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WHITE HOUSE  
AGENT ORANGE WORKING GROUP  
(WHAOWG)

FACT SHEET  
ON SCIENTIFIC RESEARCH  
OF THE FEDERAL GOVERNMENT

Membership

- o Department of Health and Human Services (Lead Agency)
- o White House Office of Policy Development
- o White House Office of Science & Technology Policy
- o Office of Management and Budget, Executive Office of the President
- o Council of Economic Advisors
- o Department of State
- o Department of Defense (Army, Air Force)
- o Department of Agriculture
- o Department of Labor
- o Veterans Administration
- o Environmental Protection Agency
- o ACTION

Observer

- o Congressional Office of Technology Assessment

Update: September 1985

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The State of Agent Orange Related Research  
in the Federal Government  
The FY 1985 Report of the Science Panel of the  
Cabinet Council Agent Orange Working Group

EXECUTIVE SUMMARY

The issue of possible adverse health effects in humans as a consequence of exposure to Agent Orange (AO) in Vietnam has attracted and maintained the attention of the nation for nearly a decade.

For the past four years, the Agent Orange Work Group (AOWG), a Cabinet Council working group composed of representatives from 12 different Federal agencies, has been evaluating the direction and extent of the government's scientific research in Agent Orange and related issues. When the AOWG was formed in 1981, it was clear from animal studies and the limited human studies that the toxic contaminant of AO, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), has the potential to cause a broad range of deleterious effects. Some concern was also expressed about the potential effects of the major components of Agent Orange: the herbicides 2,4,5-trichlorophenoxy acetic acid (2,4,5-T) and 2,4-dichlorophenoxy acetic acid (2,4-D). The extent to which these effects were likely to appear in humans exposed to AO in Vietnam, however, was unknown.

Between 1981 and 1987, AOWG member agencies will have expended \$150 million in AO-related research. The majority of these funds has been directed at closing the largest gap in our knowledge on AO: the effects of AO on humans. Ten major

epidemiological studies scheduled for completion by 1990, and five ongoing health surveillance projects should provide information on whether exposure to AO has affected the health of Vietnam veterans and for framing hypotheses which can be tested in follow-up studies if necessary. Additional resources have been expended to better characterize known toxic properties of 2,3,7,8-TCDD and AO, to investigate the toxic endpoints that are less well-studied, and to synthesize the expanding literature on this subject.

Based on the growing body of information in hand, the worst case scenarios envisioned by some as a consequence of exposure to AO are not being realized. Populations known or possibly exposed to AO which are being studied have not so far exhibited increased incidences of cancer, or death from other causes, or abnormally high rates of birth defects in their offspring. This optimism is tempered by the knowledge that other, less-well characterized effects of concern may be associated with 2,3,7,8-TCDD (e.g., immunotoxicity). Some effects (e.g., cancer) may not become manifest for several more years, due to a longer latency period.

The consensus of the Science Panel is that initiation of any new, major epidemiological study should await and be built upon the results of studies already underway. The time for broad, hypothesis-generating studies has passed; focused, hypothesis-testing studies should characterize the future.

A large number of ongoing research projects designed to characterize the toxicity and mechanisms of action of 2,3,7,8-TCDD in laboratory animals will also help to identify possible adverse human health effects and will assist in the interpretation of epidemiologic study results.

September 1985

The State of Agent Orange Related Research  
in the Federal Government:  
The FY 1985 Report of the Science Panel of the  
Cabinet Council Agent Orange Working Group

I. Introduction

The controversy surrounding the tactical use of herbicides -- principally, Agent Orange (AO) -- in Southeast Asia during the Vietnam conflict has continued for more than a decade. Few environmental or occupational health issues have received the sustained national attention that has been focused on AO. The controversy has encompassed a broad range of issues, including questions on the actual use of the herbicide in Vietnam, the subsequent ecological effects, the procedures for disposing of surplus herbicides, and, most notably, the possible link to reported adverse health effects among Vietnam veterans.

As each of these different facets of the controversy came to light, additional government agencies were called upon to address the associated issues. Today, twelve agencies of the Federal Government are coordinating their efforts, under the leadership of the Agent Orange Working Group (AOWG), to seek resolution of the scientific, medical, legal and social problems surrounding the AO question. The scientific and medical issues are dealt with through the Science Panel of the AOWG which is composed of AOWG members and reports directly to the parent work group.

Section II of this report contains a brief description of the AOWG, its history and its mission. In Section III, there is a description of the state-of-the-science as of 1981 when the AOWG first was formed and which provided the basis for further research at that time. Section IV discusses the research that has been and is being conducted within the Federal government on AO-related matters. Although this report is not intended to be a thorough review of the state-of-the-science regarding AO or 2,3,7,8-TCDD, it does provide a brief overview of Federally sponsored research as reflected by these and other projects. This, together with an examination of implications of our state of knowledge by a group who have been involved for six years, is provided in Section V. Finally, Section VI contains a discussion of future directions for Federally-sponsored, AO-related research.

## II. Brief History of the Agent Orange Working Group (AOWG)

On July 17, 1981, President Reagan formally established the Agent Orange Working Group as an entity reporting to his Cabinet Council. However, the AOWG traces its roots to December 11, 1979, when the White House formed the Interagency Working Group (IWG) to Study the Possible Long-Term Effects of Phenoxy Herbicides and Contaminants. The mission of IWG was to monitor, coordinate and set priorities among the pertinent Federal Government research activities, to design a research agenda, and to organize the means of ensuring that this research agenda was carried out.

In response to continuing concerns of veteran groups that exposure to herbicides in Vietnam could result in health problems, the President expanded the membership of the IWG, renamed the group (AOWG), and raised its status to Cabinet Council working group level. The IWG's mandate was reaffirmed with a stated emphasis on AO research. The current membership of AOWG is found in Appendix A.

In addition to assuming the mission of the IWG, the AOWG was charged with providing scientific guidance for the Congressionally mandated epidemiological study of Vietnam veterans, presumed to have been exposed to AO. The legislative history associated with the Act calling for the epidemiology study specifically refers to "...the importance of the provision directing the President to assure (preferably through an interagency task force) that the mandated study be fully coordinated with ongoing or future governmental studies..." The Act was later amended to include consideration of other than AO-related factors in investigating the health outcomes of Vietnam veterans.

The AOWG has formed a subcommittee, the AOWG Science Panel, to facilitate its consideration and evaluation of scientific questions related to AO. Every 12 to 18 months the AOWG collects a list of ongoing Federal research projects related to AO. This year, the work group is additionally providing a short analysis of this information and identifying possible directions for future research, by means of this report.

