



Oklahoma Geological Survey
The University of Oklahoma
Mewbourne College of Earth & Energy
G. Randy Keller, Director and State Geologist

Position Statement on Triggered or Inducedⁱ Seismicity

- We take allegations of triggered seismicity seriously and are actively assessing the possibility that this may be occurring in Oklahoma.
- It is well understood that earthquakes can be triggered by fluid injection at depth.
 - It is also well documented from the historical and geologic record that Oklahoma frequently has naturally occurring earthquakes.
 - It is true that the past few years have seen a significant increase in earthquake activity within Oklahoma. While we are studying the possibility that some of this activity could be related to oil and gas operations, it is unlikely that all of the earthquakes can be attributed to human activities.
 - It is however possible that there have been incidents of triggered seismicity within Oklahoma over the past several years.
 - If cases of triggered seismicity are identified, our goal is to adequately and thoroughly document and research these cases, so that proper steps can be taken to mitigate the likelihood of future triggered seismicity.
 - We will also attempt to work collaboratively with operators of these wells to gain as great of an understanding of the triggering process as possible.
 - When earthquakes appear to be triggered, there are methods to, with the cooperation of operators, assess whether seismicity truly is triggered or not.
 - We consider a rush to judgment about earthquakes being triggered to be harmful to state, public, and industry interests. We are taking a measured and scientific approach to addressing issues so that any conclusion that earthquakes are linked to oil and gas activities can be scientifically defensible.
- We are currently working on addressing cases in Oklahoma where triggered seismicity has been suggested. This requires careful examination of a large amount of complex data and does not happen quickly.
- We have also completed an evaluation of one such case documented in an OGS Open File (OF1-2011) that is available from the OGS website. This case involved hydraulic fracturing of a well in Garvin County in South-Central Oklahoma.
- We are actively working with and advising the Oklahoma Corporation Commission concerning issues of possible triggered seismicity.
- It is important to note that earthquake processes in the stable interior of continents occur on the order of hundreds to ten's of thousands of years while meaningful earthquake monitoring in Oklahoma and the central United States as a whole has only been possible for about 40 years.
 - Earthquakes often cluster in space and time in any tectonic setting, making any short-term trends in seismicity difficult to interpret.
 - Many processes are thought to occur within the Earth that could potentially generate the seismicity patterns observed in recent years.
 - Most earthquakes in Oklahoma do not occur on well-known faults, but there are many undocumented faults throughout Oklahoma due to its complex geologic history. Thus, we are working on a new fault map for the state.

ⁱ Induced seismicity is the more colloquial term, but triggered seismicity is the more accurate term for earthquakes inadvertently cause by anthropogenic activities. This indicates that the stress released in the earthquake was accumulated through natural processes, but the mechanism that caused the stress release was due the affects of human activities.