1.0. Executive Summary

Fairbanks, Alaska has some of the highest measured ambient $PM_{2.5}$ (particulate matter less than or equal to 2.5 microns in diameter) concentrations in the United States, with wintertime levels often exceeding the 24-hour $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) of 35 $\mu g/m^3$. In an effort to understand the sources of $PM_{2.5}$ in the Fairbanks airshed, source apportionment using Chemical Mass Balance (CMB) modeling was conducted for the winters of 2005/2006, 2006/2007, and 2007/2008 at the State Building site and five locations (State Building, North Pole, Relocatable Air Monitoring System (RAMS), NCORE, and NPF3) during the winter of 2011/2012.

Throughout the period of study, $PM_{2.5}$ concentrations averaged between 18.3 and 24.2 $\mu g/m^3$, with multiple exceedances of the 24-hour NAAQS on the scheduled sample days. The results of the CMB modeling using source profiles developed by the Environmental Protection Agency (EPA) and a previous Missoula, Montana study revealed that wood smoke (likely residential wood combustion) was the major source of $PM_{2.5}$ throughout the winter months in Fairbanks, contributing between ~58% and 86% of the measured $PM_{2.5}$ at the five sites. The other sources of $PM_{2.5}$ identified by the CMB model were secondary sulfate (8-21%), ammonium nitrate (3-10%), diesel exhaust (not detected-9%), and automobiles (2-6%). Approximately 1% of the $PM_{2.5}$ was unexplained by the CMB model.

Additional chemical analyses were carried out to confirm the results of the CMB modeling. ^{14}C analyses were conducted on a subset of the filter samples from each of the five sites during the winter of 2011/2012, with the results showing that ~42 - 50% of the measured ambient $PM_{2.5}$ came from a new carbon, or a wood smoke source. In summary, CMB modeling results, coupled with the ^{14}C results, support that wood smoke is the major contributor to the ambient $PM_{2.5}$ in the Fairbanks airshed during the winter months.