

## RELATIVE COMPARISON OF COMMERCIALLY AVAILABLE PCB STANDARDS

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### Introduction

In the dioxin analysis, it has been determined that twelve kinds of co-planer PCBs (Co-PCBs) which have a Toxicity Equivalent Factor (TEF) as designated by WHO (1998) are to be analyzed. As a rule, analytical standards are used in this method, but in any case this is a comparative method, and analytical standards are an essential necessity. Regarding the absolute concentration of these target compounds in analytical standards, it is nearly impossible for users to verify "true values", but it is possible to compare the difference in concentration based on supplier, product number and lot number. In the present study, the results of comparing concentrations of commercially available Co-PCB standards are reported.

### Method

The Co-PCB standard products analyzed in this study are shown in Table 1. Ampoules of standards were opened and diluted to obtain a concentration of 25-50pg/ $\mu$ L for each compound. Equivalent quantities of twelve kinds of <sup>13</sup>C-Co-PCB internal standards were added, and HRGC/HRMS analyses were carried out. HRGC/HRMS measurement mass (m/z) are shown in Table 2. Because in order to get many data points for each peak, data sampling times for Native, <sup>13</sup>C, lock mass and lock mass monitor were set at 45, 45, 30 and 30 msec respectively (cycle time = 200msec). Traceable or certified volumetric glassware and syringes were used. However, because products were not directly assayed, there is some degree of "uncertainty" in the measurement results regarding preparation/dilution (of course GC/MS measurement) after opening ampoules.

### Results

In Table 3, the analytical results for each compound from each supplier are shown. Average RRF values shown are based on peak area and concentration for both Native and <sup>13</sup>C isomers after analyzing each solution 5 time injections. As an example, in Table 4, results of five analyses of supplier "D's" products are shown. The difference between "(1) Average RRF" of each supplier's standards and "(2) Overall Average" was within a range of 0.00 ~14.29% (Table 5).

## ANALYSIS II - POSTER

Table 1. List of suppliers, product name or number and Lot No's of analyzed standards.

| ID   | Name of Suppliers              | Product Name or Product Number (Lot Number) |                       |
|------|--------------------------------|---|-----------------------|
| A-1  | AccuStandard                   | C-WHO-01-25X(B0060180)                      |                       |
| A-2* | AccuStandard                   | C-077S (A7060164)                           | C-126S (A9120285)     |
|      |                                | C-081S (A8120299)                           | C-156S (A9040361)     |
|      |                                | C-105S (A7030330)                           | C-157S (A7010161)     |
|      |                                | C-114S (A9100343)                           | C-167S (075-194)      |
|      |                                | C-118S (A9070209)                           | C-169S (A9050207)     |
|      |                                | C-123S (A7090117)                           | C-189S (B0040112)     |
| A-3* | AccuStandard                   | C-077S-TP (11309-077)                       | C-126S-TP (11309)     |
|      |                                | C-081S-TP (052-193)                         | C-156S-TP (052-262)   |
|      |                                | C-105S-TP (11309-105)                       | C-157S-TP (11309-157) |
|      |                                | C-114S-TP (052-221)                         | C-167S-TP (012-207)   |
|      |                                | C-118S-TP (052-224)                         | C-169S-TP (024-163)   |
|      |                                | C-123S-TP (052-219)                         | C-189S-TP (052-298)   |
| B*   | Dr.Ehrenstorfer                | #77 (00519IO)                               | #126 (91129IO)        |
|      |                                | #81 (90108IO)                               | #156 (00505IO)        |
|      |                                | #105 (00328CY)                              | #157 (00228IO)        |
|      |                                | #114 (00218IO)                              | #167 (00229IO)        |
|      |                                | #118 (90616IO)                              | #169 (90702CY)        |
|      |                                | #123 (90713IO)                              | #189 (00118IO)        |
| C    | Cambridge Isotope Laboratories | WHO Coplanar AND MONO-ORTHO PCBs (PR-11167) |                       |
| D    | WELLINGTON LABORATORIES        | BP-MXJ (BPMXJ0798)                          |                       |

\* : mixed after dilution of individual compounds

Table 2. Measurement mass (m/z) by HRGC/HRMS.

| Congener Name | Native   | <sup>13</sup> C |
|---------------|----------|-----------------|
| TeCBs         | 291.9194 | 303.9597        |
| PeCBs         | 325.8804 | 337.9207        |
| HxCBs         | 359.8415 | 371.8817        |
| HpCBs         | 393.8025 | 405.8428        |

