Ozone Monitoring Data (2001-2013) and Derivation of the W126 Index Values and Design Values for the Current Standards that are Presented in the Associated Spreadsheet

The spreadsheet includes calculated values for two metrics: (1) the design value metric for the current primary and secondary O_3 standards: the annual 4th highest daily maximum 8-hour O_3 concentration, averaged over three consecutive years, in parts per billion (ppb), hereafter referred to as the "4th max" metric; and (2) the W126 index, averaged over three consecutive years, in parts per million-hours (ppm-hrs), hereafter referred to as the "W126" metric.

Hourly O_3 concentration data were retrieved from EPA's Air Quality System (AQS) database in summer 2014 for 1,849 O_3 monitors which operated between 2001 and 2013. These data were used to calculate 4th max and W126 values for each 3-year period from 2001-2003 to 2011-2013. Before calculating these values, some initial processing was done on the hourly data. First, data collected using monitoring methods other than federal reference or equivalent methods and data collected from monitoring sites not meeting EPA's quality assurance or siting criteria in 40 CFR part 58 were removed. Second, data collected by multiple monitoring instruments operating at the same site were combined by selecting the monitor with the most hourly observations each year, then filling in missing hourly concentration values using data collected from the remaining monitors at the site. Finally, data were combined across 62 pairs of monitoring sites approved by the appropriate EPA regional offices, in order to maintain a continuous data record when these sites were replaced or relocated a short distance away. The final dataset consisted of hourly O_3 concentration data for 1,672 monitoring sites.

The 4th max values were calculated according to the data handling requirements for the current O_3 standards (Appendix U to 40 CFR part 50). First, moving 8-hour averages were calculated from the hourly O_3 concentration data for each site. For each 8-hour period, an 8-hour average value was calculated if there were at least 6 hourly O_3 concentrations available, and stored in the first hour of the period. Daily maximum 8-hour average values were found using the 8-hour periods beginning from 7:00 AM to 11:00 PM each day. These daily maximum values were used if at least 13 of the 17 possible 8-hour averages were available, or if the daily maximum value was greater than the 4th max level being evaluated. Finally, the annual 4th highest daily maximum value was found for each year, then averaged across each consecutive 3-year period to obtain the final set of 4th max values.

The spreadsheet includes two columns with 4th max values, one with all decimal digits retained ("max4") and one with all decimal digits truncated ("max4.trunc") as specified by Appendix U. For the truncated values, the annual 4th highest daily maximum 8-hour values were truncated to the next lowest unit ppb, then the truncated values were averaged across each consecutive 3-year period, and then the resulting 3-year average values were again truncated. The "max4.valid" field indicates "TRUE" if daily maximum values were available for at least 90% of the days in the O_3 monitoring season[1] on average across the three years, with a minimum of 75% of the days in the O_3 monitoring season in any single year.[2]

---

[1] The O_3 monitoring seasons for each state are defined in Appendix D to 40 CFR Part 58.
[2] According to Appendix U to 40 CFR Part 50, "max4.trunc" values greater than the level of the current standard (70 ppb) would also be considered valid.

To calculate the W126 values, the hourly O_3 concentration values (in parts per million) for daytime hours (defined as the 12-hour period from 8:00 AM to 8:00 PM each day) at each site were weighted using the following equation:

Weighted $O_3 = O_3 / (1 + 4403*\exp(-126 * O_3))$

These weighted values were summed over each calendar month, then adjusted for missing data (e.g.,; if 80% of the daytime hourly concentrations were available, the sum would be multiplied by 1/0.8 = 1.25) to obtain the monthly W126 index values. Monthly W126 index values were not calculated for months where fewer than 75% of the possible daytime hourly concentrations were available. Next, moving 3-month sums were calculated from the monthly index values, and the highest of these 3-month sums was determined as the annual W126 index. Three-month periods spanning multiple years (e.g., November to January, December to February) were not considered in these calculations. The annual W126 index values were averaged across each consecutive 3-year period to obtain the final W126 values, with units in parts per million-hours (ppm-hrs).

In the calculations for the spreadsheet, all decimal digits were retained in the annual W126 index values from which the 3-year average W126 values were derived. The "w126" column contains 3-year average W126 values, and the "w126.round" column shows those values rounded to the nearest integer ppm-hr. The "w126.valid" field indicates "TRUE" if hourly O_3 concentration values were available for at least 90% of the daytime hours during the O_3 monitoring season on average across the three years, with a minimum of 75% of the daytime hours during the O_3 monitoring season in any single year.