

Abstract

This study investigates the worst-case ambient concentrations of O₃ and its precursors (NO_X and VOCs) that may occur from the construction of large industrial facilities in the Terrace-Kitimat valley airshed. This research is important as the Terrace-Kitimat valley naturally emits high levels of biogenic VOCs in the summer and many of the proposed facilities will, if constructed, emit high quantities of NO_X. To date, literature concerning O₃ production from industrial development in coastal airsheds with complex terrain is sparse.

The Comprehensive Air Quality Model with Extensions (CAMx) was used as the photochemical model for this research. Spring and summer periods were selected from 2010. Control and Test Case emission inventories were developed, the former for model evaluation and the latter to assess pollutant change. Model evaluation showed that CAMx was able to emulate daytime O₃ peaks in an adjacent valley for both periods though overnight titration by NO was less adequately replicated. Sensitivity tests revealed that this was due in part to inadequate Control Case emissions quantification; results improved with the addition of small scale area-based NO_X emissions to account for missing sources in the original emissions inventory.

Results from the spring period suggest that increased industrial emissions, in general, would not contribute to valley-wide O₃ increases greater than 5 ppb, as biogenic VOC emissions are minimal throughout the airshed during this season. On the other hand, results from the summer period suggest that increased industrial emissions would, at times, contribute to a greater than 55% increase in O₃ concentrations, particularly downwind of Kitimat on days with high temperatures, low planetary boundary layer heights, differential heating of the land and ocean surface temperatures and consecutive days of horizontally recirculating wind.

This research also used the modelled O₃ - reactive nitrogen ratio during hours conducive to photochemistry to determine the O₃ sensitivity of the Terrace-Kitimat valley airshed. The

airshed is currently sensitive to NO_x emissions however the full construction of all proposed industrial projects would likely change the O_3 sensitivity of a large portion of the valley to be sensitive to emissions of VOCs, especially in and around Kitimat.