### III. Basis for the Research Efforts Commencing in 1980

#### A. What was known

##### 1. Effects in animals

Health concerns associated with the use of Agent Orange can be traced to experiments in the late 1960s which showed that a trace contaminant in AO -- 2,3,7,8-TCDD -- could generate birth defects in the offspring of pregnant mice exposed to low doses of the chemical. The 2,3,7,8-TCDD also caused death in laboratory animals at very small doses, for example, single doses of less than a millionth of a gram of this chemical resulted in death in guinea pigs. In some other species, e.g., hamsters, the lethal dose is more than a 1000-fold greater than that required to kill guinea pigs. In the late 1970s, animal experiments demonstrated that 2,3,7,8-TCDD is carcinogenic in rats and mice at very low levels. Further experimentation suggests additional toxic effects from low levels on a variety of other systems, including the liver, the reproductive system, the immune system and lipid metabolism.

##### 2. Effects in humans

The severity of the toxicological responses and the wide range of sensitivity observed in animal studies heightened concerns about the possible effects in humans and their relative sensitivity to 2,3,7,8-TCDD. Partial answers to these questions have been ascertained from investigations of the consequences of occupational exposures associated with industrial accidents.

Information from such sources are never "clean"; that is, occupational settings and industrial accidents are generally marked by uncertain exposures and/or concurrent exposures to other chemicals. While these limitations make specific cause-and-effect determinations difficult, by 1980, the following human responses were known or thought to be associated with exposure to 2,3,7,8-TCDD or chemicals containing this compound.

- a. Chloracne -- a persistent, acne-like condition which can be disfiguring, but is not life-threatening.
- b. Soft tissue sarcoma -- a relatively rare form of connective tissue cancer.
- c. Porphyria cutanea tarda -- a metabolic disorder, associated with changes in urine content and sensitivity of the skin to light.

In addition, case reports suggested an association between exposure to 2,3,7,8-TCDD and various toxic effects, e.g., liver dysfunction, abnormal lipid metabolism, neurologic problems and loss of libido.

#### B. What was not known

##### 1. Effects in animals

Many researchers believe that the key to understanding the toxicity of 2,3,7,8-TCDD (and the toxicities of scores of chemically related substances) lies in understanding its mechanism of action in biological systems. By 1980, some scientists had suggested a hypothesis that linked the toxicity of 2,3,7,8-TCDD

to its chemical shape and the presence of certain "TCDD-receptors" in the cytoplasm of cells in target organs. Once combined with the toxicant, the TCDD-receptor complexes would move to the nucleus of the cell, where a series of reactions would be initiated, which would lead eventually to various toxic responses. Other scientists suggested that the key effect of 2,3,7,8-TCDD might be on the membrane of the cell.

In order to test either of these hypotheses and to understand the mechanism of action of 2,3,7,8-TCDD more completely, it was necessary to study its absorption, metabolism, and tissue distribution in whole animals, supplemented by in vitro experiments.

Additional toxic endpoints of concern needed to be investigated, e.g., neurotoxicity, behavioral effects, and mutagenicity. Further work was needed to characterize more fully the toxic endpoints already demonstrated, e.g., liver effects and immunotoxicity.

## 2. Effects in humans

In 1980, the biggest gap in our knowledge about AO clearly lay in the area of its effects on humans. In Congressional testimony, AOWG members emphasized this lack of information, pointing out that animal tests alone would never fully bridge this gap. Since few human studies had been completed, the results of animal studies and reports in the news media had heightened concerns of many Vietnam veterans

regarding their increased potential to sire children with birth defects due to their exposure to AO. Other veterans were worried about the possibility of an increased likelihood of contracting cancer due to their service in Vietnam. Still others were concerned about an association between Vietnam/AO and a broad range of adverse health effects, from specific debilitating diseases to general malaise.

One of the biggest impediments to a study of the effects of AO on Vietnam veterans was that the extent to which individuals had actually been exposed to AO during their military service was unknown. Additionally, no one knew how to gauge relative amounts of exposure among different individuals.

### 3. Information Management

In 1980, there were already hundreds of scientific papers written on AO and/or 2,3,7,8-TCDD, and the rate of publication of papers on the subject was expanding rapidly. There was a need to systematically capture this information and to assimilate it into an orderly, comprehensible form.

### IV. Federal Research Related to AO: 1981-1987

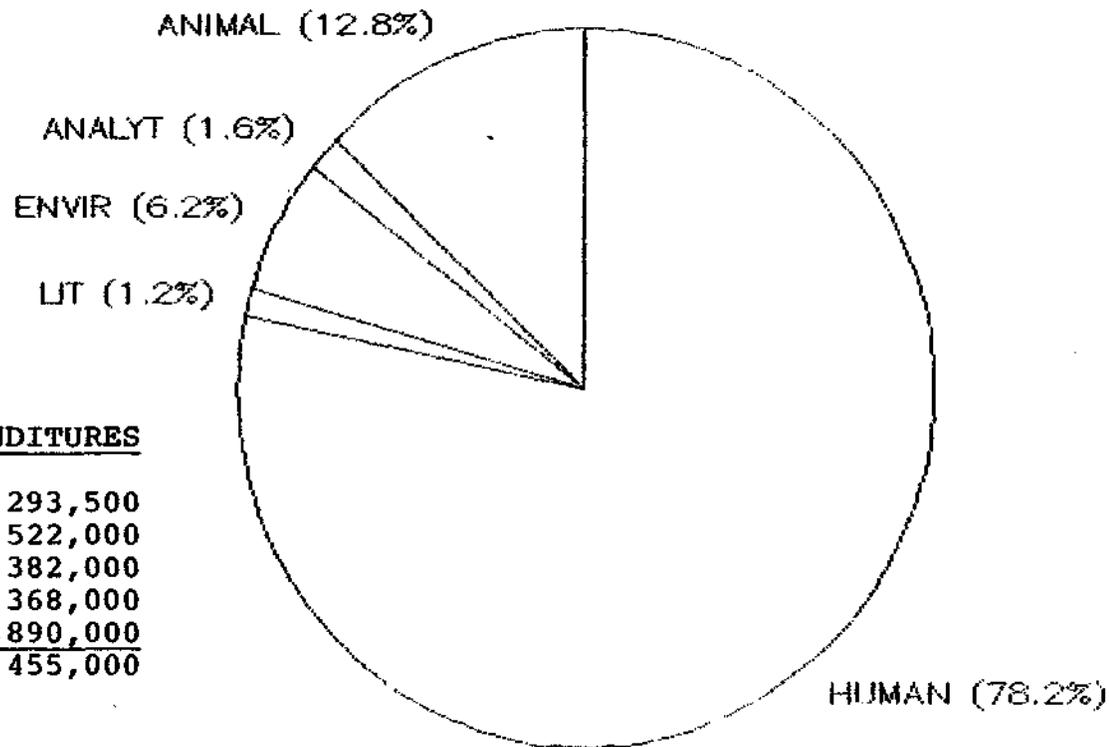
Between 1981 and 1987, the Federal government will have devoted more than \$150 million to its attempts to address the gaps in the scientific data base identified in Section III. Figures I and II illustrate the proportions of these funds which were and are being expended by the various agencies for the different types of studies. Figures III-VII show

the breakdown of these expenditures for each agency by category of study, e.g., various human health effects and laboratory studies. Appendix B contains a complete project-by-project listing of this work from which the data for the Figures were drawn. Appendix C contains descriptions of the research supported by each agency and provides the basis for the discussion in the remainder of this section.

