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A. Young

# HERBICIDE "AGENT ORANGE"

## HEARING

BEFORE THE

## SUBCOMMITTEE ON MEDICAL FACILITIES AND BENEFITS

OF THE

## COMMITTEE ON VETERANS' AFFAIRS HOUSE OF REPRESENTATIVES

NINETY-FIFTH CONGRESS

SECOND SESSION

ON

HERBICIDE "AGENT ORANGE"

OCTOBER 11, 1978

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# HEARINGS ON HERBICIDE "AGENT ORANGE"

**WEDNESDAY, OCTOBER 11, 1978**

House of Representatives,
Subcommittee on Medical Facilities and Benefits,
Committee on Veterans' Affairs,
*Washington, D.C.*

The subcommittee met, pursuant to notice, at 10 a.m. in room 334, Cannon House Office Building, Hon. David E. Satterfield III (chairman of the subcommittee) presiding.

Mr. Satterfield. The subcommittee will come to order.

We are meeting this morning to hear testimony from various officials of the executive branch concerning one of the herbicides used in Vietnam during the early 1960's until the early 1970's. This herbicide, commonly referred to by its code name Agent Orange, was a mixture of 2,4–D and 2,4,5–T and was the herbicide most widely used during this period of military operations. The Department of Defense had two purposes for using Agent Orange in its military operations in Vietnam. First, it was used to defoliate trees and plants for better observation of the enemy; and second, to deny the enemy food crops being grown in and adjacent to terrain under enemy control.

Agent Orange was used by spraying on a target area usually by fixed-wing aircraft or by helicopter.

About the use of Agent Orange. We meet here this morning not to question this use but, instead, because of our concern about the possible adverse health effects this herbicide may have had with respect to our Vietnam veteran population.

We are aware of the report of August 16, 1978, which was transmitted to our colleague, who unfortunately passed away yesterday, the Honorable Ralph Metcalfe of Illinois. We are aware that it identified contaminant dioxin which was found in Agent Orange. That report indicated that dioxin is highly toxic, stable, and persistent. The report also indicated that insufficient research had been conducted with regard to possible health effects it might have on those who came in contact with it.

We are aware that the General Accounting Office also report that Department of Defense officials have little information on the number of personnel exposed or the extent of exposure to this herbicide, but that it has acknowledged that aircraft crews involved in the spraying missions were the most likely to have been exposed.

I ask unanimous consent that the letter of August 16, 1978, from the General Accounting Office to the Honorable Ralph H. Metcalfe, together with its four enclosures, be admitted to the record at this point.

Without objection it is so ordered.
[The information follows:]

U.S. GENERAL ACCOUNTING OFFICE,
COMMUNITY AND ECONOMIC DEVELOPMENT DIVISION,
*Washington, D.C. August 16, 1978.*

B-159451

HON. RALPH H. METCALFE,
*House of Representatives.*

DEAR MR. METCALFE: By letter dated April 10, 1978, you expressed concern about possible long-range adverse health effects on individuals that were exposed to the herbicide Agent Orange and requested that we examine certain aspects of the Department of Defense use of this herbicide in Vietnam and the Veterans Administration handling of disability claims submitted by herbicide-exposed Vietnam veterans. As agreed with your office of June 28, 1978, this report addresses (1) the extent of the Defense use of herbicides and othe chemicals in Vietnam, (2) the number of military and civilian personnel exposed to these chemicals, and (3) the Defense-funded studies of the health effects of these chemicals.

Our review of the Veterans Administration handling of disability claims submitted by herbicide-exposed Vietnam veterans is continuing. In addition, the Environmental Protection Agency is currently reevaluating the registered uses of chemicals 2,4,5-T, a component of Agent Orange, in this country. We plan to include these matters in a final report to you by January 1979. We expect to work closely with your staff during this period.

In summary:

Agent Orange, a 50:50 mixture of 2,4-D and 2,4,5-T, was the most widely used herbicide in Vietnam. The component 2,4,5-T contains a contaminant, TCDD (dioxin) that is highly toxic, stable, and persistent, and its use has caused great public concern.

Defense has little information available on the number or extent of personnel exposure to herbicides in Vietnam. Officials acknowledged, however. that aircraft crews involved in herbicide spraying missions were more likely to have been exposed than others; this group possibly could be traced through military records.

Defense research before herbicide use in Vietnam was primarily concerned with herbicide effectiveness rather than its health effects. Subsequent Defense ecological studies failed to demonstrate long-term health effects. In its 1974 report, however, the National Academy of Sciences concluded that further extensive studies are needed.

Defense plans to epidemiological studies related to herbicide uses in Vietnam.

These matters are discussed in greater detail in the following sections.

USE OF HERBICIDES AND OTHER CHEMICALS IN VIETNAM

Defense field tested herbicides in Vietnam in 1961 and carried out military herbicide operations from 1962 to 1971. The herbicides were used primarily for (1) defoliating trees and plants to improve observation and (2) destroying food crops of hostile forces. Four herbicides were used:

Agent Orange (a mixture of 2,4-D and 2,4,5-T);

Agent Purple (a similiar mixture of 2,4-D and 2,4,5-T that continued a different form of 2,4,5-T—it was replaced by Agent Orange in 1964);

Agent White (a mixture 2,4-D and Picloram); and

Agent Blue (cacodylic acid).

The military use of herbicides in Vietnam is detailed in enclosure I.

According to a National Academy of Sciences report, about 18.85 million gallons of herbicides were sprayed during the 1962 to 1971 period. From August 1965[1] to 1971, Defense sprayed 11.22 million gallons of Agent Orange, 5.24 million gallons of Agent White, and 1.2 million gallons of Agent Blue over about 3.6 million acres of South Vietnam. Out of this area, 66 percent was sprayed once, 22 percent was sprayed twice, 8 percent was sprayed three times, and 4

[1] About 1.27 million gallons were used before August 1965, but a breakdown of the quantities of individual types of herbicides used was not available.

percent was sprayed four or more times. The quantities sprayed annually and application rates are summarized in enclosure II.

Agent Orange was sprayed undiluted in Vietnam at the rate of about 3 gallons (containing 12 pounds of 2,4–D and 13.8 pounds of 2,4,5–T) per acre. Civilian applications of this herbicide's components are usually diluted in oil or water. A Defense official said that the heavier application was needed to assure success of the heribicide operations.

In October 1969 Defense restricted the use of Agent Orange to areas remote from population. This action was prompted by a National Institute of Health report that 2,4,5–T could cause malformations and stillbirths in mice. Researchers later attributed similar problems to the contaminant TCDD, which is produced during the manufacture of 2,4,5–T. In April 1970 Defense suspended all use of Agent Orange in Vietnam, about the same time that the Department of Agriculture restricted the domestic use of 2.4,5–T because of its possible health hazards.

In 1971 Defense directed the Air Force to dispose of all remaining stocks of Agent Orange. These stocks contained TCDD contaminant levels ranging from less than 0.05 to 47 parts per million and averaging about 2 parts per million. Current manufacturing standards for 2,4,5–T require TCDD levels to be less than 0.1 part per million.

Defense officials said that the disposal of Agent Orange was completed in September 1977.

### OTHER CHEMICALS

A Defense official said that malathion and DDT were the other principal pesticides used in Vietnam; they were used throughout the war for mosquito control. Malathion was sprayed by aircraft, and DDT was applied by back pack and paint brush. The official said that no information is readily available on the quantities used in Vietnam.

Malathion is still used domestically for insect control. However, in 1972 EPA cancelled all except public health and quarantine uses of DDT because of its persistence, biomagnification, and toxicological effects.

### PERSONNEL EXPOSURE TO HERBICIDES

A Defense report shows that about 2.6 million military personnel served in South Vietnam from January 1, 1965, to March 31, 1973. Defense records indicate that the number of United States civilian personnel employed by Defense in South Vietnam ranged from 49 in March 1965 to 1,522 in September 1969—cumulative data on civilians are not readily available. Defense has little information, however, on the number of personnel exposed to herbicides in Vietnam, Defense officials stated that (1) no such personnel records were maintained, (2) it would be difficult to estimate meaningful exposure data because the potential for exposure varied widely among personnel, and (3) only a few military personnel would have been exposed directly to spraying. But some personnel could have been exposed indirectly to low levels of herbicides through ingestion of contaminated drinking water and food and by skin contact.

Defense officials acknowledged that certain groups of personnel such as the herbicide handlers and aircraft crews (particularly crewchiefs and flight engineers) involved in herbicide spraying missions were most likely to have been exposed to herbicides than others. The officials said that, if required, the identity of the aircraft crews possibly could be traced through military records. The herbicide handlers were mostly Vietnamese and it would be difficult to identify and trace them.

### DEFENSE-FUNDED STUDIES OF THE HEALTH EFFECTS OF HERBICIDES

The herbicides used in Vietnam were also used in the United States when the military spraying program began. A Defense official stated that, consequently, military studies made before the program began were concerned primarily with military effectiveness rather than environmental and health effects. Defense subsequently funded several studies of the ecological effects of herbicides use; included was a study made by the National Academy of Sciences, as mandated by the Congress in Public Law 91–441 (Oct. 7, 1970), on the effects of herbicides in Vietnam.

None of the major Defense-funded studies concluded that herbicide use damaged human health; however, the National Academy of Sciences, in a

February 1974 report, expressed concern over TCDD because (1) its very high toxicity to animals; (2) its presence in Agent Orange, (3) preliminary reports of the presence of TCDD in fish in Vietnam, and (4) the lack of any data permitting assessment of TCDD effects in humans. As a result, the Academy recommended that long-term studies be made to obtain a firmer basis for assessing the potential harmful effect on man. More specifically, the National Academy of Sciences stated that:

"Further intensive studies are especially required with reference to the ecological distribution, the pharmacology mechanism of toxicity, possible mutagenicity, and carcinogenicity of TCDD and its possible teratogenicity in man."

Defense-funded studies are summarized in enclosure III; the National Academy of Sciences summary of the physical and biological characteristics of the herbicide components used in Vietnam is in enclosure IV.

Defense officials believe that no firm link has been made between long-term adverse health effects and exposure to herbicides in Vietnam. They stated that Defense (1) has no plans to conduct epidemiological studies on the possible ill health effects of herbicide use in Vietnam and (2) has not issued any instructions to its medical facilities to monitor complaints of illness possibly resulting from herbicide exposure.

As agreed during the June 28, 1978, meeting with your Office, we discussed the matters in this report with Defense officials and incorporated their comments where appropriate. As also agreed we are providing copies of this report to the House Committee on Veterans Affairs. Unless you publicly announce its contents earlier, no further distribution of this report will be made until 30 days from the date of the report.

Sincerely yours,

HENRY ESCHWEGE, *Director.*

Enclosures.

ENCLOSURE I

## THE MILITARY USE OF HERBICIDES IN SOUTH VIETNAM[1]

Military herbicides operations began in South Vietnam (SVN) in early 1962 and were phased out in 1971. After a relatively slow buildup from 1962 to 1965 the operations increased rapidly to a peak in 1967; declined but only slightly, in 1968 and 1969; and dropped sharply in 1970. According to information from Defense the last herbicide spraying by fixed-wing aircraft occurred on January 7, 1971. After this, herbicide operations were limited to spraying around fire base perimeters, on enemy cache sites, and along land and water communication routes; all were carried out by helicopter or on the ground. The last helicopter spraying operation under United States control was flown on October 31, 1971.

### THE HERBICIDAL AGENTS USED

The herbicidal agents used in SVN were identified by code names that referred to the color bands painted on the containers of the chemicals: Orange, White, Blue, and Purple.

Agent Orange is a 50:50 mixture of the n-butyl esters of 2,4-D ([2,4-dichlorophenoxy] acetic acid) and 2,4,5-T ([2,4,5-trichlorophenoxy]acetic acid). Each gallon of Orange contains 4 pounds of 2,4-D and 4.6 pounds of 2,4,5-T on an acid equivalent basis[2]. Agent Orange was used most extensively in Vietnam until its use was terminated on April 15, 1970, because of concerns of its possible teratogenicity and its contamination with the highly toxic TCDD.

Agent Purple is a 50:30:20 mixture of the n-butyl ester of 2,4-D, and n-butyl and isobutyl esters of 2,4,5-T. It was used only until 1964, and was then replaced by Agent Orange.

Agent White is a mixture containing 2 pounds of 2,4-D and 0.54 pounds of picloram (4-amino-3,5,6-trichloropicolinic acid) per gallon on an acid-equivalent basis. It is a formulated product containing 2,4-D and picloram as the triisopropanolamine salts, with the addition of surfactants and water.

---

[1] Information excerpted from "The Effects of Herbicides in South Vietnam," National Academy of Sciences, February 1974.

[2] Acid equivalent is the weight of the acid form of the chemical. This is used because the weights of various ester or amine formulations vary. Expression in terms of acid equivalents provides a uniform basis for comparison of different formulations.

Agent Blue is formulated as the sodium salt of cacodylic acid (hydroxylimethylarsine oxide). It contains a minimum of 21-percent sodium cacodylate with additional free cacodylic acid for a total dimethylarsinic acid equivalent of not less than 26 percent on a weight basis, or 3.1 pounds of cacodylic acid and about 1.7 pounds of arsenic per gallon with 5-percent surfactant and 0.51 percent antifoam agent.

All agents were for use at a rate of 3 gallons per acre (28 liters per hectare), except that in the earlier operations and on rare occasions thereafter only half of this dose was used. The herbicides were applied by fixed-wing aircraft (UC-123), helicopter (UH-1), from trucks, from river boats, and from backpacks. Aircraft were outfitted with special spraying equipment consisting essentially of a container and a spray boom with nozzles. The container of the plane spray system had a 1,000-gallon capacity and normally flew at 150 feet with a delivery speed of 130 to 140 knots. The spray-on time of 3½ to 4 minutes permitted approximately 950 gallons of herbicide to be distributed at the rate of 3 gallons per acre. The capacity of the helicopter spray system container was 200 gallons but the helicopter could carry only 100 gallons because of weight limitations. Herbicide spraying from tanker trucks used 50-gallon or 100-gallon drums. Spraying by river boats was done directly from the agents original 55-gallon drums; backpack sprayers had 3-gallon drums. The great majority of the herbicides were sprayed by plane—at least into the latter part of 1970, from which time helicopter herbicide operations increased and gradually became the only aerial means of heribcide delivery.

MILITARY CLASSIFICATION OF THE HERBICIDE OPERATIONS IN SVN

The herbicide operation objectives were (1) defoliation (the use of herbicides to cause trees and plants to lose their leaves to improve observation) and (2) crop destruction (the application of herbicides to plants to destroy their food value), directed at crops of hostile forces. Herbicides were also used, although on a much smaller scale and only by helicopter or on the surface (ground or water), for clearing vegetation around the perimeter of fire support bases and other military installations, on landing zones and enemy cache sites, and along lines of communication. Thus, there were essentially two military objectives of all herbicide operations—defoliation and crop destruction.

APPLICATION OF HERBICIDES IN THE VIETNAM WAR

[In millions of gallons]

| Agent | 1962 to July 1965 [1] | August to December 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | Total |
|---|---|---|---|---|---|---|---|---|---|
| Orange | | 0.37 | 1.64 | 3.17 | 2.22 | 3.25 | 0.57 | 0 | 11.22 |
| White | | 0 | .53 | 1.33 | 2.13 | 1.02 | .22 | .01 | 5.24 |
| Blue | | 0 | .02 | .38 | .28 | .26 | .18 | 0 | 1.12 |
| Total | 1.27 | .37 | 2.19 | 4.88 | 4.63 | 4.53 | .97 | .01 | 18.85 |

[1] Detail by type of herbicide not available.

HERBICIDES USED IN SVN 1965–71

| Agent and active chemical components | Military application rate (pound per acre) | Millions of gallons used, August 1965 to 1971 |
|---|---|---|
| Orange: | | |
| 2,4-D | 12.00 | |
| 2,4,5-T | 13.80 | 11.22 |
| White: | | |
| 2,4-D | 6.00 | |
| Picloram | 1.62 | 5.24 |
| Blue: Cacodylic acid | 9.30 | 1.12 |
| Total | | 17.58 |

Source: "The Effects of Herbicides in South Vietnam," National Academy of Sciences, February 1974.

## Enclosure III

### Summary of Defense-Funded Studies Which Discuss Possible Health Hazards From Massive and Repetitive Applications of Herbicides

Available Defense studies of the health effects of the herbicides used in Vietnam are discussed in this enclosure. These studies were made after concern was raised about the potential ecological and environmental hazards of spraying.

#### ASSESSMENT OF ECOLOGICAL EFFECTS OF EXTENSIVE OR REPEATED USE OF HERBICIDES (FINAL REPORT 15 AUGUST–1 DECEMBER 1967)

The contractor, the Midwest Research Institute (Kansas City, Missouri) conducted a survey to assess the ecological consequences of the extensive and repeated use of herbicides, including herbicides in Vietnam. The scope included an examination of over 1,500 pieces of scientific literature, and interviews with over 140 experts on herbicide use and animal and plant ecology.

The contractor reported that only one generation had passed since chemical herbicides began to be widely used, and no articles or books had addressed the long-term ecological effects of herbicides on flora and fauna, rangeland, forests, other nonagricultural lands, waterways, lakes, and reservoirs. The authors hoped that their study would lead to a deeper study based on the additonal research that is needed.

The report concluded that the aerial spraying of herbicides in Vietnam caused little or no toxicity hazard to people or animals. The report stated:

"The possible toxic hazards involved in the aerial spraying of herbicides in Vietnam are of concern to scientists and to the public.* * * After examining the voluminous toxicity data and the actual rates at which these chemicals have been applied we can make the following observations: (1) the direct toxicity hazard to people and animals on the ground is nearly nonexistent, (2) destruction of wildlife food and wildlife habitat will probably affect wildlife survival more than any direct toxic effects of the herbicides, (3) the application of Orange or white alongside of rivers and canals or even the spraying of the water area itself at the levels used for defoliation is not likely to kill the fish in the water, (4) food produced from land treated with herbicides will not be poisonous or significantly altered in nutritional quality (we use herbicides in large amounts on cropland in this country); if residues of a more persistent herbicide such as picloram should carry over to the next growing season it would retard plant growth rather than concentrate some toxic residue in the crop, (5) toxic residues of these herbicides (Orange, White, and Blue) will not accumulate in the fish and meat animals to the point where man will be poisoned by them, and (6) the primary ecological change is the destruction of vegetation and the resulting change is the destruction of vegetation and the resulting ecological succession in the replacement of this vegetation."

#### CONGENITAL MALFORMATIONS, HYDATIDIFORM MOLES AND STILLBIRTHS IN THE REPUBLIC OF VIETNAM, 1960–1969

A medical team representing the U.S. Military Assistance Command, Vietnam, and the Ministry of Health, Republic of Vietnam (RVN), made a cooperative study of data on about 499,000 births from 1960 to 1969 in 22 Saigon, provincial, and district hospitals to determine whether 2,4,5-T could be shown to increase developmental abnormalities in humans.

The December 1970 report describes the incidence of recorded congenital malformations, stillbirths, and hydatidiform moles in RVN before (1960–65) and after (1966–69) larger-scale military use of herbicides. The study failed to show any influence of herbicides on birth defects.

The report noted, however, that the study had several biases because:

Nearly all the information was derived from population centers and the large hospitals.

Data was restricted almost exclusively to ethnic Vietnamese. For example, Montagnards as a rule did not enter district or province hospitals, but delivered at home.

Many records had been destroyed.

Some hospitals admitted to incomplete reporting of birth defects during the earlier part of the 1960s.

THE EFFECTS OF HERBICIDES IN SOUTH VIETNAM

In response to public concern about the possible effects of herbicide use on the environment and people, the Congress directed Defense to contract with the National Academy of Sciences for a study of the ecological and physiological effects of the widespread use of herbicides in South Vietnam. (Public Law 91-441, Oct. 7, 1970.) The report was issued in February 1974.

A NAS committee spent about 1,500 man-days in South Vietnam during the course of the study. The study noted that (1) long-term field studies were virtually impossible because of the security conditions in South Vietnam and (2) safe access to large areas of the country was denied to the field teams, thereby frustrating their efforts to secure critical data.

The NAS committee could not gather any definitive indication of direct damage by herbicides to human health. The committee, however, was unable to visit the Montagnards in their own locales to verify common and consistent reports of serious illness and death, especially among children, after exposure to herbicide sprays. The committee concluded that although no independent medical studies of exposed populations were available from the time of spraying against which reports of illness and death could be confirmed or refuted, the reports on the Montagnards were so consistent that they could not be dismissed and should be followed up as promptly as possible by intensive studies which should include both medical and behavioral science approaches.

Because of (1) the very high toxicity of TCDD (dioxin) to animals, (2) the presence of this substance in Agent Orange, (3) preliminary reports of TCDD in fish in Vietnam, and (4) the lack of any data permitting assessment of TCDD effects on humans, the committee recommended long-term studies to obtain a firmer basis for assessing the potential harmful effects of TCDD on man. The committee made several other pertinent recommendations which largely depended on data to be subsequently obtained from Vietnam.

