Decadal Trends in Observed Analytical Uncertainties for IMPROVE Elemental Data

K. Trzepla-Nabaglo and W.H. White

Crocker Nuclear Laboratory, University of California at Davis, Davis, CA 95616; 530-752-1213, E-mail: whwhite@ucdavis.edu

The Interagency Monitoring of PROtected Visual Environments (IMPROVE) network has collected 24h PM2.5 samples for elemental and light-absorption analyses continuously since 1988, at a sustained frequency of twice a week or every third day. The network today includes about 170 sites, about 70 of these having operated continuously since 1995. The same size selective inlets and Teflon filters have been used throughout the measurements, and all analyses have been performed by Crocker Nuclear Laboratory at the University of California in Davis. All original sample filters collected since 1995 are archived on the Davis Campus.

The elements Na - Zr and Pb have been reported throughout the program, but the analytical methods have undergone some evolution. For example, the elements Na – Mn were determined by Particle Induced X-Ray Emission (PIXE) through November 2001, by X-Ray Fluorescence (XRF) analysis in a He-flushed atmosphere from December 2001 through December 2004, and by XRF analysis in vacuum since January 2005. In addition to these fundamental changes, incompletely-documented operational factors such as detector performance and calibration details have introduced other variations in the measurements.

Because the past analytical methods were all non-destructive, the archived filters can be reanalyzed with the current analytical protocol. For any one site, the historical series of consistently collected samples can be processed in a single analytical batch. The 15-year sample archive from Great Smoky Mountains National Park (Gatlinburg, TN) was recently selected to generate such an analytically homogeneous data set.

This presentation examines trends in the relationships between reanalyzed and originally-reported data for sample elemental composition at Great Smoky Mountains National Park. Figure 1 shows examples of the measurements' stability over time, a critical consideration when interpreting observed trends.

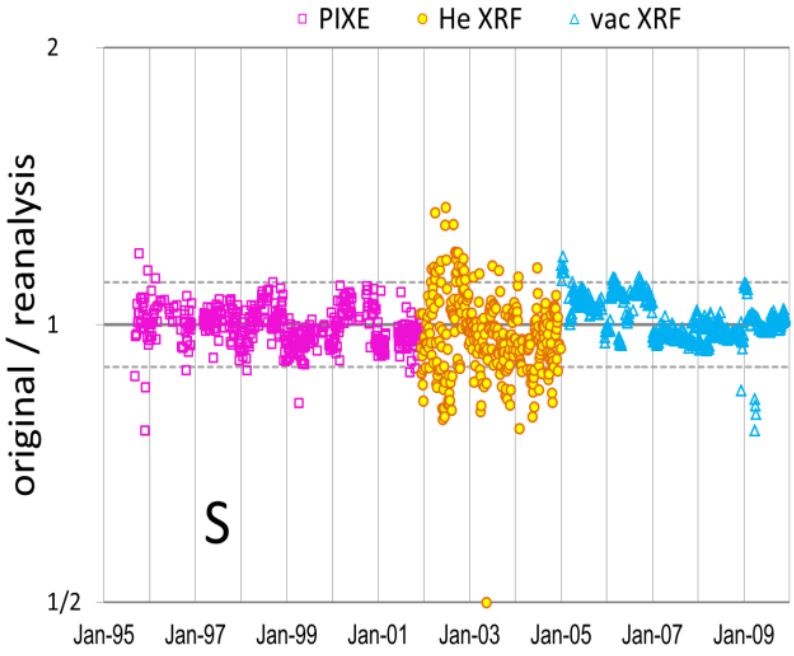

Figure 1. Long-term repeatability of analyses for sulfur and potassium. Each point represents one 24h PM2.5 filter sample from Great Smoky Mountains National Park, and shows the ratio of mass loadings (g/g) determined by the original analysis, performed shortly after sampling, and recent reanalysis with current system and protocol. Sample dates are indicated at the bottom, and major method distinctions are indicated at the top. Dashed horizontal lines indicate ratios of 9/10 and 10/9.