Item ID Number:	00190
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Report/Article Title	Typescript: The Military Use of Herbicides in South Vietnam, 1962-1971, 16 May 1983
Journal/Book Title	
Year	0000
Month/Day	
Color	☐
Number of Images	2
Description Notes	Summary of history of herbicide use, including types and amounts, in Vietnam.

MAY 16 1983

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THE MILITARY USE OF HERBICIDES IN SOUTH VIETNAM, 1962-1971.

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 1947. 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%

(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 Herbicides in 1972 suggested that the mean concentration of TCDD may have been approximately 33 ppm (Range: 17 to 47 ppm TCDD) for Herbicide Purple 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

CHEMICAL	POUNDS
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, primarly 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 Environmental Protection Agency (EPA) suspended many uses of herbicides containing 2,4,5-T because an epidemiologic study in the United States attributed abortogenic (miscarriage) effects to its use.