

Oklahoma Geological Survey

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Summary Statement on Oklahoma Seismicity April 21, 2015

Based on observed seismicity rates and geographical patterns of migrating seismicity in Oklahoma, which follow major oil and gas plays with large amounts of produced water, these rates and patterns of seismicity are very unlikely to represent a naturally occurring rate change and process. The rate of magnitude 3+ earthquakes has increased from 1½ per year prior to 2008 to the current average rate of 2½ per day, a rate that is approximately 600 times the historical background. The Oklahoma Geological Survey (OGS) considers it very likely that the majority of recent earthquakes, particularly those in central and north-central Oklahoma, are triggered by the injection of produced water in disposal wells. The primary source for suspected triggered seismicity is not from hydraulic fracturing, but from the injection/disposal of water associated with oil and gas production. Produced water is naturally occurring water within the Earth that is often high in salinity and co-exists with oil and gas in the subsurface. As the oil and gas is extracted/produced, so is the water. This water is then separated from the oil and gas and re-injected into disposal wells, often at greater depth from which is was produced.

It is often stated that disposed water is waste-water or "flow-back water" from hydraulic fracturing. While there are large amounts of waste-water generated from hydraulic fracturing, this volume represents a small percentage of the total volume of waste-water injected in disposal wells in Oklahoma.

The observed seismicity of greatest concentration, namely in central and north-central Oklahoma, can be observed to follow the oil and gas activities (plays) characterized by large amounts of produced water. Seismicity rates are observed to increase after a time delay as injection volumes increase within these plays. In central and north-central Oklahoma, this time delay has typically been several weeks to a year or more.

The OGS continues to work with the Oklahoma Corporation Commission, Oklahoma Independent Petroleum Association, Oklahoma Oil and Gas Association and the Governor's Coordinating Council on Seismic Activity to better understand Oklahoma seismicity and communicate the results of our work to the public.

As communicated in the joint USGS-OGS statement dated May 2, 2014, the earthquake hazard in Oklahoma has increased due to the increased rate of seismicity. It is important for Oklahomans to learn what to do during a significant earthquake, and be prepared. The OGS and the Oklahoma Office Emergency Management provide such information on their respective websites.

A more detailed version of this summary statement on Oklahoma seismicity can be found on the OGS website: http://www.ogs.ou.edu