

## DIOXIN AND DIBENZOFURAN LEVELS IN ADIPOSE TISSUE FROM AN OFFICE WORKER WORKING NEAR THE SEVESO, ITALY DIOXIN INCIDENT

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### ABSTRACT

Adipose tissue from an autopsy performed in 1989 was analyzed for dioxins and dibenzofurans. The subject was a male who had lived and worked for about 9 months near Seveso Zone A, the area most contaminated by 2,3,7,8-TCDD in July, 1976, after a chlorophenol plant chemical explosion. This is the second known autopsy and dioxin analysis of a Seveso resident following the dioxin-related explosion of 1976. The person, a resident of Rome, worked at an office near Zone A, starting six months after the incident of July, 1976. The TCDD level was 10 ppt, lipid basis, which is somewhat above the U.S. and Canadian mean of 5 ppt.

### INTRODUCTION

In the summer of 1976, an explosion in a trichlorophenol reactor at the Icmesa factory near Seveso, Italy, distributed a cloud of 2,3,7,8-TCDD-contaminated material over a portion of the nearby populated area. Zone A was the zone of highest contamination, followed by Zone B and Zone R.<sup>1</sup> One autopsy was performed on a 55 year-old woman who died of pancreatic cancer (for which no causal linkage to dioxin has been established) 5 months after the incident. Her adipose tissue was analyzed for 2,3,7,8-TCDD, and contained 1,840 ppt on a wet weight basis, as reported by Reggiani.<sup>2</sup> A second series of TCDD analyses were reported on other exposed persons from Seveso from blood analyses performed at the Centers for Disease Control. On a lipid basis, values up to 56,000 ppt of 2,3,7,8-TCDD were reported.<sup>3,4</sup>

This paper reports a third set of human tissue data from the Seveso incident. Rather than addressing the population who lived in the cloud contaminated area, it analyzes an adult male office worker who worked 9 months near Seveso Zone A, beginning 6 months after the incident. He recently died with a small anaplastic carcinoma in the lower portion of the right lung, after undergoing chemotherapy for hepatocarcinoma of unknown etiology. Multiple organs were taken at the autopsy for examination. This paper reports complete dioxin and dibenzofuran levels, including 2,3,7,8-TCDD, from adipose tissue obtained from this worker 13 years after the incident. The issue of office worker safety near a highly contaminated work area is the rationale for the analysis of the adipose tissue.

### METHODS

Analytic methods have been previously reported,<sup>5</sup> and are similar to those used in the two WHO interlaboratory comparison studies of dioxin measurement in human milk and blood and the US Environmental Protection Agency-National Institutes of Health interlaboratory study of human adipose tissue, in which the dioxin laboratory successfully participated.<sup>6</sup>

### RESULTS

The data is presented in Table I and several graphs. The TCDD level is 10 ppt which compares with the US general population mean of 5 ppt.<sup>7</sup> Other congeners are unremarkable, and can be compared to the US human adipose tissue levels. The total dioxin and dibenzofuran toxic equivalents, using the International Dioxin Toxicity Equivalency Factors,<sup>8,9</sup> are 55 ppt for this patient. This compares with 46 ppt for the US population; however, TCDD contributes a total of only 10 ppt TEQ in this Italian office worker. Of interest is the fact that using International TEQs, total dioxin toxicity is the same - 29 ppt - in this patient as the American mean, whereas the dibenzofuran TEQ is higher.

## DISCUSSION

A TCDD level of 10 ppt was found in a male patient who recently died of cancer and who worked for less than one year near the Seveso, Italy heavily dioxin-contaminated area. This level may be considered to be within the general population range, at least in the United States. His adipose tissue TCDD level is far below that of a woman who lived in this contaminated area, which was previously reported. However, this does not preclude some elevation above Italian background, which is not known at the present time. Moreover, this level is far below the very high TCDD blood levels, from archived blood taken immediately following the incident, where levels of up to 56,000 ppt were reported.<sup>4</sup>

