BRACEWELL

INSIGHTS

Reports Connecting Seismic Activity to the Injection of Produced Water

April 28, 2015

*By: **Jason B. Hutt** and **Brittany M. Pemberton***

In recent days, the Oklahoma Geological Survey (OGS), Southern Methodist University (SMU) in Dallas, and the U.S. Geological Survey (USGS) have each indicated that they are increasingly convinced that there is a connection between the underground injection of produced water and induced seismicity"”small earthquakes caused by something other than naturally occurring activity. The Oklahoma Geological Survey released a ***statement*** on April 21, 2015 indicating that the increased seismic activity experienced in many parts of Oklahoma in recent years is "very unlikely" to be the result of naturally occurring forces. In its statement, the OGS noted that Oklahoma has experienced more earthquakes in 2014 than in any year since 1977 and that, in many parts of the state, the seismicity rate is up to 600 times higher than the background seismicity. The OGS drew a clear distinction, however, between hydraulic fracturing itself and the injection or disposal of water associated with oil and gas production. It stated that the increased seismicity is not caused by drilling or extraction of oil or natural gas. Rather, it is the disposal of naturally occurring water that is produced during the fracking process (known as "produced water" or "brine") and re-injected into disposal wells that potentially causes increased activity, with the highest correlation being associated with oil and gas plays that contain the largest volumes of this kind of water. The OGS was also careful to note that produced water connected to induced seismic activity represents a small percentage of the total volume of wastewater injected in disposal wells throughout the state. On the same day that the OGS released its statement, researchers at Southern Methodist University published a ***study*** in the journal Nature Communications that concluded that a string of earthquakes that occurred in 2013 and 2014 near Azle, Texas, was "most likely" caused by high volumes of wastewater injection in combination with brine extraction from oil and natural gas wells. The study focused on the Newark East Gas Field north and east of Azle, an area that has two intersecting faults. On the east side of the faults, two gas wells produce large amounts of brine. At the same time, two injection wells push wastewater into the Ellenburger formation (an aquifer below the Barnett shale) west of the faults. The SMU researchers created a 3D model to analyze the pressure of the fluids within the rock formation of the gas field and concluded that this combination of removing water from one side of the fault and injecting it on the other side of the fault caused the string of earthquakes because it created pressure that caused the fault to slip. They also noted that, in some cases, even very small changes in the fluid pressure could trigger seismic activity. Because the Azle earthquakes occurred in

somewhat unique circumstances, the SMU team indicated that their research may not be applicable to increases in seismic activity in other parts of the country where fracking occurs, such as Oklahoma and Kansas. The U.S. Geological Survey released a preliminary ***study*** on April 23, 2015 that officially links the increase in earthquakes in areas not near a fault line to fracking activities. The USGS report connects increased seismic activity in 17 areas across eight states to wastewater injections from hydraulic fracturing operations. The report focuses on central and eastern United States, and it is intended to describe how injection-induced earthquakes can be incorporated in U.S. seismic hazard maps, which are used to forecast the likelihood of seismic activity over a 50-year period. The report summarizes a series of models USGS scientists developed evaluating the rates, locations, maximum magnitude, and ground motions of earthquakes in earthquakes in Alabama, Arkansas, Colorado, Kansas, New Mexico, Ohio, Oklahoma and Texas. In a statement introducing the report, the USGS noted that injection of large volumes of wastewater from a variety of processes (including fracking) can increase the underground pore pressure. Such an increase in pressure may have the effect of lubricating nearby faults, thereby triggering earthquakes. The USGS report predicts that more than 140 million Americans now live in areas that could experience strong earthquakes. However, the USGS was careful to note that "most wastewater disposal wells do not produce felt earthquakes," and the agency agreed with the OGS that hydraulic fracturing itself is very rarely the direct cause of felt earthquakes. The USGS expects to release its final hazard model later in the year. Further studies are underway, including other States and industry organizations. To the extent that scientists continue to find a "likely" nexus between oil and gas extraction-related activities and seismic activity, companies may face new headwinds from state oil and gas commissions as well as private litigants.