

Redelivery of IMPROVE Data, 2000-2004 Summary

In October 2005 UC Davis resubmitted all of the IMPROVE aerosol data for the five year Regional Haze Rule (RHR) baseline period, 2000-2004. The data were resubmitted to correct several errors and discrepancies in the data in order to provide the RHR analysts with the best available data set. There were four systematic changes that affected large blocks of data:

1. New flowrate validation flags were assigned. The flags were determined quantitatively and consistently across the entire five year period. The new Version 2 samplers, installed in 2000, provide flowrate data with 15-minute resolution, allowing flowrates to be determined precisely throughout the 24-hour measurement period and allowing flags to be assigned based on short-term behavior such as drops in flowrate for a specified number of hours.
2. Flowrates were recalculated to correct an error in the calculation that existed prior to January 2004. The flow calibration coefficients are referenced to 293°K, which is in the denominator of the volumetric flow equation (see Equation 351-7a in SOP #351). However, the UC Davis data processing software did not follow the SOP, but rather used the temperature at the time of annual calibration as the denominator in this equation. These calibration temperatures have ranged from 264°K to 315°K. Because the bias is proportional to the square root of the ratio of these Kelvin temperatures, the range of bias extended from about 5% high ($(\sqrt{293/264}) - 1$) to about 4% low ($(\sqrt{293/315}) - 1$), with over 80% of the instances falling within a bias of $\pm 2\%$. So, most concentrations have been changed slightly, but few by more than 2%. A single calibration temperature was applied at each site for the entire period between calibrations, typically about a year. Thus, the bias did not appear as random fluctuations, but rather as offsets in lengthy blocks of data.
3. Spectral corrections were applied to sulfur and aluminum data collected beginning in December 2001, when UC Davis ceased using PIXE and conducted all elemental analyses using XRF. These spectral corrections were incorporated into the PIXE analysis but required post-analysis processing with the XRF. UC Davis had neglected to apply the corrections once the switch to XRF was made but decided to make the corrections in the redelivery. Sulfur is subject to a small positive

interference from lead, and aluminum is subject to a small positive interference from bromine. For the S/Pb correction, 98% of the corrections are smaller than 1%, and for the Al/Br correction 70% of the corrections are smaller than 1%. Corrections greater than 5% occur when the S or Al concentration is very small (i.e., not because the Pb or Br concentration happens to be large).

4. Carbon analysis data were resubmitted to correct a bias in the data. In prior submittals the data for the OP fraction were truncated to zero if the reported value was negative. But negative values occur when the subtracted artifact is large compared to the measured value, and thus represent physically meaningful fluctuations about zero. Approximately one in ten OP values was affected by this change.

In addition to these systematic changes, a number of site-specific data problems were resolved and the data were resubmitted. Examples included inadvertently swapped samples, backdated flowrate calibrations, samples requiring reanalysis, and equipment problems that were resolved after the original data submittal.

Data Prior to 2000

It was decided not to resubmit data prior to 2000. The Version 1 sampler, in use prior to 2000, did not have a flowrate flashcard, and thus flowrate and temperature were not available with short time resolution. Flowrate and temperature for an entire week of samples were determined from a single measurement by the operator during the weekly site visit. Thus, there are no data available to formulate the new flags applied in the recent 2000-2004 resubmittal. Furthermore, the pre-2000 temperature data are so crude and imprecise that it would make no sense to fine tune the data by applying the small calibration temperature correction.

PIXE was used for all samples prior to December 2001, and the S/Pb and Al/Br spectral corrections were applied at that time. It was only when PIXE was abandoned in 2001 that the correction was inadvertently omitted.

The OP correction could be applied to data prior to 2000. However, it is a small correction that affects only about 10% of the data of just this single component of the carbonaceous aerosol. This one small correction does not warrant the effort involved in reprocessing twelve years of data.