# AGENT ORANGE/DIOXIN EXPENDITURES

AGENCY EXPENDITURES BY STUDY TYPE

\$152,455,000 TOTAL EXPENDITURES

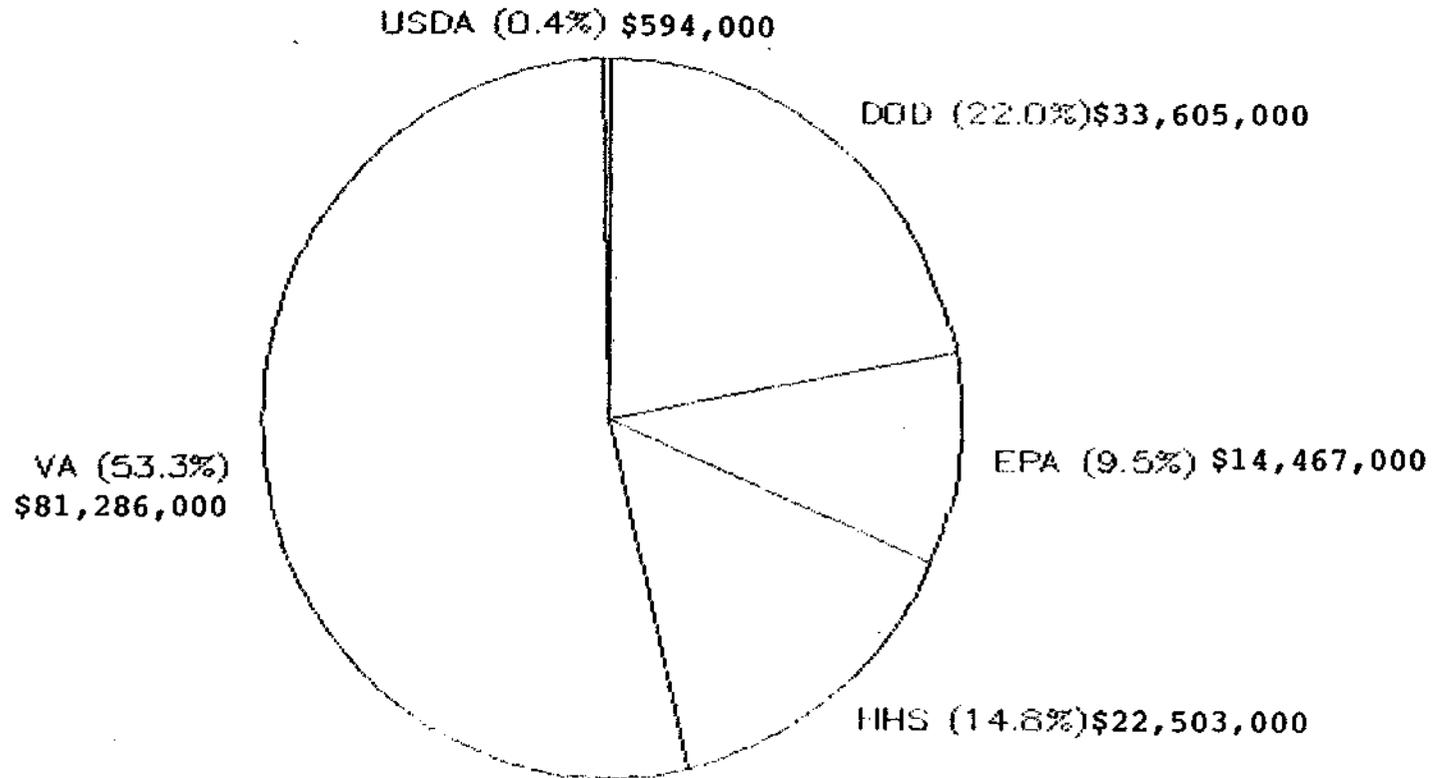


<u>STUDY TYPE</u>	<u>EXPENDITURES</u>
HUMAN	\$119,293,500
ANIMAL	19,522,000
ENVIRONMENT	9,382,000
ANALYTICAL	2,368,000
LITERATURE	1,890,000
<u>TOTAL</u>	<u>\$152,455,000</u>

# AGENT ORANGE/DIOXIN EXPENDITURES

\$152,455,000

TOTAL COST



#### A. Effects in animals

Over the past five years, hundreds of additional scientific papers have been published on the effects of AO and/or 2,3,7,8-TCDD on animals. Of special note was a study, expressly prompted by the concern of the veterans, that investigated the possible induction of certain birth defects in the offspring of male mice exposed to AO. This interest was prompted by the parallel to male soldiers exposed to AO in Vietnam, who were concerned about reproductive problems they might encounter. The results of the study indicated that exposure of male mice to the components of AO had no effect on their reproductive outcomes.

As the project titles in Appendix B indicate, research has continued in the previously studied areas of 2,3,7,8-TCDD animal toxicity; e.g., immunotoxicity, mutagenicity, lipid metabolism, and liver damage. Additional progress has been made in understanding the mechanism of action of 2,3,7,8-TCDD, its tissue distribution, and metabolism. New work has begun in certain behavioral endpoints.

In summary, the animal toxicology of 2,3,7,8-TCDD is increasingly well-characterized, although fundamental questions about the mechanisms of that toxicity and its relevance to humans remain unanswered.

#### B. Effects in humans

The major expenditures in Federally sponsored AO research over the past five years have been directed at the

TABLE 1: The Eleven Major Epidemiological Studies of U.S. Vietnam Veterans, Agent Orange and TCDD Exposure, and Vietnam Experience Currently Ongoing or Completed in the United States

<u>Title</u>	<u>Responsible Federal Agency and Study Location</u>	<u>Type of Study</u>	<u>Total Study Population Size</u>	<u>Completion Date</u>
Air Force Health Study	United States Air Force School of Aerospace Medicine, San Antonio, Texas	Matched Cohort Study of RANCH HAND Personnel and Controls, Mortality, Morbidity and Reproduction	2,500	a) Baseline Reports 1983 - 1984 b) Long-term follow-up planned
VA Mortality Study	Veterans Administration Agent Orange Projects Office, Washington, D.C.	Mortality Study of Vietnam-Era Veterans	75,000	Late 1985
Vietnam Experience Twin Study	Veterans Administration Medical Center, St. Louis, Missouri	Morbidity Study of Identical Twins	1,200	1986
Birth Defects Study	Centers for Disease Control, Atlanta Georgia	Case-Control Study of Anatomical Birth Defects	8,400	Completed August 1984
Agent Orange Epidemiological Study of Ground Troops	Centers for Disease Control, Atlanta Georgia	Three-Cohort Morbidity Study of Vietnam Veterans to determine the health effects of Agent Orange	18,000	1988
Selected Cancers Study	Centers for Disease Control, Atlanta, Georgia	Case-Control Study of Soft Tissue Sarcoma, Lymphoma and other Cancers	2,000	1989

TABLE 1: The Eleven Major Epidemiological Studies of U.S. Vietnam Veterans, Agent Orange and TCDD Exposure, and Vietnam Experience Currently Ongoing or Completed in the United States (Continued).

