geoconvention
Calgary • Canada • May 15-19 2017

An Update to the Induced Seismicity Story in the Duvernay

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Summary

Since 2013, increased seismic activity in the Fox Creek area has been detected which coincides with increased hydraulic fracture completions in the Duvernay Play. In January 2015, the Alberta Energy Regulator instituted requirements in regards to induced seismicity that mandated operators to assess the associated risk of induced seismicity during hydraulic fracture operations and monitor for seismic activity. Each well which will undergo hydraulic fracturing operations will undergo a risk assessment which includes specific completions designs as well as subsurface factors that will be addressed in this presentation. The three main subsurface risk elements that are addressed for each well are proximity to subsurface structure, the regional stress regime and any historical seismicity which has been observed.

The risk elements of subsurface structure and regional stress are intertwined as not all structural features are risked the same. Seismic data is used to assess the subsurface structure while regional and local measurements of Sv, Shmin and pore pressure provide estimates of in-situ effective stress and stress anisotropy. Based on the assessment of these two elements and correlating with observed seismic activity, it was determined that the mechanism of induced seismicity can be linked to the in-situ stresses, although subtle structural flexures and faults also play a role in the geographic location, magnitude and observed local distribution of induced seismicity.

One thing that also needs to be considered in terms of risk assessment is the subject of ground motion and amplification factors due to the near surface. In engineering applications, ground motion amplification factors (AFs) are used in seismic codes to capture the amplification effects of local soil conditions on ground motions and, consequently, on seismic design forces. The recent induced seismic activity in Fox Creek is used to develop AFs for geotechnical and structural vulnerability analysis.