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Particle Size Analysis for the Pike 1 Project – An innovative approach to sand control in the McMurray oil sands

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Advanced statistical cluster analysis of particle size distribution (PSD) histograms has provided Devon the ability to group McMurray reservoir sands of similar histogram shape into one of four distinct clusters, or classes. This innovative methodology has added value for both reservoir characterization and sand control testing objectives.

Pike is a joint-venture project, owned 50% each by Devon Canada (operator) and BP Canada Energy Group ULC, that is currently under review by the Alberta Energy Regulator (AER) & Alberta Environment for resource development of the McMurray bitumen oil sands via steam assisted gravity drainage (SAGD). In the Pike 1 Project area, the PSD of the Middle McMurray reservoir sands is highly variable due to the complex nature of the depositional environment, and Devon has employed the use of advanced statistical algorithms and techniques to classify the PSD histograms for sand control testing objectives and permeability mapping. Using an unsupervised hierarchical classification technique, a dynamically-growing self-organizing tree (DGSOT) algorithm was used to cluster all of the PSD histograms from within the bitumen pay zone based on similarity. This analysis resulted in the creation of four distinct synthetic sand classes. Select intervals of unconsolidated reservoir sand, that matched each of the sand class synthetics, was then extracted from core for sand control testing. This sampled material is referred to as the 'sandprints'.

Having established four distinct sands within the Pike 1 Project, Devon implemented a two-tiered approach to utilizing this data set. Firstly, sandprint mapping was explored in Petrel by up-scaling each of the sand classes within the bitumen pay zone and extrapolating these classes throughout the reservoir to create 3-dimensional maps. This process provided an important control parameter in the placement of SAGD pads. Secondly, sand control testing was initiated to evaluate the performance of various liner designs. Understanding that 4 distinct sands were present at Pike, Devon recognized the importance of acquiring sufficient quantities of each specific sand to allow for a consistancy in the liner testing program. Each of the four sandprints have been tested against a variety of SAGD liner technologies for sand retention efficiency and pressure-drop mitigation. Two recognized, independent laboratories were employed to evaluate the sand control capabilities of current industry liner options. Each lab provided a unique approach to testing procedure and focus. Constant-rate versus constant-drawdown was the fundamental difference between each labs test design. Nearly 100 sand control tests were conducted and, after reviewing the data, Devon has established it's own methodology for sand control testing on a go-forward basis.

Devon will provide the results of this comprehensive testing program, as related to the sand control capabilities of various liner types. A description and physical display of each of the Pike sandprints (in-situ & cleaned) will showcase the overwhelming effectivness of this classification techinique, and it's potential applicability elsewhere in the McMurray oil sands. Finally, a variety of liner types tested by Devon will be discussed and displayed for informative purposes.

Acknowledgements

The authors would like to acknowledge all Devon technical staff for generously reviewing and providing feedback throughout the duration of this process. The folks at *Transform*© are recognized for supporting our numerous technical inquiries. A final thank you to Dan Agar, Dave Brown, and the remaining Core Laboratories Calgary staff for continued exceptional customer service.

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