## ANALYSIS II - POSTER

Table 3. Comparison of average of analytical results for each isomer (CV's are in parenthesis).

| Name of Compounds            | (1) Average RRF |                |                |                |                |                | (2) Overall Average |
|------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|---------------------|
|                              | A-1             | A-2            | A-3            | B              | C              | D              |                     |
| 3,4,4',5'-TeCB (#81)         | 1.18<br>(0.75)  | 1.23<br>(0.93) | 1.23<br>(0.37) | 1.45<br>(0.73) | 1.21<br>(0.55) | 1.27<br>(0.13) | 1.26<br>(7.50)      |
| 3,3',4,4'-TeCB (#77)         | 1.20<br>(0.93)  | 1.23<br>(0.85) | 1.32<br>(1.02) | 1.27<br>(0.67) | 1.50<br>(0.58) | 1.30<br>(0.51) | 1.30<br>(8.10)      |
| 2,3,4,4',5'-PeCB (#123)      | 1.23<br>(0.77)  | 1.24<br>(0.87) | 1.32<br>(0.38) | 1.28<br>(0.77) | 1.27<br>(0.26) | 1.30<br>(0.65) | 1.27<br>(2.64)      |
| 2,3',4,4',5'-PeCB (#118)     | 1.19<br>(0.49)  | 1.21<br>(0.54) | 1.24<br>(0.39) | 1.30<br>(0.55) | 1.32<br>(0.36) | 1.29<br>(0.30) | 1.26<br>(4.21)      |
| 2,3,4,4',5'-PeCB (#114)      | 1.21<br>(0.44)  | 1.24<br>(0.59) | 1.25<br>(0.67) | 1.24<br>(0.26) | 1.23<br>(0.54) | 1.27<br>(0.74) | 1.24<br>(1.71)      |
| 2,3,3',4,4'-PeCB (#105)      | 1.24<br>(0.76)  | 1.23<br>(0.98) | 1.37<br>(0.75) | 1.14<br>(0.38) | 1.25<br>(0.45) | 1.32<br>(0.55) | 1.26<br>(6.18)      |
| 3,3',4,4'-PeCB (#126)        | 1.20<br>(0.52)  | 1.24<br>(0.22) | 1.28<br>(0.62) | 1.24<br>(0.48) | 1.40<br>(0.44) | 1.28<br>(0.31) | 1.27<br>(5.42)      |
| 2,3',4,4',5,5'-HxCB (#167)   | 1.22<br>(0.50)  | 1.30<br>(0.66) | 1.28<br>(0.44) | 1.23<br>(0.28) | 1.36<br>(0.30) | 1.31<br>(0.34) | 1.28<br>(4.01)      |
| 2,3,3',4,4',5'-HxCB (#156)   | 1.19<br>(0.57)  | 1.25<br>(0.60) | 1.24<br>(0.41) | 1.19<br>(0.40) | 1.18<br>(0.28) | 1.23<br>(0.41) | 1.21<br>(2.43)      |
| 2,3,3',4,4',5'-HxCB (#157)   | 1.19<br>(0.42)  | 1.45<br>(0.59) | 1.27<br>(0.75) | 1.26<br>(0.33) | 1.38<br>(0.26) | 1.25<br>(0.35) | 1.30<br>(7.35)      |
| 3,3',4,4',5,5'-HxCB (#169)   | 1.24<br>(0.51)  | 1.22<br>(0.36) | 1.27<br>(0.46) | 1.18<br>(0.29) | 1.30<br>(0.36) | 1.32<br>(0.56) | 1.25<br>(4.12)      |
| 2,3,3',4,4',5,5'-HpCB (#189) | 1.19<br>(0.48)  | 1.21<br>(0.59) | 1.23<br>(0.23) | 1.23<br>(0.60) | 1.31<br>(0.38) | 1.25<br>(0.48) | 1.24<br>(3.27)      |
| Average                      |                 |                |                |                |                |                | (4.74)              |

Notes:

(1) Average RRF : Coefficient of variations shown are based on average CV's after 5 injections of each supplier's product (refer to Table 4).

(2) Overall Average : Coefficient of variations are based on average values ((1) Average RRF) shown in the Table for A-1, A-2, A-3, B, C and D.

