



## Forensic Analysis of PCDD/Fs and PCBs in the Lower Two Miles of the Passaic River, NJ

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**Michael Bock** (mbock@intell-group.com) (TIG Environmental, Portland, ME, USA) and Nicholas Rose (nrose@intell-group.com) (TIG Environmental, New York, NY, USA)

**Background/Objectives.** Elevated levels of polychlorinated dibenzo-p-dioxins (PCDDs)/polychlorinated dibenzofurans (PCDFs) and PCBs are 2 of the 8 chemicals of concern (COC) identified by USEPA in Lower Passaic River (LPR), New Jersey, sediments. Previous work (e.g., Bock et al 2021) has demonstrated variability in the PCDD/F profiles in different areas of the river. This is consistent with the river's nearly two centuries of highly industrialized activity and previous studies implicating multiple sources of PCDD/Fs evident in different areas of the river. Building on these previous studies, we conducted a detailed chemical forensic evaluation of the lower two miles of the LPR to refine our understanding of the composition and spatial distribution of different PCDD/F profiles as well as PCB congener profiles in surface and buried sediments. The spatial distribution of PCDD/F and PCB profiles in the lower two miles was combined with other lines of evidence to explore the distribution of these profiles and their relationship to potential sources.

**Approach/Activities.** Sediment chemistry results collected from the lower two miles between 2018 and 2019, part of the largest sediment study conducted in the lower 8.3 miles of the river to date, formed the basis of the forensic analyses. The dataset included the seventeen 2,3,7,8-substituted PCDD/F congeners and 209 PCB congeners. Principal component analysis (PCA), hierarchical cluster analysis (HCA), polytopic vector analysis (PVA), and other lines of evidence were combined into a weight of evidence evaluation to examine spatial patterns of sediment PCDD/F and PCB contamination.

**Results/Lessons Learned.** The forensic analysis shows spatial heterogeneity in the distribution of various dioxin and PCB congener concentrations and congener profiles. Different profiles were associated with different areas of the lower two miles of the river as well as with different depths. The results confirm and build upon the findings reported by others during the past two decades that demonstrate that multiple sources of PCBs; 2,3,7,8-TCDD; and other PCDD/Fs can be identified in the river. The likely sources of PCDD/Fs include dye and pigments, trichlorophenol, PCBs, chlorobenzenes, Aroclors, and non-point sources. Likely PCB sources include several different Aroclor and non-Aroclor sources such as dyes and pigments. The distribution of PCDD/Fs and PCB profiles in the river sediment reveals numerous inputs of PCDD/Fs and PCBs at different locations along the lower two miles of the river. Our findings with respect to PCDD/Fs are inconsistent with the hypothesis that the transport of 2,3,7,8-TCDD associated with the manufacture and use of TCP at the former Diamond Alkali chemical plant is the single significant source of 2,3,7,8-TCDD to the lower two miles of the Passaic River but rather reveals a complex mixture of different sources associated with numerous inputs of both PCBs and PCDD/Fs.