ECOLOGICAL STUDIES ON A HERBICIDE-EQUIPMENT TEST AREA (TA C-52A) EGLIN AFB RESERVATION, FLORIDA, FINAL REPORTS JANUARY 1967 TO NOVEMBER 1973

The Air Force systems Command studied the ecological consequences of repetitive applications of massive quantities of herbicides from 1962 to 1970. The Command studied approximately one square mile at the Eglin Air Force Base Reservation in Florida. During this period, 346,117, pounds of herbicides (including 160,948 pounds of 2,4,5-T) were spread on the test area because of aerial spray equipment testing programs. The January 1974 report was authored by Capt. Alvin L. Young, Ph.D; Associate Professor of Life Sciences, United States Air Force Academy.

An evaluation of the effects of the spray equipment testing program on faunal communities was conducted from May 1970 to August 1973. In a 1973 study liver and fat tissue from 70 rodents from both on and off the test area were analyzed for TCDD. The analysis indicated that TCDD or a chemically similar compound accumulated in the liver and fat of rodents collected from an area receiving massive quantities of 2,4,5-T. On the basis of pathological studies, however, there was no evidence that the herbicides produced any developmental defects or other specific lesions in the animals sampled or in progeny. Lesions were interpreted to be of naturally occurring type and were not considered related to any specific chemical toxicity.

FATE OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN THE ENVIRONMENT: SUMMARY AND DECONTAMINATION RECOMMENDATIONS

The Department of Chemistry and Biological Sciences, United States Air Force Academy, initiated studies on Agent Orange and TCDD in April 1972, at the request of the Air Force Logistics Command. These studies were to (1) investigate soil incorporation/biodegradation as a disposal method for Agent Orange; (2) investigate the ecological effects associated with past uses of Agent Orange; and (3) investigate the soil persistence and food chain accumulation of TCDD. The October 1976 report was authored by Capt. A. L. Young, Ph.D; Maj. C. E. Thalken, DVM, MS; Lt. Col. E. L. Arnold, Ph.D; Capt. J. M. Cupello, Ph.D; and Maj. L. G. Cockerham, MS.

The report included data on the animal studies conducted at the Eglin Air Force Base Reservation test site (see preceding report summary p. 8). During 1973 and 1974 106 beach mice and 67 fetuses were examined. The authors re-

ported no evidence that the herbicides produced any adverse long-term health effects in the rodents. Specifically, the authors reported that:

Histopathologic examination in 1973 and 1974 of organs from the 173 adult and fetal beach mice showed only lesions which are normally observed in microscopic surveys of large numbers of field animals.

Mature animals with liver levels of TCDD from 20 ppt[1] to 1,300 ppt had no liver lesions. This is most significant in view of the massive quantities of both 2,4,5,-T and TCDD that were applied to the test site.

There was no evidence to indicate that TCDD was mutagenic or carcinogenic in the field at the concentrations noted. None of the 34 fetuses examined from animals captured on the test grid showed teratogenic effects.

The authors concluded that these studies suggest that long-term, low-level exposure (less than 1 ppb[2] to TCDD may in fact not be teratogenic, mutagenic, or carcinogenic.

## Enclosure IV

### Characteristics of Herbicides Used in Vietnam

The physical and biological characteristics of the components of the herbicides used in South Vietnam as summarized by the National Academy of Sciences in its February 1974 report, are presented below.

#### PICLORAM

Picloram, a component of Agent White, is a selective herbicide highly active on many broad-leaved plants. In the form used in herbicide operations in SVN it has a low volatility, making damage by vapor unlikely, but has a high solubility in water and a high stability in soil which may result in problems with herbicide movement in surface and drainage waters.

The acute oral toxicity of picloram and its salts and esters is low for mammals, and chronic toxicity is low for mammals and a variety of other animals including birds, fish, and crustaceans. No toxicity studies in man are known. No teratogenicity was found in rats at 1,000 mg/kg/day.[1]

#### CACODYLIC ACID

Cacodylic acid, the active component in Agent Blue, is a nonselective herbicide that kills many herbaceous plants. It is a nonvolatile, highly soluble organic arsenic compound which is broken down in soil, mostly into inorganic arsenate bound as insoluble compounds which also exist naturally in the soil.

Acute and chronic toxicity studies in a variety of animals indicate a low-to-medium toxicity rating. No teratological studies nor toxicity studies in man seem to have been reported.

#### 2,4-D AND 2,4,5-T

2,4–D and 2,4,5–T as the butyl esters, the active constituents of Agent Orange, are moderately volatile and highly insoluble in water; the triisopropanolamine salt of 2,4-D, present in Agent white, is nonvolatile and very soluble in water. Both 2,4-D and 2,4,5-T are stable at ambient temperatures. They are not very persistent within the plant because they are bound into nontoxic complexes or degraded. A highly toxic compound, TCDD, is a contaminant of 2,4,5–T but not 2,4–D (nor picloram).

Persistence of 2,4–D and 2,4,5–T in the soil is limited, and breakdown is largely accomplished by microorganisms. Adverse effects on soil microorganisms are found at concentrations of 100 ppm or more—about four times higher than would have been caused by one Agent Orange mission in SVN.

Extensive toxicological studies have shown 2,4,5–T and 2,4–D to be moderately toxic but are still inadequate to define the pharmacology or mechanisms of pathology. In acute exposures, the $LD_{50}$[1] ranges from 100 (pigs) to 2,000 (chicks) mg/kg.[2] Chronic doses are better tolerated and there is little cumulative action—e.g., 100 mg/kg/day for a year caused only minor deleterious effects in cattle, sheep, and chickens. A variety of unsatisfactory observations suggest that these

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[1] Parts per trillion.
[2] Parts per billion.
[1] Milligrams per kilogram of body weight per day.
[1] $LO_{50}$—Single lethal dose to 50 percent of test population of animals.
[2] mg/kg—milligrams per kiligram of body weight.

findings apply also to man (if effects caused by TCDD are excluded). Acute exposures such as drenching by sprays sometimes produced vomiting, headache, reduced sensory perception, and limb paralysis. Long-term occupational exposure did not produce any consistent signs of toxicity.

2,4,5-T is moderately teratogenic in mice; cleft palates were produced in the offspring of mice treated with 300 to 100 mg/kg/day through day 6 to 15 of pregnancy or a single dose of 150–300 mg/kg on a day 12 or 13.

Kidney anomalies occurred in some strains. Less clear-cut results were obtained in the hamster and rat. No malformations were produced by similar chronic treatments in some rat strains and rabbits, sheep, and rhesus monkeys. The significance of these findings for man, if any, has not been established.

TCDD (2,3,7,8-TETRACHLORODIBENZO-PARA-DIOXIN)

TCDD, a contaminant of 2,4,5-T and thus of Agent Orange, is a very toxic material. Its teratogenicity in mice is well established, though in rhesus monkeys no teratological effects have been found. The toxicity to adults of different animal species varies within wide limits (over 1,000 times), and teratogenicity in mice also varies considerably between strains. The teratogenic dose can be lower than the embryolethal dose which, in turn, is somewhat lower than the adult toxic dose. Presence of TCDD in 2,4,5-trichlorophenol and 2,4,5-T was responsible for chloracne outbreaks and other toxic effects in workers involved in the manufacture of those products.

The presence of TCDD in 2,4,5-T has caused great public concern, and TCDD may indeed pose a great environmental hazard. It is a stable and persistent compound, but it seems to be taken up by plants to only a very limited extent and is not transported from early- to late-formed parts. This inability to transport in plants and its low solubility, relatively long persistence, and lack of vertical mobility in soils, makes TCDD more nearly resemble the chlorinated hydrocarbon insecticides in behavior than it does the more biodegradable phenoxy acid herbicides such as 2,4-D and 2,4,5-T, and even picloram. It can be concentrated by aquatic organisms in experimentally designed ecosystems, but to a lesser degree than DDT. Contamination of underground water supplies appears very unlikely.

2,4,5-T is probably the main source of TCDD in the environment. It should however, be realized that at the present level of less than 0.05 ppm TCDD in the about-5,000,000 pounds of 2,4,5-T presently manufactured annually in the United States the amount of TCDD thus produced is maximally about 4 ounces (110 grams) per year which are spread over several million acres. 2,4,5-trichlorophenol should not be entirely disregarded as another potential source of TCDD. A closely related compound hexachlorodibenzo-para-dioxin, toxic at levels about 10 to 30 times higher than TCDD, may be present in or produced from a widely used chemical—pentachlorophenol. All herbicides used in the herbicide operations in SVN are toxic to animals in varying degrees. Some have been found to kill, damage tissue, or malform embryos of exposed pregnant female animals. TCDD is highly toxic and is teratogenic at least in mice. Although all these findings cannot be extrapolated to man, the question of possible harm to human embryos is raised. Further intensive studies are especially required on the ecological distribution, the pharmacology, mechanism of toxicity, and possible mutagenicity and carcinogenicity of TCDD and its possible teratogenicity in man.

Mr. SATTERFIELD. The purpose of this hearing, as I have stated, is not to inquire into the validity of use of Agent Orange in Southeast Asia but to concentrate on whether exposure to that herbicide had any adverse effects on health. If the problem does exist with regard to certain Vietnam veterans, we want to know it, and we would like to know it at the earliest practical time. We want those veterans to know it. If, on the other hand, no problem exists, we want to know that also. We feel that we have reached the point where we need to know more and that the public needs to know more about what has been done and what is being done about this problem. This hearing is designed specifically to help us learn whether we know everything there is to know about the health effects on veterans as a result of an exposure to

Agent Orange; what questions, if any, remain unanswered; what is being done to determine the answers to such questions; and what progress is being achieved in that regard.

If additional research is necessary, we want to know that. This committee is in a position to aid and assist such inquiries, especially if action by Congress to assist research is indicated.

This morning we have witnesses from the Veterans Administration, the Department of Defense, the Department of Health, Education, and Welfare, and the Veterans of Foreign Wars. With the exception of the witness from the Veterans of Foreign Wars, each of these is represented in the membership of the Ad Hoc Committee on Herbicides which was appointed by the Chief Medical Director of the VA, in May 1978 to explore:

A. The potential adverse effects of defoliants on the health of Vietnam veterans, including the symptoms and signs associated with those effects.

B. Methods for diagnosing and treating any adverse health effects discovered.

C. Approaches through which the VA might attempt to discover the relevance of adverse effects to defoliants on its patient population.

I am sure the remarks of our witnesses will assist us in these inquiries.

At this time I recognize Hon. John Paul Hammerschmidt, the ranking minority member of the full committee and the subcommittee, for any opening remarks he wishes to make. Mr. Hammerschmidt.

Mr. HAMMERSCHMIDT. Thank you, Mr. Chairman. I would like to express my own satisfaction that we are having these hearings today. I think this places our committee in the proper role of coordinator to help agencies on the one hand and citizens' groups on the other to understand what is happening in our effort to come to grips with the possible effects of Agent Orange. I am pleased that the Department of Defense, the Veterans' Administration, and the Department of Health, Education, and Welfare will be testifying.

This should provide us with information regarding coordination within the executive branch and should also address the most important areas of concern. These areas are, in my opinion, the following:

What, indeed, is the toxic effect of this chemical?

Who and how many of our servicemen were exposed to it, and what was the level of exposure?

Finally, what efforts are being made to aid these veterans as the matter is being studied?

I am also, of course, thankful the veterans groups are to be represented as I look forward to hearing their views on what else might be done to responsibly address the need of our veterans to obtain relief in those cases where relief is warranted.

This concludes my statement, Mr. Chairman. I look forward to hearing from the witnesses.

Mr. SATTERFIELD. Thank you.

Before proceeding, I would like to make a statement. When we set these hearings we were not aware that today is a holiday for some of our colleagues, several of whom had indicated they wished to attend and to testify. In light of that fact, it is my feeling that the record

of this hearing should remain open so that these colleagues will have an opportunity to submit statements for inclusion in the record of these proceedings. Accordingly, without objection the record of these hearings will remain open for 30 days for this purpose.

Our first witness this morning is Major General Dettinger, Deputy Surgeon General of the U.S. Air Force.

General, we welcome you this morning. I understand you have several gentlemen with you.

Mr. EDWARDS. May I ask some questions?

Mr. SATTERFIELD. Yes.

Mr. EDWARDS. This is the first time I have seen all this information. I was wondering why all of the testimony was not delivered to us yesterday or the day before.

Mr. SATTERFIELD. Can the staff answer that?

For the record, in case the reporter could not hear the staff response, the statements in question were not submitted and therefore not received by the subcommittee staff until yesterday afternoon for some and this morning for others.

Mr. EDWARDS. Mr. Chairman, I think all the witnesses ought to explain why the information is so delayed. It really gets in the way of a proper hearing if we have to hear the information and read the material for the first time while the witness is testifying.

Mr. SATTERFIELD. I quite agree with the gentleman. Perhaps our witnesses, when they begin their statements, will offer an explanation. We would be happy to hear it. Meanwhile General Dettinger, I understand you have several colleagues with you. It will be helpful to the record if you will introduce them.

## STATEMENT OF MAJ. GEN. GARTH DETTINGER, DEPUTY SURGEON GENERAL, U.S. AIR FORCE, ACCOMPANIED BY CAPT. AL YOUNG, FROM U.S. AIR FORCE OCCUPATIONAL AND ENVIRONMENTAL HEALTH LABORATORY, BROOKS AFB, TEX., AND TOM DASHIELL, OFFICE OF ASSISTANT SECRETARY OF DEFENSE, RESEARCH AND ENGINEERING

General DETTINGER. Mr. Chairman, I am Maj. Gen. Garth Dettinger.

I have with me on my right Dr. or Capt. Al Young who has a Ph. D. in plant physiology, who has been with the herbicide program in the Air Force for the last 10 years. I can say that he is probably one of the world's leaders in knowledge of plant herbicides.

On my left, Mr. Tom Dashiell, of the Assistant Secretary of Defense's Office for Research and Engineering who also has had years and years of experience with herbicides.

Sitting behind me is Maj. James Tremblay, who is a registered professional engineer and who is associated with the USAF Occupational and Environmental Health Laboratory.

We only heard about this late Friday evening that we were to testify. The gentlemen who are involved here with us were in San Antonio. They came up during the holiday period and prepared the statements over the weekend for this rush hearing. As a matter of fact, I asked that it be delayed just a bit so we could more carefully prepare a statement and get it to you for your deliberation.

In addition, the large tome we prepared here is just hot off the presses, and that was one of the problems. It had not yet been released at all, and it is here now for the first time—thousands and thousands of man-hours of work. With that Mr. Chairman, may I begin?

Mr. SATTERFIELD. The letter that I sent was to the Secretary of Defense. And if I understand you correctly, you are saying that you were designated to appear for him as late as last Friday?

General DETTINGER. Yes, sir.

Mr. SATTERFIELD. Do you have any additional questions, Mr. Edwards?

Mr. EDWARDS. No.

Mr. SATTERFIELD. Thank you, sir. You may proceed with your statement.

General DETTINGER. Mr. Chairman, gentlemen, it is a pleasure to be here today to talk about the toxicology, environmental fate, and human risk of Herbicide Orange and its associated dioxin.

Two phenoxy herbicides, 2,4–D and 2,4,5–T, both registered by EPA, were used to formulate Herbicide Orange. All herbicides were procured from commercial sources to a military specification. Each of these herbicides has been used extensively in agriculture since the mid-1940's.

Would you believe Mrs. Fanny Fern Davis was the first to use this on the White House lawn? It was 2, 4–D and it was widely publicized at the time; so these herbicides have been used for a long period of time.

During the 9-year period from 1961 through 1969, approximately 78 million pounds of 2, 4, 5–T were used domestically in the United States; while between 1961 and 1971, a 10-year period, approximately 52 million pounds of 2, 4, 5–T were disseminated in South Vietnam. The 2,4,5–T contained the contaminant dioxin, a highly toxic compound formed during the production processes. The amount of dioxin disseminated in the United States during the 9-year period between 1961 and 1969 was probably at least four times the amount disseminated in South Vietnam. However, the domestic and worldwide use of such herbicides has not resulted in a documented increase in illness among users or the general population. There are many anecdotal episodes but pure scientific evidence of a cause and effect relationship is not there yet.

The use of Herbicide Orange in South Vietnam was primarily for the purpose of denying the enemy the cover of dense jungle foliage. The potential for exposure of U.S. military personnel to direct spray of Herbicide Orange would have been highly unlikely. Much of the aerially applied spray was deposited on the dense canopy cover in remote areas, and I stress again, in remote areas held by the Vietcong or the North Vietnamese, not our own troops.

The amount of herbicide penetrating to the forest floor (6 percent of that applied) would have been similar to the levels normally applied to brush-infested ranch land in the United States. Entry into a treated area by military personnel in South Vietnam could then be viewed as similar to entry into defoliated brush-infested ranch land in the United States treated with 2, 4, 5–T if our troops entered there at all.

Ground combat forces normally did not enter a previously treated area for several weeks after treatment, if at all, because defoliation did not occur until 3 or 4 weeks following treatment. Numerous environmental factors e.g., photodegradation has been shown to destroy dioxin within a matter of hours—probably within 6 hours but certainly within 24 hours, would have reduced the potential for exposure to military personnel under such circumstances.

Some U.S. personnel were exposed to the herbicides—and I refer to those actively engaged in the handling and dissemination operations. Some absorption of chemicals following direct skin contact and by inhalation of vapors and aerosols did undoubtedly occur, but percutaneous absorption would have been minimal because of the closed transfer systems employed and the use of protective equipment employed during ground loading operations. Nonetheless, occasional leaks did occur during ground handling operations and sporadic skin contact could have occurred.

In the airborne operations, occasional leakage also occurred. The potential for exposure of the vapors of 2,4–D, 2,4,5–T and dioxin in the ground loading or airborne operations would have been similar to our disposal operation of 2.2 million gallons of Herbicide Orange in the summer of 1977.

I am pleased to report that during the disposal operations, where we maintained the strictest surveillance operations, the level of 2,4–D and 2,4,5–T were at least two orders of magnitude below the accepted permissible exposure levels for these materials. No dioxin was detected during ground transfer disposal operations in any air samples collected. It is reasonable to conclude that the levels of 2,4–D, 2,4,5–T and dioxin in air during routine ground transfer and airborne operations in South Vietnam would not have been any different than the levels noted during the disposal operations in 1977.

A comprehensive occupational physical examination program was conducted as part of the disposal operation. A comparison of available preoperational and postoperational physical examinations did not reveal any acute physical effects as a result of involvement in the dedrumming and transfer activities where these 2.2 million gallons were dumped to be carted away and disposed of.

Ground combat forces and combat helicopter elements were routinely exposed to aerially applied insecticide and smoke screens immediately prior to, and during air and ground assault operations. The insecticides (primarily malathion, which is used extensively in this country and is the prime insecticide used) were for the purpose of reducing mosquito populations in an attempt to control malaria and the smoke screens were to provide camouflage. I want to stress that herbicides were not used in this fashion.

In general, if the available data on animal toxicology for 2,4–D and 2,4,5–T were classified according to the U.S. Environmental Protection Agency scheme, the relative toxicity of 2,4–D and 2,4,5–T would be classed as slightly to moderately toxic. By this same scheme dioxin would be classed as extremely toxic. Animal toxicology data indicate that no-effect dose levels for 2,4–D, 2,4,5–T and dioxin do exist in animals. It is reasonable to conclude, therefore, that there also exist threshold levels of exposure for humans below which no effects would

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occur. Animal experiments do confirm that there is a clear species susceptibility difference and, in fact, the experience with a number of episodes involving human exposure to dioxin suggests that man is a more resistant species to dioxin than other animals. In addition, in cases where documented exposure to dioxin has occurred—and there have been at least 28 industrial occupation exposures—the reported physical effects were, in general, transitory.

The tumorogenicity, teratogenicity, or mutagenicity of dioxin have not been substantiated in humans; however, as with many other chemical compounds routinely found in the environment today, the long-term effects of even the slightest exposure to dioxin cannot be unequivocally defined at this time.

Chloracne is a visible, diagnosable acniform condition which can occur following exposure to TCDD (dioxin). In the absence of chloracne, systemic symptoms would have been unlikely in our U.S. personnel assigned to Vietnam. It is conceivable that mild chloracne signs could have developed and gone undetected and that mild systemic conditions including the nervous system (tingling or numbness in the extremities), mild psychiatric conditions (nervousness, anxiety, depression), or other systemic involvements (such as malaise, weakness or loss of appetite) could have also gone undetected. These symptoms, however, would have cleared shortly after removal from exposure to the chemicals as has been shown to occur in industrial accidents where individuals were known to have been exposed to high levels of dioxin; thus any current symptoms claimed to exist by Vietnam veterans are almost certainly due to some etiology other than the past exposure of these individuals to Herbicide Orange in Vietnam.

I regret that we were not able to present this large tome in a more timely manner. It really only came to my attention this past Friday. This does represent a massive amount, and probably the single most comprehensive compilation of the world's literature on the toxic effects of herbicides and dioxin.

With this, Mr. Chairman, I would like to present this for your exhibit. Thank you very much. We will try to answer any questions.

Mr. SATTERFIELD. I understand you are presenting it for the record?

General DETTINGER. Yes; Mr. Chairman.

Mr. SATTERFIELD. Without objection. It will be accepted in the file of these proceedings so that it will be available for inspection and it is ordered. Would you answer the questions now of Congressman Edwards.

Mr. EDWARDS. Thank you, General, for your testimony. It is your conclusion, after your studies, that the claims made by certain persons with regard to the damage that the spraying of this herbicide in Vietnam resulted in is generally without foundation?

