



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

July 23, 2010

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: SANDWICH-Related Correction to the Urban-Focused Visibility Assessment Data File, as Used for the Final Document

FROM: Philip A. Lorang, Leader
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TO: PM NAAQS Review Docket (EPA-HQ-OAR-2007-0492)

Subsequent to release of the Second External Review Draft of the Urban-Focused Visibility Assessment (UFVA) document in November 2009 and its review by CASAC in March 2009, EPA staff realized an error affecting that document.¹ This memorandum describes the error and its correction in the final version of the document released in July 2010. While a close comparison between corresponding tables in the second and final versions will identify some changes, the corrections have had essentially no perceptible effect on graphical representation of results, and no conclusions have needed to be revised or restated.

This memo also documents the release of a corresponding corrected version of the large data file that was originally made available to the public in November 2009, containing detailed hourly inputs to and outputs from the process of estimating current hourly PM₁₀ light extinction levels in the 15 study areas.

Description of the Error

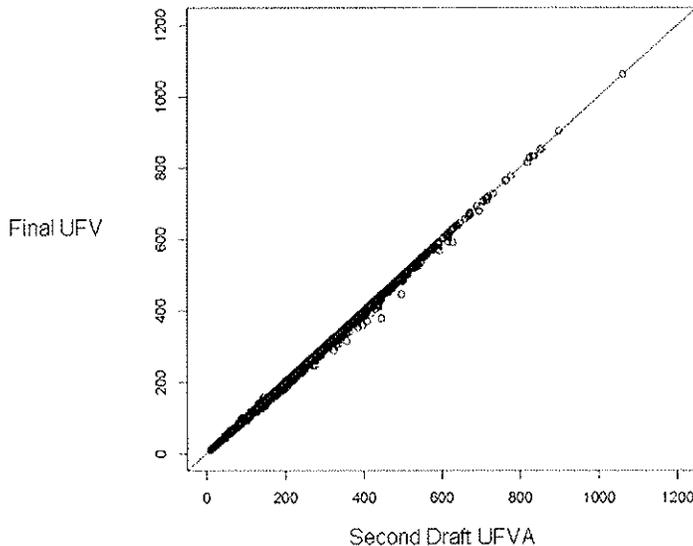
The error occurred in the SANDWICH processing of 2005-2007 data from the PM_{2.5} Chemical Speciation Network (CSN). This processing had been performed by EPA for other purposes well before the start of work on the UFVA. In that processing, any missing hourly relative humidity (RH) value was mistakenly treated as indicating an RH of zero. This zero value was used in a formula for estimating nitrate losses from Teflon filters in PM_{2.5} Federal Reference Method samplers. The results for the affected sample days were that nitrate loss was overestimated, nitrate remaining on the FRM filter was underestimated, and organic

¹ Not individually discussed here are corrections in the final document that involved the replacement of incorrect versions of graphics and obvious text errors.

carbonaceous material (OCM) on the FRM filter was overestimated, since the SANDWICH method estimates OCM by mass closure. The incorrect values of 24-hour OCM were used in the UFVA and affected estimates of hourly OCM and PM₁₀ light extinction. The incorrect values of nitrate did not influence the UFVA estimates of hourly nitrate or PM₁₀ light extinction because the UFVA methodology for estimating these parameters ultimately depends on the nitrate measurement from the CSN sampler, not the FRM sampler. The overestimate of OCM resulted in overestimates of PM₁₀ light extinction in 2005-2007 on days where RH data were missing from the meteorological data set used at the time of the SANDWICH processing. While the SANDWICH error was due to missing RH data, the UFVA analysis utilized a newly assembled data set for RH in which missing values were filled in with data from the next nearest available weather station. Hence, there are no missing RH values in the UFVA analysis and, therefore, the affected OCM values could be and were used to estimate PM₁₀ light extinction values via the original IMPROVE algorithm.

