THE HISTORICAL EVIDENCE OF THE HUMAN CONTRIBUTION TO DIOXIN-LIKE COMPOUNDS PRESENT IN THE ENVIRONMENT (Introductory Lecture to the Special Session: Human Sources and Activities Associated with Dioxin-Like Compounds and POPs in the Environment)

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Intoduction

The purpose of this paper is to provide introductory and background material to the Special Session on Human Sources of Dioxin-Like Compounds and POPs in the Environment. Within the context of sources of these compounds, a question arises as to the historical time period when these chemicals may have initially appeared in the environment, and the influence of human activities to their levels, occurences and trends. In this paper I will focus on the historical evidence for the influence of human society on levels of PCDDs and PCDFs in the environment.

Methods

Three primary lines of physical evidence are presented to explore the historical tracings of dioxin-like compounds in the environment. The first line of evidence is the time-trend profile ofPCDDs and PCDFs that emerges from an EPA study and analysis of dated lake sediment cores spanning the years 1884 - 1974.[1] The second line of evidence stems from a British study of the march of concentration of PCDDs and PCDFs in historically archived grass samples spanning the years 1881 - 1995.[2,4] The third presentation of evidence is the chronology and profile of PCDDs and PCDFs in archived canned meat samples, spanning the years 1900 – 1980's.[3]

Results and Discussion

Figure 1 is a profile of total PCDD/PCDF taken from a freshwater lake in the western U.S. The lake is removed from direct point source discharges. The only input into the lake system is atmospheric deposition into the lake and over the watershed area. In general, PCDD and PCDF concentrations begin to rise in the 1930s – 1940's time period; apparently crest in maximum concentration in mid 1960's. The core shows a decline in the mid 1970's. Figure 2 displays the chronology of PCDD/PCDF concentrations in archived grass samples in the U.K.[2] The grass samples were taken from an experimental agricultural plot and stored from 1891 to the present. No herbicides were ever applied to the plot. Therefore the concentrations in the grass reflects atmospheric deposition.[4] The archived grass samples shows a similar pattern in that total PCDD/PCDF concentration increases in the 1930's, and platueas in concentration about the 1960's to 1970's time period. However, unlike the sediment core sample, the grass samples dramatically increase in dioxin and furan concentrations from the early 1970's up until mid to late 1970's. From the 1981 until 1995 time period, there is a remarkable decrease in dioxin and furan concentrations to about the levels found in the mid 1940's. Concentrations in archived canned meat samples give an analogous trend as the sediment core study.[3] Figure 3 displays these data. The concentrations in the animal fats to the beef, pork and poultry samples rise in concnetration from 1900 until the 1970's. There is a precipitous decrease in the level of dioxins and furans in

meat samples from the plateau of the 1970's until the early 1980's. The latest meat samples are approximately at the same level of CDD/CDF contamination as the early 1900's. This evidence suggests that human sources and activities in the decades of the 20th century are mostly responsible for the emergence of dioxin-like compounds in the environment. However, the sediment core and archived grass studies also indicate the presence of trace levels of dioxin and furan prior to 1900. These studies suggest that, although human industrial sources in the post 1930 time-frame predominate, PCDDs and PCDFs were likely present in the environment in the late 1800's, a conclusion that agrees with that of Alcock and Jones.[2]

References

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4. Kjeller, L.; Jones, K.C.; Johnston, A.E., Rappe, C. (1991) Increases in the polychlorinated dibenzo-p-dioxin and furan content of soils and vegetation since the 1840"s. Environ. Sci. Technol. 25: 1619-1627.

Figure 1. The chronology of CDD and CDF concentrations in dated sediment cores to Beaver Lake in Northwestern United States (ng/kg dry wt)

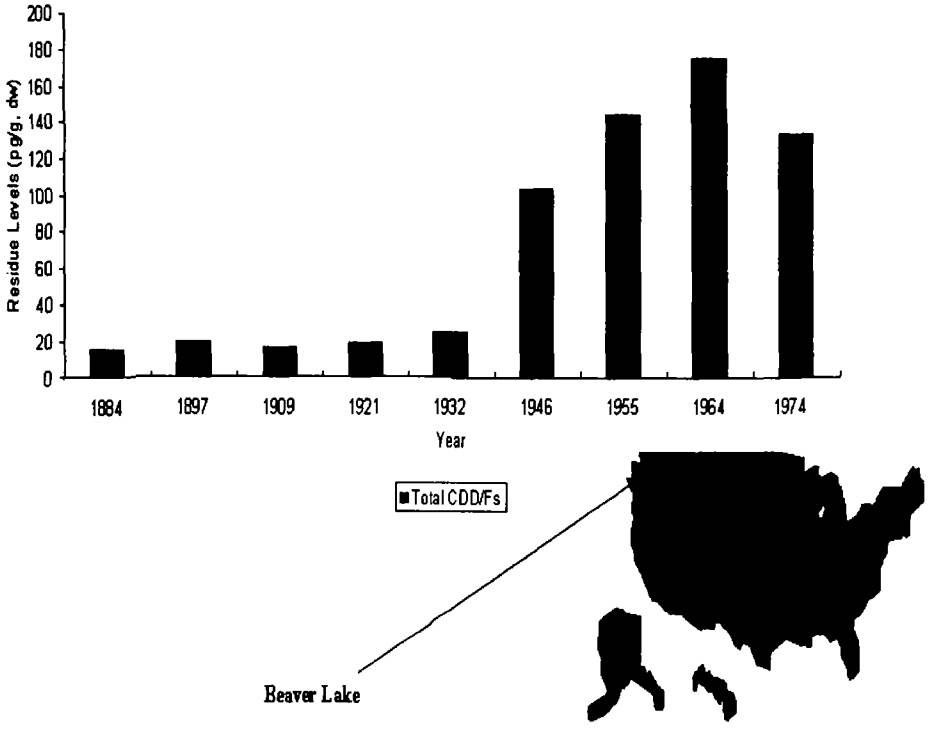

Figure 2. PCDD and PCDF in UK Park Grass herbage (ng/kg)

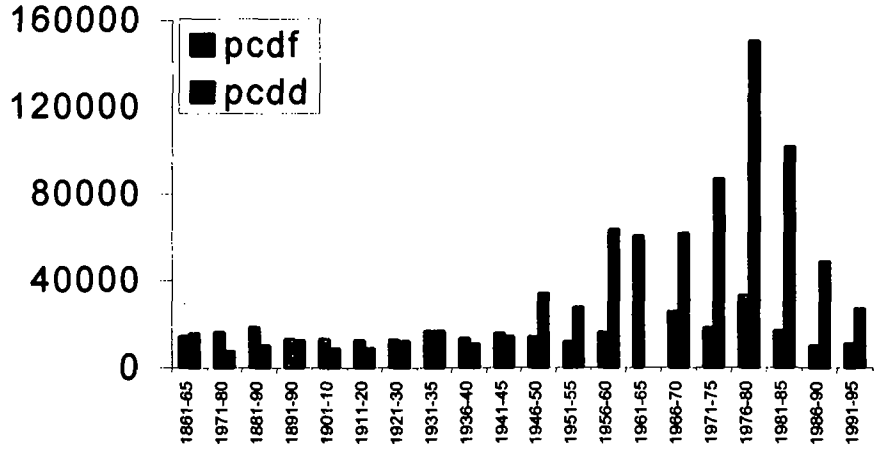

Figure courtesy of Dr. Ruth Alcock, Lancaster University, Lancaster, U.K.

Figure 3.0 Chronology of PCDD/PCDF concentrations in archived meat samples