

2023 Battelle Sediments Conference
A3. Contaminant Forensics
Tuesday, January 10, 2023
5:45pm - 7:00pm

Identifying Byproduct (aka "Inadvertently Generated") Polychlorinated Biphenyls in Waterbodies

Background/Objectives. Inadvertently generated polychlorinated biphenyls (IG PCBs or byproduct PCBs) are PCBs unintentionally produced as a byproduct of industrial processes. A variety of processes, including pigment manufacturing and other processes that combine chlorine, carbon, and heat, have been identified as potential byproduct PCB processes. Recent studies have drawn attention to the presence of byproduct PCBs in consumer products, as well as in various environmental media from urban or remote locations. Although many byproduct PCB congeners can be present in product PCBs (such as Aroclors), certain byproduct PCB congeners are distinct from Aroclor PCBs. The goal of this work was to identify congeners that can be used to identify and quantify byproduct PCB contributions in waterbodies and at sediment sites.

Approach/Activities. We conducted a comprehensive literature review of processes associated with byproduct PCBs, with the goal of identifying the suite of congeners linked to byproduct PCB processes. Our review covered numerous manufacturing processes linked to byproduct PCBs, including syntheses of pigments, silicones, chlorinated paraffins, chlorinated solvents, and other industrial chemicals. Out of the full suite of byproduct PCB congeners, we identified byproduct PCB congeners that are not present in Aroclors at appreciable quantities and are also not products of reductive dechlorination of Aroclor mixtures. We also considered the impact of typical chromatographic coelutions on the suitability of each potential diagnostic congener, as well as the historical production levels of each Aroclor mixture. Lastly, we employed a variety of references for Aroclor composition in order to account for any potential interlot variability.

Results/Lessons Learned. Our review identified more than 140 byproduct PCB congeners that have been measured in pigments and paints, as well as in various consumer or industrial products or processes. Out of this set of congeners, a total of 17 were identified as being strongly indicative of byproduct PCBs using the methodology described above (*i.e.*, byproduct PCB congeners that were not present in Aroclor mixtures at appreciable levels and were also not products of reductive dechlorination). The byproduct PCB list identified in this work includes congeners that are frequently cited in the literature as tracers of non-legacy PCB discharges, such as PCBs 11, 207, and 209 and 14 additional congeners that are mainly associated with pigments, silicones, and emissions from combustion processes. This list of diagnostic congeners can be used to differentiate potential PCB sources in forensic analyses of sediment and waterbody samples.