

LEVELS OF 2,3,7,8-TCDD IN BLOOD FROM AGENT ORANGE SPRAYED LOCATIONS IN VIETNAM

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Introduction

Dioxins are of special interest in Vietnam because the largest known contamination with 2, 3, 7, 8-TCDD occurred in Vietnam with the spraying of the herbicide Agent Orange between 1962 and 1971. This phenoxyherbicide, half 2, 4-dichlorophenoxyacetic acid (2, 4-D) and half 2, 4, 5-trichlorophenoxyacetic acid (2, 4, 5-T), was sprayed primarily as a defoliant over approximately 15 % of the south of Vietnam; it was not used in the north of Vietnam.¹

Defoliation of the jungle is not in question. However, questions about health arose from this application of TCDD contaminated herbicide. In Vietnam, concern about possible Agent Orange health effects includes liver cancer, hydatidiform mole and choriocarcinoma, and birth defects. In US Vietnam veterans, diabetes and cancer have been found associated with elevated TCDD blood levels and also to time served in South East Asia for cancer.²⁻⁴ Since health damage from dioxin cannot occur without dioxin exposure, we elected to study levels of TCDD in residents of Vietnam. Other toxic chemicals which could cause illness were tested for in some cases. This study extends previous findings of TCDD levels in humans, food, wildlife and the environment beginning with the first US-Vietnamese work from the 1970s to the present with 8 new locations in Vietnam.

Materials and Methods

We (JDC, HTQ, and AS) collected specimens of human blood, milk, adipose tissue, food, wildlife and environmental samples between 1984 and 2004 for TCDD, and 1986-1988 for DDT and HCB, throughout Vietnam; from the non-sprayed north of the country to Agent Orange sprayed southern parts of the country.⁵⁻⁷ Sampling was intentionally biased to collect specimens from potentially contaminated areas. No attempt was made to perform a representative sampling of the population, of food or of wildlife. This study reports recent findings of blood levels in people living in 8 Agent Orange sprayed locations. Samples were kept frozen until delivery to the laboratories which performed the subsequent analyses. Analysis for the samples we report here was done in Hamburg, Germany. The analytic methods have been described elsewhere.⁸

Results and Discussions

In Table 1, we report 143 blood dioxin analyses from 8 newly sampled regions where Agent Orange was heavily sprayed and hence where exposure to Agent Orange and its TCDD contaminant were likely to have occurred; An Tay Commune, Ben Cat District, Binh Duong Province; Phu My Hung Commune, Cu Chi District, Ho Chi Minh City Province; Binh My Commune, Tan Uyen District, Binh Duong Province; Truong Dong Commune, Hoa Thanh District, Tay Ninh Province; Tra Noc Commune, Can Tho City, Can Tho Province; Can Gio District, Ho Chi Minh City Province; Dien Khanh District, Khanh Hoa Province and Phu Cat District, Binh Dinh Province. Total TEQ varies from 7.7 to 264 ppt. Of this total, TCDD contributes 0.5 to 180 ppt.

In Binh My, (Figure 1), a substantial contribution of TEQ is from PCDFs, some from other PCDDs, and little from TCDD. The elevated TEQ could, without congener specific analysis, have erroneously been attributed to TCDD. In Tra Noc, TCDD contributes a majority of the TEQ in some persons but in others a substantial amount of the TEQ is from PCDDs other than TCDD, with some contribution from PCDFs and dioxin like PCBs. The highest TEQ level seen in Tra Noc was 264 ppt, primarily from TCDD. By way of comparison, the highest TCDD level found

recently in blood from south of Vietnam residents was slightly over 400 ppt.⁹ Typical blood TCDD levels in Vietnam are about 2 ppt in the South and 1 ppt in the North.

Despite heavy Agent Orange spraying, some blood samples did not show elevated TCDD whereas others did. So exposure to TCDD from Agent Orange was best determined by blood dioxin measurement rather than spraying history. Some locations such as Tra Noc show considerable variation in blood TEQ levels in different individuals whereas others, such as Binh My, show much less variation. This could not be predicted from Agent Orange spraying records without dioxin blood analyses from individual residents.

Health studies attempting to find associations between TCDD from Agent Orange need to take into account total TEQ from all dioxins and dioxin like compounds and also must consider other possible causal associations with toxic chemicals such as DDT or HCB and with other possible causes for illnesses.

Blood TEQ levels from An Tay Commune, Ben Cat District, Binh Duong Province are shown in Figure 2. While total TEQ ranges from just over 10 ppt and as high as a bit over 60 ppt, here, atypically, PCDF frequently contributes to a great extent to the total TEQ and TCDD contributes relatively little. These findings are consistent with metal sintering or reclamation nearby contaminating persons directly or contaminating their food. Thus, while we have previously documented marked elevation of TCDD from Agent Orange in humans, in other locations such as An Tay, we note elevated TEQ but to a large extent from PCDFs rather than TCDD. In previous studies in Vietnam, we have also found HCH, HCB, DDT and metabolites and elevated PCBs (the latter in one location only) in humans and in food.¹⁰ There is no doubt elevated TCDD from Agent Orange still exists in Vietnam. However, it is important in considering health consequences also to consider other chemicals which may contribute to illness. Although our exposure studies have documented elevated TCDD in humans, food and the environment, epidemiology studies to determine the health consequences of Agent Orange exposure are strongly indicated.

