Understanding Analytical Tests and Data Quality Requirements for Oil Sands mining

Speaker: Tea Malkova | CNRL

November 4, 2020, 12:00 pm Mountain Time

E-Technical Division Talk- 1 CPD Credit will be awarded for this event.

ABSTRACT
During the past forty years of oil sands mining, the contribution of many physical and chemical characteristics to the extractability of Athabasca oil sands has been documented. Between-operator and between-laboratory variations can be sufficiently large that variability in the data can exceed the resolution required for reliable prediction of oil sand performance. Any operator, who intends to generate a data base over several years of core programs, should pay attention to the consistency of their data.

A typical mining core analysis includes the following tests:

- Bitumen, water and solids content. The systematic error between two laboratories, both performing competently by current industry standards, can be up to 0.5% absolute. This implies a bitumen tonnage error of 5% relative.
- Water soluble ions and pH. Process water chemistry controls how any clays in the oil sand act in the extraction process: clays in presence of Calcium have negative impact on bitumen recovery. High Chloride concentrations lead to pipe corrosion.
- Methylene blue index. This index which is a measure of clay activity is a critical parameter in both extraction and tailings management. In extraction, the amount of clay in the oil sand feed defines the maximum recovery. In tailings, the clay content and activity provides the geotechnical character that determines if there is segregation of the coarse and fines particles during settling and early stages of consolidation.
- Particle size distribution. This description is important for three purposes:
  o Operational: Transport of slurries and the necessity to avoid sanding out of lines;
  o Process (most primary separation cells being defined in part by a metrics such as tones of fines per m² of cell surface per hour); and
  o Tailings (anticipated volumes of fluid fine tailings and settling basin capacity) purposes.

Of the analytical tests described above, only the Dean-Stark method measures distinctly defined “absolute” characteristics of the oil sand. On the other extreme, particle size distributions are influenced very strongly by the method used to make the measurement.

The Fines Management Working Group of COSIA undertook a project to develop a Method for measuring fines that would result in “technically sound, statistically defendable, and consistent measurement methodology for oil sands fines (<44-micron particle size) which is applicable across all areas of an oil sands processing facility.” The ultimate client for this work was the Alberta Energy Regulator (AER), as required by the now replaced Directive 74. Their ability to equitably monitor tailings management practices at the various sites would be enhanced if all of the oil sand operators in the Athabasca region could generate comparable fines data.

The project objective was also extended to include “the incidental benefit to measuring the entire Particle Size Distribution (PSD).” However, the data acquired during the inter-laboratory study was not sufficient to support findings regarding the entire PSD. Given the poor reproducibility demonstrated during inter-laboratory study and
the rescinding of Directive 74, the FMWG did not recommend the developed Method to be implemented as an industry standard.

BIOGRAPHY

Tea Malkova is a Mine Geologist at CNRL Horizon. She has 30+ years’ experience in geology, areas of gold mine and oil sands exploration. Last twelve years she was involved in oil sands laboratory analysis and statistics and the Fines Management Working Group of COSIA. Tea obtained her M.Sc. Geology at the St-Petersburg State University in Russia in 1986 and B.Sc. Software Engineering at the St-Petersburg University of Aerospace Instrumentation in 2003.