Whitehorse - Tuesday, September 11, 2018

Session #1 - Long term planning

Time **920am-940am**

Topic **Climate Change for Northern Latitudes: Considerations for Engineering in a Future of Known Unknowns**

Presenter(s) Andrew Baisley, O'Kane Consultants

Abstract Engineers and scientists, are asked to develop robust and resilient designs to not only withstand the stressors and rigours of present day climate, but in some cases, the unknowns of future climate. The two largest disturbances mining presents to the landscape are disturbances to the water balance and energy balance; both of which will be influenced by climate change. Implications for understanding the required equilibrium between the closure landscape and the existing landscape provide an indication of timescales involved. No where will the disequilibrium's in the energy and water balances be greatest than in northern latitudes. Closure timeframes are typically 100 years, if not longer; therefore, an appropriate framework to address the challenge of designing structures with defensible controls on identified risk is required. The changes in climate over these timeframes will include non-stationarity of long term trends in addition to inter- and intra-annual climate variations. Therefore, it is important to understand these changes in climate as the performance of the design will be measured relative to the external stressors. Simply put, engineered performance will be not remain stationary when compared to influences of climate.

This paper presents a framework to incorporate climate change into mine closure planning from a risk perspective, as risk management will be a key component in decision making for mine closure designs. The newest Representative Concentration Pathway (RCP) emission scenarios allow for ranking climate change outcomes from "very likely" to "less likely" to occur. By combining the likelihood of occurrence for various climate outcomes with the magnitude of the potential failures, a risk-based design criteria can be developed for each closure component. The creation of realistic and attainable design criteria begins on with a conceptual framework, allowing non-technical persons to better understand complexities of detailed design. The framework presented uses the Köppen-Geiger climate classification system to differentiate climates, largely because of its ability to reflect seasonal differences. Boundaries are determined by a global dataset of long-term monthly precipitation and temperature records that can be adapted to future climate change predictions. Understanding how climate is expected to change at a seasonal level is more valuable from a planning perspective than from an annual basis. Köppen-Geiger's strong ties to landscape signals such as vegetation and water availability make it ideal for closure planning. A case study is also presented to demonstrate the utility of the framework for the mines in arctic regions.

Bio Andrew is a Project coordinator and Geoscientist with O'Kane Consultants. His specialty is integrated mine closure and risk assessments where he helps companies focus resources to reduce unfunded liabilities. With the rest of the team at O'Kane Consultants, Andrew helps develop mitigation strategies for emerging risks facing the mining industry. Andrew has written many guidance documents on behalf of O'Kane Consultants for the mining industry to help improve not only the state of practice but state of the art thinking. Further areas of technical specialty include climatic influences on hydrological systems, specifically, linkages between energy and water regimes and the consequent resilience of ecosystems to climate change.