<u>Title</u>	<u>Responsible Federal Agency and Study Location</u>	<u>Type of Study</u>	<u>Total Study Population Size</u>	<u>Completion Date</u>
Vietnam Experience Epidemiologic Study	Centers for Disease Control, Atlanta Georgia	Matched Cohort Morbidity Study of Vietnam and non-Vietnam Veterans	12,000	1987
VA/AFIP Soft Tissue Sarcoma Study	Veterans Administration Agent Orange Projects Office, Washington, D.C.	Case-Control Study of Soft Tissue Sarcoma	250 cases 750 controls	Late 1986
NIOSH Dioxin Registry	National Institute for Occupational Safety and Health, Cincinnati, Ohio	Mortality Study of Workers at 12 Production Sites Where Dioxin Containing Products Were Manufactured	6,000	1986
NIOSH Industrial Morbidity Study	National Institute for Occupational Safety and Health, Cincinnati, Ohio	Morbidity Study of Workers at 2 Production Sites Where Dioxin Containing Products Were Manufactured and a Comparison Group	800	1988
NCI Kansas Soft Tissue Sarcoma Study	National Cancer Institute, Bethesda, Maryland	Case-Control of Soft Tissue Sarcoma	100 cases 300 controls	1986

TABLE 2: The Five Major Current Health Surveillance Projects of U.S. Vietnam Veterans, Agent Orange and TCDD Exposure.

<u>Title</u>	<u>Responsible Federal Agency and Study Location</u>	<u>Type of Surveillance</u>	<u>Target Population</u>	<u>Status</u>
VA Patient Treatment File Review	Veterans Administration Agent Orange Projects Office, Washington, D.C.	Review of VA hospital inpatient medical records	Vietnam era veterans who have been hospitalized in VA medical facilities	Ongoing
Agent Orange Register Review	Veterans Administration Agent Orange Projects Office, Washington, D.C.	Review of the records of the medical examinations at VA hospitals	Vietnam veterans who have reported to VA hospitals for an Agent Orange examination	Ongoing
A Review of the Soft Tissue Sarcoma Cases in Patient Treatment File for Vietnam Era Veterans	Veterans Administration Agent Orange Projects Office, Washington, D.C.	Review of pathology reports and the tissue specimens of patients diagnosed as having International Classification of Diseases (ICD) 171	Vietnam era veterans who have been hospitalized in VA medical facilities	Ongoing
AFIP Agent Orange Registry	Armed Forces Institute of Pathology, Washington, D.C.	Review of tissue specimens	Vietnam era veterans	Ongoing
VA/EPA Adipose Tissue Study	Veterans Administration and the Environmental Protection Agency, Washington, D.C.	500 samples of human fat	U.S. Vietnam era males	Ongoing

most critical need: studies of the potential effects of AO in humans. This work, coordinated through the AOWG, has been and is being conducted primarily by the Centers for Disease Control (CDC), the Department of Defense (DOD), and the Veterans Administration (VA). Epidemiological studies are complex and time-consuming projects, and, although many of these investigations are still in progress, all but one are scheduled for completion before the end of the decade. Table I briefly describes the epidemiological studies in progress.

The US Air Force is conducting a major investigation into the health of all identified individuals who were involved with the spraying of AO in Vietnam (Operation Ranch Hand), a group which were known to be exposed to AO. The mortality experience and the health status of the individuals in the cohort will be compared with that of other Southeast Asian veterans of the Air Force and followed for two decades to assess both the immediate and delayed results of exposure to AO.

In addition to the Ranch Hand study, ongoing human studies by the VA and CDC focus on health outcomes among Vietnam and Vietnam-era veterans. Investigations of both mortality and morbidity of Vietnam veterans are underway.

As noted in Section III, a major problem associated with human investigations has been estimating exposure of study subjects. This has attracted a significant portion

of the AOWG's time and attention, as well as the imagination and persistence of specified investigators, and of the personnel in the DOD Environmental Support Group in the US Armed Services. The uncertainty associated with obtaining an objective assessment of exposure to AO has influenced all of the epidemiological studies. The AO study being conducted by CDC will compare the health of cohorts of Vietnam veterans whose different proximities to AO applications have been obtained from detailed examination of herbicide application records and of daily records of troop movements and troop rosters. The Cancer and Mortality Studies will assign an index of opportunity for exposure to individuals based on quarterly reports of their assigned units' activities and proximity to herbicide applications during the period in which they were assigned to the unit. In some instances, however, individual AO exposures have been so difficult to estimate that investigators have had to assume that "service in Vietnam" is a surrogate for exposure to AO. Consequently, the effects of other aspects of the "Vietnam experience" have become even more difficult to distinguish from "AO exposure" per se.

In addition to studies focusing on Vietnam veterans, investigators are examining other populations which may have been exposed to AO-like materials. There are now "dioxin registries" of industrial workers who were involved in the

production or handling of 2,4,5-T and other chemicals which were contaminated with dioxins.

Some agencies are conducting health surveillance projects which, while lacking the rigor of formal studies, may provide information on possible links between AO exposure and/or Vietnam service and a variety of health effects. (See Table II.) Such information, if it points toward an association between exposure and adverse effects, will form the basis for hypotheses which can be tested in more rigorous studies.

In summary, during the past five years, major steps have been taken in our effort to address the critical gap in our understanding of AO. Over the next five years, we hope that the ongoing studies will produce sufficient information for us to both reach broad conclusions, and to more sharply focus our questions.

### C. Other

#### 1. Information Management

Since 1980, the VA has published six volumes of an annotated bibliography and review of the scientific literature related to the toxic effects of AO and related compounds. The VA has prepared a "lay summary" of this material to make these results more comprehensible to the interested non-scientific public.

#### 2. Environmental Fate and Transport

Various agencies have conducted research on the question: what happens to 2,3,7,8-TCDD once it enters the environment?

The answer to this question is relevant to the potential exposure to humans. For example, studies by the Air Force and others have indicated that, once incorporated into the soil, 2,3,7,8-TCDD has a half-life of roughly a decade. In addition, studies by NIEHS and EPA suggest that the bioavailability (an index of the toxic potential of chemicals in a contaminated matrix) of 2,3,7,8-TCDD from different contaminated soils can vary widely.

### 3. Monitoring.

A number of agencies have been active in developing more sensitive, more rapid, and/or less expensive methods for analyzing for 2,3,7,8-TCDD in different substances, e.g., soil, mother's milk, and human adipose tissue. These methods have expedited the agencies' search for 2,3,7,8-TCDD in various parts of our environment. In the future, it may be possible to use some of these methods to assist in determining who has been exposed to 2,3,7,8-TCDD-containing chemicals, such as AO.

