

II. Synopsis of Background

A. The USAF Commitment

Since 1978 news media presentations have focused attention on possible adverse health effects in former military personnel, allegedly due to Herbicide Orange [a mixture of 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxy-acetic acid (2,4,5-T)] which was used as a defoliant during the Vietnam Conflict. Other herbicides containing 2,4,5-T were also used extensively, and as commonly used by the news media, the term "Herbicide Orange" refers to all of these 2,4,5-T products. These herbicides were contaminated with 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (Figure A-1, Section XV), and the presence of this toxin is the basis for much of the concern over exposure to these defoliants. Claims for compensation have been filed against the Veterans Administration (VA), by more than 3,000 veterans. In response to Congress, the General Accounting Office (GAO) investigated the issue and subsequently recommended that the Department of Defense (DOD) conduct a long-term epidemiologic study of the problem. The Department of the Air Force has made a formal commitment to the Congress and the White House to conduct such a study. On 16 September 1980, the White House directed the DOD to initiate the RANCH HAND study with reasonable speed and high quality. This decision was subsequently reaffirmed by the new administration.

B. The Peer Review Process

This protocol has received rigorous peer review. From the outset, the Air Force principal investigators have acknowledged the scientific complexities of the effort and voluntarily sought outside peer review and consultative guidance. The following reviews have been conducted:

<u>Reviewing Agency</u>	<u>Date</u>
University of Texas, School of Public Health	June 1979
Air Force Scientific Advisory Board	August 1979
Armed Forces Epidemiologic Board	August 1979
National Research Council, National Academy of Sciences	December 1979

Members of each independent review agency were provided copies of the protocol and key references in advance of the review. An extensive briefing of the protocol was presented to three of the four agencies. Each review group provided a report of their opinions and recommendations. The Air Force principal investigators responded to reports from the first three peer reviews and indicated concurrence or nonconcurrence with each of the recommendations. Most of

the peer group recommendations were gratefully accepted and incorporated appropriately within the protocol. Because the National Research Council's report cited "major deficiencies in design" and emphasized public credibility issues, the protocol was referred to the Interagency Work Group to Study the Possible Long-Term Health Effects of Phenoxy Herbicides and Contaminants for an additional scientific review and recommendations to the White House as to whether the Air Force should conduct this study. This review was conducted in June 1980 and resulted in an affirmative recommendation. The White House subsequently directed that the study be formally started.

C. The Military Use of Herbicides

Research and development on phenoxy herbicides began in the early 1940s, when most of the initial phytotoxic screening programs and the development of application technologies were sponsored by the DOD. The herbicide, 2,4,5-T, was first commercially produced in the United States in 1944. During the years from 1961 through 1969, the DOD procured 53 million pounds of this herbicide (approximately 34 percent of the total US production) for use in the Republic of Vietnam (RVN). However, 8.9 million pounds of that amount were not sprayed in Vietnam, but were destroyed by at-sea incineration in 1977. The first sustained DOD operational use of herbicides was initiated during the Vietnam Conflict (Operation RANCH HAND) and the first shipment of herbicides used in RANCH HAND was received at Tan Son Nhut Air Base, (RVN), on 9 January 1962. The use of these compounds was intended to accomplish two objectives: (1) the defoliation of vegetation to improve visibility and thus decrease the risk of ambush, and (2) the destruction of enemy crops.

Four 2,4,5-T-containing herbicides were used by the military during the period 1962-1970. These four included:

(1) Herbicide Purple (used from 1962 through 1964)

n-butyl	2,4-D	50%
n-butyl	2,4,5-T	30%
iso-butyl	2,4,5-T	20%

(2) Herbicide Pink (used from 1962 through 1964)

n-butyl	2,4,5-T	60%
iso-butyl	2,4,5-T	40%

(3) Herbicide Green (used from 1962 through 1964)

n-butyl	2,4,5-T	100%
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(4) Herbicide Orange (used from early 1965 through 15 April 1970)

n-butyl	2,4-D	50%
n-butyl	2,4,5-T	50%

Analyses of archived samples of Herbicide Purple suggest that the mean concentration of TCDD may have been approximately 33 ppm (Range: 17 to 47 ppm TCDD) while archived samples of Herbicide Orange had a mean concentration of approximately 2 ppm (Range: <0.02 to 15 ppm TCDD).

In addition, two other herbicides were widely used in RVN. These were Herbicide Blue, an organic arsenical formulated from the sodium salt of cacodylic acid, and Herbicide White, a water soluble triisopropanolamine salt formulation of 2,4-D and picloram. The amounts of the various herbicides used in RVN from January 1962 through February 1972 are shown in Table 1.

Table 1.

ESTIMATED QUANTITIES OF HERBICIDES AND TCDD
 SPRAYED IN RVN, JAN 1962-FEB 1972

<u>CHEMICAL</u>	<u>POUNDS</u>
2,4-D	55,940,150
2,4,5-T	44,232,600
TCDD	368
Picloram	3,041,800
Cacodylic Acid	3,548,710
Herbicide Total	106,763,260

Ninety-six percent of the 2,4,5-T disseminated in RVN was contained in Herbicide Orange; the remaining 4 percent in Herbicides Green, Pink, and Purple. However, Herbicides Green, Pink and Purple contained approximately 40 percent of the estimated amount of TCDD disseminated in RVN. Green, Pink and Purple were sprayed as defoliants on less than 90,000 acres from 1962 through 1964, a period when only a small force of U.S. military personnel were in RVN. Ninety percent of all the Herbicide Orange (containing 38.3 million pounds of 2,4,5-T and 203 lb of TCDD) was used in defoliation operations on 2.9 million acres of inland forests and mangrove forests of RVN.

Most of the herbicide used in RVN was sprayed from aircraft. RANCH HAND aircraft, the C-123, disseminated 88 percent of all herbicide. Helicopters and ground application equipment used by personnel from all branches of the U.S. Armed Forces applied the remaining 12 percent, primarily Herbicide Blue, to maintain visibility around base perimeters.

Concurrent with the change to Herbicide Orange, the scope of aerial use shifted from four aircrews on temporary assignments, to 36 permanently assigned aircrews, and additional support personnel. Following the announcement in October 1969 that the administration of 2,4,5-T to pregnant rodents

caused an increase in the rate of congenital abnormalities, the DOD confined Herbicide Orange spray operations to nonpopulated areas and in April 1970, all uses of the 2,4,5-T containing herbicides were halted. Other non-2,4,5-T herbicides continued to be used until June 1971 and Operation RANCH HAND was officially deactivated in October 1971. In March 1972, all remaining stocks of 2,4,5-T-containing herbicides were removed from RVN, and transported to Johnston Island, Pacific Ocean, for open storage (Project PACER IVY), and eventual incineration at sea in 1977 (Project PACER HO). In 1979, the Environmental Protection Agency (EPA) suspended the use of herbicides containing 2,4,5-T because an epidemiologic study in the United States attributed abortogenic effects to its use.