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# USE OF PCB CONGENER ANALYSIS IN ECOLOGICAL RISK ASSESSMENT

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Common analytical methods for detecting and quantifying polychlorinated biphenyls (PCBs) in environmental samples rely on matching a pattern of peaks to a series of Aroclor standards. Due to differences in degradation, partitioning, and metabolism, the PCB pattern in environmental samples can be very different from the Aroclor standards, making identification and quantitation of PCBs difficult.

To identify an appropriate approach for PCB analyses, members of the U.S. Environmental Protection Agency Region 9, Biological Technical Assistance Group (BTAG) have considered PCB environmental fate and ecotoxicity, reviewed methods and laboratory capabilities for PCB analysis, and evaluated site-specific data from California and elsewhere.

Results of the BTAG review indicate analytical methods for routine measurement of specific PCB congeners in soil, sediments and tissues are currently available, and are cost-effective in comparison to Aroclor-based methods. Accordingly, BTAG has developed a core list of congeners (Table 1) and a tiered approach for PCB congener-specific analysis in ecological risk assessment:

## Phase I: Scoping Assessment

- Total PCB concentrations at the 1 part-per-billion (ppb) level are required.

- Total PCB estimation may be achieved by measuring the sum of all homologues.

**Phase II: Predictive Assessment or Validation Study**

- In addition to total PCBs, congener specific analysis is needed to characterize bioaccumulation through the food chain and to more fully assess potential toxic effects on ecological receptors.
- A Core List of 27 congeners was developed, largely based on the dioxin-like PCB toxicity, analytical considerations, and environmental abundance.
- Reporting limits needed for congener analysis in soil, sediments and tissues are in the low part-per-trillion (ppt) range.

**Phase III: Impact Assessment**

- Both total PCBs and congener specific analyses are needed. In addition to the Core List, analysis of other congeners may be considered.
- Reporting limits needed for congener analysis in soil, sediments and tissues are in the low part-per-trillion (ppt) range.

