Distinguishing Pyrogenic PAH Sources in Sediment from MGP and Other Tar Sources Using Exploratory Data Analysis and a Large Reference Data Set

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Background/Objectives. Over the past 28 years, staff from the laboratory at META Environmental, Inc. has analyzed many hundreds of tars and tarry materials from former manufactured gas plants (MGPs), coke plants, tar refineries, and related operations. A large subset of those data have been compiled and the trends in PAH distributions examined graphically, statistically, and with a variety of exploratory data analysis (EDA) techniques. For example, it was shown that tarry materials with very similar compositions could be distinguished using the appropriate chemicals and principal components analysis.

Approach/Activities. Urban background is a 'catch all' term that includes a variety of sources of PAHs within urban environments. In sediment, urban background is commonly a mixture of petrogenic and pyrogenic PAHs; however, pyrogenic PAHs usually dominate. The chemical data from several sediment studies and from META's tar reference archive were "mined" for characteristics and compounds and trends that help delineate former manufactured gas plant (MGP)-derived PAHs from general urban background. In addition to simple ratio approaches, multivariate exploratory methods, such as principal components analysis (PCA), cluster analysis, and positive matrix factor analysis (PMF) were used to identify and quantify differences between background patterns and the tar references.

Results/Lessons Learned. As with the tarry materials analysis, the data show that background can often be distinguished from tarry materials using the appropriate compounds and multivariate methods, even at relatively low concentrations. The findings of the data mining exercise will be summarized and chemical characteristics, such as PAH patterns and co-contaminants, with the greatest forensic value will be highlighted.