause of the seismicity. In general, waste fluids from oil and gas production in Kansas are injected back into deep subsurface formations "under gravity." The added mass from this injection may lower the frictional resistance between rocks along an existing fault system and, under certain circumstances, allow a fault to move.

To be absolutely clear, we have no reason to believe that this seismic activity is caused by hydraulic fracturing. While hydraulic fracturing does by definition create extremely low-level seismicity, the seismicity is generally too small to be felt at the surface. Hydraulic fracturing has been connected to a small number of felt earthquakes in other states, but not in Kansas. We need to differentiate between hydraulic fracturing (a well-completion technique) and salt water disposal (a production technique). While we have been disposing of salt water in disposal wells for decades, today's horizontal wells are generally more productive, both in terms of oil and salt water, than traditional vertical wells.

Determining the exact nature and cause of the recent seismic activity is challenging. That is especially true in Kansas, where, because of the lack of seismic activity, we have relatively few instruments to record it. As I mentioned, the USGS operates a national network; the locations and magnitudes of the earthquakes shown in the graphs and maps

are from that network. Determining an appropriate response, when data are relatively sparse, is difficult. But we are rectifying that.

Last April, the USGS installed temporary stations in south-central Kansas, then installed more in November after the Sumner County event. The KGS has since installed additional stations, and Rick Miller from the KGS will talk about that shortly. And Mike Tate from KDHE will talk to you about their role and the seismic action plan. Ryan Hoffman will talk about the KCC's role in this process. Again, I appreciate the opportunity to appear today. The Governor and the people of south-central Kansas have made it clear that they are concerned about these events, and we continue to work toward a better understanding of this activity and an appropriate response.