

Posting type	Advisory
Subject	Over-reporting of sodium in salt-rich samples
Module/Species	A/ Na
Sites	Entire network
Period	Before 1/1/2011
Recommendation	Treat pre-2011 Na data as qualitative.
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Supporting information

Elemental concentrations in samples analyzed with the legacy PIXE and XRF systems were reported with a semi-empirical correction for the expected attenuation of X-rays within the deposit. Attenuation generally increases as the fluorescing element's atomic number decreases and is strongest for Na, the lightest element reported. Samples collected since the beginning of 2011 have been analyzed with Epsilon 5 XRF systems manufactured by PANalytical. Results are now taken directly from the new systems' integrated software, with no adjustment made for deposit thickness.

The legacy corrections for attenuation scaled estimated deposit thickness to the sum of measured elemental masses. The XRF elements do not include H, C, O, or N, which together account for a majority of the total mass in most samples. The legacy correction assumed that these and other missing elements contributed the same, fixed, proportion of every sample's total mass.

Sea salt is unique among the major aerosol components in having nearly all its mass directly measured as constituent XRF elements. Figure 1 illustrates how strongly the legacy correction's imputation of unmeasured elements sometimes overcorrected for the attenuation of Na fluorescence in salt-dominated samples. The moderately nonlinear associations PANalytical Na now exhibits with Cl^- and total mass are consistent with the expected attenuation of Na fluorescence at high sample loadings, an effect that current reporting leaves uncorrected.

Figure 1. Comparisons of XRF sodium, XRF chlorine, IC chloride ion, and gravimetric mass in individual 24h IMPROVE fine-particle samples from Point Reyes. Elemental and ionic species are plotted as equivalent concentrations of sea salt. Off-scale ion and total mass concentrations are plotted at boundaries.

