

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 µg/m³. 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 at multiple locations throughout Fairbanks each winter between 2005/2006 and 2012/2013. PM_{2.5} source apportionment was also conducted at the NCORE and State Building sites during the summer of 2012 for comparison. Modeling for each of the sites/years was conducted using source profiles from both the Environmental Protection Agency (EPA) as well as Fairbanks-specific profiles developed by OMNI Environmental Services (OMNI).

Throughout the program, wintertime PM_{2.5} average concentrations ranged from 8.2 µg/m³ (RAMS, winter 2008/2009) up to 46.9 µg/m³ (NPF3, winter 2012/2013), with many of the sites having frequent exceedances of the 24-hour NAAQS on the scheduled sample days. The results of the CMB modeling using source profiles developed by the EPA revealed that wood smoke (likely residential wood combustion) was the major source of PM_{2.5} throughout the winter months in Fairbanks, contributing between ~60% to over 80% of the measured PM_{2.5} depending on site and winter / year. The other sources of PM_{2.5} identified by the CMB model were secondary sulfate (~7-21%), ammonium nitrate (3-11%), diesel exhaust (not detected-11%), and automobiles (not detected-7%). Approximately 1-2% of the ambient PM_{2.5} was unexplained.

When conducting CMB modeling with Fairbanks-specific space heater source profiles developed by OMNI, final results were somewhat similar to the sources identified using EPA profiles. Consistent with the EPA modeling, wood smoke was identified as being a large source of PM_{2.5} at the majority of the sampling sites, contributing from 30% to 77% to the ambient wintertime PM_{2.5}. In addition, the OMNI profile for No. 2 fuel oil combustion was frequently identified during the winter months, contributing anywhere from 10% to 47% to the ambient PM_{2.5} throughout the winter months at each of the sites. Combustion of No. 2 fuel oil (and contribution to ambient PM_{2.5}) was determined to be especially high at the State Building and Peger Road sites.

Summer source apportionment revealed that ambient levels of PM_{2.5} were very low at both the State Building and NCORE sites (~5.5 µg/m³). CMB modeling using both the EPA and OMNI profiles identified wood smoke as the predominant source during the summer months, likely from residential outdoor biomass waste burning and regional controlled/wildfires. In summary, CMB modeling results using both the EPA and OMNI profiles support that residential home heating (residential wood stoves and heating with No. 2 fuel oil) are the major contributors to the ambient PM_{2.5} in the Fairbanks airshed during the winter months. Wood smoke was also consistently identified during the summer months, albeit at much lower concentrations compared to winter concentrations.