

Forward 4-D seismic modelling of the Hibernia Reservoir

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Over the past 2 years, the Hibernia oil field has produced approximately 60 million barrels of oil. Seismic reflection data rely on contrasts in subsurface acoustic impedance (density \times velocity) to image different lithologic units. Pore fluids have

different densities and velocities resulting in the possibility of measuring seismic signature changes when one pore fluid is substituted for another (i.e., water for oil). This study examines the modelled time dependant changes that oil

depletion has on seismic signature in the Q fault block of the Hibernia Reservoir.

Computer models were constructed to represent the pre-production reservoir conditions, and then were simulated to account for hydrocarbon depletion and migration as production time is increased. By modelling the response of the reservoir, we can determine a set of elastic parameters that will give us insight as to the changes that we might expect in seismic signature. Changes to the seismic signature will largely be dependent on changes in oil saturation and fluid

pressure. These observations will allow us to model the heterogeneity (oil, water contrast) in the subsurface.

By observing changes in the seismic signature, we can gain more knowledge about subsurface fluid flow paths, and subsequently improve reservoir planning to maximize recovery of the resource. These computational models give the Hibernia Management and Development Company insight as to the parameters that would be required for potential 4-D (time dependent) seismic acquisition in the Hibernia Reservoir.