

**CONCENTRATIONS OF PCDDs AND PCDFs IN SOIL SAMPLES FROM
SOUTHERN MISSISSIPPI, USA**

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ABSTRACT

We analyzed 36 soil samples from southern Mississippi. The results are reported both on dry weight and organic carbon content as determined by loss of ignition ("LOI") bases. In all samples the octa CDD dominated, however, the variation was more than a thousand fold. The I-TEQ (d.w.) varied by a factor of more than 200. In all samples the PCDDs were found at higher concentrations than the PCDFs; in six of the samples the ratio between these two groups of compounds was above 100.

INTRODUCTION

The concentrations of PCDDs and PCDFs in various matrices in southern Mississippi have recently been studied. Results from the analysis of food samples (1) and sediments (2) have been reported. In another paper, we reported on 36 soil and 14 pine needle samples (3).

Most soil data in the literature have been reported on a dry weight basis (d.w.). Where, however, the compounds of interest are highly lipophilic and probably formed or bound to organic particles, like PCDDs and PCDFs, the results can be reported based on the organic carbon content as determined by the loss of ignition.

Here, we report the concentrations of octa CDD and I-TEQ in these 36 soil samples, based both on d.w. and LOI. In addition, we also discuss the ratio of Σ PCDDs/ Σ PCDFs (the "D/F ratio") in these 36 soil samples.

MATERIALS AND METHODS

The soil samples were collected from eight counties in southern Mississippi: George (N=1), Lamar (N=5), Greene (N=5), Forrest (N=5), Jackson (N=5), Jones (N=5), Perry (N=5), and Wayne (N=5). The sampling and analytical procedures have been described elsewhere (3).

RESULTS AND DISCUSSION

Most Cl_4 - Cl_8 PCDDs and PCDFs were detected in all 36 samples. 2,3,7,8-Tetra CDD was identified in 17 of the 36 samples at a detection limit of 0.02 - 0.05 $\mu\text{g/g}$ d.w. or 0.3 - 2.4 $\mu\text{g/g}$ LOI. The highest concentration was in a sample from Wayne County (T-8002) where we found a concentration of 1.2 $\mu\text{g/g}$ d.w. or 36 $\mu\text{g/g}$ LOI. In this sample the contribution of 2,3,7,8-tetra CDD to the sum of all tetra CDDs was approximately 75%. In another sample (T-6005) from Jones County (0.41 $\mu\text{g/g}$ d.w. or 11 $\mu\text{g/g}$ LOI), the 2,3,7,8-tetra CDD was the dominant isomer, contributing almost 100%. The dominance of 2,3,7,8-tetra CDD has been associated with production and use of the herbicide 2,4,5-T. 2,3,7,8-Tetra CDF was detected in 32 of the 36 samples at a detection limit of 0.01 - 0.04 $\mu\text{g/g}$ d.w. or 0.29 - 2.1 $\mu\text{g/g}$ LOI.

Hexa-, hepta- and octa CDDs as well as hepta- and octa CDFs were detected in all 36 samples, with octa CDD being the dominant congener, see Table 1. The values of octa CDD ranged between 11 and 15 000 $\mu\text{g/g}$ d.w. The same variation was found for the octa CDD values on a LOI-basis (400 - 430 000 $\mu\text{g/g}$). The highest octa CDD d.w. was collected in Perry County near an oxbow (T-7003: 15 000 $\mu\text{g/g}$), while the highest octa CDD LOI was in the De Soto National Forest near Bogue Homa Creek (T-6004: 430 000 $\mu\text{g/g}$).

The D/F ratio was between 5 - 40 for 23 of the 36 samples. In four samples (T-5005, T-6002, T-7005 and T-8002) the D/F ratio was below 5; the lowest in sample T-8002 (D/F = 1.3). The PCDF pattern seems more similar to a PCB pattern than to an incineration pattern. This sample also has the highest 2,3,7,8-tetra CDD, as discussed above.

Nine samples had a D/F ratio above 40 and six of these were above 100; the maximum was 1600. There seems to be a correlation between high concentrations of octa CDD and a high D/F ratio, see Table 1. This is in agreement with the sediment samples from the same region (2). For comparison, the D/F-ratio for four commercial pentachlorophenols from the US are 0.9, 2.4, 4.3 and 13.8 (4).

