

## Internal quality control of isomer-specific analysis of PCBs in serum

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### 1. Introduction

The Biomonitoring Laboratory, of the Finnish Institute of Occupational Health has analyzed PCB's in serum isomer-specifically for more than ten years for the purpose of biomonitoring PCB exposure from different sources: environmental, accidental (short occupational exposures) and occupational exposure (condensator manufacture and hazardous waste disposal). Part of the data have been reported in previous DIOXIN meetings<sup>1-4</sup>). Analytical quality in such long-term studies is of primary importance. In this paper we report on the quality assurance procedures we have used.

### 2. Materials and methods

All the analyses were done equally with "normal" samples using the method by Luotamo et al<sup>5</sup>): capillary gas chromatography with electron capture detection. All the individual isomers were separately weight  $2.5 \pm 0.5$  mg / 10 mL of n-hexane (solution A), this is made once in one or two years. As first dilution 75-150  $\mu$ L of each solution A / 10 mL of acetone, where individual isomer concentrations were about  $2.5 \pm 0.5$   $\mu$ g/L (solution B), this is done at least once a year. Daily used standards are 20, 40, 60, 80 and 100  $\mu$ L of solution B and added with internal standard solution (PCB#30 and PCB#116 40 $\mu$ L, concentrations about 4  $\mu$ g/mL) diluted to 10 ml of n-hexane for standards. Spiked serum (10 mL) is added with 10  $\mu$ L of solution B, giving the final concentrations  $2.5 \pm 0.5$   $\mu$ g/L, and internal standard solution, giving the final concentrations of 8-9  $\mu$ g/L.

For the routine biomonitoring purposes, we report the sum of nine lower chlorinated PCB isomers (Low-PCBs).

For internal quality control purposes we use outdated pooled serum from Finnish Red Cross - from persons not known to be exposed to PCBs. This serum is analyzed in every analytical

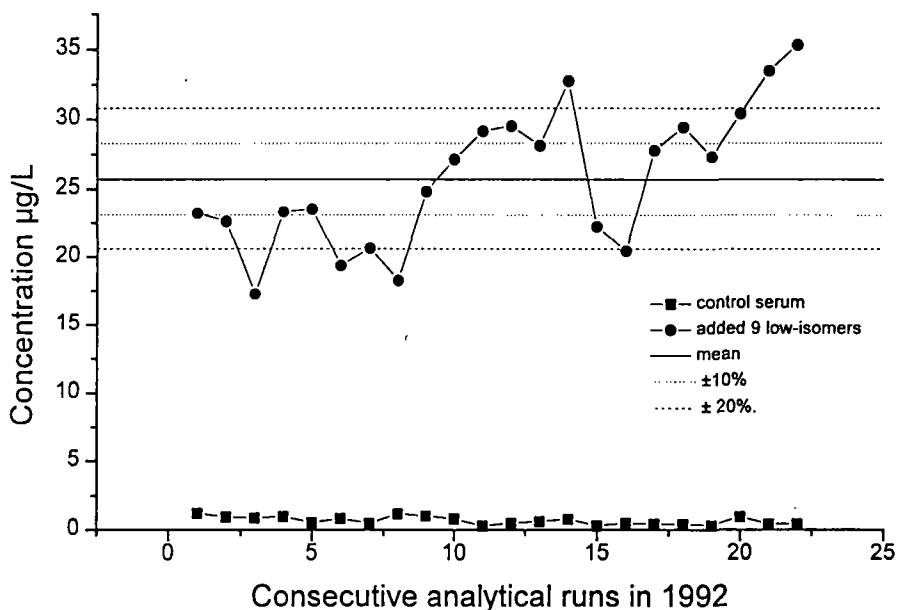
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run as blank control. This serum is spiked with individual PCB isomers: Low-PCB's (= PCB #008 + PCB #018 + PCB #028 + PCB #033+ PCB #044 + PCB #047 + PCB #066 + PCB #074 +PCB #101), and other isomers PCB #060, PCB #105, PCB #118, PCB #128, PCB #138, PCB #153, PCB #156, PCB #171, PCB #180, PCB #183 and PCB #189. These individual PCB isomers are purchased from Ultra Scientific Inc. (USA), Promochem GmbH (Germany), Ehrenstorfer (Germany), and CIL, Cambridge Isotope Laboratories (USA).