General DETTINGER. Yes; we feel that is so from our present evaluations of the entire world literature and evaluations of the substance over many years at our Eglin Test Range. There is no denying that the contaminant dioxin, which was unknown during the early production because simply it was not detectable at the amounts that it was contained in the 2,4,5-T, certainly is a toxic substance. However, the distribution of this was so minute generally, certainly far, far less than the industrial accidents that have occurred, such as an acci-

dent in Italy where high concentrations were dumped on the people following an explosion in 1976. Those individuals received documented high levels of dioxin, yet many of the things that have been claimed—higher incidents of spontaneous abortions—have not occurred.

Higher incidences of birth defects have not occurred. Persistent symptoms have not occurred. Therefore, taking these into account, together with review of the literature, we feel clearly the risk or the possibility of individuals having sustained some adverse effects from use of Agent Orange in South Vietnam is extremely remote—extremely remote.

I cannot say that on a rare occasion in some remote location some people were not sprayed directly, but this was never the way it was done in the operational field. What many people saw were these other antipesticides and antiinsecticide operations going on, or the smoke that was often given as combat troops went into an area. But almost exclusively 94 percent of this material was sprayed in Vietnam in forested areas—only a small amount of it was sprayed on foodcrops, and again it was in the remote areas held by the enemy at that time.

Mr. EDWARDS. General, the U.S. military used this defoliant for a number of years. Why, then, was it halted in 1970 if it was so benign?

General DETTINGER. Well, I think we all know that at that time clearly there was a mounting tide of opposition to the Vietnam war. There was a great deal of public sentiment against our involvement there. This was classified by many people as another chemical warfare agent. In fact, it was used in the United States for 15 years before the Air Force used it in Vietnam, but in its connotation over there it was swept into, I clearly believe, the entire opposition that arose at that time against our involvement in South Vietnam.

I will say purely as a sop to the political side, this was one of the programs we felt should be removed to decrease the opposition to our involvement there.

Coincidentally, at that time there were reports in other areas of the world. There was an episode in Globe, Ariz., which received wide publicity in the press. There were other reports at that time which stimulated public arousal, and so at that point in time it was decided best that we remove the agent which was obviously being accused of widespread but unconfirmed, and since unconfirmed, damage to human life and to property. And as a matter of fact, the National Academy of Sciences carried out a review in 1973 and 1974, and did a thorough evaluation in Vietnam of the results of Herbicide Orange. They came to the conclusion that they could find no evidence of carcinogenesis, mutagenesis, teratogenesis, and that the results were remarkably small on the population and the environment in South Vietnam.

Mr. EDWARDS. Do we have the report of the National Academy of Sciences? Can you make that report available?

General DETTINGER. I believe we can. Yes. Mr. Dashiell has that, and we can make that available to you.

Mr. SATTERFIELD. Without objection it will be admitted in the file of this hearing.

Mr. EDWARDS. General, would you state that this is an accurate statement, that laboratory testing of dioxin on mice, rats, and

monkeys has pointed out an alarming incidence of birth defects, miscarriages, cancer, and other disorders in animals exposed to dioxin?

General DETTINGER. There is no question that the dioxin in experimental animals, in concentrations which were considerably above what would normally have been used or to which our troops would have been exposed, have caused problems. There is no question dioxin is a toxic substance. However, some of those studies have been shown ultimately to have a very high level of TCDD present in the material that was used.

Some of the test animals unfortunately were in these series of mice, a series in 1968, a particular strain, that has been shown to have inherently a large birth defect incidence. In some of the Rhesus monkey studies, again, unfortunately, some of the monkeys used in that study were, if you will, leftovers from another study. Therefore, the clear cut cause and effect between dioxin and the findings in the monkeys is under some possible suspicion.

Mr. EDWARDS. My time has expired. I would like to ask you one more question, General. You point out in your statement that in the period 1961 through 1969 approximately 78 million pounds of 2,4,5-T were used domestically in the United States, and during about the same period 52 million pounds were disseminated in South Vietnam.

The area in which the material was disseminated in the United States was how much larger than the area of use in Vietnam?

General DETTINGER. I would like to defer that, please, to Captain Young.

Can you answer that specific question?

I think perhaps we ought to get that for the record.

[The information was submitted as follows:]

Approximately 14 million acres were sprayed in the United States and approximately 3 million acres in Vietnam.

Mr. EDWARDS. Would you guess 10, 20, 30 times greater in the United States?

General DETTINGER. We would rather not guess; and I cannot.

Mr. EDWARDS. It is certainly clear that it was disseminated in the great ranchlands of the West, millions and millions of acres, while it was much more concentrated in Vietnam.

General DETTINGER. Yes; there is this factor. The materials sprayed in the United States in the late 1950's and early 1960's was a variety that had a clearly higher concentration of dioxin than that Herbicide Orange used in Vietnam, so we will have to also modify the statement and say there was more dioxin also delivered, probably 4 times as much minimally in the United States in that amount than was delivered in the 52 million pounds in South Vietnam, but we must admit the area was smaller in Vietnam.

Mr. SATTERFIELD. Mr. Hammerschmidt.

Mr. HAMMERSCHMIDT. Thank you, Mr. Chairman.

General Dettinger, is there medical opinion that disagrees with your own opinion that any current symptoms claimed to exist by Vietnam veterans are almost certainly due to some etiology other than Agent Orange?

General DETTINGER. On any topic there are people who will talk on both sides, and there surely are other individuals who have been seen

on TV who have an opinion diametrically opposed to the one we hold, there is no question. I do not think as yet that the scientific validity of their statements has been proven conclusively at all. Many of the symptoms that people complain of—Vietnam veterans—are those that occur in the normal population without any exposure to chemicals whatsoever.

The alleged numbness and tingling is a very, very common symptom of hyperventilation of individuals who are under some sort of mental anxiety or strain. Depression, malaise, lethargy, clearly go along with individuals who are suffering some sort of emotional trauma in their social adaptation or their living. Impotence, loss of sexual drive is extremely common. These are very vague symptoms. There has not been one single human death reported at all from any exposure to any of these herbicides or dioxin, TCCD, not one.

Mr. HAMMERSCHMIDT. General, is it true as some suggest that one medicine drop of dioxin can kill 1,200 people? That is, I know, an interesting question. What I was wondering, how many tons of Orange go into one drop of dioxin?

General DETTINGER. I cannot give you that figure. There is no question it is extremely toxic in the micrograms. No question. But one drop, it is an amount I just cannot tell you, I am sorry, at this point.

Mr. HAMMERSCHMIDT. Do you believe there is a reluctance within the administration to establish a connection between dioxin and many problems of veterans due to the possible difficulty of processing claims?

General DETTINGER. No, I do not believe so, sir. Actually, what we have been doing is trying our darndest to first get a real handle on the world literature to find out what is scientifically reported in this area. We are giving this now to the Veterans' Administration. We have offered the service of one of our extremely competent physicians to help in their evaluation of the problem. We certainly want to get to the bottom of it, there is no question.

There is a lot of ongoing study in this area not within the Department of Defense right now, although we have collected the names of all Ranchhands—these are the people who were involved with the spraying operation—we have 499 names now we finally collected—very difficult to do this many years later. We have also contacted the president of the Ranchhands Reunion group, and we will be getting to them a questionnaire in an attempt to locate all of the people and to try to survey what happened to these people who we clearly know were involved with handling these materials. These would be the people involved. As for the people who were on the ground—it is extremely remote that any of them would have ever gotten in contact with the material.

Mr. HAMMERSCHMIDT. Have you discussed the operational handling during Vietnam with any of the 300 men who have applied to the Veterans' Administration based on Agent Orange maladies?

General DETTINGER. None of the Ranchhand group as far as we know has made application for any disability. We had one gentleman call from that group recently who said he is married and he wanted to have a child, and he wondered if there was any danger. We assured him we felt there was none. But none of these 499 that we know of today has applied for any kind of disability.

Mr. HAMMERSCHMIDT. Mr. Chairman, I just have one more statement for this witness.

General, I detect throughout your statement a rather positive attitude toward the use of these dioxins. Don't you feel that perhaps DOD should be a bit more cautious and adopt a wait-and-see attitude concerning any potential long-range disabilities?

General DETTINGER. Of course we need to look at the many industrial exposures and find out exactly what will happen in the long term. We no longer use the material. Our best evidence now indicates that we do not have a problem and that there is not a problem. We can only go on the best available scientific evidence to date.

There was recently, just this spring, an international conference held in Lyon, France, and it was suggested that several of the major accidents be carefully followed over the next several years both here in this country, in Germany, and elsewhere to determine exactly what the long-term effects were of people who were known to be exposed to specific doses of the dioxin. Where it was established clearly, we are following those. We are also continuing our own studies on the degradation of dioxin at our Eglin Test facility. We are going to cooperate fully with the VA in providing all this, and any additional information on the Ranchhand group. So we are certainly not letting this lay down at all. We recognize there may be a remote possibility for long-term effects with dioxin alone.

The 2,4-D and 2,4,5-T have been given orally as medicines, would you believe, in the years past for various kinds of conditions. So, therefore, these herbicides are certainly not in question at all.

Mr. HAMMERSCHMIDT. Sir, I thank you for your comprehensive statement and your responsive answers.

Mr. SATTERFIELD. Mr. Applegate.

Mr. APPLEGATE. Thank you, Mr. Chairman.

General, I appreciate your being here and giving us some valuable information as we deliberate.

I think that Mr. Hammerschmidt and Mr. Edwards very probably asked the questions of interest to me. I suppose as we hear some further testimony on down the line we will have some additional questions. I guess the only thing that I wanted to get verification on is that, talking about the smaller area of Vietnam compared to the large expansive areas of the United States and how much they use. You said the amount of dioxin would have been about four times the amount. Is that per unit or is that a total?

General DETTINGER. That is the total amount delivered to the continental United States, sir. The total amount delivered versus the total amount delivered to Vietnam. I think Dr. Young can come up with an answer regarding the area that was mentioned before, if we may, Mr. Chairman.

Dr. YOUNG. Sir, we are talking about in Vietnam applying some 44 million pounds of 2,4,5-T. Remember, when Vietnam was over we did return 1.3 million gallons of Herbicide Orange from Vietnam back to Johnston Island in 1972. So not all the 2,4,5-T that we procured was actually disseminated in Vietnam. Some was brought back. There was still some 800,000 gallons that was never shipped to Vietnam but also had been procured. In Vietnam we sprayed Orange on approximately 3 million acres. Granted, quite a bit of that was repetitive.

Many times some areas received more than twice. Some areas as many as four times. But we are talking about 78 million pounds applied in the United States over the same time period, but applied repetitively to probably 8 to 10 million acres annually. You are talking about every 2,4,5-T was applied in forestry situations and brushland situations, on about 8 to 10 million acres, and so that 78 million was probably applied in repetitive situations during that time period.

How much actual total lands, we really would not have a figure on that. But probably no more than 4 times the amount in Vietnam at the most. Certainly not a magnitude, not 10 times greater.

Mr. APPLEGATE. Thank you.

Mr. SATTERFIELD. Mr. Cornell.

Fr. CORNELL. No questions, Mr. Chairman.

Mr. SATTERFIELD. General, I have a couple questions. I understand from your statement dioxin exists only in 2,4,5-T?

General DETTINGER. That is correct.

Mr. SATTERFIELD. Are there any ongoing studies in the Department of Defense on the question of health effects, possibly long-range health effects, of dioxin or 2,4-D or 2,4,5-T?

General DETTINGER. We have none at least in the Air Force ongoing at the present time, no, sir.

Mr. SATTERFIELD. You do not know about the rest of the defense establishment?

General DETTINGER. We know that EPA has some studies which are just starting. There is a Dr. Walter Melvin who is a professor at the Colorado State University who is going to be doing human fat and human milk levels of TCDD for the EPA which will be very important because we would like to know certainly if this material is stored in the fat, the levels of it and fate of it. We simply do not know what the fate is in the human body.

The other herbicides are excreted quickly, within 4 or 5 days, so there is no problem there. We know there is no buildup; biomagnification problem does not exist. We feel there is probably not a biomagnification problem with TCDD as occurs with some of the pesticides. Actually, again, it is rapidly photodegradated when it is on the leaves, on the material.

Mr. SATTERFIELD. Earlier you mentioned some studies in connection with the effects of dioxin on rats and mice. Who conducted those studies?

General DETTINGER. May I refer that to Dr. Young.

Captain YOUNG. Yes. The first studies were reported in the Journal of Science in 1970, the work by Courtney, et al. She reported in fact 2,4,5-T was very teratogenic, but I think the most important thing to remember is in the footnote at the end of her publication. In the postscript she indicated that, upon analysis of the 2,4,5-T it was found to contain 28 parts per million TCDD. Subsequent to that, there has been a lot of additional work done, and we find that it is very difficult to get, quote, "purified 2,4,5-T." Small amounts of TCDD in 2,4,5-T will cause teratogenicity, birth defects in laboratory animals.

Mr. SATTERFIELD. Was there any indication in the study to which you referred about what levels were involved—are you telling me 28 parts per million was the level?

Captain YOUNG. Of TCDD in the 2,4,5-T.

Mr. SATTERFIELD. Do you know what quantities of 2,4,5-T and in what period of time these were administered to the test animals?

Captain YOUNG. Sir, we have that information in the report.

Mr. SATTERFIELD. It is in the report?

Captain YOUNG. Yes, sir. We have prepared that information. We have cited some 144 toxicological papers.

Mr. SATTERFIELD. Could you tell me whether or not the study we are talking about was a single or multipoint study in terms of the test animals? In other words, were they given varying levels, one group a certain level, another group a different level, so that one could plot a curve of the results?

Captain YOUNG. Yes, sir, that has been done, yes. That particular study was a little study at that time but since in the NIH Environmental Sciences they have conducted extensive studies.

Mr. SATTERFIELD. I was intrigued by the fact that the monkey study to which reference was made was not conclusive because the monkeys were infected with other tests and therefore did not present a pure strain. In light of all that, the question I have is whether or not you feel there should be additional tests on the toxicity and the effect of this chemical in test animals?

General DETTINGER. Certainly there should be and there are additional studies being done now. We surveyed quickly just before we came here. The Dow Chemical Corp. is doing these kinds of studies. There are numerous types of these studies ongoing. Of course, the human groups in West Virginia, that accident that occurred in 1949, the accident in 1953 are all going to be studied very carefully and so there is no question further work is coming out.

Mr. SATTERFIELD. I assume from what you have said that if any agencies of Government need the help and assistance of the DOD with regard to possible exposure in Vietnam they would receive your help?

General DETTINGER. Absolutely.

Mr. SATTERFIELD. If I am correct, studies are still ongoing and that it appears some questions which have arisen might not be completely answered. I assume your statements this morning are based upon present scientific knowledge but that the jury may still be out?

General DETTINGER. That is probably correct. However, we feel that to be honest at this point we should reassure people there is no great worry that many are putting forward, that they are in trouble now because of their involvement in South Vietnam.

Mr. SATTERFIELD. I appreciate that, but I think ongoing studies are something this committee is very much interested in. I appreciate very much your bringing this to our attention. I am sure we will follow up on it. Mr. Edwards.

Mr. EDWARDS. General, your testimony was that approximately 52 million pounds of 2,4,5-T were disseminated in South Vietnam. This report——

General DETTINGER. Sir?

Mr. EDWARDS [continuing]. On page 129 says that an estimated 107 million pounds of herbicides were aerially disseminated on 6 million acres in South Vietnam.

General DETTINGER. Yes. This was a total procurement; 52 million pounds of the Herbicide Orange were procured, not all delivered I

should say on Vietnam. Remember, we did, as has just been pointed out, recover a great deal of it back to Johnston Island and destroyed it.

Mr. EDWARDS. Can you correct your statement, then?

General DETTINGER. It is somewhat complicated in that there are several herbicides that were used. Of course we are talking about Orange. In the early phase small amounts of Green, Pink, and Purple were used. These herbicides—again, purple was the common one being used in the United States. These had larger amounts of multidioxin, but they were used in very small quantities in South Vietnam. We were referring to the Herbicide Orange that was comparable at the time, and the major item used in South Vietnam. The 107 million pounds that you referred to here was the total amount of herbicides, and there were some arsenic herbicides used, Herbicide Blue, of which there were some 5,200 gallons of that delivered and used. That contains arsenic.

Mr. EDWARDS. Then perhaps it might have been clear to the committee if your statement had said while during the 10-year period approximately 107 million pounds of herbicides were aerially disseminated on 6 million acres in South Vietnam, approximately 52 million pounds of 2,4,5-T were disseminated. Would that be a correct statement? We can correct this by saying that the amount in the United States was 78 million pounds of 2,4,5-T and 44 million pounds of 2,4,5-T in South Vietnam.

Thank you.

Mr. SATTERFIELD. Thank you.

If there are no other questions, I wish to express our appreciation for your appearance this morning. Your testimony has been very helpful to us.

General DETTINGER. Thank you very much, sir.

Mr. SATTERFIELD. Our next witness is Dr. Paul A. Haber. We welcome you this morning and understand you have certain gentlemen accompanying you. We would appreciate your identifying them for the record, please.

Then, if you would proceed with your statement, we would appreciate it.

**STATEMENT OF DR. PAUL A. HABER, ASSISTANT CHIEF MEDICAL DIRECTOR FOR PROFESSIONAL SERVICES, DEPARTMENT OF MEDICINE AND SURGERY, VETERANS' ADMINISTRATION, ACCOMPANIED BY DR. W. J. JACOBY, JR., DIRECTOR, MEDICAL SERVICE DEPARTMENT OF MEDICINE AND SURGERY; DR. L. B. HOBSON, ACTING ASSISTANT CHIEF MEDICAL DIRECTOR FOR RESEARCH AND DEVELOPMENT, DEPARTMENT OF MEDICINE AND SURGERY; J. C. PECKARSKY, DIRECTOR, COMPENSATION AND PENSION SERVICES; JOHN B. DeLEO, ASSISTANT GENERAL COUNSEL; AND CHARLES M. JOHNSTON, ASSISTANT GENERAL COUNSEL**

Dr. HABER. Mr. Chairman and members of the committee, in March 1978 the Veterans' Administration Department of Medicine and Surgery was informed of increasing public concern, particularly on the

part of Vietnam veterans, over the possible long-range effects of exposure of American military personnel to herbicides during the Vietnam war. Veterans' Administration central office (VACO) staff learned that a television documentary had been prepared by CBS and was due for public release. A copy of this documentary was reviewed by VACO officials.

At this time it was also learned that the Department of Veterans' Benefits Chicago office had received several claims for veterans in the area alleging adverse health effects from exposure to Agent Orange. Agent Orange, as has been testified, was one of the chemical combination types of herbicides used over several years during the Vietnam war. Its use was terminated early in 1971. All residual stock of Agent Orange was destroyed by the U.S. Air Force during 1977.

The Veterans' Administration Department of Medicine and Surgery (D.M. & S.) staff immediately took steps to inquire into this matter and to initiate the necessary actions. This has proved to be a very complex and time-consuming effort. However, I wish to emphasize as strongly as I can that no health care has been deferred or denied any veteran alleging adverse health effects as a result of exposure to herbicides in Vietnam because of this complexity and the magnitude of the task.

A vigorous effort was launched to review pertinent literature pertaining to herbicides. It was found that a large number of scientific treatises and research studies had already accumulated in the world literature since the herbicides were first brought into public use during the early 1940's. One of the most authoritative publications was the investigation and report of the National Academy of Sciences, released during 1974. This has already been brought to the committee's attention by the previous witness.

This report covered health and environmental issues devolving on the use of herbicides during the Vietnam war. The report suggested that the likelihood of long-term, serious adverse health effects among persons other than the North Vietnamese or the South Vietnamese Montagnards is highly remote. The report did refer to allegations of serious health consequences for North Vietnamese and Montagnard women and children, but there was no real possibility of verification of these claims because of the military situation at the time of the National Academy of Sciences' study.

Later publications appeared under authorship of North Vietnamese physicians alleging significant infertility, abortion, fetotoxicity, teratogenesis, and carcinogenesis among Vietnamese who had been exposed to Agent Orange, and you have heard from the previous witness about the most recent study compiled by the Air Force and just released this month.

Veterans' Administration Department of Medicine and Surgery staff immediately initiated inquiries about adverse health effects of herbicides from other Federal agencies known to have had experience with the military, agricultural, or industrial use of these chemicals. These agencies included DOD, including its constituent uniformed services, USDA, EPA, NCI, NIOSH, NIEHS, and FDA. Polarized points of view were uncovered ranging from the persuasion that Agent Orange was essentially innocuous for human beings to the conviction that

herbicides may have long-range adverse health effects for animals and man.

During the Vietnam war the defoliants were known as Agent Orange, Agent White, Agent Blue, and Agent Purple. Agent Orange was used predominantly during the latter phase of the war. These agents were mixtures of known herbicidal chemicals. Agent Orange was a mixture of 2,4-D and 2,4,5-T. A contaminant of 2,4,5-T was 2,3,7,8-tetrachlorodibenzoparadioxin, also known as TCDD or dioxin. This chemical substance is highly toxic and the effects are best known from animal experiments.

The main effects are tissue edema, liver necrosis, gastric mucosal hypertrophy, gastrointestinal erosion, thymic and lymphatic atrophy. Fetal toxicity, teratogenesis and tumor production have been reported in animals.

