PMF Analysis of Winter 2016 Neil Armstrong Academy Data

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Abstract

A study was conducted by the State of Utah on the Neil Armstrong Academy campus, 5194 Highbury Pkwy, West Valley City, UT 84120, during January and February 2016. Among the objectives of the study was to identify winter-time sources of fine particulate material in West Valley, Utah. Fine particulate mass and components, particulate organic markers and related gas phase species were all measured on an hourly average basis.

The following hourly averaged data were used in the PMF analysis:

Fine Particulate Mass. $PM_{2.5}$ mass was measured using an R&P Model 8599 FDMS (Filter Dynamics Measurement System) Tapered Element Oscillating Microbalance (TEOM)..

Fine Particulate Cations and Anions: A URG model 9000D AIM was used to measure particulate phase anions and cations.

Carbonaceous Material: Black carbon and UV absorbing carbon were determined with a dual wavelength Aethalometer (Magee Scientific). Aerosol carbon was measured with a Sunset Lab instrument.

Gas Phase Species: Concentrations of NO_X, NO_2 and CO were measured by the State. Mass spectrometric measurements of methanol and C8 aromatics were also available and used in the PMF analysis.

Organic Marker Compound Data: The GC/MS Organic Aerosol Monitor (GC-MS OAM) uses a chemically deactivated quartz filter for collection followed by thermal desorption and GC-MS analysis. Compounds measured by the GC-MS OAM and used in the PMF analysis included Fluorene, Levoglucosan, Dehydroabietic Acid, Syringe Aldehyde, o-Phthalic Acid, Adipic Acid and 4-Oxoheptanedioic Acid.

A total of 557 hourly averaged data sets with 23 components were available for a Positive Matrix Factorization (PMF2) analysis of the data set. The data were best described by a solution with 6 factors. Two of the factors were associated with emissions from mobile sources, diesel and automotive. These two factors accounted for a total of 13% of the $PM_{2.5}$, with the automobile related factor being the larger. One factor was associated with wood smoke emissions and accounted for 3%. Two factors were associated with the formation of secondary fine particulate material. The larger of the two was associated with the production of secondary nitrate and

accounted for 70% of the $PM_{2.5}$, while the second was associated with the secondary formation of particulate organic material, but accounted for only 3%. The final factor was associated with fine particulate sulfate and SO_2. This factor was associated with 11% of the fine particulate material. Sources which could account for this factor include emission from the oil refineries to the northeast of the sampling site and from the smelter to the west. Meteorological back-trajectory data clearly indicted the more likely source was from the smelter.

Details of the PMF analysis and the importance of secondary fine particulate material at the Neil Armstrong Academy sampling site will be presented.