Oklahoma Corporation Commission

Oil and Gas Conservation Division
Tim Baker
Director
UIC Program

- In Oklahoma there are 4,626 Disposal Wells
- 7,037 EOR Wells
- 969 Arbuckle disposal wells

Oldest Arbuckle wells date back to 1956.
Seismicity Investigation

- Delineated 10 K (6.2 mi) around 4.0 event
- Researched all saltwater disposal wells disposing into the Arbuckle
- Contacted operator to provide information on the actual completion depth of the well.
- If information established the well was completed in the basement rock the operator must plug back.
- Required Arbuckle wells to report weekly.
Seismicity Investigation
Seismicity Investigation

- The number of seismic events continued to rise.
- The dramatic increase in earthquakes, exceeded staff resources.
- Commission placed the onus on the industry to provide data on all Arbuckle wells.
- Operators found in basement must plug back.
Earthquakes

- Alfalfa
- Grant
- Garfield
- Noble
- Pawnee
- Logan
- Payne
- Oklahoma
- Lincoln

- 2011 Earthquakes
- 2012 Earthquakes
- 2013 Earthquakes
- 2014 Earthquakes
Logan Co. Trend
OGS > 2.6

- Earthquake activity.
- 2012  2
- 2013  14
- 2014  359
- 2015  274  (7/01/15)
Volume Comparison to Seismicity
Logan Co. Trend Directive

- Compared 2014 volumes to 2012 – reduced by a total of 3.4 million bbls/yr.
- Operators were given 60 days to reduce volumes.
State Response to EQ

- Industry forms work group to assist in providing data to OGS (Summer 2014)
- Governor directs Sec. of Energy to form coordinating council on seismicity (Sept. 2014)
Seismicity Investigation

- Staff redefined the area of interest.
- Goal was to prioritize the wells to be reviewed.
- New area of interest was created.
- Notice to operators was given to provide well log data to OGCD.
OGCD Areas Of Interest

- Directive sent out March 18th
- Operators had 7 days to begin reporting.
- Operators had until April 18th to provide their information to the OGCD.
- Operators who do not provide this information or do not have an approved plugging schedule will be required to reduce their disposal volumes by 50% until they satisfy the directive.
8/3/15 Directive sent out
Seismicity Investigation

- Western and Eastern Directives reduced 40% of reported volumes.
- Combined with the Cushing Directive the area was reduced nearly 800,000 bbls/d.
- Monitored for 6 months to observed results.
OCC Well & Seismic Monitoring
Seismicity Investigation

- Found seismic activity outside of AOI
- No Arbuckle disposal for several mi.
- Found frac. notices in close proximity to EQ activity.
- Correlated time of frac. to time of EQ.
Frac Induced Seismicity
Frac Induced Seismicity

- Researched 7,742 Frac Focus Reports.
- Compared OGS EQ catalog to Frac Focus reports within 2k/well lateral.
- Looked for at least 1 EQ within 1 wk of time of frac.
  Found 282 wells with at least 1 EQ.
Focus Area Anomalous Seismic Activity and Proposed County Array

- Focus_Area_Anomalous_Activity
- 1.25Mile_Wells

Date: 11/1/2016
Frac Induced Seismicity Action Plan

- OGS observes 2.5 Ml or greater/2(km) radius of lateral. Operator initiates mitigation plan.
- OGS observes 3.0 Ml - Operator initiates hard pause. (6hr.)
- OGCD observes 3.5 Ml operator suspends operations/Tech.conf.