Human studies include industrial workers exposed to the chemicals during production, agricultural and railroad workers who utilized the herbicides, industrial accidents occurring within the United States and Europe, and Vietnamese citizens exposed to the chemicals following defoliation. The only human disorder which can be definitely linked to herbicide exposure is chloracne. The lesion may heal completely or result in scar tissue. Temporary symptoms can be produced after heavy exposure, including nausea, diarrhea, fatigue, anorexia, headaches, backaches, cutaneous sensory deficiency, impaired olfactory or gustatory sensation, tremors, and temporary focal muscle paralysis. These symptoms disappeared after a short period of time.

Many statements regarding chronic adverse effects of the herbicides in man are unsubstantiated at this time. Because of this confusing scientific evidence, D. M. & S. staff established an informal group whose purpose was to bring together pertinent known evidence concerning the health effects of herbicides and to formulate a factual base on which the VA could develop health care policies.

This group included representatives of all Federal agencies with regulatory functions and expertise concerning toxic chemicals, plus consultants from the chemical manufacturing industry and university medical centers, and has held three meetings so far. Since it has become evident that the group's deliberations may be of interest to both the Federal agencies and nongovernmental bodies, permission has been requested to reconstitute this group as a formal Federal advisory committee.

Meanwhile, it was judged important to start immediately with formulation of administrative processes to manage health care issues for individual veterans at all the VA medical centers. A brochure covering the broad issues pertaining to herbicides was developed and mailed to all medical center directors and chiefs of staff. The original copy of the brochure was prepared to March 12, 1978. It has been updated periodically as new perceptions of the problem emerged.

Next a hotline discussion with all medical center directors and chiefs of staff was held on April 7, 1978. During this conference call, detailed explanations were given concerning the main issues and guidance was provided on how to manage individual claims by veterans who express concern over possible long-term effects of exposure to the herbicides. This hotline—and I might say the hotline conference is a tele-

phone hookup where we can speak to all VA medical centers at one time and encourage questions from them if the need arises.

This hotline conference was followed up with a telegram which provided direction to the VA medical centers' staffs on appropriate management of claims for health care.

Investigation of the problem revealed that the main scientific concern is whether a highly toxic contaminant of herbicide 2,4,5-T, namely TCDD, or dioxin, may persist in body tissues for protracted periods and thus serve as an indicator of proper exposure. Inquiry into the possibility of identifying specialized laboratory facilities within the VA or in another Federal agency which would be able to demonstrate the presence of dioxin in body tissue was made. No such laboratory could be found. To create such a facility would cost approximately $80,000 and would take about a year. A qualified Federal laboratory is located at Wright Patterson Air Force Base. Another laboratory which does reliable Government contract work at the University of Nebraska was also identified.

It was then decided to conduct a brief, controlled investigation of 20 age- and service-matched veterans, 10 being individuals who have had unquestionable exposure to Agent Orange during the Vietnam war and 20 being veterans who have not knowingly had any exposure to this agent during their military service. The objective of the study is to determine whether dioxin does indeed persist in body fat for as long as 8 to 10 years, at the level of concentration which is capable of instrumental identification with the present state of the art, roughly 1 part per trillion.

Another objective is to discover whether persons who have never been exposed to Agent Orange during the Vietnam war also carry in their body fat dioxin or other chemicals which cannot be differentiated from dioxin by currently available laboratory methods.

A third objective would be to correlate symptoms and levels of exposure with amounts of dioxin found in fat after 8 to 10 years. If dioxin is found only in the Vietnam veterans who have been exposed to Agent Orange, a biopsy approach to diagnosis may prove valuable. If dioxin is, however, found in persons never exposed to Agent Orange, or if no dioxin is found in the tissues of Vietnam war veterans who have persistent symptoms stemming from the time of their exposure to Agent Orange, the biopsy approach would obviously be of little value.

Review of literature and consultation with knowledgeable scientists have also suggested that dioxin may affect chromosomes and other body defense mechanisms—receptor sites, enzyme systems, or immunity mechanisms—so that remote adverse health consequences may be mediated even though the dioxin itself may disappear. There is considerable animal experimentation indicating that such effects can be created by dioxin-type chemical moieties.

Since the effects achieved on animals sometimes are mimicked by human ill health, VACO D.M. & S. staff have taken further steps to insure that all parameters of health management of Vietnam veterans are inquired into by the medical staff of our field medical centers. A detailed administrative document was developed, therefore, to insure proper present and future surveillance of Vietnam veterans for possible remote adverse health effects relating to toxic chemicals.

VA Department of Medicine and Surgery Circular 10–78–219, dated September 14, 1978, has been delivered to all medical centers. This circular should insure that each veteran who alleges exposure to herbicides or complains of symptoms believed to be due to exposure to herbicides will immediately receive proper administrative and health care management. These services are directed specifically to resolving the issue of whether or not verified symptoms can be professionally attributed to herbicide poisoning or attributed to some other etiologic agent or process. This will immediately provide the veteran with two benefits.

The first of these is a diagnosis and appropriate therapy.

The second benefit will be that a medical basis will have been established for the processing of a claim which any veteran may make for veterans' benefits. However, emphasis, at least from the Department of Medicine and Surgery, is on medical care. Veterans will receive appropriate treatment for whatever condition is discovered at the time they report for medical examination.

The circular also provides for quarterly reporting of statistics on the number of veterans who requested medical examination for alleged herbicide-related symptoms and the numbers professionally attributed to herbicides. These statistics will enable VA central office staff to evaluate the magnitude of the herbicide problem with more precise knowledge.

Steps are currently being taken to develop a complete central office registry for all veterans with proven exposure to herbicides during the Vietnam war. The purpose of this registry is to insure that there will be a follow-up on every case in the event that future scientific research shows that delayed adverse health effects may be a sequel to remote one-time exposure to herbicides. It is also possible that other disease entities may later be discovered to have an entiologic relationship to exposure to herbicides. The registry will take cognizance of this eventuality, including the possibility of adverse health effects on the families of Vietnam veterans.

To insure completeness of information, D.M. & S. staff have arranged with the Armed Forces Institute of Pathology to receive pathologic specimens removed at VA medical centers from Vietnam veterans with possible exposure to herbicides. Circular 10–78–234, dated September 29, 1978, was written and sent to all VA medical centers. Tissues thus referred to the AFIP will be retained perpetually to facilitate research and reinvestigation of individual cases in the light of new knowledge concerning the biological properties of herbicides.

To insure impartiality in assessing the validity of professional attributions of individual health problems to herbicide exposures, D.M. & S. has proposed the creation of an evaluation committee. Members will be derived from appropriate specialists in the various disciplines of relevance (internal medicine, neurology, psychiatry, pathology, et cetera). This committee will be activated in the near future—as a matter of a fact next week—as information will be forwarded to VACO in accordance with Circular 10–78–219.

The Veterans Administration has maintained a detailed computerized file over the past two decades on all medical diagnoses of veterans who have been admitted to bed care sections of VA medical centers. It is possible, therefore, to review retrospectively whether any partic-

ular disease has increased over the past 15 to 20 years in any age group of veterans.

Since the possibility of cancer is the most alarming prospect for any individual, VA D.M. & S. staff have commenced a review of the prevalence of cancer of the principal body organs such as liver, pancreas, lung, et cetera, in all age groups of veterans from a time preceding the use of herbicides in Vietnam through to the most recent time. If an increased incidence of cancer is discovered in any year for veterans of the age group which may be representative of the Vietnam veterans, the individual case files will be reviewed for the possibility that the veteran may have been exposed to herbicides.

The VA D.M. & S. staff have been advised, both through its review of the medical literature and through its consultations with knowledgeable resources, that the development of a rather distinctive skin eruption, chloracne, alluded to by the previous witness, occurs characteristically in persons known to have significant exposure to dioxin. This chloracne type lesion has also been evoked in experimental animals by feeding experiment involving minute quantities of dioxin. Field staff have been specially altered to the significance of this sign, so that veterans who have had chloracne will be studied very thoroughly for confirmatory evidence of exposure to herbicides.

D.M. & S. staff will also commence a review of prior diagnoses of skin diseases which have come to the attention of the VA through the mechanism of veterans' benefits adjudication. VA Department of Veterans Benefits fortunately maintains a computer file on decisions regarding skin disease rating for benefits. D.M. & S. staff will be able to identify appropriate cases by review of this file. This work has been started. It should be emphasized, however, that this approach is merely to gain access rapidly to likely cases of herbicide poisoning. It is known that exposure to dioxin does not invariably evoke chloracne, although there is a high correlation between the two.

D.M. & S. staff discovered that during 1949 an industrial accident occurred in a Monsanto Chemical Factory at Nitro, West Virginia, during which a total of 289 employees were significantly exposed to 2,4,5-TCP. Subsequent analysis of this revealed it to contain dioxin. All those exposed became ill. Families of the factory employees also were exposed and became ill, since the employees carried the chemicals home on their clothes.

The Veterans' Administration is most anxious to obtain epidemiologic data showing the outcome of this episode of exposure for individual victims, since this may be anticipated to provide elucidation of the problems of the Vietnam veterans who were exposed to herbicides. VA has identified an Institute for Environmental Health Sciences at the State University of Colorado, which is willing to undertake such an epidemiological analysis. We are also inquiring into the outcome of other industrial accidents.

It should be noted that there is a significant difference between the numbers of veterans who have reported to VA medical centers for examination and the large numbers claimed in public media to have been exposed to or to have become ill from the effects of herbicides.

During the period 1962 through 1971, approximately 18.85 million gallons of herbicides were sprayed over the combat zones of Vietnam. That figure is of course subject to change in view of the recent dis-

closures by the previous witness in the Air Force. But during this time it was theoretically possible that about 4.2 million American soldiers could have made transient or significant contact with the herbicides because of this operation.

By contrast, no complaints referrable to this use of herbicides reached the VA before 1978. By close of business June 30, 1978, fewer than 300 veterans had presented themselves at VA medical centers for health problems they believed had been caused by exposure to the herbicides, although a larger number had applied for veterans' benefits.

Matters are made much more difficult by the fact that 8 years have elapsed since the use of the herbicides was terminated in Vietnam. In addition, it is known now that prior to, during, and subsequent to the Vietnam war, equally large quantities of the same herbicides have also been used in the United States of America without a great many concerns over adverse health effects. Herbicides of the 2,4,5-T type have been used by millions of Americans in agriculture, horticulture, and forestry operations. Undoubtedly millions of Americans, including Vietnam veterans, have encountered dioxin in this nonmilitary fashion.

The Environmental Protection Agency has just this year filed the first rebuttable presumption injunction against the continued use of 2,4,5-T. However, despite this injunction dioxin containing chemicals may not disappear from domestic use very soon. If later proof is produced that human health is significantly impaired by dioxin, the VA's task will be to distinguish harm which veterans may have encountered through the use of the herbicides during the war from harm which may have come to them through nonmilitary domestic exposures to chemicals. We do not anticipate that this will be easy.

From the information and data presented, it is clear what a complex and difficult task the thorough and complete investigation and evaluation of this whole herbicide problem is. We pledge, however, that the Veterans' Administration, working in close cooperation with other concerned government and private organizations, will continue to pursue it to its proper resolution.

Mr. Chairman, I am attaching for your information a copy of the rating practices and procedures to be used in handling claims for service-connected benefits arising out of alleged exposure to defoliants and statistical data on the claim for service-connection received by the Department of Veterans Benefits to date.

Mr. Chairman, that concludes my statement. Mr. Peckarsky and the other gentlemen here and I will be glad to answer any questions you and other members may have.

Mr. SATTERFIELD. We thank you very much. Without objection, the attachment to your statement, rating practices and procedures, disability—Vietnam defoliant exposure and other information to which you refer will be admitted in the record.

[The information follows:]

RATING PRACTICES AND PROCEDURES

DISABILITY—VIETNAM DEFOLIANT EXPOSURE

*Claims contending relationship between defoliant exposure and disability.*—Claims for service-connected disability benefits are being received from veterans

who claim disability incurred through or aggravated by exposure to defoliants used during the Vietnam War.

Except for a skin condition known as chloracne, there are presently no firm data to incriminate the herbicides as causative agents of any other known category of disease or chronic symptom. However, a contaminant Dioxin, found in small quantities in defoliants is toxic.

No special procedures will be initiated for these claims. Instead, each case will receive a thorough development of all available evidence. This will include a request to both the veteran and the service department to furnish verification of exposure to herbicides, the extent and duration thereof and the dates on which such exposure occurred.

All other required development will be done concurrently with the request for verification of exposure to defoliants, and each case will be extended the same consideration given any other claim for service connection.

Where no disability is claimed but only exposure to herbicide is alleged, the claim will be administratively disallowed and the veteran advised that mere exposure itself is not a disease or disability. The claimant will be advised that specific disabilities must be claimed. This should be accompanied by evidence of the earliest manifestation of symptoms together with evidence of continuity.

A veteran's claim alleging herbicide related genetic damage based upon damage or defect in the veteran's child will be administratively disallowed since Title 38 U.S.C. makes no provision for such a claim.

Copies of all ratings involving defoliants will be submitted to the Compensation and Pension Service (211C3). There should be no hesitancy in submitting cases, appearing to have merit, but not meeting current criteria for service connection, to the Compensation and Pension Service (23B/211C) for advisory opinion.

Between 1 and 2 million veterans served in South Vietnam during military herbicide operations from 1962 to 1971.

There is little information on the number of personnel exposed to herbicides in Vietnam as no records were kept.

Some personnel may have been exposed indirectly to herbicides through ingestion of contaminated drinking water and food and by skin contact.

Central Office receives ratings of claims for diseases from herbicide exposure.

There have been between 450 to 500 claims filed for disease from herbicide exposure through September 30, 1978.

To date copies of 92 ratings have been received in central office in which herbicide exposure has been claimed.

These 92 ratings represent decisions of original jurisdiction prior to any appellate review.

Of the total number or ratings received 1 claim was allowed for a skin condition presumably due to herbicide.

An additional 7 claims were allowed for other reasons—6 for skin condition not related to herbicide, and 1 for malignancy also not found to be related to herbicide.

Of the remaining 84 claims disallowed 12 were claims for exposure to agent orange only without a diagnosed disease or injury.

Of the 72 denied claims with diagnosis or specific allegation some had more than one diagnosed condition falling into the following categories:

Skin condition (acne, eczema, keloids, uriticaria, etc.)—42.
Nervousness and fatigue (claimed)—24.
Paralysis or numbness of extremities (alleged)—16.
Cardiovascular and hypertension—6
Cancers (leukemia, Lymphoma, bone, bladder, etc.)—6.
Eent pathology—3.
Impaired sexual activity (alleged)—2.
Hodgkin's disease and swollen glands—2.
Lung condition—1.
GI condition—1.

In order to assist regional offices in the development of claims for disease due to herbicide exposure we have requested DOD to furnish us with complete maps of each herbicide mission, the dates they were carried out, the units performing the spraying missions, the unit present in the area at the time of the mission or those units entering the area after they were sprayed.

We are also developing claims for skin conditions claimed to be due to herbicides to determine in retrospect whether the skin condition claimed was actually Chloracne.

In those claims in which the skin disease is determined to be chloracne, and the veteran now has other chronic disease of unknown cause the claim is submitted for review by an independent medical expert to determine whether the two conditions are etiologically related.

HERBICIDAL CHEMICAL EXPOSURE CLAIMS

| | Number | Percent |
|---|---|---|
| A. Total number of cases in study | 92 | 100.0 |
| Claims with diagnosis or specific allegation | 80 | 87.0 |
| Claims with no diagnosis | 12 | 13.0 |
| B. Claims with diagnosis or specific allegation | 80 | 100.0 |
| Allowed | [1] 1 | 1.3 |
| Allowed for other reason | [2] 7 | 8.7 |
| Denied | [3] 72 | 90.0 |
| In summary: | | |
| Total claims | 92 | 100.0 |
| Allowed | 8 | 8.7 |
| Denied | 72 | 78.3 |
| No diagnosis | 12 | 13.0 |

[1] Claims for skin condition.
[2] 6 claims skin condition, 1 claim lung cancer.
[3] These 72 claims having more than 1 diagnosis or specific allegation fall into the following categories: Skin condition (acne, eczema, keloids and urticaria), 42; nervousness and fatigue (claimed), 24; paralysis or numbness and other symptoms of extremities, 16; cancers (leukemia, lymphoma, bone and bladder), 6; cardiovascular and hypertension, 6; EENT pathology, 3; impaired sexual activity (alleged), 2; Hodgkins and swollen glands, 2; lung condition, 1; GI condition, 1.

VETERANS' ADMINISTRATION, DEPARTMENT OF MEDICINE AND SURGERY WASHINGTON, D.C.

To: Directors, all VA hospitals, domiciliary and outpatient clinics.
Subject: Possible exposures of veterans to herbicides during the Vietnam War, RCS 11-49.

1. The purpose of this Circular is to proivde supplemental information to the teletype directive dated May 19, 1978, on the above subject, and instructions for documentation in the medical record. It is essential that all concerned personnel be given copies of the teletype directive and this Circular.

2. Recent publicity in the news media about illness among persons who were exposed to herbicidal agents used in Southeast Asia, may result in veterans presenting themselves at VA health care facilities for evaluation. It should be understood that there is no positive evidence for deleterious effects on the health of individuals exposed to these herbicides which is of a permanent nature. However, it is widely agreed that it is necessary to provide such individuals with meticulous medical follow-up for prolonged periods of time in order to obtain definitive answers about the health related effects of herbicides.

3. Accordingly, VA policy is to examine thoroughly all veterans who claim toxic effects from exposure to herbicides during the Vietnam War and to maintain appropriate records on them so that any late complications due to these agents can be determined and treated.

4. All Vietnam Era veterans who currently are being treated in a VAHCF, and those who apply for such care will be asked to identify their previous military occupational code number, and asked whether they were exposed to herbicidal sprays or bulk chemicals during their periods of service in Vietnam. The military occupational code number will be entered on the VA Form 10-10 (April 1978) Application for Medical Benefits, in item 13, Military Service.

5. If a veteran states that he/she was exposed to defoliant sprays or bulk chemicals, he/she will be asked the questions appearing on the initial data base, possible exposure to toxic chemicals, part I, of the regular medical history for an examination (Attachment A).

6. In eliciting the medical history and performing the physical examination (Attachments B & C), particular attention should be given to those organs which are most commonly affected by chemical intoxicants: nervous system, immune system, blood-forming system, liver, kidneys, thyroid, adrenals, gonads, skin, and lungs. Evidence concerning the following symptoms/conditions should be ascertained: an altered sex drive, sterility, frequent abortions, congenital deformities among children, repeated infections, and neoplasia. Particular attention should be directed to the detection of chloroacne, a skin condition which has been associated with acute exposure to herbicide mixtures containing the toxic chemical,

Dioxin. It is important when the first manifestation of these symptoms/conditions occurred and the details of any treatment provided.

7. *Appropriate diagnostic studies should be performed and consultations obtained* as indicated by the patient's symptoms and signs. Performance of nonroutine diagnostic studies such as sperm counts may be appropriate if suggested by the workup. Any surgical, cytologic or other similar tissue removed in conjunction with any diagnostic, operative or other procedure should be processed and reported in the usual manner. All slides, blocks, and tissues will be retained for inclusion in a special tissue registry, the location and operation of which will be described in a separate circular.

8. There is controversy among experts regarding to diagnostic value of measuring levels in body fat of Dioxin, a toxic contaminant of the of the herbicides utilized in Vietnam. In order to help resolve this controversy a study will be conducted, under VACO auspices, which will measure Dioxin levels in fat tissue taken from VA patients with a history of exposure to herbicides and from an unexposed control group. Until this study is completed, no VAHCF should attempt to measure tissue Dioxin levels in any of its patients without prior consent from VACO (11F).

9. Whenever a veteran seeks evaluation at a VAHCF for possible toxicity due to herbicides, the Medical Administration Service should be notified of this fact promptly. Following notification, that Service will initiate the procedures listed below:

(1) The patient data card will be used to imprint a 3 x 5 card.

(2) The 3 x 5 card will be filed alphabetically in a special file, which will be retained indefinitely.

(3) The file will be labeled "Possible Toxic Chemical Exposure File".

(4) In Item No. 17 of VAF 10-10, "Do you believe the need for care is" the following statement will be entered in the blank space: "Possible Toxic Chemical Exposure".

(5) For extra control purposes—insert at the top of VAF 10-10m, (Medical Certificate and History) the following statement: "The veteran states he/she has been exposed to chemical defoliant".

10. For all Vietnam veterans for whom these 3 x 5 cards are generated, it is essential that uniform recording of the initial data base discussed in paragraph 4 be provided. The following medical record forms will contain the data as illustrated on Attachments A, B, and C: Progress Notes (SF 509 or VAF 10-7978l) and Physical Examination (SF 506 or VAF 10-7978e). The heading, "Initial Data Base—Possible Exposure to Toxic Chemicals (Part I, II or III)" will be placed at the top and bottom (including reverse side of each form) to insure proper identification and easy retrieval. If a Vietnam veteran is currently hospitalized, the illustrated progress notes form (Parts I and II) will be completed and, in addition, the current physical examination form, already completed, will be stamped with the heading "Initial Data Base—Possible Exposure to Toxic Chemicals—Part III."

11. When the VAF 10-10 involving a potential chemical exposure and the Initial Data Base are completed and there is no indication for hospitalization or outpatient treatment, the forms will be placed in an existing or newly created veteran's Consolidated Health Record (CHR) rather than being placed in the rejected VAF 10-10 file. The placement of these forms in the CHR will insure that the record is retained for historical, clinical, statistical and research purposes.