It is an interesting observation that soil samples taken at baseline sites were found to have concentrations of octa CDD in the range of 13 000 to 15 000 $\mu\text{g/g}$ d.w. Similar results have been discussed in other papers for this part of the State of Mississippi (5).

These concentrations of octa CDD are also similar to the concentrations found in sediment samples in the Leaf - Chickasawhay - Pascagoula Rivers drainage area in the same part of the State of Mississippi. Further investigation, including multivariate data analyses and hierarchical cluster analyses, will be performed to identify the source(s) of this contamination.

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Table 1: Results from the analysis of soil samples

| County | Sample ID | OctaCDD pg/g d.w. | OctaCDD pg/g LOI | TEQ pg/g d.w. | TEQ pg/g LOI | D/F ratio |
|---------|-----------|----------------------|---------------------|------------------|-----------------|--------------|
| George | T-1001 | 36 | 790 | 0.164 | 3.63 | 16 |
| Lamar | T-2001 | 110 | 1600 | 0.636 | 9.19 | 14 |
| | T-2006 | 170 | 2800 | 0.554 | 9.15 | 17 |
| | T-2007 | 500 | 7200 | 1.42 | 20.3 | 30 |
| | T-2008 | 140 | 4000 | 0.363 | 10.3 | 33 |
| | T-2009 | 37 | 2000 | 0.146 | 7.74 | 26 |
| Greene | T-3001 | 51 | 1400 | 0.2 | 5.33 | 79 |
| | T-3005 | 410 | 8400 | 1.03 | 21.3 | 110 |
| | T-3006 | 3500 | 60000 | 5.26 | 90.3 | 410 |
| | T-3007 | 36 | 920 | 0.18 | 4.59 | 15 |
| | T-3008 | 75 | 3600 | 0.372 | 17.8 | 9.7 |
| Forrest | T-4001 | 4300 | 88000 | 10.9 | 223 | 33 |
| | T-4002 | 260 | 2500 | 1.12 | 10.6 | 9.8 |
| | T-4003 | 200 | 3900 | 1.05 | 20 | 9.7 |
| | T-4004 | 450 | 7400 | 0.934 | 15.2 | 38 |
| | T-4005 | 110 | 2200 | 0.254 | 4.98 | 28 |
| Jackson | T-5001 | 98 | 2200 | 0.426 | 9.56 | 19 |
| | T-5002 | 67 | 1600 | 0.384 | 9.08 | 12 |
| | T-5003 | 34 | 700 | 0.311 | 6.31 | 6.9 |
| | T-5004 | 29 | 400 | 0.373 | 5.18 | 5.3 |
| | T-5005 | 20 | 530 | 0.265 | 7.07 | 4 |
| Jones | T-6001 | 260 | 5800 | 0.899 | 20.3 | 23 |
| | T-6002 | 4000 | 52000 | 20.3 | 263 | 3 |
| | T-6003 | 590 | 8000 | 1.31 | 17.7 | 12 |
| | T-6004 | 13000 | 430000 | 14.3 | 474 | 650 |
| | T-6005 | 1200 | 32000 | 2.81 | 72.9 | 14 |
| Perry | T-7001 | 7100 | 200000 | 8.09 | 232 | 1600 |
| | T-7002 | 1200 | 9500 | 2.75 | 22.3 | 66 |
| | T-7003 | 15000 | 180000 | 22.6 | 279 | 150 |
| | T-7004 | 140 | 4200 | 0.516 | 15.7 | 11 |
| | T-7005 | 18 | 750 | 0.172 | 7.11 | 2.6 |
| Wayne | T-8001 | 39 | 1200 | 0.173 | 5.35 | 14 |
| | T-8002 | 210 | 6500 | 7.15 | 221 | 1.8 |
| | T-8003 | 2400 | 37000 | 3.41 | 53.1 | 190 |
| | T-8004 | 11 | 780 | 0.0828 | 5.7 | 17 |
| | T-8005 | 880 | 7700 | 1.66 | 14.5 | 63 |