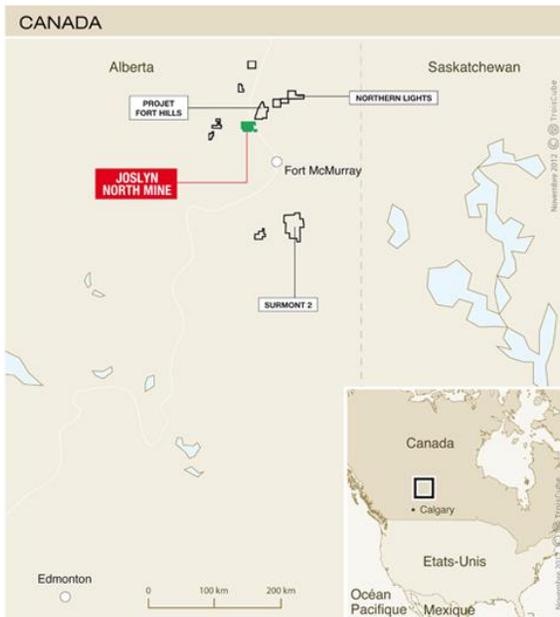




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## Geopolymer-amended tailings management-Total E&P's Joslyn North Mine, Alberta



GES Geotech was retained by Total E&P Canada to evaluate the potential impact of geopolymer-treated oil sands tailings on the environment. This project was carried out from 2011 to 2014.

The geopolymers under evaluation included cement kiln dust (CKD), fly ash, lime and gypsum, as well as various combinations of these geopolymers.

CKD can be used in a number of applications including mine tailings stabilization. CKD has advantage in terms of its price and availability in Alberta. Further, it has been used for reducing heavy metals concentrations of sludge for the stabilization and solidification of waste. Thus, CKD was considered as a good candidate for

further investigation for stabilizing and treating oil sands tailings.

Literature review carried out by GES showed that utilization of geopolymers would lead to dewatering of tailings ponds, with the target to reduce lifespan of ponds from 40 years to seven. With this solution, the size of tailings ponds will become substantially smaller, thus providing economic benefits to oil sands producers.

GES' analytical tests showed that CKD acts as a coagulant for lowering the water contained in the mature fine tailings (MFT) and thickened tailings (TT). This water could be later recycled and reused in the oil extraction process mining.

Further, GES analyzed the results of the leaching tests on several geopolymer-treated tailings. Geopolymer amendments were achieved using different concentrations of CKD, fly ash, lime and gypsum. Two leaching tests (TCLP and SLT) were implemented. The TCLP test corresponds to the 'worst' case scenario for metal leaching in acid medium (pH=4.93), while the SLT test corresponds to precipitation and infiltration effects most likely to occur in the field. Test results were compared to the Canadian Drinking Water Quality (CDWQ) standards as well as the Alberta Surface Water Quality (ASWQ) standards. The results illustrated that adding a small percentage of geopolymers to oil sand tailings has no major impact on tailings recycle water quality and heavy metal leaching for most of the geopolymers tested. Based on GES' findings, Total E&P Canada is investigating their final choice of geopolymer(s) for optimum tailings amendment.