### V. Evaluation

Research mentioned in this report reflects a Federal investment of more than \$150 million into the issue of the potential adverse human health effects of exposure to AO. The knowledge base, while by no means complete, is considerably broader and deeper than it was only four years ago when the AOWG came into existence.

Although considerable work remains to be done, the work completed to date generally supports an optimistic prognosis for the Vietnam veteran. The early results from these studies suggest that the projected worst case scenarios of the effects on veterans of service in Vietnam and/or possible exposure to AO have not been realized. While most of the studies are still in progress and their results will provide additional important information, the currently available data do not indicate the overwhelming adverse effects associated with such service or exposure that some had feared.

The results of several studies support this evaluation. First, baseline data from the Ranch Hand study indicate that the Vietnam veterans most likely to have been exposed to AO (those involved with the handling and application of the chemical) have not experienced a disproportionate number of serious adverse health effects when compared to other Air Force personnel with no known exposure to AO.

Second, in a health survey conducted by the VA, there were no significant associations found between cancer incidence and self-reported AO exposure, or other variables that should be related to herbicide exposure.

Third, a study conducted and published by the CDC and co-funded by CDC, VA and DOD, indicates that Vietnam veterans are at no greater risk of fathering deformed children than are their comparisons who have not been to Vietnam. (These results are consistent with a related study conducted in

Australia which found no evidence that Australian Army service in Vietnam increased the risk of fathering children with anomalies diagnosed at birth.)

Fourth, an animal study conducted by NIEHS suggested that AO exposed males are not likely to be the source of birth defects in offspring.

Between now and the end of the decade, more human health information will be generated on the AO problem than has been generated in all the years up to this time. While the limited data in hand should be encouraging to those concerned about possible adverse health effects to AO-exposed Vietnam veterans, it is still too early to make final statements. In particular, the potential for effects which manifest themselves only many years after exposure (e.g., cancer) have yet to be assessed fully. Also, effects which have not been so fully examined (e.g., immunotoxicity) may be found, and since the populations involved in some of the ongoing studies are larger than those in the completed studies, less common adverse effects may be discovered.

#### VI. Future directions

Since the early 1970s, the country has been sensitized to the possible presence of 2,3,7,8-TCDD in various environmental settings, including many in the United States. For example, over the past five years, 2,3,7,8-TCDD contamination has been reported at US locations from the forests of the Pacific Northwest to the streets of Newark, New Jersey. In the

early 1980s, the discovery of 2,3,7,8-TCDD contaminated soil at more than 40 locations in Missouri led to actions by EPA and CDC to limit human exposure to the contamination at some of these sites.

This increased attention has been accompanied by suggestions that additional human studies should be undertaken to investigate the possible deleterious effects of exposure to 2,3,7,8-TCDD contaminated material, such as AO. Populations within the US and additional cohorts of Vietnam service personnel have been mentioned as likely subjects of study. During the past year, however, the Science Panel has reached the conclusion that the human studies and surveillance of records which are already underway should be sufficient to detect the important human effects. Additional major epidemiological studies, associated with either Vietnam or domestic exposure, should profit if they await the results of the studies already underway before being initiated. Future studies should build on the information being gathered, i.e., testing specific hypotheses suggested by the current studies. In short, there is a consensus in the Science Panel that broad, hypothesis-generating studies are already underway; future studies should be focused to test hypotheses generated from completed and ongoing studies.

We now recognize that the "AO problem" has always been a subset of both the overall "Vietnam experience problem" and the larger "dioxin problem". The latter also encompasses

domestic contamination situations mentioned previously, the panoply of "dioxin-like" chemicals emitted from combustion sources, and the problem of destroying 2,3,7,8-TCDD once it has been discovered in the environment. The results of such investigations may provide additional insights into the AO problem, as the AO research described in this report will reciprocate by shedding light on the larger "dioxin" question.

APPENDIX A

Agency Membership in Agent Orange Work Group

Department of Health and Human Services (Chair)  
Centers for Disease Control  
Center for Environmental Health; National Institute of  
Occupational Safety and Health  
National Institute of Environmental Health Sciences  
Public Health Service  
National Cancer Institute

ACTION

Council of Economic Advisors

Department of Agriculture

Department of Defense

Department of Labor  
Office of Occupational Safety and Health

Department of State

Environmental Protection Agency

Office of Management and Budget

Office of Policy Development

Office of Science and Technology Policy

Congressional Office of Technology Assessment (Observer)

Veterans Administration

APPENDIX B

PROJECT-BY-PROJECT LISTING OF  
AGENCY AO-RELATED RESEARCH EFFORTS\*

\*The following tables list AO and related research studies sponsored by the Federal Government beginning in 1980. Studies carried out by one Agency, but funded by another have been listed under the Agency funding the study. Projects related to the investigation and clean-up of 2,3,7,8-TCDD contaminated sites have not been included.

DEPARTMENT OF AGRICULTURE HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY				STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED		
A CASE CONTROL STUDY OF THE RELATIONSHIP BETWEEN EXPOSURE TO 2,4-D AND SPONTANEOUS ABORTIONS IN HUMANS				X		X		1980-1981 365,000
EXPOSURE OF FOREST WORKERS TO GROUND APPLICATIONS OF 2,4-D					X	X		1981-1984 165,000

DEPARTMENT OF AGRICULTURE OFFICE OF SCIENTIFIC RESEARCH LAB/LITERATURE STUDIES

STUDY EFFORT	TYPE OF STUDY		STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL ANALYTICAL	LITERATURE	COMPLETED ONGOING		
BIOLOGICAL AND ECONOMIC ASSESSMENT OF 2,4,5-T AND SILVEX			X	X	1977-1983	64,300

DEPARTMENT OF DEFENSE/AFIP HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY				STATUS		STUDY PERIOD	TOTAL \$ 1981-87	
	MORTALITY	NORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED			ONGOING
ARMED FORCES INSTITUTE OF PATHOLOGY MORPHOLOGIC STUDIES/VIET VETS			X				X	1980-1986	350,000

DEPARTMENT OF DEFENSE/AIR FORCE HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY				STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED		
PROJECT RANCH HAND EPIDEMIOLOGIC INVESTIGATION OF HEALTH EFFECTS IN AIR FORCE PERSONNEL FOLLOWING EXPOSURE TO HERBICIDE ORANGE (AIR FORCE HEALTH STUDY)	X	X	X	X			X	1981-1999 28,600,000

DEPARTMENT OF DEFENSE/AIR FORCE OFFICE OF SCIENTIFIC RESEARCH LAB/LITERATURE STUDIES

STUDY EFFORT	TYPE OF STUDY			STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL	ANALYTICAL LITERATURE	COMPLETED	ONGOING		
2,3,7,8-TCDD INDUCED IMMUNOSUPPRESSION	X				X	1985-1987	62,600
MECH OF CELLULAR MEMBRANE EFFECTS OF TCDD	X				X	1984-1987	225,000