## ANALYSIS II -POSTER

Table 4. Analytical results for ID (D) (CV's are in parenthesis).

| Name of Compounds            | RRF of injection 1, 2, 3, 4 and 5 |             |             |             |             | Average |        |
|------------------------------|-----------------------------------|-------------|-------------|-------------|-------------|---------|--------|
|                              | Injection 1                       | Injection 2 | Injection 3 | Injection 4 | Injection 5 |         |        |
| 3,4,4',5'-TeCB (#81)         | -                                 | 1.28        | 1.27        | 1.27        | 1.27        | 1.27    | (0.13) |
| 3,3',4,4'-TeCB (#77)         | -                                 | 1.31        | 1.29        | 1.30        | 1.31        | 1.30    | (0.51) |
| 2',3,4,4',5'-PeCB (#123)     | 1.29                              | 1.30        | 1.30        | 1.31        | 1.31        | 1.30    | (0.65) |
| 2,3',4,4',5'-PeCB (#118)     | 1.29                              | 1.29        | 1.29        | 1.29        | 1.30        | 1.29    | (0.30) |
| 2,3,4,4',5'-PeCB (#114)      | 1.25                              | 1.28        | 1.27        | 1.27        | 1.27        | 1.27    | (0.74) |
| 2,3,3',4,4'-PeCB (#105)      | 1.31                              | 1.33        | 1.32        | 1.32        | 1.31        | 1.32    | (0.55) |
| 3,3',4,4'-PeCB (#126)        | 1.28                              | 1.28        | 1.28        | 1.29        | 1.28        | 1.28    | (0.31) |
| 2,3',4,4',5,5'-HxCB (#167)   | 1.30                              | 1.30        | 1.31        | 1.31        | 1.31        | 1.31    | (0.34) |
| 2,3,3',4,4',5'-HxCB (#156)   | 1.22                              | 1.22        | 1.23        | 1.23        | 1.22        | 1.23    | (0.41) |
| 2,3,3',4,4',5'-HxCB (#157)   | 1.24                              | 1.25        | 1.25        | 1.25        | 1.25        | 1.25    | (0.35) |
| 3,3',4,4',5,5'-HxCB (#169)   | 1.31                              | 1.31        | 1.33        | 1.32        | 1.32        | 1.32    | (0.56) |
| 2,3,3',4,4',5,5'-HpCB (#189) | 1.24                              | 1.25        | 1.25        | 1.25        | 1.25        | 1.25    | (0.48) |

- : data are not available

Table 5. Difference between the "(1) Average RRF" values of each supplier's standards and the "(2) Overall Average" RRF's for each compound (%).

| Name of Compounds            | ID   |       |      |       |       |      |
|------------------------------|------|-------|------|-------|-------|------|
|                              | A-1  | A-2   | A-3  | B     | C     | D    |
| 3,4,4',5'-TeCB (#81)         | 6.56 | 2.41  | 2.41 | 14.02 | 4.05  | 0.79 |
| 3,3',4,4'-TeCB (#77)         | 8.00 | 5.53  | 1.53 | 2.33  | 14.29 | 0.00 |
| 2',3,4,4',5'-PeCB (#123)     | 3.20 | 2.39  | 3.86 | 0.78  | 0.00  | 2.33 |
| 2,3',4,4',5'-PeCB (#118)     | 5.71 | 4.05  | 1.60 | 3.13  | 4.65  | 2.35 |
| 2,3,4,4',5'-PeCB (#114)      | 2.45 | 0.00  | 0.80 | 0.00  | 0.81  | 2.39 |
| 2,3,3',4,4'-PeCB (#105)      | 1.60 | 2.41  | 8.37 | 10.00 | 0.80  | 4.65 |
| 3,3',4,4'-PeCB (#126)        | 5.67 | 2.39  | 0.78 | 2.39  | 9.74  | 0.78 |
| 2,3',4,4',5,5'-HxCB (#167)   | 4.80 | 1.55  | 0.00 | 3.98  | 6.06  | 2.32 |
| 2,3,3',4,4',5'-HxCB (#156)   | 1.67 | 3.25  | 2.45 | 1.67  | 2.51  | 1.64 |
| 2,3,3',4,4',5'-HxCB (#157)   | 8.84 | 10.91 | 2.33 | 3.13  | 5.97  | 3.92 |
| 3,3',4,4',5,5'-HxCB (#169)   | 0.80 | 2.43  | 1.59 | 5.76  | 3.92  | 5.45 |
| 2,3,3',4,4',5,5'-HpCB (#189) | 4.12 | 2.45  | 0.81 | 0.81  | 5.49  | 0.80 |