### 3. Results and discussion

A control chart of the sum concentration of the lower chlorinated 9 isomers is given in Fig. 1 as an example from the year 1992. We keep record on the new standard solutions, new lot of serum, changes in chromatography (e.g. new columns, service etc.).

Fig. 1. Internal quality control chart of , the sum concentrations of the low-PCBs.



The individual PCB isomer results for consecutive analytical runs are given in Table 1.

Table 1. Internal quality control results for individual isomers (N=8).

PCB #	Target (µg/L)	Mean	Med	Min	Max	S.D.	CV%
<b>Low-PCB's</b>	22.2	21.0	21.6	17.3	20.6	2.5	12
PCB #008	2.4	2.1	2.2	1.5	2.5	0.3	14
PCB #018	2.7	2.4	2.4	2.0	2.9	0.4	17
PCB #028	2.6	2.5	2.6	1.7	3.1	0.5	20
PCB #033	2.3	2.1	2.2	1.7	2.5	0.3	14
PCB #044	2.3	1.8	1.9	1.4	2.0	0.2	11
PCB #047	2.4	2.3	2.3	1.9	2.7	0.3	13
PCB #066	2.6	2.3	2.3	1.9	2.6	0.2	9
PCB #074	2.5	2.2	2.3	1.9	2.7	0.3	14
PCB #101	2.4	2.1	2.0	1.5	2.6	0.4	19
<b>High-PCB's</b>	22.8	19.6	20.1	13.3	24.9	4.1	21
PCB #060	2.0	1.9	1.7	1.6	3.0	0.5	26
PCB #105	2.3	2.1	2.2	1.3	3.2	0.6	28
PCB #118	2.3	2.4	2.3	1.7	3.5	0.6	25
PCB #128	2.1	1.3	1.3	0.8	2.0	0.4	31
PCB #138	2.4	1.9	1.9	1.2	2.5	0.4	21
PCB #153	2.3	1.9	1.9	1.4	2.5	0.4	21
PCB #156	2.5	1.4	1.6	0.4	2.2	0.7	50
PCB #171	2.4	1.5	1.5	1.0	2.1	0.4	27
PCB #180	2.0	2.0	2.1	1.2	2.6	0.6	30
PCB #183	2.5	2.1	1.9	1.6	2.8	0.5	24
<b>Control</b>		0.9	0.9	0.5	1.2	0.3	33

We believe, that our internal quality assurance scheme maintains and demonstrates acceptable precision. For the assessment of analytical trueness, we have also participated in external quality assurance schemes. In the Centers for Disease Control<sup>(6)</sup>, quality assessment scheme three laboratories analyzed serum pools from goats fed with different technical Aroclors, using capillary gas chromatography with electron capture detection. Data indicated good agreement among the laboratories for total PCBs. Congeners PCB#66, PCB#74, PCB#105 and PCB#118 showed persistent difference among the laboratories.

We also participated the: "Study on the quality of methods for the simultaneous determination of toxicologically relevant PCB congeners occurring in foods" organized by IUPAC (International Union of Pure and Applied Chemistry) (7). Laboratories (N=17) analyzed PCB congeners in hexane (individual congener concentrations varied from about

6-200 ng/mL). We had good agreement (compared to the overall mean) with following congeners: PCB#18, PCB#28, PCB#37, PCB#66, PCB#74, PCB#114, PCB#128, PCB#138, PCB#153, PCB#156, PCB#167, PCB#183. Our results deviated most with congeners: PCB#105, PCB#118, PCB#170, PCB#189.

We have also participated successfully in the German ("Deutsche Gesellschaft für Arbeitsmedizin und Umweltmedizin E.V.") quality control rounds, in which 19 laboratories analyzed serum specimens with overall means of concentrations of 1.2-2.8 µg/L (environmental) and 21.-4.4 µg/L (occupational) the isomers PCB#28, PCB#52, PCB#101, PCB#138, PCB#153 and PCB#180.

## 4. References

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