DEPARTMENT OF DEFENSE/ARMY ENVIRONMENTAL SUPPORT GROUP HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY					STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED	ONGOING		
VA SOFT TISSUE SARCOMA			X			X		1985	12,000
VA MORTALITY STUDY	X						X	1984-1987	561,000
CDC BIRTH DEFECTS STUDY				X		X		1983-1984	223,000
CDC EPIDEMIOLOG. STUDY	X	X	X	X	X	X		1984-1988	758,000
VA TWIN STUDY		X		X				1985-1987	75,000
VA ADIPOSE TISS. STUDY					X			PENDING	-
AFI SARCOMA STUDY			X					1984-1989	86,000
CDC SELECTED CANCERS			X				X	1984-1989	72,000
VA CHLORACNE		X						1984-1989	55,000
VIXIN WORKERS		X						1984	12,000
VA PATIENT TREATMENT FILES		X						1984-1989	47,000
SERVICES HERBS TAPES					X			1982-1989	372,000
MISCELLANEOUS SUPPORT CDC VIETNAM EXPERIENCE STUDY	X	X	X	X	X			1980-1989	1,377,500
CDC VIETNAM EXPERIENCE STUDY							X	1984-1985	794,000

ENVIRONMENTAL PROTECTION AGENCY HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY				STATUS		STUDY PERIOD	TOTAL \$ 1981-97	
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED			ONGOING
REPORT OF ASSESSMENT OF A FIELD INVESTIGATION OF SIX-YEAR SPONTANEOUS ABOR- TION RATES IN THREE OREGON AREAS OF RELATION TO FOREST 2,4,5-T SPRAY PRACTICES				X		X		1979	0
NORTHWEST HUMAN MILK STUDY					X	X		1980	0
NATIONAL MONITORING OF HUMAN ADIPOSE					X		X	1983-1985	75,000
NEBRASKA ADIPOSE TISSUE STUDY					X	X		1980	0
RETROSPECTIVE STUDY OF DIOXINS AND FURANS IN ADIPOSE TISSUE OF VIETNAM-ERA VETERANS (VA/EPA)					X		X	1982-1989 VA FUNDING	

ENVIRONMENTAL PROTECTION AGENCY LAB/LITERATURE STUDIES

EFFORT	TYPE OF STUDY			STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL	ANALYTICAL	LITERATURE	COMPLETED		
ASSESS OF PCB TRANSFORMER/ CAP FIRES			X		X		1984-1985 140,000
UPTAKE OF DIOXINS BY FISH	X					X	1984-1987 909,000
MICROB. DISSIM. OF 2,3,7,8- TCDD		X			X		1980 0
POTENTL FOR 2,3,7,8-TCDD TRANSPORT IN SOILS		X				X	1984-1987 812,000
BACTER DECOMP OF TCDD		X				X	1982-1987 486,000
MISSISSIPPI CATFISH STUDY	X				X		1980 0
EXPOS ASSESS MTHDS FOR TCDD AND OTHER DIOXINS				X		X	1984-1987 667,000
OF ENV. SAMPLES DS AND CDFS		X			X		1982-1984 290,000
BIOAVAIL. OF FR. WATER FISH FOR TCDD	X				X		1982-1984 250,000
OREGON MONKEY STUDY	X				X		1980 0
EVAL OF MUNIC. WASTE COMBUSTORS		X			X		1982-1984 300,000
QUALITY ASSUR. SUPPORT			X			X	1984-1985 1,162,000
REGION X DEER & ELK STUDY	X				X		1980 0
UPTAKE OF DIOXINS BY PLANTS AND LARGE ANIMALS		X				X	1984-1987 435,000
LA. CRAYFISH/CATFISH STUDY	X				X		1980 0
EVAL OF LARGE SCALE COMBUSTION SOURCE		X			X		1982-1983 400,000
RISK ASSESS APPROACH TCDD AND OTHER DIOXINS				X		X	1984-1987 335,000
AL DIOXIN STUDY		X				X	1984-1985 4,600,000
BEEF FAT PHASE II	X				X		1980 0

ENVIRONMENTAL PROTECTION AGENCY LAB/LITERATURE STUDIES

EFFORT	TYPE OF STUDY			STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL	ANALYTICAL	LITERATURE	COMPLETED		
EVAL UV PHOTOLYSIS/ APEB CHEM DETOX		X				X	1984-1987 607,000
HEALTH ASSESS OF PCDDS & PCDFS				X		X	1985 50,000
BIODEG AND CARBON ADSORPTION OF TCDD		X			X		1980 0
INVEST OF IN SITU STABIL. TECHNOLOGY		X				X	1984-1987 397,000
SORPTION/DESORPTION OF TCDD		X				X	1984-1987 670,000
METHODS ANALYS. ENVIR. OF TCDD BY MASS. SPECT.				X		X	1984-1985 300,000
PHARMACD. OF TCDD IN MONK. & HEALTH ASSES. OTHER DIOXINS	X					X	1984-1987 837,000
MUNDELON. ANTIBOD. METHOD OF DIOXIN ANALYSIS				X		X	1984-1985 200,000
INACTIVE MINES FOR REPOS. OF DIOXIN SOIL		X				X	1984-1985 185,000
ROUND ROBIN SURVEY-METHODS DIOXIN ANALYSIS IN ADIPOSE				X		X	1985 10,000
WISCONSIN MONKEY STUDY	X					X	1980 0
PHOTOCHEMISTRY		X				X	1986-1987 200,000
BIOAVAILABILITY TO ANIMALS	X					X	1985-1986 150,000

HEALTH AND HUMAN SERVICES/CDC HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY					STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED	ONGOING		
CDC BIRTH DEFECTS AND MILITARY SERVICE IN VIETNAM STUDY				X			X	PUBLISHED AUG. 1984	1,604,000
CDC EPIDEMIOLOGIC STUDY OF GROUND TROOPS EXPOSED TO AGENT ORANGE DURING THE VIETNAM CONFLICT	X	X	X	X	X		X	SEPT 1989 VA FUNDING	
DEVELOPMENT OF TCDD REFERENCE STANDARDS FOR LAB ANALYSIS OF HUMAN TISSUES					X		X	1984-1985 EPA FUNDING	
DEVELOPMENT OF LAB METHODS FOR TCDD ANALYSIS OF HUMAN ADIPOSE TISSUES AND SEVENTH ULTRALOW (PPM) LEVELS					X		X	1984-1985 EPA FUNDING	
EXPOSURE STUDIES OF MO RESIDENTS OF TCDD-CONTAMINATED AREAS									
PILOT STUDY		X					X	1984-1985 EPA FUNDING	
PILOT STUDY FOLLOWUP		X			X		X	1985-1986 EPA FUNDING	
ADIPOSE TISSUE TESTING					X		X	1985-1986 EPA FUNDING	
REPRODUCTIVE OUTCOMES				X			X	1985-1986 EPA FUNDING	
ASSESSMENT OF HEALTH RISK OF EXPOSURE TO 2,3,7,8-TCDD IN SOIL IN A RESIDENTIAL COMMUNITY (TIMES BEACH, MO)					X		X	1984 EPA FUNDING	
DETAILED CURRENT LITERATURE REVIEWS WITH PUBLISHED REPORTS ON THE STATE OF SCIENTIFIC KNOWLEDGE OF THE HEALTH EFFECTS OF TCDD					X		X	1979-1985	140,000