12. A quarterly report, beginning with the quarter ending September 1978, will be submitted to reach the Associate Deputy CMD for Operations (11) by the 8th workday of the month following the close of the quarter. Negative reports are to be submitted. The report will contain the following information:

(*a*) Total number of Vietnam Era veterans claiming symptoms related to possible exposure to chemical defoliants or bulk chemicals during their tours of service in Southeast Asia.

(*b*) Of the total number of veterans alleging symptoms in subparagraph a above, the number of veterans with symptoms professionally attributed to exposure to chemical defoliants.

(*c*) Copies of Attachments A, B, and C, with copies of pertinent laboratory data and consultations, completed for each veteran included in subparagraph b will accompany the quarterly report.

Color-coded month tags should be placed on the 3 x 5 cards to provide the data required by subparagraph a. Local controls should be established to provide subparagraph b data.

13. We recommend that consideration be given to the designation of one or two clinical staff members as "environmental health physician(s)" to provide clinical management of veterans claiming exposure.

14. Questions concerning VACO's position on possible exposures to herbicides should be referred as follows: policy questions to Dr. Paul Haber (11) at extension 2213 or Dr. Richard Levinson (11F) at extension 3560, clinical questions to Dr. Gerrit Schepers (111) at extension 2550; and administrative questions to Medical Administration Service (136B) at extensions 2933 and 3468.

HERBERT M. BAGANZ, M.D.,
*Acting Deputy Chief Medical Director.*

SEPTEMBER 14, 1978.
Attachments.

Circular 10-78-219
September 14, 1978

RCS 11-49
Attachment A

| MEDICAL RECORD | PROGRESS NOTES |
|---|---|
| DATE | INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART I |

A. Date _____ Current Status of Veteran: ____ Outpatient / Inpatient

B. Branch of Service:
Military or Civilian Unit Designation:

C. How many exposures does the veteran allege?

D. What was the nature of each exposure?

E. When and where did these exposures occur? (Specify dates, military field bases, and length of exposure.)

F. Define severity of the exposure - circle or check, as appropriate.

| Severe | Direct | Repeated | Prolonged |
|---|---|---|---|
| Short | Mild | Indirect | |

G. At time of exposure - what was the veteran's job in service?
(Field participation, rear echelon, administration, etc.)

H. How directly was the veteran brought in contact with chemicals? (Check one)

____ Veteran was member of headquarters personnel and far removed from site of chemical exposure.

____ Veteran was in field.

____ Veteran operated apparatus used for chemical spraying or handled bulk chemicals in such a manner that gross exposure was possible.

I. If, in field, was veteran undercover (building, trench, foxhole, etc.) or out in open? Was he in a vehicle at the time?

*(Continue on reverse side)* (SEE OTHER SIDE)

PATIENT'S IDENTIFICATION (Print typed or written names give Name—last, first, middle; grade, rank; date, hospital or medical facility)

REGISTER NO | WARD NO

PROGRESS NOTES
STANDARD FORM 509 (Rev. 11-77)
Prescribed by DOD/DVA
FPMR (41 CFR) 101-11.6
509-110

INITIAL DATA BASE-POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART I

A-1

Circular 10-78-219
September 14, 1978

Attachment A
(Reverse Side)

PROGRESS NOTES

Date

INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART I

J. How long was veteran present at site of chemical exposure?

K. Was veteran issued protective gear? ____Yes ____No
If "yes" - did veteran wear this gear? ____Yes ____No
Describe gear:

L. Did veteran enter areas where chemicals previously had been sprayed or spilled - or did veteran eat from utensils or drink water contaminated by chemicals? Does veteran remember chemical names? Describe in detail.

M. What steps were taken to remove chemicals from veteran or the environment?

N. Has veteran been exposed to other potentially toxic chemicals:
(1) Prior to military service: ____Yes ____No
(2) During military service: ____Yes ____No
(3) After military service: ____Yes ____No IF "YES" DESCRIBE:

O. (1) What is veteran's military occupation code number? _____
(2) Veteran possesses a copy of DD 214, Report of Separation-Active Duty?
____Yes ____No IF "YES" ENCOURAGE VETERAN TO BRING A COPY.
(3) Veteran possesses a copy of Service health/medical record?
____Yes ____No IF "YES" ENCOURAGE VETERAN TO BRING IN A COPY.
(4) Has veteran received VA Care?
____Yes ____No IF "YES", STATE LOCATION.

GPO 1977 O-VC-740-[illegible] STANDARD FORM 20 BACK (Rev. 11-73)

INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART I

Circular 10-78-219
September 14, 1978

RCS 11-49
Attachment B

| MEDICAL RECORD | PROGRESS NOTES |
|---|---|
| DATE | INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART II |
| | REVIEW DATA ON PART I |
| | A. Pertinent Medical History - include symptoms at time of exposure, or later - attributed by the veteran to exposure - (continue on another Part II if needed) |
| | B. Pertinent Physical Examination (PE) - (check one). |
| | ___Physical Examination to be done (Use SF 506 or VAF 10-7978i) "Initial Data Base - Chemical Exposure, Part III " |
| | ___Repeat Physical Examination is indicated (a prior PE has been done within six months and has been reviewed). |
| | ___Repeat PE is not indicated (a prior PE has been done within six months and has been reviewed). |
| | (Continue on reverse side) (SEE OTHER SIDE) |

PATIENT'S IDENTIFICATION (Use typed or written corner plate. Name, last, first, middle; grade; rank; case, hospital or medical facility)

REGISTER NO. | WARD NO.

PROGRESS NOTES INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART II

STANDARD FORM 509 (Rev. 11-77) Prescribed by DSA/OMB, FPMR (41 CFR) 101-11.205-3 509-110.

B-1

Circular 10-78-219
September 14, 1978

Attachment B
(Reverse Side)

**PROGRESS NOTES**

DATE

INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART II

Check if following examination ordered:

C. Yes No

___ ___ Complete blood count including differential
Chest X-Ray (if no chest X-Ray within six months)

___ ___ Liver Function Profile

___ ___ Renal Function Profile

___ ___ Sperm Count

___ ___ Referral to a Dermatologist

D. Other Comments:

1. Evidence of Neoplasia: Present ___ Absent ___

*Family History of:*

Neoplasia Related Factors (e.g., cigarette smoking, radiation exposure, etc.)

2. Evidence of - Veteran and/or Family:

*Infertility:* Present ___ Absent ___

Abortions: Yes___ No ___

Teratogenesis: Yes ___ No ___

If "yes", Describe:

3. Were veteran's spouse or children in Vietnam? Yes ___ No ___
If "yes", give details.

GPO: 1977 O-VC--240-460(118) STANDARD FORM 509 BACK (Rev. 11-71)

Circular 10-78-219
September 14, 1978

RCS 11-49
Attachment C

Standard Form 506

| CLINICAL RECORD | PHYSICAL EXAMINATION |
|---|---|

| DATE OF EXAM. | HEIGHT | WEIGHT | | | TEMPERATURE | PULSE | BLOOD PRESSURE |
|---|---|---|---|---|---|---|---|
| | | AVERAGE | MAXIMUM | PRESENT | | | |
| | | | | | | | |

*INSTRUCTIONS.—Describe (1) General Appearance and Mental Status; (2) Head and Neck (General); (3) Eyes; (4) Ears; (5) Nose; (6) Mouth; (7) Throat; (8) Teeth; (9) Chest (General); (10) Lungs; (11) Cardiovascular; (12) Abdomen; (13) Hernia; (14) Genitalia; (15) Rectum; (16) Prostate; (17) Back; (18) Extremities; (19) Neurological; (20) Skin; (21) Lymphatics.*

INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART III

(Continue on reverse side)

| PATIENT'S IDENTIFICATION (For typed or written entries give Name-last, first, middle; grade; date; hospital or medical facility) | REGISTER NO. | WARD NO. |
|---|---|---|
| | | |

INITIAL DATA BASE - POSSIBLE EXPOSURE TO TOXIC CHEMICALS - PART III

PHYSICAL EXAMINATION
Standard Form 506
General Services Administration and Interagency Committee on Medical Records
FPMR 101-11.606 B
October 1975 506-105

VETERANS' ADMINISTRATION, DEPARTMENT OF MEDICINE AND SURGERY,
WASHINGTON, D.C.

Subject: Special registry at the Armed Forces Institute of Pathology for pathological material from veterans with possible exposure to herbicides during the Vietnam war.

To: Directors, Medical Centers, Medical Regional Office Centers, domiciliary, outpatient clinics and regional offices with outpatient clinics.

1. Attention is directed to DM&S Circular 10-78-219, RCS 11-49 dated September 14, 1978 Possible Exposures of Veterans to Herbicides During the Vietnam War with particular reference to paragraph 7. This paragraph states that a special tissue registry will be established for central collection of surgical, cytologic and autopsy material from veterans included in this category.

2. This Circular announces the establishment of this special registry in the Environmental and Drug Induced Pathology Department at the Armed Forces Institute of Pathology (AFIP).

3. All pathological material (surgical, cytologic or other similar tissue) from veterans with possible exposure to herbicides during the Vietnam War will be examined and reported in the customary manner at each medical facility. In addition, a duplicate set of slides, blocks and representative wet tissue will be forwarded promptly to the AFIP with the case clearly marked as "Possible Exposure to Herbicides-Vietnam War." Information will also be placed on SF 515, Tissue Examination in the patient's medical record noting that pathological material has been sent to the AFIB for inclusion in the special category.

4. The material for shipment to the AFIP will be packaged in the normal manner and addressed to the Director, Armed Forces Institute of Pathology, Attention Environmental and Drug Induced Pathology Department, Washington, D.C. 20306.

5. Any questions in this connection should be directed to Dr. Paul C. LeGolvan, Deputy Director, Pathology Service (113), extension 2348.

HERBERT M. BAGANZ, M.D.,
*Acting Deputy Chief Medical Director.*

SEPTEMBER 29, 1978.

CHARTER OF VETERANS' ADMINISTRATION ADVISORY COMMITTEE

*A. Official designation*

Advisory committee on health-related effects of herbicides.

*B. Objectives and scope of activity*

It has recently been brought to light that enormous quantities of herbicidal chemicals were used during the Vietnam War and that there is a possibility that large numbers of Americans, many of whom now qualify as veterans, may have encountered these chemicals to an extent that long range significant health problems may have been initiated. There is considerable controversy in the published literature and it is possible that much information remains unpublished. The Veterans Administration has not previously been required to resolve toxicological issues of such a complex and highly controversial nature. The Committee will, therefore, assemble and analyze the information which the Veterans Administration needs in order to formulate appropriate medical policy and procedures in the interests of the involved veterans. The Committee will have an entirely fact-finding and advisory role and will not be required to develop policy. The Committee will adhere to all the provisions of U.S. Public Law #92-463, 5 U.S.C. App. I, Executive Order #11769 and Presidential Circular A-63, of March 27, 1974 and subsequent applicable revisions.

*C. Period of time necessary to carry out the committee purpose*

It is anticipated that the Committee may achieve its objectives within twelve calendar months. If an extension of time is needed, this will be properly negotiated.

*D. Agency official to whom the committee reports*

The Committee will report to the Chief Medical Director through the Assistant Chief Medical Director for Professional Services.

*E. Agency responsibility for providing the necessary support*

Veterans' Administration Department of Medicine and Surgery.

*F. Duties and functions of committee*

The Committee holds quarterly sessions at the Veterans Administration Central Office in accordance with an appropriate schedule of dates set at preceding meetings. A structured agenda is followed. Members are asked to prepare special presentations and gather categories of data uniquely accessible to them. All members state their views fully and explicitly and support these with documentation as needed. The views of individuals with differing opinions are recorded. Testimony is obtained from knowledgeable persons. Meetings are open to the public except when, in the discretion of the Chairman, the privacy of individuals, who may come under discussion, may be infringed. Members of the public may direct questions to the Chairman in writing and submit prepared statements for review by the Committee. At the discretion of the Chairman, such members of the public may be asked to clarify such submitted material prior to consideration by the Committee. The Committee maintains summary minutes of its findings and develops conclusions and interim reports for consideration by the staff of the Veterans Administration. The Committee maintains liaison with all other federal agencies which have knowledge of and expertise in toxicology of chemical substances which may be pertinent to the herbicide issue.

*G. Estimated operating costs*

The estimated annual cost for operating the Committee is $5000 and about 300 staff man-days. The Committee should have 12–15 members.

*H. Number and frequency of meeting*

The Committee meets quarterly for one half day per session.

*I. Termination date*

Unless renewed by appropriate action prior to its expiration, the Committee will expire two years from the date below.

*J. Date charter was filed*

AD HOC VACO ADVISORY COMMITTEE MEMBERS

Gerrit W. H. Schepers, M.D., Sc.D., Medical Service, VACO, Chairman.
Richard Levinson, M.D., Deputy ACMD for Professional Services, VACO.
William J. Jacoby, Jr., M.D., Director, Medical Service, VACO.
Lawrence Hobson, M.D., Ph.D., Deputy Director for Research and Development, VACO.
Philip C. Kearney, Ph.D., Office of the Secretary for U.S. Dept. of Agriculture.
Carolyn Offutt, M.S., Dioxin Project Manager, Environmental Protection Agency.
Donna Kuroda, Ph.D., Physical Science Administrator, Environmental Protection Agency.
Hans Falk, Ph.D., Associate Director, Health Hazard Assessment, National Institute of Environmental Health Sciences.
Cipriano Cueto, Ph.D., Director, Pesticides Program, National Cancer Institute.
J. W. Thiessen, M.D., Aberdeen Proving Grounds, Major, Mc. US Army.
Charles Peckarsky, L.L.B., Director, Compensation and Pension Service, VACO.
Paul LeGolvan, M.D., Deputy Director, Pathology Service, VACO.
Col. Sherrill Laney, Office of the Surgeon General, MC US Air Force.

To: ACMD for Professional Services.
From: Chief Medical Director (111).
Subject: *Ad Hoc Advisory Committee on Defoliants.*

1. Please convene a committee which can provide DM&S with expert advice on medical aspects of defoliants.

2. The committee's membership should be composed of experts from the VA, other Federal agencies and appropriate private sector institutions.

3. Dr. Gerrit Schepers may serve as Chairman of the Committee.

4. The specific areas which the committee should explore are as follows:

(*a*) The potential adverse effects of defoliants on the health of Vietnam Veterans, including the symptoms and signs associated with those effects.

(*b*) Method for diagnosing and treating the adverse health effects of defoliants.

(*c*) Approaches through which the VA might attempt to discover the prevalence of the adverse effects of defoliants on its patient population.

5. In general, I would expect that the committee would complete its business in the course of one year and then disband.

6. I would like to receive periodic written reports covering the committee's progress.

JOHN D. CASE, M.D.

U.S. GOVERNMENT MEMORANDUM

To: Program Chief for cardiology and pulmonary diseases (11).
From: ACMD for professional services (11F).
Subject: Formation of an Ad Hoc Advisory Committee on Defoliants.

1. Please organize an ad hoc committee which can provide me with expert advice on the medical aspects of defoliants.
2. I would like you to serve as Chairman of the Committee.
3. The committee members may include those named on the attached list.
4. The specific areas which the committee should explore are as follows:
(*a*) The potential adverse effects of defoliants on the health of Vietnam Veterans, including the symptoms and signs associated with those effects.
(*b*) Methods for diagnosing and treating the adverse health effects of defoliants.
(*c*) Approaches through which the VA might attempt to discover the prevalence of the adverse effects of defoliants on its patient population.
5. In general, I would expect that the committee would complete its business in the course of one year and then disband.
6. I would like to receive quarterly committee reports covering the committee's progress.

PAUL A. L. HABER, M.D.

MAY 30, 1978.

VETERANS' ADMINISTRATION AD HOC COMMITTEE ON HEALTH RELATED EFFECTS ON HERBICIDES

AGENDA—SEPTEMBER 25, 1978

1. Roll-Call: Members, Consultants, Visitors.
2. Minutes: Review and approve after corrections. Appendices will be furnished later since they still are being Xeroxed.
3. Matters arising out of the minutes: Needed discussion. Some of the discussion can be continued at later phases of the meeting.
4. Dr. Paul Haber: Overview of VACO approach to the problem. Briefing of Vietnam War Veterans Committee Charter and status.
5. James Allen, DVM, Ph. D. University of Wisconsin, Madison, WI. Personal Research on the Toxicology of 2,4-D, 2,4,5-T and TCDD.
6. K. Dianne Courtney, Ph. D., EPA Research Triangle Park, NC. Teratogenicity Studies with Chlorodibenzo-p-dioxins.
7. V.A. Circular 10-78-219: Instructions to VA field health care facilities. Management of Individual claims concerning exposure to potentially toxic chemicals.
8. Richard Levinson, MD: Registry on herbicide cases: Status Report Inquiry by steering committee on herbicides.
9. Other matters: Open discussion.
10. Next meeting: Date. Desirable agenda items.

GERRIT W.H. SCHEPERS, M.D.
*Chairman.*

AGENDA—ADVISORY COMMITTEE ON HERBICIDES

Room 119, VA Central Office. July 7, 1 p.m., 810 Vermont Ave., NW., D.C.
1. *Registration of attendees:* Please provide correct names, titles, addresses.
2. *Introductions:* Dr. Gerrit Schepers, Chairman.
3. *Professional Services Overview of herbicide issue:* Dr. Richard Levinson.
4. *Review of VACO Actions with respect to Herbicides:* Dr. Schepers, et al. Brochure. Telegram and hotline. Administrative directive. Correspondence and telephonic communications.
5. *Literature review:* Dr. Dury, Membership.
6. *Methods for Diagnosing and Treating Adverse Health Effects of Herbicides:* Laboratory Tests for Dioxin: Dr. Marjorie Williams, Clinical Symptoms: Dr. Thiessen. Other: Membership.
7. *Evidence for delayed effects of herbicides, especially dioxin*—Carcinogenicity: VA PTF: Dr. Schepers. Other: Membership. Teratogenicity: Membership.

Fetotoxicity and Infertility: Membership. Persistence of dioxin in human tissues: Membership.

8. *Permissible exposure levels for human subjects:* Industrial experience—Dr. Verald Rowe. NIOSH position—Dr. Wills. Catastrophes eg Seveso—Dr. Kearney. Other current exposures—Membership.

Other current exposures—Membership.

9. *Research Needs. Policy issues. Membership.*

10. *Additional members.*

11. *Next meeting date.*

12. *Adjourn:* No later than 4 p.m.

GERRIT W.H. SCHEPERS, M.D.,
*VACO Medical Service.*

MINUTES OF THE AD HOC VACO ADVISORY COMMITTEE ON HERBICIDES

Meeting of July 7, 1978, 810 Vermont Ave., N.W., Washington, D.C.

1. *Attendance: Members:*

Gerrit W. H. Schepers, M.D., Sc.D., Medical Service, VACO, Chairman
Richard Levinson, M.D., Deputy ACMD for Professional Services
William J. Jacoby, Jr., M.D., Director, Medical Service VACO
John J. Castellot, M.D., Deputy Director, Medical Service, VACO
Lawrence Hobson, M.D., Ph. D, Deputy Director for Research and Development, VACO
Abraham Dury, Ph. D., Consultant to Medical Service, VACO
Philip C. Kearney, Ph. D., Office of the Secretary for U.S. Dept. of Agriculture
Donna Kuroda, Ph. D., Ecological Effects Division, Environmental Protection Agency
Carolyn Offutt, M.S., Dioxin Project Manager, Environmental Protection Agency
Hans Falk, Ph. D., Associate Director, Health Hazard Assessment, National Institute of Environmental Health Sciences
Cipriano Cueto, Ph. D., Director, Pesticides Program, National Cancer Institute
Joseph A. Thomasino, M.D., Aberdeen Proving Grounds, Major, Mc, U.S. Army
Charles Peckarsky, L.L.B., Director, Compensation and Pension Service, VACO
Majorie Williams, M.D., Director, Pathology Service, VACO
Johan Bayer, Office of Surgeon General, Colonel, MC U.S. Airforce.

*Consultants:*

Ben B. Holder, M.D., Medical Director, DOW Chemical Company, Midland, MI
Walter W. Melvin, M.D., Sc. D., Professor of Environmental Health Sciences, Colorado State University

*Visitors:*

Hank Spring, Representing Congressman S. B. McKinney
Jim Michie, Representing Senator E. Kennedy

2. Dr. Schepers introduced the members of the committee and explained the manner in which it came into being. In authorizing the committee the Chief Medical Director required it to explore the following:

(*a*) The potential adverse effects on veterans of defoliants used in Vietnam and to assess the symptoms and signs associated with those effects.

(*b*) Methods for diagnosing and treating adverse health effects of defoliants.

(*c*) Approaches through which the VA might discover the prevalence of adverse effects of defoliants used in Vietnam on its patient population. The CMD further expected the Committee to accomplish its task within one year, to prepare interim reports and a final report. Dr. Schepers outlined the manner in which VACO became involved with the herbicide problem since March 1978 and the steps which have been taken. About 500 claims have been lodged with regional offices of the Department of Veterans Benefits. An almost equal number of Vietnam Veterans have also applied for medical examinations. Since only a minority of VA health care specialists is skillful in the discipline of toxicology a brief brochure (Appendix A) was prepared and sent to all health care facilities. Interim telephonic and written orientation also was provided for these HCF's concerning administrative aspects of managing veterans who claim exposure to potentially toxic chemicals. A final version of this directive is currently being reviewed by VACO departmental chiefs. A copy will be mailed to members of the committee. The CMD also created a VACO Steering Committee to deal with inter-service issues on this problem. The steering committee submitted the questions listed in Appendix B.

