

## **Texas Earthquakes, are they Natural or Man Made?**

On May 7<sup>th</sup>, central time, a magnitude 4 earthquake rocked the community of Venus Texas and neighboring counties. This represents the largest magnitude earthquake detected in north Texas to date and is part of a larger trend of increasing felt quakes in the region. The epicenter, or detected location of the initial quake, was found to be within several miles of multiple waste-water injection wells, each injecting more than 700,000 barrels of fluid each month (Figure 1). These are extremely high numbers that surpass other county injection wells by the hundreds of thousands. Whether or not these injection wells are linked to the magnitude 4 earthquake, or other recent quakes, remains to be seen, but research done and being undertaken at several universities may uncover clues that will help give scientists, engineers, and law-makers a better idea of the seismic history around Texas and their relationships to the oil and gas industry and how we should approach the possible seismic hazards related to these induced earthquakes.

Texas contains over 50,000 injection wells where fluids used in enhanced oil recovery methods are injected deep underground to extract more oil than otherwise would have been possible using conventional methods. According to the Texas Railroad Commission, 7,500 of these wells are used for wastewater disposal. In wastewater disposal, chemical fluids used in both conventional and enhanced recovery methods are injected back deep underground far away from known potable water sources. Much of the media concern over fracking causing earthquakes may actually be better directed at the practice of waste-water injections. USGS scientists have noted that fracking itself, where fluids are injected underground to crack open rocks and then extracted with the oil, differ in comparison to waste-water injections, where waste chemicals from the fracking process are deposited underground away from human activity. Fracking wells have not been found to be heavily associated with earthquakes in contrast to fluid injection wells.

Research by the University of Colorado Boulder found that these disposal wells are 1.5 times more likely to be associated with earthquakes than other oil and gas related wells. Further research has shown that there is evidence that earthquakes possibly caused by oil and gas operations, commonly called induced earthquakes, tend to occur closer to each other near injection wells than natural earthquakes do. These earthquakes are detected through machines called seismometers that record ground motion when the waves of an earthquake pass through. These machines do not detect all earthquakes however, due to a variety of reasons such as background noise generated by passing humans, air, cars or just machine error.

Work currently undertaken at the University of Texas at Austin is looking at finding more earthquakes from information recorded by these machines through specialized methods that detect similarities in the recordings to other previously detected earthquakes. Having a larger catalog of earthquakes gives scientists a greater ability to do more accurate research on patterns and phenomenon associated with these quakes. It still remains to be seen exactly how much oil and gas operations affect the occurrence of earthquakes, but the close proximity of these earthquakes to high volume injection wells and the recent increases in felt earthquakes since injections have started seem to indicate a significant relationship.

# Well Locations

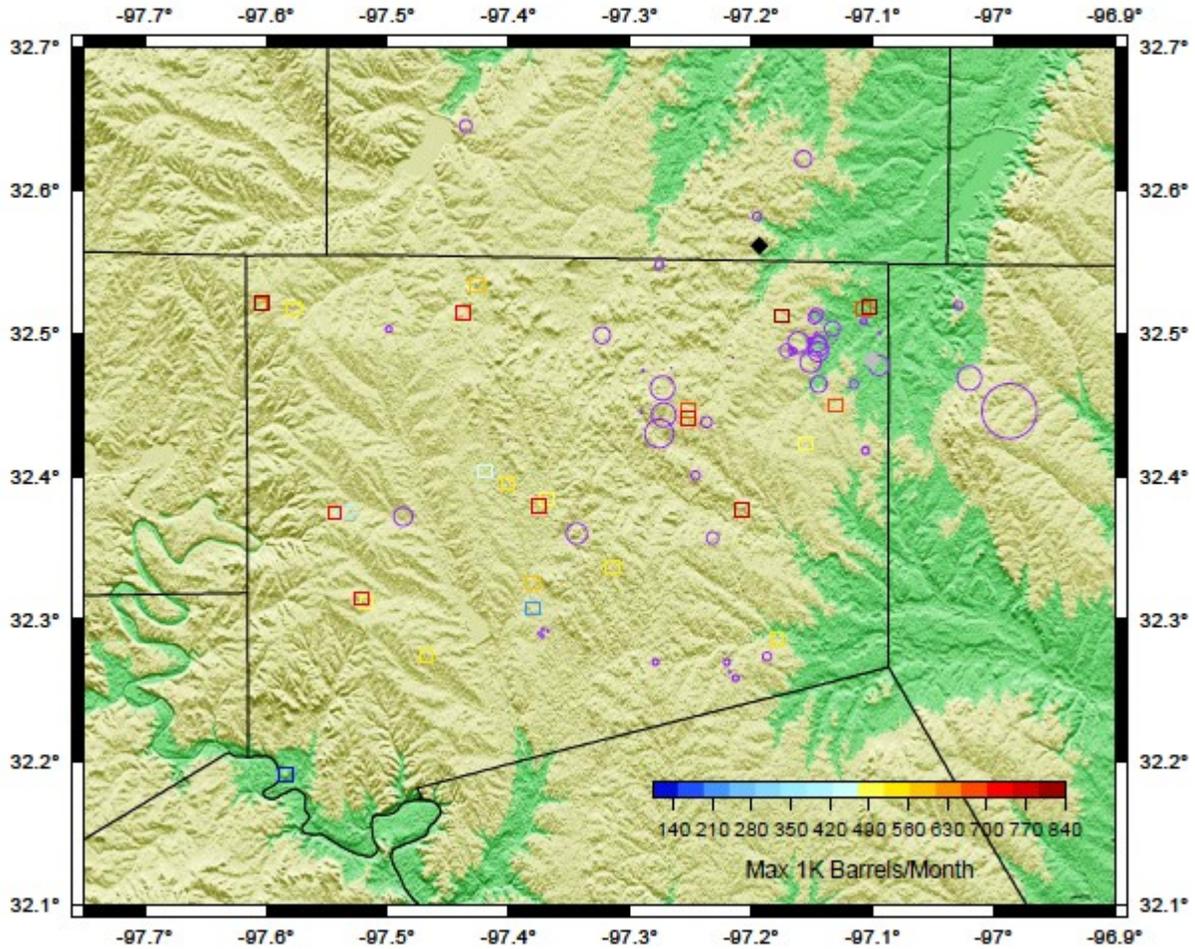


Figure 1) Johnson County injection wells color coded by barrels/month, with circles earthquakes detected using specialized methods. The bigger the circle, the more earthquakes detected in that area.