No causal link between dioxin level and the patient's cancer is implied by this paper. At most, the current findings are consistent with a relatively small intake of TCDD from the Seveso incident in this patient, assuming first order kinetics, a one compartment model, and a TCDD half-life of between five and ten years. This subject's TCDD value is similar in general to U.S. It is possible to calculate back to 1976 to determine what the TCDD level might have been, assuming a mean for Italian adults of 5 ppt. If one assumes a 5-year half-life, first order kinetics, a single compartment model, and 2 to 2.5 half-lives, a 25 to 35 ppt TCDD blood level might have been found immediately after exposure. Such a level would be considered elevated. However, assuming a 10-year half-life and 1 half-life decay in levels, we would estimate about a 15 ppt level in 1976-1977, which is but slightly elevated, as compared to the U.S. mean for TCDD. Considering other recent studies including Poiger's and Ryan's on half-lives,<sup>10,11</sup> excretion of toxic chemicals is more rapid sooner after exposure than later. Thus, this worker's potential exposure to TCDD and related chemicals may have been even higher than we have calculated with our model.

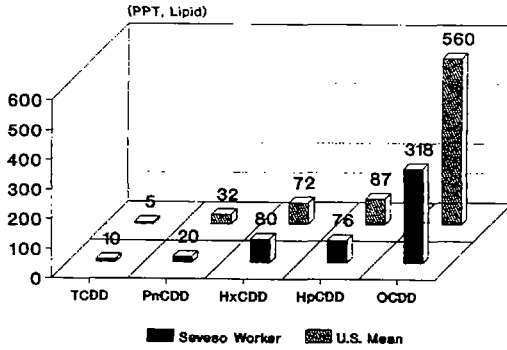
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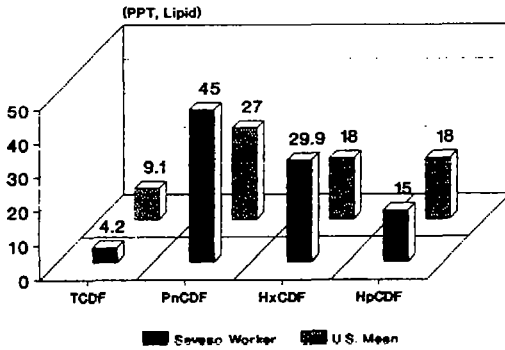
TABLE I Dioxin and Dibenzofuran Levels in Adipose Tissue PPT Lipid Basis					
Congener	TEF <sup>7,8</sup>	Seveso, Worker Value	Seveso TEQ	American Mean Value <sup>6</sup>	American Mean TEQ
2,3,7,8-TCDF	0.1	4.2	0.42	9.1	0.91
2,3,7,8-TCDD	1	10	10.00	5.0	5.00
2,3,4,7,8-PnCDF	0.5	45	22.50	27	13.50
1,2,3,7,8-PnCDD	0.5	20	10.00	32	16.00
1,2,3,4,7,8/1,2,3,6,7,8-HxCDF	0.1	25	2.50	NA	NA
2,3,4,6,7,8-HxCDF	0.1	4.9	0.49	NA	NA
Total HxCDF		29.9	2.99	18	1.8
1,2,3,4,7,8/1,2,3,6,7,8-HxCDD	0.1	66	6.60	NA	NA
1,2,3,7,8,9,-HxCDD	0.1	14	1.40	NA	NA
Total HxCDD		80	8	72	7.2
1,2,3,4,6,7,8-HpCDF	0.01	15	0.15	18	0.18
1,2,3,4,6,7,8-HpCDD	0.01	76	0.76	87	.87
OCDD	0.001	318	0.32	560	0.56
OCDF	0.001			60	.06
Total PCDDs		504	29	756	29.6
Total PCDFs		94	26	132	16.5
Total PCDD/PCDFs		598	55	888	46

NA = Not available  
<sup>7,8</sup> See references 6 and 7  
<sup>6</sup> Reference 6

GRAPH I: PCDDs COMPARED BY CONGENER



GRAPH II: PCDFs COMPARED BY CONGENER



GRAPH III: TOTAL TEQs

