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Induced Seismicity in the Duvernay: Development of Monitoring and Mitigation Procedures

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Summary

Induced seismicity in Fox Creek has become a more pressing issue within the last year. Two large scale events, both with magnitude over 4.0 have occurred within the Fox Creek area such that they were considered the first events associated with hydraulic fracture completions. As a response to the increased seismic activity in the area, the regulator has instituted subsurface order no. 2. The subsurface order stipulates that from February onward, all operators in the Duvernay within the subsurface boundary must assess the potential risk, monitor and mitigate for any induced seismic activity.

Once the subsurface order was publically released and considering that Shell had imminent hydraulic fracture operations, a monitoring plan was quickly devised with the aid of another operator. The agreement included the sharing of temporary surface stations specifically placed in locations to monitor operations from both companies. The monitoring partnership eventually evolved into a more long-term agreement with a broader array as well as a data sharing agreement such that both companies can learn from the data being gathered.

The required risk assessment takes into account subsurface structure using seismic as well as historical seismicity in the area. However, Shell's internal guidance also suggests that exposure to populated areas or sensitive infrastructure, injection near the crystalline basement, proposed completion operations and political sensitivities also be considered. Based on the assessed risk, the internal guidance also makes recommendations on what type of induced seismicity monitoring to be invoked.

Mitigation procedures in the event the induced seismic activity is detected required input from a multitude of different disciplines. Although the frequency and magnitude of the induced seismic activity are difficult to predict, a mitigation plan was developed with the completions group with the hope that there is a reduction in the observed induced seismic activity while still stimulating the reservoir. Communication protocols have also been developed such that not only field personal, who will implement operational changes, but Shell Leadership, Shell Health and Safety and External Communications are aware of the activity and further actions can be taken.