

An Analytical Approach to Hydraulic Fracturing and Induced Seismicity Monitoring

John L. J. Duhault, Starbird Enterprises Inc, Calgary, Canada: starbird@telus.net

Summary

The public's fears about hydraulic fracturing and subsequent potential for induced seismicity are a growing concern, even in tried and true oil fields of Alberta. The stakeholders need to be shown that a well thought out approach to understanding hydraulic fracturing and potential induced seismicity can be done in a logical step by step procedure.

A Decision Tree Analysis (DTA) approach is proposed to help identify the steps needed to determine if the proposed oil field activity could penetrate existing potable water aquifers or could generate induced seismicity events that might cause local damage. This process would proceed in a logical manner and conclude with an option to:

- Carry on with no need for monitoring,
- Self-monitor for improved oil field knowledge and economics (microseismic) or for sensitive areas
- Or monitor with environmental protocols tied to grounded scientific research

DTA Approach

The first step is to determine the depth of the local potable water zones followed by whether the project is for waste water injection or for hydraulic fracturing of a tight reservoir for future production. Next, a thorough review of the local stratigraphy, geology and geophysics would be examined. This would be followed by the style of fracture treatment and finally the proximity of local population or sensitive areas would be assessed. The DTA analysis would guide the user to the appropriate level of induced seismicity monitoring with or without environmental protocols

The steps created for this DTA were based on field data and observations, published data, personnel communication, conferences and various industry, academia and government web sites. Although some of the steps can run together or in tandem, the analysis will guide geoscientists and completion engineers in the direction of what to pay attention to and what recommendations to make as to the level of environmental protocol necessary for their specific hydrocarbon extraction operation and seismic hazard assessment.

Case Studies

Three examples from Western Canada will show the highly variable nature of hydraulically fracturing reservoirs in the Western Canadian basin. They will also illustrate how each area would require a different need or level of induced seismicity monitoring due to the magnitude of the induced seismicity anticipated.