The following figure compares the PM₁₀ light extinction estimates from the second draft and final UFVA, across all 15 study sites. The correction of the error has noticeably changed only a small percentage of the values, and it has changed those values relatively little. It can also be noted that the larger of the changes are to PM₁₀ light extinction levels in the middle of the range of the data, from about 300 to 700 Mm⁻¹. Changes to values in this range did not much, if at all, influence the PM₁₀ light extinction design values under the various NAAQS scenarios considered in the UFVA. For example, for the 90th percentile daily maximum daylight PM₁₀ light extinction NAAQS form, design values ranged from about 70 to 350 Mm⁻¹, with the exception of Los Angeles at about 450 Mm⁻¹. Also, changes to value in this range did not much, if at all, affect the percentage of days or hours with light extinction above the Candidate Protective Levels (CPLs), since the highest CPL considered was 191 Mm⁻¹.

Effect of Correction of SANDWICH
 processing error on PM10 light
 extinction (Mm^{-1}).
 All 15 study sites.
 Daylight hours with RH \leq 90%.



Availability of Corrected Detailed Data File for Current Conditions

EPA has posted to the public websites <http://www.epa.gov/ttn/analysis/pm.htm> and http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_2007_risk.html a corrected data file titled “UFVA data file w SANDWICH fix July 21 2010.csv” containing the following input and output variables associated with the estimate of 1-hour light extinction and PRB light extinction for the 15 study areas. This list of variable names and meanings is included in the zipped file.

areaname	area Name
area	number code for study area
RH	hourly relative humidity (input)
Datetime	date and time of start of hour, 0:00 is midnight
hrly_frm	continuous 1-hour PM2.5 normalized to match the FRM for 24-hour average
hrlyso4	PM2.5 1-hr sulfate, fully neutralized (final result)
hrlyno3	PM2.5 1-hour nitrate, fully neutralized CSN-consistent (not SANDWICH) (final result)
hrlyocm	PM2.5 1-hour OCM by sandwich (final result)
hrlysoil	PM2.5 1-hour PM2.5 soil by IMPROVE fine soil formula (final result)
hrlyec	PM2.5 1-hour EC (final result)

hrlynon_frm	sum of the above 5
prb.soil	PRB PM2.5 fine soil, from CMAQ (input)
prb.ec	PRB PM2.5 elemental carbon, from CAMQ (input)
prb.no3	PRB PM2.5 nitrate, no NH4, from CMAQ (input)
prb.so4	PRB PM2.5 sulfate, no NH4, from CMAQ (input)
prb.ocm	PRB PM2.5 ocm including non-carbon, from CMAQ (input)
hrly_total_prb	sum of the above 5, no NH4 or H2O added
non_prb_soil	difference between hrlysoil and prb.soil
non_prb_ec	difference between hrlyec and prb.ec
non_prb_no3	difference between hrlyno3 and prb.no3
non_prb_so4	difference between hrlyso4 and prb.so4
non_prb_ocm	difference between hrlyocm and prb.ocm
hrly_total_non_prb	sum of the above 5 variables
pmt_lc	1-hour PM10 in LC, used to calculate pmc (input)
pmc	1-hr PM10-2.5 (final result)
pmc_flag	a code to indicate how pmc was estimated 81102 means hourly PM10 first had to be converted from STP to LC 85101 means hourly PM10 was reported as LC, no conversion needed Ratio means pmc = a regional factor x raw_hrly_pm25 (always in LC)
frh	F(RH)
bext	PM10 light extinction calculated from hrlyso4, hrlyno3, hrlyocm, hrlysoil, hrlyed, an assumed value of 10 Mm ⁻¹ for Rayleigh scattering
pmc, and	
so4bext	a term in the bext summation
no3bext	a term in the bext summation
ocmbext	a term in the bext summation
ecbext	a term in the bext summation
soilbext	a term in the bext summation
pmcbext	a term in the bext summation
dayshrs	code for whether the hour was treated as daylight (0=nondaylight, 1=daylight)
sdate	dd/mm/yyyy
raw_hrly_pm25	original hourly PM2.5 from continuous instruments (input)
hr	hour of the day. "1" indicates midnight to 1 am
mth	month
year	year
day	indicates whether the hour is considered to be daylight. "1" means daylight
cat	a numerical code for the area name