**Table 1.** Comparison of PCB Congener Lists Recommended by Various Groups

| PCB Congener IUPAC# | McFarland and Clarke, 1989[1] | Bay Protection & Toxic Cleanup Program (Cal/EPA, 1994)[2] | USACOE (by district)[3] | US FWS (Eisler and Belisle, 1996)[4] | BTAG CORE LIST[5] |
|---|---|---|---|---|---|
| 5 | | A | | | |
| 8 | | NS&T | NY Balt, Detr | yes | BTAG |
| 15 | | A | | | |
| 18 | Group 3 | NS&T | NY Balt, Detr | | BTAG |
| 26 | | | | aquatic | |
| 27 | | A | | | |
| 28 | | NS&T | NY Balt, Detr | *yes | BTAG |
| 29 | | A | | | |
| 31 | | A | | | |
| 37 | Group 4 | | | yes | |
| 44 | Group 3 | NS&T | NY Balt, Detr | yes | BTAG |
| 49 | Group 3 | A | NY Balt | yes | |
| 52 | Group 3 | NS&T | NY Balt, Detr | yes aquatic | BTAG |
| 60 | | | | yes | |
| 66 | | NS&T | NY Balt, Detr | yes aquatic | BTAG |
| 70 | Group 3 | A | | yes aquatic | |
| 74 mono-ortho | Group 3 | A | | *yes | |
| 77 non-ortho | Group 1A | | Balt, Detr | *yes | BTAG, WHO |
| 81 non-ortho | Group 4 | | | | BTAG, WHO |
| 82 | | | | yes | |
| 87 | Group 2 | | NY Balt | yes | |
| 95 | | A | | aquatic | |
| 97 | | A | | | |
| 99 | Group 2 | A | | *yes, aquatic | |
| 101 | Group 2 | NS&T | NY Balt, Detr | yes aquatic | BTAG |
| 105 mono-ortho | Group1B | NS&T | NY Balt, Detr | *yes, aquatic | BTAG, WHO |
| 110 | | A | | aquatic | |
| 114 mono-ortho | Group 4 | | | yes | BTAG, WHO |
| 118 mono-ortho | Group 1B | NS&T | NY Balt, Detr | *yes, aquatic | BTAG, WHO |
| 119 | Group 4 | | | | |
| 123 mono-ortho | Group 4 | | | | BTAG, WHO |
| 126 non-ortho | Group 1A | | Balt, Detr | *yes | BTAG, WHO |
| 128 di-ortho | Group 1B | NS&T | NY Balt, Detr | *yes | BTAG |
| 132 | | A | | | |
| 137 di-ortho | | A | | | |
| 138 di-ortho | Group 1B | NS&T | NY Balt, Detr | *yes, aquatic | BTAG |
| 149 | | A | | aquatic | |
| 151 | Group 3 | A | | aquatic | |
| 153 di-ortho | Group 2 | NS&T | NY Balt, Detr | *yes, aquatic | BTAG |
| 156 mono-ortho | Group 1B | A | Balt | *yes | BTAG, WHO |
| 157 mono-ortho | Group 4 | A | | | BTAG, |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | WHO |
| 158 di-ortho | Group 4 | A | | yes | |
| 166 di-ortho | | | | yes | |
| **PCB Congener IUPAC#** | **McFarland and Clarke, 1989[1]** | **Bay Protection & Toxic Cleanup Program (Cal/EPA, 1994)[2]** | **USACOE (by district)[3]** | **US FWS (Eisler and Belisle, 1996)[4]** | **BTAG CORE LIST** |
| 168 di-ortho | Group 4 | | | | |
| 169 non-ortho | Group 1A | | Balt | *yes | BTAG, WHO |
| 170 di-ortho | Group 1B | NS&T | NY Balt, Detr | *yes, aquatic | BTAG |
| 174 | | A | | | |
| 177 | Group 3 | A | | aquatic | |
| 179 | | | | *yes | |
| 180 di-ortho | Group 2 | NS&T | NY Balt, Detr | *yes, aquatic | BTAG |
| 183 | Group 2 | A | NY Balt | yes | |
| 184 | | | NY Balt | | |
| 187 | Group 3 | NS&T | NY Balt, Detr | yes aquatic | BTAG |
| 189 mono-ortho | Group 4 | A | | yes | BTAG, WHO |
| 194 di-ortho | Group 2 | A | | | |
| 195 | | NS&T | NY Balt, Detr | | BTAG |
| 201 | Group 3 | A | | aquatic | |
| 203 | | A | | | |
| 206 | | NS&T | NY Balt, Detr | aquatic | BTAG |
| 209 | | NS&T | NY Balt, Detr | | BTAG |

NOTES:

[1] McFarland and Clarke: Group1A=3-methylcholanthrene-type inducers, Group 1B=Mixed-type inducers, Group 2=phenobarbital-type inducers, Group 3=weak inducers or non-inducers, prevalent in fish and invertebrates, Group 4=Mixed-type inducers, potential toxicity, low prevalence.

[2] Cal/EPA. Bay Protection & Toxic Cleanup Program. QAPP. 1994. NS&T=Congeners on the National Status and Trends Program of the National Oceanic and Atmospheric Administration; A=Additional

[3] Personal Communication, US Corps Of Engineers: NY = New York District, Balt= Baltimore Distr, Detr=Detroit & Chicago Distr.

[4] Eisler and Belisle: * = reportedly accounts for more than 70% of the total PCB; yes = frequency in commercial formulations, samples (environmental, biological samples and human tissue), relative toxicity, persistence, and occurrence; aquatic = particularly prevalent in aquatic biota or as important components.

[5] BTAG Core List: Selected congeners identified; Selection based on NS&T and WHO Lists; WHO= Congeners on WHO list (Van den Berg, 1998).

## REFERENCES

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