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Table 1: Summary of blood dioxin analysis in 8 locations in Vietnam (pg/g or ppt, lipid)

An Tay Commune, N=20			
	Minimum	Median	Maximum
2,3,7,8-Tetra-CDD (ppt lipid)	0.8	2.2	4.6
TEQ PCDD	3.9	9.9	15.7
TEQ PCDF	4.5	11.3	44.9
TEQ coplanar PCBs	0.9	1.8	5.0
TEQ mono-ortho PCBs	0.7	1.6	4.9
TEQ total	12.9	28.6	63.3

Phu My Hung Commune, N=20			
	Minimum	Median	Maximum
2,3,7,8-Tetra-CDD	2.4	7.3	13.2
TEQ PCDD	6.9	12.6	17.9
TEQ PCDF	6.1	8.5	27.4
TEQ coplanar PCBs	0.8	2.9	6.9
TEQ mono-ortho PCBs	1.3	2.3	4.8
TEQ total	20.5	34.1	53.7

Truong Dong Commune, N=20			
	Minimum	Median	Maximum
2,3,7,8-Tetra-CDD	0.5	1.5	3.3
TEQ PCDD	2.7	7.5	19.4
TEQ PCDF	1.7	3.6	8.1
TEQ coplanar PCBs	0.9	2.2	5.4
TEQ mono-ortho PCBs	0.2	1.5	5.3
TEQ total	7.7	17.8	39.0

Binh My Commune, N=12			
	Minimum	Median	Maximum
2,3,7,8-Tetra-CDD	2.2	4.2	10.2
TEQ PCDD	12.8	26.5	38.4
TEQ PCDF	19.0	39.6	52.0
TEQ coplanar PCBs	1.6	2.5	6.9
TEQ mono-ortho PCBs	1.3	3.0	16.2
TEQ total	41.2	79.8	107.9

Tra Noc Commune, N=12			
	Minimum	Median	Maximum
2,3,7,8-Tetra-CDD	13.6	30.9	180
TEQ PCDD	6.3	22.4	44
TEQ PCDF	2.9	6.2	17
TEQ coplanar PCBs	1.4	3.8	19
TEQ mono-ortho PCBs	1.4	5.3	23
TEQ total	32	81	264

Can Gio District, N=20			
	Minimum	Median	Maximum
2,3,7,8-Tetra-CDD	1.7	5.5	13.0
Dien Khanh District, N=20			
2,3,7,8-Tetra-CDD	n.d.(1.0)	1.5	3.3

Phu Cat District, N=19			
	Minimum	Median	Maximum
2,3,7,8-Tetra-CDD	n.d.(1.0)	2.8	9.7

Figure 1: TEQs of PCDDs, PCDFs, and PCBs from individuals in Binh My Commune, Tan Uyen District, Binh Duong Province and Tra Noc Commune, Can Tho City, Can Tho Province. (pg/g or ppt lipid)

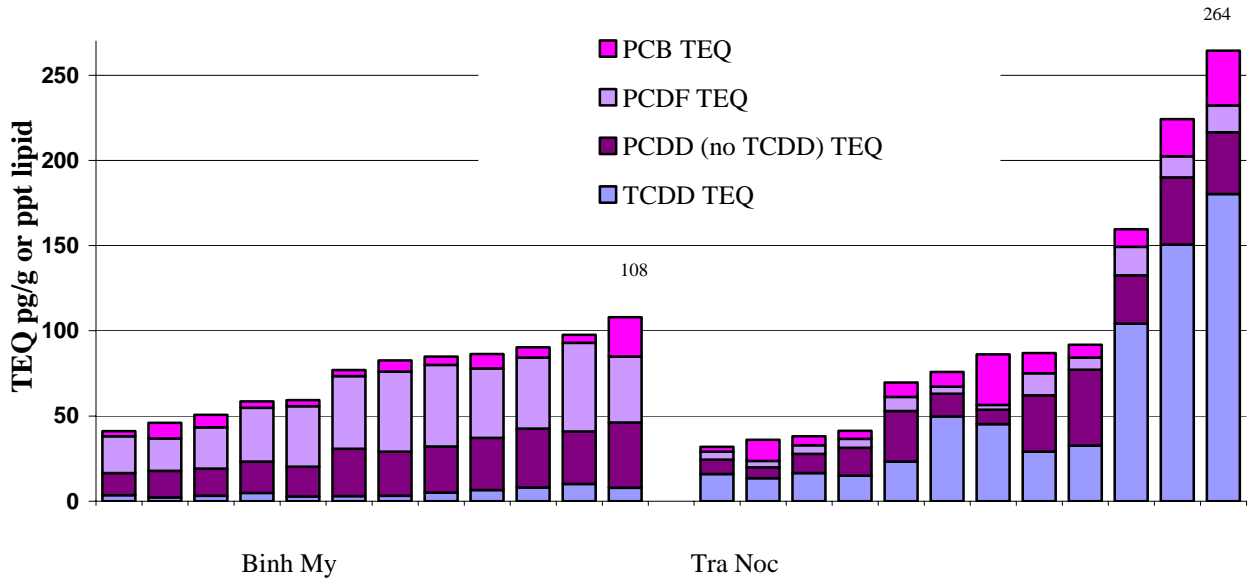


Figure 2: Blood TCDD, PCDD, PCDF, and PCBs TEQ in An Tay Commune, Ben Cat District, Binh Duong Province. (pg/g or ppt lipid)

