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Utilization of Biological Samples to Assess Exposure to Agent Orange

Recent advancements in the analytic sensitivity of laboratory instruments have made it possible to analyze very low concentrations of 2,3,7,8-TCDD in samples of human fat (1). The results of several independent efforts (2-4) indicate that there is a background average level of 2,3,7,8-TCDD in human fat of approximately 7 parts per trillion (ppt) (range 0-20 ppt).

One study analyzed fat samples from volunteer Vietnam veterans (4). The results indicated that two veterans classified by the Veterans Administration as "heavily exposed" to Agent Orange had fat levels of 2,3,7,8-TCDD of 35 and 99 ppt. The remaining 10 veterans who were classified as "lightly exposed" and "possibly exposed" had levels between 3 and 13 ppt. Four veterans who had no service in Vietnam had levels between 4 and 8 ppt.

The results of this study indicate that it may be possible to distinguish high exposure to Agent Orange by analysis of fat samples. The results also indicate that veterans classified as "lightly exposed" to Agent Orange have only background levels of 2,3,7,8-TCDD in their fat, the same levels as are found in the U.S. population in general.

Analysis of fat is a difficult method for several reasons. A surgical or suction procedure is necessary to obtain 20 grams of fat (about the size of an egg) and the cost is about \$1,000 per sample. Efforts are underway currently to analyze a large volume of serum (200 ml) to detect low levels of 2,3,7,8-TCDD. Data are also being sought which would describe the distribution of 2,3,7,8-TCDD between adipose tissue and serum in the human body. Success with the serum method would provide a method to recognize levels of exposure which were high enough to raise levels of 2,3,7,8-TCDD above background levels in the population.

The recent advances in laboratory analytic techniques could be used to ascertain whether veterans in the various exposure categories of the CDC Agent Orange study have levels of 2,3,7,8-TCDD above the background levels in the population. For example, a sample of veterans currently meeting criteria for the CDC Agent Orange study category of "high likelihood of exposure" and a sample of veterans from the non-exposed category could be asked to provide fat (or possibly serum) specimens for analysis. An evaluation of the results should provide insight into the adequacy of the military records to select truly exposed and truly unexposed individuals. Additionally, the results should indicate whether the levels of 2,3,7,8-TCDD are significantly different from the levels in the general U.S. population.

Analysis of fat (or serum) from other populations could also provide valuable insights. Several studies are currently underway in which analysis of fat is being conducted on Vietnam veterans, chemical workers, and persons with residential and recreational exposures to 2,3,7,8-TCDD. Analysis of fat (or serum) could also be conducted on selected individuals in the CDC Vietnam Experience study who have known high or low levels of exposure. Samples of fat already collected from Ranch Hand participants during elective surgery could be analyzed and compared to the levels of exposure experienced by the individuals.

1. Patterson DG, et al. High resolution gas chromatography/high-resolution mass spectrophotometric analysis of human adipose tissue for 2,3,7,8-TCDD. Anal. Chem 1986; 58:705-716.
2. Graham M, Hileman FD, Kirk D, et al.: Background human exposure to 2,3,7,8-TCDD. Fourth International Symposium on Chlorinated Dioxins and Related Compounds, 1984; Ottawa, Canada; October 16-18.
3. Graham M, Hileman FD, Wendlong J, Wilson JD. Chlorocarbons in adipose tissue samples. Fifth International Symposium on Chlorinated Dioxins and Related Components, 1985. Bayreuth FRG, September 16-19.2508R
4. Gross ML, Lay JO, Lyon PA, et al.: 2,3,7,8-tetrachlorodibenzo-p-dioxin levels in adipose tissue of Vietnam veterans. Environ Res 1984; 33:261-268.