HEALTH AND HUMAN SERVICES/NCI HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY				STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION ANALYTICAL	COMPLETED	ONGOING		
LUNG CANCER - STRUCTURAL PEST CONTROL WORKERS	X					X	1984-1986	100,000
CONTROL STUDY OF LYMPHOMA AND SOFT TISSUE SARCOMA			X		X		1981-1982	487,000
NCI PESTICIDE WORKERS			X			X	1983-1985	870,000

HEALTH AND HUMAN SERVICES/NIHES LAB/LITERATURE STUDIES

STUDY EFFORT	TYPE OF STUDY		STATUS		STUDY PERIOD	TOTAL \$ 1981-97
	ANIMAL ENVIRONMENTAL	ANALYTICAL LITERATURE	COMPLETED	ONGOING		
DED-WEED.LV-69: SALMONELLA	X		X		1980	0
2,4-D: DROSOPHILIA	X		X		1981	7,400
2,4,5-T: DROSOPHILIA	X		X		1981	7,400
2,4,5-T: N-BUTYL ESTER: SALMONELLA	X		X		1981	1,200
2,4-D. N-BUTYL ESTER: SALMONELLA	X		X		1981	1,200
2,4,5-T: SALMONELLA	X		X		1980-1981	1,200
CYTOGENETICS	X		X		1982	4,200
2,4,5-T: CYTOGENETICS	X		X		1982	4,200
DIBENZOFURAN: CYTOGENETICS	X		X		1981	4,150
2,4-D: SALMONELLA	X		X		1980-1981	1,200
2,7-DICHLORO-DIBENZO-P-DIOX: SALMONELLA	X		X		1982	1,200
DIBENZOFURAN: SALMONELLA	X		X		1980	0
2,4-D. DIMETHYLAMINE SALT: SALMONELLA	X		X		1980	0
PENTACHLOR. & DIOXIN CONTAM IN PCP		X	X		1984	200,000
NEUROTOXICITY OF 2,4-D IN RODENTS	X		X		1980-1981	27,000
PEST. & TRANS. ACROSS BIL. LIP. MEM.	X		X		1980-1987	983,000
DIL. & TOX. ON THE LIVER	X			X	1980-1986	741,000
OCCUPTL. & ENVMTL. HLTH. CTR. GRANT	X		X		1980-1984	95,000

HEALTH AND HUMAN SERVICES/NIEHS LAB/LITERATURE STUDIES

STUDY EFFORT	TYPE OF STUDY			STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL	ANALYTICAL LITERATURE	COMPLETED	ONGOING		
ALTER. OF CELL-SURF. MEMBRANE FOR DI TOX	X				X	1985-1989	415,000
EFFECTS ON NUTRIENT ASSIMILATION	X				X	1982-1986	760,000
BIOAVAILABILITY OF TCDD (RAT) DERMAL AND ORAL	X			X		1983-1984	110,000
TOXICANT DEREG ENDOCRINE HEME BIOSYNTH	X				X	1985-1987	316,000
DI-EPITH CELL INTERACT. MECH AND ASSAY	X				X	1985-1987	219,000
...RE-TOXICITY RELAT.	X				X	1980-1984	35,000
MOLECULAR TOXICOLOGY OF TCDD	X				X	1981-1986	462,000
IMMUNOSUPPRESSION BY IN UTERO EXPOS	X			X		1990	0
ARACHIDONATE PROCTS IN DI AND PCB TOX	X				X	1985-1987	497,000
IMPLCNS. OF LOW LVL. EXP. TO DIOXIN	X				X	1990-1992	758,000
TOX. ACT. OF TETRACHLOROBENZENE AND DIOXIN	X				X	1990-1993	214,000
XENOB. IND. OF PLE. REP. IN LIVER TOX	X				X	1980-1986	1,144,000
CHL. DIB-P-DIOX. MECH. OF TOX.	X				X	1982-1987	546,000
MOLCLR. MDLS. OF DIOX. BNDG. PROTEINS			X		X	1987-1985	90,000
...HEXACHLORO-DIBENZO-P-DIOXIN	X				X	1990	0
MCH. FOR TOX. OF CHL. DIBENZODIOX.	X				X	1981-1987	471,000

HEALTH AND HUMAN SERVICES/NIEHS LAB/LITERATURE STUDIES

STUDY EFFORT	TYPE OF STUDY			STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL	ANALYTICAL	LITERATURE	COMPLETED		
TER. OF TCDD CLFT. PAL. INDC. (MICE)	X					X	1983-1985 400,000
DISPOSIT OF TCDD FTL. DIST. IN MICE	X					X	1984-1985 50,000
PRE-DIOX. IN PCP BIOCH., EF., & TOX	X				X		1980-1982 172,000
ATMC. EM. SPCT. FOR DIOXIN TR. ANLYS.	X					X	1983-1986 344,000
SYNTH. OF 6 CHLOR DIBENZO-P-DIOX				X		X	1982 61,000
MOLECULAR BASIS OF DIOXIN TOXICITY				X		X	1983-1985 120,000
B. OF TETRACHLORO- DIBENZO-P-DIOX	X						1980 0
ROLE OF TCDD RECEPTOR IN TUMOR PROMO	X					X	1985-1989 400,000
TOXIC AND ANORECTIC EFFECTS OF TCDD	X					X	1985-1987 456,000
MECHANISMS OF TCDD TOXICITY	X					X	1985-1987 300,000
MECHANISMS OF IMMUNOSUPPRESSION	X					X	1984-1985 130,000
BIOASSAY OF TETRACHLORO-DIBENZO- P-DIOXIN	X						1980 0
QUAN. ANAL. OF TCDD BY MASS SPECT.				X		X	1981 25,000
TYC HLE MST IN VTR. BIASY. DVLMT.	X					X	1982-1984 181,000
MECHANISMS OF D. TOXICITY	X					X	1985-1988 253,000
THEORETICAL MOLS OF A DIOXIN RECEPTOR				X		X	1983-1984 25,000
MECHANISMS OF TOXICITY OF DIOXIN	X					X	1985-1987 310,000

