



Oklahoma
Corporation
Commission

News Release



February 27, 2018

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Moving Forward

New protocol to further address seismicity in state's largest oil and gas play

A new protocol has been developed to further reduce the chances of a felt earthquake resulting from well completion activities in Oklahoma's newest and biggest oil and gas play.

In December 2016, the Oklahoma Corporation Commission's Oil and Gas Conservation Division (OGCD) and the Oklahoma Geological Survey (OGS) developed a seismicity protocol for oil and gas operators that were planning operations for the South Central Oklahoma Oil Province (SCOOP) and the Sooner Trend Anadarko Basin Canadian and Kingfisher counties (STACK) plays. As expected, these areas now account for the vast majority of new oil and gas activity in Oklahoma.

OGCD Director Tim Baker says the protocol met with full cooperation from the oil and gas industry, but the data gathered since it went into effect supports new actions.

"The overall induced earthquake rate has decreased over the past year, but the number of felt earthquakes that may be linked to well completion activity, including hydraulic fracturing, in the SCOOP and STACK has increased," noted Baker. "These events are relatively rare and smaller on average than those linked to injection activity. Most importantly, the risk of such events appears to be manageable. Learning how to mitigate the risk of causing such events is an ongoing process. The changes we are announcing today are part of that process."

Among the changes being made in the seismicity protocol:

- 1) All operators in the defined area will be required to have access to a seismic array that will give real-time seismicity readings.
- 2) The minimum level at which the operator must take action has been lowered from a 2.5 magnitude (ML) to 2.0 ML. Generally, the minimum level at which earthquakes can be felt is about 2.5 ML.

- 3) **Some operators will have to pause operations for 6 hours at 2.5 ML. Under the previous protocol, the minimum level requiring a pause was 3.0ML.**

Baker said the data gathered over the past year indicates earlier action may be best.

“While more study needs to be done, the indications are that those operators who have their own seismic arrays and took actions when there were seismic events too small to be felt decreased the risk of having multiple, stronger earthquakes,” said Baker

OGS Director Dr. Jerry Boak agrees the changes in the protocol are necessary, but should only be seen as a step.

“Ultimately, the goal is to have enough information to develop plans that will virtually eliminate the risk of a felt earthquake from a well completion operation in the SCOOP and STACK,” said Boak.

According to State Seismologist Dr. Jake Walter, to accomplish that goal and further reduce the risk of strong earthquakes from wastewater injection, Oklahoma must add to its existing state seismic network by building a system capable of providing the needed data 24 hours a day. Currently, the OGS seismic network detection capability ranges between 2.0-2.5 ML across the state, and earthquake verification by an analyst occurs during normal business hours, except for larger events.

“The cost associated with expanding the seismic network would be a relatively small investment that would help to ensure the safe development of Oklahoma’s billions of dollars worth of oil and natural gas,” said Walter. “When coupled with other data on oil and gas activities that we hope will be forthcoming, we could develop a framework that would enable operators to know before they commence operations just what the estimated seismicity risk could be, what steps to take beforehand, and what to do during operations to minimize seismic hazards. As we speak, such mitigation efforts are being implemented by operators in the SCOOP/STACK. The sharing of the resulting data with OGS will help us to learn exactly what works.”

Baker, Boak and Walter agree that while important, the threat of induced earthquakes from well completion activity is much smaller than the threat linked to injection of oil and gas wastewater in the north-central area of the state, where the larger and more frequent earthquakes have occurred.

“Production within the 15 thousand square mile earthquake Area of Interest (AOI) resulted in an unprecedented amount of salt water which was already in the formation coming up with the oil and natural gas,” Baker explained. “That produced water was put back underground using disposal wells. There is broad agreement among researchers that disposal of these large amounts of water into the Arbuckle, the state’s deepest formation, can be linked to the high earthquake rate we saw in recent years within parts of the AOI. By comparison, the SCOOP and STACK plays have very small amounts of produced water and whatever earthquake activity there is tends to be much smaller. We currently estimate

less than four percent of detectable, induced earthquake activity in Oklahoma can be linked to hydraulic fracturing, and of that, an even smaller percentage can be felt. While the earthquake rate in the large AOI has been dropping since limits on disposal were put in place by the OGCD, disposal into the Arbuckle formation within the AOI is still the larger concern.”

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Editors, Producers: A map of the region of the STACK and SCOOP plays and the new protocol is attached

SUMMARY OF REVISED WELL COMPLETION SEISMICITY PROTOCOL*

This Directive shall replace the protocol dated December 20, 2016.