3. Dr. Levinson reviewed the perspectives of the Office of the ACMD for Professional Services concerning the herbicide issue. He pointed out that the VA has traditionally managed only disease of biological origin and that it has only recently become involved with diseases of environmental etiology such as radiation effects, asbestos exposure and now herbicides. The need for education of the HCF staff is apparent. Education of patients is equally important, particularly because environmentally caused diseases are potentially preventable. There may be specific areas which will require more research, and perhaps research which the VA should sponsor or accomplish. The deliberations of the committee should address these issues.

4. Dr. Dury provided highlights of his reviews of the literature on herbicides and promised to provide a written summary. He referred to the work of Captain A. Young of the USAF who has summarized numerous publications. This report still is being evaluated by the USAF prior to its release. Dr. Dury reported that in both experiments with animals and experience with human subjects accidentally exposed to herbicides short term toxicity effects are on record. There is considerable disagreement concerning long term or delayed adverse health effects. Both the dosage and the duration of exposure influence the severity and type of health effects elicited in animal experiments. Little is known about any adjuvant or neutralizing action of mixtures of herbicides. Health effects have been recorded for animals and man with respect to symptoms, gross pathology, biochemical responses, and histological changes. The best information about human subjects derives from the DOW experiences with inadvertent exposures. Other information is suggested by the Missouri horse farm accident and the Globe Arizona event. There is evidence that dioxin at the 10 ng/kg level and 2,4,5-T at 500 ppt may induce fetotoxicity, teratogenesis and carcinogenesis in experimental rodents. There may be receptor site inhibition so that delayed indirect effects may become possible. There is no recorded evidence of this for man.

5. Dr. Holder pointed out that it is important to distinguish between the health effects of individual herbicides and their contaminants. These chemicals are not necessarily capable of the same biological action. This is especially true for the dioxins, of which there are many variants. The 2,3,7,8-tetrachlorodibenzo-paradioxin (TCDD) appears to be the most toxic. Some of the misunderstanding about the toxicity of dioxin stems from failure to differentiate one dioxin type from another. For the Vietnam War herbicide issue, the proper dioxin (TCDD) is of relevance. It also is important to realize that not all herbicides contain dioxins and, when present, the dioxin is not always in the same amount. The 2,4,5-T supplied to the military during the Vietnam War had concentrations of TCDD varying from one part-per-million (ppm) to about 50 ppm. The phenoxy herbicide was a standard grade agricultural product. Since the war, chemical manufacturing techniques have improved so that current batches of phenoxy herbicides tend to have much less dioxin contamination. Most of Dow's experience with human subjects and much of their toxicology work on animals goes back many years. Dow has been studying these phenoxy herbicides for the past 36 years. Their main human experience involving over-exposure to TCDD leading to symptoms commenced during 1965 when about 60 employees received excessive exposure to TCDD in a trichlorophenol plant. No 2,4,5-T was involved. These 60 employees developed chloracne. Two individuals developed some depression, but all recovered. There was no lost time. It is the concensus of world experts that symptoms from TCDD toxicity does not occur in the absence of chloracne. For this reason, it seems doubtful whether Vietnam War veterans, who never developed chloracne at the time of exposure in Vietnam, did or will show signs of other disease. Little TCDD in Globe and no 2,4,5-T in Missouri or Seveso again remind that one must not group chemicals, but must relate to specific materials. In a response to a question by Dr. Queto, Dr. Holder affirmed that Dow is studying possible human reproductive effects from TCDD and has completed some karyotyping on a 2,4,5-T population.

6. Dr. Falk has had considerable experience with animal experimentation, but no direct involvement with human subjects. The chemical structure of herbicides may determine the toxicity depending, in case of the esters of 2,4,5-T, on the ease with which they can be metabolized. The position of the chlorine atoms also may alter toxicity. This applies similarly to the impurities in 2,4,5-T and its esters which have different potencies depending on whether the chlorine atoms on the dibenzo-p-dioxins are located in critical positions.

Early experiments were carried out with the acid which was contaminated with nearly 30 ppm of the tetrachlorodibenzodioxin, giving rise to teratogenicity

in mice and rats. When purified 2,4,5-T was used, the teratogenicity with regard to the kidney disappeared, which was largely due to the dioxins but remained noticeable regarding cleft palates in mice. With regard to rats, teratogenic potency declined considerably. This susceptibility of the mouse to 2,4,5-T (pure) in producing malformed offspring appears to be unique because subsequent studies in other species like the rabbit, the sheep, as well as, the rat produced little evidence of teratogenicity.

Agent Orange consists of the n-butyl esters of 2,4-D and 2,4,5-T in equal amounts and was also studied for teratogenicity in mice. It did not produce as much toxicity as its two components when tested separately although this finding is hard to interpret. It suggests that the two agents together are not showing enhanced toxicity.

The teratogenic activity of 2,4,5-T was first observed by Dr. Courtney, who obtained a sample of 2,4,5-T which was contaminated with 2,3,7,8-tetrachloro-p-dioxin. When it was pointed out that the impurity was not present in most of the samples of 2,4,5-T and was itself highly toxic, additional studies were carried out to evaluate 2,4,5-T as distinct from its impurities for teratogenicity. It turned out that the "dioxin" impurity was teratogenic and that the purified 2,4,5-T was without effect in the rat but was still producing malformations in the mouse. The dioxin, however, produced kidney anomalies in the rat and the mouse. Because of the difference in response of mice and rats to 2,4,5-T in the absence of dioxins, it is of importance to learn that in other laboratories 2,4,5-T produces no malformations in the rabbit and in sheep. In a study by Collins and Williams impure 2,4,5-T was teratogenic in the Syrian hamster which seemed to be a function of the impurity present in the sample. King, et al. confirmed that purified 2,4,5-T and 2,4-D did not produce malformations in the rat and studies in the chick embryo did not produce evidence of teratogenicity that was clear cut. The teratogenic effect of 2,4,5-T in mice when the content of the dioxin was less than 0.1 ppm was reported by Roll confirming that in the mouse indeed the pure 2,4,5-T was active. Khera and McKinley studied 2,4,5-T and 2,4-D as well as certain esters of these herbicides in rats and observed malformations at comparatively high dose levels. Similar studies on esters were also carried out by Courtney in CD-1 mice and fetotoxicity as well as teratogenicity was observed for each one of the compounds. The solvent seemed to make a contribution in altering the toxicity. Courtney also carried out several studies to determine the distribution of 2,4,5-T between the pregnant animal and its fetuses in the mouse as well as the rat to clarify the difference in toxicity.

7. Dr. Melvin said that mention frequently is made of the Globe and Missouri episodes, about which there is some doubt with respect to the role of dioxin. A much better documented event occurred at Natro, West Virginia, during 1949 in which 282 persons were grossly exposed to 2,4,5-TCP. This included factory workers and their families. Much of the material was carried home on the clothes of the workers so that their wives and children also were exposed. Most became seriously ill, with significant neurological symptoms and chloracne. There were no deaths. All recovered symptomatically except for chloracne scars. Although this group has survived for more than thirty years, epidemiological data have never been derived from their individual health experiences. Since the population of West Virginia is relatively stable, it may be possible to trace some of these individuals. They would constitute a valuable source of guidance concerning the long term or delayed effects of herbicides on human health. Dr. Melvin also described some aspects of an industrial accident in Rotterdam, Netherlands, during 1963, involving exposure of at least 10 individuals. Since the Dutch government maintains relatively good public health records it may be possible to trace the health histories of these individuals. Dr. Melvin was the Scientific Director of the USAF from 1970 through 1977 and thus is familiar with the disposal of millions of gallons of Agent Orange. About 200 AF employees were involved with the dedrumming process. Some probably made contact with the chemicals. However, there was strict, biological, medical and industrial hygienic monitoring of the operation so that contact was minimized. Agent Orange was fully studied for its chemical characteristics at this time (Appendix G). It may be worthwhile following up the health histories of these individuals.

Dr. Melvin further stated that it is his impression that the acute biological observations reported after exposure to Agent Orange (animal and human) are due to the 2,4-D and the 2,4,5-T themselves and not to the dioxin. The occurrence of symptoms shortly after exposure to Agent Orange therefore does not signify that dioxin exposure necessarily had occurred, but only that there had

been exposure to 2,4-D and or 2,4,5-T. By contrast, Dioxin has not manifested an immediate toxic symptomatic response. It does evoke chloracne about 4 to 8 weeks later both after cutaneous and after inhalation exposure. This cutaneous reaction (chloracne) does not correlate precisely with the intensity or duration of exposure to the dioxin. Individuals who have had minimal exposure will show more exposure. Individual susceptibilty, personal hygiene and other factors may be significant determinants of health effects.

8. Dr. Kearney described the involvement of the Department of Agriculture with the same herbicides which were used in Agent Orange. Although the EPA has the principal regulatory responsibility for pesticides, USDA has some additional control over herbicides in general. Recently, the Department has had a flood of letters of inquiry, protest and complaint. Much concerns the fear of residents in forested areas of the U.S. that the use of herbicides and pesticides sprayed from low flying aircraft may exert health effects of an undesirable kind, either through direct exposure or through the herbicides entering the ecosystem. Although the present assessment of the USDA is that these fears are ground, less, based on the known information concerning the biological actions of herbicides and pesticides, the Department has nevertheless created a medical team which will systematically examine persons who claim that they must have been significantly exposed to these chemicals. Dr. Sheldon Wagner, a dermatologist, is heading this investigation. Drs. Kearney and Melvin have remained in touch with the Italian and Swiss authorities who are monitoring the outcome of the Seveso industrial chemical accident in Italy. One death has been reported. This was an elderly woman who died from metastasising pancreatic cancer shortly after the incident. It is generally held that this cancer developed too soon after the chemical trauma to have been caused by chemicals released in that incident. No TCDD was found in liver or mesenteric fat samples analyzed to a tolerance of 0.25 nanograms per gram.

9. "Dr. Kuroda outlined the Rebuttable Presumption Against Registration with EPA filed against 2,4,5-T and its contaminant 2,3,7,8-tetrachlordibenzo-p-dioxin. This document was published in the Federal Register for Friday, April 21, 1978. The Agency is concerned about the carcinogenic and teratogenic effects found in laboratory animals when exposed to either 2,4,5-T or the dioxin. TCDD is a potent teratogen in almost every laboratory animal tested and 2,3,4-T containing low levels of TCDD (.05 ppm) is teratogenic in several strains of laboratory rodents. Even Down studies have determined that levels of TCDD as low as 10ng/day cause adverse reproductive effects in laboratory rats. Laboratory studies have shown statistically significant increases in the number of tumors in rats fed levels of TCDD as low as 5 ppt. One laboratory study has shown 2,4,5-T containing 0.05 ppm TCDD to be carcinogenic in mice. Although the evidence for mutagenic effects of TCDD did not meet the multi-test criteria for issuing the RPAR, the Agency is continually reviewing all new data especially and forthcoming from the Seveso incident. Dr. Kuroda raised the question of whether TCDD can cause effects, especially chronic effects, without causing chloracne in exposed individuals. Although there are animal species that do exhibit adverse effects without chloracne when administered TCDD, these species may not have sebaceous glands. Dr. Kuroda suggested that we look at individuals living around forested areas such as Oregon that may have been sprayed by 2,4,5-T for possible adverse effects. This population may exhibit some of the same effects supposedly seen by the Vietnam veterans since the type of exposure is similar, although the levels may be lower. She believed the Agency has received some data on people exposed (sprayed) to 2,4,5,-T that would be of interest and would try to make it available to the committee. She commented that the "Zero" content for dioxin in some military tests are not absolute zeros but reflect the limited analytical sensitivity of chemical tests available ten years ago. Dr. Melvin commented that there is an equal number of publications which provide evidence that TCDD is not mutagenic.

10. Dr. Cueto discussed the effects of mixtures of herbicided versus the effects of the individual ingredients. He could not recall any research which has specifically been done with the actual Agent Orange used in Vietnam. He is aware of only one paper incriminating 2,4,5-T as being capable of producing excess tumors in experimental animals. There was however no specific tumor type produced—only total tumor counts were slightly increased as compared with the natural incidence of tumors in the control animals. Until more research has been done, he believes that carcinogenicity can be neither ruled out nor accepted as a valid effect. He knows of no literature showing that 2,4-D can produce a similar effect. The NCI has sponsored several investigations of which the

results are still unreported and thus not yet analyzed by the Institute staff. His Institute may be willing to sponsor additional needed research. However, he cannot make a firm commitment at this time since the Institute is currently undergoing reorganization so that command lines and action centers may change.

11. Col. Bayer stated, in response to various questions, that the DOD never contracted with chemical companies to have the components of Agent Orange specially made for DOD. The available production of the chemical industry in the USA (eight (8) companies) was used. Agent Orange therefore varied quantitatively by lot according to the source of manufacture. DOD has kept records of individual lot numbers so that the composition of each lot can perhaps be traced if the chemical companies kept similar records. DOD destroyed all its stock of Agent Orange during 1977 by burning it at sea in an EPA designated area. However, it should be possible to reconstitute the formulations of individual lots if the action of precise mixtures is deemed relevant to the inquiry concerning Agent Orange. To the present, nothing has been published to show that the combination of 2,4-D and 2,4,5-T in itself produces effects different from the biological action ascribable to the individual components separately.

12. Dr. Williams described steps that had been taken to ascertain availability of sources for analysis of dioxin levels in body fat. Dr. Williams noted that they have identified two individuals at academic institutions who have experience with the analysis and are willing to accept specimens from the VA. The costs per analysis are in the range of $600-$800 but are volume dependent. Both individuals need some reasonably firm estimates of likely number of specimens requiring analysis over a given time period such as one year. Dr. Williams noted that in-house experience in VA Laboratory Services with dioxin analysis does not exist. However, it could be developed if there were to develop a continued demand over years for a 100 or more analyses per year.

13. Dr. Thomasino queried the value of this proposed biopsy endeavor by the VA. His main concern is that there is no known body of knowledge linking tissue concentrations of dioxin to any specific syndrome of biological effects. He compared the work done at the Kettering Laboratory in Cincinnati on tissue lead levels versus clinical evidence of lead poisoning. He pointed out that it took many years of experimentation and clinical investigation before that threshold for toxic tissue burdens of lead could be arrived at. In the case of lead, one has a specific atomic moiety to measure. Matters are much more vague for dioxins. If dioxin is found in any of the fat samples obtained from veterans, it would be impossible to ascribe any meaning to such findings since there is no defined disease syndrome with which the dioxin tissue burden can be correlated. Likewise, if no dioxin is found in any of the specimens, it would still be impossible to say what this signifies, since the dioxin could have been in the tissues or in some other vital organ formerly, may or may not have induced biological responses, and subsequently may have leached out of the tissue. Until there are biomonitor data with which to correlate tissue dioxin levels, it may not be worth the enormous expense to start this biopsy program. Dr. Melvin concurred with this critique.

14. Dr. Hobson outlined the political overtones which have relevance to this biopsy issue. In the CBS presentation of Agent Orange, there was a scenario showing a physician extracting a fat sample from a patient and the physician stated emphatically that he could obtain confirmation of dioxin poisoning through such biopsy specimens. Veterans, and action groups speaking for the veterans are firmly convinced that the VA must test them for dioxin. A populist scientific spokesman also said in the CBS program that dioxin accumulates in fat and may later be released to re-exert toxic actions on vital organs during periods of weight loss. Many veterans therefore believe firmly that they may be walking around with such a chemical "time bomb" in their tissues. The VA essentially has no option but to check whether there is any proof that dioxin remains in fat eight years after the last exposure in Vietnam. If no dioxin is found in the men who are known to have had significant exposure to Agent Orange or who may even have had specific symptoms, this will be meaningful information. If as much dioxin is found in persons who have never been in Vietnam as in those who were decisively exposed to Agent Orange, this also would be meaningful information. If the determination for dioxin proves exceedingly difficult or erratic, as suggested by Dr. Holder, confirmation of this through the VA endeavor, would again be meaningful, since, if no reliable data can be obtained in even the best laboratory, the validity of the CBS statement can be challenged. Dr. Cueto supported this approach.

15. Dr. Schepers mentioned the current review of cancer incidence statistics which can be derived from the VA's enormous data file which is compiled from the diagnoses reported for each hospitalized veteran (Patient Treatment File-PTF). The annual incidence of liver cancer has recently been reviewed. Records are available for the period 1963 through 1977. There is no conclusive indication that liver cancer has increased in the age categories representative of veterans who served in the Vietnam War. For veterans below the age 25 years, there have been 32 cases over the period 1967 through 1977. This represents an average of about 3.0 cases per year. However, during 1974 there were 7 cases and in 1976 5 cases occurred. In between these two years there were none. (Appendix D-1) When these cancers are averaged out over three year periods (Appendix D-2) there does appear to be a slight increase of cases between 1969 and 1974. For the age group 25 years through 34 years there were 63 cases with an average of about 5.6 per year. However, spurts of cancer increase also occurred in 1973 and 1976. These spurts yielded higher values for the final six years of this review period. There is no explanation yet for this. The records have been called for to determine whether any of these cases represented Vietnam War veterans. The tables do however show that liver cancer has all along been relatively prevalent in the older age group veterans, none of whom may be expected to include Vietnam War veterans.

16. Ms. Offutt stated that the EPA can probably assist with the identification of these individuals. She described the serious concerns of her agency with the question of pollution of the ecosystem by herbicides and pesticides. The rebuttable presumption injunction to which Dr. Kuroda had referred is an illustration of the posture the EPA may adopt on these matters. She clarified that if as a result of the evidence which may be offered during hearings concerning this rebuttable presumption, the hypotheses on which it is based are destroyed, the EPA will withdraw the presumption. Until such retraction occurs, the presumption reflects the persuasions of the EPA concerning herbicide 2,4,5-T. The EPA has a voluminous collection of literature on herbicides, and Ms. Offutt invited members of the committee to consult their library rather than attempting to start all over again.

17. The meeting was adjourned at 4 p.m. The members all expressed preference for a morning meeting. The next session of the committee will be called for September 8, 11, 22 or 25, 1978.

GERRIT W. H. SCHEPERS, M.D.,
*Chairman.*

Dr. HABER. Thank you.

Mr. SATTERFIELD. Please answer the questions of Mr. Edwards.

Mr. EDWARDS. Thank you, Mr. Chairman, and thank you, Dr. Haber, for your testimony.

It appears that the VA is moving ahead with plans in some depth on this subject. However, even though 7 or 8 months have passed, you have no real results to report to us as yet; is that not correct?

Dr. HABER. Yes, sir, that is substantially correct.

Mr. EDWARDS. As you pointed out on page 9, where your testimony was that approximately 18.85 million gallons of herbicide were sprayed on Vietnam while this study indicates that approximately 107 million pounds—they are gallons, it is different, I see. We will correct that appropriately.

Dr. HABER. Yes, sir.

Mr. EDWARDS. Major General Dettinger's testimony was to the effect that the GI's in Vietnam were not significantly exposed to dioxin. Do you believe that to be your testimony, too?

Dr. HABER. Yes, sir; we would agree with that. Obviously most of our information has to come from the Department of Defense on exposures but we have seen nothing to contravene what they have indicated.

Mr. EDWARDS. Dr. Haber, what procedure do you follow when a veteran walks into a VA office and says that he has Agent Orange poisoning?

Dr. HABER. The procedure to be followed has been outlined in a number of communications we have addressed to our field medical centers. The veteran coming into a VA hospital and alleging exposure will undergo a complete history and physical examination. A specific notation will be made on a 3 by 5 locater card, color-coded for the month in which the veteran appears, on which pertinent data alleging the symptoms, questioning him in detail about the time of exposure insofar as he can remember it, the occurrence of any symptoms at that time.

We have indicated to our physicians and other interested staff that the complete history must indicate any further exposure to other agents, any symptoms of the nature that we have heard so much about, the occurrence of paraseizures, numbness and tingling of the extremities, loss of sexual drive, anxiety or other more organic symptoms such as gastrointensinal discomfort, easy fatigability, any symptoms which can be referrable to any of the organ systems, unusual or protracted infections or others of that like.

Laboratory examinations are then undertaken to confirm the presence of such abnormalities and if there is any reason for it, from the standpoint of skin disease, we would undertake to do a biopsy of the tissue that appeared to be diseased. This material will then be collected and put into a master file. If tissues were taken from the veteran, these would be sent to the Armed Forces Institute of Pathology to be retained in perpetuity against the possibility that new knowledge, subsequently developed, may reveal pathology of a type as yet unknown.

In the central office we are maintaining a total registry of all Vietnam veterans who have presented themselves to the hospital for alleged defects and these will be analyzed as the reports come in.

In addition, we have a special committee set up of internists, neurologists, psychiatrists, pathologists, who will review all cases to determine whether or not there is any clue that the alleged symptoms may or may not have been due to the exposure to the herbicides. If pathology is found of any sort, whether related to this instance or not, the veteran would of course be treated, hospitalized, if he is eligible and if that should turn out to be necessary.

On his medical record, a detailed examination into the facts relating to this exposure through an overprint which we have sent out to our field hospitals is completed and this is also retained in a form which is recoverable.

