

Dioxin and Furan Concentrations in Elk Lipids

Vernon J. Feij and Gerald L. Larsen

USDA, ARS, Biosciences Research Laboratory, P. O. Box 5674-University Station,
Fargo, ND 58105-5674 USA

Introduction

A major source of dioxins and furans (PCDD/PCDF) in beef produced in the United States was found to be pentachlorophenol (PCP) treated wood components in production facilities (1,2,3). This source obscured any geographical differences that may have existed at the sites studied. We believe that animals not raised in confinement may provide a better representation of geographical levels because they will not have frequent or continuous exposures to treated wood items. Herein we report dioxin concentrations in lipids from elk (Wapiti; *Cervus canadensis*) that frequented the Yellowstone National Park burn areas of Wyoming and from animals residing in the northeastern ten percent of North Dakota.

Materials and Methods

Wildlife management personnel from the North Dakota and Wyoming Game and Fish Departments obtained samples of kidney fat or back fat from hunters and sent them to the Biosciences Research Laboratory in Fargo, North Dakota. Hunters estimated the ages of the animals. Some samples were of inadequate quantity or quality for analysis and were discarded. Analyses were done by EPA 1613 methods.

Results and Discussion

The analyses for PCDD/PCDF from kidney or back fat samples collected by hunters in Wyoming and North Dakota are shown in Table 1. One of the animals (a 0.5 year old male calf) had unusually high levels of many of the congeners with a TEQ value of 10.789. Other animals had low concentrations of nearly all of the congeners measured. Congener profiles of the animals with the highest concentrations (all from North Dakota) were similar to profiles from beef cattle that had been exposed to wood treated with PCP. These elk may have frequented farm facilities containing treated wood or may have occasionally rubbed on or licked utility and fence posts that had been treated with PCP. Only three animals that frequented the Yellowstone Park burn areas have been analyzed for PCDD/PCDF. None had

high levels of dioxins and furans. The samples were taken in the fall of 1996, eight years after fires destroyed much of the vegetation in that area. Elk have been observed to chew on the charred bark of trees, increasing the likelihood that animals residing in the burn areas would have above average dioxin levels. The low PCDD/PCDF levels found in these animals suggest that dioxins and furans were not formed in large quantities or that feeding habits and environmental degradation have kept levels low. To our knowledge dioxin levels in elk have not previously been determined. Avian and aquatic species have been studied extensively, especially those from northern latitudes and those from the Great Lakes areas (4). Odsjo has found concentrations of 0-7 ppb and 4-12 ppb of DDT and PCBs respectively, in fat of reindeer from the northern part of Sweden (5). Our results show that the low PCDD/PCDF levels in elk fat are similar to the low levels found in our beef surveys (1,3,6). The highest levels found in adult elk were similar to the highest levels found in a beef survey conducted by EPA/FSIS (bulls 3.8, heifers 3.3 ppt) (6), but were more than an order of magnitude lower than the highest levels found in beef in our geographical survey (1,3). Specific site identity allowed us to trace high concentrations in beef to animal contact with PCP treated wood components, but site identity was not addressed in the EPA/FSIS study.

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Table 1. Concentrations of dioxins and furans in elk back fat or kidney fat (ppt).

Age (years) & Sex	Wyoming			North Dakota									
	7 F	3.5 M	5 F	Adult F	0.5 M	Adult F	2.5 M	3.5 M	3.7 M	Adult F	Adult F	Adult F	0.5 M
2,3,7,8-TCDF	0.000	0.006	0.000	0.044	0.053	0.084	0.012	0.044	0.043	0.104	0.085	0.082	0.108
1,2,3,7,8-PeCDF	0.129	0.028	0.019	0.000	0.008	0.000	0.039	0.046	0.047	0.141	0.191	0.059	0.104
2,3,4,7,8-PeCDF	0.067	0.047	0.046	0.047	0.137	0.185	0.187	0.115	0.252	0.390	0.420	0.385	1.087
1,2,3,4,7,8-HxCDF	0.129	0.034	0.016	0.000	0.077	0.136	0.221	0.146	0.646	0.650	0.513	0.668	2.775
1,2,3,6,7,8-HxCDF	0.055	0.030	0.020	0.015	0.082	0.091	0.123	0.069	0.261	0.331	0.341	0.247	1.635
2,3,4,6,7,8-HxCDF	0.029	0.007	0.000	0.001	0.041	0.056	0.095	0.095	0.103	0.254	0.342	0.122	0.848
1,2,3,7,8,9-HxCDF	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.025	0.000	0.010	0.000	0.000	0.046
1,2,3,4,6,7,8-HpCDF	0.051	0.033	0.041	0.055	0.142	0.128	0.166	0.162	0.950	0.811	1.074	0.515	4.239
1,2,3,4,7,8,9-HpCDF	0.038	0.000	0.000	0.000	0.000	0.000	0.007	0.018	0.050	0.072	0.081	0.023	0.405
OCDF	0.000	0.000	0.075	0.135	0.153	0.249	0.107	0.223	0.222	0.185	0.211	0.033	1.058
2,3,7,8-TCDD	0.040	0.116	0.378	0.008	0.056	0.067	0.056	0.095	0.182	0.116	0.120	0.638	1.042
1,2,3,7,8-PeCDD	0.073	0.201	0.106	0.075	0.315	0.390	0.358	0.325	0.797	0.548	0.996	1.124	8.131
1,2,3,4,7,8-HxCDD	0.078	0.063	0.037	0.021	0.138	0.144	0.252	0.159	0.662	0.572	1.159	1.288	6.186
1,2,3,6,7,8-HxCDD	0.095	0.092	0.067	0.050	0.254	0.27	0.525	0.297	2.382	4.491	6.192	2.854	17.053
1,2,3,7,8,9-HxCDD	0.067	0.005	0.003	0.006	0.078	0.031	0.153	0.053	0.190	0.417	0.871	0.120	3.913
1,2,3,4,6,7,8-HpCDD	0.140	0.186	0.304	0.235	0.527	0.658	1.491	0.723	5.543	9.575	13.024	5.613	39.229
OCDD	0.537	0.419	2.443	0.222	0.751	1.809	2.574	2.233	5.934	10.146	17.899	11.266	25.994
TOTAL TEQ	0.164	0.267	0.475	0.086	0.363	0.446	0.488	0.677	1.209	1.248	1.948	2.006	10.789

Analytical values are method blank subtracted and lipid adjusted.