HEALTH AND HUMAN SERVICES/NIEHS LAB/LITERATURE STUDIES

STUDY EFFORT	TYPE OF STUDY		STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL ANALYTICAL LITERATURE	COMPLETED	ONGOING		
ENVIRMTL HLTH SCI CNTR GRANT	X			X	1980-1987	597,000
DIOXIN NMR STUDY		X	X		1984	35,000
EFFECTS ON INTESTINAL CELLS	X		X		1981-1982	4,000
HEXACHL BENZ DISPOSIT	X		X		1981-1984	75,000
INTL. RES/EXPOS TO PHENOXY ACID HERB	X		X		1981-1983	456,000
MEMBRANE/LP RECEPTOR NRSA	X			X	1984-1987	36,000
LIPID ASSIMILATION NRSA	X		X		1981-1984	36,000
3-TCDD DISP J. MICE & G.P.	X				1980-1983	200,000
2,3,7,8-TCDF METABOLISM IN RATS, MICE & G.P.	X				1981-1985	100,000
CONTROL OF GENE EXPRESSION BY DIOXIN	X			X	1985-1990	243,000
FOOD EFFECTS ON STEROID HORMONE SYNTHESIS	X			X	1985-1988	204,000

HEALTH AND HUMAN SERVICES/NIOSH HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY				STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED		
NIOSH HEALTH HAZARD EVAL AND LEUKEMIA CLUSTER IN MADISON COUNTY, KENTUCKY ALLEGEDLY ASSOCIATED WITH PENTACHLOROPHENOL TREATED AMMUNITION BOXES			X			X		1981-1984  > 615,000
NIOSH HEALTH HAZARD EVAL AND TECHNICAL ASSISTANCE		X					X	1983-1989
NIOSH DIOXIN REGISTRY AND MORTALITY	X		X				X	1980-1987 1,328,600
NIOSH DIOXIN REGISTRY MORBIDITY & REPRO OUTCOME STUDY		X	X	X			X	1985-1988 4,095,000
NIOSH SOFT TISSUE SARCOMA INVESTIGATION (TECH. ARTICLE)			X				X	1981-1983 4,000

VETERANS ADMINISTRATION HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY					STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	NORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED	ONGOING		
VIETNAM VETERANS MORTALITY STUDY	X						X	1982-1989	2,334,000
EPIDEMIOLOGY STUDY (CDC)	X	X	X	X	X		X	1983-1989	67,694,000
BIRTH DEFECTS (CDC)				X			X	1981-1983	488,000
TWIN STUDY: VIETNAM EXPERIENCE TWIN STUDY (VETS I)		X		X			X	1982-1987	
TWIN STUDY: VIETNAM EXPERIENCE TWIN STUDY (VETS II)		X						SUSPENDED	3,359,000
VA/AFIP SOFT TISSUE SARCOMA			X				X	1984-1989	302,000
VA/AFIP SOFT TISSUE SARCOMA TREATMENT FILE		X	X				X	NO FUNDING	-
TCDD IN BODY FAT OF VIETNAM VETERANS AND OTHER MEN		X			X		X	1980	-
RETROSPECTIVE STUDY OF DIOXINS AND FURANS IN ADIPOSE TISSUE OF VIETNAM-ERA VETERANS (VA/EPA)					X		X	1982-1989	810,000
CASE CONTROL STUDY OF LYMPHOMA			X				X	1985-1989	150,000
FEMALE VETERAN SURVEY	X						X	1985-1988	480,000
COHORT MORTALITY STUDY OF VIET VETS	X						X	1985-1989	370,000
PTF/VIETNAM SERVICE INDICATOR							X	1982-1984	140,000

VETERANS ADMINISTRATION HUMAN HEALTH STUDIES

STUDY EFFORT	TYPE OF STUDY				STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	MORTALITY	MORBIDITY	CANCER	REPRO- DUCTION	ANALYTICAL	COMPLETED		
INVESTIGATOR INITIATED RESEARCH: CHRONIC EFFECTS OF HERBICIDE EXPOSURE ON TESTICULAR FUNCTION IN VIETNAM VETERANS		X					X	
INVESTIGATOR INITIATED RESEARCH: FAT TISSUE ANALYSIS FOR 2,3,7,8-TCDD (DALLAS)					X		X	1980-1989 INCLUDED BELOW
INVESTIGATOR INITIATED RESEARCH: FAT TISSUE ANALYSIS FOR 2,3,7,8-TCDD (SAN ANTONIO)					X		X	

VETERANS ADMINISTRATION LAB/LITERATURE STUDIES

EFFORT	TYPE OF STUDY			STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL	ANALYTICAL	LITERATURE	COMPLETED		
REVIEW OF LITERATURE ON HERBICIDES, INCLUDING PHENOXY HERBICIDES AND ASSOCIATED DIOXINS				X		X	1981-1989 439,000
INVESTIGATOR INITIATED RESEARCH: URINARY 6-HYDROXY CORTISOL: PHYSIOLOGICAL AND PHARMACOLOGICAL STUDIES (INCLUDING AGENT ORANGE)	X					X	
INVESTIGATOR INITIATED RESEARCH: EFFECT OF TCDD ON LIPID METABOLISM	X					X	
INVESTIGATOR INITIATED RESEARCH: MECHANISMS OF DIOXIN INDUCED TOXICITY USING THE CHLORACNE MP	X					X	
INVESTIGATOR INITIATED RESEARCH: BEHAVIORAL TOXICITY OF AN AGENT ORANGE COMPONENT: 2,4-D	X					X	→ 1980-1989 4,385,000
INVESTIGATOR INITIATED RESEARCH: EFFECTS OF 2,3,7,8-TETRACHLORODIBENZODIOXIN ON HEPATOBILIARY FUNCTION IN ANIMALS	X					X	
INVESTIGATOR INITIATED RESEARCH: MECHANISM OF TCDD ABSORPTION AND TOXICITY ON LIPID AND LIPOPROTEIN METABOLISM	X					X	
INVESTIGATOR INITIATED RESEARCH: METABOLISM OF THE HERBICIDES PRESENT IN AGENT ORANGE AND AGENT WHITE	X					X	
INVESTIGATOR INITIATED RESEARCH: TCDD EXPOSED RHESUS MONKEYS: EFFECTS ON BEHAVIOUR AND STRESS HORMONES	X					X	
INVESTIGATOR INITIATED RESEARCH: NEUROMUSCULAR TOXICITY OF AGENT ORANGE	X					X	

VETERANS ADMINISTRATION LAB/LITERATURE STUDIES

S. EFFORT	TYPE OF STUDY			STATUS		STUDY PERIOD	TOTAL \$ 1981-87
	ANIMAL	ENVIRONMENTAL	ANALYTICAL	LITERATURE	COMPLETED		
INVESTIGATOR INITIATED RESEARCH: EFFECTS OF LOW DOSE TCDD ON MAMMALIAN CHROMOSOMES AND LIVER CELLS	X					X	
INVESTIGATOR INITIATED RESEARCH: MECHANISM OF PORPHYRIA CAUSED BY TCDD AND RELATED CHEMICALS	X					X	1980-1989 INCLUDED ABOVE
INVESTIGATOR INITIATED RESEARCH: EFFECTS OF AGENT ORANGE ON SLEEP	X					X	
INVESTIGATOR INITIATED RESEARCH: UPTAKE AND METABOLISM STUDIES AND PHARMACOL & TOXICOL	X					X	
MONOGRAPHS				X		X	1982-1987 136,000
THE TASK FORCE				X		X	1983-1987 199,000