We are, unfortunately, Mr. Edwards, handicapped by the fact that there is no single specific test which can be done which would verify or deny the possibility of Vietnam exposure. I have made allusion to the fact that we wish—we are now bringing forth a research protocol which will take fat samples from exposed veterans with, of course, their consent, and match this with an equal number of fat samples from veterans who could not have been exposed to dioxin in Vietnam because they were never in Vietnam. We will then determine whether indeed there is the persistence of dioxin in such tissues and whether there is a difference between veterans who have exposure and those who have not. This research study will be conducted by the Veterans' Administration.

Mr. EDWARDS. Dr. Haber, I believe you just testified that there is no diagnostic test to determine the presence of dioxin in the body tissue. So how are you going to be able to tell if the 10 test cases have dioxin in the tissue?

Dr. HABER. Well, Mr. Edwards, my point is, there is no standard test at this point that would say, regardless of whether a test shows dioxin or not, that would say yes, this veteran's symptoms are due to herbicide exposure or not. What we are undertaking is a research study which would hopefully lay to rest the charge made by some that dioxin is retained in the fat tissues for long periods of time. That has not been substantiated in human subjects as far as we are aware. So this research study would determine whether or not that allegation is a real possibility.

Mr. EDWARDS. Mr. Chairman, my last question is regarding the 450 to 500 claims that have been filed with the VA claiming herbicide exposure. This is as of September 30, 1978. What has happened to those 450 to 500 cases?

Dr. HABER. With your leave, might I ask Mr. Peckarsky to respond to this question?

Mr. PECKARSKY. Mr. Edwards, of the 450 claims that have been filed, 92 of them have been adjudicated. That is, a decision has been made and a copy of that decision has been forwarded to us in Washington, as is required by our current procedures.

Those 92 claims, 8 of them have been allowed; 72 of them have been denied. That makes a total of 80 claims where we had a specific diagnosis. The other claims had no diagnosis at all and obviously no basis for the allowance of benefits because the law requires that benefits be based on disability. The other——

Mr. EDWARDS. So what are you telling us about the other 400 cases?

Mr. PECKARSKY. They are still in various stages of development trying to present the case in the most favorable light for the veteran, which is our mandate. When all of the evidence that is potential is rounded up and evaluated, they too will be rated and they will also be sent to the central office for review.

Mr. SATTERFIELD. I would like to ask a question at that point about those who have been adjudicated. Were they adjudicated on the basis of exposure to Agent Orange or were they adjudicated on the basis of service-connected disability established by some other means?

Mr. PECKARSKY. Very good question, Mr. Chairman.

There is no such provision under law for relating a claim to an incident or an alleged exposure. The law is based on disability incurred or aggravated coincident in point of time with military service, so that the etiological basis is of really no significance under the law unless it is one of the various disabilities that the law has considered chronic constitutional diseases and poses a statutory period for the granting of service connection, such as arthritis, cancer, multiple sclerosis.

There is no disability relatable to Agent Orange that the Congress has seen fit to call chronic constitutional disability. Therefore, etiology is not an important factor in our adjudications. Development of disability and the ability factually to relate it in point of time to the service are the two elements that we have to develop and that we have to dispose of.

Mr. SATTERFIELD. Thank you for that explanation. I noted in the statement of Dr. Haber that he said no health care had been deferred or denied any veteran alleging adverse health effects as a result of exposure to herbicides. I assume by your statement that you mean if a veteran has a health defect which he can demonstrate was incurred in the service and which did not exist prior to that service, then he is being treated, that the question of what may have produced that defect insofar as his own opinion is concerned is not the point. The point is whether he has a disability, regardless of cause.

Dr. HABER. Precisely, Mr. Chairman.

Mr. SATTERFIELD. Thank you, sir. Mr. Hammerschmidt.

Mr. HAMMERSCHMIDT. Dr. Haber, I would like to congratulate the Veterans Administration for its obvious effort to be fair and thorough in this matter. In your statement, I detect no attitude of callousness nor carelessness. So I am impressed with the way you are on top of it.

I want to turn back to Mr. Peckarsky for a moment to pursue the line of questioning that Mr. Edwards and the chairman were discussing with you, just to clarify for the record and for my own mind.

I note that in the statement that one of those claims that was adjudicated was evidently for—was presumably due to herbicide, a skin condition. Yet under title 38 of the Code you say that there is no allowance for a claim alleging herbicides. That may be because it is related to genetic damage. I am not sure.

Would you clarify how that one claim was allowed, Mr. Peckarsky?

Mr. PECKARSKY. Yes, sir. What we did was told all of our field stations, the 58 field stations we have in every State of the country, to send us a copy of the rating decision, any time there was an allegation that the disability for which they were claiming compensation was or could have been the result of exposure to defoliants in Vietnam.

In attempting to compile a report for the Congress for the purposes of this hearing, we attempted to categorize the various categories of claims in relationship to whether or not there was an allegation that this particular disability was related to exposure. It really, under the law, has no foundation in title 38. The skin condition that we granted service connection for was chloracne. It is, as has been pointed out by Dr. Haber, one of those entities most often associated with exposure to defoliants and this was a rather easy case to service connect.

We have also denied service connection for skin diseases because they were either developed too late to be related in service exposure or were not the proper types of skin conditions or some other agency that could have caused them was shown in the man's history. So there is no firm yes or no conclusion that can be drawn.

Mr. HAMMERSCHMIDT. Well, should medical evidence and time develop in fact that there could be genetic or other physical damage from herbicides, then the code would need to be changed to accommodate, I am assuming.

Mr. PECKARSKY. Genetic damage, yes, sir, definitely. Currently the law only provides for payment of compensation on the basis of average impairment of earning capacity in an individual. So obviously what he passes on genetically to his progeny does not affect his earning capacity and therefore there is no current provision of law to compensate for such potentiality. Should this develop, Congress would have to give this serious consideration.

Mr. HAMMERSCHMIDT. Dr. Haber, you mention in your statement the 1949 industrial accident in West Virginia. Has any data evolved from this accident that you have in hand and, if not, when do you expect to have that data?

Dr. HABER. Yes, sir. There has been some data, but it is not as complete as we would like. What happened was, there was an industrial explosion in this town, a number of people were exposed, some 233; they all became ill. The recovery was complete in almost all cases. There seemed not to have been any definitive evidence that any of those patients, people, died of malignancy or other causes attributable presumably to the herbicide.

We are working with a number of other government agencies to get to the bottom of that. We feel that that and, as the previous witness indicated, several other accidents need to be examined in greater detail. We are working with a number of Federal agencies to try to get to the bottom of this and, if need be, we will do whatever has to be done in order to get definitive answers to those questions.

Mr. HAMMERSCHMIDT. Well, if you should come to any conclusions or tentative conclusions that you think would be appropriate and helpful to these hearings while the records are still open, I am sure that the chairman would appreciate them, should that develop.

Dr. HABER. Indeed.

Mr. HAMMERSCHMIDT. The Department of Medicine and Surgery circular provides for the quarterly reporting concerning veterans requesting assistance for herbicide-related symptoms. For whom is this report prepared?

Dr. HABER. For the Associate Deputy Chief Medical Director, but it would come to my attention. I am the responsible agent in the Department of Medicine and Surgery.

Mr. HAMMERSCHMIDT. When will the first report be prepared?

Dr. HABER. The first report is due I believe October 16. We will have some data about that.

Mr. HAMMERSCHMIDT. Will this committee be furnished a copy of those reports for our hearing record?

Dr. HABER. Yes, sir.

Mr. HAMMERSCHMIDT. Mr. Chairman, in most of those inquiries I have made on any evidence that might develop from the Veterans' Administration, I ask unanimous consent it be included in the record in the proper manner.

Mr. SATTERFIELD. Without objection it is so ordered. The file of this hearing will remain open for a reasonable period of time to receive any such reports.

Mr. HAMMERSCHMIDT. Thank you, Mr. Chairman.

Mr. SATTERFIELD. Thank you. Fr. Cornell.

Fr. CORNELL. Thank you, Mr. Chairman.

Dr. Haber, am I correct in concluding from what you said that chloracne is the only problem that you feel today might be related to exposure to the herbicides?

Dr. HABER. No. I think that goes a little bit further than I would care to go. What we are saying is that chloracne is important because it is the most unequivocal evidence of tissue damage because of exposure to the herbicides. We know when a veteran alleges long-term ill

effects due to herbicides and his medical record demonstrates the presence of chloracne beginning terminus with his exposure or within a period of several weeks or a few months thereafter, we have something very solid to go on. All I am saying is that that is one definite link we feel confident about that has been established.

As Mr. Peckarsky indicated already, service connection has been granted on that basis.

Fr. CORNELL. But that is the only claim where it has been granted?

Dr. HABER. Yes. That is the only instance where we can definitely make a link. We are not saying, and I hope I am not providing the impression, that there is no chance that all these other broad effects cannot occur. All we are saying is that at this time the cumulated weight of the evidence, two massive studies, one done by the National Academy of Sciences completed in 1974, one done by the Air Force just recently completed, these two studies do not provide us with incontrovertible evidence that there is a relationship between exposure and all these alleged ill effects. The only thing we can really hang our hat on is the chloracne.

Fr. CORNELL. I gather from your testimony also that you seem to concur with the statement of genetics injury, that exposure was probably for most of the soldiers in Vietnam one-time remote exposure; is that correct?

Dr. HABER. I could not disagree with that; yes, sir.

Fr. CORNELL. And therefore, we would not have any evidence of food chain effect in our veterans as far as herbicides were concerned?

Dr. HABER. No, sir, I would not care to go that far. I think there are reports in the research literature which indicate that there may be evidence of chlorinated hydrocarbons in our food chain already in this country. One study I remember having seen at the University of Florida indicated that healthy male athletes showed evidence of chlorinated hydrocarbons in the urine, indicating some of these hydrocarbons may have already entered the food chain.

I think the point is, if we find a veteran now who has evidence of chlorinated hydrocarbon somewhere in his body, one would have to ask whether this came from just the normal food chain cycle in this country or from Vietnam.

I suppose there are quantitative differences that we could find to differentiate between those.

Fr. CORNELL. But you do think it is possible that they might have felt the food chain effect even in the service in Vietnam?

Dr. HABER. I would think that is possible, yes, sir.

Fr. CORNELL. What validity do you—if you would care to give an opinion—place on the publications that you mentioned under the authorship of North Vietnamese physicians alleging various effects, infertility, abortion, and such?

Dr. HABER. Based upon my rather detailed reading of the National Academy of Sciences report and the hurried reading which I have been able to give this new report from the Air Force which just reached us in the last 24 hours, these are both very authoritative views, in my opinion. They are the most informative and objective documents at hand. They represent thousands of man-hours of work by objective, well-qualified scientists of all kinds of persuasions, biologists, phy-

sicians, physicists, toxicologists, chemists, a whole variety of people of all kinds of political persuasion. I think if there was ever any objective study, these two studies would seem to me to be able to meet that qualification.

Fr. CORNELL. You think therefore there might very well be the—these effects might result from the food chain of the Vietnamese people, the results of it?

Dr. HABER. I would think that is certainly a possibility that has to be considered.

Fr. CORNELL. One last question.

You mentioned in your statement on page 9 that equally large quantities of the same herbicides were used in the United States without the deluge of concerns over adverse health effects. Do you not think it is possible that the people involved might not have realized the source of problems that they subsequently had, the relationship of dioxin to their physical ailments?

Dr. HABER. Yes, sir; I do.

Fr. CORNELL. And as a consequence, also, it could be, as far as the veterans are concerned, that they did not realize this either until the news media carried the stories about it and, as a consequence of course, you had these applications for consideration?

Dr. HABER. Entirely possible.

Fr. CORNELL. Thank you, Mr. Chairman.

Mr. SATTERFIELD. Thank you. Mr. Edwards.

Mr. EDWARDS. Thank you, Mr. Chairman.

Both the Surgeon General and you, Dr. Haber, rely to a certain extent on the report and study of the National Academy of Sciences released during 1974 to the effect generally that the use of herbicides by the American Armed Forces in Vietnam, did not result in serious injury to American military there. Now, however, in your statement you do point out that there are allegations of serious health consequences as a result of the defoliation for North Vietnamese and Montagnard women and children and that their later publications appeared under authorship of North Vietnamese physicians alleging significant damage to Vietnamese who were exposed to Agent Orange.

Why would the Vietnamese be damaged while the American GI's would not be?

Dr. HABER. Well, I think—first of all, the likelihood of more intimate exposure on the part of the North Vietnamese than American troops is, I imagine, significantly greater. I think one would have to, without impugning anybody's integrity, wonder about the objectivity of North Vietnamese physicians. What I am trying to suggest is that in time of war, when there were difficulties of various sorts, that it could be construed that the Vietnamese physicians who reported such instances might have been less than completely objective. That is, I think, the only point we are trying to make.

Mr. EDWARDS. Perhaps doctors from the Veterans Administration could go over and ask them whether their reports were valid or not?

Dr. HABER. It would be extremely difficult at this time to assure the accuracy of some of those observations. Although the——

Mr. EDWARDS. But you are having such a great difficulty in finding out whether or not there was any effect, you have no diagnostic method and perhaps they have. They are not totally unskillful.

Dr. HABER. I would only suggest that we are anxious to get the truth wherever we can, Mr. Edwards. If that remains a significant possibility, I would wonder if—it would be possible for Veterans Administration to somehow run that down.

Mr. EDWARDS. Thank you.

Mr. SATTERFIELD. I might observe at this point that you are not in a position probably, to voluntarily obtain that information?

Dr. HABER. I think that is extremely accurate, Mr. Chairman.

Mr. SATTERFIELD. Mr. Hammerschmidt.

Mr. HAMMERSCHMIDT. Dr. Haber, I have one more question that is probably a highly—it is highly technical knowledge to respond to, which you have. I am not sure I am going to ask it right.

Regarding the food chain presence of dioxin, I wonder what happened when it entered water. The veterans often drank water in areas where defoliation had occurred and the water came from standing sources such as bomb craters, where rainwater had accumulated. If dioxin ran off of these areas into the craters, I wonder if it loses its toxic nature or could it have a concentrated effect in that particular situation?

Dr. HABER. To the best of my knowledge, dioxin is not soluble in water, although it is, I believe, in diesel fuel oil and alcohol solvents. It would be impossible for me to speculate on how much was dissolved in drinking water someplace. I think that is difficult to answer.

Mr. HAMMERSCHMIDT. So you are saying the possibility is there, there could be a concentrated effect?

Dr. HABER. Yes, there could be, although I think solubility in water is very minimal.

Mr. HAMMERSCHMIDT. Thank you, sir.

Mr. SATTERFIELD. I have a couple of questions.

I noticed in your report that you refer to the fact that there was no adequate laboratory in the VA, which you can identify, that might do pertinent investigative work. You identified the University of Colorado as being available for certain research. Is it your feeling that you might need additional funds by way of appropriation for that purpose? Or can this be handled within the framework of funds already available, or do you know?

Dr. HABER. Although I may be guilty of naivete, I would think this is something we could probably undertake within existing funds.

Mr. SATTERFIELD. The reason I ask the question is that if it is determined that funds are needed for this purpose, this committee would be most interested in any suggestion or report dealing with such a problem. In that case, I hope you will communicate with us.

Dr. HABER. We are mindful of the committee's interest and grateful for the suggestion. Actually, the chemical analysis requires a mass spectrography which is not usual in laboratories. We went to considerable difficulty to identify places where this test could be cranked up. Our plan is to go ahead with this research study. If we find significant differences, then we would say to veterans who are applying, "If you are willing to submit to the biopsy, we can definitely ascertain whether you have traces of carcinogenesis."

Mr. SATTERFIELD. If I interpret your message correctly, you are telling us that if it is determined down the road that there are genetic effects, you will be making recommendations to us, possibly

in connection with amendments to the law, and that if it is determined that an adverse health effect exists, it would be the intention of the VA to establish some sort of an outreach effort to inform those who may have been exposed of that possibility?

Dr. HABER. Yes, sir. I would consider it our public duty and responsibiilty to do that. I would have to defer to the General Counsel with respect to what our legal authority is in such a matter.

Mr. JOHNSTON. I would think we would have sufficient legal authority to make such an outreach.

Mr. SATTERFIELD. If you found that you did not, would you come to us to request it?

Mr. JOHNSTON. Yes, sir.

Mr. SATTERFIELD. I ask that question because one of my colleagues made inquiry about the outreach program and the response from the VA indicated none was now contemplated. I assume again that this response reflects the fact that your investigation is an ongoing one and you do not feel you have evidence now to justify it.

Dr. HABER. Precisely.

Mr. SATTERFIELD. I would like to echo what other colleagues have said in extending congratulations to the VA for the effort it is making. I am pleased particularly that you are proceeding on the presumption that you do not have all the answers and that you feel it is necessary to pursue every course of action in order to ascertain whether or not exposed veterans have been adversely affected.

I congratulate you for utilizing all of the resources at hand in that quest. I feel you have made a very interesting presentation in terms of what you are doing and what you plan to do. Again, I just want to say that we on this committee join you in that effort. At any time you feel we can be helpful, we certainly want you to let us know.

Dr. HABER. Thank you very much, Mr. Chairman.

Mr. SATTERFIELD. If there are no other questions, I wish to express our appreciation to you for appearing here this morning. Your testimony will be very helpful to us.

Thank you, sir.

Our next witness is Dr. Cueto, Director of the Pesticides Program, National Cancer Institute, Department of Health, Education, and Welfare.

Dr. Cueto, we welcome you this morning. We would be very happy to receive your statement.

## STATEMENT OF DR. CIPRIANO CUETO, DIRECTOR, PESTICIDES PROGRAM, NATIONAL CANCER INSTITUTE, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Dr. CUETO. Thank you, sir.

Mr. Chairman, I have a written statement which I have submitted and I would like to read that and then after that to emphasize at least three points in the statement.

Mr. SATTERFIELD. You may proceed.

Dr. CUETO. In general, extensive information exists on the acute and subchronic toxicity of the herbicides, 2,4-dichlorophenoxyacetic acid, 2,4-D, and 2,4,5-tricholorophenoxyacetic acid, 2,4,5-T, and its

contaminant 2,3,7,8-tetrachlorodizenbo-p-dioxin TCDD. Mixtures of these herbicides equivalent to or approximating the composition of Agent Orange have been available commercially and used in this country as well as in other countries. The health problems in the production and use of these compounds or their mixtures has been mainly associated with 2,4,5-T and its chlorinated dioxin, TCDD.

In acute and subchronic studies in experimental animals, 2,4,5-T and its contaminant TCDD have been associated with close related fetotoxic and teratogenic effects in mice, rats and hamsters. The data suggest that quantitative levels of these compounds constituting a potential harmful exposure might be estimated if one limits the question to short-term risk. This is not the case with reference to potential long-term risk.

In chronic studies, the data suggests that 2,4,5-T is carcinogenic in mice. Other data indicates that TCDD is carcinogenic in rats, and may be a strong promoter of the carcinogenicity of other chemicals. There also is evidence indicating that other chlorinated dibenzodioxins less acutely toxic than TCDD may be carcinogenic.

It becomes apparent that evaluation and prediction of the possible latent manifestations of adverse health effects in humans exposed to low or high levels of a mixture of 2,4,4-D and 2,4,5-T containing a poorly defined spectrum and concentrations of dioxins is almost impossible. This is not to say that extensive reviews of the problems have not been published—National Academy of Science, Committee on the Adverse Effects of Herbicides in Vietnam, 1974. A recent review by the International Agency for Research on Cancer (IARC) states the following in terms of possible carcinogenic effects in humans.

A number of cases of cancer have been reported in workers exposed to TCDD, but no adequate epidemiological studies were available. An increased proportion of liver cancers has been reported in Hanoi, after the spraying of herbicides (2,4-D and 2,4,5-T) containing TCDD in South Vietnam. The significance of these observations cannot be assessed because not enough details were reported. More details of the reported cases and more extensive observation of the exposed people are needed before an evaluation of the carcinogenicity of chlorinated dibenzodioxins to man can be made.

In the first paragraph, in referring to the presence of this mixture and its use in this country, I would like to point out that the concentrations of the Agent Orange are of such a nature that they approximate 96 percent. They are said to be a 50-50 mixture. That type of material was registered in this country, was in use in this country in 1970.

However, the material was in a concentrated form for the purpose of diluting and using it in a diluted form.

The question as to whether the material used in Vietnam was a concentrated form should be asked. Not only is it a matter of the rate of application, but the concentration of the solution itself that was used. This makes a difference.

The other point is with reference to some of the work of BAMS, who reported in 1973, stating that the most significant finding in both mice and guinea pigs treated with sublethal doses of TCDD were in the lymphoid system, resulting in suppression of cell mediated immunity; low levels of TCDD that did not produce overclinical or pathological changes still reduce those defenses.

One microgram per kilogram of body weight given orally once weekly for 4 weeks to mice before infection with salmonella increased mortality and decreased the time from infection to death. The point is that of a very sensitive effect, an effect which occurs at such low levels that one would not expect to see perhaps chloracne, has been detected in experimental animals.

Then finally, in the paragraph referring to the carcinogenic effects, there are four compounds that we have tested at the National Cancer Institute. One of them is the unchlorinated material, referred to as the unsubstituted dibenzodioxin, the other is a dichloro-dibenzodioxin, the other one is a hexichloro-dibenzodioxin. Then there is the TCDD tetrachlorodibenzodioxin. The unsubstituted showed no carcinogenic effects on the animals in the conditions of your study.

