

Development and testing of a new 10000 PSI NMR overburden probe

*Michael Dick*¹, *Dragan Veselinovic*¹, *Taylor Kenney*¹ and *Derrick Green*¹

¹Green Imaging Technologies, Fredericton, NB, Canada

Abstract. It is well known the measurements at overburden pressures can greatly affect any petrophysical properties, most notably porosity and permeability. NMR measurements are also affected by overburden pressures. Existing NMR compatible pressure vessels are limited in pressure, have signals from the vessel itself that makes interpreting the NMR results difficult or lack sufficient pressure safety measures. Previously, we presented work which employed an Oxford Instruments P5 overburden cell (SCA2016, Dick et al., SCA2018, Dick et al., SCA2019, Dick et al.). This cell's design was optimized from a signal to noise standpoint as its NMR components were embedded into the vessel itself. However, it was limited in its operating pressure (<5000 PSI) and had significant background signals from the cell itself.

In this work, we expand on the original design of the P5 overburden cell to remove background signals and increase the working pressure to 10k psi. Modification to internal components to NMR invisible materials and changing the secondary containment system to metal are the main modifications. The investigation included exploring various grades of metals for their use within an NMR instrument. Specifically, the magnetic susceptibility and the production of magnetic field eddy current due to the magnetic field switching used in an NMR were explored. Further, the pressure seals within the probe have all been upgraded allowing a maximum confining pressure of 10000 PSI to be achieved. Finally, the NMR frequency of the probe has been changed from 2MHz to 12 MHz improving the SNR performance by approximately 10X.