Elemental Characterization of Airborne Particulate Matter Collected within IMPROVE and CSN Networks

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The deployment of PM$_{2.5}$ monitoring networks in the U.S. is a critical component in the national implementation of the PM$_{2.5}$ National Ambient Air Quality Standards (NAAQS). Data from the Federal Reference Method (FRM) compliance network is used to determine attainment with the NAAQS. In addition, two nationwide networks currently monitor chemical species in PM$_{2.5}$.

The Interagency Monitoring of Protected Visual Environments (IMPROVE) network, directed by the EPA and governed by a steering committee of representatives from federal, state and regional organizations, monitors visibility conditions, tracks changes in visibility, and works to identify sources and causes of regional haze at all Class 1 areas, in about 170 sites nationwide since 1988. The PM fractions are collected using samplers developed in UCD. Three different types of filters are used in four channels to collect: PM$_{2.5}$ on 25 mm PTFE filters ( Pall Inc., 3 µm pore size) for elemental analysis by XRF on 37 mm Nylon filters for ionic analysis, on 25 mm quartz filters for organic/elemental carbon (OC/EC), and PM$_{10}$ on 25 mm PTFE filters for sole PM mass analysis. The elemental analysis of samples have been performed at UCD from the beginning of the program together with gravimetric analysis while OC/EC and ionic measurements have been done by UCD contractors.

The inception of Chemical Speciation Network (CSN) network was initiated by the U.S. Environmental Protection Agency (EPA) in 2000, in order to provide monitoring of PM$_{2.5}$ in urban areas for the purpose of identifying sources, developing implementation plans, and supporting ongoing health effects research. Commercially available samplers in the CSN network collect PM$_{2.5}$ on three different filter media: 47 mm PTFE (MTL, 2 µm pore size) for XRF analysis, quartz for OC/EC analysis, and Nylon for ionic analysis. UCD performs the XRF analysis of deposits on PTFE filters.

The work presented here provides the initial evaluation of the elemental data from both networks by the same EDXRF instrument (Panalytical Inc., the Netherlands). Instrumental performance, method detection limits, uncertainties and long term reproducibility are evaluated. Comparison of the XRF data with independent method (i.e. IC) is utilized for evaluation. Generally, good agreements between two methods are obtained for both networks (Fig.1).

Figure 1. Time series of 3S/SO$_4$ for IMPROVE network.