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MORBIDITY AND MORTALITY WEEKLY REPORT

Epidemiologic Notes and Reports

Serum 2,3,7,8-Tetrachlorodibenzo-*p*-dioxin Levels in Air Force Health Study Participants - Preliminary Report

In 1978, the United States Air Force responded to a congressional mandate to initiate an epidemiologic study of the possible health effects of exposure to herbicides and their 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) contaminants in Air Force veterans who served in the Ranch Hand defoliation operation during the Vietnam conflict. Accordingly, the Air Force conducted a nonconcurrent prospective study, the Air Force Health Study, of all 1,267 members of the Ranch Hand unit and a series of matched controls (1).

The controls were selected from the Air Force veterans who served in air cargo units stationed in Southeast Asia (but not in Vietnam) during the same period as the Ranch Hand unit and were individually matched to the Ranch Hand personnel by date of birth, rank (officer, enlisted), and occupation. Investigators assumed that the controls had not been exposed to herbicides or TCDD during the war. Both groups were given physical examinations in 1982 (2), 1985 (3), and 1987-1988. They will be examined again in 1992, 1997, and, finally, during the concluding year, 2002.

Recently, CDC scientists developed a method for measuring TCDD in human serum (4). This lipid-based measurement, which is highly correlated with paired measurements of TCDD in adipose tissue ($r = 0.98$) (5), has been applied to U.S. Army veterans (6) as well as to participants in the phase of the Air Force Health Study reported here.

This phase of the Air Force study focused on measuring serum TCDD levels in 150 Ranch Hand veterans and 50 controls. All participants were enlisted men; the Ranch Hand veterans had been either herbicide loaders or herbicide specialists in Vietnam. Serum samples from all 200 participants were collected at four Red Cross Centers (Atlanta, Cleveland, Los Angeles, and Tulsa) according to a standardized protocol. One hundred forty-seven of the specimens obtained from Ranch Hand personnel and 49 of those from controls yielded serum TCDD levels that met the quality control criteria (4).

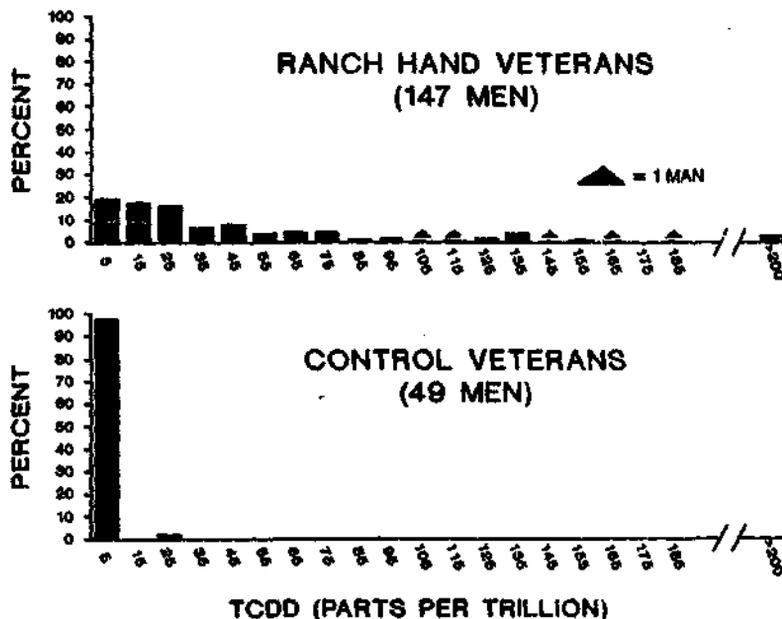
The demographic and health characteristics of Ranch Hand personnel and controls were similar (Table 1); however, their serum TCDD levels differed markedly (Figure 1). The mean serum level of the 147 Ranch Hand personnel was 49 parts per trillion (ppt) (median, 26 ppt); 62% had TCDD levels above 20 ppt, which is considered the upper limit for U.S. residents without known TCDD exposure (7). The mean serum

TCDD -- Continued

TABLE 1. Selected characteristics of 200 Air Force Health Study participants, by group, 1987

	Ranch Hand Veterans (n = 150)	Control Veterans (n = 50)
Demographic Characteristics		
Age (Mean)	46	49
Race (Black)	5%	6%
Mean Tour Length (Months) in Southeast Asia	12	25*
Self-Reported Herbicide Exposure[†]		
Military	93%	8%
Leisure	15%	4%
Civilian Occupation	5%	4%
Health Characteristics		
Current Smoking (Cigarettes)	51%	37%
Smoking History (Pack Years [‡])	14	12
Current Alcohol Use	80%	78%
Alcohol History (Drink Years [§])	29	30
Percent Body Fat (Mean)	21%	22%

*Controls were based outside of Vietnam and had tours of 2 to 3 years.

[†]From questionnaire.[‡]Defined as the equivalent of smoking one pack of cigarettes per day for 1 year.[§]Defined as the equivalent of drinking 1.5 ounces of an 80-proof alcoholic beverage per day for 1 year.**FIGURE 1. Serum TCDD* levels of Ranch Hand and control veterans participating in the TCDD-measurement phase of the Air Force Health Study, 1987**

*2,3,7,8-tetrachlorodibenzo-p-dioxin.

TCDD -- Continued

level of the 49 controls was 5 ppt (median, 5 ppt); 2% (1 person) had a level above 20 ppt. Additionally, 79% of the Ranch Hand personnel and 2% of the controls had TCDD levels at or above 10 ppt (chi-square test, $p < 0.0001$).

The five highest TCDD levels in the Ranch Hand group were 201, 210, 211, 303, and 313 ppt. The one control who had a level greater than 20 ppt (21.3 ppt) reported exposure to industrial chemicals since 1960 in a steel foundry in Indiana.

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Editorial Note: The serum TCDD measurement provides a direct assessment of exposure. The distribution of TCDD levels in this phase of the Air Force Health Study indicates that some Ranch Hand personnel had unusually heavy TCDD exposure. The one control who had a TCDD level above background level had been exposed to industrial chemicals in the recent past. No threshold level has been determined as yet for the health effects of TCDD in humans.

The half-life of TCDD in humans has been calculated as approximately 7 years (8) on the basis of TCDD levels in serum samples taken in 1982 and 1987 from 36 of the Ranch Hand personnel who had TCDD levels above 10 ppt in 1987. A half-life of 7 years suggests that only about two to four TCDD half-lives have elapsed since potential exposure of Ranch Hand personnel in Vietnam and that serum TCDD can serve as a biological marker for previous TCDD exposure of Air Force Health Study participants.

A report on the entire 1987-1988 Air Force Health Study will be published after TCDD measurements have been completed for all participants and after the report has been reviewed by the Agent Orange Working Group of the Domestic Policy Council (Executive Branch). The result of the half-life study will be reported in a separate publication.

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