Long Term Forecast and Modelling of South Athabasca Oil Sands and Provincial Emissions in Alberta

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In situ oil sands development is expected to dominate bitumen production in the coming decades and much of it will be located in the south Athabasca oil sands area (SAOS). Meanwhile, shale gas development in Upper Peace River area may also be projected to increase in production. In order to assess impact of environmental footprints of oil sands production and other energy development under the new Alberta Climate Leadership Plan (CLP), future Alberta province-wide emissions are developed based on 2010 baseline year and forecasted future development scenarios for two separate periods: 2030 and 2045. The year 2030 was selected to capture a major milestone of Alberta's CLP that will phase out emissions from coal-burning electricity generation by 2030. The study selected year 2045 by taking into account available activity data for the oil and gas industry as well as the limitation of mobile emission projection tools.

This study introduces the method of building a comprehensive database for point source and non-point air emissions inventory and model inputs for long-term forecasting in regions of Alberta province. Particularly, the future-year inventory in the SAOS region were developed based on Alberta energy projection from 2010 to 2045 and focused on in-situ oil and gas and shale gas production. Coal-fired power plants will be all phased out by 2030.

This study also applies CMAQ model to simulate the ground level concentrations of ozone, $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO, and acid deposition in SAOS and Upper Peace region for baseline case in year 2010, future development scenarios of high production level in year 2030, and future development scenarios of high production level in year 2045. The 2010 baseline year modelling results are evaluated against observations from air monitoring stations. By comparing future scenarios with the baseline year 2010, CMAQ model predicts changes in ground level NO_2 and CO concentrations, of $PM_{2.5}$ and PM_{10} concentrations in the major part of SAOS area and larger increase of $PM_{2.5}$ and PM_{10} concentrations in the southern portion of SAOS area. Nevertheless, the model captures the monthly patterns of NO, NO_2 and O_3 throughout the year.