Evaluating the Ratio of Total PAH-34 to PAH-17 in Great Lakes Legacy Act Projects

Mark Loomis (Loomis.Mark@epa.gov) and Lou Blume (U.S. EPA, Chicago, IL, USA)
Kenneth Miller, Judy Schofield, Neal Jannelle, and Zaileen Rahim (GDIT, Alexandria, VA, USA)

Background/Objectives. Polycyclic aromatic hydrocarbons (PAHs) are a group of primary contaminants of concern in Great Lakes Legacy Act (GLLA) studies. PAH analysis conventionally reports a sum of 17 or 34 individual analytes as PAH-17 or PAH-34, respectively. For some GLLA studies, the PAH analyses include the full suite of 34 PAHs while for other studies, only a subset of the analyzed samples has included the expanded suite. Individual PAH compound results are generated as part of the GLLA studies, but most data interpretation is conducted using a calculated total across all of the individual PAHs. Typically, this total is compared to a project action level however, in some studies, a multiplier of 1.7 has been used to "convert" a PAH-17 total into a PAH-34 total. This adjustment assumes that if the additional PAHs were analyzed for a given sample that PAH-34 total would be 1.7x (or 70% greater than) the PAH-17 total reported.

Data collected from GLLA studies are being used to evaluate the suitability of this multiplier. GLLA data are being used to: (1) to determine the ratio of total PAH-34 to total PAH-17 concentrations for GLLA sediment samples for which the full suite of 34 PAHs were analyzed; (2) evaluate how much this ratio varies, and whether the ratio is impacted by various factors (location, analysis method, etc.) and (3) evaluate whether the ratio between PAH-34 to PAH-17 differs significantly from the previously estimated ratio of 1.7.

Approach/Activities. The first step to completing the analyses is to determine total PAHs for all sediment samples for which the full suite of 34 PAHs were analyzed. Since calculation schemes and the method of handling non-detects vary across studies, totals need to be calculated in a consistent manner using multiple non-detect handling schemes (e.g., using 0 for non-detects, and using ½ the reporting limit for the given PAH). Once total PAHs have been calculated, the ratio of PAH-34 to PAH-17 concentrations (based on the same non-detect handling scheme) will be calculated for each sample. The distribution of these ratios will be summarized by calculating various descriptive statistics (the arithmetic and/or geometric mean, median, standard deviation and range). As an additional evaluation of the variability of the ratios, confidence bounds, such as a 95% confidence interval, around the ratio also will be calculated. Separate descriptive statistics and confidence bounds will be calculated for various subsets of data. These may be done by dividing the data into subsets based on the study AOC and analytical method. Statistical comparisons of the ratios across subsets can be performed using Analysis of Variance (ANOVA) of the log-transformed ratios, or a non-parametric equivalent if necessary.

Results/Lessons Learned. To date, over 2,000 samples collected across 13 different AOCs have been analyzed for the full PAH34 suite as part of the GLLA. Initial results of the PAH results from these samples have shown that the determined ratios vary widely both from the assumed 1.7x target, and from each other based on site-specific and analytical factors.