TCDD, the dichloro material, showed there was an indication of possibility of lung cancer developing. It was not a clear sound statistical significant finding, but there is indication of it. The TCDD and the hexichloro-dibenzodioxin in a report that is forthcoming from our group indicates that there are liver and perhaps lung carcinomas developing, adenomas.

The Dow Chemical Co. has also reported, in a meeting in New York just a month or so ago, with levels of one-tenth of 1 microgram per kilogram in a 2-year study of TCDD, it was detected that there was an increase in lung squamous cell carcinomas and in the liver, in the hepatocellular carcinomas.

It was also stated that at levels lower than these in which toxicity was only slight or not detected, that no tumors were seen, no increased tumors were seen. However, one has to realize that as one hears the dosage, one sees less of an effect or it has the possibility of seeing less of an effect, unless one increases the number of animals, so that one increases the power of the tests. So one is decreasing the power of the tests as one lowers the dose.

I believe that is all that I care to mention at this time. I certainly would be pleased to either comment or attempt to answer questions.

Mr. SATTERFIELD. Very well. Mr. Hammerschmidt.

Mr. HAMMERSCHMIDT. Thank you, Dr. Cueto. I take it from your testimony dioxin may have a strong effect as a catalyst in other diseases, that is, the presence of dioxin on a long- or short-term basis might encourage the development of many, many other diseases. Is this a correct reading?

Dr. CUETO. What I am suggesting is there is a possibility of effects at lower levels of exposure involving the immunal system and that the compound may act as an immunal suppression, so one gets into a very difficult situation of relating symptoms to the chemical while the symptoms may be related to other sources, from either bacterial infection, virus infection, and so forth.

Mr. HAMMERSCHMIDT. Would the Dow studies that came out a month or two ago that you referred to, the ones presented in New York—those were laboratory studies on animals; is that correct?

Dr. CUETO. Yes.

Mr. HAMMERSCHMIDT. I think you have given us a good suggestion on some further questions that we may want to ask previous witnesses, and I am sure the chairman will follow through on that.

That is all I have, Mr. Chairman.

Mr. SATTERFIELD. In response to your suggestion I feel we should indeed ask these questions. We will submit them in writing to the other witnesses and accept their answers in the file.

Now I would like to ask a question or two. You said quite a bit about carcinogens. This is something we are hearing a great deal about. I hear repeated time after time the statement that carcinogens cause cancer. Is that a factual statement?

Dr. CUETO. Pardon?

Mr. SATTERFIELD. That carcinogens cause cancer.

Dr. CUETO. It is a particular type of cancer. A carcinogen is defined as a chemical that causes cancer, so the answer has to be yes.

Mr. SATTERFIELD. Is it correct to state that it causes cancer? Has a cause and effect relationship between any carcinogen and cancer been factually established?

Dr. CUETO. There is evidence to consider there is such a thing as chemical carcinogenesis.

Mr. SATTERFIELD. That evidence is epidemiological?

Dr. CUETO. That evidence is evident in humans. There are compounds that have been defined as being carcinogenic to humans. Yes, when we are dealing with humans it is epidemiological data. However, there is no doubt chemical involvement has occurred.

Mr. SATTERFIELD. That is not clinical data; it is epidemiological data?

Dr. CUETO. Epidemiological data combined with clinical data so that the findings of the cancer are identified clinically, the history is taken and then it becomes epidemiological. You have a blending of epidemiological and clinical.

Mr. SATTERFIELD. In the final analysis isn't that just an opinion?

Dr. CUETO. I assure you, sir, there is sufficient evidence that certain chemicals cause cancer.

Mr. SATTERFIELD. In connection with the Dow report, I am interested in your statement that there was evidence of increase in liver and lung cancer. How was this determined?

Dr. CUETO. This is in the experimental animals.

Mr. SATTERFIELD. That is what I understand.

Dr. CUETO. One administers material to the animal and then observes the animal for a period of time. And these studies, the Dow studies and our study, was approximately 2 years. And then tissues are examined and then one detects the presence of a tumor or lesion and then compares it with controls and analyzes the data to attempt to see if one can relate it to the chemical.

Mr. SATTERFIELD. I think you stated that the dosage of dioxin in these animals was 1 microgram per kilogram?

Dr. CUETO. Yes, one microgram—0.1 of a microgram per kilogram.

Mr. SATTERFIELD. What type of laboratory animal was involved?

Dr. CUETO. This was a rat.

Mr. SATTERFIELD. Do you relate, then, 0.1 of a microgram per kilogram in a rat as being equivalent in terms of a human?

Dr. CUETO. No, not at all. One has to involve metabolic rate, and so forth. The animal metabolizes the material much faster than man, so that one has to take into consideration certain of these factors.

Mr. SATTERFIELD. What would be the equivalent, then, of that level in a rat which would produce the same result in man? What would be the amount?

Dr. CUETO. It would be close to the 0.1 microgram per kilogram because one has to consider, as I said, surface area, but one is in the area ballpark. If it is 0.1 or maybe perhaps the material may even be considered to be 0.05 micrograms, but even at 0.05 micrograms we were finding carcinogenic effects or indications of them.

Mr. SATTERFIELD. In the animals?

Dr. CUETO. In the animals.

Mr. SATTERFIELD. Isn't it a fact that a rat is a rather low moisture content animal whereas man has a high moisture content? Does that make any difference?

Dr. CUETO. Yes. There are certain species differences and this is one of the points that I think should also be considered with TCDD, and that is that various species seem to be responding with certain end points that are characteristic for each of the species. Teratogenic effects have been found not only in one species but in three species.

Carcinogenic effect is now being found not only in one species, the rat, but also the mouse. So that one begins to see that these chemicals do affect different species. Where you have a problem is where you have only one species being affected and the others not being affected. Then you have questions as to whether the information is pertinent to humans. But in this particular case the more information that is obtained, the more indication is that it is pertinent to the various species.

Mr. SATTERFIELD. What has bothered me in connection with laboratory studies with animals as related to humans is that we really have not done very much to establish a relationship between what might happen in a human as compared to what happened in laboratory tests in animals. Is it safe, then, to say this is again an opinion that an equivalent dosage in a human would produce the same result?

Dr. CUETO. No. I think there are areas referred to as risk assessment and risk evaluation and prediction demand, and this sort of thing, that takes many factors into consideration. It is a very difficult sort of thing and one can predict anything, and no one is able to check it. Therefore, what you find in the mouse you can predict will occur in man, and it is very difficult to check those findings.

Mr. SATTERFIELD. Predictions are basically opinions, then.

Let me ask you this. In the laboratory test animals, you stated that dioxin is given orally. What would one expect in man, that he would take the same quantity all in one dose?

Dr. CUETO. One would expect perhaps dermal and inhalation routes to be more pertinent to the situation in man. Therefore, the route may have an effect, and this effect may be one of quantitative differentiation one should make. The reason I say quantitative, primarily the material evidently is absorbed through the GI tract and it is absorbed dermally and by inhalation, and the material is stored then in the animal tissues as the compound itself, so evidently it gets through by the various routes and gets to the tissues.

Mr. SATTERFIELD. The thing that bothers me is that the metabolism of a rat is quite different from that of man. Is there any evidence that dioxin metabolizes in a human or is it discharged with body waste?

Dr. CUETO. In the report, which I highly recommend that a copy be obtained—or I can try to supply one—there is a review of the very small type of information that you are asking for.

Mr. SATTERFIELD. In what report is that?

Dr. CUETO. This is the World Health Organization, IARC monograph. IARC is the International Agency for Research on Cancer, volume 15. It reviews the herbicides.

Mr. SATTERFIELD. If you could possibly make one available, we would be happy to include it in the file on this hearing.

Dr. CUETO. I will see that you get one.

Mr. SATTERFIELD. Mr. Hammerschmidt, do you have a question?

Mr. HAMMERSCHMIDT. I have one more question. Dr. Cueto, I think you were in the audience when I asked a question of Dr. Haber on a hypothetical case. Let's say our troops were in an area where it had rainfall and runoff from a defoliated area, and as we have discovered here we really have not asked the question of the rate and concentration of the herbicide that was used over there; do you think it is possible dioxin may have been carried from a defoliated area in rainfall to a low-lying area where the troops might orally take on water, and do you think they could have gotten that in their system? I know it is a hard question to answer because it is so hypothetical, but will you respond the best you can?

Dr. CUETO. The approach to answer there would be, of course, that has been indicated before in terms of the solubility of the material. It is very insoluable in water. However, one ought to consider the mechanical transportation of material and the material being absorbed into material containing the water—pollutants and mud itself in being pushed along—so that one could get a distribution in the environment of this material.

We should note one of the first actions taken by the regulatory agency was against the use of 2,4,5-T and aquatic bodies in order to prevent the possibility of a distribution through maybe physical means, not solubility necessarily, of the materials themselves.

Mr. HAMMERSCHMIDT. Thank you, Doctor.

Mr. SATTERFIELD. Thank you very much, Dr. Cueto. We appreciate your appearing this morning. Your testimony is very helpful to us.

The next and last witness is Mr. Philip Mayo, who is Special Assistant to the National Legislative Director for Veterans of Foreign Wars.

Mr. Mayo, we welcome you. We will be very glad to receive your testimony.

## STATEMENT OF MR. PHILIP MAYO, SPECIAL ASSISTANT TO NATIONAL LEGISLATIVE DIRECTOR, VETERANS OF FOREIGN WARS, ACCOMPANIED BY DONALD H. SCHWAB, NATIONAL LEGISLATIVE DIRECTOR

Mr. MAYO. This is Mr. Donald Schwab, who is the legislative director of the Veterans of Foreign Wars.

Mr. Chairman and members of the subcommittee, thank you for the privilege of appearing before this distinguished subcommittee to present the views of the Veterans of Foreign Wars of the United States with respect to Agent Orange.

My name is Philip R. Mayo, and it is my privilege to serve the more than 1.85 million men and women of the Veterans of Foreign Wars of the United States as special assistant to the director, national legislative service.

Mr. Chairman, the Veterans of Foreign Wars has become increasingly aware of the disturbing allegations being made regarding health hazards experienced by Vietnam veterans as a result of their exposure to the powerful defoliant commonly known as Agent Orange. The defoliant was used in Vietnam between 1962 and 1970, when it was withdrawn from use because of its apparent dangerous effects on human and plant life, and after in excess of 100 million pounds were used to defoliate more than 5 million acres of the Vietnamese countryside.

This defoliant contained a chemical known as 2,4,5-T, which in its contaminant form, dioxin, is recognized as an extremely lethal chemical toxin. Dioxin has proved fatal to laboratory animals at extraordinarily low dosages. According to the Honorable Richard L. Ottinger, the Library of Congress has estimated that one medicine drop of dioxin can kill 1,200 people. Further, experiments performed on mammals have shown that very low levels of dioxin caused cancer, liver tumors, birth defects, nervous system disorders, liver dysfunction, genetic changes, spontaneous abortions or miscarriages, and a host of other symptoms such as nausea, dizziness, and skin disease.

According to an article inserted in the Congressional Record of May 11, 1978, by a member of this subcommittee, Hon. Don Edwards, the toxic effects of dioxin on human beings has been ascertained from studying the cases of victims of industrial accidents at production facilities—such as the accident at Sevesco, Italy, in July of 1976, wherein people were thoroughly exposed to the poison and as a result the Catholic Church permitted abortions for all pregnant women who had been exposed. Also, an article appeared in the July 10, 1978, issue of the Stars and Stripes reporting the occurrence at a Moscow Mills, Mo. horse farm, where dioxin-contaminated waste oil was utilized in a horse arena, causing the death of 67 horses.

In addition, scientists disagree with respect to safe levels of dioxin exposure, and whether dioxins enter the human food chain and are stored in the body tissues. Dr. James Allen of the University of Wisconsin determined that consumption of as low as five parts per trillion of dioxin in the diet was capable of causing an increased incidence of tumors in experimental animals. The National Academy of Sciences determined in a study conducted in 1974 that there was no conclusive evidence in existence to warrant the association between exposure to herbicides and birth defects in South Vietnam.

Notwithstanding the foregoing, the VFW has noticed during recent years that there has surfaced among veterans exposed to dioxin a number of heretofore inexplicable symptoms similar to those enumerated above. The Veterans' Administration, as a result of increasing concern exhibited over the possibility of these conditions being attributable to Agent Orange, conducted a briefing with respect to this issue on September 1, 1978, and outlined their methodology for management of such cases, as enunciated in VA Circular 10–78–219 dated September 14, 1978.

The VFW strongly supports the timely study of the possible deleterious effects of dioxin upon veterans and of providing medical care and compensation for any disability resulting therefrom. We have requested our service officers stationed at VA regional offices and VA hospitals to closely monitor any case wherein dioxin toxicosis is suspected so that we may assist the Veterans' Administration, Congress, and veterans so exposed. It is our intention to identify the largest number of such cases possible, and to establish appropriate controls and followup, thereby enhancing the determination of the actual existence of any disease or disability related to or directly resulting from exposure to Agent Orange.

Mr. Chairman, we commend you and this subcommittee for recognizing the need for exploring the possible deleterious effects related to the use of Agent Orange in Vietnam upon our Vietnam veterans so exposed. We recognize a degree of apathy may be encountered within government agencies due to possible culpability or reluctance to establish etiology which could generate a large volume of claims for service-connected disability. We welcome, also, the opportunity to provide your subcommittee with any information subsequently developed as a result of the efforts of our service officers.

This concludes my testimony and I will be happy to respond to questions that you may have at this time.

Thank you.

Mr. SATTERFIELD. Thank you very much. Mr. Hammerschmidt.

Mr. HAMMERSCHMIDT. Thank you, Mr. Mayo, for your helpful statement. Have you seen any concrete evidence of apathy within Government agencies due to possible culpability which could generate a large volume of claims?

Mr. MAYO. Our service officers and our claims people have not had any cases to adjudicate in our Board of Appeals at the VA. There is nothing happening in that regard.

Mr. HAMMERSCHMIDT. Does the VFW—and I might say in your own very fine outreach program which involves many millions of veterans across the country and your concern over their medical claims—have any feel for the number of claims for Agent Orange disability might increase beyond the present level of some 300 claims?

Mr. MAYO. Yes, sir, that is the thrust of what I get from our national service people. They indicated that the number of inquiries made of our service officers in this connection is increasing, and there have been a good number of them.

Mr. HAMMERSCHMIDT. Do you have any figures you could supply us for the record on that?

Mr. MAYO. Not at hand. This has just been recently undertaken.

Mr. HAMMERSCHMIDT. If you could develop those for our records, it would be helpful to us.

Mr. MAYO. Yes.

Mr. HAMMERSCHMIDT. Thank you very much, Mr. Chairman.

Mr. SATTERFIELD. I wish to thank you for appearing this morning and for your statement. I notice with interest in your statement you say:

> We recognize a degree of apathy may be encountered within Government agencies due to possible culpability or reluctance to establish etiology which could generate a large volume of claims for service-connected disability.

I certainly hope that is not the case. I think one thing that our hearings this morning have indicated is that there are ongoing studies and certainly it appears to me that the VA at the present time, at least, is proceeding as it should. We certainly are interested in their continuing to do so and will do everything we can to aid and assist in it. I really do not think, and I recognize what you say, that culpability is a question any longer. What we are interested in is result. If there is an adverse result, then we want to do something about it for our veterans. In that regard, I think I can speak for this committee by saying that insofar as the potential for a large volume of claims for service-connected disability, is concerned, it should no longer be a question.

If indeed there is ground for establishing service connection, and our country is responsible for it, then the volume of those claims ought not to be considered at all. I do not think anybody on this committee would disagree with that. So I think we are in complete agreement with the thrust of your statement.

I hope that these hearings have indicated at least to the other members and to you and those who have listened to us this morning that this issue is not a closed book as some have suggested. Those agencies which are involved and which have responsibility are proceeding. We hope they will continue to do so until we obtain the final answers we all seek.

Thank you very much for being here this morning. Your testimony will be very helpful to us.

I would like to say that there are a number of things we have asked to be submitted for the record and for the file of these hearings. In order to receive that information, the record will remain open for a period of 30 days and the file will remain open for a reasonable period of time in order to receive whatever additional information the witnesses here this morning can supply. Additional information will be included in the record at this point.

[Material follows:]

DEPARTMENT OF THE AIR FORCE,
HEADQUARTERS UNITED STATES AIR FORCE,
*Washington, D.C., December 11, 1978.*

HON. DAVID E. SATERFIELD, III,
*House of Representatives,*
*Washington, D.C.*

DEAR MR. SATTERFIELD: Reference is made to the Congressional Testimony concerning Herbicide Orange, October 11, 1978. The following corrections should be made in the testimony as agreed to during the discussion on the floor:

Page 26, line 457, change 52 million to 44 million.
Page 42, line 735, change 52 to 44.
Page 43, line 766, change 52 to 44.

In the initial testimony submitted for the record, reference was made to 52 million pounds of Herbicide Orange procured. However, only 44 million pounds were actually disseminated. This change was made per your request to correct the testimony.

I am most appreciative of your interest in the health of our military personnel. If I can be of further assistance, please let me know.

Sincerely,

GARTH B. DETTINGER,
*Maj. General, USAF, MC,*
*Deputy Surgeon General.*

DEPARTMENT OF THE ARMY,
HEADQUARTERS, U.S. COMMANDER, BERLIN AND U.S. ARMY, BERLIN,

*APO New York, October 13, 1978.*

AEBA–GC–C

Hon. DAVID SATTERFIELD,
*U.S. House of Representatives,*
*Washington, D.C.*

DEAR CONGRESSMAN SATTERFIELD: I read with interest an article (Army Times, 16 October 1978) on your investigation into potential long-term health problems caused by the chemical defoliant Agent Orange. From December 1967 through December 1968 I was the Assistant Division Chemical Officer, 4th Infantry Division, and I remain attuned to comments and articles concerning defoliant use and residual effects.

As opposed to other areas in South Vietnam, the Central Highlands is predominantly a deciduous hardwood area. In that there is comparatively little herbaceous vegetation (i.e. rice crops or large grassy areas), Agent Orange was used to a far greater degree than the water soluable defoliants White or Blue.

My duties in RVN required intimate involvement with defoliation operations, conducting spray missions on a near daily basis. These missions ran the spectrum from small scale perimeter defoliation to massive operations involving the use of hundreds of barrels of Orange on a single ridge line.

One operation which I supervised in the spring of 1968 may be of particular interest because of the employment requirements of the defoliant. We had a brigade headquarters (with its associated support activities) positioned in a valley at Dak To. This complex was overlooked by a large ridge line which became known as Rocket Ridge. The NVA/VC would set up rocket and mortar positions on this commanding position so as to strike at the brigade's vital communications and helicopter assets. Their hit-and-run tactics made direct counter-engagement with them almost impossible, and the thick vegetation prevented surveillance and observation of their positions. We were directed to defoliate the ridge so as to remove vegetation and permit a clear view of their positions.

While this was effectively accomplished, to the point of eliminating the threat from Rocket Ridge, the means employed should be particularly germane to you. Using a CH–47 helicopter with a 600 gallon tank, pump, and spray bar, we flew upwards of 80 missions over the ridge.

The system required the rear deck of the helicopter to be opened, and the rotor blades caused a constant backwash of the spray into the helicopter where I and my personnel operated. Each day we would finish our duties absolutely drenched with Orange; our fatigues totally saturated and the defoliant actually dripping from our hair. To be sure, some quantities of the 100 percent strength agent were ingested by breathing and swallowing. In total, we sprayed thousands of gallons daily over a three week period.

The point is that few military personnel or Vietnamese civilians could possibly have been exposed to Orange to the degree that I and my crew were, and the operation described above is only one of many similar missions.

It is my firm conviction that Orange caused absolutely no immediate or residual effects on personnel. Although I can claim no medical expertise, I can attest to excellent health for myself as well as other soldiers with whom I've subsequently maintained contact.

While I am not a pathologist and cannot debate medical hazards except from personal observation, I have the strong opinion that ex-soldiers claiming residual health defects may indeed be looking for the easy dollar from Uncle Sam. This bandwagon effect has apparently become popular, and I seriously question both the legitimacy of the claim and their integrity.

I do not know if this information will be of value to you, but it appears that there are enough documented cases of personnel heavily and repeatedly exposed to defoliants which should bear on your examination. I would personally conclude that claims of long-term health degradation have little justification.

Sincerely,

DONALD R. TAYLOR,
*Major, Chemical Corps,*
*Brigade Chemical Officer.*

[From the Virginia Farm Bureau News]

HERBICIDE LIMITATIONS RELAXED

The U.S. Agriculture Department has announced a relaxation in limitations on the use of the herbicide 2,4,5-T.

Assistant Secretary M. Rupert Cutler said he will permit spraying within 200 feet of streams. The limitation had been set at a quarter mile.

The prohibition against use of the chemical within one mile of permanent dwellings will remain in effect.

Cutler also said he is reconsidering a proposal to use 2,4,5-T this year on an estimated 101 acres in the Rogue River National Forest. He rejected its use in the area August 11.

The chemical is used by farmers to control weed growth and by foresters for the elimination of unwanted hardwoods in pine forests.

Mr. SATTERFIELD. Without any further questions, and there being no other witnesses—the committee will stand adjourned.

[Whereupon, at 12:20 p.m., the subcommittee adjourned.]

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