

CHLORINATED DIOXIN AND DIBENZOFURAN LEVELS IN HUMAN BLOOD SAMPLES FROM  
VARIOUS COUNTRIES, INCLUDING VIETNAM, THE SOVIET UNION, THE UNITED  
STATES AND GERMANY

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ABSTRACT:

Dioxins and dibenzofurans have recently been found in all humans sampled, as techniques for isomer-specific identification in human tissue have improved. Blood provides an easily obtained tissue for analysis. With the techniques used here, 65 ML of whole blood is the minimum amount needed for a dioxin analysis and gravimetric determination of lipid, necessary to calculate body burden. We report, for the first time, population blood PCDD/F levels for various geographical regions of the USSR, Vietnam and the USA as well as the results of individual analyses of blood from Germany.

INTRODUCTION

During the past decade, human adipose tissue and milk from general population has been analyzed, in an isomer-specific fashion, for dioxins and dibenzofurans. Such information is of importance not only for health reasons but as a reflection of regional and global contamination with these toxic synthetic chemicals. Since humans are at the top of the food chain, they provide an excellent example of integration of dioxins and dibenzofurans in the environment.

With improvements in analytical technique, it has become possible to almost routinely measure dioxins and dibenzofurans in blood also. Therefore, we began collecting blood from various regions where little is known concerning human dioxin levels, such as the Soviet Union. In the USSR, an attempt was made to collect pooled blood from a wide geographical area, from European cities such as Moscow and also from Asian Siberia; from Novosibirsk, Irkutsk, and Biakal City. There is also great interest in areas where geographic variations have been reported within one country, such as Vietnam, an unusual situation, as noted in World Health Organization human milk studies. These will be compared to the USA and Germany. In the USA we pooled blood from 100 New York State residents from blood bank volunteers and performed one analysis. In Germany, 85 individual analyses were performed and the data presented in summary form. Other countries were sampled, and may be presented, if time is sufficient for analyses.

## RESULTS

The results available at the time of preparation of this manuscript are presented in table and graphical form in Table I and Figure I. Higher levels of PCDD/Fs in the American blood probably reflects the use of plasma, rather than whole blood, used for all other specimens. All results are presented on a lipid basis.

## CONCLUSIONS AND DISCUSSION

Differences can be noted in specific congeners between countries, as can total dibenzodioxin or total dibenzofuran levels and dioxin "toxic equivalents", calculated as "International" or US EPA toxic equivalents.

Evidence of variations in human tissue levels was most strikingly demonstrated previously in Vietnam samples from the north, with low adipose tissue PCDD/F levels, as compared to the south, with higher levels, from industry and, in some cases, probably phenoxyherbicide use. However, the widespread findings of dioxin human tissue contamination reflects industrial contamination and potential human health concerns.

The results from the cities in the USSR and from Vietnam are not available at the time of submission of this manuscript. They will be presented at *Dioxin 90*, as may data from several other countries, as time permits.

TABLE I

| PCDD/Fs in Blood from Various Countries |       |                              |              |                       |            |
|---|-------|------------------------------|--------------|-----------------------|------------|
| Congener                                | TEQ   | American Pool = 100 (plasma) | American TEQ | German N = 85 (whole) | German TEQ |
| 2,3,7,8,-TCDD                           | 1     | 5.2                          | 5.20         | 3.6                   | 3.60       |
| 1,2,3,7,8,-PeCDD                        | 0.5   | 21.0                         | 10.50        | 14.0                  | 7.00       |
| 1,2,3,4,7,8-HxCDD                       | 0.1   | 13.0                         |              |                       |            |
| 1,2,3,6,7,8-HxCDD                       | 0.1   | 84.0                         |              |                       |            |
| 1,2,3,7,8,9-HxCDD                       | 0.1   | 15.0                         |              |                       |            |
| Total HxCDD                             |       | 112.0                        | 11.20        | 81.1                  | 8.11       |
| 1,2,3,4,6,7,8-HpCDD                     | 0.01  | 187.0                        | 1.87         | 93.8                  | 0.94       |
| OCDD                                    | 0.001 | 1174                         | 1.17         | 595.9                 | 0.60       |
| 2,3,7,8-TCDF                            | 0.1   | 3.1                          | 0.31         | 2.5                   | 0.25       |
| 1,2,3,7,8-PeCDF                         | 0.05  | 2.8                          | 0.14         |                       |            |
| 2,3,4,7,8-PeCDF                         | 0.5   | 13.0                         | 6.50         | 36.8                  | 18.4       |
| (Total PeCDF)                           |       | 15.8                         |              |                       |            |
| 1,2,3,4,7,8-HxCDF                       | 0.1   | 15.0                         |              |                       |            |
| 1,2,3,6,7,8-HxCDF                       | 0.1   | 14.0                         |              |                       |            |
| 1,2,3,7,8,9-HxCDF                       | 0.1   | nd(1.2)                      |              |                       |            |
| 2,3,4,6,7,8-HxCDF                       | 0.1   | 3.6                          |              |                       |            |
| (Total Hx-CDF)                          |       | 32.6                         | 3.26         | 31.6                  | 3.16       |
| 1,2,3,4,6,7,8-HpCDF                     | 0.01  | 36.0                         |              |                       |            |
| 1,2,3,4,7,8,9-HpCDF                     | 0.01  | nd(1.8)                      |              |                       |            |
| (Total Hepta-CDF)                       |       | 36.0                         | 0.36         | 21.8                  | 0.22       |
| OCDF                                    | 0.001 | 4.2                          | 0.00         | 5.5                   | 0.01       |
| Total PCDDs                             |       | 1499.2                       | 29.94        | 788.40                | 20.25      |
| Total PCDFs                             |       | 91.7                         | 10.57        | 98.20                 | 3.64       |
| Total PCDD/PCDFs                        |       | 1590.9                       | 40.51        | 886.60                | 23.89      |