

A Nationwide Study of Dioxin and Furan Residues in Beef

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The United States Environmental Protection Agency (EPA) has identified environmental polychlorinated dibenzodioxins and dibenzofurans as chronic toxins to humans. Beef was designated as a major contributor to the human dioxin burden because animals grazing on forage contaminated by fallout from burning processes would store these lipophilic materials in adipose tissue. A statistical survey of chlorinated dioxin and furan levels in beef consumed by the U.S. population was conducted jointly by the EPA and the United States Department of Agriculture.¹⁾ The survey was designed to provide data on the dioxin burden that the population receives from consumption of beef. Details on feeding regimes, age and geographical sources of the feed consumed by the animals being surveyed were generally not available.

We selected twelve experiment stations throughout the U.S. for sampling beef, Figure 1 (Idaho voluntarily joined later). Thus, the age, general diet and location during rearing of the sampled animals will be known. The collections are being made as part of normal management operations and will be made over approximately a two year period. Ultimately, most stations will provide us with samples from a sufficient number of animals to allow us to determine animal variations from a given site as well as geographical variations. Samples collected are back fat, perirenal fat, ribeye muscle, liver and serum from healthy bulls, 2 years old and older; females, 1-2 years old, 4-6 years old, and 8 years or older. We plan to do all of the matrixes from only a sufficient number of animals to establish relationships. Analyses are being done by EPA method 8290. Results obtained on perirenal fat samples are summarized in Table I. Analyses generally show a preponderance of the higher chlorinated congeners with a few animals showing non-detect levels for all congeners and a few animals from a given site showing levels substantially higher than the average for that site.

References

1) Winters, D., M. Lorber, D. Cleverly, J. Schaum, R. Harless, A. Dupuy, D. McDaniel, J. Ferrario, C. Byrne, R. Ellis, C. Deyrup, K. Meier, W. Leese, J. Walcott. (1994): A statistical survey of dioxin-like compounds in the United States beef supply. *Dioxin '94 Organohalogen Compounds* 20: 73.

Table 1. Analysis for Total Dioxins and Furans^a in Perirenal Fat.
EPA METHOD 8290, Column - DB 5 60M 0.25u, Concentrations Found (parts-per-trillion)^{b,c}

Sample No. and Sex	Age (years)	Location	Tetra CDFs	Tetra CDDs	Penta CDFs	Penta CDDs	Hexa CDFs	Hexa CDDs	Hepta CDFs	Hepta CDDs	Octa CDFs	Octa CDDs
33 F	4	PA	ND	0.302	1.55	0.968	5.09	6.78	3.59	11.4	ND	27.9
			0.156								2.51	
34 F	5	PA	ND	ND	1.27	5.01	5.90	34.2	3.78	36.4	ND	19.0
			0.326	0.513							1.28	
35 M	2	PA	ND	ND	ND	ND	ND	4.10	0.958	4.19	ND	8.63
			0.321	0.494	0.303	0.428	0.378				1.06	
46 M	1.5	PA	ND	0.929	9.62	15.2	33.2	61.8	18.2	56.7	2.04	54.3
			0.258									
47 F	5.7	PA	ND	ND	ND	ND	2.36	5.23	5.36	13.0	0.790	21.1
			0.230	0.367	0.237	0.344						
49 M	1.5	PA	ND	1.21	5.74	21.6	49.3	99.7	30.6	71.6	1.95	25.8
			0.150									
54 M	6	FL	ND	ND	ND	ND	ND	1.29	0.778	1.83	ND	2.76
			0.088	0.184	0.274	0.404	0.431				0.994	
55 M	6	FL	ND	ND	ND	ND	0.404	0.199	ND	1.97	ND	2.88
			0.78	0.111	0.069	0.093			0.181		0.414	
56 M	6	FL	ND	ND	ND	ND	ND	ND	ND	1.74	ND	2.08
			0.291	0.445	0.279	0.469	0.422	0.621	0.773		1.28	
57 M	6	FL	ND	ND	ND	ND	1.11	1.42	ND	1.98	ND	ND
			0.298	0.467	0.289	0.428			0.821		1.35	2.68
22 F	4	OR	ND	0.701	0.919	2.31	2.86	8.79	1.41	9.70	ND	12.5
			0.139								0.791	
24 F	6	OR	ND	ND	ND	ND	4.64	4.98	3.08	11.4	ND	14.4
			0.277	0.332	0.251	0.228					1.28	
76 M	2	OR	ND	ND	0.830	ND	10.6	23.6	6.96	33.3	ND	132
			0.239	0.485		0.513					1.72	
65 F	5.5	MT	ND	ND	ND	ND	ND	0.660	ND	2.07	ND	4.31
			0.127	0.271	0.164	0.185	0.224		0.413		1.09	
66 F	5.5	MT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
			0.285	0.499	0.290	0.414	0.398	0.584	0.475	0.821	1.52	1.76
73 F	5	ND	ND	ND	0.997	ND	2.79	5.45	2.22	14.6	ND	36.5
			0.0986	0.183		0.198					0.481	
75 F	4	ND	ND	ND	0.806	ND	1.78	1.56	0.806	4.22	ND	5.65
			0.110	0.196		0.190					0.983	
81 M	5	NE	4.75	ND	ND	ND	2.10	ND	1.01	10.8	ND	52.2
				0.465	0.345	0.352		0.628			4.04	
82 M	5	NE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
			0.240	0.438	0.321	0.460	0.424	0.628	0.568	0.886	1.55	1.79
84 M	3	NE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
			0.415	0.767	0.462	0.631	0.578	0.838	0.863	1.14	2.25	2.60

^a Analyses by Dr. Thomas O. Tieman, Wright State University, Dayton, OH 45435.

^b The designation ND indicates "None Detected" in excess of the minimum detectable concentration which is listed directly below the ND designation.

^c Most of the contributions to the levels are due to 2,3,7,8 congeners.

Figure 1

Dioxin Project Locations of Cooperators



