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Geochemical Modelling of the McMurray Formation, Telephone Lake Asset, Northeastern Alberta, Canada

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Bitumen-saturated reservoir sands of the McMurray Formation are documented to be mineralogically and chemically mature throughout the Main McMurray Fairway. This massive bitumen resource is being exploited through mining and in situ techniques. The dominant in situ technology is Steam Assisted Gravity Drainage (SAGD) . Little consideration has been given to the effects of chemical reactions and diagenetic processes occurring to the reservoir during steam chamber development and growth. Such diagenetic reactions may impact reservoir quality close to the wellbore and may lead to potential scaling of the liner within the wellbore.

The Telephone Lake oil sands asset is one of Cenovus Energy's future growth opportunities. This asset is situated in a tributary valley, east of the Main McMurray Fairway. Geochemical modelling using the program PHREEQC has been conducted to evaluate mineral saturation conditions (saturation indices) as well as reaction path modeling using kinetic processes. Solution compositions have a direct impact on the stability of the minerals that can form under these temperature conditions. Geochemical modelling has been used to answer:

- What types of mineral changes and chemical reactions can be expected within the reservoir?
- Is there a predictable chronology of reactions based on the evolution of the pressure and temperature regime within the steam chamber?
- How does steam quality and chemical composition influence these diagenetic reactions?
- Can liner scaling be expected, and if so, what would be the expected dominant mineral precipitates?

These questions were addressed through quantitative and qualitative mineral examination, and chemical modelling scenarios. Mineral examination was conducted by QEMSCAN evaluation which not only provided mineral recognition and textural information, but also provided mineral quantification. Three cored wells were examined to determine the degree of spatial variability in mineralogy. One of these wells was selected to run detailed mineral quantification analysis and modelling. In total 53 samples were analyzed from sand-rich reservoir facies and muddy laminae within the SAGD net pay interval. Mineral evaluations from sandy and muddy intervals permitted the full mineralogical variability of the reservoir interval to be captured in the geochemical modelling process. This presentation will focus on the methodology and results of the geochemical modelling.