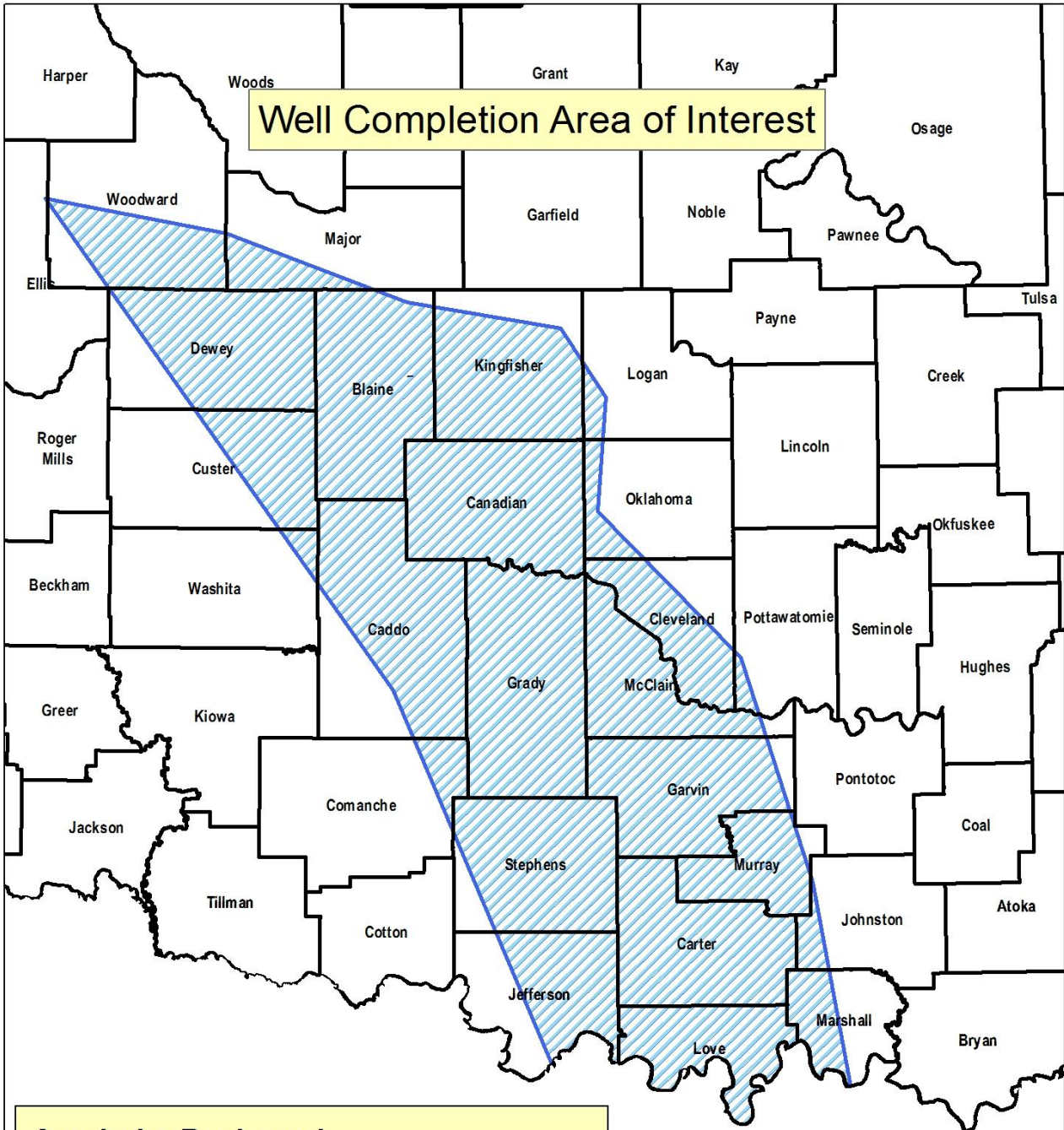
Terms: Oil and Gas Conservation Division (OGCD)
Induced Seismicity Department (ISD)
Oklahoma Geological Survey (OGS)

Prior to initiating completion activities on a horizontal well in the defined Well Completion Area of Interest (see map), operator shall certify to the OGCD, on the frac notice form, that it has adopted a seismicity response plan related to potential seismicity within five (5) kilometers (km) (3.1 mi) of completion operations.

- While the OGS Earthquake Catalog is the magnitude of record for all events, protocol action is to be initiated upon the first detected actionable magnitude. If the OGS magnitude is higher than the magnitude detected on the operator's private array, further protocol action will be required at the level appropriate to the OGS magnitude.
- All operators conducting Hydraulic Fracturing Operations within the OCC Completions Area of Interest shall monitor seismicity during active operations, using a seismic array. The area to be monitored shall be a 5 km radius from the well bore to be completed.
- The seismic monitoring array must be able to detect a minimum magnitude of completeness within the range of 2.0-2.5ML and allow for the operator to timely implement its seismic response plan.
- Upon request operator shall provide the ISD staff with its seismicity monitoring and response plan.
- Plan must include seismicity response procedures to the well completion design.

Operators' actions following seismic activity within 5 km (3.1 miles) of hydraulic fracturing operations:

- If, during active operations, the operator detects a seismic event within the monitoring area at least 2.0 ML but less than 2.5 ML, the operator shall implement its seismicity response plan.
- If magnitude is at least 2.5 ML but less than 3.0 ML the operator will notify the ISD of the event.
 - If operator has not initiated its seismicity response procedures prior to a 2.5 ML event, the operator shall pause hydraulic fracture operations for 6 hrs and a technical conference call will be held with ISD staff and operator regarding proposed seismicity response procedures.
 - If operator has initiated its seismicity response procedures prior to a 2.5 ML event, a technical conference call will be held with ISD staff and the operator regarding proposed seismicity response procedures, if any, and steps ISD deems necessary.
- If magnitude is at least 3.0 ML but less than 3.5 ML:
 - Operator shall pause hydraulic fracture operations for 6 hours and a technical conference call will be held with ISD staff and operator regarding proposed seismicity response procedures.
 - Upon agreement between operator and OGCD staff regarding mitigation practices and reduced seismic activity, operator will be permitted to resume with a revised completion procedure.
- If magnitude is 3.5 ML or greater:
 - Operator immediately suspends operations.
 - In-person technical conference held with OGCD staff and operator to examine whether operation can resume with changes.



Well Completion Area of Interest

Anadarko Basin and Area of Interest

-  OK_StateBoundary
-  Counties
-  Anadarko Basin and Area of Interest

Date: 1/9/2018

