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PM2.5 Active Aerosol Collection Field Campaign Report

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Acronyms and Abbreviations

ARM	Atmospheric Radiation Measurement
LBNL	Lawrence Berkeley National Laboratory
Q-ICPMS	quadrupole inductively coupled plasma mass spectrometry
PM	particulate matter
RMBL	Rocky Mountain Biological Laboratory
SAIL	Surface Atmosphere Integrated Field Laboratory

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1.0 Summary

The long-range transport of aerosols can affect local air quality as well as contribute elements and constituents to mountain watersheds that have potentially positive (e.g., nitrate) and negative (e.g., heavy metals) effects to the local ecosystem. Isotopic analysis of aerosols can be a powerful tool for deconvolving the relative contributions of far-distant and local sources to the composition of collected aerosols. Our field campaign involved the week-long collection of PM2.5 (i.e., particulate matter with an aerodynamic diameter of about 2.5 microns) aerosols on filters, which were returned to the laboratories at Lawrence Berkeley National Laboratory (LBNL) for analysis. The sampling sites were located at the Gothic, Colorado Surface Atmosphere Integrated Field Laboratory (SAIL) Atmospheric Radiation Measurement (ARM) and the Mt. Crested Butte, Colorado SAIL ARM sites. The original intention was to measure the lead (Pb) and strontium (Sr) isotopic compositions of the collected aerosols at high precision to provide constraints on source portioning and attribution, as well as analyze the chemical compositions and nitrogen and carbon isotopic compositions. However, severe blank issues arose that prevented the planned isotopic analyses of Sr, Pb, C, and N and severely affected the analyses of the bulk chemical compositions of the collected aerosols, resulting in the failure of the study. The issue is described in Section 2.0.

2.0 Results

Given the nature of the planned isotopic analyses, which are highly blank-sensitive, we selected high-purity quartz glass filters. However, though the proper filters were ordered, the manufacturer supplied the wrong filters in packaging for the filters that were ordered. This was not realized until the end of the campaign when all the filters, blank filters, and sample filters were analyzed for bulk composition using quadrupole inductively coupled plasma mass spectrometry (Q-ICPMS) on the dissolved filter solution. We found that the major and trace element compositions of the blank filters and sample filters were virtually identical. The blank filters had a major element composition consistent with a ceramic filter material, rather than high-purity silica. In the case of Sr, the filter blank represented over 96% of the recovered Sr (i.e., the Sr from the aerosol was less than 4% of the total Sr). To put that in perspective, for Sr isotopic analyses the blank contribution needs to be less than 0.1 % of the sample to allow accurate correction. Similarly for Pb, the filter blank represented over 85% of the recovered Pb, while the blank contribution needs to be less than 1% of the sample for blank correction.

3.0 Publications and References

None.

4.0 Lessons Learned

The major lesson is not to trust manufacturers and suppliers to provide the material requested. In this case it appears that the filters were package with inaccurate package labeling. Never assume the package labeling is correct. If we had checked the filter blank before deploying the filters for the campaign we

may have avoided the failure of the project. Unfortunately, even if we thought to check the blanks, there was not sufficient time before the beginning of the campaign.

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